Housing and Inequality *

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Abstract

We review the literature in order to uncover the links between housing and inequality. We focus on three distinctive features of housing: consumption, the location asset and capital. For most households these are bundled together in a single good. Housing consumption, access to good neighborhoods and housing wealth are symptoms of inequality. Moreover, housing acts as a propagation mechanism for inequality through the location-specific returns to human capital investment and the ability to use housing as collateral to finance investments. The paper uses this approach to analyse the impacts of discrimination and segregation on housing and inequality. It then reviews housing regulation and fiscal and monetary policies related to these three features for providing affordable housing consumption, access to housing in opportunity-rich locations, and for promoting homeownership.

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1 Introduction

The present paper reviews the economics literature for the purpose of uncovering the links between housing and inequality. The paper argues that the links go in both directions. It looks at three distinctive features of housing. One is spending on housing consumption by both renters and homeowners, and amounts to about a quarter of income. Poorer households have higher housing expenditure shares. The price and income elasticities of housing demand are important magnitudes. Housing inequality is a component of consumption inequality. Two, housing location is an asset for both renters and homeowners. Access to schools and jobs provides crucial social context that is central to the propagation of income and wealth inequality. And, three, housing is capital for homeowners and is the most important form of wealth for most households; it is also the main form of collateral.

These three features are bundled together in a single good for most households. It is difficult to unbundle them as for most households housing is indivisible. The housing asset differs from financial assets because it generates consumption services and embodies geographical location and social context. Housing is different from other durables in two ways, most important of which is that the location asset is embodied in housing capital. To enjoy the return of housing as location asset requires, in most cases, to live in the house. Households typically do not live in more than one house at the same time. As the OECD (2020) housing and inclusive growth report puts it, *Housing can both reflect and reinforce inequalities across socio-economic groups, across generations, and across space.*

We clearly cannot review the vast housing literature. We focus on inequality and refer to a number of existing extensive surveys. Specifically, Davis and Van Nieuwerburgh (2015) and Piazzesi and Schneider (2016) focus on housing as a financial asset in a macroeconomic context, with an emphasis on how the returns to housing assets (mainly house price) are related to its volatility, its correlation with other financial assets, and overall asset portfolio choice. Duca et al. (2021) provide an extensive review of house price cycles using international evidence. Here we focus on housing as a location asset and on those attributes that are most closely related to inequality. The financial aspect of housing we focus on pertains to its role as collateral in helping smoothing consumption and undertaking investment in human capital. Although most housing transactions involve search, the large volume of research on search models of the housing market, ably reviewed

by Han and Strange (2015), does not focus on housing and inequality. We review in this paper a few exceptions in connection with misinformation, foreclosures and evictions which do bear on inequality. While Olsen and Zabel (2015) discuss US housing policy in depth, we focus on policies related to the three features of housing that we defined earlier, that is consumption, location and financial asset attributes of housing.

The remainder of the paper is organized as follow. Section 2 presents a simple framework to think about the three features of housing. It highlights the role of housing as both a source of inequality and a propagation mechanism for inequality. Sections 3, 4 and 5 review the literature on the three features of housing within the basic framework. Section 6 discusses key issues related to racial discrimination and segregation. Section 7 explores the implications for housing and inequality of both housing market regulation, and of broader fiscal and monetary policies. Section 8 concludes.

2 A Simple Framework for Housing and Inequality

To put the research on housing and inequality into perspective, this section sketches a simple analytical framework that focuses on the three features of housing that are critical for inequality, consumption, the location asset and capital. The issues related to housing and inequality span micro and macro research; there is no single canonical model. Instead, we seek to lay down a framework for organizing the discussion of these issues.

At time t, taking aggregate and household-level state variables as given, household i maximizes its expected lifetime utility by making consumption and investment decisions. The aggregate state variables considered here are the gross return to non-housing financial assets R_t, a location-specific house price index $p_t(\ell)$, a rental price index $q_t(\ell)$, and the wage rate $w_t(\ell)$ in each location $\ell \in \mathcal{N}$. We start by assuming that there is free mobility of non-housing financial assets across locations so that the return R_t is equalized across locations. Houses are immobile and therefore house prices and rents are location-specific. Together with the assumption that households can only work (and also attend school) at the location where they live, wages are also location-specific.[1]

The sources of inequality are household-level state variables. They include the level of human capital s^i_{t-1} and non-housing financial assets a^i_{t-1}, and a set of state variables related to housing. First, housing location $\ell^i_{t-1} \in \mathcal{N}$, a set of locations. Second, tenure

[1] We discuss the implication of working from home in Section 4.5.

status $\iota = r, o$. If household i is a homeowner ($\iota = o$), then it owns housing capital h^i_{t-1}. Third, households experience idiosyncratic income and preference shocks:

$$w^i_t(\ell) = \bar{w}_t(\ell) + \eta^i_t, \quad \mathcal{L}^i_t(\ell) = L_t(\ell) + \psi^i_t, \qquad \eta^i_t, \psi^i_t \sim i.i.d. \tag{1}$$

2.1 Household optimization

Given the state variables, a household chooses whether to relocate to a new location ℓ^i_t, and then chooses investment in human capital z^i_t, non-housing consumption c^i_t and housing services h^i_t. The lifetime utility for household i is $\sum_{t=0}^{\infty} \beta^t E_0 \left[u^i\left(c^i, h^i\right)\right]$, where β is a discount factor. The infinite life-time specification allows for the interpretation that location and human capital choice affect the utility of future generations in a dynastic setting. The expectation is taken with respect to shocks (η^i_t, ψ^i_t). Per-period utility is :

$$u^i\left(c^i, h^i; \ell^i\right) = \frac{\mathcal{L}^i\left(\ell^i\right)\left[\left(\omega\left(h^i - \bar{h}\right)^{\frac{1-\varepsilon}{\varepsilon}} + (1-\omega)\left(c^i\right)^{\frac{1-\varepsilon}{\varepsilon}}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{1-\sigma}}{1-\sigma}, \tag{2}$$

where $\bar{h} \geq 0$ is the minimum amount of housing services required, which affects the income elasticity of housing consumption.[2] The parameter ϵ determines the price elasticity of housing consumption. The utility depends directly on the location choice through $\mathcal{L}^i\left(\ell^i\right)$ to reflect location-specific preference, such as locational amenities.

The accumulation of human capital follows:

$$s^i_t = S\left(z^i_t; s^i_{t-1}, \ell^i_t\right), \tag{3}$$

where human capital in the next period depends on the investment in human capital z_t, given location choice and the current level of human capital. For example, access to better schooling in a certain location can contribute to the accumulation of human capital for a given level of investment; employment opportunities at a certain location are more valuable than at other locations; or there are salient peer effects across individuals' human capitals at the location, all of which enter S via ℓ^i_t.

The budget constraint for household i depends on tenure status. An owner is endowed

[2]There are alternative ways to generate non-unitary income elasticity for housing, e.g. replacing $\bar{h}$ by ϕh to capture 'status preferences' for housing (Grossmann et al., 2021) or adopting a non-homothetic CES utility (Finlay and Williams, 2022).

with h_{t-1}^i units of housing asset:

$$c_t^i + z_t^i + p_t\left(\ell_t^i\right) h_t^i + M_t^i \kappa_t^o + a_t^i = w_t\left(\ell_t^i\right) s_{t-1}^i + R_t a_{t-1}^i + p_t\left(\ell_t^i\right) h_{t-1}^i; \quad (4)$$

$$a_t^i \geq -\left(1-\phi\right) p_t\left(\ell_t^i\right) h_t^i. \quad (5)$$

The constraint (5) states that the housing asset can be used as collateral for borrowing to finance investment and to smooth consumption.[3] In contrast, a renter does not own any housing asset and cannot borrow:

$$a_t = w_t\left(\ell_t^i\right) s_{t-1}^i + R_t a_{t-1}^i - c_t^i - z_t^i + q_t\left(\ell_t^i\right) h_t^i - M_t^i \kappa_t^r + a_t^i \geq 0. \quad (6)$$

The indicator M_t^i represents a moving decision taking the value 1 in the case of a move, and 0 otherwise. Moving can be due to changing housing size or housing location, i.e. $M_t^i = 1$ if either $h_t^i \neq h_{t-1}^i$ or $\ell_t^i \neq \ell_{t-1}^i$. The parameters (κ_t^o, κ_t^r) capture fixed moving costs for owners and renters.

The setup focuses on two aspects of housing decisions: neighborhood choice ℓ_t^i and housing services h_t^i. It spells out the three features of housing. First, housing enters utility (2) as a *consumption service* for both renters and owners. Second, housing is a *location asset* for both renters and owners, providing amenity in utility (2); entering the accumulation of human capital (3); and defining wage income in budget constraints (4) and (6). Third, housing enters budget constraint (4) and collateral constraint (5) as *an investment in housing asset* for owners. The effect of the collateral constraint also works through the investment in human capital z_t^i through the budget constraint (4). These three features reflect the tight relationship between housing and consumption inequality, income inequality and wealth inequality. All three features of housing are *symptoms of inequality;* the two investment aspects of housing are both *sources of inequality* and *propagation mechanisms of inequality.*

The aggregate state variables include R_t and vectors of location-specific house prices, rents and wages $(\mathbf{q_t}, \mathbf{p_t}, \mathbf{w_t})$ for all locations $\ell \in \mathcal{N}$. Let $\mathbf{x_t^{r,i}} = \left(s_{t-1}^i, a_{t-1}^i, \ell_{t-1}^i, \eta_t^i, \psi_t^i, \mathbf{q_t}, \mathbf{w_t}, R_t\right)$, $\mathbf{x_t^{o,i}} = \left(s_{t-1}^i, a_{t-1}^i, \ell_{t-1}^i, h_{t-1}^i, \eta_t^i, \psi_t^i, \mathbf{p_t}, \mathbf{w_t}, R_t\right)$ be the vector of state variables for a renter and owner, respectively, where the latter also includes initial housing stock. We denote the decisions of households as functions of the state vector $\mathbf{x_t^{\iota,i}}$ conditional on tenure status $\iota = o, r$. In each period, there are two decision stages. In the first stage, the household

[3]This constraint focuses on using housing wealth as collateral and abstract from specific details of mortgage contracts such as adjustable-rate versus fixed-rate mortgage that will be discussed in section 7.

chooses location $\ell_t^{\iota,i} = L^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}})$. In the second stage, the household chooses consumption $c_t^{\iota,i} = \mathcal{C}^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}, L^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}))$, human capital investment $z_t^{\iota,i} = \mathcal{Z}^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}, L^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}))$, and housing size $h_t^{\iota,i} = \mathcal{H}^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}, L^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}))$, for tenure status $\iota = o, r$. These decisions are discussed in Section 3 to 5 along with the three features of housing.

