NBER WORKING PAPER SERIES

PROPERTY TAXES AND HOUSING ALLOCATION UNDER FINANCIAL CONSTRAINTS

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Working Paper 35587
http://www.nber.org/papers/w35587

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2026

This paper has benefited from conversations with Manuel Amador, David Argente, Andy Atkeson, Christian Badarinza (discussant), Anmol Bandhari, Bence Bardoczy, Salome Baslandze, David Berger, Gideon Bornstein, Ashley Craig, Juan Carlos Conesa, Walter D'Lima (discussant), Sebastian Dydra, Vadim Elenev, Dirk Krueger, Carlos Garriga, Caitlin Gorback (discussant), Dan Greenwald, Deeksha Gupta, Fatih Guvenen, Irem Güçeri, Jonathan Heathcote, Kyle Herkenhoff, Hugo Hopenhayn, Troup Howard, Brandon Kaplowitz, Paolo Martellini, Ellen McGrattan, Konstantin Milbradt, Ben Moll, Michaela Paffenholz, Chris Phelan, Facundo Piguillem, Tarun Ramadorai, Juan Carlos Suárez Serrato (discussant), Florian Scheuer (discussant), Liyan Shi, Jaehee Song (discussant), Cailin Slattery (discussant), Kamila Sommer (discussant), Claudia Steinwender, Ludwig Straub, Venky Venkateswaran, Gianluca Violante, Daniel Waldinger, Conor Walsh, Francis Wong, Alex Zevelev (discussant), Nathan Zorzi and comments from conference and seminar participants at the 116th National Tax Association Conference, the Syracuse-Chicago Webinar Series on Property Tax Administration and Design, the CESifo Public Economics Week at LMU, Pizzanomics at EIEF, the 2024 Cornell Real Estate Symposium, the Minneapolis Fed, Toronto, CUNY, JHU Carey Finance Conference, Fannie Mae-Philly Fed Conference, NYU Stern, Duke University, the UGA Macro Workshop, the Chicago Fed-Indiana Housing Conference, Micro and Macro Implications of Household Behaviour and Financial Decision-Making, University of Pittsburgh, the Philadelphia Fed, Columbia Business School Alumni Conference, NYC Metro Real Estate Conference, Mannheim, University of Zurich, UT-Austin, Copenhagen Business School, AREUEA, Chicago Fed, Berkeley econ, Berkeley Haas, and the CEPR Public Economics Annual Symposium. Golder thanks the German Research Foundation (DFG) for financial support (project number 554426549). First version: July 9, 2024. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Property Taxes and Housing Allocation Under Financial Constraints
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NBER Working Paper No. 35587
August 2026
JEL No. H24, H71, J11, R21

ABSTRACT

Low property taxes amplify lock-in among elderly homeowners, limiting housing access for young families. Raising them reallocates housing toward the young through two channels: capitalization into lower prices reduces required downpayments for financially constrained buyers, a form of embedded leverage, while higher tax obligations raise holding costs for older owners. In our overlapping generations model, raising California's property taxes to Texas levels increases young homeownership while decreasing elderly homeownership. Removing step-up basis also lowers elderly homeownership, suggesting their tenure is sustained by bequest tax advantages. The tax treatment of housing shapes housing allocation across generations.

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1 Introduction

Housing is allocated unevenly over the life cycle. It is owned and occupied disproportionately by older and wealthier households, while younger households are more likely to rent and occupy less housing. A possible reason this mismatch persists is lock-in: barriers to reallocation that leave households in housing that no longer suits their circumstances. These frictions stem from multiple sources, including transaction costs, preferences (Andersen et al. 2022), mortgage design (Quigley 1987; Fonseca and Liu 2024), regulation (Glaeser and Luttmer 2003), and notably tax considerations (Kopczuk and Munroe 2015; Ferreira et al. 2010; Hilber and Lyytikäinen 2017). Persistent challenges with housing affordability and tight vacancy make it important to understand which policies may affect housing allocation across generations.

The tax treatment of homeownership influences lock-in motives through various instruments with distinct incentives and distributional consequences. Property taxes, levied annually on the stock of housing value, generate continuous ownership costs which affect both purchasing and tenure decisions. Realization-based taxes, by contrast, are triggered only upon sale, and provisions such as the step-up in basis at death limit taxation of accrued gains if the property is held until death. While prior literature has extensively examined the effect of these different tax instruments on government revenue and house prices, their differential impacts on residential mobility and homeownership have received comparatively little attention, but are important for understanding how tax instruments shape the distribution of housing access.

Our paper explores the role of real estate taxation in reallocating housing over the life-cycle. We develop an overlapping generations (OLG) model with heterogeneous agents, incomplete markets, and tenure choices to analyze the impact of different taxes on housing decisions over the life cycle. We find that raising property tax rates from 0.8% of market value in low-property tax California to the 2% rate of higher-tax Texas would increase homeownership by young households (those aged 25–44). By contrast, higher property taxes would reduce ownership by the elderly (those above 65). Our key finding is therefore that property taxes reallocate homeownership towards the young from the elderly.

Two key mechanisms drive this result. The first is the capitalization of higher property taxes into lower purchase prices, which relieves down payment constraints faced by financially constrained buyers. The second is that property taxes raise the ongoing cost of holding housing, which falls most heavily on older, long-tenured owners. The combination of these forces means that higher property taxes enable younger individuals to achieve greater homeownership. Our results suggest that property taxes can be viewed as a form of "embedded leverage" in the sense that they reduce the upfront, out-of-pocket cost borne by buyers in exchange for a series of ongoing property tax payments, which is most valuable for agents financially constrained by downpayment requirements.

We first provide empirical support for the capitalization mechanism and associated impacts of property taxes on homeownership and housing allocation. We document the lifecycle mismatch in housing: ownership and occupancy are concentrated among older and wealthier households (Figure 1). We then use quasi-experimental variation through staggered reassessments in North Carolina, which generate predetermined shocks to effective property tax rates. In our preferred specification, a one percentage point increase in property taxes reduces house prices by 22.6%. We also find that elderly households respond to property tax shocks by downsizing their lot sizes, while younger households move to larger lots. We then extend this identification strategy to a much broader sample using a long-differences specification on Census data. These estimates suggest that areas that see higher property tax changes have greater homeownership and housing consumption by young households, driven by households with sufficient income flow to afford obligated housing payments.

We then quantify the role of property taxes through a structural model. We build a complex yet tractable model featuring six state variables and a lifecycle that spans working years and retirement. We include a full set of choices over tenure (rent vs. own), housing quantity, savings, and consumption. Our focus is on two key financial frictions based on loan-to-value (LTV) and payment-to-income (PTI) constraints. We allow for general equilibrium in housing markets, allowing house prices and rents to adjust based on local supply elasticities, while treating the owner-occupied and rental stocks as segmented markets that adjust in supply but cannot be costlessly converted into one another. Property tax revenues fund local public goods which residents value at a rate φ, which determines the strength of the capitalization channel by influencing the extent to which taxes are offset by benefits. We calibrate φ directly from our quasi-experimental capitalization evidence.

We include lock-in effects resulting from preferences as well as transaction costs. The preference drivers of housing lock-in include a precautionary savings motive, resulting from an incomplete markets environment with income risk. Additionally, households have a bequest motive, which increases housing demand. Households face capital gains taxes if they sell during their lifetime, but not if they bequeath the property at death (due to the step-up basis provision). These factors, along with the costs associated with moving, push up housing demand and house prices, constraining housing accessibility for younger households.

We focus on a model calibration for California, which has unusually low property taxes as a result of statewide mandates imposed by Proposition 13 (İmrohoroğlu et al. 2018; Ferreira 2010; Wasi and White 2005). Our model calibration matches numerous empirical moments related to homeownership, wealth, income, and the share of population LTV and PTI constrained across the lifecycle.

Our central policy counterfactual examines the effects of raising California's average property tax rate from its current 0.8% to 2%, matching the rate in Texas. This policy change has a slight negative impact on homeownership overall, but results in a large reallocation of housing across generations. Households under the age of 44 see increases in homeownership of 0.3 percentage points, or 0.6%. Households under 65 gain a larger share of the total owned housing stock overall. By contrast, older households, those above 65 see declines in homeownership of 6.2 percentage points, or 9.2%. This results in a welfare gradient where elderly welfare decreases relative to the welfare of younger households. The reallocation operates through financial constraints which impact households differentially across the life-cycle. The capitalization of property taxes into lower house prices loosens the LTV constraints facing young families, who have not yet built up wealth buffers, while higher ongoing tax obligations tighten the PTI burdens of elderly homeowners, pushing them to downsize. High-income and low-wealth households overall drive this increase in homeownership, consistent with the role of these two financial constraints.

We also examine another tax instrument which amplifies housing lock-in: the treatment of accrued capital gains at death. Under current law, the cost basis of inherited housing is stepped up to its market value when the owner dies, so the capital gains accrued over a lifetime can escape capital gains taxation entirely if the property is held until bequest. This provision creates a strong incentive for elderly households to retain housing they might otherwise sell, since this avoids a large capital gains realization. We find that removing the step-up provision and moving to deemed realization at death substantially lowers homeownership among the most elderly households, those above 75, by 11.8 percentage points (18.2 percent). Homeownership increases for younger households, those below 45, by 1.42 percentage points (3.1 percent). This suggests that a substantial share of elderly homeownership is sustained by the favorable tax treatment of bequests, and the step-up basis is an important force shaping homeownership across generations.

Our central finding, that higher property taxes reallocate ownership from older to younger households, is robust across a wide range of parameter shifts. Under inelastic housing supply, the capitalization effect is stronger, and the increase in young homeownership is larger, while under more elastic housing supply the reallocation towards the young weakens as the capitalization effect is smaller and the total housing stock shrinks. The inelastic housing supply case can also be interpreted as an implementation of a land value tax, which would tax existing buildings and structures while exempting new construction. A land value tax, accompanied by a higher rate, would therefore also shift housing allocations towards the young. The size of the public goods valuation parameter also determines the strength of the capitalization channel and the level of welfare, but our core results about reallocation across generations are robust to different values of this valuation parameter. Across specifications including varying financial constraints and the macroeconomic environment, such as increasing the loan-to-value limit, changing the minimum house size, varying house price growth trends, and changing the interest rate, our finding that welfare increases more for the young than the old in response to property tax increases is robust. The level of the young homeownership increase is sensitive to parameters that govern the size of the downpayment, including looser LTV limits and smaller house sizes, because the same price decrease due to capitalization provides less downpayment relief.

We also test a number of alternative policy counterfactuals. We remove capital gains taxes entirely and observe increases in ownership for 35–64 year-old households and decreases for the elderly. Restricting public goods transfers to younger households amplifies the gains by the young, consistent with their higher valuation of local amenities. We observe that assessment caps intended to mirror other institutional features of Proposition 13 also amplify elderly ownership of housing. When we add a second region (Texas) where households can migrate to, the capitalization effect is stronger and young homeownership increases more. Finally, we also observe similar generational reallocation benefits from policies which lower lock-in directly by reducing transactions costs.

Our paper relates to several strands of literature. First, we relate to a literature that has focused on various dimensions of homeownership. Seko et al. (2023) emphasizes housing utilization in the context of aging societies. Housing choices under misallocation have also been studied in the context of housing regulation (Glaeser and Luttmer 2003); lock-in due to negative equity and interest rates (Ferreira et al. 2010; Fonseca and Liu 2024); and lock-in due to preferences (Badarinza et al. 2024). We focus on property taxes as a mechanism for addressing possible housing mismatch. Posner and Weyl (2017) argue that housing misallocation results from a holdup problem and advocate self-assessed valuation and Harberger taxes to address housing lock-in. Housing mismatch arises in our framework through different lock-in mechanisms and can, therefore, be important even in fully liquid housing markets. We also build on a growing body of work that studies the implications of public policy for homeownership and housing choice (Attanasio et al. 2012; Chambers et al. 2009a; Floetotto et al. 2016; Chambers et al. 2009b). Closely related is work by Sommer and Sullivan (2018), who focus on the ownership implications of mortgage interest deductions. We differ by focusing on a local policy variable, which results in large spatial variation, and highlighting mechanisms which include both shifts in capitalization as well as changes in housing holding costs.

We are also closely linked to papers considering the role of property taxes generally. In the theoretical literature, public finance thought on property taxation has focused on its efficiency and distortionary effects. George (1884) argues that land taxes are efficient as they are non-distortionary, an idea generalized to urban settings with public goods by Arnott and Stiglitz (1979). Conversely, applying Diamond and Mirrlees (1971)'s production efficiency theorem to property taxation highlights its distortionary effect on housing improvements. This paper introduces a novel rationale for property taxes by treating homeownership as an endogenous state and showing how property taxes can mitigate housing lock-in.

Other research has explored empirical consequences of property taxes in practice. Several papers have highlighted biases or costs in the tax assessment process (Amornsiripanitch 2020; Avenancio-León and Howard 2022). Dray et al. (2023) explores the history of property taxes in the United States. The papers most closely related to ours document capitalization effects of property taxes on housing values (Jiang et al. 2024; Livy 2018; Høj et al. 2018; Giertz et al. 2021; Oliviero and Scognamiglio 2019; Lutz 2015; Elinder and Persson 2017; Hilber 2017; Chen et al. 2025) and effects of changes in property tax rates on migration (Fraenkel 2022; Giesecke and Mateen 2022). We develop a framework to map differing capitalization estimates into an underlying parameter of public goods valuation, and explore broader implications of the capitalization channel for household choices, such as homeownership and housing tenure. We directly contrast with other papers in this literature in Section 4.3. We also connect to work that has examined capital gains taxes and step-up basis in housing on turnover (Feldstein et al. 1980; Poterba and Weisbenner 2000; Cunningham and Engelhardt 2008; Shan 2011), and differ by investigating the ultimate effects on homeownership and housing allocation.

Our paper is also related to a broader literature on taxation. Closely related is work by Guvenen et al. (2023) and Aguiar et al. (2024), who contrast wealth and capital gains taxes. Our work differs in that it focuses on housing assets, which introduce novel lock-in motives that do not exist for financial assets. Housing is neither a negative externality itself nor a productive asset, generating a distinct motive for asset taxation. Kragh-Sørensen (2022) focuses on the distributional and transitional dynamics of property taxes, highlighting that optimal taxation would raise property taxes while lowering capital gains taxes. Dávila and Hébert (2023) argues for taxing dividends rather than corporate income in the presence of financial constraints at the firm level. Our framework, which focuses on the distributional consequences of high house prices, is also consistent with other work on the redistributive effects of asset price shocks, such as Fagereng et al. (2023).

Finally, our paper is also related to the literature on optimal capital taxation in lifecycle economies with uninsurable idiosyncratic risk (Conesa et al. 2009; Fehr and Kindermann

2015; Aiyagari 1995; Davila et al. 2012). We contribute to this literature by highlighting the importance of property taxes as a tool for redistributing housing wealth across generations.

2 Empirical Analysis

In this section, we present empirical results to support the basic assumptions and predictions of our structural model. We highlight descriptive facts about the allocation of housing across generations, and present quasi-experimental evidence on the causal impact of property taxes on house prices and housing allocation.

2.1 Data

We create a dataset to analyze individual-level variables in relation to the effective property tax rates corresponding to each observation. The individual-level data are drawn from the American Community Survey (ACS) 1-year public use microdata from 2016–2021. The most granular geography we use is the Public Use Microdata Area (PUMA). We draw homeownership, age, household size, and housing characteristics from the ACS.[1]

We also measure property tax assessments at the individual level using data from Verisk Marketing Solutions (formerly Infutor). Its tax assessment panel contains a yearly cross-section of tax lots in the U.S. from 2016–2021. Full sample selection details are in Appendix B. We connect tax assessment data on property tax paid to transaction prices for the same properties to create local estimates of effective property tax rates. County-level realized rates and amounts are shown in Figure A1 in the Appendix. We observe considerable variation in property tax rates both across and within states, and we exploit both sets of variation below.

2.2 Concentration of Homeownership among the Elderly

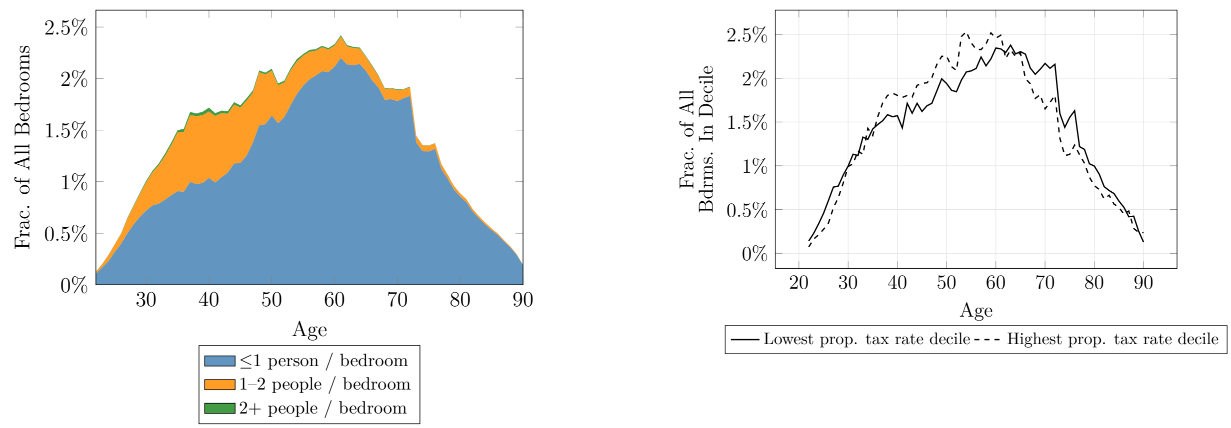
We begin by documenting a key stylized fact: housing stock ownership is heavily concentrated among older households. As shown in Panel A of Figure 1, the largest share of bedrooms in owner-occupied units is owned by people aged 50–70. This concentration of homeownership among elderly households creates heterogeneity in bedroom utilization across age groups. Panel A of Figure A2 shows that households aged 30–50 have the highest rates of housing

[1] We also connect this dataset to test score data to account for public goods such as school quality (from 2013, provided by Opportunity Insights using the Stanford Education Data Archive), housing supply elasticity (Baum-Snow and Han 2024), as well as distance to the nearest city center to account for urban character.

crowding, with the largest fraction living with more than one person per bedroom. In contrast, the 50–70 age group, which owns the largest share of bedrooms, tends to underutilize its housing space relative to younger households.

Figure 1: Housing Allocation Across the Life Cycle

Panel A: Bedroom Ownership Distribution *Panel B: Distribution by Property Tax Decile*



Notes: This figure measures housing ownership and crowding across the age distribution using ACS 1-year data from 2019 matched with PUMA-level property tax rates from Verisk sale records measured from 2017–2019. Panel A shows the fraction of all bedrooms in the U.S. owned by each age group. This is the weighted sum of all bedrooms in the microdata for each age group, divided by the weighted sum of all bedrooms in the sample. Within each age group, the fraction is bucketed by the number of people per bedroom, which is calculated by dividing the number of people in the household by the number of bedrooms. Panel B decomposes the distribution in Panel A and shows the top and bottom deciles of PUMA-level property tax rates, as drawn from the Verisk sales records.

We next examine how housing allocations vary between areas with different property tax rates. Higher property taxes are associated with shifts in the homeownership distribution toward more bedrooms and less crowding for those aged 25 to 40. Panel B of Figure 1 compares the distributions of bedrooms owned by age for the top and bottom deciles of PUMAs by property tax rate. In high-property tax PUMAs, more bedrooms are owned by younger age groups. Figure A2 Panel B shows the fraction of each age group with more than one person per bedroom. In PUMAs with higher property taxes, people aged 20–40 live in less crowded housing, and people aged 40–70 utilize each bedroom more.

2.3 Property Taxes and Capitalization

We focus on two mechanisms through which changes in property taxes could result in the reallocation of housing across age groups. Property taxes can be capitalized into housing prices, lowering downpayment constraints for households with low wealth (the capitalization effect). Property taxes also raise the flow cost of holding housing (a user cost channel).

To identify the capitalization effect, we use a quasi-experimental design based on the effects of mass reassessments of property taxes, which take place at predetermined intervals.

Local jurisdictions manage the property assessment process differently; we follow the empirical approach of Fraenkel (2022) and Giesecke and Mateen (2022) applied to North Carolina, where we can identify systematic reassessments that affect entire areas. Appendix B defines the sample selection in more detail, which isolates reassessment episodes that generate plausibly exogenous variation in property tax burdens. With these treatments in hand, we run the regression

$$Y_{it} = \alpha + \beta \cdot \text{Treat}_i \times \text{Post}_{it} + \gamma_i + \delta_t + \mathbf{X}_{\mathbf{it}}'\theta + \varepsilon_{\mathbf{it}} \tag{1}$$

where we compare outcomes Y, which include property tax amounts and sale prices, against an indicator for whether the area was in a treated jurisdiction after the property tax assessment cycle. We control for year and ZIP code fixed effects, as well as individual property controls. For outcomes related to property tax, we examine all property tax assessments and control for a property fixed effect. For outcomes on sale price, we include a control for the last sale price to mimic a repeat-sales approach.

Table 1: Quasi-Experimental Evidence on Capitalization

	Property Tax Amount			log(price)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post	87.7***	113.1***	101.6***	-0.011**	-0.010**	-0.012**
	(22.9)	(20.7)	(16.7)	(0.005)	(0.005)	(0.005)
log(Prev. Sale Amt.)				0.365***	0.364***	0.365***
				(0.011)	(0.012)	(0.011)
DiD Specification	TWFE	Stacked	Sun and Abraham	TWFE	Stacked	Sun and Abraham
Implied Disc. Rate				3.15%	4.43%	3.30%
Property FE	Y	Y	Y	N	N	N
Unit-Level Controls	N	N	N	Y	Y	Y
ZIP FE	N	N	N	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Clusters Level	ZIP	ZIP	ZIP	ZIP	ZIP	ZIP
Observations	376250	1365408	376250	92708	325454	92708

Notes: *p<0.1; **p<0.05; ***p<0.01. This table shows results from a quasi-experimental strategy on the impact of mass property tax reassessment on property tax amounts and house prices. The empirical design follows equation (1), and the sample design is discussed in Appendix B. For columns (1), (2), and (3), the dependent variable is the property tax amount. The sample includes assessments conducted 2 years before and after treatment for treated properties, as well as all years for the untreated properties. For columns (4), (5), and (6), the dependent variable is the log of the sale price of a property. Columns (1) and (4) run a standard two-way fixed effects specification, Columns (2) and (5) use a stacked DiD estimator following Cengiz et al. (2019), and Columns (3) and (6) use a saturated DiD estimator following Sun and Abraham (2021). Standard errors are clustered at the ZIP code level.

Our results, shown in Table 1, highlight large capitalization effects of property taxes on housing values. Our preferred specification is the stacked approach of Cengiz et al. (2019) shown in columns (2) and (5). The implied discount rate, comparing the future stream of property tax payments against the upfront reduction in property values, is 4.43% in this design. Event studies for this specification are shown in Figure A3. We also show robustness with respect to the standard TWFE approach and Sun and Abraham (2021).

