Macro Shocks and Housing Markets

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Introduction - setting

Global Financial Crisis and COVID-19 recessions [data]

Sharp recession	(Rising unemployment, market dislocations)
Conventional policy	(fiscal stimulus, monetary rate cuts)
Unconventional policy	(Treasury & MBS purchases, liquidity prgs)
GFC housing market	(Weak sales, falling prices)
Covid housing market	(Rising sales, record prices)

What was so different about the housing market reaction?

1. COVID-19 was a different type of shock.
2. Economic conditions were different when it hit.

Favorable shock to housing demand, and strong balance sheets.

Introduction - questions

Questions:

What role did policy play in the US COVID housing market?

How has the housing market been apparently resilient to sharp monetary tightening?

What does this foretell for future policy?

Approach -

Data trends: Monetary, Fiscal, Demand, Supply

A simple model - transparent framework

Extend the model to allow ”rate lock”

Implications for monetary policy transmission

Introduction - Implications

Main Implications:

The increase in demand from COVID was important for demand and prices

Prices have been surprisingly resilient to higher rates, but not transactions!

Paralysis in supply for sale undercuts Fed attempts to tighten with higher rates.

COVID: Two policy episodes

Stimulus Period

Monetary stimulus - Fed funds drops to zero

Mortgage rates fall roughly 100 bp

Fiscal stimulus provided "excess savings"

- Excess savings for potential homebuyers was limited (Aladangady et al, 2022), $8000 - $10,000 dollars.
- Forebearance and unemployment enhancements helped financial security but could not be used for loan underwriting.

COVID: Mortgage rates and home prices

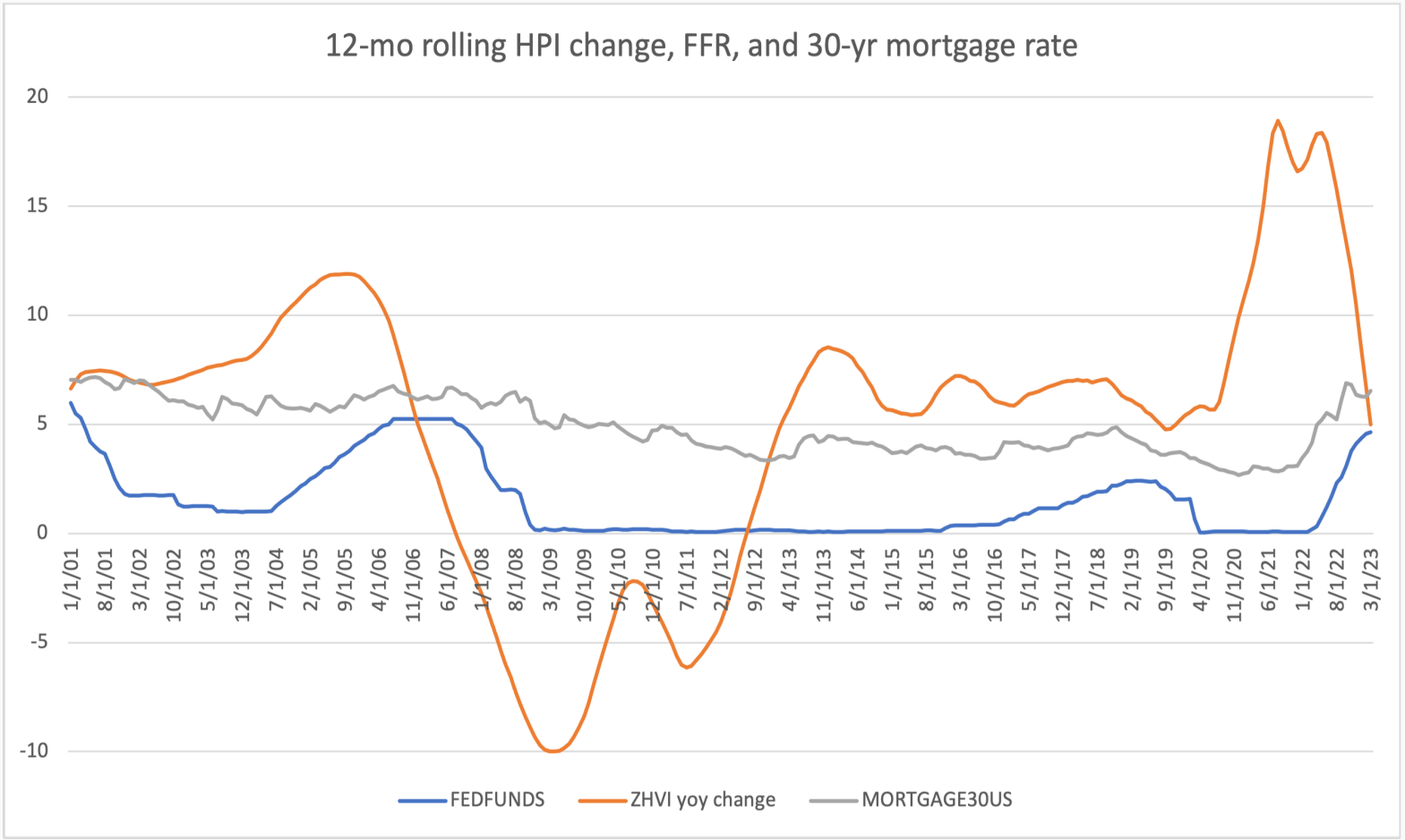

Figure 1: Annual Home Price Appreciation, Federal Funds Rate, and 30-year mortgage rate. The 30-year fixed rate is the dominant mortgage contract in the US.