2.2 Housing market equilibrium

We focus on housing market equilibrium and abstract from the production side of the economy, taking as given the economy-wide return to financial assets R_t, location-specific wage $w_t(\ell)$, and supply of rental and owner-occupied housing, $(\mathcal{Q}^r(\ell), \mathcal{Q}^o(\ell))$. We acknowledge that these are not independent of individual housing decisions in a general equilibrium setting; see discussion on labor sorting across locations in Section 4 and discussion on housing market regulations in Section 7.

Given location and tenure specific housing supplies $(\mathcal{Q}^r(\ell), \mathcal{Q}^o(\ell))$, house price $p_t(\ell)$ and rent $q_t(\ell)$ are determined by equating housing demand to housing supply for the respective tenure in each location $\ell \in \mathcal{N}$:

$$\sum_i \mathcal{H}^\iota(\mathbf{x}_\mathbf{t}^{\iota,\mathbf{i}}, \ell) = \mathcal{Q}^\iota(\ell); \quad \iota = o, r; \quad \ell \in \mathcal{N}. \tag{7}$$

In a unified economy and in the absence of housing, our basic framework would lead to a standard long-run equilibrium in the style of the Ramsay-Cass-Koopmans model. As Caselli and Ventura (2000) show, various sources of consumer heterogeneity can produce equilibrium distributions of outcomes, provided that they possess sufficient structure so that representative individual conditions are satisfied. We therefore adopt the respective cases of heterogeneity in initial asset conditions and in initial skills [*ibid.* p. 911]. They are sufficient to produce rich cross-sectional distributions of outcomes in assets, wealth and incomes. Allowing for housing and for accumulation of human capital (equation 3) would require extending the model, but should not, in principle, interfere with the results pertaining to distributions of outcomes.

Our economy is not unified. It extends over many locations $\ell \in \mathcal{N}$, each with its own supply of rental and owner-occupied housing $(\mathcal{Q}^r(\ell), \mathcal{Q}^o(\ell))$. Embedding our framework in this decentralized setting along with location-specific human capital accumulation provides a conceptual link to economy-wide inequality. Matching actually observed outcomes for an entire economy requires accounting for heterogeneity, but that is beyond the scope

of the paper. Patterns of heterogeneity vary enormously across countries, making it very challenging to compare persistent aspects of housing-related inequality across them.

Presence of the location asset introduces numerous complexities of central significance for inequality. With many locations settled, even mild assumptions about the model structure introduce multiplicities. Different locations identified as neighborhoods are alternatives among which households are indifferent at spatial equilibrium at any point in time. Additionally, individuals may move. This is a particularly important feature of the urban model and is key to understanding the persistence of all dimensions of housing inequality as examined by this paper. We pursue this further in section 4.

This simple framework does not yet explicitly model the tenure decision.[4] It also assumes that homeowners' housing consumption is the same as homeowners' housing asset. This excludes homeowners owning multiple houses where they may rent out part of their housing assets. Henderson and Ioannides (1983), define households whose investment demand for housing is at least as much as their consumption demand as homeowners. Owned housing stock in excess of consumption demand is treated as income-earning assets; see section 5.3 below. Given that transitions across tenure status are relatively infrequent[5] and most homeowners do not own more housing than the homes they owner-occupy, the simple framework is a good starting point.[6]

3 Housing Consumption

The fundamental role of housing is to provide shelter, which is a major consumption service that individuals demand. Dispersion in housing consumption is a symptom of inequality. For three reasons this tops the list for policy makers aiming to alleviate inequality. First, housing expenditure has become one of the biggest single household expenditure items. Second, in the cross-section poorer households spend larger fraction of their income on housing. Third, households and especially poorer households have been spending more on housing over time.[7]

[4]There is an literature on understanding the determinants of homeownership rates, see e.g. Chambers et al. (2009) for a quantitative model and Goodman and Mayer (2018) for a survey.

[5]According to Ioannides and Zabel (2019), Figure 1, transitions from renting to owning and vice versa fluctuate between 2% and 4%, 1970–2015, with the former generally exceeding the latter in the US.

[6]Using the OECD Wealth Distribution Database for 27 countries, Causa et al. (2019) document that about 20 percent of average households own real estate properties other than their main residence.

[7]See Stigler (1954) for some historical evidence. He points out the cross-section pattern was first documented by Hermann Schwabe in 1868, the director of the Berlin Statistical Bureau. He survey empirical studies that report the average expenditure share on rent and fuel for workman's families was

3.1 Housing Expenditure Share

The aforementioned patterns of housing consumption have been widely documented for recent decades. Using micro data on household expenditure for 20 countries, OECD (2020) reports that housing is the largest single expenditure item, compared to food, clothing, health, education, leisure and transport. Across households, the housing expenditure in OECD countries share declines from 37% for households in the bottom income quintile to 31% for the middle quintile and to 25% in the top quintile. Over time, the average housing expenditure share increased by 6 percentage points during 2005 to 2015.[8] The increase is for the bottom income quintile much higher, at 9 percentage points, triple those of the top quintile.[9]

3.1.1 Housing Affordability Crisis

Similar patterns of housing expenditure shares have been documented using micro data for individual countries, such as in France and Germany, the U.K. and the U.S. (Accardo et al., 2017; Dustmann et al., 2022; Belfield et al., 2015; Albouy et al., 2016). The most provoking pattern is the rise in the housing expenditure share for low-income households, often used to describe a *housing affordability crisis*, a concern to policy makers around the world, discussed in section 7.1. Its implications go beyond the matter of housing as shelter: it could imply that low-income households have even less for non-housing consumption, saving or investment in human capital, leading to a broader and a more persistent inequality.

Studies have shown that both a large increase in the cost of housing and the absence of growth in income for low-income households are responsible. There is ample evidence on the lack of growth in income for poorer household during recent decades, see Hoffman et al. (2020) among others. Because low-income households are more likely to be renters, studies of the cost of housing for low-income households have focused on the rise in rents.[10] Evidence that poorer households are more likely to be renters than owners

about 9–11% for England in 1794, about 14% for Belgium in 1853, and about 20% for Massachusetts in 1875. Though the evidence is scant, the cross-section pattern and the time-series pattern of housing expenditures may have been a centuries-old phenomenon.

[8]The only other household spending item that experienced a significant increase is health with a 1 percentage point increase.

[9]This differential growth pattern can be extended back to 1995 for 10 countries where the housing expenditure share increased by 13 percentage points for the bottom income quintile, 7 percentage points for the middle and 3.5 percentage points for the top.

[10]Belfield et al. (2015) for the U.K., Dustmann et al. (2022) for Germany, Albouy et al. (2016) and

abounds. Using the OECD Wealth Distribution Database, Causa et al. (2019) document that the homeownership rate among the top income quintile is more than 10 percentage points higher than among the bottom quintile for 26 countries around 2011 – 2016. The difference in homeownership is more than 25 percentage points for 20 countries and 50 percentage points for 9 countries.[11] The homeownership rate has either not risen much or even declined for the bottom income quintile,[12] indicating the importance of barriers to transitioning from renting to owning especially for low-income households; see section 7.3 for discussion on policies related to homeownership.

The fact that poorer households tend to be renters coupled with the fact that poorer households have experienced a larger increase in housing expenditure share has led to the concern that the rising housing cost is a *rental affordability crisis*. For the U.S., Albouy et al. (2016) report that the percentage of renters who spend more than 30 percent of income on housing has risen by 20 percentage points while those spending more than 50 percent on housing has risen by 15 percentage points from 1970 to 2013. OECD (2020) defines the housing overburden rate as the share of households spending more than 40% of their income on housing. The OECD Affordable Housing Database data for 31 OECD countries around 2014 – 2018 reports a very high overburden rate for households in the bottom quintile. Renters in the private market have average overburden rate of 35 percent, and it is above 50 percent in four countries.[13]

3.2 Income and Price Elasticities of Housing Demand

The variation in housing expenditure share across households and across time depend crucially on the income and price elasticities of housing demand. As the housing choice of a homeowner is both a consumption and an investment decision, we defer its discussion to Section 5 where the role of housing as capital is discussed. Moreover there are also multiple ways to calculate imputed rent as a measure of the user cost of housing for homeowners: market rent of similar properties, or self-reported rental-equivalent; or out-of-pocket expenses. This poses challenges to estimating the price and income elasticities

Ghent and Leather (2021) for the U.S., and OECD (2020) studies of 31 countries.

[11]The 9 countries includes Canada, Denmark, Finland, France, Germany, Luxembourg, United Kingdom, United States and The Netherlands.

[12]For the U.S., Quigley and Raphael (2004) report the difference in homeownership rate between the top and bottom income quintiles increased from 27 to 32 percentage points from 1960 to 2000, as the homeownership rate fell for the bottom quintile but rose for the top quintile during these four decades.

[13]The four countries include Chile, Israel, New Zealand and the U.K.. Six other countries are above 40 percent: Finland, Greece, Iceland, Spain, Sweden and the United States.

of housing for homeowners (Albouy et al., 2016; Finlay and Williams, 2022). The discussion that follows therefore focuses on renters so as obtain a clearer mapping of housing expenditure in the data and the model.