To support a broader interpretation of these results, which are local to North Carolina and estimated in the short-run, we also show more descriptive data estimated across the whole country in Table A1. We regress the value of a house on a PUMA's property tax rate, controlling for a battery of controls based on the characteristics of the building and local area (including housing supply elasticities, test scores, and distance to the city center). In the specification with state fixed effects, a one percentage point increase in the property tax rate is associated with a 22% decrease in property value, indicating a substantial capitalization effect close to our estimates in North Carolina. Columns (3)–(4) analyze the impact of property tax rates on the price-to-rent ratio, to address the concern that areas with lower housing costs could adopt higher property tax rates to ensure a minimum level of government services.[2] Our theoretical user-cost model predicts that house prices should be lower relative to rents in areas with higher property tax rates, which is exactly what we observe. We also subset using only prices and rents from single-family homes in columns (5)–(6) to address the concern that owner-occupied and rental housing may serve different market segments and also find similar effects in this specification.[3] The additional R^2 contributions due to property taxes in Columns (3) and (5) show that at the cross-PUMA level, property tax rates account for 15% of the overall explained variation.[4]

We also examine how the strength of the capitalization effect depends on the local supply elasticity in Appendix Table A2. Especially when we focus on the variation in supply elasticities across states, we find considerably more evidence of capitalization in more inelastic environments (i.e., changes in housing demand can result in larger shifts in quantities rather than prices in more elastic areas). This channel is consistent with basic economic frameworks (such as DiPasquale and Wheaton (1992)) and suggests one reason why capitalization drawn from different settings may yield somewhat distinct estimates. For these reasons, we calibrate the precise magnitude of capitalization effects using local supply elasticities in Section 4.

[2]Because this specification relies on aggregate rent data, this estimation is run at the PUMA level, resulting in fewer observations.

[3]Appendix Table A3 also shows comparable capitalization estimates when focusing on the states of California and Texas, the key focus of our subsequent analysis.

[4]We provide additional cross-sectional evidence with binscatters of the regressions in columns (2) and (4) from Table A1 of the residualized dependent variables for property tax rates in Appendix Figure A6. Panel A shows the residualized binscatter for $\log(price)$ and Panel B for $\log\left(\frac{price}{rent}\right)$. Both show that higher property tax rates are associated with lower prices and price-to-rent ratios after much of the variation has been absorbed by other controls including state fixed effects.

2.4 Embedded Leverage Interpretation of Property Taxes

The trade-off between property taxes, which entail lower upfront costs in exchange for a higher ongoing stream of future property tax payments, suggests that property taxes can be viewed as a form of "embedded leverage." This is true in the sense that other leveraged products, such as mortgages, also lower up-front prices paid by equity-holders in exchange for promises of future payments. A natural question in this setting is what the implied interest rate is for the leverage entailed by property taxes. Our baseline capitalization estimates imply a discount rate of around 4.43%.[5] One way to think about this estimate is that households that can borrow at less than this rate generally dislike the role of property taxes, as they could lever the property themselves for a cheaper cost than the market-implied discount for property taxes overall. However, financially constrained households—those who borrow at a higher rate than this, or are entirely unable to borrow—may prefer properties with higher property tax streams.

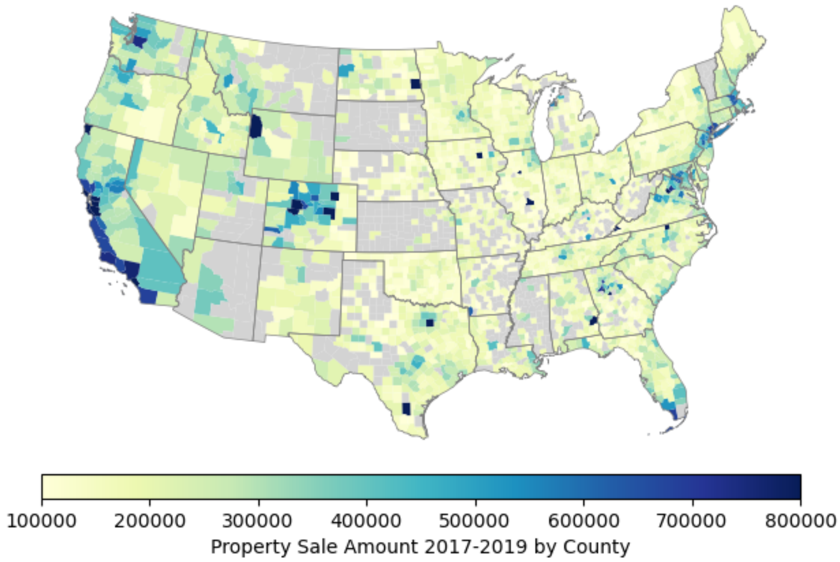
To further illustrate the significance of the capitalization force for our understanding of housing values, we show the impact of property taxes on housing value in Figure 2. Panel A of this figure shows the average house price across counties based on market transactions. However, a challenge in interpreting house prices drawn from market values is the drastically different stream of future property taxes faced by properties across the country. To provide a more consistent benchmark, we consider a counterfactual in which property taxes across the country are assumed to be zero. To derive new prices under that benchmark, we draw on our estimates of the capitalization effect as well as the cross-county variation in property tax rates.

The difference in house prices between the two figures can be thought of as precisely quantifying the embedded leverage in existing house prices. Appendix Table A4 highlights the empirical sale distribution in each state, along with our estimate of the hypothetical value under zero property taxes. Panel B in Figure 2 plots the implied leverage component directly. Several states conventionally regarded as cheap, such as Texas and Illinois, look considerably more expensive when taking into account the substantial property tax liabilities. Other states, such as California, remain expensive—but relatively not as expensive when incorporating low property tax liabilities. This distinction between high-tax Texas and low-tax California forms a key part of our subsequent analysis. Finally, other high-cost areas, such as those in the Northeast, are even more expensive when incorporating the value of the property tax liability stream. A population-weighted variance decomposition of county-level log prices and counterfactual log prices under a zero property tax regime shows that the

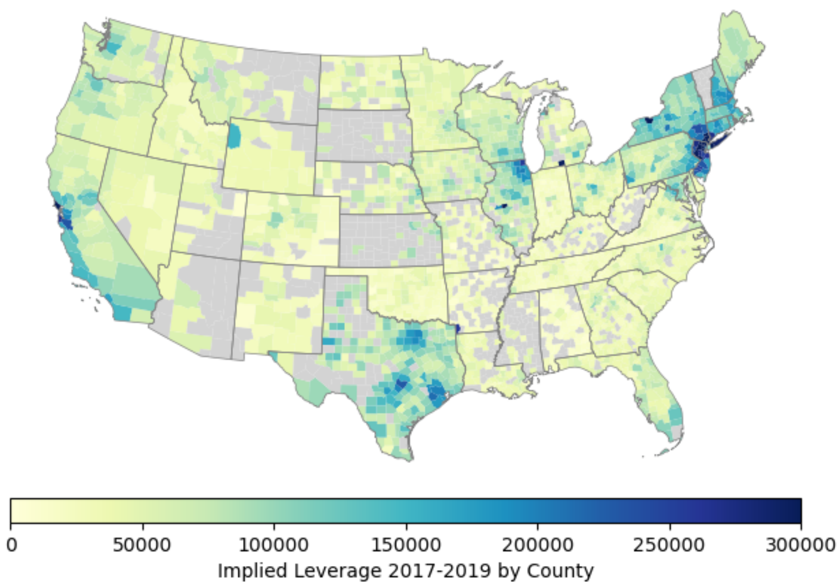
[5] When we estimate passthrough in levels, rather than logs, we get an estimate of 3.59% using our stacked estimator.

Figure 2: House Prices Under Property Taxes

Panel A: Empirical House Price Distribution



Panel B: Implied Leverage Due to Property Taxes



Notes: This figure shows the empirical house price distribution across counties in the United States (Panel A), as well as the difference between the imputed house price distribution under a zero-property tax hypothetical and the current distribution (Panel B). The empirical distribution is taken as the average house sale price from 2017–2019 in housing transaction deeds records from Verisk. To produce the counterfactual prices with zero property tax, we calculate $\widehat{\text{Price}}^{\text{no tax}} = \exp(\hat{\beta} \cdot (-\text{PropTaxRate})) \cdot$ Price where $\hat{\beta}$ is the capitalization coefficient of log price on the property tax rate from the implied relationship between prices and property taxes from our stacked difference-in-differences specification in Table 1 columns (2) and (5). Counties with missing data are shown in light gray. Appendix Table A4 shows the averages at the state level.

zero property tax prices have 8.8% lower variance than county prices as observed, which is another measure of how much property taxes matter for price dispersion.

2.5 Demographic Implications of Property Taxes

How do households trade off the implications of property taxes as an additional leverage component? Differences in income and wealth by age could result in differential preferences for distinct property tax liabilities. Panel A in Appendix Figure A4 shows the income distribution by age in our sample, and Panel B shows the interest, dividend, and rental income by age, which we use to highlight the wealth distribution. Income peaks in the 40s–50s, while capital income is increasing with age. These statistics illustrate a mismatch in income streams, indicating a potential role for financial constraints: many households have the flow labor income to pay for a mortgage before they have the capitalized stream of capital income (wealth) to afford the down payment on a house, even a starter house.

We examine the demographic implications of higher property taxes with a long differences estimator using the Census ACS Public Microdata Sample, which has full geographic coverage and detailed demographic information. We examine the 5-year differences in demographics with the differences in property tax amounts within PUMA, from 2016–2021:

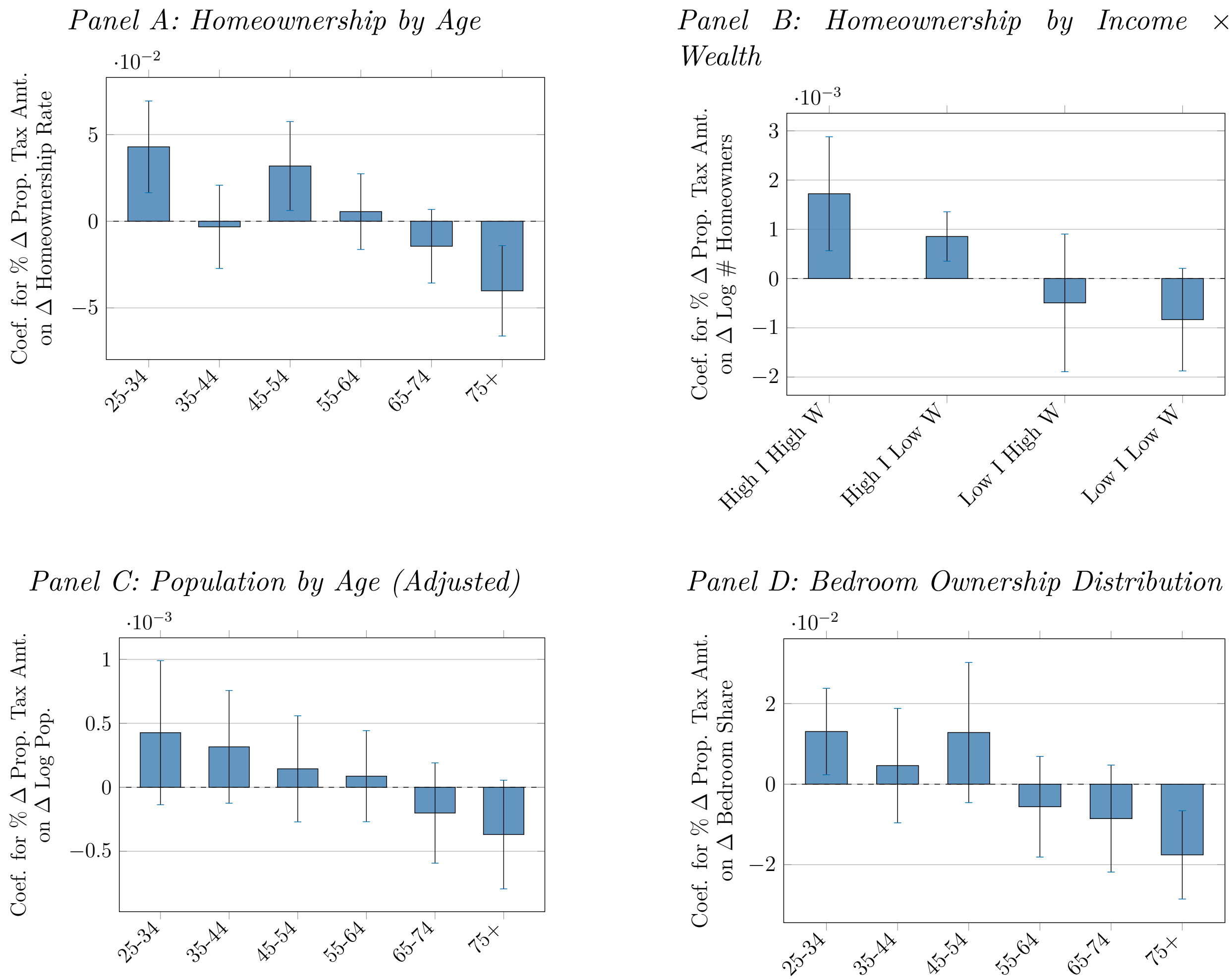
$$\Delta^5 Y_p^{(a)} = \beta^{(a)}\,\Delta^5\%\text{Tax}_p + \mu^{(a)}_{s(p)\times q(p)} + \gamma_1^{(a)}\,\text{HomeownRate}_p^0 + \gamma_2^{(a)}\,\text{Share65}_p^0 + \varepsilon_p^{(a)}, \quad (2)$$

where $\Delta^5 Y_p^{(a)}$ is the change in homeownership measured at the PUMA (p) level for age group (a). $\Delta^5\%\text{Tax}_p$ is the 5-year percentage change in a PUMA's property tax amount, hedonically adjusted for the fact that we observe a repeated cross-section with different characteristics, $\mu^{(a)}_{s(p)\times q(p)}$ are state by home price value quintile fixed effects interacted with age group, and HomeownRate_p^0 and Share65_p^0 are PUMA level homeownership rates and share of population 65 years or older in the pre-period. The long difference absorbs static PUMA-level differences, and the fixed effects and controls, interacted with age group dummy variables, absorb time-varying trends in demographics for each age group.

We show the resulting estimates in Figure 3. The coefficients in Panel A, which examines the effect of changes in property tax on the homeownership rate by age group, imply that a doubling of the property tax amount (a 100% increase) leads to an increase in the homeownership rate in the 25–34 cohort of 4.3 percentage points and an increase for the 45–54 cohort of 3.2 percentage points. By contrast, the oldest group has a decrease in homeownership of 4 percentage points.

We also find evidence that the increase in homeownership in high-property tax areas is concentrated among the set of financially constrained households. We partition the population into quadrants based on above or below median interest, dividend, and rental income

Figure 3: Property Tax Changes and Demographic Outcomes



Notes: This figure shows demographic-specific coefficients for 5-year changes in property taxes on 5-year changes in homeownership at the Census Public Use Microdata Area (PUMA) level, estimated from Equation (2): $\Delta^5 Y_p^{(a)} = \beta^{(a)}\,\Delta^5\%\text{Tax}_p + \mu^{(a)}_{s(p)\times q(p)} + \gamma_1^{(a)}\,\text{HomeownRate}_p^0 + \gamma_2^{(a)}\,\text{Share65}_p^0 + \varepsilon_p^{(a)}$. For Panels A, C, and D, the coefficients are age-group specific. For Panel B, the coefficients are Income × Wealth quadrant specific. High income ("High I") or wealth ("High W") corresponds to the individual having above median yearly household income or above median interest/dividend/rental income, which is our wealth proxy from the Census data. Low income or wealth is below median. Panel A shows the coefficients for the percentage change in property tax amount on the change in the homeownership rate in a PUMA. Panel B shows the coefficients for the percentage change in property tax amount on the change in log(number of homeowners) in a PUMA. Panel C shows the coefficients for the percentage change in property tax amount on the change in age-adjusted log(*population*) to isolate the aggregated effect of migration. The age adjustment takes the 2016 population in each PUMA, ages it forward 5 years assuming no mortality, and our dependent variable is then the 2021 population numbers for each age group in a PUMA minus the 2016 aged forward numbers. Panel D shows the coefficients for the percentage change in property tax amount on the change in the share of owner-occupied bedrooms in a PUMA that a given age group owns. All specifications are 5-year differences at the PUMA level, with state by property-value-quintile by demographic-group fixed effects, demographic-group specific coefficients, and controls for the PUMA's homeownership rate and share of population 65 or older to control for time-varying trends. Data for all panels come from the Census American Community Survey Public Use Microdata Sample from 2016–2021.

($0 in our sample), and above or below median income ($62,400 in our sample). We regress the change in the log of the number of homeowners in each income–wealth quadrant on the change in the property tax amount and show the estimates in Panel B. Estimated coefficients imply that for a doubling of property tax amounts, the number of high-income and high-wealth homeowners increases by 18.8%, and the number of high-income low-wealth homeowners increases by 8.9%. These estimates are sizable in magnitude and statistically significant. We also find that areas with higher property taxes see shifts in population towards younger households in a monotone fashion in Panel C.

Another margin of response to property taxes is downsizing: whether individuals who face property tax shocks readjust their housing consumption. Because the Census dataset is a repeated cross-section, we analyze the difference in aggregates rather than at the individual level. We examine how the share of total bedrooms owned by each age group changes with property tax amount changes. This aggregates individual downsizing and moving decisions to give a sense of a five-year change in the number of bedrooms owned by age with respect to property tax changes. Panel D shows the same regressions but for the share of all bedrooms owned by an age group out of the bedrooms owned by owner-occupants. For the 45–54 cohort, a doubling of the property tax implies an increase in the share of bedrooms owned of 1.3 percentage points, and for the 75 and older cohort a decrease of 1.8 percentage points. We observe similar associations when examining the raw cross-sectional relationship between property taxes and these demographic and housing outcomes in Appendix Table A5.

We additionally examine downsizing with the Verisk data in our quasi-experimental setup in North Carolina:

$$\Delta \log(\text{LandSqft})_{it} = \beta^{(a)} \left(\text{TreatedEver}_i \times \text{Post}_t\right) + \mathbf{X}'_{it}\boldsymbol{\gamma}^{(a)} + \alpha^{(a)}_{\text{ZIP}} + \delta^{(a)}_t + \varepsilon^{(a)}_{it}, \ \text{Moved}_{it} = 1. \quad (3)$$

We find evidence of downsizing for the elderly, relative to the young, among movers after a reassessment shock, as shown in Appendix Figure A7. Conditional on moving, younger households respond to property tax assessments by moving to 18% larger lots, while older households downsize to 17% smaller parcels of land.

3 Model

We begin with a simplified two-period model to illustrate how property taxes can affect the housing allocation across generations through their capitalization into prices and their interaction with financial constraints.

3.1 Main Mechanism in a General Equilibrium Model

Environment In this section, all choice variables without time subscripts are detrended versions of time-dependent variables and are expressed in stationary units. Time is discrete and runs forever, $t = 0, 1, 2, \dots$ A new cohort of young households is born each period and lives for two periods. Households receive labor income Y when young and no labor income when old. There is a single non-depreciating asset, housing, which is perfectly divisible and provided in fixed supply normalized to $\bar{H}$. Households have access to a risk-free savings technology yielding a gross return $\mathcal{R} > 1$ per period.

Preferences Households maximize lifetime utility

$$\log C + \beta \log C', \tag{4}$$

where C is consumption when cohorts are young, and C' is consumption when they are old. $\beta \in (0, 1)$ is the discount factor. We do not include housing in the utility function and instead focus on the role of housing as an asset and a source of public good benefits.[6]

Property taxes and public goods Households are subject to a property tax rate $\tau \in [0, 1)$ on the value of their housing. This raises tax revenues which fund local public goods. Public good benefits are part of a dividend $D(\tau)$ received by homeowners:

$$D(\tau) = \bar{D} + \varphi\, \tau\, P, \tag{5}$$

where $\bar{D} > 0$ represents the baseline dividend from housing (i.e., imputed rent net of maintenance), φ is the efficiency of public goods provision (assumed to be greater than zero), and P is the house price. Homeowners receive $D(\tau) - \tau P = \bar{D} + (\varphi - 1)\tau P$. When $\varphi < 1$, each dollar of tax revenue produces less than one dollar of public good value. This may reflect deadweight loss or lower valuation of public goods.

Budget constraints Young households are born at time t, receive income Y, purchase housing H at a price P_t, save $K_{t+1} \geq 0$ in capital, and can borrow $B_t \geq 0$:

$$C_t + P_t\, H + K_{t+1} = Y + B_t. \tag{6}$$

When the household is old (at time $t + 1$), the household sells its housing, collects the net dividend, earns returns on capital, and repays debt with interest at the same gross rate $\mathcal{R} = 1 + r$:

$$C'_t = \left[\bar{D} + (\varphi - 1)\tau P_{t+1}\right]\, H + P_{t+1}\, H + \mathcal{R}\, K_{t+1} - \mathcal{R}\, B_t. \tag{7}$$

[6]However, introducing housing services in utility (e.g., $\log C + \eta \log h + \beta[\log C' + \eta \log h']$) does not change the qualitative results. The key channel in our framework operates through the budget and borrowing constraints.

Collateral constraint Household borrowing is limited by the value of housing collateral:

$$B_t \leq \lambda\, P_t\, H, \quad \lambda \in [0,1]. \tag{8}$$

The parameter λ governs leverage and $1-\lambda$ is the required downpayment ratio. This constraint captures a central friction in our quantitative model.

Housing market clearing In each period, the young purchase all of the housing from the elderly. Since housing is provided in fixed supply, the market clearing condition is:

$$H_t^{\text{young}} + H_t^{\text{old}} = \bar{H}. \tag{9}$$

Since the old sell all their housing to consume in their final period, in equilibrium we have $H_t^{\text{young}} = \bar{H}$.

No arbitrage condition A no-arbitrage condition equates the return on housing to the return on capital. Holding one unit of housing purchased at P_t yields, at $t+1$, the resale value P_{t+1} plus the net dividend $\bar{D} + (\varphi - 1)\tau P_{t+1}$. No-arbitrage requires:

$$\frac{P_{t+1} + \bar{D} + (\varphi - 1)\tau P_{t+1}}{P_t} = \mathcal{R}. \tag{10}$$

Effect of property taxes on house prices The following lemma collects the sign of this capitalization effect, its semi-elasticity form in an economy with trend price growth, and the resulting identification of the public-goods valuation φ, as in Brueckner (1982).

Lemma 1 (Capitalization and identification of φ)**.** *Consider a balanced-growth path along which house prices grow at rate $\gamma \geq 0$, $P_{t+1} = (1+\gamma)P_t$, with $\mathcal{R} - 1 > \gamma$. The no-arbitrage condition (10) then implies*

$$P(\tau) = \frac{\bar{D}}{\mathcal{R} - (1+\gamma)\big[1 + (\varphi - 1)\tau\big]}, \tag{11}$$

which is well defined whenever the denominator is positive. Then:

(i) Sign of capitalization. $\operatorname{sign}\!\big(dP/d\tau\big) = \operatorname{sign}(\varphi - 1)$*: higher property taxes reduce house prices when public goods are valued below cost ($\varphi < 1$), leave them unchanged when the property tax is a fair fee for services ($\varphi = 1$), and raise them when public goods are valued above cost ($\varphi > 1$).*

(ii) Semi-elasticity. *The capitalization semi-elasticity, the object recovered by reduced-form capitalization studies, is*

$$\varepsilon \;\equiv\; \frac{d\log P}{d\tau} \;=\; -\,\frac{(1+\gamma)(1-\varphi)}{\bar{D}/P}. \tag{12}$$

(iii) Identification of φ. *Inverting* (12)*, the valuation parameter is recovered from the semi-elasticity and the observable net dividend yield* $\bar{D}/P$ *as*

$$\varphi \;=\; 1+\frac{\varepsilon}{1+\gamma}\cdot\frac{\bar{D}}{P}. \tag{13}$$

The proof is presented in Appendix A1. Part (i) of Lemma 1 shows that whether prices fall with the property tax is governed by the efficiency of public goods provision, as in Brueckner (1982). In the empirically relevant case where households value the public goods funded by property taxes at less than their cost ($\varphi < 1$), higher property taxes reduce house prices. The two boundary cases are intuitive: when public goods are valued at cost ($\varphi = 1$), the tax is a fair fee for services and prices are unaffected, and when they are valued above cost ($\varphi > 1$), higher taxes raise prices. Part (ii) summarizes the strength of this response by the semi-elasticity ε and shows that capitalization is stronger the lower is φ: the more lightly households value the public goods, the more a tax increase operates as a pure carrying cost that is priced out of the house, so $|\varepsilon|$ increases as φ falls,[7] vanishing at $\varphi = 1$.