COVID: Mortgage rates and home prices

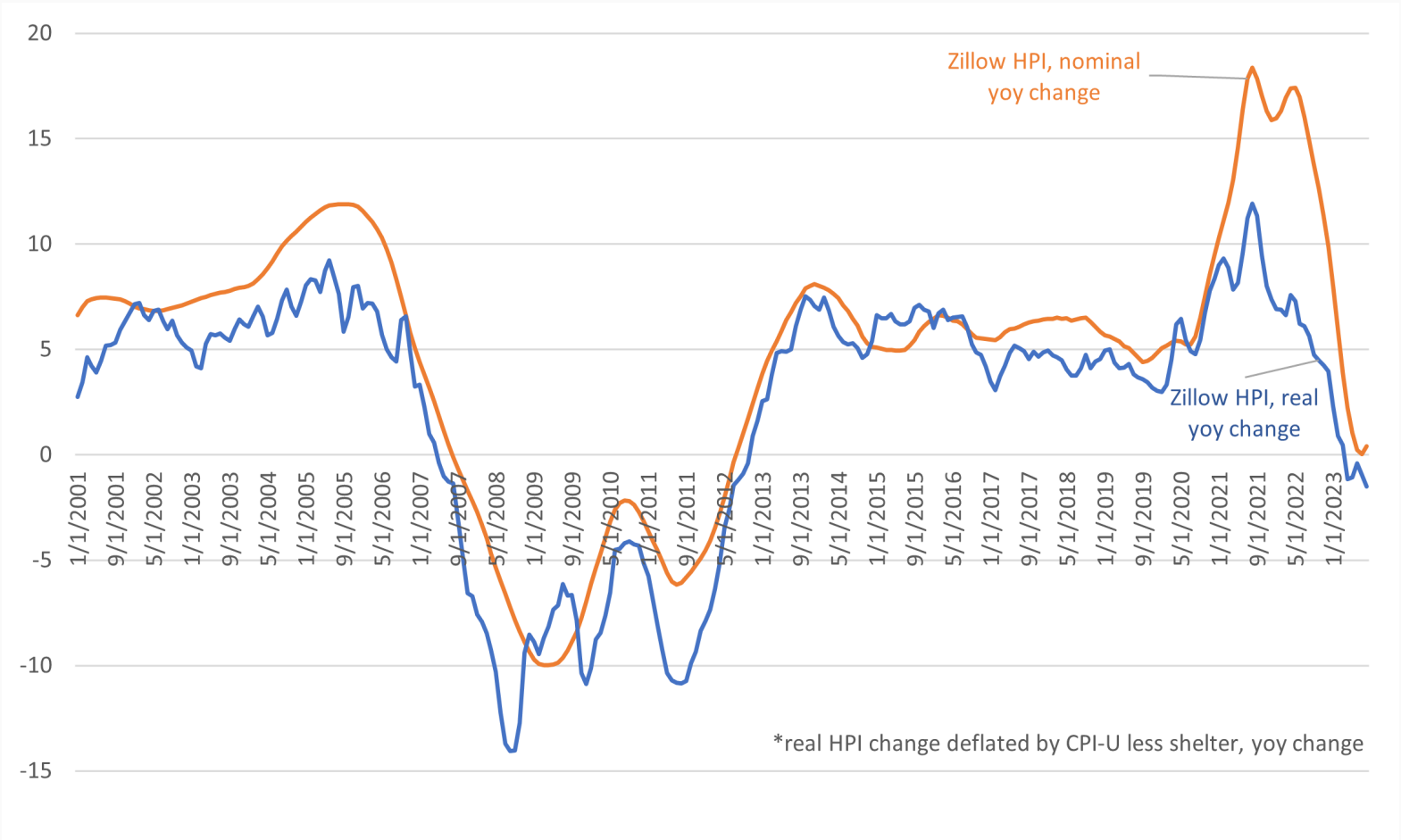

Figure 2: Annual Home Price Appreciation, nominal and real

COVID: Mortgage rates and home prices

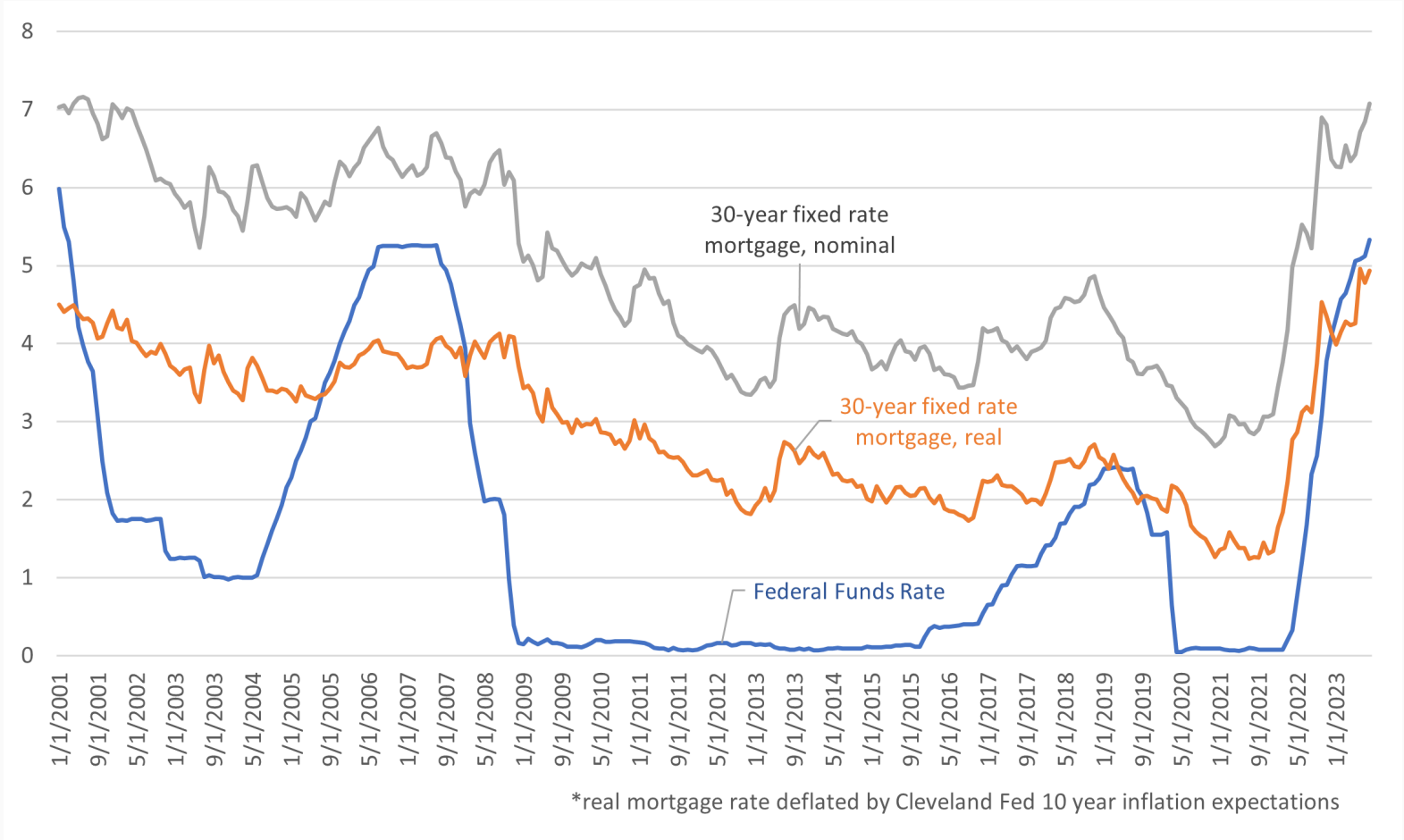

Figure 3: Annual Federal Funds Rate, and 30-year mortgage rate, nominal and real

COVID: Fiscal Support

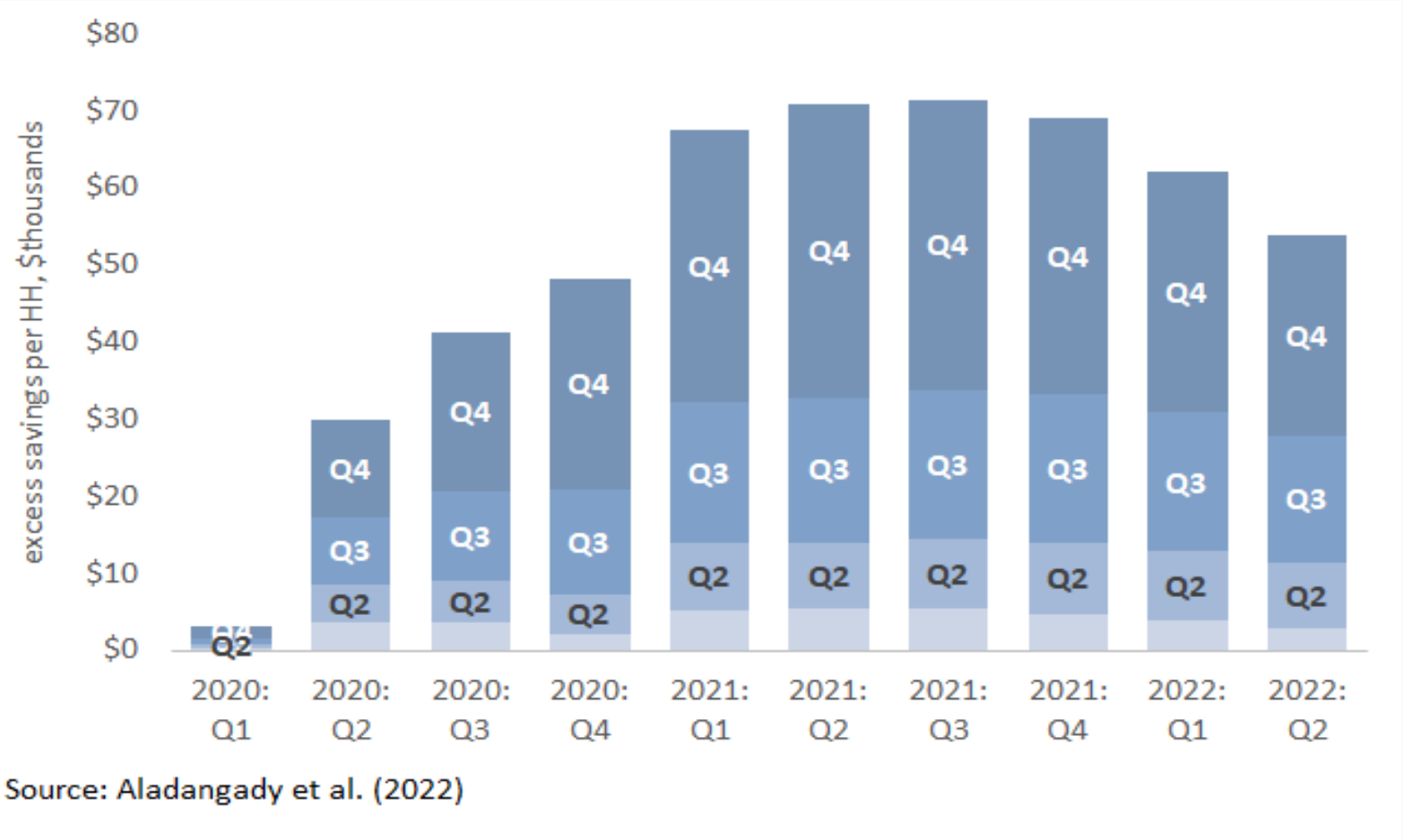

Figure 4: Estimated excess savings per household by income quartiles, thousands

Even first time homebuyers tend to track median income.