Focusing on the renter's optimization problem, when the borrowing constraint is not binding, the relative expenditures across housing and non-housing satisfy:

$$Renter: \frac{c_t^i}{q_t(\ell_t^i)h_t^i} = \left(1 - \frac{\bar{h}}{h^i}\right)\left(\frac{1-\omega}{\omega}\right)^{\varepsilon} q_t(\ell_t^i)^{\varepsilon-1}. \tag{8}$$

A Cobb-Douglas utility function (when $\bar{h} = 0, \epsilon = 1$) is the special case where both income elasticity and price elasticity are equal one. However, because this implies that the housing expenditure share is the same across households, across time and across locations, a Cobb-Douglas utility function is of limited use for understanding housing and inequality.

Albouy et al. (2016) and Finlay and Williams (2022) provide a brief review of estimates of price and income elasticities of housing. Davis and Ortalo-Magne (2011) find that median housing expenditure shares are roughly constant across US MSAs, which leads them and a substantial fraction of authors of macro housing models to adopt Cobb-Douglas preferences. However, an aggregate approach that does not control for local costs of housing masks offsetting price and income effects. Using city-level variations in income, prices and rental expenditures for the U.S., Albouy et al. (2016) estimate that the elasticity of substitution across housing and non-housing consumption and the income elasticity of housing demand are both less than one. These findings are in line with previous estimates and confirmed by the more recent estimates of Finlay and Williams (2022) who use micro data on consumption and thus avoid assumptions about aggregating preferences within a city.

The intuition for requiring price and income elasticities to be less than one to explain the cross-section and time-series housing expenditure share patterns is as follows. When income elasticity is equal to one, the expenditure share is the same across households within the same location with the same rent $q(\ell)$. Having price elasticity less than one can account for the time-series pattern. However, to explain the cross-section pattern would require poorer households to sort into locations with higher rents. This sorting pattern is counterfactual, indicating that having income elasticity less than one is essential for the

cross-section pattern.[14] If the price elasticity is equal to one, then housing expenditure share is independent of rent. With an income elasticity of less than one (for the cross-section pattern), a rising income would imply a falling housing expenditure share over-time, which contradicts the time-series pattern.

The price and income elasticities of housing demand have been shown to have important implications for the relationship between housing and inequality. Borri and Reichlin (2018) attribute to price inelastic housing demand a "housing cost disease". They show that slower productivity growth in the construction sector implies a rising relative price of housing, which in turn contributes to rising wealth inequality since 1970 for eight large OECD countries. Grossmann et al. (2021) rely on income inelastic housing demand in their study of the effect of a zoning deregulation which slows down rent and house price growth. Through the rent channel a higher welfare gain is generated for households at the bottom of the earnings distribution compared to those at the top, leading to lower welfare inequality. Also focusing on income inelastic housing demand, Finlay and Williams (2022) show that an increase in aggregate skill premiums can lead to an increase in spatial sorting by skill group.

3.3 Housing Quality

An increase in housing expenditure may reflect a quality improvement in housing either through voluntary choice or involuntary compliance with housing regulations. Quigley and Raphael (2004) document that improvements in the quality of rental units from 1960 to 2000 in the US were likely due to regulations requiring plumbing and kitchen facilities, local zoning ordinances reducing density and minimum size requirements etc. The concern is that these minimum standards might force the poorest households to choose housing quality above their desired levels.

Improvement in the quality of rental units might account for the rise in the housing expenditure share of the bottom quintile during 1960–2000. The same is less clear for more recent decades.[15] An important measure of lack of improvement in housing quality is the

[14] Minimum standard imposed by housing regulations (see Section 3.3) can introduce an additional constraint $h_t \geq \hat{h}(\ell)$, which implies higher housing expenditure for households for whom this constraint binds even if income elasticity is one. This constraint, however, is unlikely to be binding for most households, thus this argument cannot explain why the expenditure share is falling across all income groups.

[15] Ghent and Leather (2021) show how overcrowding in high-cost cities in the U.S. leads to an understatement of the extent of affordability problems measured by housing expenditure shares. For the U.K., Belfield et al. (2015) report a decline in floor space per person. OECD (2020) emphasize the large

self-assessment of the quality of neighborhoods (Quigley and Raphael, 2004), represented by the location ℓ_t in our framework. The important role of locations in the rise of housing inequality is the subject of Aladangady et al. (2017), using US data from 1930 to 2012. They find an increase in inequality in housing prices and rents that is not explained by tangible dwelling characteristics such as plumbing, heating system, or number of rooms, but rather by locations that offer different "intangibles" such as access to employment and local amenities. The importance of spatial variation of housing prices is also the subject of Diamond and Moretti (2022). They find that the spatial variation across commuting zones in housing prices is the most important item for the spatial variation in the cost-of-living indexes.

4 Housing Location

4.1 Moving as investment: access to jobs and schools

The decision process for location choice is similar for renters and owners; we focus here on the formulation for renters. The choice for homeowners requires two important qualifications: one, returns from expectations of capital gains due to growth in house prices in effect enter constraint (4) and affect homeowners' asset portfolio choice, which is discussed in section 5.3; and two, homeowners benefit from housing as collateral, equation (5); see section 5.4.

Dropping the household superscript i for the ease of expression, with the state vector $\mathbf{x_t^r}$ defined in section 2, the renter's problem can be written in recursive form:

$$V(\mathbf{x_t^r}) = \max_{c_t, h_t, z_t, \ell_t \in \mathcal{N}} \{u\left(c_t, h_t, \ell_t\right) + \beta E_t\left[V(\mathbf{x_{t+1}^r})\right]\}, \tag{9}$$

subject to skill accumulation in (3) and budget constraint (6). Within each time period, the household first chooses location then chooses consumption, and investment in housing and human capital. The decision rules in the second stage, as denoted in section 2, depend on the state vector $\mathbf{x_t^r}$ and location choice ℓ_t. Using these decision rules, the first stage location decision becomes:

$$V(\mathbf{x_t^r}) = \max_{\ell_t \in \mathcal{N}} \left\{u(\mathcal{C}^r(\mathbf{x_t^r}, \ell_t), \mathcal{H}(\mathbf{x_t^r}, \ell_t), \ell_t) + E_t\left[V\left(\mathbf{x_{t+1}^r}\right)\right]\right\}, \tag{10}$$

subject to the skill accumulation (3) and budget constraint (6), with (c_t, z_t, h_t) replaced

number of children living in overcrowded homes among the low-income households.

by the decision rules $\mathcal{C}^{\iota}(\mathbf{x}^{\iota}_{\mathbf{t}}, \ell_t)$, $\mathcal{Z}^{\iota}(\mathbf{x}^{\iota}_{\mathbf{t}}, \ell_t)$, and $\mathcal{H}^{\iota}(\mathbf{x}^{\iota}_{\mathbf{t}}, \ell_t)$.

Moving is an investment decision: it trades off incurring current costs, including moving cost κ^r, rent $q_t(\ell_t)$, earnings $w_t(\ell_t)$, and amenity value $\mathcal{L}(\ell_t)$, all standard features of a static model, with future returns encapsulated in the expectation of the continuing value, $E_t\left[V(\mathbf{x}^{\mathbf{r}}_{\mathbf{t+1}})\right]$, a function of the future state vector $\mathbf{x}^{\mathbf{r}}_{\mathbf{t+1}}$. Location ℓ_t enters into the future state vector, and also affects the skill accumulation $S\left(\mathcal{Z}(\mathbf{x}^{\mathbf{r}}_{\mathbf{t}}, \ell_t); s_{t-1}, \ell_t)\right)$.

The complementarity between location and human capital investment is captured by our skill accumulation equation (3). As future skill depends on current skill, the duration of staying in a neighbourhood will play important role. Abstracting from the borrowing constraint, human capital investment equates expected marginal cost with expected marginal benefit:

$$E_t\left[\frac{\partial V(\mathbf{x}^{\mathbf{r}}_{\mathbf{t+1}})}{\partial a_t}\right] = E_t\left[\frac{\partial V(\mathbf{x}^{\mathbf{r}}_{\mathbf{t+1}})}{\partial s_t}\,\frac{\partial S\left(z_t; s_{t-1}, \ell_t\right)}{\partial z_t}\right], \tag{11}$$

where the marginal value of skill depends on wage and future value of skill:

$$\frac{\partial V(\mathbf{x}^{\mathbf{r}})}{\partial s_{t-1}} = \beta E_t\left[w_t\left(\ell_t\right)\frac{\partial V(\mathbf{x}^{\mathbf{r}}_{\mathbf{t+1}})}{\partial a_t} + \frac{\partial S\left(z_t; s_{t-1}, \ell_t\right)}{\partial s_{t-1}}\frac{\partial V(\mathbf{x}^{\mathbf{r}}_{\mathbf{t+1}})}{\partial s_t}\right]. \tag{12}$$

The location asset ℓ^i_t proxies for contextual information discussed above and enters the period budget constraint through its rental rate $q(\ell_t)$, and as a determinant of the wage rate $w(\ell_t)$. It generates future payoffs in terms of better jobs, expressed by $w(\ell_{t+1})$, and human capital investment via $S(z_t; s_{t-1}, \ell_t)$. It follows that the location asset earns in the current period an individual an improvement in the remuneration of labor, provided that agglomeration effects are present. That depends on lagged skills, and in the following period, via the improvement in skills. While it is impossible to solve explicitly for the law of motion, it is clear from (11) that we may solve conceptually for z^i_t as a function of ℓ^i_{t+1}, given R_t,. By substituting back into (10) we obtain a law of motion for the location asset. Finally, by substituting in for human capital investment z_t in (3) we obtain the law of motion for skill. Equations (3) and (10) form a system of difference equations that describe the joint evolution of location and skill, provided that the following sources of neighborhood effects are specified: wages as functions of locations, and the contribution of location and of investment in human capital to skill. Neighborhood effects complement human capital investment through access to schools $S\left(z_t; s_{t-1}, \ell_t\right)$, where both school quality and peer effects matter. Parameters of both laws of motion enter the join evolution

of (ℓ_t, s_t) and of course their steady states. The location asset also shifts the period utility via $\mathcal{L}(\ell)$.