Part (iii) allows us to discipline φ directly from the data: given an estimated semi-elasticity ε and the observed net dividend yield $\bar{D}/P$, equation (13) pins down the public-goods valuation exactly, with no linearization around $\tau = 0$, provided $\bar{D}/P$ is measured at the observed τ and γ. We implement this mapping when calibrating the quantitative model: applying (13) at the calibrated California house-price trend of $\gamma = 4.21\%$ (Section 4), Table A6 reports the implied φ for our own capitalization estimates and for estimates from the literature, across alternative values of $\bar{D}/P$. In what follows, we focus on the empirically relevant case $\varphi < 1$.

Welfare effects across generations We now characterize how a small change $d\tau$ in the property tax rate affects welfare for different generations in the steady state ($P_t = P$) of our OLG economy with $\gamma = 0$ for simplicity.

Proposition 2 (Intergenerational redistribution)**.** *Consider the steady state of the two-period OLG economy with* $\varphi < 1$*. A marginal increase in the property tax rate has the following welfare effects:*

(i) (The old generation loses.) *The old hold housing* $\bar{H}$ *from the previous period with*

[7] Although the semi-elasticity in (12) depends on the endogenous equilibrium price P, substituting the closed-form price (11) expresses it purely in primitives: $\varepsilon(\varphi) = -\frac{(1+\gamma)(1-\varphi)}{r-\gamma+(1+\gamma)(1-\varphi)\tau}$, with $r \equiv \mathcal{R} - 1$. Differentiating directly, the $(1+\gamma)(1-\varphi)\tau$ terms cancel in the numerator, leaving $\frac{d\varepsilon}{d\varphi} = \frac{(1+\gamma)(r-\gamma)}{\left[r-\gamma+(1+\gamma)(1-\varphi)\tau\right]^2} > 0$, whose sign depends only on $r > \gamma$. Hence ε is strictly increasing in φ and the strength of capitalization $|\varepsilon|$ is strictly decreasing in φ.

predetermined savings and debt. Their welfare changes by

$$\frac{dV_{\text{old}}}{d\tau} = \frac{\mathcal{R}}{C'}\frac{dP}{d\tau}\bar{H} < 0, \tag{14}$$

where the factor $\mathcal{R}$ reflects that a change in τ affects the old both through the resale price and through the net dividend $\bar{D} + (\varphi - 1)\tau P$ they receive while holding the house.

(ii) (Young collaterally constrained households win.) *When the collateral constraint binds, the welfare change decomposes as*

$$\frac{dV_{\text{young}}}{d\tau} = \underbrace{-\frac{1-\lambda}{C}\frac{dP}{d\tau}\bar{H}}_{\substack{>0\text{: down payment}\\ \text{relief when young}}} + \underbrace{\frac{\beta\mathcal{R}(1-\lambda)}{C'}\frac{dP}{d\tau}\bar{H}}_{\substack{<0\text{: lower housing}\\ \text{value when old}}}. \tag{15}$$

The young benefit on net whenever

$$\frac{\beta C}{C'} < \frac{1}{\mathcal{R}}, \tag{16}$$

which corresponds to the condition for the collateral constraint to bind.

The proof is presented in Appendix A2. The decomposition of the welfare effects of property taxes in (15) highlights two channels that are of opposite sign when $\varphi < 1$. The first channel, captured by the positive first term, is downpayment relief when young. Lower house prices reduce the out-of-pocket cost of housing of $(1-\lambda)P\bar{H}$ by $(1-\lambda)|dP/d\tau|\bar{H}$. This is the "embedded leverage" effect, where property taxes relax collateral constraints by reducing house prices and therefore reducing down payments. The second channel, captured by the negative second term, is a lower housing value when old, since the young will eventually sell their housing and collect the net dividend at depressed prices. Here the factor $\mathcal{R}(1-\lambda)$ nets two forces: the full return-adjusted capital loss ($\mathcal{R} \cdot dP/d\tau$, the same loss the old bear) against the reduced debt repayment ($-\mathcal{R}\lambda \cdot dP/d\tau > 0$), which works in the young's favor because they borrowed less at the lower price and repay with interest.

The sufficient condition (16) implies that the young benefit whenever the collateral constraint binds, since then the marginal value of relaxing the downpayment requirement (valued at the high marginal utility $1/C$ when young) exceeds the discounted cost of lower future housing wealth (valued at the lower marginal utility β/C' when old with higher consumption). Equation (14) states that the old unambiguously lose from a property tax increase. Property taxes therefore redistribute from old homeowners to young, financially constrained buyers through the capitalization channel.

A Numerical Illustration To fix ideas, consider a baseline calibration with $r = 0.05$, $\bar{D} = 0.05$, $\tau = 0.01$, $\varphi = 0.5$, $\gamma = 0$, and $\lambda = 0.8$ (a 20% down payment). At these values the steady-state house price is $P = \frac{0.05}{0.05+0.005} = 0.909$, and the price responds sharply to taxation: the semi-elasticity is $\frac{d\log P}{d\tau} = \frac{(1+\gamma)(\varphi-1)}{\mathcal{R}-1-(\varphi-1)\tau} = -\frac{0.5}{0.055} = -9.1$, so a one percentage point increase in the property tax lowers prices by roughly 9%. This price decline lowers the downpayment constraint. With $\lambda = 0.8$, for a constrained household, the same one percentage point increase reduces the required down payment by $(1-\lambda) \times 9\% = 1.8\%$ of the original house price.

3.2 Setup

To build on the core mechanism in Section 3.1, we augment the model along the following dimensions, which we describe in detail below. First, we introduce a rental market and empirically relevant adjustment costs, which allow us to quantify the impact of property taxes on housing allocations across different age groups.

Second, we allow for a much richer income process, which produces a precautionary savings motive—one of the main drivers of lock-in effects in the model. We also include other lock-in components, such as bequest motives for the elderly (which can be achieved by accumulating housing assets), and transaction costs.

Finally, housing markets are determined in general equilibrium through the interaction of housing demand and supply in the segmented owner-occupied and rental markets. Each market features an isoelastic supply curve and clears at the prevailing price.

3.3 Model Framework

Economic Environment The economy consists of overlapping generations of households that live for a maximum of J periods. Households work for J_y periods and then retire for J_o periods, so that $J = J_y + J_o$. In each period, households choose their housing tenure—renting or owning—denoted by $S \in \{R, O\}$, as well as their desired housing quantity.

Preferences Households derive utility from non-durable consumption C and housing consumption H according to a standard Cobb-Douglas utility function. Ownership decisions directly affect utility through an ownership premium. The period utility function is:

$$U^S(C,H) = \frac{1}{1-\sigma}\left(C^\alpha H^{1-\alpha}\right)^{1-\sigma} + \mathbb{1}_{\{S=O\}}\Xi^O, \tag{17}$$

where α is the preference weight for non-durable consumption relative to housing, σ is the coefficient of relative risk aversion, and Ξ^O captures additional utility benefits from homeownership (e.g., customization, stability, pride of ownership).

Bequest Motives A key driver of housing demand is the desire to leave bequests. Households face an age-specific probability of death $1 - p(j)$ in each period. Upon death, their utility depends on the bequests they leave, which are a function of total wealth:

$$B(W') = \Psi \frac{1}{1-\sigma}(W')^{1-\sigma}, \tag{18}$$

where Ψ is the intensity of the bequest motive and W' is total wealth at the time of death (defined formally below). This generates an incentive for households to accumulate wealth, including housing wealth, particularly as they age.

Financial Markets. Households have access to a risk-free asset that accumulates interest at rate r. Additionally, they can purchase housing, which provides a stream of housing consumption (also accessible through renting), depreciates each period at rate δ, carries a user cost in the form of annual property taxes τ, and is subject to a capital gains tax τ_k upon sale while the agent is alive. Bequests are untaxed, following the step-up basis provision.

If households purchase a home, they can finance it with a mortgage at interest rate r. Mortgage origination is subject to a loan-to-value (LTV) constraint θ_{LTV} and a payment-to-income (PTI) constraint θ_{PTI}. To evaluate the PTI constraint, we use an amortization rate a to compute implied payments at origination. After purchase, households are not subject to any constraints on the pace of mortgage repayment.

Housing Market The house price P is subject to aggregate trends. Homeowners face a minimum house size constraint $\underline{H}$, reflecting the indivisible nature of housing and the fact that very small housing units may not be available for purchase. This requirement amplifies the role of the down payment constraint in ensuring that households must accumulate sufficient resources to purchase the smallest available house. Renters face no such constraint and can choose arbitrary housing quantities.

Housing markets are determined in general equilibrium through the interaction of housing demand and supply in the segmented owner-occupied and rental markets.

Each market features an isoelastic supply curve and clears at the prevailing price. For owner-occupied housing,

$$H_O^{\text{supply}} = c_O \cdot P^\rho, \qquad H_O^{\text{demand}} = H_O^{\text{supply}}, \tag{19}$$

while the rental market takes the identical form in the rental price R,

$$H_R^{\text{supply}} = c_R \cdot R^\rho, \qquad H_R^{\text{demand}} = H_R^{\text{supply}}, \tag{20}$$

where c_O and c_R are the owner-occupied and rental housing supply shifters, respectively, and ρ is the supply elasticity, common to both markets.

Each house sale incurs transaction costs equal to a fraction F of the house value, creating an additional source of lock-in.

Income Process During working years, household income follows a stochastic process that generates income uncertainty and precautionary saving:

$$Y = \exp\big(\mu + \chi(j) + z\big), \tag{21}$$

where $\chi(j)$ represents the deterministic age-income, μ is an income shifter, and $z = \rho_z z_{-1} + \varepsilon$ is a persistent AR(1) process with autocorrelation ρ_z and innovation ε, which has standard deviation σ_z. Income is subject to labor taxes. We use a tax function based on Bénabou (2002) and Heathcote et al. (2017):

$$T_\ell(y) = y - \lambda_T y^{1-\phi_T} + \Delta y, \tag{22}$$

where λ_T and ϕ_T govern the level and progressivity of the U.S. income tax schedule, respectively, and Δ captures the state-specific income tax difference. When calibrating for California, state-specific income tax rates enter through the calibrated value of Δ.[8] After retirement, households receive pension payments that we specify following Guvenen and Smith (2014), ensuring realistic replacement rates and income profiles for elderly households.

Aggregate Trends In a stationary environment, house prices would be constant each period, generating zero capital gains against which capital gains taxes would apply. To generate a balanced growth path producing nominal gains in housing investment, we allow for a consistent growth rate γ applied to income and house prices over time. All choice variables (income, house prices, assets and rents, etc.) are normalized by $(1+\gamma)^t$ so that the model is solved in stationary form. We also allow for these trends to vary by state.

3.4 Household Decision Problem

State Variables and Choice Set Let $s = (A, H, Y, j, d)$ denote the household's state vector, where A represents liquid assets (including mortgage debt when negative), H is the current housing stock ($H = 0$ for renters), Y is current income, j is age, and d is the number of consecutive periods the household has lived in an owner-occupied home ($d = 0$ for renters).

In each period, households choose from the set

$$\mathcal{C} = \big\{\textit{adjust},\ \textit{noadjust},\ \textit{rent}\big\}, \tag{23}$$

where *adjust* means purchasing a (new) home, *noadjust* means remaining in the current home (available only to current homeowners), and *rent* means renting.

[8] California levies a progressive state income tax with a top marginal rate exceeding 13%, while Texas has no state income tax. These differences are captured by separate calibrations of the income tax adjustment.

Value Function The household's problem incorporates idiosyncratic taste shocks that create smooth choice probabilities and realistic tenure transitions. The value function is:

$$V(s, \varepsilon) = \max_{k \in \mathcal{C}} V^k(s) + \varepsilon^k, \tag{24}$$

where ε^k are i.i.d. Type 1 Extreme Value distributed taste shocks with location parameter zero and scale parameter 1.

Household Wealth Total wealth entering the bequest function is defined as:

$$W' = \begin{cases} (1+r)A' + (1-\delta-\tau)PH' & \text{if the household owns housing } (H' > 0), \\ (1+r)A' & \text{if the household rents } (H' = 0). \end{cases} \tag{25}$$

Adjusting Homeowners Households that purchase a new home (either first-time buyers or those trading to a different house) solve:

$$V^{adjust}(s) = \max_{C, A', H'} U^O(C, H') + \beta\big[p(j)\,\mathbb{E}\big[V(s', \varepsilon)\big] + \big(1 - p(j)\big)B(W')\big], \tag{26}$$

$$\begin{aligned} \text{s.t.} \quad A' + PH' + C &= (1+r)A + Y - T(Y) + T^L + T^L_k \\ &\quad + \mathbb{1}_{\{H>0\}}\big[(1-F)(1-\delta)PH - \tau PH - \tau_k\big(1 - (1+\gamma)^{-d}\big)PH\big], \\ A' &\geq -(1-\theta_{LTV})PH', \\ (r+a)(-A')^+ + \tau PH' &\leq \theta_{PTI}\,Y, \\ H' &\geq \underline{H}, \\ W' &= (1+r)A' + (1-\delta-\tau)PH', \\ s' &= (A', H', Y', j+1, 1). \end{aligned}$$

The budget constraint on the right-hand side includes proceeds from selling the previous home (if any), net of transaction costs F, depreciation δ, accumulated property taxes τ, and capital gains taxes τ_k on the unrealized gain $(1-(1+\gamma)^{-d})PH$. The indicator $\mathbb{1}_{\{H>0\}}$ makes explicit that these terms apply only to households that currently own housing; a previous renter has no housing to sell. The transfers T^L and T^L_k are lump-sum rebates of property tax and capital gains tax revenue, respectively.

Non-Adjusting Homeowners Households that remain in their current home solve:

$$V^{noadjust}(s) = \max_{C, A'} U^O(C, H) + \beta\big[p(j)\,\mathbb{E}\big[V(s', \varepsilon)\big] + \big(1 - p(j)\big)B(W')\big], \tag{27}$$

$$\begin{aligned} \text{s.t.} \quad A' + C &= (1+r)A + Y - T(Y) + T^L + T^L_k - (\delta+\tau)PH, \\ A' &\geq -(1-\theta_{LTV})PH, \\ W' &= (1+r)A' + (1-\delta-\tau)PH, \\ s' &= (A', H, Y', j+1, d+1). \end{aligned}$$

Renters Households that rent solve:

$$V^{rent}(s) = \max_{C,A',H_R} U^R(C,H_R) + \beta\big[p(j)\,\mathbb{E}\big[V(s',\varepsilon)\big] + \big(1-p(j)\big)B(W')\big], \quad (28)$$

$$\begin{aligned}
\text{s.t.} \quad A' + C + R\,H_R &= (1+r)A + Y - T(Y) + T^L + T^L_k \\
&\quad + \mathbb{1}_{\{H>0\}}\big[(1-F)(1-\delta)PH - \tau PH - \tau_k\big(1-(1+\gamma)^{-d}\big)PH\big], \\
A' &\geq 0, \\
W' &= (1+r)A', \\
s' &= (A', 0, Y', j+1, 0).
\end{aligned}$$

Here, H_R denotes the household's current-period rental housing choice and does not get carried into the next-period state. A household renting in the previous period has $H = 0$ and $d = 0$, so any terms related to sale vanish from the budget constraint. A household transitioning from owning to renting ($H > 0$) receives sale proceeds, net of transaction costs and taxes, as in the problem for an adjuster.

Households decide each period whether to purchase a new house (*adjust*), remain in their current home (*noadjust*), or rent (*rent*). These decisions are influenced by the taste shocks ε^k, which represent unobserved idiosyncratic preferences over tenure status.

Importantly, the household's problem is subject to three financial constraints. First, a down payment constraint requires that purchasers have sufficient assets to provide a down payment at origination. Second, a payment-to-income constraint ensures sufficient cash flow to cover mortgage payments and property taxes. Third, a minimum housing requirement $\underline{H}$ ensures that the down payment constraint is binding, limiting the household's ability to circumvent it by purchasing very low-cost housing.

Government Budget Constraint Let Λ be the stationary distribution of households over the state space $s = (A, H, Y, j, d)$. The government rebates property and capital gains tax revenues to residents as equal lump-sum transfers T^L and T^L_k, respectively. The balanced-budget conditions are:

$$T^L = P\int_{\mathcal{S}} \varphi\tau H(s)\,d\Lambda(s), \quad (29)$$

$$T^L_k = P\int_{\mathcal{S}} \tau_k\big(1-(1+\gamma)^{-d}\big)H(s)\left[\pi^{adjust}(s) + \pi^{rent}(s)\right]d\Lambda(s). \quad (30)$$

3.5 Equilibrium Definition

Definition 3 (Stationary Recursive Competitive Equilibrium). *A stationary recursive competitive equilibrium is a collection of:*

1. Prices*: house price P and corresponding rent R;*

2. Value functions: $V(s, \varepsilon)$ *and option-specific values* $V^{adjust}(s)$, $V^{noadjust}(s)$, $V^{rent}(s)$;

3. Policy rules:

$$\Big\{C(s),\ A'(s),\ H'(s),\ H_R(s),\ k(s)\Big\},$$

together with the associated discrete-choice probabilities $\pi^{adjust}(s)$, $\pi^{noadjust}(s)$, *and* $\pi^{rent}(s)$;[9]

4. Stationary distribution: $\Lambda(s)$ *over the household state space* $s = (A, H, Y, j, d)$.

These objects satisfy:

1. ***Household optimization.*** *For every state* s *and taste-shock vector* ε, *the policy rules maximize the right-hand side of* (24) *subject to the budget and borrowing constraints in* (26)–(28).

2. ***Stationarity.*** *The distribution* Λ *is invariant under the induced transition operator* $\mathcal{T}$:

$$\Lambda = \mathcal{T}\big(\Lambda, P, R, policies\big).$$

3. ***Market clearing.***

$$H_O^{demand}(\Lambda) = H_O^{supply}(P) = c_O\, P^{\rho}, \tag{31}$$

$$H_R^{demand}(\Lambda) = H_R^{supply}(R) = c_R\, R^{\rho}. \tag{32}$$

4 Calibration

In this section, we describe how we calibrate our OLG model to match key features of the housing market and household behavior in California. Because of the passage of Proposition 13, California has low effective property tax rates on average, especially for households with longer housing tenures. We account for the low average property tax rates in our baseline model and consider tax assessment caps in a robustness exercise. Our calibration strategy combines externally set parameters from the literature with internally calibrated parameters chosen to match specific empirical targets. Calibration targets are shown in Table 2. We then validate the model's performance by examining how well it reproduces observed patterns in homeownership and other variables across age.

Table 2: Calibration

Parameter	Description	Value	Source/Target
		External	
σ	Relative risk aversion	2.000	Standard value
r	Interest rate	0.024	See text
δ	Depreciation rate	0.022	See text
θ_{LTV}	1 - LTV limit	0.200	See text
θ_{PTI}	PTI limit	0.360	Greenwald (2018)
a	Mortgage amortization rate	0.017	Greenwald et al. (2021)
F	Transaction cost selling	0.050	Díaz and Luengo-Prado (2010)
ρ_z	Autocorrelation income	0.910	Floden and Lindé (2001)
σ_z	Standard deviation income	0.210	Floden and Lindé (2001)
γ	House price trend California	0.042	FHFA state HPI, 1991–2025
$\underline{H}$	Minimum house size	1.000	See text
β	Discount factor	0.950	See text
P	House price California ($100k)	5.000	ACS 2019
ϕ	Rent-to-price ratio California	0.030	ACS 2019
τ	Property tax rate California	0.008	Verisk Marketing Solutions
τ_k	Capital gains tax rate	0.150	See text
ρ	Housing supply elasticity California	0.232	Baum-Snow and Han (2024)
ϕ_T	Income tax progressivity rate	0.181	Heathcote et al. (2017)
λ_T	Income tax level	0.775	See text
Δ	Income tax difference California	0.009	See text
φ	Valuation of public goods California	0.465	See Section 4.3
		Internal	
α	Preference for non-durable consumption	0.677	Rent-to-income ratio = 20.0%
Ψ	Bequest motive intensity	0.833	Wealth of the elderly (65–74) = $410,000
Ξ_O	Homeownership benefit California	0.529	California homeownership rate = 61.0%
μ	Income shifter California	−0.212	California median income = $76,000
c_O	Owner-occupied housing supply shifter California	0.432	Implied from equilibrium at P
c_R	Rental housing supply shifter California	0.442	Implied from equilibrium at R
T^L	Lump-sum property tax transfer	0.023	Implied by government budget constraint
T_k^L	Lump-sum capital gains tax transfer	0.009	Implied by government budget constraint

Notes: This table presents the parameter values used in the calibration of the overlapping generations model described in Section 4. External parameters are set based on existing literature or empirical estimates, while internal parameters are chosen to match specific model-generated moments to empirical targets. One model period corresponds to four years, and all parameters and targets are annualized.

4.1 External Model Parameters

Demographic and Lifecycle Parameters We assume households enter the model at age 25, retire at age 65, and live until age 85. Given that one model period corresponds to four years, this implies a total of 15 model periods: 10 working periods and 5 retirement periods. This structure captures the key phases of the lifecycle while keeping the model computationally tractable.

[9] Here, $k(s) \in \mathcal{C}$ denotes the household's discrete choice. For notational convenience, we set $H_R(s) = 0$ under *adjust* and *noadjust*, and $H'(s) = 0$ under *rent*; under *noadjust*, $H'(s) = H$.

Financial Market Parameters We set the real interest rate $r = 2.4\%$, consistent with long-run averages for real returns on safe assets. This rate applies to both returns on risk-free assets and mortgage interest rates. The housing depreciation rate is set to $\delta = 2.2\%$ annually, to account for both physical depreciation and obsolescence.

Financial Constraints We calibrate financial constraints to match institutional features of U.S. mortgage markets. The loan-to-value limit is set to $1-\theta_{LTV} = 80\%$, corresponding to the typical down payment requirement of 20% for conventional mortgages. We also include a payment-to-income constraint $\theta_{PTI} = 36\%$ following Greenwald (2018), which captures lenders' requirements that mortgage payments not exceed a certain fraction of borrower income. The mortgage amortization rate follows Greenwald et al. (2021) at $a = 1.7\%$ and is used to compute implied mortgage payments at the time of origination.

Transaction Cost We set the transaction cost for selling a home to $F = 5\%$ of the property value, based on estimates from Díaz and Luengo-Prado (2010) that include realtor commissions, legal fees, and other costs associated with property sales.