House Price Appreciation and Supply

Housing supply did not respond strongly to increased demand and higher prices.

Owner-occupied units were roughtly flat from the GFC through 2016, then started to slowly rise.

Growth rate average around 2% per year from 2016 through 2023.

Supply of single family housing

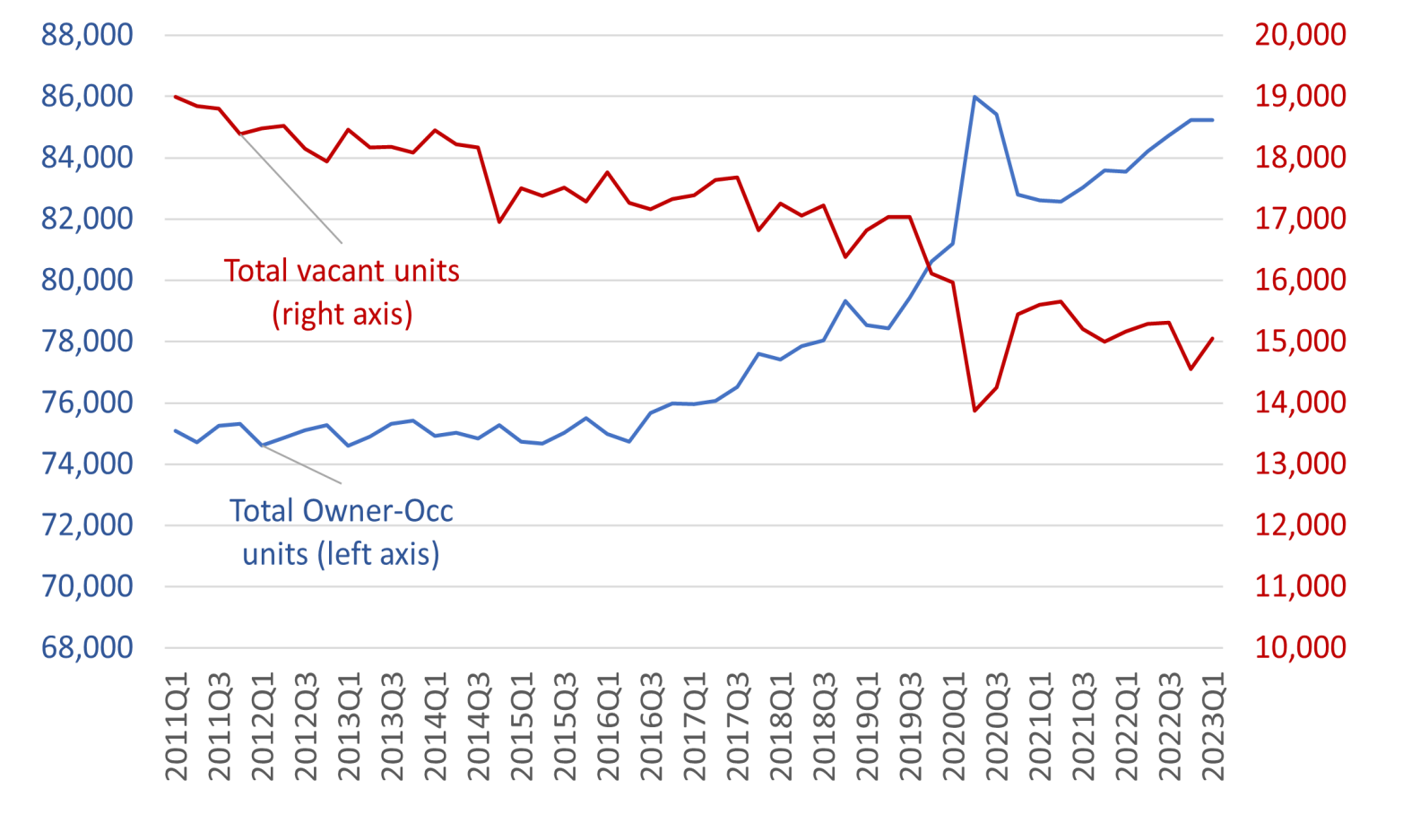

Figure 5: Stock of owner-occupied and vacant units (thousands) rose 13% over 12 years.

Supply of new housing

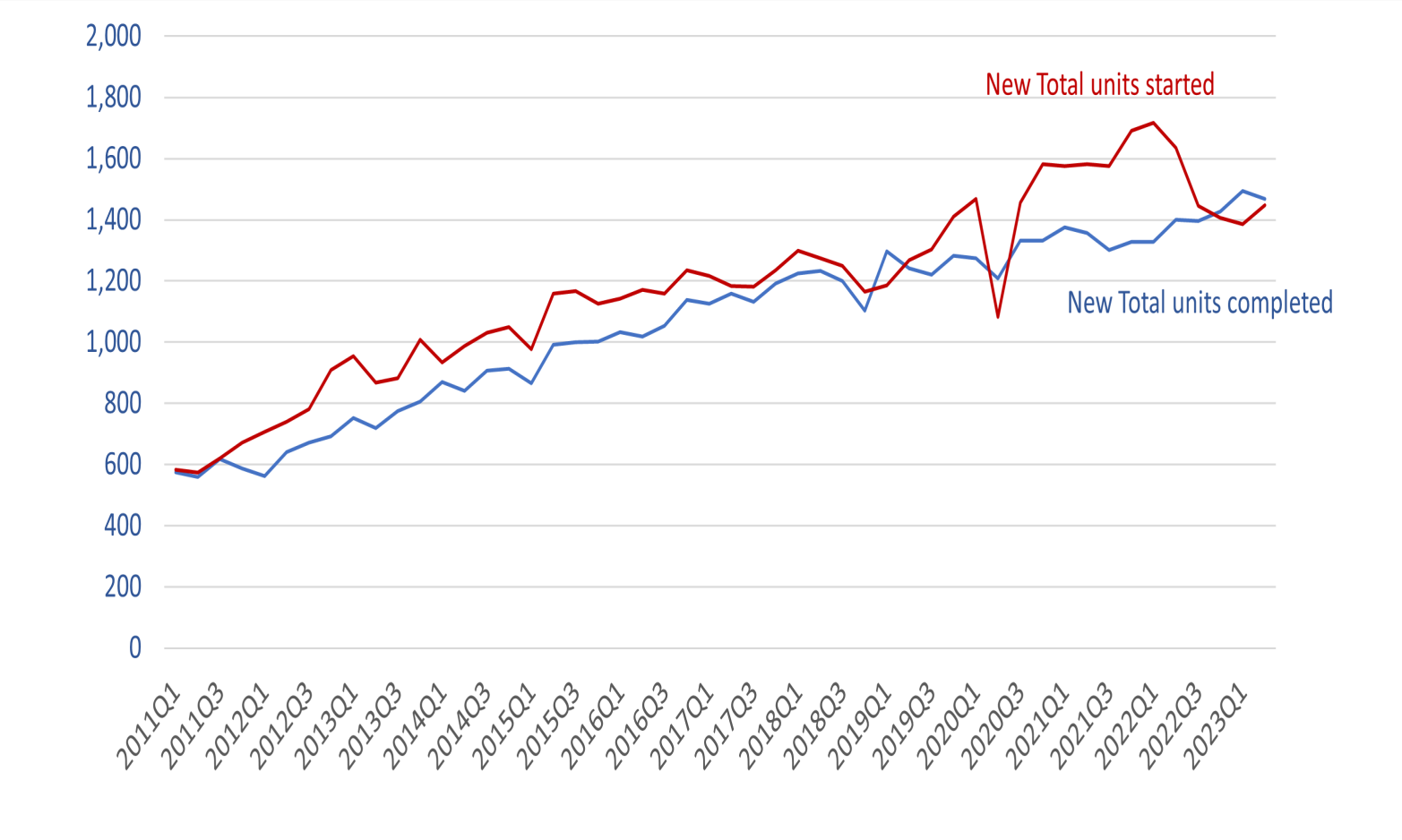

Figure 6: Flows of new owner-occupied units (thousands)

COVID: House Price Appreciation and Demand

Prices accelerated in H2 2020, rising 10% for the year and another 19% in 2021.