Whereas a long-standing literature has incorporated a forward-looking approach to location choice, the term *location as an asset*, which we adopt, was introduced by Bilal and Rossi-Hansberg (2021) , B&R-H for short. As an asset, location is not subject to borrowing constraints: Savers in the location asset incur current costs in order to avail themselves of locations with higher future returns. Borrowers transfer resources to the present by going to low-cost locations, i.e. those that received bad income shocks. Location asset returns are heterogeneous, they depend on household labor supply, fertility decisions and numerous individual characteristics affecting costs and future benefits of living in a location. B&R-H show that individuals who are constrained in financial markets use the location asset to transfer consumption to the present by living in locations with low location costs but relatively poor job and educational opportunities; section 4.2 discusses their empirical results.

Ngai and Sheedy (2020) focus, using a housing search model, on moving as an investment in match quality between the household and location, which proxies for the full range of neighborhood amenities.[16] Search and other frictions may impede moves, with households tolerating quality mismatch, unlike the frictionless world of B&R-H. Frequency of moving defines residence spells, which are linked to exposure to neighborhood effects (Chetty and Hendren, 2018a,b) and adjustment to households' asset portfolios (see section 5.3).

Moving as an investment decision implies that a range of factors can hinder households' ability to exercise the option of housing as investment in the location asset, thereby contributing to housing-related inequality. Restrictions in housing supply that curtail access to inexpensive locations can have inequality consequences both currently and in the future via the propagation mechanisms (B&R-H; see discussion in section 7.4.1). As an investment, a higher interest rate can also lower mobility, contributing to an increase in mismatch especially for poorer household (Ngai and Sheedy, 2020). Researchers have documented a long-standing decline in renters' mobility in the US, which is mostly due to rent-to-rent moves (Ioannides and Zabel, 2019). The pronounced decline in residential

[16]Given the flow of first-time buyers/renters and new homes are small relative to existing stocks, moving contributes significantly to increasing both housing supply and demand, which is an important margin for understanding housing market dynamics regarding house prices, sales and houses for sale (Ngai and Sheedy, 2020, 2022).

mobility in the U.S. involves in particular young adults, a group that may most need to invest in location assets.[17] An important next step in this area is to establish causal motives of moves (Kennan and Walker, 2011).

4.1.1 Endogenous Sorting and Hedonic Price of Neighborhoods

Next, we underscore the richness and complexity of the basic framework by exploring rent determination $q(\ell)$ in a setting that allows for a rich set of individual and social effects. We abstract from full dynamic generality by assuming just a two-period snapshot of the basic framework, that is, two-period dynasties consisting of a parent and child each. The approach leads to an exact solution of the sorting model while allowing for neighborhood (contextual) social effects. The solution combines the logic of equations (3), (7), and (10) and obtains an equilibrium housing rent that drives individuals' self-selection into neighborhoods, defined over the positive reals, $\ell \in \mathcal{N} = R_+$.

Locations differ in terms of parents' average neighborhood schooling. Individuals are characterized by a vector of attributes: $\mathbf{B} := (\zeta_1, \Upsilon, \zeta_3, \zeta_4, \zeta_5)$, whose components are defined respectively as: log of parental schooling at time 0, $s_0 = e^{\zeta_1}$, parental income, Υ, log of a child's idiosyncratic characteristic, $a = e^{\zeta_3}$, log of preference parameter, $\beta = e^{\zeta_4}$, that weights a child's schooling outcome in the utility function, and a random shock that enters the educational production function, ζ_5, which will be assumed to be uncorrelated with all other components of $\mathbf{B}$. That is: $\mathbf{B} = (\ell n s_0, \Upsilon, \ln a, \ln \beta, \zeta_5)$.

Simplifying the model so to solve explicitly for the equilibrium rent while emphasizing novel features of our framework, we assume that individuals consume a unit of housing each and maximize their utility with respect to non-housing consumption and their own child's expected schooling:

$$\max_{\ell} : \left\{ \frac{1}{\gamma} \left[1 - e^{-\gamma(\Upsilon - q(\ell))} \right] + e^{\zeta_4} E(s_1|\ell) \right\}, \ \gamma \geq 0, \tag{13}$$

where γ is a parameter. This takes the place of (2) or (10). A child's schooling outcome produced in location ℓ is described by an educational production function, the counterpart of (3) here, as a function of average parental schooling in ℓ, $S(\ell)$; own parent's schooling,

[17] From 1976 to 2016, the percent of those who moved in the preceding year declines monotonically with age. The mobility of those of age 20–24 declined from 40% to 25% during 1976–2016.

e^{ζ_1}; the child's own characteristic, e^{ζ_3}; and a random shock e^{ζ_5}. That is:

$$s_1 = (S(\ell))^{\delta_1} e^{\delta_2\zeta_1+\zeta_3+\zeta_5}, \tag{14}$$

where δ_1 and δ_2 are positive parameters. The random shock ζ_5 is the only quantity that is not observable by individuals when they choose location; it is assumed to be independent of location. Average schooling at each location, $S(\ell)$, and housing rent, $q(\ell)$, are both endogenous. They are determined consistently with equilibrium sorting of households across locations.

Ioannides (2013), section 3.3, derives, under the assumption that the vector $\mathbf{B}$ has a normal distribution $N(\mu, \mathbf{\Sigma})$, the following closed form solution for $q_\ell(S)$:

$$q(S) = L_0 \ln\left[1 + L_1 S^{\delta_1+L_2}\right], \tag{15}$$

where L_0, L_1 and L_2 are auxiliary functions of the underlying parameters and δ_1 a parameter of the educational production function (14), all positive. The rent function $q(S)$, indeed its *hedonic function*, is increasing in S and sigmoid under reasonable assumptions. Neighborhood parental schooling is given as an implicit function of all parameters and increasing in income Υ. The distribution of income of parents who choose neighborhood S is normal, and that of parental education lognormal, with means and variances defined in terms of the underlying parameters. These distributions characterize endogenous sorting that is mediated by the housing market. Although this solution assumes that housing is consumed at the unit level, willingness to pay for neighborhood quality has a rich set of determinants. Underlying this result is that parental education and income, i.e. the wage rate, are positively correlated within neighborhoods and increasing in neighborhood quality. Further progress in understanding housing and inequality from the perspective of housing market equilibrium requires a full specification of heterogeneity, as discussed in section 2.2.

In a broadly related study, Gilraine et al. (2023) formalize the provision of education through a local public sector and, in addition, introduce intra- and intergenerational wealth effects from rising housing prices. This works because rising prices improve school quality and therefore human capital and future incomes. Their data from 2002 to 2017 from a large US school district is combined with Zillow data on housing transactions.

4.2 Location Assets and Wages Empirics

The empirical analysis of B&R-H assumes assortative matching of workers' skills with French cities, ranked in terms of average returns to the location asset. These rankings proxy for continuity in the location asset, as assumed by B&R-H. They use French individual tax returns as panel data to confirm key predictions of the theory: those in the bottom wealth quintile move more frequently, thus confirming the dynamic nature of the decision. Moving to better locations pays off gradually over time: wages increase by 10% after moving, and by 20% after 10 years. A negative income shock of at least 25% causes those in the bottom wealth quintile to downgrade their location by about 2 percentage points relative to movers in the top quintile. Low-wealth individuals downgrade their location but do not adjust their holdings of financial assets. High-wealth individuals do not downgrade their location but reduce their holdings of financial assets. With locations ranked in terms of average incomes alone, the estimated dynamic location effects abstract from the effects of schools and neighborhood effects. As B&R-H note, treating location as an asset could also facilitate the evaluation of such global phenomena as "factor rewards in particular locations, occupations, and industries" [*op. cit.*, p. 2488].

The empirical analysis of B&R-H rests on assortative matching of individuals' skills and cities and is consistent with a rich literature which confirms individuals' earnings are higher in bigger cities. In particular, DeLaRoca and Puga (2017), using data from Spain, show that both the mean and dispersion of earnings are greater in bigger cities. They attribute the latter to the fact that big city experience not only improves skills but also benefits most those with higher innate ability. This in turn causes greater dispersion of earnings within occupational groups in bigger cities.

The residential careers of households involve choices of locations and therefore allow empirical analyses of wages and locations. Card et al. (2022) use longitudinal data from the Longitudinal Employer-Household Dynamics (LEHD) program of the US Census Bureau. The data follow individuals as they move across commuting zones (CZs). Consistent with recent research from France, Spain and Germany, they find that two thirds of the variation in observed wage premiums for working in different CZs is attributable to skill-based sorting, and the effect is much stronger for college-educated workers. This leads in turn to a positive correlation between measured returns to skill and CZ average wages (or CZ size), that is "almost entirely due to sorting on unobserved skills within the

college workforce." They find that the degree of assortative matching across CZs is much larger for college-educated workers. Moreover, they find that differences in local housing costs more than offset the corresponding earnings premiums, suggesting that workers who move to larger CZs have lower net-of-housing consumption.

This finding is consistent with Hsieh and Moretti (2019), namely that stringent restrictions to housing supply in high productivity cities, "superstar cities", limit the number of workers who have access to highly productive jobs. As a result, productivity growth is translated into higher house prices and higher nominal wages. Using US county-level data (aggregated up to 220 metropolitan areas), Hsieh and Moretti conclude that spatial dispersion in marginal labor productivity is associated with spatial dispersion in housing prices (something they attribute to variations in zoning restrictions), while spatial equilibrium holds. Thus, housing supply restrictions lead to inequality in welfare across space by creating barriers to labor mobility of skilled workers and lower aggregate US growth, by 36 percent from 1964 to 2009, according to their estimates.

4.3 Location and Empirics of Life Cycle Outcomes

A large literature on neighborhood effects affecting life cycle outcomes has been surveyed by Ioannides (2013) and Graham (2018). A series of studies, conceptually related to Card *et al.* (2022), who focus on households, starts with Chetty and Hendren (2018a,b). They focus on individuals and use information on moves for seven million families across US commuting zones and counties in order to estimate neighborhood effects on intere-generational mobility. By observing household careers over successions of residential neighborhoods and implementing clever identification strategies that exploit variations across birth cohorts, genders, and quantiles, they estimate that the neighborhood effects on children's incomes converge to those of permanent residents at a rate of 4% per year of exposure. When they work with US county-level estimates, a more granular level of aggregation, they estimate that for children in low-income families, each year of childhood exposure to one standard deviation "better county," defined as those with less concentrated poverty, less income inequality, better schools, a larger share of two-parent families, and lower crime rates, increases household income at age 26 by 0.5%.[18]

[18]See Chyn and Daruich (2021) and section 7.2.1 below, and Fogli et al. (2022) for uses of micro estimates in macro quantitative models and the importance of the associated general equilibrium effects.