Income Process The stochastic income process parameters are set to $\rho_z = 0.91$ for the autocorrelation and $\sigma_z = 0.21$ for the standard deviation of innovations, following estimates from Floden and Lindé (2001) for the U.S. economy. We use a canonical Gaussian AR(1) specification while recognizing that a more recent literature documents richer features of individual earnings dynamics.[10]

Tax System We incorporate progressive federal income taxation using the parameterization from Heathcote et al. (2017), with a progressivity parameter $\phi_T = 0.181$ and level parameter $\lambda_T = 0.775$. State income taxation is captured by $\Delta = 0.9\%$, based on California's average marginal state income tax rate. Capital gains taxes are set at $\tau_k = 15\%$ applied to housing gains.[11]

Housing Supply We parameterize the housing supply elasticity using the estimate from Baum-Snow and Han (2024), setting $\rho = 0.232$ for California. This parameter captures the regulatory and geographic constraints on new housing construction in California. In particular, the relatively low housing supply elasticity in California plays a role in our analysis

[10]For instance, using administrative data, Guvenen et al. (2021) find substantial negative skewness and excess kurtosis in earnings innovations. Income risk enters our model primarily through a precautionary savings motive that raises housing demand, and a main dimension along which the newer estimates differ, heavier left tails, would likely strengthen this motive. Abstracting from these features therefore means that our estimates of the precautionary force, and the resulting higher elderly housing accumulation, are likely conservative.

[11]We abstract from state capital gains taxes, the federal deductibility of state and local taxes, and the mortgage interest deduction. The last two provisions rely on filers to itemize deductions, which only a small fraction of tax filers do. See Sommer and Sullivan (2018) for a fuller exploration of the mortgage deductibility provision specifically.

by resulting in larger capitalization effects from property taxes.

Property Taxes and Housing Markets We set the property tax rate in our baseline specification to $\tau = 0.8\%$ based on our analysis of property tax assessment data from Verisk Marketing Solutions. We set the baseline rent-to-price ratio to $\phi = 0.030$, based on the gross rent-to-price ratio from the 2019 ACS for California. This pins down the baseline rental price as $R = \phi P$. In the counterfactuals, R adjusts endogenously to clear the rental housing market.

The house price $P = 5$ (in units of \$100,000) is the price per unit of housing services. Owner-occupied housing is subject to a minimum size of $\underline{H} = 1$ unit, and we normalize housing units so that a minimum-sized owner-occupied home is valued at the weighted median of Californian owner-occupied properties in the 2019 American Community Survey (ACS) rounded down to the nearest \$100,000, roughly 15% below the median sale price of a single-family home in California in 2019. This constraint captures the lumpiness of homeownership and prevents households from purchasing arbitrarily small owner-occupied homes. We set this amount at the median value of existing owners to help capture the fact that longer-tenured homeowners typically occupy homes valued below newly transacting homes, and to help match homeownership and average house price moments. However, Section 6 shows that our results are robust to changing this threshold.

Balanced Growth Path We set the annual growth rate γ so that house prices and income grow at this rate along the balanced growth path. All choice variables are detrended by $(1 + \gamma)^t$. We use the growth rate of the FHFA nominal house price index for California from 1991–2025, setting $\gamma = 4.21\%$, and consider robustness around this value in Section 6.

4.2 Internally Calibrated Parameters

We choose the internally calibrated parameters to match specific empirical moments that are central to our analysis of housing allocation and property tax effects.

Consumption-Housing Trade-off The preference parameter for non-durable consumption $\alpha = 0.677$ is calibrated to match observed rent-to-income ratios of 20.0% used in prior research (Mabille 2023). This ensures that our model generates realistic spending patterns between housing and other consumption.

Bequest Motives The bequest motive intensity $\Psi = 0.833$ is calibrated to match the wealth holdings of elderly households aged 65–74, targeting a median net worth of \$410,000 (4.1 in \$100k model units). This parameter is crucial for generating realistic wealth accumulation patterns over the lifecycle and ensuring that elderly households have appropriate incentives to hold housing wealth. This benefit motive is age-independent. We interpret Ψ

as capturing a variety of forces that sustain wealth holdings later in life, including transfer motives, precautionary demand for late-life expenses, and reluctance to spend down assets consistent with the literature on retirement financial management (De Nardi 2004; Lockwood 2018).

Homeownership Preferences We set the homeownership benefit in California to $\Xi_O = 0.529$ to match the observed homeownership rate of 61.0%. The homeownership benefit captures utility benefits of owning that are not otherwise explicitly modeled, such as greater control over the property and attachment to it.

Income Level The income shifter $\mu = -0.212$ is calibrated to match the median household income of $76,000 in California, thereby capturing California's relatively high wage level.

Housing Supply Shifters The owner-occupied and rental housing supply shifters, $c_O = 0.432$ and $c_R = 0.442$, are implicitly determined from the calibrated California equilibrium to ensure that the respective housing markets clear at the calibrated house price P and rent R, given the corresponding supply elasticities. They determine the levels of the owner-occupied and rental housing supply functions and are used in the counterfactual analysis when house prices and rents become endogenous.

Tax Revenue Transfers The lump-sum transfers financed by property tax and capital gains tax revenues are $T^L = 0.023$ and $T_k^L = 0.009$, respectively, in the baseline equilibrium. Both transfers are implied by the corresponding government budget constraints and are recomputed endogenously in each counterfactual to rebate the respective tax revenues to households.

4.3 Calibrating Public Goods Benefit φ

We calibrate the public goods benefit parameter φ by applying (13) and our quasi-experimental estimation of the capitalization effect. Table A6 reports the implied φ for our preferred quasi-experimental estimate and for estimates from the literature, across alternative values of $\bar{D}/P$.

We construct the dividend yield of housing net of non-tax expenses starting with a gross cap rate of 4.31% from the hedonically adjusted California 2019 ACS. We subtract operating expenses excluding taxes using rent and price shares from Demers and Eisfeldt (2022), and economic depreciation, which comes from the BEA residential-structures rate of 2.2% applied to California's structure share of value of 44% from Davis et al. (2021). This leads us to $\bar{D}/P = 2.47\%$. We use the semi-elasticity from our quasi-experimental stacked difference-in-differences specifications, which implies a semi-elasticity of property taxes on housing values of $\varepsilon = -22.6$. This leads us to $\varphi = 0.46$ for our baseline specification. The literature reports a wide range of capitalization effects. The parameter φ helps to rationalize this dispersion, with each estimate corresponding to a different valuation of local public goods that depend on time and location.

4.4 Equilibrium and Solution Method

We solve for the stationary distribution of the OLG model (24)–(29) numerically in the following way. First, we fix a lump-sum property tax transfer. We then determine the value functions $V^{h,l}$ of the individual housing options using backward induction. Given an initial distribution for the newborn generation, the policy functions, and the probabilities of selecting each option, we calculate the distribution over the state space by forward induction. We repeat this process until, in a stationary equilibrium, the collected taxes and the rebated taxes equal each other.

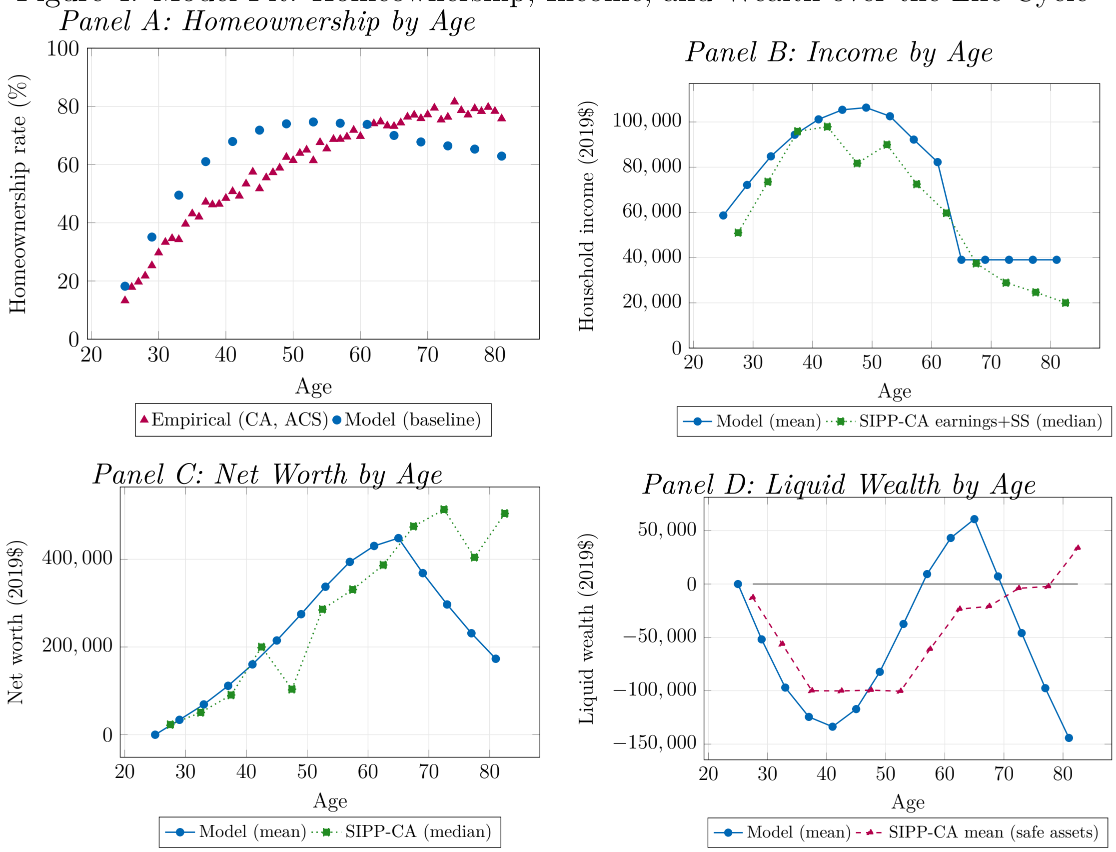
4.5 Model Fit and Validation

A key test of our model is its ability to reproduce the distinctive lifecycle homeownership patterns observed in California. Figure 4 examines out-of-sample moments to evaluate our model's fit for California. We compare model-generated outputs with empirically observed patterns for homeownership rates (Panel A), income (Panel B), net worth (Panel C), and liquid wealth (Panel D) by age. While our model explicitly targets the average homeownership rate in California, we use as an out-of-sample moment the ability of the model to target the age gradient of homeownership, which is a key focus of our analysis. The model successfully captures several important features of the data.

The model reproduces the fact that homeownership rates start low and then rise throughout the lifecycle. This reflects barriers to homeownership due to the need to accumulate wealth to pay downpayments. While the model matches high rates of elderly homeownership in California, empirical homeownership rates are even higher. This is possibly due to the additional property tax assessment cap features of Proposition 13, making our estimate relatively conservative. We model this feature in more detail in Section 6.

Our model is also able to capture the hump-shaped nature of income across the lifecycle when matched against the median income in California from the Census Survey of Income and Program Participation (SIPP). We compare the model mean to the data median to leave out the extreme tail of high earners observed in the data. For net worth and liquid wealth, the model matches the lifecycle wealth accumulation in the data well until around age 65, when the elderly in our model increase their leverage. A likely reason for this is that households, in our model, are able to easily borrow against the value of their house,

Figure 4: Model Fit: Homeownership, Income, and Wealth over the Life Cycle



Notes: This figure compares the model's baseline stationary equilibrium to California data over the life cycle. Panel A shows the homeownership rate by age against California households in the 2019 American Community Survey. Panels B–D compare the model mean by age to California households in the Census Survey of Income and Program Participation (SIPP), pooling the 2018–2020 panels and converting to 2019 dollars with the CPI-U; one observation is a household with head aged 25–84, and statistics are household-weighted. Panel B shows the weighted median of household income and Panel C the weighted median of total net worth. Panel D shows the weighted mean of liquid wealth, defined as safe assets (bank deposits and bonds) net of home mortgage debt. This matches the definition of wealth in our model, where we do not have retirement or equity wealth. Because the model also abstracts from the top tails of income and wealth, each panel compares the model's mean to the median for income and net worth. For liquid wealth, the median is zero, so we instead take the mean of our safe-asset definition.

while income verification and other frictions in the real world limit the ability of elderly households to tap into housing equity. Our results therefore understate the illiquidity of elderly housing wealth, making our estimates of the reallocation induced by higher holding costs conservative.

Our model also matches how different financial constraints evolve over the lifecycle. We examine, as another out-of-sample moment, the ability of each age and income group to purchase the minimum house size in the model given LTV and PTI constraints. Results are shown in Appendix Figure A8. Panel A shows that the model is able to match that the share of LTV constrained households decreases with age. The data counterpart is estimated using SIPP data from California. Panel B shows that for PTI, both model and data feature a U-shaped relationship between PTI constraints across age. Our model has a higher rate of

PTI constraints at the oldest ages, above 75. Panels D, E, and F show the same plots but for income quintiles. The model is able to closely replicate patterns of financial constraints with income quintiles, namely, that lower-income households are more financially constrained along both LTV and PTI. Because property taxes loosen LTV constraints and tighten PTI constraints, we examine the distributional impacts across age in the next section.

5 Real Estate Taxes and the Generational Reallocation of Housing

In this section, we use our calibrated model to examine how changes in property taxes affect housing allocation. Our primary policy counterfactual increases California's property tax rate, allowing us to quantify the effects on homeownership, housing consumption, and welfare across various age. We also consider a counterfactual in which the step-up basis provision is replaced with deemed realization at death.

5.1 Counterfactual Design

Our primary counterfactual increases the effective property tax rate in California from 0.8% to 2.0%, matching the tax rate in Texas. We allow house prices and rental rates to adjust endogenously to reflect the capitalization of higher property taxes into lower property values as a result of the shift in demand and empirically-derived housing supply elasticities.

Additional property tax revenue is redistributed to California residents through lump-sum transfers, reflecting valuation of public goods that we calibrate from data (as discussed in Section 4.3). In our baseline specification, transfers are distributed equally among all California residents, reflecting the role of property taxes as a funding mechanism for public goods.

We solve for the new equilibrium in steady-state under the higher property tax regime, allowing all household decisions to fully adjust. This includes homeownership choices, housing consumption, and savings behavior.

5.2 Capitalization Effects and Price Responses

We highlight results from our main calibration in Table 3 and show the estimates across age in Figure 5. The property tax increase generates substantial capitalization effects. When California's property tax rate increases from 0.8% to 2.0%, average house prices in California decline by 12.6%, falling from \$500,000 to \$437,000. This represents a significant reduction in the upfront cost of homeownership, directly addressing the down payment constraints faced by households constrained by LTV.

The magnitude of this price response in our main counterfactual is smaller than our quasi-experimental estimate. The capitalization effect is stronger when households do not value public goods (a price decline of 14.3% under $\varphi = 0$, rather than 12.6% in the baseline) and when the housing stock cannot contract in response to the higher user cost (15.1% under inelastic supply). We examine these variations in Section 6. Moving both variables in this direction brings the model closer to our quasi-experimental estimate, and the model's implied response lies within the wide range of capitalization estimates in the literature (Appendix Table A6).

5.3 Homeownership and Housing Consumption Responses

The property tax increase generates substantial changes in homeownership patterns. In aggregate, homeownership declines slightly by 2.1 percentage points overall. However, this average conceals large reallocation across ages. Homeownership rises among the very youngest age group (25–34) by 0.6 percentage points, or 2.0%. Homeownership is mostly unchanged among the group aged 35–44. Overall, among younger households (those aged 25–44), homeownership increases by 0.3 percentage points. These households also see an increase in their share of owned housing, which also incorporates an intensive-margin shift as younger buyers adjust to own more housing quantities, conditional on owning.

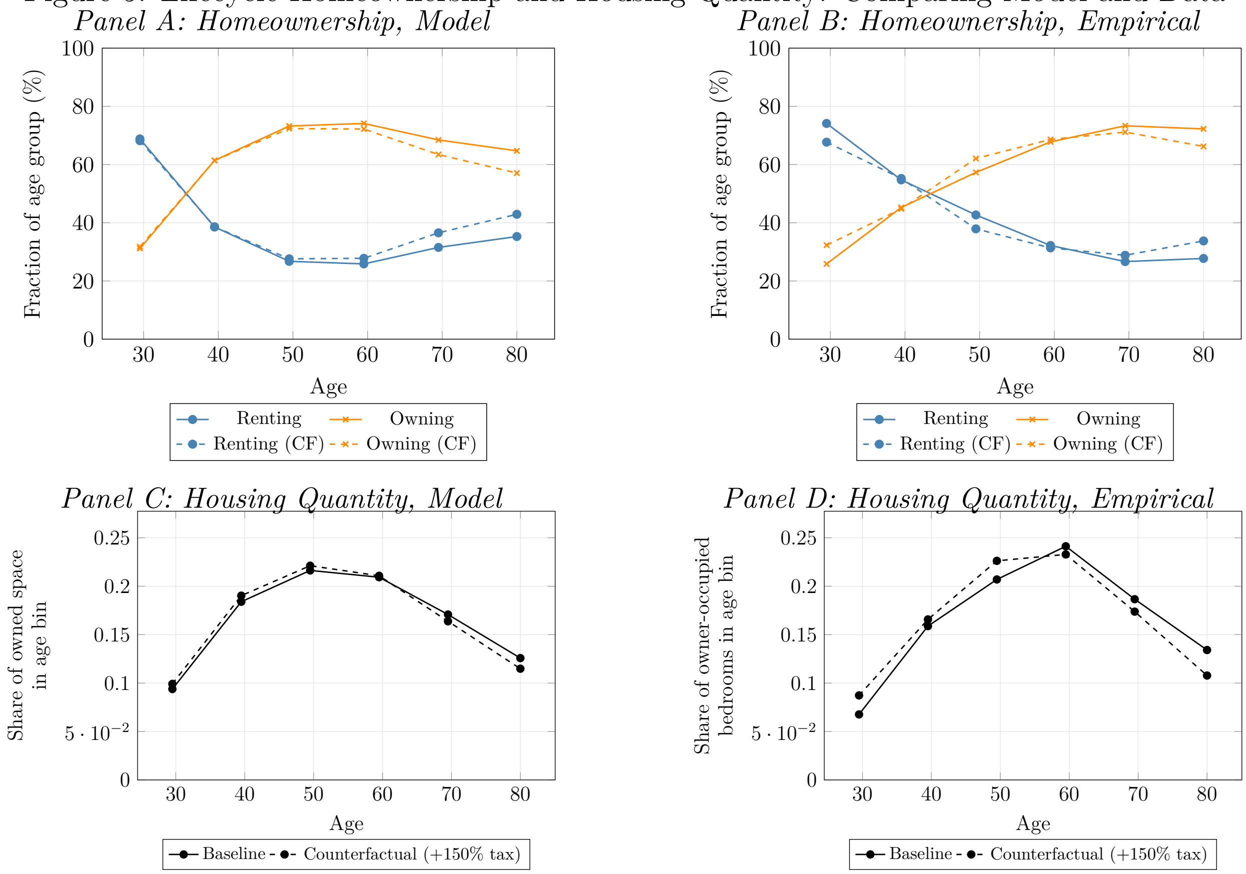
By contrast, older households see declines in homeownership and housing shares. Households aged 65–74 see a decline in homeownership of 5.0 percentage points, or 7.3 percent. Those above 75 see declines in homeownership of 7.6 percentage points, or 11.8 percent. Collectively, the elderly (those above 65) see declines in homeownership of 6.2 percentage points, as higher holding costs weaken the lock-in forces keeping long-tenured owners in place.

Taken together, these results indicate that the property tax redistributes housing from older owners toward younger constrained buyers. Figure A9 benchmarks these model-implied changes in homeownership, and in the share of housing owned, against empirically implied counterfactuals recovered from our long-differences estimates. The model reproduces the direction, and broadly the magnitude, of the age-specific reallocation we observe in the data, providing an out-of-sample check on our estimates.

5.4 Implications for Financial Constraints

Property taxes affect the two main mortgage constraints in opposite directions. By capitalizing into lower prices, they lower required downpayments and hence loosen LTV constraints.

Figure 5: Lifecycle Homeownership and Housing Quantity: Comparing Model and Data



Notes: This figure compares life-cycle profiles generated by raising the property tax in California in our structural model from 0.8% to 2.0% (Panels A and C) with implied empirical counterfactuals of a 150% tax increase built from our reduced-form estimates from the PUMA level long difference specification in Equation 2 (Panels B and D). The top row plots homeownership rates and the bottom row plots the share of owner-occupied housing held by each age group. Solid lines show the baseline share of each age group, and dashed lines show the counterfactual under higher property taxes. The empirical specifications use the American Community Survey (ACS) 1-year public-use microdata (2016–2021) and are estimated on the entire US. Baseline values are the observed homeownership rate (B) or share of owner-occupied bedrooms (D) of each ten-year age bin, computed on one record per household (the householder), for households in California. The structural model is solved on a four-year age grid (ages $25, 29, \ldots, 81$); we aggregate it to the ten-year age bins used in the empirical specification (25–34, 35–44, 45–54, 55–64, 65–74, 75+) by cohort-mass-weighting, in which each four-year model age contributes to a bin in proportion to its years of overlap and its survival mass. For homeownership (A), the bin value is the overlap-weighted mean homeownership rate; for housing quantity (C), where each panel plots a share of a common total that sums to one across age bins, the bin value is the overlap-weighted sum of the underlying age-specific shares.

By raising the flow cost of ownership they tighten PTI constraints. The incidence of these two forces changes sharply by age. LTV constraints bind more for the young, who have income but not wealth, while PTI constraints bind more for the elderly, who have wealth but not income. Property taxes therefore shift the burden of constraints away from LTV to PTI, and both forces work in the direction of generational reallocation from elderly to young households.

Figure 6 shows both the baseline rate at which constraints bind as well as how this changes with higher property taxes. Here, we show the model is able to match the empirical pattern of which financial constraints bind over a lifetime. The share of LTV-constrained households is highest among the young and declines with age, while the share of PTI-constrained households rises with age. Panel A shows the share constrained by each limit by age in the baseline and counterfactual while Panel B reports the percentage point change to the counterfactual. Raising the property tax lowers the share of LTV-constrained households and raises the share of PTI-constrained households in the model, with the LTV relief concentrated among the young and the PTI tightening concentrated among the elderly. Panels C and D show that the same pattern holds for the union of the two constraints.[12]

We examine the beneficiaries by income, wealth, and by income within age in Appendix Figure A10. Panel A shows the homeownership change by income quintile, where the homeownership rate increases for the top two income quintiles and decreases for the others. Panel B shows that homeownership increases are driven by the relatively rich young households, and actually decline for poorer younger households. Panel C shows that the lowest wealth quintile has the largest increase in homeownership. Financial constraints therefore determine which dimension of the embedded leverage interpretation of property taxes matters for homeownership. Lower prices relax the LTV constraint, which is binding for low-wealth households. Higher recurring tax payments raise obligated payments and tighten the PTI constraint for low-income households.