Policy support was augmented by pandemic-driven demand for housing, especially single family homes.

- Working from home rose from 5% of days pre-COVID to 60% in late 2020, stabilizing at 30% from 2021 through 2023.

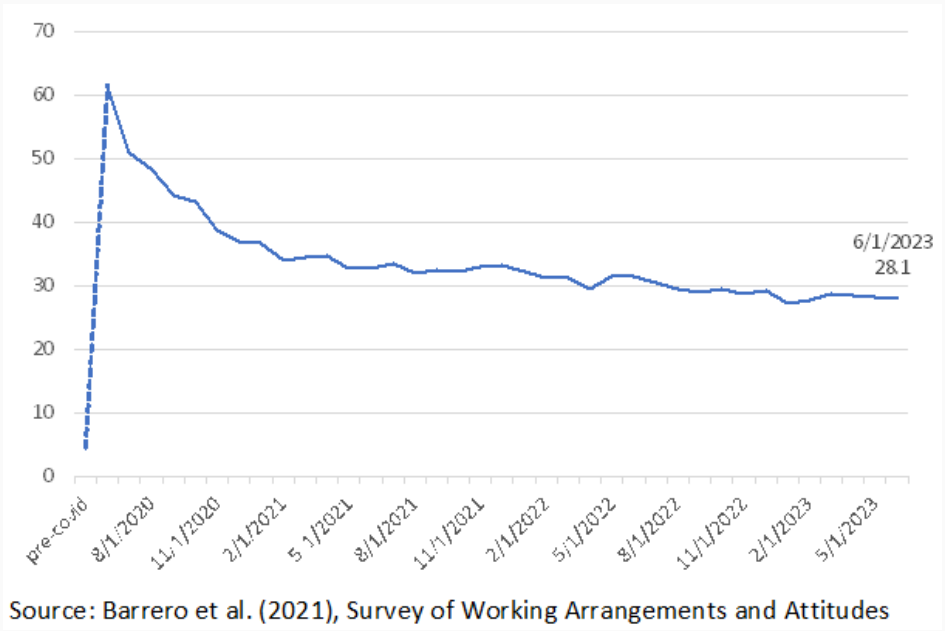

Figure 7: Working from home, Barrero, Bloom, and Davis (2021)

Second phase: Tightening

Fed tightening began in March 2022, eventually raising Fed funds by 500+ bp, and tapering asset purchases starting June 2022.

Mortgage rates rose from 3% to 6.9% by October 2022 - above 7% now.

Yet, house prices remain near their summer 2022 peak.

Second phase: Tightening

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Yet, house prices remain near their summer 2022 peak.

How to understand prices?

- Balance sheets remain strong.
- Incomes and employment remain robust.
- Pandemic-driven demand seems persistent (recall WFH).
- Supply remains on-trend: not expanding.

Is this enough to support P?

Model Strategy

Use Garriga et al (2021) model of house pricing that allows for heterogeneity; we model repeat and first-time buyers.

Calibrate to data from preCOVID 2019, Stimulus 2020-21, and Tightening 2022-23.

Use the Stimulus period home price appreciation to identify the demand shock relative to 2019.

Calculate the implied impact of rate Tightening in 2022-23, given measured incomes and supply.

Model basics

The optimization problem for consumer of type i is given by

$$U_i = \max \left[\sum_{t=0}^{\infty} \beta^t \left[\log c_{i,t} + \gamma_i \log h_{i,t} \right] \right] \tag{0.1}$$

$$\text{s.t.} \quad \underbrace{c_{i,t}}_{\text{cons. spending}} = y_i + \underbrace{b_{i,t+1} - \left(r_t^m + \triangle\right) B_{i,t}}_{\text{mortgage adjustment}} + \underbrace{\left(1 + r_t^d\right) D_{i,t} - D_{i,t+1}}_{\text{deposit portfolio adjustment}}$$

$$+ \underbrace{p_t^h \left(h_{i,t-1} - h_{i,t}\right)}_{\text{housing adjustment}}, \quad \forall i, t$$

Model basics

With log utility, relative consumption of housing services is given by

$$h_{it} = \gamma_i \frac{c_{it}}{p_t^h \left[1 - \triangle_{t+1}^h - \triangle_{t+1}^\phi\right]}, \quad \forall i, t \tag{0.2}$$

γ scales up relative demand for housing and

$$\begin{aligned} \Delta_t^h &\equiv \left(p_{t+1}^h / p_t^h\right) / \left(1 + r_{t+1}^d\right) \\ \Delta_{t+1}^\phi &\equiv \phi_t \left(r_{t+1}^d - r_{t+1}^m\right) / \left(1 + r_{t+1}^d\right) \end{aligned}$$

Model basics

The steady state expression for home prices, driven by demand (income, preferences) and financial conditions (interest rates, leverage):

$$p^h = \frac{r^d}{\underbrace{(1-\phi)r^d + \phi r^m}_{\text{user cost}} + \underbrace{\phi r^m \left(1+r^d\right) \sum_{i=1}^{I} \left(\frac{N_i \gamma_i h_i}{\bar{H}}\right)}_{\text{Leverage Effect}}} \underbrace{\left(\frac{1+r^d}{r^d}\right) \sum_{i=1}^{I} N_i \frac{\gamma_i y_i}{\bar{H}}}_{\text{Fundamentals}}$$

Simplifying with γ in common over all i

$$p^h = \frac{\left(1+r^d\right)}{(1-\phi)r^d + \phi r^m + \left(1+r^d\right)\phi r^m \gamma} \cdot \sum_{i=1}^{I} N_i y_i \gamma \frac{1}{\bar{H}} \qquad (0.4)$$

Model Calibration

Table 1: Model Baseline Parameter Values

Parameter	Symbol	Baseline
Number of Types	I	2
Type 1 Buyer Income	y_1	65
Type 2 Buyer Income	y_2	80
Number of Type 1	N_1	0.46
Number of Type 2	N_2	0.54
Housing Supply	$\bar{H}$	100
Outside Interest Rate	r^d	0.0387
Mortgage Interest Rate before tax	r^m	0.0372
LTV constraint	ϕ	0.8
Tax benefit of mortgage balance	τ	0.25
Housing Preference	γ	0.18

Notes: Parameters used in the 2019 baseline calibration.

Table 2: Parameter Values for Alternative Scenarios

Parameter	Symbol	Stimulus	Tightening
Number of Types	I	2	2
Type 1 Buyer Income	y_1	70	76
Type 2 Buyer Income	y_2	85	90
Number of Type 1	N_1	0.42	0.41
Number of Type 2	N_2	0.58	0.59
Housing Supply	$\bar{H}$	104	105
Outside Interest Rate	r^d	0.037	0.0585
Mortgage Interest Rate	r^m	0.030	0.0530
LTV Constraint	ϕ	0.8	0.8
Investor Housing Preference	γ	0.21	0.21

Notes: Parameters used in the alternative policy episodes for 2020-21 (Stimulus) and 2022 (Tightening).

Model Scenarios

Table 3: Results in Alternative Policy Scenarios

Parameter	Symbol	Stimulus	Tightening
House P Apprec (relative to baseline)	Δp^h	40.67%	−10.86%
House P Apprec (relative to peak)	Δp^h		−36.63%
Type 1 Housing Demand	h_1	92.57	93.87
Type 2 Housing Demand	h_2	112.41	111.16
Type 1 Consumption	c_1	60.64	65.38
Type 2 Consumption	c_2	73.64	77.42
Type 1 DTI increase at mean home	DTI(100)	12.34%	10.79%
Type 1 DTI increase at median home	DTI(h_2)	21.43%	18.42%
Type 1 DTI increase over baseline	DTI(100)	23.21%	27.04%
Type 1 DTI increase over baseline	DTI(h_2)	33.18%	35.79%

Notes: Steady-state alternative solutions implied by the model.

Model Scenarios: Summary

Stimulus

- Given the decline in mortgage rates and rising income, prices would have risen 22% without any demand shift.
- Increasing the preference parameter from .18 to .21 (16.7%) results in a total 41% price increase, matching home price appreciation from 2020 to 2022.
- Still very sensitive to rates: reducing the rate stimulus by 30bp, reduces implied SS home price appreciation by 10 pp or 25%.