4.3.1 Experiments and Exogenous Moves

Research relying on observational data may bias estimations. Data from exogenous moves are thus particularly useful. Chyn (2018) compares young adult outcomes of children, displaced by demolitions of public housing to outcomes for originally similar but undisplaced peers in nearby public housing in Chicago. The displaced households were offered tenant-based housing vouchers. He finds that displaced children were more likely to be employed and earned more in young adulthood, experienced fewer violent crime arrests and had lower high school dropout rates. Nakamura et al. (2022) study lifetime outcomes in the context of a "natural experiment." In a town in Iceland, a volcanic explosion in 1973 covered a third of houses with lava and forced relocation of the population. Benefits and costs of relocation were uneven: parents were slightly worse off, but children experienced dramatically increased lifetime earnings and education, even though the town in question had a fairly high income. Destruction appears to have removed impediments to moving for individuals who might have been poorly matched originally. In addition, several studies use field-experimental data from the "Moving to Opportunity" (MTO) program, a major randomized housing mobility experiment; for details, see 7.2.1 below.

4.3.2 The Inner Workings of Neighborhoods

Beneficial aspects of location on adult outcomes for young movers prompt the question what generates them. Patacchini and Zenou (2011) suggest that they are due to peer effects influencing parental input to children's human capital investment. Using data from an entire cohort of the UK National Child Development Study (NCDS), they compare outcomes for households that chose private dwellings in residential neighborhoods with those that were administratively assigned dwelling units in Council housing (public or social housing in the context of the UK). In "good" neighborhoods, better educated parents provide time input in their kids' education, and their kids are more likely to reach high educational levels. That is not the case for those living in "bad" neighborhoods. They suggest that their results are causal and imply that parental involvement and neighborhood quality are complements. Han (2022) utilizes data on spillover effects in the neighborhoods where residents of demolished public housing projects in Chicago were relocated. He finds that parents in those neighborhoods reacted to perceived neighborhood quality decline by increasing parental involvement after arrival of relocated residents.

Oreopoulos (2008) provides a perspective from Canadian data. With the caveat that there is less residential segregation in Canada than in the US, he reports that the residential neighborhood environment matters most to an individual's mental health and exposure to crime, but has little influence on self-sufficiency or child development. Instead, smaller social interaction settings, such as among classmates or roommates, appear to matter more.

4.4 Endogenous Amenities and Spatial Equilibrium

In a large economy, like the US, cities of different sizes coexist and provide different combinations of amenities, with climatic as well as industrial diversity. Land use restrictions are more pronounced in larger and more highly sought after cities (Gyourko et al., 2013; Baum-Snow, 2023). Those those bigger cities also host more heterogeneous populations. Individuals' pursuit of better lifetime prospects is therefore associated with greater earnings inequality. The heterogeneity of housing stock affords flexibility in accommodating different tastes and demands (and can provide more through conversions). Thus, shocks to housing demand due to arrival of wealthier consumers increase housing prices for all. The attraction of superstar cities gives rise to both income and welfare inequality, as is confirmed by empirical research (see below). Since individuals typically have alternatives about where to live, the Rosen–Roback concept of spatial equilibrium is particularly valuable in analyzing inequality is spatial settings.

Diamond (2016) demonstrates how sorting has reshaped higher-skilled US cities. From 1980 to 2000, the rise in the US college/high school graduate wage gap coincided with increased geographic sorting as college graduates concentrated in high wage, high rent cities. The supply of diverse amenities, an outcome of consumer as well as producer decisions, includes such amenities as retail, transportation, crime, environmental quality, schooling, and job quality. Such amenities together with changes in cities' wages and rents have increased welfare inequality between high school and college graduates by more than is implied by the increase in the college wage gap alone.[19]

Diamond and Gaubert (2022) emphasize that, by 2017, sorting to US cities has centered around consumption amenities (no longer around production as in earlier times). They assess how well-being inequality has changed by examining the impact of the dif-

[19]See Almagro and Dominguez-Iino (2022) for a similar urban reshaping in Amsterdam induced by tourism. It led to new housing regulations, all of which have had notable distributional effects.

ferent drivers of sorting: changes in nominal wages in isolation, then rents, and finally amenities. Using a specific model and parameterization, they find that nominal wage inequality increased by 16.7 percentage points between 1980 and 2000, and by 10.7 between 2000 and 2017. Adding the effects of changes in rents shows that the increase in wage inequality declines by 10 percentage points, because high-skill workers tend to live in more expensive locations. However, adding the effects of changes in endogenous amenities leads to a larger change in well-being inequality of 17 and 12.1 percentage points between 1980–2000 and 2000-2017, respectively.

4.4.1 Neighborhood Income Distributions and Overall Inequality

Findings by Hardman and Ioannides (2004) with data for micro neighborhoods from the US American Housing Survey, and further contributions by Schmidheiny (2006) and Wheeler and La Jeunesse (2008) with data from a sample of 359 U.S. metropolitan areas have established interesting geographic patterns of income inequality. For example, Wheeler and La Jeunesse (2008) show that overall income inequality within a metro area tends to be driven by variation within neighborhoods, not between them. See Ioannides (2013), Ch. 3, for a review.

Reardon et al. (2015) adopt and extend this approach, using data from the decennial censuses and the American Community Survey, by focusing (in their terminology) on patterns of "neighborhood context." They define these patterns in terms of curves expressing the median incomes of neighborhoods (defined as US census tracts) as functions of household incomes (magnitudes and percentiles). Such curves are, in general, increasing, regardless of household race or ethnicity, income, and metropolitan area. They demonstrate large and persistent racial differences in patterns of neighborhood context, even among households with the same annual income across demographic groups, specifically Asians, Whites, Hispanics and Blacks. Their approach demonstrates evocatively how segregation increases with income. The plot of median neighborhood income becomes steeper for higher incomes, especially for Black households; e.g., see *ibid.,* Figure 3. The steepness of these curves indicates the degree of income segregation; see also section 6.3.2 below. These patterns of neighborhood context also provide a simple visualization of the extent of sorting itself. E.g., perfect sorting corresponds to 45^o-degree curves; perfect mixing to horizontal curves; see also Hardman and Ioannides (2004).

The fact that these patterns have changed little over time is an enduring puzzle. Sampson and Levy (2022) point out, even though residents of both advantaged and disadvantaged neighborhoods in Chicago travel far and wide, their relative residential isolation by race and class persists: racial disparities in mobility-based disadvantage are even more pronounced than residential neighborhood disadvantage.

4.5 Working from Home

The Covid-19 pandemic and the policy response throughout the world forced reliance on telecommuting technologies, commonly known as Working-from-Home, WFH for short. Not all jobs are amenable to WFH; nevertheless substantial numbers of workers continued their work remotely, thus avoiding dangerous exposure to infection in crowded urban centers and reducing time spent on commuting. Introducing WFH within a spatial hedonic equilibrium predicts intracity and intercity consequences for the housing market: across cities, workers can keep their high-productivity jobs but save by moving to cheaper cities; within cities, the smaller importance of job access flattens the intracity house-price gradient. Brueckner et al. (2023) use data for house prices and rents from Zillow, for local amenities and productivity from Albouy (2016), and for county population outflows from the United States Postal Service address change data. They confirm these predictions, including in connection with population outflows, in broad-stroke. WFH has thus important implications for housing and inequality. In high-productivity cities real-estate owners lose and renters gain, with the opposite effects in low-productivity cities. Davis et al. (2023) emphasize the effect of WFH as a technology complementary to working from the office that has the effect of increasing demand for residential space and house values. Their approach does not predict a mass exodus to remote locations, but it does support the notion that at least some telecommuting will continue after the pandemic ends. Of course, many jobs do not lend themselves to telecommuting, so WFH introduces another source of inequality, with long run consequences for the industrial composition of cities and inequality. Overall, recent research highlights that for some workers WFH has become firmly entrenched. It favors primarily highly skilled workers and occupations and is likely to have major distributional consequences, softening urban housing markets while strengthening suburban and rural ones.

5 Housing Capital

The third feature of housing is as an investment in real-estate assets. Housing capital is about half of the national capital stock in many countries. It is the single most important form of wealth for most homeowners, except those at the very top. The distribution of housing wealth is both a symptom of inequality, and a source of and propagation mechanism for inequality. It determines a household's disposable income net of spending on housing, through the budget constraint (4), and as a collateral in the borrowing constraint (5). The latter is unique to owning: renters by definition do not own their own homes and thus do not benefit from housing capital gains or housing as collateral. Inequality of housing wealth can affect future income and wealth inequality through investment in human capital, location and housing assets.

For a homeowner housing choice is both a consumption decision and an investment decision. When the constraints are not binding, the relative consumption across housing and non-housing satisfies:

$$Owner: \frac{c_t^i}{h_t^i} = \left(1 - \frac{\bar{h}}{h^i}\right)\left(\frac{1-\omega}{\omega}\right)^{\varepsilon}\left[p_t(\ell_t^i) - E\left(\frac{p_{t+1}(\ell_t^i)}{R_{t+1}}\right)\right]^{\varepsilon}. \tag{16}$$

If the house price is equal to the discounted sum of future rents, and in the absence of other costs and taxes, the term in brackets in the r.h.s. above is equal to the rent $q_t(\ell_t^i)$, a relationship predicted by user cost theory (Poterba (1984)). The relative housing expenditure for owners in (16) then coincides with that for renters in (8), *cet. par.*

The evidence on trends in house prices versus rents is mixed. Belfield et al. (2015) and Dustmann et al. (2022) argue that rents have risen faster then prices, but Bonnet et al. (2014) and Fagereng et al. (2022) argue that house prices that have risen faster. The takeaway is that the consumption aspect of housing for owners might not be too different from those for renters, *cet. par.*

When housing and non-housing consumption are gross complements ($\epsilon < 1$), a rise in house price accompanied by a corresponding rise in rent would have similar impact, for both renters and owners, on reducing relative non-housing consumption expenditure, as shown in (8), implying a clear fall in renters' non-housing consumption. What truly differentiates the housing decision of owners from renters are the additional effects of house price on housing wealth and its collateral value: *the wealth effect* through the budget constraint (4), and *the collateral effect* through the collateral constraint (5).