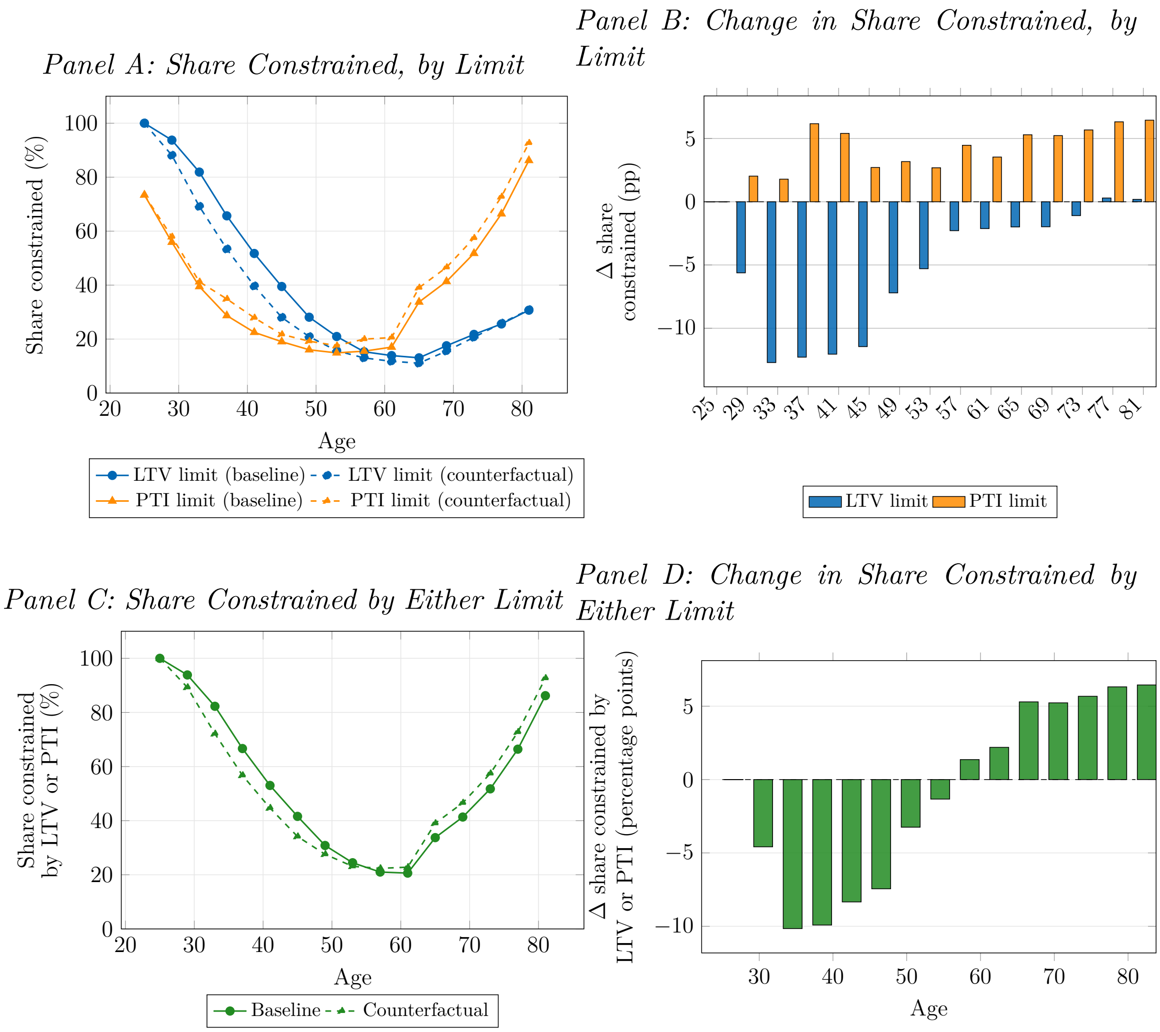
5.5 Welfare Analysis

These resulting shifts in homeownership and housing consumption have substantial implications for aggregate income and welfare in our model. Appendix Figure A11 shows model-implied welfare before and after the property tax reform. The pattern mirrors the homeownership results: welfare rises for the very youngest households and is negative for older households, with the largest negative effects seen for households between 60–80 years of age.

Welfare rises for the youngest households aged 25, reflecting the role of lower house prices on downpayment relief, but the gains fades quickly with age. For the 25–34 group as a whole the consumption-equivalent change is -0.01%, closer to zero. Losses increase for older ages, reaching -0.59% by ages 35–44, -0.98% at ages 45–54, -1.53% at 55–64, -1.96% at 65–74, and -1.48% for households aged 75 and above. Welfare losses rise with age through retirement because older households have accumulated larger housing positions. The capitalized drop in prices therefore represents a larger capital loss, while higher property taxes also represent greater holding costs while they remain homeowners. Since we compare station-

[12] We abstract from liquidity effects which may result from these shocks to PTI ratios. Prior literature has emphasized possible consequences of such tax shocks, including on consumption (Wong 2023) and property tax delinquencies (LaPoint 2022). For these reasons, many local governments limit reassessment shocks on low-income or elderly residents, reducing property taxes for these demographics through lower assessments or tax credits.

Figure 6: Share of Households Constrained by the LTV and PTI Limits



Notes: This figure reports the share of households that would be credit constrained when purchasing a house, by age, in the baseline and the counterfactual. At each age, every household hypothetically purchases the minimum-size owner-occupied house, financing the down payment with its assets and borrowing the remainder. A household is LTV-constrained if the required mortgage exceeds the model's borrowing limit, and PTI-constrained if the implied mortgage payment plus property taxes exceeds the payment-to-income limit; a household can be constrained by both. Panels A and B report each limit separately; Panels C and D report the share constrained by either limit. Shares are weighted by the baseline population distribution within each age. At age 25 households hold no assets, so the LTV limit binds for everyone in both scenarios and the change in Panel D is zero at that age.

ary equilibrium, these losses reflect the welfare of households at each age in the higher-tax counterfactual compared to their counterpart in the baseline economy. We do not consider the transitory losses which incumbent owners would face following an unanticipated shock to property taxes.

The spread of 1.5 percentage points between the youngest and oldest ages shows generational reallocation of housing resulting from property tax increases. For the very oldest households above 80, welfare losses are still negative but slightly smaller in magnitude than for those just above retirement. At advanced ages, households face few remaining years of tax payments, and the dominant cost they face is the lower value of the housing wealth they will pass on to the next generation. Bequests enter utility through the warm-glow function, and so are discounted and valued less at the margin than households' own consumption.

In the aggregate, consumption-equivalent welfare changes by -1.03%. This reflects our baseline valuation of public goods of $\varphi = 0.46$. At this valuation, much of the property tax is not offset by public goods that households value, so it registers as a net burden. Additionally, because housing supply is not perfectly elastic, the lower prices discourage housing construction and contract the housing stock, which adds additional real cost. The level of the aggregate effect therefore depends on how households value the public goods that property tax revenue funds. Panel B of Figure A11 traces the welfare change under alternative valuations: when public goods are fully valued ($\varphi = 1$), the aggregate change is positive at +1.40%, whereas it is more negative when they carry no value ($\varphi = 0$).

The gradient shift in welfare, which benefits the young relative to the old, is stable across these cases while the overall level shifts. The generational reallocation of welfare is therefore a robust feature of our model, while the sign of the aggregate effect depends on the extent to which local goods are valued.

5.6 Changing Step-up to Deemed Realization at Death

Holding the capital gains rate fixed, our secondary counterfactual replaces step-up basis with deemed realization at death, so that gains accrued on owner-occupied housing are taxed at death rather than reset in basis. By removing the tax reward for holding a home until death, the experiment isolates the lock-in created by the bequest treatment of accrued gains.[13]

We implement this by subtracting capital gains taxes from the wealth in the bequest function. With step-up basis in our baseline specification, there was no capital gains tax levied on bequeathed wealth:

$$W'_{\text{step-up}} = \begin{cases} (1+r)A' + (1-\delta-\tau)PH' & \text{if household owns housing } (H'>0), \\ (1+r)A' & \text{if household rents } (H'=0). \end{cases} \tag{33}$$

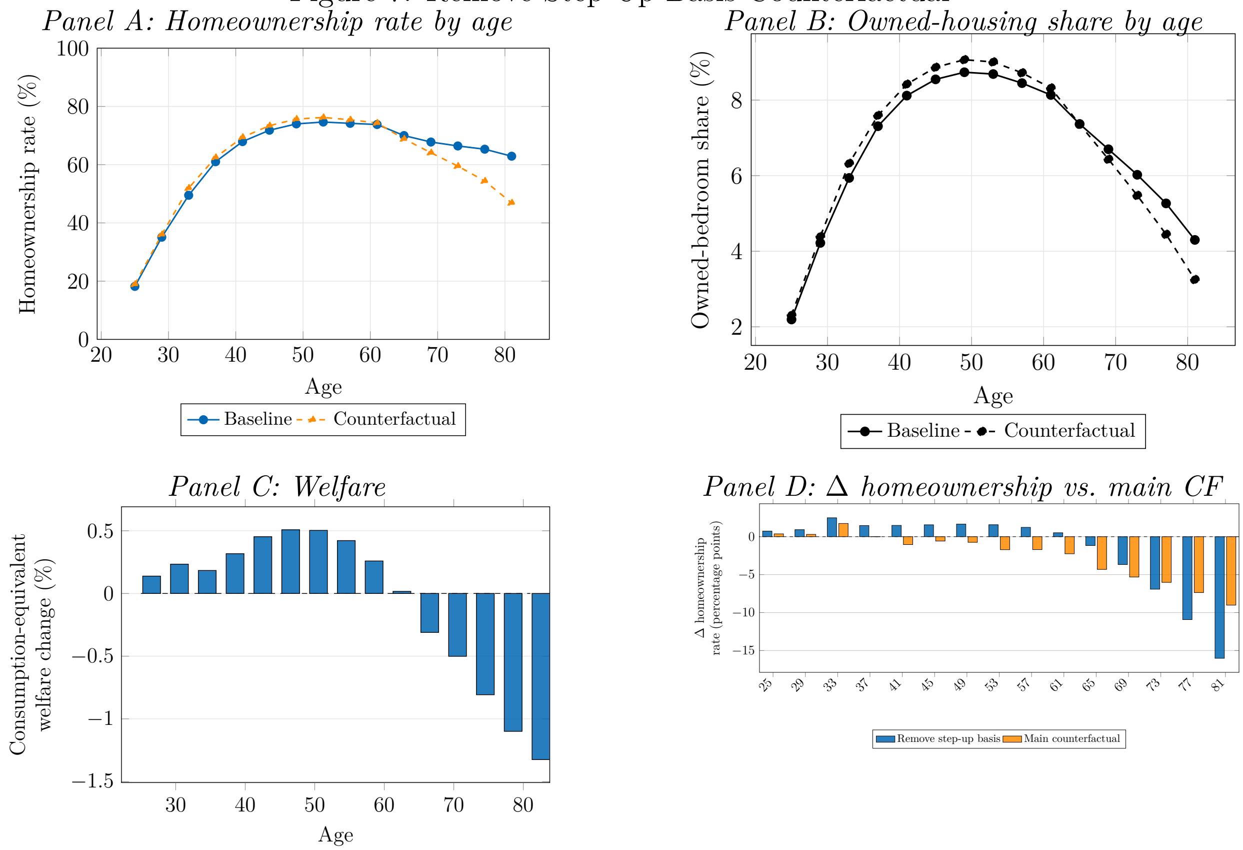
When we remove it and switch to deemed realization at death, bequeathed wealth is:

$$W'_{\text{realized}} = \begin{cases} (1+r)A' + (1-\delta-\tau-\tau_k\big(1-(1+\gamma)^{-d}\big))PH' & \text{if hh owns housing } (H'>0), \\ (1+r)A' & \text{if household rents } (H'=0), \end{cases} \tag{34}$$

where τ is the property tax, τ_k is the capital gains tax rate, γ is the per-period housing

[13]Similar policy proposals have been advanced in the STEP Act and the Fiscal Year 2022 Treasury Green Book.

Figure 7: Remove Step-Up Basis Counterfactual



Notes: This figure shows the model-implied outcomes from a counterfactual that removes the step-up in cost basis at death, so that the heirs pay capital gains taxes at death (deemed realization at death). We implement this by subtracting capital gains taxes from bequeathed wealth. In every panel, results compare the baseline and counterfactual steady-state equilibria, and the horizontal axis is the model age, plotted in four-year intervals from 25 to 81. Panel A plots the homeownership rate by age in the baseline (solid) and counterfactual (dashed). Panel B plots each age group's share of the total owned-housing (owned-bedroom) stock, baseline (solid) versus counterfactual (dashed). Panel C plots the consumption-equivalent welfare change by age (in percent). Panel D compares the change in the homeownership rate (counterfactual minus baseline, in percentage points) by age under the remove-step-up-basis counterfactual against the main property-tax counterfactual that raises California's property tax rate from 0.8% to 2%.

growth rate, and d is the duration of homeownership in periods.

The reform produces a strong reallocation of housing from the very old to middle-aged and younger households. Aggregate homeownership is essentially unchanged, falling by only 0.91 percentage points. However, we see a large shift across ages (Figure 7, Panels A and B; Table 3). The decline is concentrated among the oldest households: homeownership among those aged 75 and above falls by 11.8 percentage points. The same pattern appears in the owned-housing share, which falls by 2.14 percentage points for the 75+ group and 0.54 for the 65–74 group.

That elderly homeownership responds this strongly to a change in the bequest treatment of gains indicates that a meaningful part of late-life homeownership is sustained by the tax advantage of bequeathing, as opposed to precautionary motives or the desire for homeownership for own consumption. Because the elderly hold housing that would otherwise be available to younger buyers, the released stock and the price decline of 1.87% raise homeownership for every group under 65. The increases in homeownership are largest, at 1.68 percentage points for households aged 35–44 and 1.60 for those aged 45–54, with smaller gains of 1.16 for the youngest group and 1.02 at ages 55–64. The owned-housing share rises correspondingly for each working-age group.

Welfare changes largely mirror housing shifts. Consumption-equivalent welfare rises for all households under 65, by between 0.19% and 0.49%, and falls for the elderly, by 0.48% at 65–74 and 1.11% at 75 and above. While the aggregate welfare change is essentially zero, we do not incorporate the value of the public funds raised into the analysis. Because these are raised for federal objectives, incorporating these is more challenging than it is for local goods. Our focus is therefore more on the intergenerational comparisons, rather than the overall benefits or costs of changes in tax policy.

Two features distinguish this experiment from the main property tax counterfactual. First, we observe close to complete reallocation. While aggregate homeownership shifts only slightly, we observe substantial realocation from ownership of the old towards other households. Second, we observe welfare gains which extend across the entire working-age population. This is because the tax shift directly targets lock-in forces resulting from elderly bequest motives, rather than raising holding costs for all owners.

6 Robustness and Extensions

Our central finding is that raising property taxes reallocates housing from elderly owners toward younger, financially constrained buyers, with welfare changes declining with age. We find this pattern is robust across a range of parameter values and alternative policies.

6.1 Parameter Robustness

In Panel A of Table 3 we vary the parameters of the model.

Housing supply elasticity The most salient parameter shift which affects our estimates is the housing supply elasticity, because this determines whether the incidence of property tax shifts falls on prices or quantities. When supply inelastic ($\rho = 0$), the entire adjustment runs through price: house prices fall 15.1%, the largest decline among our specifications, and the reallocation toward the young is correspondingly strong, with homeownership rising by 1.28 and 1.07 percentage points for the two youngest groups. Under this assumption, aggregate welfare increases. Because housing is fixed, property tax changes do not affect housing quantities, and instead result in a clearer redistribution of the housing stock from the old to the young, with the young gaining up to 1.55% in consumption-equivalent terms.

The inelastic case also has the interpretation as an implementation of a land value tax, which would tax existing buildings and structures while exempting new construction. The incidence of such a tax therefore falls solely on prices rather than new construction, as in this counterfactual. While there are other well-known Georgist arguments for such taxes, our results also highlight that a land value tax set at a higher rate would also redistribute housing to younger households.

As supply becomes more elastic, the capitalization force weakens, and a growing share of the adjustment takes the form of a contraction in the housing stock. When we double the supply elasticity, the down payment relief for young buyers decreases, and homeownership increases less (alongside a smaller aggregate housing stock). These results highlight that the strength of the reallocation force is greatest under inelastic supply.

Valuation of public goods The other key parameter which varies the strength of the capitalization effect is the valuation of public goods parameter, φ. Raising φ weakens capitalization: the house price decline falls from 14.3% when public goods carry no value ($\varphi = 0$) to 10.4% when they are fully valued ($\varphi = 1$). The valuation also shifts the entire welfare profile up or down. When public goods are not valued, every cohort is worse off and aggregate welfare falls by 2.86%; when they are fully valued, the youngest households gain 2.94%, the aggregate change turns positive at 1.40%. The key takeaway is that the valuation of public goods shifts the level of welfare, but leaves the gradient across age largely unchanged. Across these different counterfactuals, the young gain relative to the old.

Financial constraints and the macroeconomic environment We also consider changes in a variety of parameters which are important for precise magnitudes but have smaller impacts. Halving the minimum house size modestly dampens the reallocation of owned housing space, as households can more easily satisfy the down payment constraint at smaller scales and capitalization of property taxes provides fewer dollars in downpayment relief. We still observe the basic pattern of reallocation of owned housing share towards the young and middle-aged, and welfare increases for younger households while declining for older ones.

Varying the trend rate of house price growth also leaves the gradient of homeownership changes across age unchanged: lower growth significantly increases the homeownership gains by the young while higher growth leaves them unchanged. Welfare shifts across age are largely similar across both counterfactuals. A lower interest rate amplifies the homeownership responses on both ends. Under this scenario the youngest groups gain up to 0.64 percentage points and the oldest lose up to 11.41 . Across all of these variations, the reallocation from old to young and the favorable welfare gradient for the young is robust.

Table 3: Model Robustness

Panel A: Model Parameters

	Age group						
Outcome	25–34	35–44	45–54	55–64	65–74	75+	All
Calibration (baseline, no counterfactual)							
Homeownership rate (%)	31.2	61.4	73.2	74.1	68.5	64.7	61.5
Owned housing share (%)	9.4	18.4	21.6	20.9	17.1	12.6	100.0
Welfare vs. young (CE %)	+0.00	+20.46	+33.91	+45.52	+73.01	+155.07	–
Main counterfactual (tax → 2.0%)							
Δ Homeownership (pp)	+0.62	-0.06	-0.86	-1.92	-5.02	-7.63	-2.06
Δ Owned housing share (pp)	+0.53	+0.63	+0.49	+0.15	-0.70	-1.09	–
Δ Welfare (CE %)	-0.01	-0.59	-0.98	-1.53	-1.96	-1.48	-1.03
Δ house price: -12.6%, Δ tax revenue: +110.7%, tax elasticity: 0.81							
Tax → 2.0% under tax-insensitive supply ($\rho = 0$ or Land Value Tax)							
Δ Homeownership (pp)	+1.28	+1.07	+0.66	+0.05	-2.37	-4.89	-0.38
Δ Owned housing share (pp)	+0.44	+0.43	+0.35	+0.17	-0.49	-0.89	–
Δ Welfare (CE %)	+1.55	+1.21	+0.92	+0.38	-0.08	+0.16	+0.76
Δ house price: -15.1%, Δ tax revenue: +111.0%, tax elasticity: 0.81							
Tax → 2.0% under doubled supply elasticity ($2 \times \rho$)							
Δ Homeownership (pp)	+0.13	-1.09	-1.97	-3.33	-7.09	-9.79	-3.36
Δ Owned housing share (pp)	+0.61	+0.74	+0.62	+0.18	-0.87	-1.26	–
Δ Welfare (CE %)	-0.83	-1.59	-2.04	-2.63	-3.06	-2.38	-2.03
Δ house price: -11.1%, Δ tax revenue: +109.6%, tax elasticity: 0.81							
Tax → 2.0% under no public-goods value ($\varphi = 0$)							
Δ Homeownership (pp)	+0.12	-0.60	-1.21	-1.99	-5.24	-7.87	-2.39
Δ Owned housing share (pp)	+0.39	+0.56	+0.52	+0.29	-0.65	-1.11	–
Δ Welfare (CE %)	-2.19	-2.39	-2.72	-3.25	-3.70	-3.23	-2.86
Δ house price: -14.3%, Δ tax revenue: +107.5%, tax elasticity: 0.80							
Tax → 2.0% under full public-goods value ($\varphi = 1$)							
Δ Homeownership (pp)	+1.48	+1.04	-0.65	-2.06	-5.14	-7.60	-1.70
Δ Owned housing share (pp)	+0.75	+0.86	+0.40	-0.03	-0.82	-1.16	–
Δ Welfare (CE %)	+2.94	+1.95	+1.25	+0.73	+0.27	+0.78	+1.40
Δ house price: -10.4%, Δ tax revenue: +118.4%, tax elasticity: 0.85							
Tax → 2.0% under smaller min. house size ($h_{\min} = 0.5$ instead of 1.0)							
Δ Homeownership (pp)	-0.25	-0.59	-0.49	-0.39	-2.62	-3.19	-1.09
Δ Owned housing share (pp)	+0.26	+0.31	+0.38	+0.32	-0.61	-0.66	–
Δ Welfare (CE %)	+0.26	+0.12	-0.08	-0.44	-0.87	-0.84	-0.25
Δ house price: -12.8%, Δ tax revenue: +109.2%, tax elasticity: 0.81							
Tax → 2.0% under lower house-price growth ($0.75 \times g$)							
Δ Homeownership (pp)	+3.93	-0.48	-1.31	-2.55	-5.67	-8.52	-1.91
Δ Owned housing share (pp)	+1.54	+0.48	+0.32	-0.09	-0.92	-1.32	–
Δ Welfare (CE %)	-0.01	-0.74	-1.12	-1.60	-1.97	-1.37	-1.08
Δ house price: -12.2%, Δ tax revenue: +114.2%, tax elasticity: 0.83							
Tax → 2.0% under higher house-price growth ($1.25 \times g$)							
Δ Homeownership (pp)	+0.64	-0.21	-0.84	-1.97	-5.19	-7.46	-2.09
Δ Owned housing share (pp)	+0.54	+0.58	+0.50	+0.16	-0.73	-1.05	–
Δ Welfare (CE %)	+0.03	-0.48	-0.98	-1.64	-2.11	-1.72	-1.07
Δ house price: -12.7%, Δ tax revenue: +110.6%, tax elasticity: 0.81							
Tax → 2.0% under a lower interest rate ($0.75 \times r$)							
Δ Homeownership (pp)	+0.64	+0.57	-0.46	-0.95	-6.11	-11.41	-2.32
Δ Owned housing share (pp)	+0.57	+0.89	+0.69	+0.51	-0.89	-1.76	–
Δ Welfare (CE %)	+0.08	-0.30	-0.75	-1.31	-1.65	-0.94	-0.77
Δ house price: -14.3%, Δ tax revenue: +107.5%, tax elasticity: 0.80							

Table 4: Model Robustness (continued)