Tightening

- Even with permanently higher demand and higher incomes, the increase in mortgage rates during 2022 would more than reverse the observed appreciation, resulting in a home price decline of 36.7% compared to peak.

Data Trends

Instead home prices remain at or near historic highs from last summer, despite 200-300+ bp rate increases?

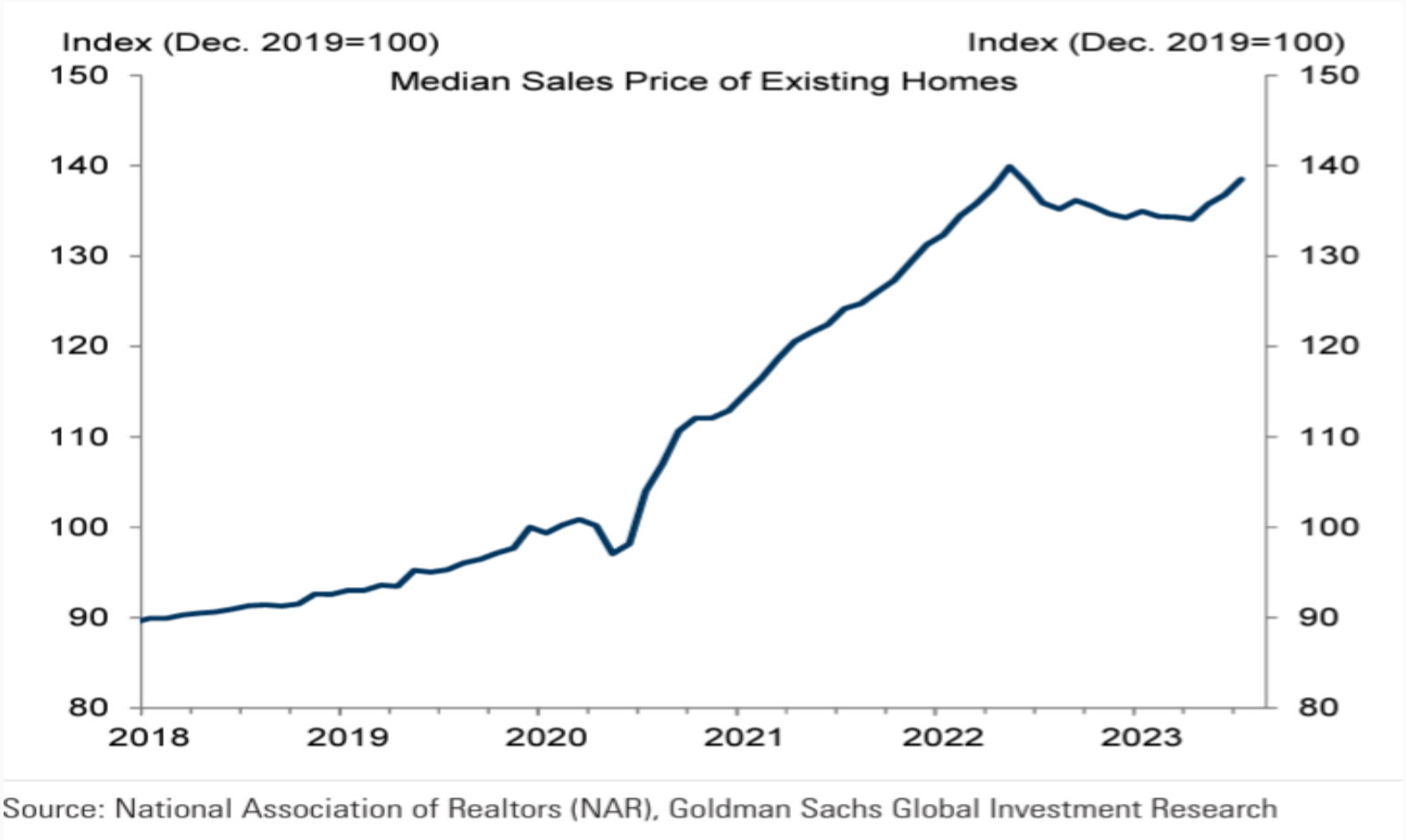

Figure 8: Median sales price of existing homes through August 2023.

Distribution of mortgage rates and market rate

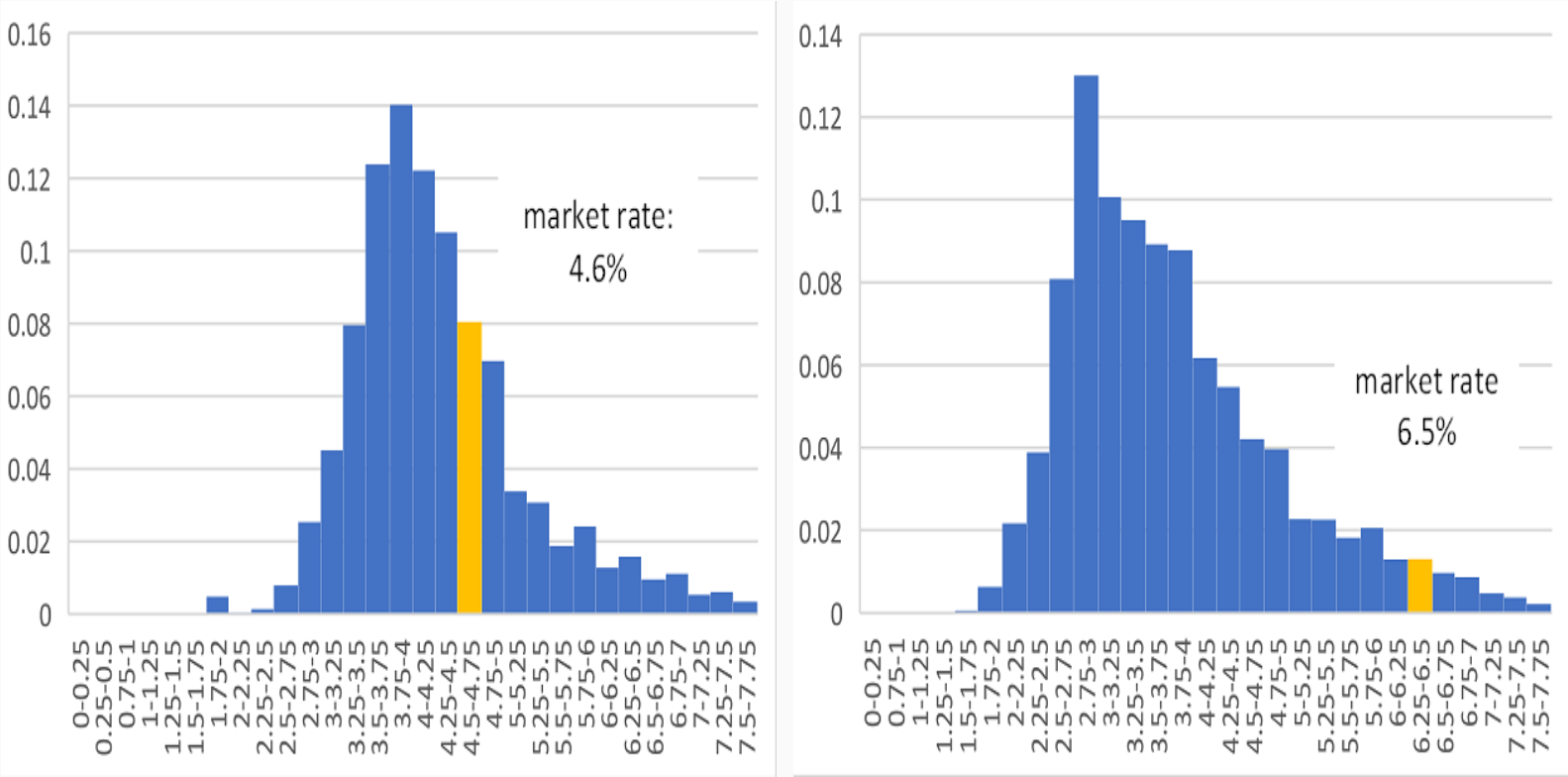

Figure 9: 30-year mortgage fixed rate distribution in 2018 (left) and 2023 (right)