5.1 Housing wealth

Housing wealth has occupied a significant fraction of national wealth for centuries. Evidence for France, Germany, the U.K. and the U.S. since 1700, and for Australia, Canada, Japan and Italy since 1970, has been documented in Piketty and Zucman (2014). Moreover, there is ample evidence for recent decades: Causa et al. (2019) use micro data from the ECB Household Finance and Consumption Survey and the Luxembourg Wealth Survey in 23 OECD countries during the 2010s to document that more than half of total assets of the middle class (proxied by households in the middle three quintiles of the income or wealth distribution) are in the form of housing assets for the majority of countries in Europe. The housing share of total assets is smaller for households in the bottom wealth and income quintiles but still at about 20% on average for the bottom wealth quintile and 50% for the bottom income quintile.

That the distribution of housing wealth is both a symptom and a source of inequality is depicted clearly by the distribution of homeownership across the spectrum of income and wealth distributions. We discussed evidence that low income households are more likely to be renters in Section 3.1. The picture is even starker along the wealth distribution. Using OECD Wealth Distribution Database for 27 countries around 2011 – 2016, Causa et al. (2019) further report that in almost all countries (with the exception of the Netherlands) the homeownership rate in the top wealth quintile was more than 50 percentage points higher than the homeownership rate in the bottom wealth quntile. For the Netherlands the difference was about 30 percentage points. The homeownership rate captures the role of housing on wealth inequality through an extensive margin, highlighting those who have (owners) and those who have not (renters). The intensive margin is also at work across homeowners due to inequality in the size of housing stock, and importantly the value of their housing stock discussed in section 5.2.

The distribution of housing wealth can persist into future generations through inheritance or other channels, highlighting the role of housing capital as a propagation mechanism for inequality. Using the ECB Household Finance and Consumption Survey in 18 OECD countries, Causa et al. (2019) document that on average about 20% of households inherited their house outright (or received it as a gift). The share is even larger among households in the bottom income quintile. Other channels through which individuals' access to homeownership depends on parental wealth include direct funding

from parents (dubbed the 'Bank of Mum and Dad').[20] Another path of intergenerational transmission is a positive relationship between parents' housing wealth and children's education, with evidence from Germany, Sweden, the U.S. and the U.K. (Karagiannaki, 2017; Pfeffer and Hallsten, 2012; Lovenheim, 2011). Moreover, education leading to higher earnings contributes to children' chances of being homeowners (in addition to its direct contribution to the intergenerational linkage of income and wealth inequality). Englund et al. (2013) using a novel administrative data set from Sweden find that strong intergenerational correlation, with intergenerational wealth elasticities in the order of 0.4 to 0.5, in net worth, and show that it comes largely from housing wealth, while their data allow them to explain all correlation.

These intergenerational channels of housing inequality can be broadly captured by the budget constraint (4) by interpreting the household problem as a dynastic problem. Current housing wealth $p_t(\ell_{t-1})h_{t-1}$ affects future housing wealth and the investment in human capital z_t. While several channels could be at work, there is strong evidence for an intergenerational linkage of homeownership. Using panel data from the U.K., Blanden et al. (2021) estimate a strong positive relationship between the homeownership status of individuals aged 42 and that of their parents when they were teenagers. For the earliest cohort of 42 year-olds observed in 2000, the homeownership rate is about 14 percentage points higher for those whose parents owned their home in 1974. For the cohort observed in 2015, that increases to 27 percentage points.

5.2 Housing returns and wealth inequality

Housing capital acts as a propagation mechanism for inequality by exacerbating the impact of changes in house prices due to unequal distribution of housing wealth. Evidence from OECD (Causa et al., 2019) and post-World War II U.S. (Kuhn et al., 2020) has revealed that housing wealth is concentrated in the middle income and wealth quantiles, whereas households at the top hold more business equity. All else equal, rising house prices make the wealth distribution more equal, while stock market booms have the opposite effect: they boost wealth at the top and lead to a more unequal distribution of wealth.

[20] Using the *British Household Panel Survey*, Wood and Clarke (2018) estimate an increase in "Bank of Mum and Dad"s funding since 1990s. Estimates of the magnitude among the first-time buyers varies from 27 percent in the *English Housing Survey* to 60 percent according to the Council of Mortgage Lenders.

Among homeowners, variations of housing returns through changes in house prices or rents can drive heterogeneity of returns across the wealth distribution and locations. Substantial spatial variation in housing returns has been documented for 15 OECD countries (Amaral et al., 2022) using city-level data, and within as well as across cities for the U.S. (Aladangady et al., 2017). Substantial spatial variation of housing returns within the US is a major contributor to housing-related inequality via wealth inequality. During the past four decades both average house prices and the cross-city standard deviations of wages and house prices have increased. Increasing average house prices initially cause wealth inequality to decline, because the share of housing wealth decreases with wealth for the top and middle quintiles. Greaney (2020) shows that first, city-level house return volatility is an important source of wealth inequality. Moreover, he predicts that removing the city level component of house return variance would lower the Gini coefficient on wealth by 2.2 percentage points. Such a change would reverse over 31% of the increase in wealth inequality that has occurred in the U.S. since 1989. Increases in geographical price dispersion increase inequality because households are imperfectly mobile across locations. Pass-through from local productivity shocks is uneven across the age and wealth distributions. House price changes reduce the welfare effects of wage changes for renters, but augment them for homeowners.

Using two countrywide data sources in Norway and following individual homeowners, Eggum and Larsen (2021) document a substantial increase in capital gains inequality over the period 2007 to 2019 both across and within geographical strata and across and within birth cohorts. Measuring capital gains based on changes in house prices, they explicitly consider three types of capital gains: realized, semi-realized, or potential depending the timing of buying and selling.

The distinction between realized and potential gains and the use of the realized capital gains are important, as revealed by the recent debate surrounding the main result of Piketty and Zucman (2014). They report an increase in the wealth to income ratio since 1970. Bonnet et al. (2014) argue that this result hinges on using house prices as the return to housing capital. They argue instead that the returns to housing capital should be measured using rents, the actual income of housing capital that accrues to landlords and the opportunity cost to owner-occupiers. The user cost theory of Poterba (1984) predicts a tight relationship between house prices and rent, thus both should deliver

similar answers. Bonnet et al. (2014), however, find that house prices grew much faster than rents since the late 1990s in Canada, Germany, France, the U.S. and the U.K.. The same pattern is also observed in Norway from 1994 to 2015 (Fagereng et al., 2022). When Bonnet et al. (2014) recalculate the value of housing capital using rents, they find a modest rise in the capital to income ratio. Their main conclusion is that a rise in housing prices does not necessarily lead to a rise in the implicit income of homeowners or the actual income of landlords, and thus is not a major reason for faster accumulation of wealth by the wealthy households. This debate is not easily settled, however, unless the authors can agree on the real consequences of housing price on access to housing and its impact on inequality.

Fagereng et al. (2022) make a different but closely related point about the distributional effects of rising asset prices. In a world without borrowing and collateral constraints, the *welfare* of households that never buy or sell assets is unaffected by changes in asset prices. A rise in house prices thus redistributes surplus from buyers to sellers. This has implications across cohorts in the housing market since the young are more likely to be net buyers of housing compared to the old: rising house prices benefit the old at the expense of the young. The presence of the collateral constraint (5), however, implies that changes in house prices can affect the welfare of homeowners even if they do not buy or sell houses. This collateral effect implies that house prices have different effects across households with different degree of leverage, as will be discussed in Section 5.4.[21]

5.3 Readjustments of Households' Asset Portfolios

The exposition so far has assumed a single, possibly stochastic, gross rate of return for homeowners. In reality, households have numerous options for saving and borrowing, whose vector of returns has a stochastic structure that also includes aggregate shocks, real and monetary. Since households must consume housing services, regardless of whether they rent or owner-occupy, they face the problem of hedging risks. Both renters and owners are exposed to aggregate and specific shocks; and in addition, owners with mortgages commit to a downpayment and interest payments that depend on the nature of their mortgage loans. Those loans may have fixed or adjustable interest rates, but the latter exposes them to aggregate shocks. Inflation is favorable to fixed rate borrowers.

[21] In the presence of collateral constraints, changes in house prices can even cause large redistribution between net buyers and net sellers of houses (Kiyotaki et al., 2011).

The choice of housing equity depends on the origin of assets. Family members may assist younger households with loans or gifts that allow them to afford greater home equity. Thus all components of households' asset portfolios are stochastically interdependent. Chetty et al. (2017) show empirically that increases in property value (holding home equity constant) reduce stock holdings, while increases in home equity wealth (holding property value constant) raise stock holdings. The stock share of liquid wealth rises by 1 percentage point — 6% of the mean stock share — for a household that spends 10% less on its house, holding wealth fixed.

Enriching the basic framework of section 2 in order to emphasize housing in the portfolio of assets requires us first, to account explicitly for the structure of returns and, second, to integrate the location asset, with its own hedging requirements. Ortalo-Magné and Prat (2016) offer a first step in the latter direction.