Panel B: Policies and Extensions

	Age group						
Outcome	25–34	35–44	45–54	55–64	65–74	75+	All
Main counterfactual (tax → 2.0%)							
Δ Homeownership (pp)	+0.62	-0.06	-0.86	-1.92	-5.02	-7.63	-2.06
Δ Owned housing share (pp)	+0.53	+0.63	+0.49	+0.15	-0.70	-1.09	–
Δ Welfare (CE %)	-0.01	-0.59	-0.98	-1.53	-1.96	-1.48	-1.03
Δ *house price: -12.6%,* Δ *tax revenue: +110.7%, tax elasticity: 0.81*							
Tax → 2.0% under a smaller downpayment requirement ($\theta = 0.1$ instead of 0.2)							
Δ Homeownership (pp)	+0.58	+0.00	-1.40	-2.12	-5.16	-7.14	-2.15
Δ Owned housing share (pp)	+0.53	+0.66	+0.32	+0.10	-0.67	-0.95	–
Δ Welfare (CE %)	+0.01	-0.57	-0.87	-1.25	-1.77	-1.51	-0.93
Δ *house price: -12.8%,* Δ *tax revenue: +109.8%, tax elasticity: 0.81*							
Tax → 2.0% under a smaller downpayment requirement ($\theta = 0.035$ instead of 0.2)							
Δ Homeownership (pp)	+0.08	+0.26	-0.45	-1.75	-5.46	-7.75	-2.08
Δ Owned housing share (pp)	+0.24	+0.68	+0.60	+0.20	-0.70	-1.03	–
Δ Welfare (CE %)	+0.15	-0.22	-0.84	-1.60	-2.20	-1.92	-1.01
Δ *house price: -12.7%,* Δ *tax revenue: +112.2%, tax elasticity: 0.82*							
Tax → 2.0% under rebates to young households only (ages 25–44)							
Δ Homeownership (pp)	+2.75	+1.67	-1.19	-2.79	-6.75	-9.40	-2.02
Δ Owned housing share (pp)	+1.21	+1.18	+0.36	-0.14	-1.15	-1.47	–
Δ Welfare (CE %)	+1.74	-0.87	-2.55	-3.42	-4.03	-3.54	-1.92
Δ *house price: -12.4%,* Δ *tax revenue: +112.6%, tax elasticity: 0.82*							
Tax unchanged; Prop. 13 assessment cap introduced (2%/yr)							
Δ Homeownership (pp)	-3.86	-0.29	+0.70	+2.12	+4.07	+4.82	+0.91
Δ Owned housing share (pp)	-1.27	-0.35	-0.11	+0.27	+0.73	+0.74	–
Δ Welfare (CE %)	-0.13	-0.05	+0.10	+0.40	+0.70	+0.62	+0.23
Δ *house price: +2.2%,* Δ *tax revenue: -19.1%*							
Tax unchanged; step-up basis removed (gains taxed at death)							
Δ Homeownership (pp)	+1.16	+1.68	+1.60	+1.02	-3.21	-11.79	-0.91
Δ Owned housing share (pp)	+0.48	+0.78	+0.81	+0.62	-0.54	-2.14	–
Δ Welfare (CE %)	+0.19	+0.34	+0.49	+0.20	-0.48	-1.11	+0.02
Δ *house price: -1.9%*							
Tax unchanged; capital gains tax removed							
Δ Homeownership (pp)	-1.92	+2.20	+2.39	+2.04	-2.98	-13.82	-1.28
Δ Owned housing share (pp)	-0.46	+0.99	+1.20	+1.10	-0.36	-2.48	–
Δ Welfare (CE %)	-0.64	+0.40	+0.67	+0.21	-0.72	-1.53	-0.18
Δ *house price: -0.6%*							
Tax → 2.0% in CA only, with migration margin (two locations CA+TX); CA outcomes							
Δ Homeownership (pp)	+3.36	-0.18	-1.54	-2.34	-5.65	-7.71	-1.87
Δ Owned housing share (pp)	+1.43	+0.76	+0.39	-0.03	-1.12	-1.43	–
Δ Welfare (CE %)	+0.23	-0.56	-1.09	-1.81	-2.41	-1.66	-1.14
Δ *house price: -13.0%*							
Tax unchanged; main-CF house price & rent imposed (demand response)							
Δ Homeownership (pp)	+7.07	+11.36	+12.61	+14.56	+20.58	+24.63	+14.33
Δ Owned housing share (pp)	-0.17	-0.80	-0.98	-0.45	+0.97	+1.43	–
Δ Welfare (CE %)	+4.23	+6.60	+7.87	+8.60	+8.72	+6.69	+7.06
Δ *house price: -12.6%*							
Tax unchanged; selling transaction cost reduced (F: 5% → 4%)							
Δ Homeownership (pp)	+0.44	+0.34	+0.12	-0.06	-1.07	-2.13	-0.26
Δ Owned housing share (pp)	+0.15	+0.17	+0.13	+0.09	-0.19	-0.36	–
Δ Welfare (CE %)	+0.45	+0.58	+0.56	+0.43	+0.28	+0.23	+0.44
Δ *house price: -0.1%*							

6.2 Alternative Policies

Panel B of Table 3 considers alternative policies, related to mortgage, spending policy, taxes, and transaction costs.

Down payment requirements One concern is whether our results are driven by assumptions about downpayment requirements, especially since mortgage products with lower requirements are available. We therefore examine whether loosening the LTV limit alters the result. Lowering the minimum downpayment from 0.2 to 0.1, and further to 0.035, leaves the reallocation and the welfare gradient qualitatively unchanged: aggregate homeownership falls by 2.15 and 2.08 percentage points under these two counterfactuals, respectively, which is close to our baseline of 2.1. While the gradient is relatively unchanged, young homeownership gains are smaller under this counterfactual. This is due to the fact that the capitalization effect of higher property taxes provides downpayment relief, and when downpayments are smaller, the capitalization effect is smaller in dollar amount. This finding therefore also supports an embedded leverage interpretation in suggesting that property taxes can substitute to an extent for downpayment requirements.

The age incidence of public goods Our baseline rebates property tax revenue lump sum, which can be read as a cash equivalent to the value of public services (incorporating some haircut to reflect partial valuation of government services). However, households may value local services differently, and young families in particular may value school and infrastructure spending more than the elderly. To illustrate the role of this valuation, we examine a counterfactual which directs the revenue entirely toward young households (aged 25–44). This sharply increases the generational reallocation: homeownership among the youngest groups rises by 2.75 and 1.67 percentage points, compared with declines of 6.75 and 9.4 percentage points for the elderly, and the youngest cohort's welfare gain rises to 1.74% in consumption-equivalent terms.

Proposition 13 assessment caps Our baseline captures California's low average property tax burden but abstracts from the within-tenure assessment caps that are central to Proposition 13. To approximate this institutional feature, we impose a 2% annual cap on assessment growth. We find that homeownership decreases for the young and increases for the elderly when adding Proposition 13 to our model from our baseline. Our welfare gradient is also reversed. This shows that removing Proposition 13 would reallocate housing from the elderly to the young, and increase young homeownership.

Capital Gains Taxes We also consider a robustness check which eliminates capital gains taxes entirely. As in the counterfactual removing step-up basis, this counterfactual also removes the discontinuity in capital gains taxes at the time of inheritance, but through eliminating capital gains taxes entirely. This counterfactual also lowers homeownership for the oldest households, but reallocates housing and welfare more evenly towards middle-aged individuals. We measure a semi-elasticity of 1.95 in this counterfactual (the average percentage decrease in total tax revenues for each percentage point decrease in capital gains tax).

Two region extension An additional robustness check runs our baseline counterfactual of raising property taxes in California, and includes a second region of the model calibrated to Texas. The calibration is described in Appendix Table A7. This provides an additional margin of adjustment for those who face the potential of a higher property tax: moving to Texas. When this option is present, our homeownership increase in California among the young is larger, and the reallocation of owned housing from the elderly to the young increases.

Price capitalization versus the tax instrument To decompose how much of the main counterfactual operates through house price capitalization alone, we hold the tax code at its baseline and instead impose the main counterfactual's equilibrium house price (-12.6%) and rent paths, allowing demand to respond. One interpretation of this counterfactual would be an increase in housing supply sufficient to realize the same house price drop as the capitalization effect. We see large increases in homeownership of 14.3 percentage points on average, against a decline of 2 percentage points in the full counterfactual, and welfare rises 7% against a 1% decline in the full counterfactual. However, the change in homeownership in this counterfactual is increasing in age, with the oldest households seeing the largest rise in homeownership and the owned housing share. This experiment also helps us to pin down that both capitalization forces (which lead to price drops) and increases in user costs (which are not included in this counterfactual) are necessary for us to get to our reallocation result in our main counterfactual.

Transaction Costs We also isolate the role of lock-in coming from frictions rather than taxation. To do so, we lower the selling cost from $F = 5\%$ to $F = 4\%$ of the value, holding the property tax system fixed. This can be interpreted as a reduction in brokerage commissions or real estate transfer taxes. This reform also results in generational transfer of housing, but through a different channel which does not entail changes in house prices. Homeownership in this counterfactual rises in the young age group 25–34 by 0.44 percentage points, while declining for the group older than 75 by 2.13 percentage points. Welfare increases overall, because we reduce a deadweight friction, but the increase is highest for the young and middle-aged. Notably, the elderly in this counterfactual gain in welfare even though they reduce their homeownership and owned housing shares, because lower transactions costs directly target lock-in and allow these households to downsize.

7 Conclusion

Our paper makes three key contributions to understanding how the tax treatment of housing affects its allocation across generations. First, we show that property taxes reallocate housing across generations. Higher property taxes capitalize into lower purchase prices, which relax downpayment constraints faced by young buyers, while raising the cost of residence, which disproportionately hits older homeowners. In our overlapping generations model calibrated to California, raising property taxes to Texas levels would increase homeownership among young households while reducing it among the elderly.

Second, our results point to a reinterpretation of property taxes as a form of embedded leverage. Because future tax obligations are capitalized into prices, market prices are an incomplete measure of the true cost of homeownership, which also includes a stream of embedded future payments, mirroring other leveraged instruments such as mortgages. In the presence of financial constraints, property taxes can therefore substitute for access to financial instruments for constrained borrowers.

Third, we show that the tax treatment of housing at death is a quantitatively important source of generational lock-in. Replacing step-up basis with deemed realization at death substantially lowers homeownership among elderly households, indicating that a meaningful share of this tenure is driven not by consumption or precautionary motives, but instead by the bequest tax advantage on accrued gains. In general equilibrium, the released housing stock from changing this tax treatment raises homeownership among younger households.

Together, these results establish that the tax treatment of housing, through both property taxes and the treatment of capital gains especially at death, is a central determinant of how housing is allocated across generations, and a policy lever for addressing the affordability pressures created by lock-in.

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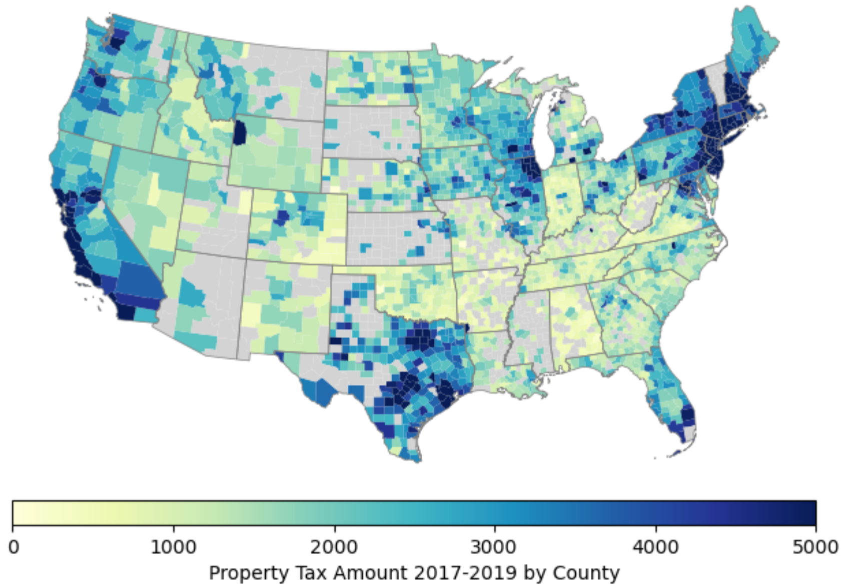
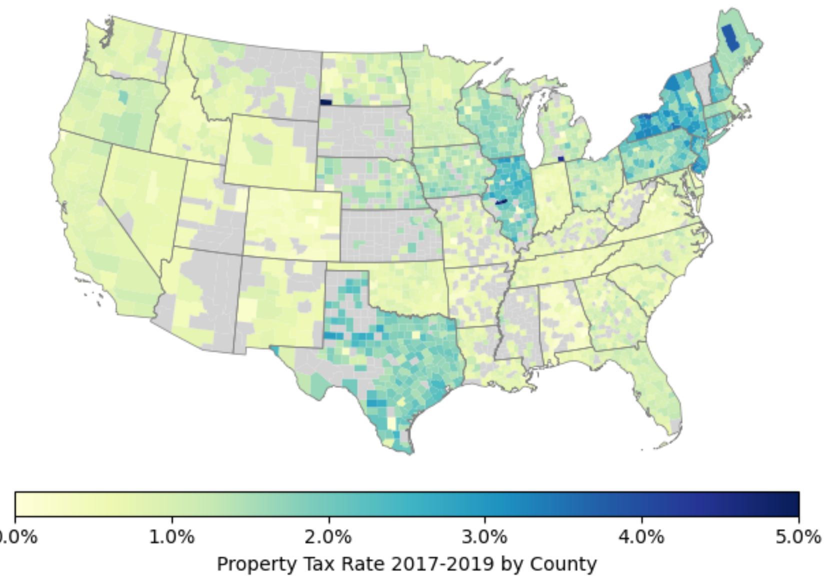
A Appendix: Additional Results

Figure A1: Regional Variation in Property Taxes

Panel A: Property Tax Amounts by County

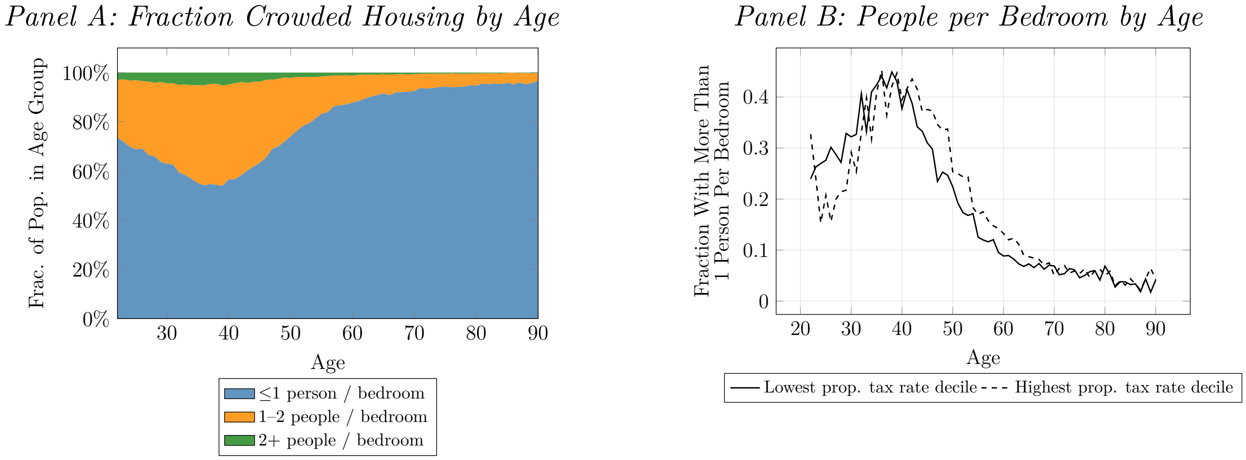


Panel B: Property Tax Rates by County



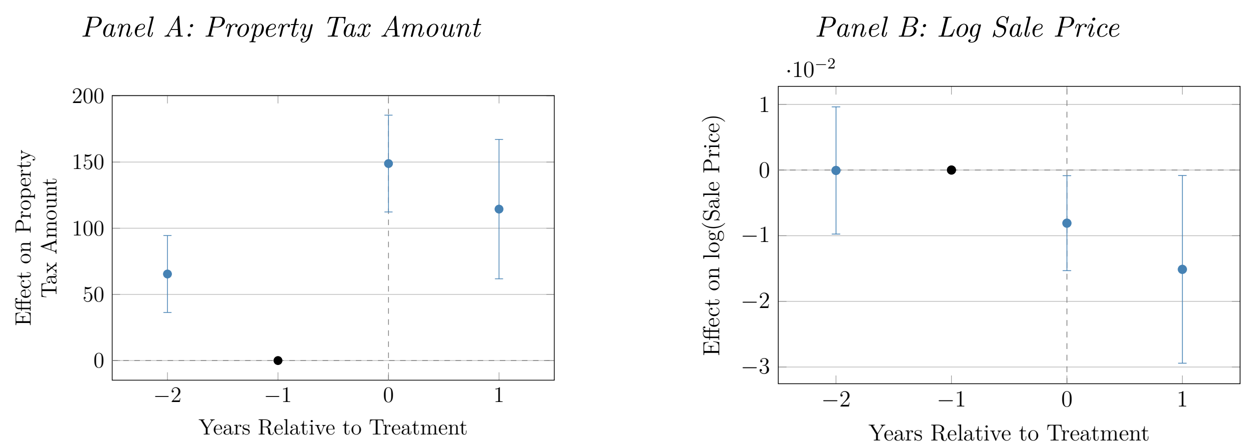
Notes: This figure highlights residential property tax variation across the United States using assessment and property sales records provided by Verisk/Infutor over the period 2017–2019. We calculate effective property tax rates by dividing annual property tax payments by sale prices for each property transaction, then aggregate these measures to the county level. Panel A shows average property tax amounts (in dollars) by county, while Panel B shows the effective property tax rates as calculated with tax amounts divided by transaction prices.

Figure A2: Housing Crowding Across the Life Cycle



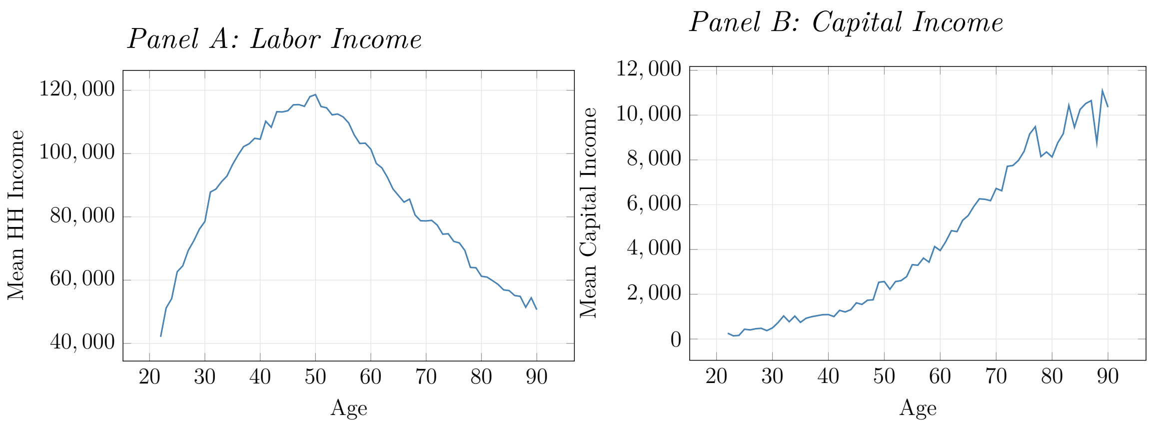
Notes: This figure measures housing crowding across the age distribution using ACS 1-year data from 2019 matched with PUMA-level property tax rates from Verisk/Infutor sale records measured from 2019. Panel A shows what fraction of each age group lives in housing with a certain number of people per bedroom. Panel B shows the fraction of each age group living with more than one person per bedroom, split by the top and bottom property tax deciles.

Figure A3: Event Studies of Treatment on Property Tax Amount and Sale Price



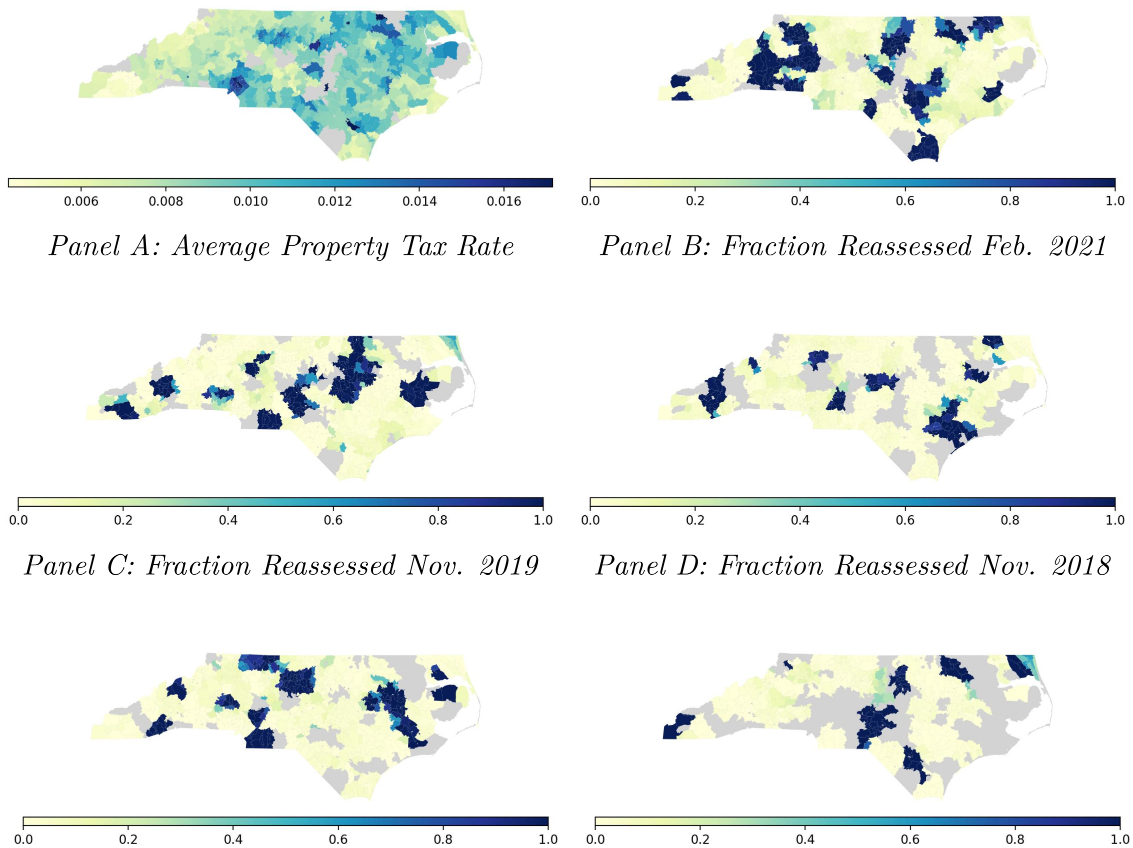
Notes: This figure shows the event studies from our quasi-experimental specifications using reassessment shocks in North Carolina. The reference period −1 is shown as the black dot. Event study coefficients are from a stacked difference-in-differences regression, referencing columns (2) and (5) in Table 1. Panel A is the effect of treatment, the reassessment shock, on the property tax amount (demeaned to be within-property, with cohort and year fixed effects; standard errors clustered by property county). Panel B is the effect of treatment on the log sale price (hedonic controls, ZIP, cohort, and sale-year fixed effects; standard errors clustered by ZIP). We focus our sample within a three-year reassessment cycle.

Figure A4: Income and Wealth Distributions By Age



Notes: Data for this figure come from the ACS 1-year data from 2017–2019. Panel A shows the mean household income for each age. Panel B shows the mean capital income for each age, where capital income is interest, dividend, and rental income.