Mortgage Lock: existing home sales fell 40%

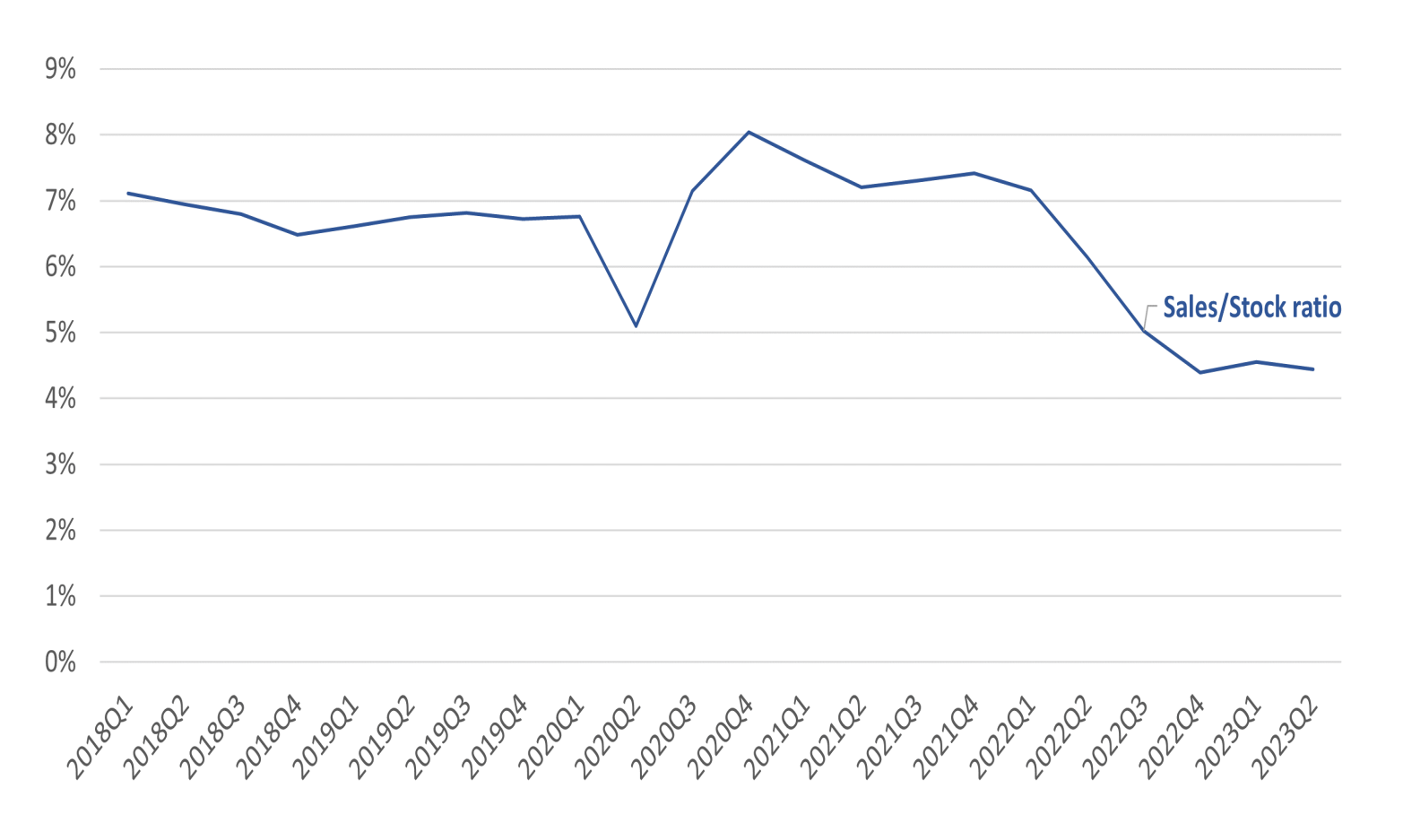

Figure 10: Sales of existing homes relative to the stock of existing owner-occupied homes

Houses on offer

The median mortgage is 300 bp below market, and 71% of mortgages are 200 bp or more below market.

Fonseca and Liu (2023): each 100 bp gap between market rate and actual rate reduces probability of sale by .68 pp; empirically, homes for sale have fallen 40% from their historic rate of 7% to 4.2%.

If only a share of homes are for sale, the market clearing condition is replaced by

$$N_1 h_1 + (\rho_1 - \rho_2) N_2 h_2 = \rho_1 N_2 h_2 + \Delta H, \tag{0.5}$$

$$or \qquad N_1 h_1 = \rho_2 N_2 h_2 + \Delta H, \tag{0.6}$$

equating demand from first time homebuyers ($N_1 h_1$) plus remaining existing homeowners who sell (share ρ_1) and do not exit (share ρ_2), with the supply from existing homeowners who sell plus new home completions. On net, new home buyers purchase new construction and the homes of existing owners who exit.

Model Scenarios: Tightening

In the Tightening scenario, home prices change with the "Calvo" friction:

- Calibrate a neutral moving model, choosing forced sales to match model results.
- Replace the calibrated forced sales with actual sales of existing homes.

Model Scenarios: Tightening

Table 4: Moving Model with Rate Lock

Parameter	Symbol	Neutral	2022 Supply	2023 y_i
Probability of existing sale	ρ_1	0.053	0.042	0.042
Probability sale and exit	ρ_2	0.014	0.0062	0.0062
New completions/stock	$\Delta H/H$	0.007	0.007	0.007
Share of first time buyers/H	N_1	0.02	0.02	0.02
House P chg to steady state	Δp^h	.2%	19.7%	36.3%
House P Apprec from peak	Δp^h	-36.4%	-14.9%	-4.6%
Type 1 Housing per buyer	h_1	95.3	81.9	82.4
Type 2 Housing per buyer	h_2	110.2	94.8	94.5

Notes: Neutral case matches the steady state by construction. Choosing ρ_1 and ρ_2 to match the data constrains supply: home price appreciation rises by 12 pp. Raising home buyer income to match 2023 data: home price appreciation rises by another 10 pp, so that overall home price decline is 4.6%.

Conclusions

- Policy
  - 2020-21 Stimulus, especially monetary, added to 17% demand shock driving 40% HPI
  - Restricted supply for sale, perhaps due to rate lock and preferences, supports prices, despite rate reversal.
- Implications
  - Rate lock implies less response to rate hikes
  - Low fixed rates imply little response to rate cuts (no refis)

  → Future policy mechanisms limited
  - Housing supply is a remaining lever
  - Affordability is the major challenge
- Future work
  - Dynamic model - preliminary results in the paper; similar magnitudes
  - Dynamic model with Calvo, or with state dependence