As discussed in section 2.2, Henderson and Ioannides (1983) pioneered a portfolio approach (with a restricted set of assets) to the choice between renting and owning. They distinguish demand for housing for housing consumption and for housing investment, defining owner-occupancy in terms of housing investment's being at least as large as housing consumption demand. Ioannides and Rosenthal (1994) find that investment demand is more sensitive to wealth and income than consumption demand, and that consumption demand is more sensitive to demographic variables and proximity to urban suburbs. In addition, their tests indicate that the value of the principal residence of most owner-occupiers is determined by their consumption demand for housing, not their investment demand. Brueckner (2017) also uses Survey of Consumer Finances data and confirms his prediction that the mix of non-housing assets differs between the constrained and unconstrained cases, net of actual and imputed rental income. Cocco (2005) articulates in more detail the role of housing in asset holdings (when consumption and investment demands are constrained to be equal). Early in life, and at low levels of financial net-worth, households keep liquid assets low which reduces the benefits of equity market participation, with important consequences for the distribution of wealth. Arrondel and Lefebvre (2001) show that the difference between consumption and investment demands cannot in itself explain housing purchases by French households. Fu (1993), Ch. 4, addresses properties of housing within households' asset portfolios in greater depth using a mean-variance approach. Crossley et al. (2022) use UK household-level data on bor-

rowing, consumption and investment to show a borrow-to-invest motive where leveraged households increase borrowing to make additional residential investments so as to get closer to their optimal asset portfolio.

Sinai and Souleles (2005) recognize that households being in effect born "short" housing services exposes them to fluctuations in rents. Owner-occupancy is thus a hedge against rent fluctuations: a purchase of a stream of housing services for a known up-front payment. Thus the housing tenure decision depends on both rent and house price risks, as well as the risks associated with the location asset. The notion of home ownership as an inflation hedge is supported by Malmendier and Wellsjo (Forthcoming). Using data from 22 European countries, they show that past inflation experiences strongly predict home ownership within and across countries. This holds even among immigrants to the US who have experienced inflation in their home countries.

Capital gains as a component of the return to housing may contribute to inequality (Eggum and Larsen, 2021). Dusansky and Koç (2007) demonstrate that expectations of capital gains in owner-occupied housing can make the demand for owner-occupied housing in effect upward-sloping. Not surprisingly, cyclical fluctuations in expectations can impact housing inequality, and in ways that interact with residential moves. Moves are the conduit through which capital gains (and losses) are realized. Moves may also interact with misinformation and disinformation, both of which played an important role in the run-up to the Great Financial Crisis of 2007–2009.

The fixed components of transactions costs of all types cause portfolio readjustments to take place at discrete times, usually coinciding with housing consumption changes. The latter may sometimes be prompted by demographic shocks or job relocation leading to moving, remodeling or changes of tenure mode. Grossman and Laroque (1990) has been generalized by Flavin and Nakagawa (2008) and Flavin and Yamashita (2011), who allow for adjustable non-housing consumption and general asset portfolios. Since overall risk preference depends on wealth, distributional consequences follow. As others have also argued, the highly levered position of young homeowners leaves little room for extensive risk diversification. Portfolio decisions require knowledge of the correlation matrix between the return to housing capital, labor income and other financial assets (stocks and bonds). But as pointed out by Piazzesi and Schneider (2016) and Davis and Van Nieuwerburgh (2015), high-quality data that would allow to pin down the correlation

matrix are scarce. Both those papers review in depth the literature on the role of housing in asset portfolios. Notably within that literature, Flavin and Nakagawa (2008) and Flavin and Yamashita (2011) allow for endogenizing the timing of adjustment of the housing quantity, in reaction to exogenous events. Thus, housing is quasi-fixed during residence spells of endogenous length, but timing depends on the share of housing in total wealth. This links the strength of the neighborhood effects, documented by Chetty and Hendren (2018a,b), to asset portfolio structure.

Martinez-Toledano (2022) emphasizes, using Spanish data, that top wealth holders time the market better, investing a larger share in housing during booms and reshuffling their portfolios away from housing and in favor of financial assets at the beginning of busts. Consequently, such portfolio reshuffling is an important driver of short- to medium-term fluctuations of wealth inequality. Sakong (2022) estimates the trading patterns of households across wealth levels in the US housing market for 1988–2013 and complements the findings of Martinez-Toledano (2022) by showing that poorer households are more likely to buy risky assets in booms — when expected returns are low — and sell after a bust — when expected returns are low. The interquartile-range-difference is 60 basis points annually. Consequently, geographical areas in the US with historically high housing market volatility will be associated with higher wealth inequality than income inequality.

5.4 Housing as Collateral

Housing capital is the main source and for most households the only source of pledgeable capital. Homeowners can not only finance purchase of housing with mortgage debt, but unlike other purchases with debt, they can use home equity to borrow for other purposes. This leveraging of mortgage debt, which presupposes a legal infrastructure of titling, is an amplification mechanism for homeowner households' resources and accords a key role to inequality.

According to the OECD Wealth Distribution Database, about one-quarter of households or one-third of homeowners have mortgages in 27 OECD countries (Causa et al., 2019). The share of households with mortgage debt increases with household income from less than 10%, for the bottom quintile, to over 40%, for the top income quintile. Mortgage debt is the largest component of household debt, accounting for more than half of total household debt in 26 OECD countries, and over 75 percent in 11 of them. Among

households with mortgages, it represents more than 80% of household debt.

The ECB Household Finance and Consumption Survey provides information on the use of the primary home as collateral, asking respondents about the purpose of the primary home mortgage for 22 OECD countries (Causa et al., 2019). They report that the main purpose of mortgages is to buy or renovate the primary home. In most OECD countries, less than 10% of homeowners use primary home mortgages for non-primary home purposes. (The only exception is Canada where it reaches 30%). The fraction is higher for homeowners in the top income and wealth quintiles. The most common uses are to purchase other real estate assets, followed by financing business or professional activity, covering living expenses or other purchases, consolidating other debts and for education purposes.

Housing wealth as a source of wealth inequality amplifies inequality through the collateral constraint (5). When house prices increase, households can and do increase their home equity-based borrowing (for empirical research; see Cloyne et al. (2019).) The literature reports different types of spending from increased borrowing, with a majority focusing on consumption and in a few studies on human capital investment and labor market behavior.

The strong correlation between house prices and aggregate consumption has motivated a large literature focusing on the collateral effect of house price on consumption and on its importance relative to the wealth effect. These two effects imply that house prices have heterogeneous effects across young and old, and across households with different degree of financial constraint. Sinai and Souleles (2005), discussed in section 2.2, suggest positive age profiles of wealth effects, since older homeowners have shorter horizons and a greater incentive to use housing wealth for consumption. However, previous empirical research finds a negative age profile of wealth effects (Attanasio et al., 2011). Subsequent research has found that consumption of more financially constrained households responds more to the rise in house prices through the collateral effect, which can reconcile the negative age profile found in the data if younger households are more constrained; see Cloyne et al. (2019).

A major challenge for the literature is to identify the extent to which a rise in house prices is independent of common factors that affect other outcomes of interest. This would be the case of an expected income growth shock which can lead to simultaneous

rise in house price, borrowing and consumption. The literature on house price growth across geographical areas faces the problem that confounding regional shocks, such as shocks to local income expectations, can be the common cause that drives both house prices and consumption (Attanasio et al., 2011). Cloyne et al. (2019) use UK administrative mortgage data containing a panel of household-level data on house prices and borrowing where homeowners refinance at regular and quasi-exogenous intervals. Andersen and Leth-Petersen (2021) use longitudinal survey data on expectations to identify unanticipated changes in home values, and link it to the administrative records on individual level mortgage borrowing and savings. Both papers find strong evidence that increasing house prices lead to mortgage extraction through refinancing. This in turn leads to higher consumption, especially for young homeowners with high loan-to-value ratios.

Researchers have used a 1992 Danish mortgage reform to identify the collateral effect. Prior to the reform, homeowners could use mortgage loans only to finance house purchases. The reform allowed them to use the loan for any purpose. Leth-Petersen (2010) finds that the collateral effect on consumption is strongest for younger households who are more financially constrained. Recent work uses the reform to investigate effects on labor market behavior. By relaxing household liquidity constraints, the reform contributed to more entry into entrepreneurship (Jensen et al., 2022) and better job matching (He and le Maire, Forthcoming).

Favilukis and Li (2023) argue that the "Great Resignation" by older workers can be fully explained by increases in housing wealth. They find that in US metropolitan areas with stronger house price growth,[22] labor force participation rates are lower, but only for home owners around retirement age, with a 65-year old homeowner's unconditional participation rate of 44.8% falling to 43.9%, if they experience a 10% excess house price growth. Their life cycle model with realistic heterogeneity in wealth, income, and ownership status predicts such a response to a positive shock to house prices, with owners reducing hours while renters increasing them. Although the effect is small, it is substantial in the context of movements in the labor force participation rate in the US.

Research finds evidence for collateral effects on human capital investment. Using short-run changes in individual housing wealth during a period of high housing wealth

[22]The sharp increase of housing wealth associated with the Covid-19 pandemic has been discussed by the popular press; see Badger and Bui, New York Times, May 1, 2022.

liquidity in the early 2000s in the US as exogenous variation in wealth of homeowners, Lovenheim (2011) estimates that each $10,000 in home equity raises college enrollment by 0.7 of a percentage point on average; the effect is much higher for low income families, 5.7 percentage points. This result highlights the importance of accessible housing wealth for inequality, discussed in section 7.3.

6 Racial Discrimination and Segregation

An important determinant of inequality in the US is race, even after controlling for household-level state variables such as initial level of skill, assets or location. Racial discrimination is by definition a driver of inequality as is unequal treatment of otherwise identical people on various taste grounds related to their race, ethnicity, gender or socioeconomic status. Its consequences for housing inequality is enormously important both in its own right and as a cause of residential segregation. Its deleterious consequences can be both long lasting and difficult to offset in the medium or the long run (Schelling, 1971; Boerma and Karabarbounis, 2022). In particular, race-based discrimination affects inequality in both ownership and rental markets. Detecting it and assessing its measurable implications for welfare are seen in both static and dynamic contexts, importantly through the long-run consequences of constrained and disadvantageous access to the location asset.[23]

Housing decisions almost always require search, person-to-person, or via intermediaries, and now increasingly via the web.[24] An important consideration is whether market-based explanations for outcomes are even sufficient to explain discrimination. As Arrow (1998) states, discriminatory outcomes are more likely when transactions are mediated through social interactions rather than depersonalized markets. Housing transactions, including person-to-person bargaining, are social interactions: "The transactors bring to it a whole set of social attitudes which would be irrelevant in the market model" [*ibid.* p. 98]. In a pioneering contribution Courant (1978) first predicted, via a search model, that if "some whites are unwilling to sell housing to blacks competitive equilibria in which blacks pay more for housing than whites are sustainable." The huge literature on the economies of markets with frictions has not yet fully explored the consequences of racial

[23]Key conceptual and econometric issues pertaining to residential segregation are developed by Graham (2018).