Figure A5: North Carolina Assessment Changes by ZIP Code



Panel A: Average Property Tax Rate

Panel B: Fraction Reassessed Feb. 2021

Panel C: Fraction Reassessed Nov. 2019

Panel D: Fraction Reassessed Nov. 2018

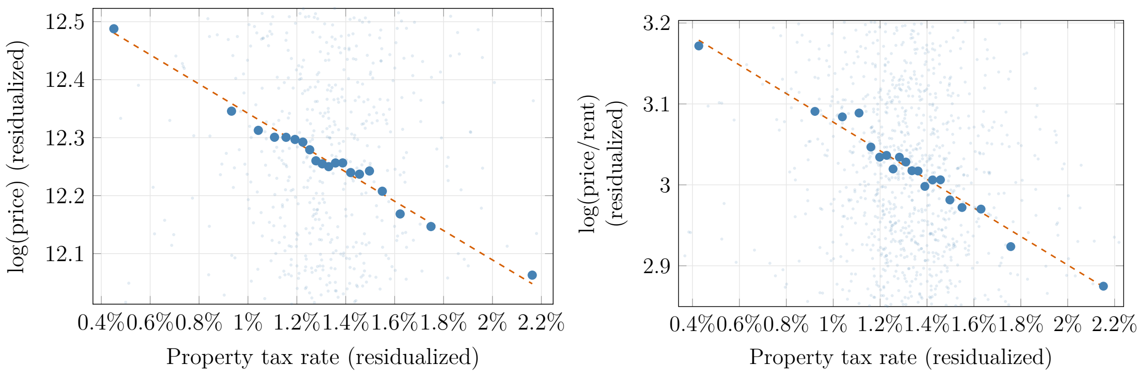
Panel E: Fraction Reassessed Nov. 2017

Panel F: Fraction Reassessed Nov. 2016

Notes: Data for this figure come from the Verisk property tax assessment data for the cross sections of Nov. 2015–2019 and Feb. 2021. Panel A shows the average property tax rate based on assessment values in each ZIP code. Panels B through F show the fraction of properties in a ZIP code that have new assessment values from the previous year. ZIP codes with a high fraction of treated properties constitute our treatment areas in that period, as outlined in Appendix B. Gray geographies are missing data for the present assessment, the previous assessment, or both.

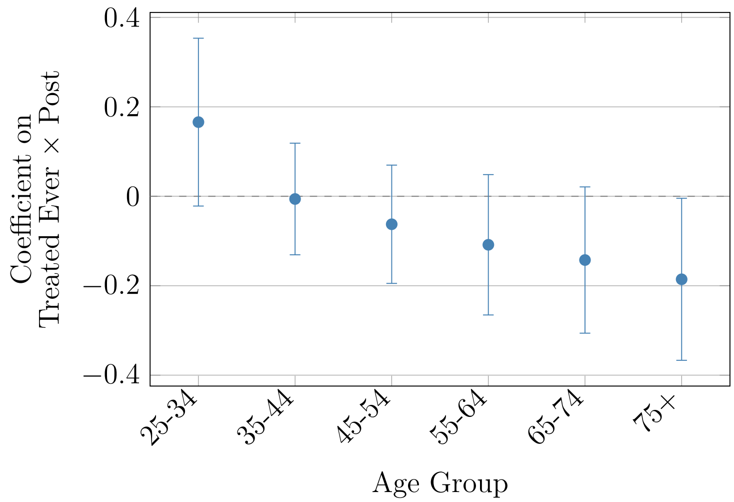
Figure A6: Cross-Sectional Variation of Prices and Rents with Property Taxes

Panel A: $\log(Price)$ *and Property Taxes* *Panel B:* $\log\left(\frac{Price}{Rent}\right)$ *and Property Taxes*



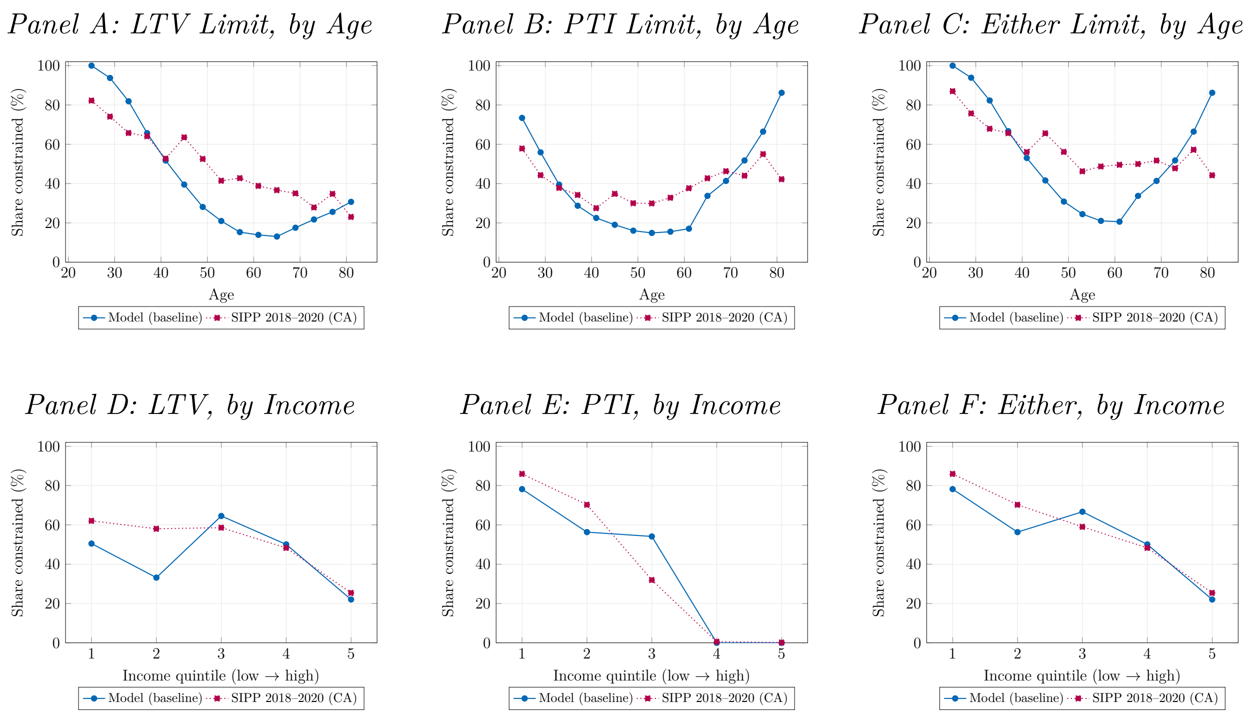
Notes: This figure shows the cross-sectional relationship between property tax rates and log(*price*) in Panel A and log(*price*/*rent*) in Panel B. Prices, price to rent ratios, and building and location characteristics come from the Census ACS 1-year Public Use Microdata Sample for 2019. Property tax rates are calculated off of market transaction prices using the Verisk (formerly Infutor) sale records measured from 2017–2019. The binscatters plot residualized log(*price*) (Panel A) and log(*price*/*rent*) (Panel B) against property tax rates, corresponding to column 2 in Table A1 and column 4 respectively. Column 2 is at the individual level and Column 4 is at the PUMA level. Both specifications control for state fixed effects and location characteristics (including housing supply elasticities, test scores, and distance to city center). Housing supply elasticities come from Baum-Snow and Han (2024) and math test scores come from Opportunity Insights Lab. Column 2 (Panel A) additionally controls for the structure type of the building and the number of bedrooms with fixed effects. Column 4 (Panel B) building level controls are PUMA level average owner occupied lot sizes, rental lot sizes, owner occupied number of bedrooms, and rental number of bedrooms. Background dots in Panel A are a random sample of individuals due to the large number of individuals. Panel B is at the PUMA level and background dots are PUMAs.

Figure A7: Property Tax and Downsizing



Notes: This figure shows age-group specific coefficients for changes in log(land sq. ft.) on treatment due to a reassessment shock at the individual level in North Carolina, estimated from Eq. 3: $\Delta\log(\text{LandSqft})_{it} = \beta^{(a)}\left(\text{TreatedEver}_i \times \text{Post}_t\right) + \mathbf{X}_{it}'\boldsymbol{\gamma}^{(a)} + \alpha_{\text{ZIP}}^{(a)} + \delta_t^{(a)} + \varepsilon_{it}^{(a)},\ \text{Moved}_{it} = 1$. Data come from Verisk (formerly Infutor) at the individual level for North Carolina from 2016–2021. The regression is conditional on an individual having moved, and the difference in land sq. ft. compares the new property's sq. ft. to the old property's sq. ft. Treatment is defined at the ZIP-code level as when an entire ZIP-code reassesses, and when property tax rates don't simultaneously change. Controls are ZIP-code fixed effects by age-group, year fixed effects by age-group, origin-property previous sale value quintile within sale year, origin property characteristics including a bedroom fixed effect, bathroom fixed effect, a control for land sq. ft. and living sq. ft. census tract level math scores and supply elasticities, and the individual level tenure at the origin property.

Figure A8: Constrained Shares in Model and Data: California



Notes: This figure runs the constrained-share experiment of Figure 6 on the data. At each age, every household hypothetically purchases the minimum-size owner-occupied house at the California baseline price, financing the down payment with its assets and borrowing the remainder. The model line is the baseline share constrained by age. The data line applies the same experiment to California households in the SIPP (2018–2020 pooled, 2019 dollars); assets are non-retirement financial assets net of unsecured debts, plus the net sale proceeds of the primary home for owners. A household is LTV-constrained if the required mortgage exceeds the borrowing limit, and PTI-constrained if the implied mortgage payment plus property taxes exceeds the payment-to-income limit; Panels C and F report the share constrained by either limit. Panels D–F repeat the experiment by income quintile: households aged 25–84 are sorted into weighted within-California quintiles of earnings plus Social Security income (the model's income concept; households with non-positive income are excluded), and the model line is the baseline share constrained by income quintile.

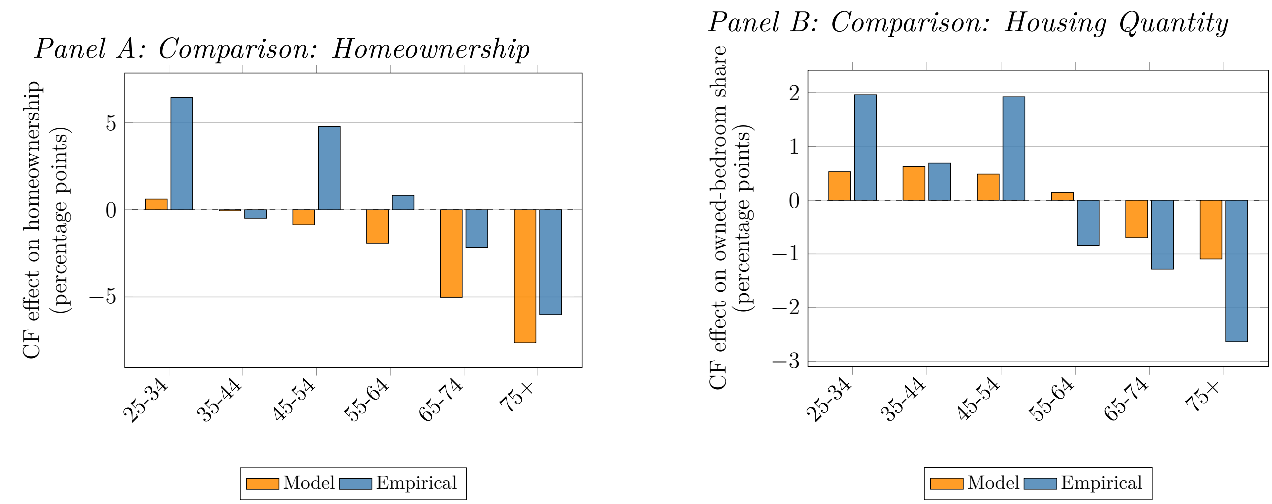


Figure A9: Comparing Model and Data

Notes: This figure compares life-cycle profiles generated by the raising of the property tax rate in California in our structural model from 0.8% to 2.0% (model) with implied empirical counterfactuals of a 150% tax increase built from our reduced-form estimates from the PUMA level long difference specification in Equation 2 (empirical). Panels A and B show the change in percentage points for the counterfactuals from the model and that implied by the empirical estimates for homeownership rate and the share of owner-occupied bedrooms owned by an age group respectively. The empirical specifications use the American Community Survey (ACS) 1-year public-use microdata (2016–2021) and are estimated on the entire US. Baseline values are the observed homeownership rate (A) or share of owner-occupied bedrooms (B) of each ten-year age bin, computed on one record per household (the householder), for households in California. The structural model is solved on a four-year age grid (ages $25, 29, \ldots, 81$); we aggregate it to the ten-year age bins used in the empirical specification (25–34, 35–44, 45–54, 55–64, 65–74, 75+) by fractional-overlap weighting, in which each four-year model age contributes to a bin in proportion to its years of overlap. For homeownership (A), the bin value is the overlap-weighted mean homeownership rate; for housing quantity (B), where each panel plots a share of a common total that sums to one across age bins, the bin value is the overlap-weighted sum of the underlying age-specific shares.

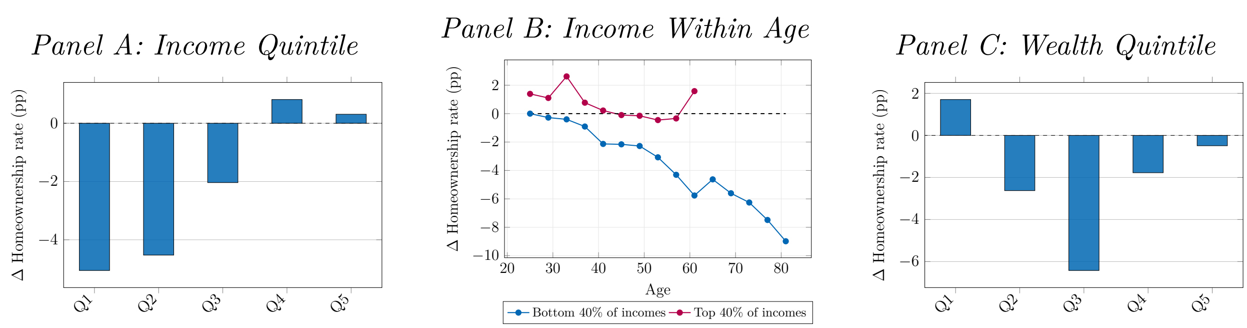
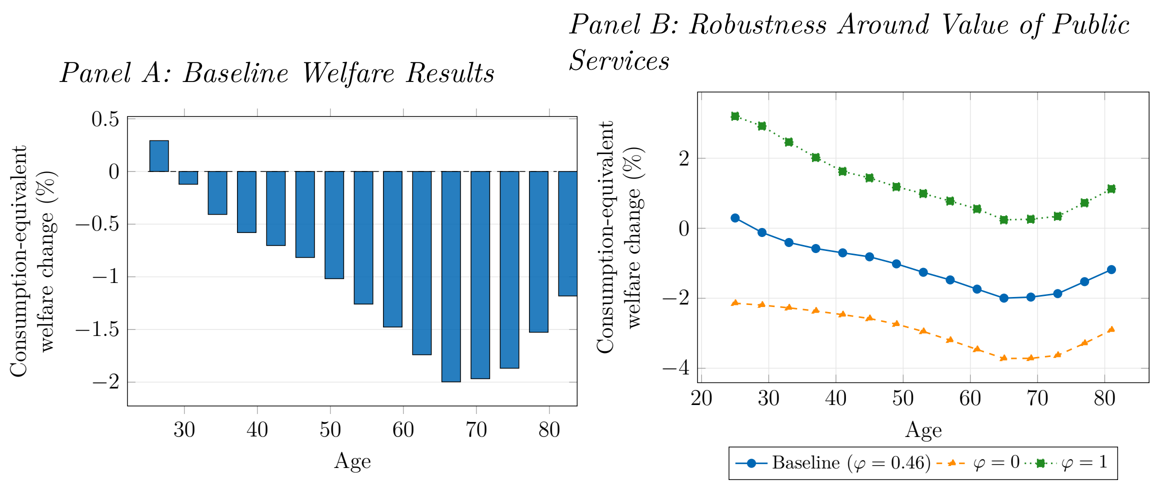


Figure A10: Homeownership Response by Income and Wealth

Notes: This figure shows the change in the homeownership rate (percentage points) between the baseline and main-counterfactual steady states, by income quintile in Panel A, by income group within age in Panel B, and by total-wealth quintile in Panel C. Income and wealth quintiles are population-weighted and computed over all ages pooled; wealth is housing plus liquid assets. Panel B applies the pooled income cutoffs within each age, so a group is a fixed income band tracked over the life cycle: the bottom (top) series is the average of the bottom (top) two quintiles' changes, and the top series ends before retirement because retirement income rarely reaches the top quintiles.

Figure A11: Impact of Property Tax Change on Welfare



Notes: This figure shows the change in model-implied consumption equivalent welfare due to a counterfactual shift in the property tax rate from 0.80% to 2.00% in our California model region to match the level in Texas, as discussed in Section 5. Results are calculated as the difference between baseline and counterfactual steady-state equilibria. Age groups are defined in 4-year intervals from ages 25–28 through 81–84, labeled by the age at the start of each interval. Panel A shows the baseline change in consumption equivalent welfare, and Panel B compares the baseline welfare change to counterfactuals with different valuations of public goods (φ). The baseline has a $\varphi = 0.46$, the green line shows the counterfactual when public goods are fully valued ($\varphi = 1$), and the orange shows when public goods are not valued ($\varphi = 0$).

Table A1: Cross-Sectional Capitalization Effect of Property Taxes

	log(price)		$\log\left(\frac{\text{price}}{\text{rent}}\right)$		$\log\left(\frac{\text{price}}{\text{sf rent}}\right)$	
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Tax Rate	-21.71***	-25.28***	-18.73***	-17.66***	-17.73***	-18.71***
	(1.34)	(2.00)	(0.74)	(1.26)	(0.75)	(1.34)
Percent Difference	-20%	-22%	-17%	-16%	-16%	-17%
Bldg and Bdrms Controls	Y	Y	Y	Y	Y	Y
Math Scores, Dist. Controls	Y	Y	Y	Y	Y	Y
Supply Elasticity	Y	Y	Y	Y	Y	Y
State FE	N	Y	N	Y	N	Y
Observation Level	Indiv.	Indiv.	PUMA	PUMA	PUMA	PUMA
Clusters Level	PUMA	PUMA	PUMA	PUMA	PUMA	PUMA
R^2	0.33	0.43	0.45	0.67	0.37	0.59
Additional R^2 from Prop. Tax	0.022	0.008	0.153	0.036	0.145	0.042
Observations	2084677	2084677	5729	5729	5725	5725

Notes: *p<0.1; **p<0.05; ***p<0.01. This table presents cross-sectional evidence of the capitalization of property taxes into housing values. Data are drawn from the ACS 1-year microdata from 2016 to 2019, merged with PUMA-level property tax rates from Verisk/Infutor sale records. Columns (1) and (2) are household-level regressions of the log of self-reported property value on the PUMA-level property tax rate among owner-occupied households, with categorical controls for the number of bedrooms and for building type. Columns (3)–(6) are aggregated to the PUMA×year level and regress the log price-to-rent ratio on the PUMA-level property tax rate. Rents are measured among all renters in columns (3) and (4) and among single-family renters in columns (5) and (6); these columns control for the mean number of bedrooms among owner-occupied units, the mean number of bedrooms among the relevant rental units, and the share of owner-occupied units on lots under one acre. All specifications additionally control for year fixed effects, third-grade math test scores in 2013 (provided by the Opportunity Insights Lab, from the Stanford Education Data Archive), distance to the nearest MSA, and housing supply elasticity (Baum-Snow and Han 2024). Columns (2), (4), and (6) additionally control for state fixed effects. All specifications are estimated by weighted least squares: columns (1) and (2) weight each household by its ACS housing-unit weight, and columns (3)–(6) weight each PUMA×year observation by its number of owner-occupied units. Standard errors are clustered at the PUMA level. Percent Difference is the implied percent change in the outcome from a one-percentage-point increase in the property tax rate. Additional R^2 is the R^2 from the full regression minus the R^2 from the same regression excluding the property tax rate.

Table A2: Capitalization Effect Interacted With Supply Elasticity

	log(price)	log(price)	$\log\left(\frac{\text{price}}{\text{rent}}\right)$	$\log\left(\frac{\text{price}}{\text{rent}}\right)$	$\log\left(\frac{\text{price}}{\text{sf rent}}\right)$	$\log\left(\frac{\text{price}}{\text{sf rent}}\right)$
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Tax Rate	-35.99***	-20.51***	-25.19***	-14.95***	-27.22***	-18.76***
	(2.81)	(2.65)	(1.61)	(1.61)	(1.67)	(1.74)
Supply Elast.	-1.50***	-0.39***	-0.62***	-0.07	-0.96***	-0.43***
	(0.11)	(0.09)	(0.08)	(0.07)	(0.08)	(0.08)
Prop. Tax Rate × Supply Elast.	38.01***	-13.93***	17.43***	-8.07**	25.33***	0.15
	(6.24)	(5.39)	(3.65)	(3.46)	(3.82)	(3.65)
Percent Difference	-30%	-19%	-22%	-14%	-24%	-17%
Bldg and Bdrms Controls	Y	Y	Y	Y	Y	Y
Math Scores, Dist. Controls	Y	Y	Y	Y	Y	Y
State FE	N	Y	N	Y	N	Y
Observation Level	Indiv.	Indiv.	PUMA	PUMA	PUMA	PUMA
Clusters Level	PUMA	PUMA	PUMA	PUMA	PUMA	PUMA
Observations	2084677	2084677	5729	5729	5725	5725

Notes: *p<0.1; **p<0.05; ***p<0.01. This table modifies Table A1 in the paper with the addition of an interaction between property taxes and housing supply elasticities drawn from Baum-Snow and Han (2024).

Table A3: Capitalization Effect in CA and TX

	log(price)	log(price)	$\log\left(\frac{\text{price}}{\text{rent}}\right)$	$\log\left(\frac{\text{price}}{\text{rent}}\right)$	$\log\left(\frac{\text{price}}{\text{sf rent}}\right)$	$\log\left(\frac{\text{price}}{\text{sf rent}}\right)$
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Tax Rate	-76.06***	-25.26***	-44.19***	-7.39**	-41.04***	-7.68**
	(3.31)	(4.90)	(2.26)	(3.29)	(2.48)	(3.47)
Supply Elasticity	-0.84***	-0.55***	-0.32***	-0.12*	-0.70***	-0.53***
	(0.08)	(0.08)	(0.07)	(0.06)	(0.09)	(0.08)
Percent Difference	-53%	-22%	-36%	-7%	-34%	-7%
Bldg and Bdrms Controls	Y	Y	Y	Y	Y	Y
Math Scores, Dist. Controls	Y	Y	Y	Y	Y	Y
State FE	N	Y	N	Y	N	Y
Observation Level	Indiv.	Indiv.	PUMA	PUMA	PUMA	PUMA
Clusters Level	PUMA	PUMA	PUMA	PUMA	PUMA	PUMA
Observations	359852	359852	1147	1147	1147	1147

Notes: *p<0.1; **p<0.05; ***p<0.01. This table modifies Table A1 in the paper by subsetting only on California and Texas.