Data Trends: Homebuyer incomes

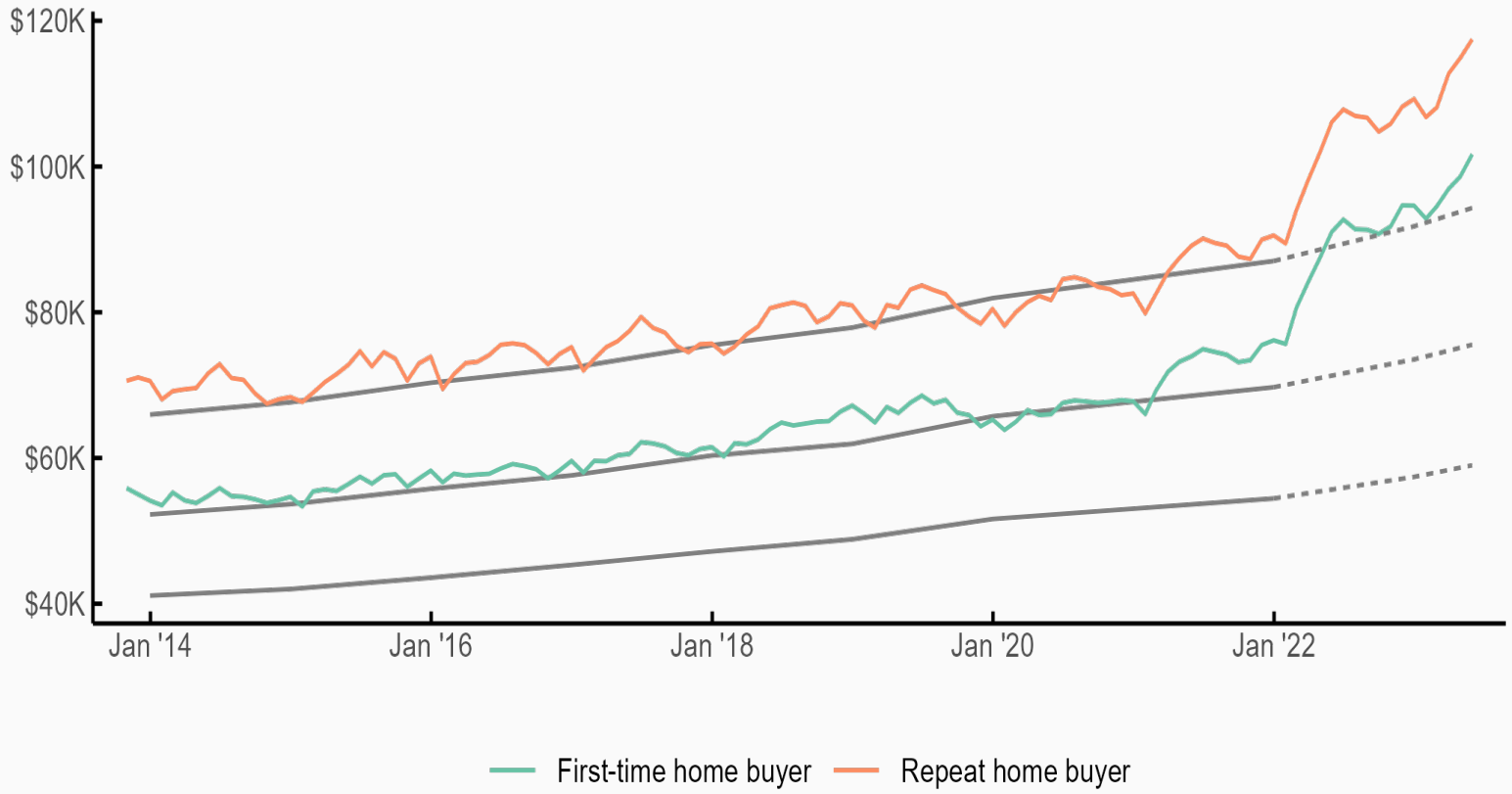

Figure 11: First time and repeat homebuyer incomes compared to 40th, median, and 60th percentile ACS incomes

Data Trends: Home prices

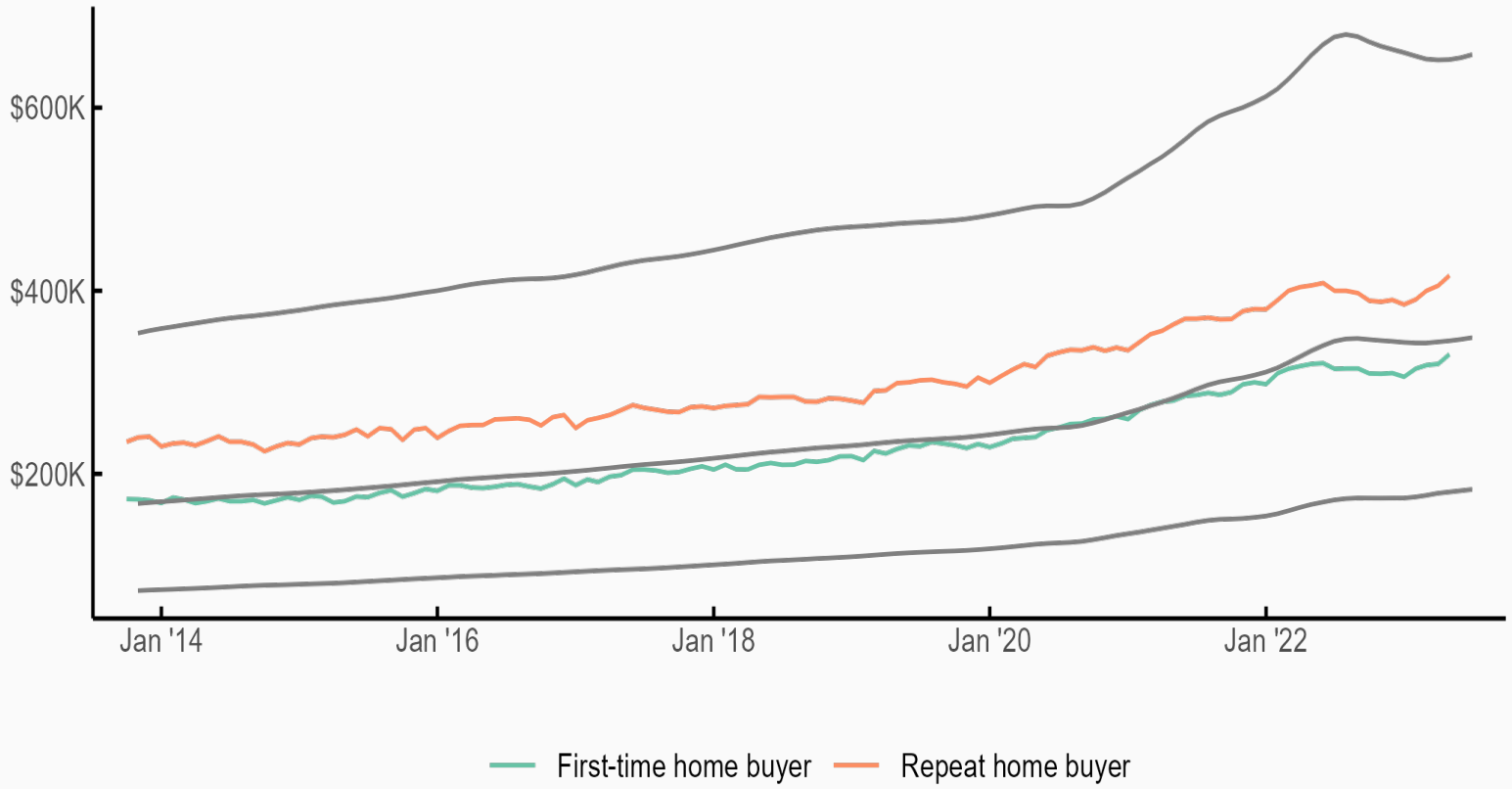

Figure 12: Home prices for first time and repeat home purchasers compared to Zillow low, median, and high tier home price bands

Data Trends: Mortgage rates

Figure 13: eMBS mortgage interest rates for first time and repeat homebuyers, Freddie Mac 30 year fixed mortgage rate

Dynamic Model: allow for rate shocks out of steady state

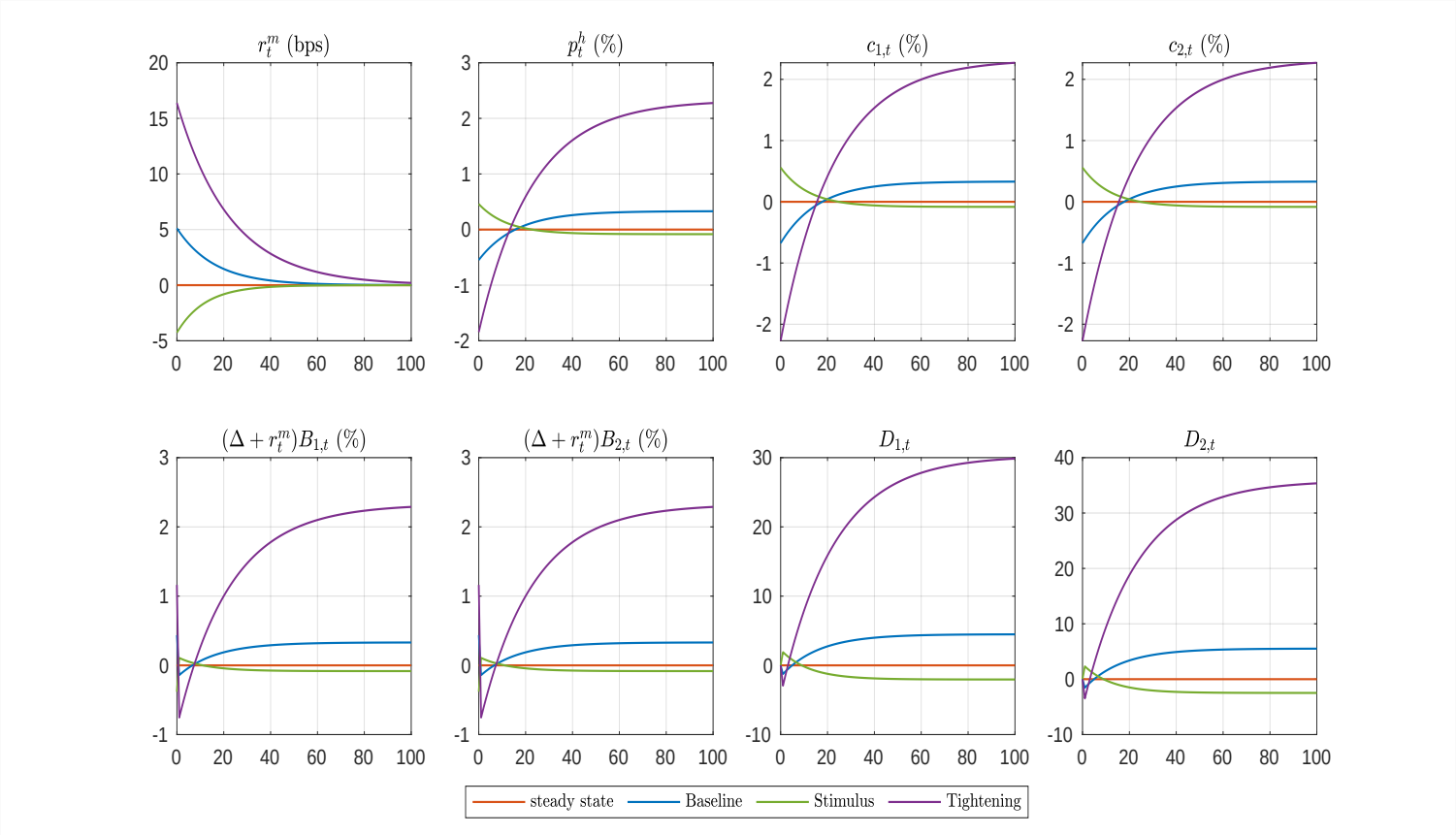

Figure 14: Impulse Responses to a 1-SD Mortgage Rate Shock with Deposit Rate Change

Dynamic Model: allow for rate shocks out of steady state

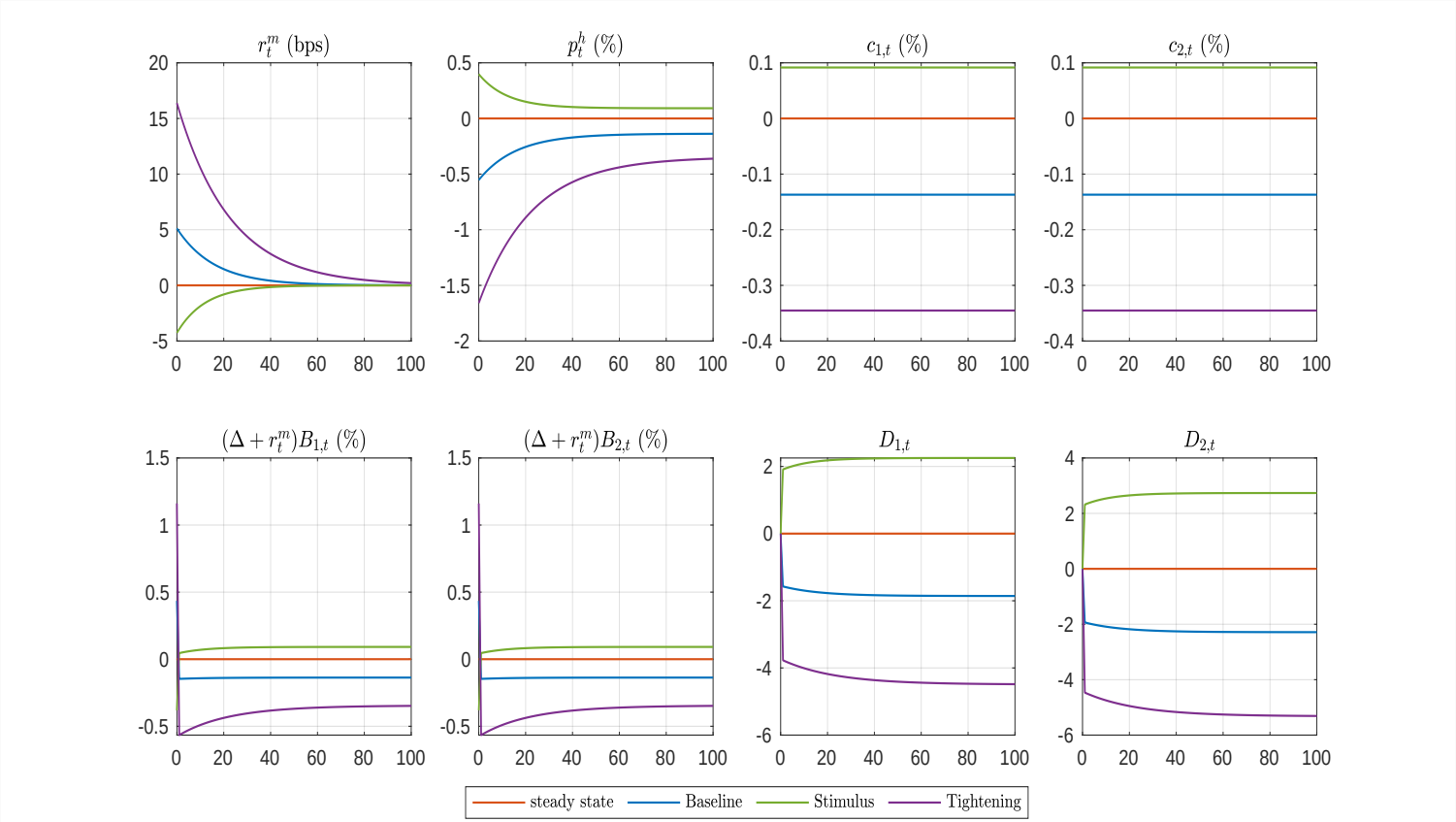

Figure 15: Impulse Responses to a 1-SD Mortgage Rate Shock with Fixed Deposit Rate

Data Sources

Table 5: Data Sources for Parameter Values

Parameter	Symbol	Source
Type 1 &2 Buyer Income	y_i	eMBS data
Share of each type	N_i	FRBNY CCredit Panel
Single Family Owner Occupied Units	$\bar{H}$	CPS/HVS data
Domestic Interest Rate	r^d	Bloomberg BB 7 year bo
Mortgage Interest Rate	r^m	Freddie Mac 30 year mtg
LTV constraint	ϕ	GSE Baseline
Tax benefit of mortgage balance	τ	Garriga et all, 2021
Median income of homeowners	y	2019 Survey of C Finance
Initial Housing Preference	γ	Inferred from SS PH/Y

Model Scenarios: Tightening Summary

Reducing forced sales and exits from 5% to 4.2% and 1.4 to 0.6%, respectively, ceteris paribus raises prices by 19.7% compared to steady state, so that prices fall 14.9% from the peak.

Calibrating buyer incomes to their 2023 levels, raises prices an additional 16.6%, so that in combination, prices are within 5% of the peak in 2022.

Housing per buyer falls below the SS median, suggesting poorer matches.

Affordability crashes - FTHB would use 25% of income more to buy the average house, even allowing for their higher incomes.

Table 6: Steady State Baseline Solution

Parameter	Symbol	Baseline
House Price	p^h	3.99
Type 1 Housing Demand	h_1	88.92
Type 2 Housing Demand	h_2	109.44
Type 1 Consumption	c_1	57.08
Type 2 Consumption	c_2	70.25
Type 1 DTI increase at mean home	DTI(100)	12.46%
Type 1 DTI increase at median home	DTI(h_2)	23.08%

Model Scenarios: placebo

Table 7: Baseline and Stimulus with Moving

Parameter	Symbol	Baseline	Stimulus
Probability of existing sale	ρ_1	0.067	0.071
Probability sale and exit	ρ_2	0.027	0.024
New completions share of existing stock	$\Delta H/H$	0.0087	0.0098
Share of first time buyers/H	N_1/H	0.035	0.034
House Price chg to prev steady state	Δp^h	0.84%	0.67%

During the Baseline and Stimulus periods, the transactions of home buyers in the market give the same quantitative price as the Steady State.