Table A4: Quantifying Embedded Leverage in Property Taxes

State	Avg Property Tax Amount	Avg House Price	Avg Property Tax Rate	De-levered Avg House Price	Implied Leverage
Alabama	$1,077	$212,284	0.51%	$238,077	$25,793
Alaska	$4,049	$335,663	1.21%	$440,842	$105,178
Arizona	$1,824	$312,315	0.58%	$356,380	$44,065
Arkansas	$1,347	$191,134	0.70%	$224,116	$32,982
California	$5,247	$655,318	0.80%	$785,287	$129,969
Colorado	$2,361	$431,386	0.55%	$488,162	$56,776
Connecticut	$6,496	$326,270	1.99%	$511,634	$185,363
Delaware	$1,858	$278,206	0.67%	$323,512	$45,305
District of Columbia	$4,838	$733,942	0.66%	$851,810	$117,867
Florida	$3,605	$320,814	1.12%	$413,538	$92,724
Georgia	$2,483	$284,511	0.87%	$346,524	$62,012
Hawaii	$2,219	$668,177	0.33%	$720,245	$52,069
Idaho	$2,152	$273,240	0.79%	$326,468	$53,228
Illinois	$5,710	$276,077	2.07%	$440,543	$164,466
Indiana	$1,508	$196,847	0.77%	$234,047	$37,200
Iowa	$2,801	$185,745	1.51%	$261,141	$75,396
Kansas	$2,949	$246,878	1.19%	$323,382	$76,504
Kentucky	$1,719	$200,383	0.86%	$243,233	$42,849
Louisiana	$2,040	$235,677	0.87%	$286,586	$50,909
Maine	$3,660	$256,899	1.42%	$354,453	$97,554
Maryland	$3,869	$368,067	1.05%	$466,737	$98,670
Massachusetts	$5,467	$480,031	1.14%	$620,895	$140,865
Michigan	$2,610	$207,763	1.26%	$275,952	$68,189
Minnesota	$3,090	$280,267	1.10%	$359,538	$79,271
Mississippi	$1,529	$207,245	0.74%	$244,835	$37,590
Missouri	$2,590	$230,250	1.12%	$296,889	$66,639
Montana	$2,707	$295,768	0.92%	$363,726	$67,957
Nebraska	$3,614	$215,071	1.68%	$314,404	$99,334
Nevada	$1,919	$333,758	0.58%	$380,072	$46,314
New Hampshire	$6,059	$305,008	1.99%	$477,786	$172,778
New Jersey	$9,224	$411,193	2.24%	$682,588	$271,395
New Mexico	$2,200	$260,083	0.85%	$314,848	$54,766
New York	$6,344	$372,441	1.70%	$547,284	$174,843
North Carolina	$2,161	$267,600	0.81%	$321,161	$53,561
North Dakota	$3,088	$252,471	1.22%	$332,828	$80,357
Ohio	$3,178	$192,215	1.65%	$279,259	$87,044
Oklahoma	$1,940	$197,897	0.98%	$246,972	$49,075
Oregon	$3,779	$375,173	1.01%	$471,064	$95,891
Pennsylvania	$4,351	$251,552	1.73%	$371,856	$120,304
Rhode Island	$5,208	$325,976	1.60%	$467,679	$141,703
South Carolina	$1,588	$253,360	0.63%	$291,895	$38,535
South Dakota	$2,591	$211,767	1.22%	$279,201	$67,434
Tennessee	$1,676	$245,019	0.68%	$285,981	$40,962
Texas	$5,866	$282,256	2.08%	$451,405	$169,149
Utah	$1,797	$312,088	0.58%	$355,455	$43,367
Virginia	$3,647	$388,726	0.94%	$480,525	$91,798
Washington	$4,048	$476,956	0.85%	$577,775	$100,820
West Virginia	$1,291	$191,013	0.68%	$222,526	$31,513
Wisconsin	$3,665	$232,599	1.58%	$332,055	$99,456
Wyoming	$1,581	$262,435	0.60%	$300,695	$38,260

Notes: This table illustrates the implications of property taxes on housing prices across states. Property tax and sales information are drawn from 2017–2019 Verisk/Infutor data. The first column shows state-level average property tax amounts from assessor data. The second column highlights the average transactions value over this period, and the third column shows the implied property tax rate as a fraction of market value. The next column produces an estimate of the “de-levered” price, i.e. a counterfactual or hypothetical value under a zero-property tax world. To produce this estimate we draw on the implied semi-elasticity of prices with respect to the property tax rate from our stacked difference-in-differences estimates (columns (2) and (5) of Table 1), along with the state-level average transaction price. The final column, illustrating the embedded or implied leverage, is the price difference between the actual transactions price and the implied de-levered price.

Table A5: Homeownership and Property Taxes

	Dependent variable: homeowner					
	Under 45	Under 45	45–64	45–64	65+	65+
	(1)	(2)	(3)	(4)	(5)	(6)
Prop Tax Rate	3.37***	6.13***	2.20***	4.39***	0.50*	3.38***
	(0.38)	(0.62)	(0.28)	(0.53)	(0.26)	(0.58)
log(HH Income)	0.17***	0.17***	0.15***	0.15***	0.11***	0.11***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Supply Elasticity	0.41***	0.37***	0.30***	0.27***	0.22***	0.20***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age, Income, Div Income Controls	Y	Y	Y	Y	Y	Y
Math Scores, Dist. to City Controls	Y	Y	Y	Y	Y	Y
State FE	N	Y	N	Y	N	Y
Clusters Level	PUMA	PUMA	PUMA	PUMA	PUMA	PUMA
Observations	888211	888211	1161205	1161205	878559	878559

*Notes:**p<0.1; **p<0.05; ***p<0.01. This table displays the cross-sectional relationships between property taxes and homeownership. Data are drawn from individual-level variables in the ACS 1-year data from 2017 to 2019, merged with PUMA-level property tax rates from Verisk/Infutor sale records. This table shows results from the regression of an indicator variable for whether the individual is a homeowner on the property tax rate of the PUMA, along with controls. Columns (1) and (2) focus on homeownership by households under 45, columns (3) and (4) focus on homeownership among households 45–64, and columns (5) and (6) focus on homeownership among the elderly. Controls in all specifications include the log of household income, housing supply elasticity (Baum-Snow and Han 2024), a fixed effect for individual age of the oldest member of each household in the ACS, the log of dividend interest and rental income, local math scores (from 2013, provided by Opportunity Insights Lab, from the Stanford Education Data Archive), and distance to city center (the distance within each CBSA to the centroid of the ZIP code with highest population density). State fixed effects are included in columns (2), (4), and (6). Standard errors are clustered at the PUMA level, and all specifications are estimated with weighted least squares, where each observation is weighted by the variable housing unit weight from the ACS.

Table A6: Estimating Public Goods Benefit

Source	ε	ϕ at $\bar{D}/P = 1\%$	ϕ at $\bar{D}/P = 3\%$	ϕ at $\bar{D}/P = 5\%$
Our own estimates				
Table 2B, col. 2 (NC, Stacked)	−22.6	0.78	0.35	−0.08
Cited literature				
Livy (2018), Ohio (Franklin Cty.), within-district	−28.6	0.73	0.18	−0.37
Oates (1969), NJ suburbs	≈ −20	0.81	0.42	0.04
Yinger et al. (1988), MA cities	−3.2 to −6.2	0.94–0.97	0.82–0.91	0.70–0.85
Palmon and Smith (1998), Houston MUDs	−12.2 to −20	0.81–0.88	0.42–0.65	0.04–0.41
Høj et al. (2018), Denmark (land tax)†	−43 to −34	0.59–0.67	−0.24 to 0.02	−1.06 to −0.63

Notes: The implied efficiency parameter φ is computed from $\varphi = 1 + [\varepsilon/(1+\gamma)] \cdot (\bar{D}/P)$, i.e., the baseline formula (13) with rent pass-through $\pi = 0$ and balanced-growth rate $\gamma = 4.21\%$. ε is the semi-elasticity of house prices with respect to the property tax rate; $\bar{D}/P$ is the dividend yield net of non-tax expenses and economic depreciation. Subsection B3 discusses literature estimates in more detail.

Table A7: Calibration for Two-Region Model

Parameter	Description	Value	Source/Target
		External	
σ	Relative risk aversion	2.000	Standard value
r	Interest rate	0.024	See text
δ	Depreciation rate	0.022	See text
θ_{LTV}	LTV limit	0.800	See text
θ_{PTI}	PTI limit	0.360	Greenwald (2018)
a	Mortgage amortization rate	0.017	Greenwald et al. (2021)
F	Transaction cost selling	0.050	Díaz and Luengo-Prado (2010)
ρ_z	Autocorrelation income	0.910	Floden and Lindé (2001)
σ_z	Standard deviation income	0.210	Floden and Lindé (2001)
γ_1	House price trend Texas	0.044	FHFA state HPI, 1991–2025
γ_2	House price trend California	0.042	FHFA state HPI, 1991–2025
$\underline{H}$	Minimum house size	1.000	See text
β	Discount factor	0.950	See text
P_1	House price Texas (\$100k)	1.700	ACS 2019
P_2	House price California (\$100k)	5.000	ACS 2019
ϕ_1	Rent-to-price ratio Texas	0.045	ACS 2019
ϕ_2	Rent-to-price ratio California	0.030	ACS 2019
τ_1	Property tax rate Texas	0.020	Verisk Marketing Solutions
τ_2	Property tax rate California	0.008	Verisk Marketing Solutions
τ_k	Capital gains tax rate	0.150	See text
ρ_1	Housing supply elasticity Texas	0.320	Baum-Snow and Han (2024)
ρ_2	Housing supply elasticity California	0.232	Baum-Snow and Han (2024)
κ	Income tax progressivity rate	0.181	Heathcote et al. (2017)
λ	Income tax level	0.775	See text
Δ_{TX}	Income tax difference Texas	−0.021	See text
Δ_{CA}	Income tax difference California	0.009	See text
φ	Valuation of public goods California	0.465	See Section 4.3
		Internal	
α	Preference for non-durable consumption	0.695	Rent-to-income ratio = 20%
Ψ	Bequest motive intensity	1.155	Wealth of the elderly (65–74) = 4.1
$\Xi_{R,2}$	Amenity benefit California	1.026	Share in California = 57%
$\Xi_{O,1}$	Homeownership benefit Texas	0.379	Texas Homeownership rate = 66%
$\Xi_{O,2}$	Homeownership benefit California	0.524	California Homeownership rate = 61%
μ_1	Income shifter Texas	−0.415	Texas median income = \$60.4k
μ_2	Income shifter California	−0.233	California median income = \$76k
m	Utility cost of moving	4.415	Moving rate = 0.37%
$c_{O,1}$	Owner-occupied housing supply shifter Texas	0.356	Implied from equilibrium at P_1
$c_{O,2}$	Owner-occupied housing supply shifter California	0.248	Implied from equilibrium at P_2
$c_{R,1}$	Rental housing supply shifter Texas	0.352	Implied from equilibrium at R_1
$c_{R,2}$	Rental housing supply shifter California	0.249	Implied from equilibrium at R_2
T_1^L	Lump-sum property tax transfer Texas	0.031	Implied by government budget constraint
T_2^L	Lump-sum property tax transfer California	0.023	Implied by government budget constraint
$T_{k,1}^L$	Lump-sum capital gains tax transfer Texas	0.006	Implied by government budget constraint
$T_{k,2}^L$	Lump-sum capital gains tax transfer California	0.010	Implied by government budget constraint

Notes: This table presents the parameter values used in the calibration of the two-location overlapping generations model. External parameters are set based on existing literature or empirical estimates, while internal parameters are chosen to match model-generated moments to empirical targets. One model period corresponds to four years, and all parameters and targets are annualized. Texas-specific parameters are calibrated analogously to their California counterparts, while parameters without location subscripts are common across locations. The Texas amenity benefit is normalized to zero, and the relative California amenity benefit is calibrated to match California's population share. The utility cost of moving is calibrated to match the interstate migration rate between California and Texas.

A1 Proof of Lemma 1

Proof. Imposing $P_{t+1} = (1+\gamma)P$ in the no-arbitrage condition (10) gives

$$(1+\gamma)\big[1+(\varphi-1)\tau\big]P + \bar{D} = \mathcal{R}\,P,$$

and solving for P yields (11). Write $\Delta_\gamma \equiv \mathcal{R} - (1+\gamma)[1+(\varphi-1)\tau] > 0$ for the denominator, so that $P = \bar{D}/\Delta_\gamma$ and, from (11), the net dividend yield is $\bar{D}/P = \Delta_\gamma$. Differentiating $P = \bar{D}/\Delta_\gamma$ with respect to τ,

$$\frac{dP}{d\tau} = \frac{\bar{D}\,(1+\gamma)(\varphi-1)}{\Delta_\gamma^2},$$

. Since $\bar{D} > 0$, $1+\gamma > 0$, and $\Delta_\gamma^2 > 0$, the sign of $dP/d\tau$ is the sign of $\varphi - 1$, establishing (i). Dividing by P,

$$\varepsilon = \frac{1}{P}\frac{dP}{d\tau} = \frac{(1+\gamma)(\varphi-1)}{\Delta_\gamma} = -\,\frac{(1+\gamma)(1-\varphi)}{\bar{D}/P},$$

where the last equality uses $\Delta_\gamma = \bar{D}/P$; this is (ii). Finally, solving (12) for φ gives $1-\varphi = -\,\varepsilon\,(\bar{D}/P)/(1+\gamma)$, i.e. (13), establishing (iii). No approximation is used at any step, so the mapping is exact at the observed (τ, γ). □

A2 Proof of Proposition 2

Proof. Part (i): Old generation. The old enter the period holding housing $\bar{H}$ with predetermined capital K and debt B. Their consumption is

$$C' = \big[1+(\varphi-1)\tau\big]P\bar{H} + \bar{D}\bar{H} + \mathcal{R}K - \mathcal{R}B.$$

Since K and B are predetermined, differentiating with respect to τ:

$$\frac{dC'}{d\tau} = \left[(\varphi-1)P + \big(1+(\varphi-1)\tau\big)\frac{dP}{d\tau}\right]\bar{H}.$$

Writing $\Delta \equiv \mathcal{R} - 1 - (\varphi-1)\tau$ and substituting $P = \bar{D}/\Delta$, $dP/d\tau = \bar{D}(\varphi-1)/\Delta^2$:

$$\frac{dC'}{d\tau} = \frac{\bar{D}(\varphi-1)}{\Delta^2}\Big[\Delta + 1 + (\varphi-1)\tau\Big]\bar{H} = \frac{\bar{D}(\varphi-1)\,\mathcal{R}}{\Delta^2}\,\bar{H} = \mathcal{R}\,\frac{dP}{d\tau}\,\bar{H},$$

where the simplification uses $\Delta + 1 + (\varphi-1)\tau = \mathcal{R}$. With log utility, $dV_{\text{old}}/d\tau = (1/C')\,dC'/d\tau$, giving (14). The inequality follows from $\mathcal{R} > 0$ and $dP/d\tau < 0$ when $\varphi < 1$.

Part (ii): Constrained young generation. With the collateral constraint binding at $B = \lambda P\bar{H}$, the young's consumption when young is

$$C = Y - (1-\lambda)P\bar{H} - K',$$

and when old (after selling housing, receiving the net dividend, and repaying debt):

$$C' = \big[1 + (\varphi - 1)\tau - \mathcal{R}\lambda\big] P\bar{H} + \bar{D}\bar{H} + \mathcal{R}K'.$$

By the envelope theorem, differentiating at the optimal capital choice K':

$$\frac{dV_{\text{young}}}{d\tau} = \frac{1}{C}\,\frac{\partial C}{\partial \tau}\bigg|_{K'} + \frac{\beta}{C'}\,\frac{\partial C'}{\partial \tau}\bigg|_{K'}.$$

Computing each partial derivative:

$$\frac{\partial C}{\partial \tau}\bigg|_{K'} = -(1-\lambda)\,\frac{dP}{d\tau}\,\bar{H},$$

$$\frac{\partial C'}{\partial \tau}\bigg|_{K'} = \left[(\varphi - 1)P + \big(1 + (\varphi - 1)\tau - \mathcal{R}\lambda\big)\frac{dP}{d\tau}\right]\bar{H}.$$

Applying the same algebraic simplification as in Part (i), with $1 + (\varphi - 1)\tau$ replaced by $1 + (\varphi - 1)\tau - \mathcal{R}\lambda$:

$$\frac{\partial C'}{\partial \tau}\bigg|_{K'} = \frac{\bar{D}(\varphi - 1)}{\Delta^2}\big[\Delta + 1 + (\varphi - 1)\tau - \mathcal{R}\lambda\big]\bar{H} = \mathcal{R}(1-\lambda)\,\frac{dP}{d\tau}\,\bar{H}.$$

Substituting yields (15).

Sufficient condition. When $\varphi < 1$, $dP/d\tau < 0$ and both $\bar{H} > 0$. The first term in (15) is positive (down payment relief) and the second is negative (lower future housing value). The young benefit on net ($dV_{\text{young}}/d\tau > 0$) if and only if the first term dominates:

$$\frac{1-\lambda}{C} > \frac{\beta\mathcal{R}(1-\lambda)}{C'}.$$

Dividing through by $1 - \lambda > 0$ gives $1/C > \beta\mathcal{R}/C'$, i.e., $\beta C/C' < 1/\mathcal{R}$, which is (16). This is exactly the wedge in the Euler equation implied by a binding collateral constraint, so the constrained young benefit on net whenever the constraint binds. □

B Data Appendix

B1 Generating Effective Tax Rates (ZIP code, PUMA)

To measure property taxes, we use property assessment data from Verisk Marketing Solutions (previously known as Infutor). The assessment panel contains a yearly cross-section of all the tax lots in the U.S. from 2016 to 2021. Each tax lot observation has variables detailing the address, census geography of the property, property characteristics, tax assessment and payment information, and information about the most recent sale of the property.
To create our panel of property taxes, we perform the following data-cleaning steps:

1. Keep properties with non-null owner (PID_prop).
2. Keep properties with non-null address ID ($ADDRID\_prop$).
3. Keep only residential properties ($PROP\_IND \in \{10, 11, 21, 22\}$).
4. Exclude mobile homes ($PROP\_MOBHOME$).
5. Keep properties with non-null street info ($STREET$).
6. Exclude unbuilt land ($PROP\_LANDUSE$ not null and not 460).
7. Drop duplicate property IDs each year; keep one with higher $PROP\_VALCALC$.
8. Keep owner-occupied properties ($PROP\_OWNEROCC \in \{S, O\}$).

To calculate tax rates from sale values, we apply the following additional filters:

1. Keep sales 2016–2021.
2. Keep sales where the price was $25k or higher.
3. Drop duplicates on the address and sale date.
4. Keep only properties with one sale.
5. Keep properties with property tax data.
6. Keep properties with property tax < 10%.
7. Aggregate to the sale year and ZIP code or PUMA level.
8. Keep ZIP code years with more than 20 sales or PUMAs with more than 100 sales.

9. Keep geographies with average realized property tax rates below 5%.

We link the sales-based tax rates at the PUMA level to the Census ACS 1-year public use microdata sample for our empirical analysis at the PUMA level. We link the sales-based tax rates at the ZIP code level to the ACS 5-year tables for the empirical analysis at the ZIP code level.

B2 Quasi-Experimental Sample for Capitalization Effects

To identify plausibly exogenous variation in property taxes for our difference-in-differences analysis, we construct a sample of systematic local property tax shocks. Appendix Figure A5 shows a map of the fraction of properties which receive reassessment shocks in each year. Areas with a small fraction of reassessment changes reflect ordinary reassessments; areas with a large fraction are associated with systematic reassessments of properties within jurisdictions. We identify property tax assessment shocks that satisfy four key criteria designed to isolate genuine reassessment events from other confounding policy changes, following Fraenkel (2022) and Giesecke and Mateen (2022):

1. **Widespread Assessment Changes.** We require that more than 90% of properties within a ZIP code experienced assessment value changes in a given year. This condition ensures we capture systematic reassessment events rather than isolated property-specific adjustments that might be correlated with unobserved property characteristics or improvements.

2. **Infrequent Previous Assessment Activity.** To identify discrete reassessment episodes, we require that fewer than 50% of properties in the jurisdiction had assessment value changes in the previous year. This criterion helps distinguish genuine reassessment cycles from areas with continuous assessment updates that might reflect ongoing market trends rather than administrative policy changes.

3. **Substantial Tax Rate Variation.** We impose a minimum threshold requiring the interquartile range of property tax rate changes within the jurisdiction to exceed 0.005 percentage points. This condition eliminates jurisdictions that primarily adjust assessment ratios (the fraction of market value used for tax purposes) rather than conducting true reassessments of underlying property values. Changes in assessment ratios typically generate uniform proportional changes across all properties, whereas genuine reassessments create heterogeneous impacts based on how individual property values have evolved since the last assessment.

4. **Assessment-Driven Tax Changes.** Finally, we decompose the total change in property tax amounts into components attributable to assessment value changes versus tax rate changes. We require that more than 90% of the variation in tax amount changes stems from assessment value changes rather than rate adjustments. This ensures our identification strategy captures the effects of reassessment rather than concurrent changes in local tax policy that might be endogenously determined by local economic or political conditions.

These criteria collectively identify reassessment events that provide plausibly exogenous variation in property tax burdens, forming the foundation for our causal identification strategy. The sample includes data from Verisk/Infutor from November 2015 to February 2021. We keep only properties with one clean observation in the post-treatment window to avoid contamination in cases of multiple transactions, and follow properties for two years around treatment to avoid contamination with other assessment cycles, which are typically three years in this state.

B3 Harmonizing Estimates in Literature on Capitalization

Estimating ε. Because the cited studies report their capitalization findings in heterogeneous units, we map each to the common semi-elasticity $\varepsilon \equiv d\log P/d\tau$, where τ is expressed as a decimal (per-unit) rate, before using the semi-elasticity to get the implied valuation of public goods parameter φ: $\varphi = 1 + [\varepsilon/(1+\gamma)] \cdot (\bar{D}/P)$. Two conventions arise:

1. *Studies reporting an implied discount rate r^*.* When a study expresses full (or near-full) capitalization as "the price response is consistent with discounting future tax liabilities at r^*," the underlying relation is $\Delta P = -\Delta T/r^*$ with $\Delta T \approx P\,\Delta\tau$, so $\varepsilon = -1/r^*$. Livy (2018) reports full capitalization at $r^* \approx 3.5\%$, giving $\varepsilon = -1/0.035 = -28.6$. Høj et al. (2018) report a preferred (2007) coefficient implying $r^* = 2.3\%$, with the credible range across their causal years (2005–2007) spanning $r^* \in [2.3\%, 2.9\%]$; this gives $\varepsilon \in [-43, -34]$, with the preferred point estimate $\varepsilon = -43$.

2. *Studies reporting a capitalization rate κ against a benchmark discount rate r_κ.* Here $\varepsilon = -\kappa/r_\kappa$, evaluated at the study's stated r_κ (typically 5%). This is the convention we use for Oates (1969) and the partial-capitalization estimates of Yinger et al. (1988) and Palmon and Smith (1998).

For the Høj et al. (2018) row, the entries within each $\bar{D}/P$ column correspond to $\varepsilon = -43$ and $\varepsilon = -34$ respectively, so the more negative ε maps to the lower φ. $\varphi = 1$ corresponds to the full benefit view (taxes fully offset by public goods); $\varphi = 0$ corresponds to the full capital-tax view. Values $\varphi < 0$ correspond to over-capitalization, where the tax capitalizes into prices more than its growth-adjusted PV. Under pass-through $\pi > 0$, all entries shift downward by π; under alternative γ, all entries scale by a factor of $1.0421/(1 + \gamma')$ in their distance from $(1 - \pi)$. Høj et al. (2018) study a *land* value tax. Because land is inelastically supplied, capitalization is mechanically near-complete (their own conclusion), so this row sits at the capital-tax pole and is not directly comparable to the property-tax studies; we report it for completeness. ε is taken from their preferred 2007 estimate ($r^* = 2.3\%$); the range reflects their causal years 2005–2007.

Livy (2018) is the literature comparison closest in methodology—within-jurisdiction tax variation with public services held fixed, in a single Ohio county—and sits squarely inside the range produced by our NC specifications, which lends external validity to the reduced-form identification. The older cross-sectional literature (Oates 1969; Yinger et al. 1988; Palmon and Smith 1998) is broadly consistent with $\varphi \in [0, 0.65]$ at typical yields, though the confidence intervals are wider. The land-tax evidence of Høj et al. (2018) sits at the capital-tax pole, as expected for an inelastically supplied base.