[24]Even so, it is not free of discrimination; see section 6.2.1 below.

discrimination. Nevertheless in other ways, the economics literature has made significant progress in improving our understanding of racial discrimination and its implications in housing and other markets.

6.1 Intermediaries and Discrimination

The behavior of real estate agents in neglecting to show certain homes to Black families, or banks in rejecting mortgage applications by minority applicants, is well established. Housing market intermediation as a social transaction is racially fraught. The US National Association of Realtors *Code of Ethics,* Article 34, featured during 1924-1949 —"A Realtor should never be instrumental in introducing into a neighborhood...members of any race or nationality...whose presence will clearly be detrimental to property values in that neighborhood." That indeed epitomized a certain era. Discriminatory behavior was defended on grounds of professional ethics and reluctance to thwart racial preferences of residents (Courant, 1978). The economics literature has sought to determine if that is indeed a bygone era. Allocation of housing units through search involves agents on both sides of the markets and intermediaries. It typically requires direct contact at least when transactions are finalized. Overt discrimination, albeit illegal, may be subtle and thus particularly powerful in the context of search. There exists renewed emphasis on informational barriers; see Bergman et al. (2020) and Bergman et al. (2023), discussed below.

6.1.1 Detecting Discrimination

Bayer et al. (2017) consider the question of racial and ethnic price differentials in the housing market using a rich new data set of repeat sales that covers two million repeat-sales housing transactions drawn from four major US metropolitan areas while accounting for house and neighborhood-by-time fixed effects. They find that black and Hispanic homebuyers pay premia of around 2% on average across the four cities, which are differences that are not explained by variation in buyer income or access to credit. They also show black and Hispanic buyers pay more for housing regardless of the race or ethnicity of the seller, suggesting that the estimated premia are unlikely to be driven by a very direct form of racial prejudice.

Kermani and Wong (2021) approach discrimination from the viewpoint of a racial gap in realized housing returns. They find disparities in returns that are much larger than what housing costs differences alone would explain; the disparities are almost entirely due to distressed home sales (foreclosures and short sales). Black and Hispanic homeowners are more likely to experience distressed sales and more likely to live in neighborhoods with many distressed sales. They have greater income instability and smaller liquid wealth; both make them more vulnerable to such shocks. Using quasi-experimental variation in loan modifications the authors show that policies that restructure mortgages for distressed minorities can increase housing returns and reduce wealth shocks.

Oh and Yinger (2015)) review four US national studies based on in-person audits and many studies based on correspondence audits in the US and in several European countries. Despite variation in methods, sample sizes, and locations, the audit studies consistently find evidence of statistically significant discrimination against home seekers who belong to historically disadvantaged racial or ethnic groups. The 2012 US national audit study found that the share of audits in which a White homebuyer was shown more available houses than an equally qualified Black home buyer was 9 percentage points higher than the share in which the Black home buyer was shown more houses than his or her White counterpart. However, the authors note that housing discrimination against Black and Hispanic home seekers appears to have declined in the US, with more advertised units being shown to such customers.

Discrimination appears to have also increased in the form of steering Black and Hispanic home seekers to minority neighborhoods. Specifically, Christensen and Timmins (2021) seek to explain how perceived discrimination can impact the choice of neighborhood. They compute the welfare effects associated with a renter confronted with choice set constraints given by the response probabilities for their demographic group. The authors' information originates in landlords' responses from real-time data collected through an online realtor platform. Landlords were sent stylized inquiries (via a bot) by fictitious applicants posing as White, African American and Latinx in order to estimate choice constraints in five different metropolitan areas. Christensen and Timmins estimate utility function parameters from a residential sorting model, using data for actual location decisions of households from the InfoUSA. [25] They find that key neighborhood amenities (school quality, crime, cafes, environment) are associated with higher levels of discrimi-

[25]https://dupri.duke.edu/infousa-data, massive consumer database.

nation. They estimate the costs of discrimination at 4.7% of annual income for renters of color, with welfare costs increasing for African Americans as their incomes rise. Such costs are mitigated by additional search.

Christensen and Timmins (2022) provide further powerful evidence that the role of intermediaries is conducive in facilitating housing discrimination in neighborhood choice. Using data from the 2012 Audits (but also from previous audits for 1977, 1989, and 2000), they find that for renters and prospective owners discrimination has declined over time. White and minority testers are shown similar numbers of units, but the units shown to minority testers are (relative to their white counterparts) closer to inferior quality schools, in neighborhoods with higher poverty rates, with fewer residents who are skilled workers and fewer college-educated families, and with more single-parent households. These facts may help explain why upward mobility experienced by African American households is inferior to those of white ones (Chetty and Hendren, 2018a,b).

They find that holding preferences and income constant, *discriminatory steering* alone can explain the disproportionate number of minority households found in high-poverty neighborhoods in the US and the higher exposure of African American mothers to toxic pollutants. Christensen et al. (2021) offer more detailed evidence that renters with African American or Hispanic/Latinx names are 41% less likely than renters with White names to be offered properties in low-pollutant exposure locations. Discriminatory constraints do not appear in high-pollutant exposure locations, whereas offers of housing choices in elevated exposure risk neighborhoods are not restricted by discrimination.

6.2 Discrimination, Information and Disinformation

Bergman et al. (2020) and Bergman et al. (2023) offer experimental evidence to explain why low-income families in the United States are more likely to live in neighborhoods that offer limited opportunities for upward income mobility (Chetty and Hendren, 2018a,b). A common explanation for this pattern is that low-income families *prefer* such neighborhoods because of either affordability or proximity to family and jobs they perceive as accessible to them. However, Bergman et al. (2023) argue that it is informational barriers that prevent families from moving to high-opportunity areas. As part of a randomized controlled trial housing voucher recipients in Seattle and King County, Washington were also provided services in the form of customized search assistance, landlord engagement,

and short-term financial assistance. The intervention increased the fraction of families who moved to high-upward-mobility areas from 14% in the control group to 54% in the treatment group. Based on these findings and additional evidence from interviews with families, Bergman et al. (2023) conclude that redesigning affordable housing policies to provide customized assistance in housing search could reduce residential segregation and increase upward mobility substantially. Both this work on informational barriers and the results of Chetty and Hendren (2018a,b) on the role of the length of exposure to neighborhood effects are powerful evidence for the role of the location asset in perpetuating housing inequality.[26]

6.2.1 Disinformation via Housing Ads

Besbris et al. (2021) examine cross-sectional data about rental housing advertised online via millions of geocoded `Craigslist.org` posts across the 50 US largest metropolitan statistical areas, merged with census tract-level data from the American Community Survey. They find that online searchers for rentals are shown different types of information depending on the demographic composition of the neighborhoods searched. Ads for units in neighborhoods with more Black, Latino, or poorer residents tend to be less precise about unit amenities, and relatively more precise about tenant (dis)qualifications, as compared with ads from Whiter or lower-poverty neighborhoods. Units in White and Asian neighborhoods are more likely to include positive descriptions of neighborhood characteristics and to include higher-rent listings in low-income White and Asian neighborhoods, which may be undergoing, or are poised to undergo gentrification. The consequences of such biased information are difficult to detect. It may be particularly important for inequality because intermediation is increasingly web-based.

6.3 Segregation: Homophily vs. Discrimination

Whereas the evidence of racial segregation is hard to dispute, its origin causes are harder to establish. In part, it could result from homophily — people like being near others like themselves (Ioannides and Zabel, 2008) — given all features of residential options

[26]Bergman et al. (2020) in a related but more data-intensive study, link randomized school quality information (from GreatSchools, a non-profit organization that provides free and accessible school quality ratings to families via a web-based platform, `www.greatschools.org`) with GoSection8.com, a US wide web site with listings for low-income families. The authors show that helping households move to better neighborhoods, that is, with better schools or other amenities, access to information complements more-expensive policies, such as MTO and CMTO, though arguably less effective.

available to minority groups. In view of section 2, homophily is in principle nested within a general specification of the "amenity" function through $\mathcal{L}(\ell^i)$, that allows for preference to be near neighbors of your own race/ethnic background. However, Aliprantis et al. (Forthcoming) argue that evidence of high-income high-wealth black households living in neighborhoods with characteristics similar to those of low-income white households is incompatible with the notion that neighborhood sorting by income and race cannot be explained by financial constraints. Instead, they argue that neighborhood sorting is due to homophily. That is, given their options, Black households sort into black neighborhoods which explains the racial gap in neighborhood quality at all income levels. High-SES Black neighborhoods in US metropolitan areas are scarce. This view is consistent with the position of Christensen and Timmins (2021, 2022), in that Black households face restricted sets of options.

Racial discrimination both offends on grounds of fairness and morality, and because it generates welfare costs. Higgins (2022) estimates the welfare cost of racial discrimination by looking at the segmentation of housing markets by race and its impact on the choice of mode of tenure. He finds that discrimination resulting in gaps in rents and home values during 1960-2019 in the US shows some improvement, especially since the 1968 Fair Housing Act. While rent and price gaps have declined by about one-half, a large gap in homeownership rates between Whites and Blacks persists. Black households are on average 20 percentage points less likely to own a house relative to White households with the same income. As a result, they sort to into lower quality homes. The dynamic assignment model of Higgins (2022) allows him to infer that Black households pay higher quality-adjusted rents and prices, especially at higher qualities. Consequently, they sort into lower quality homes. Relative to an integrated market, Black households were (on average) in terms of lifetime consumption-equivalent welfare five percent worse off in 1960 and remain one percent worse off in 2019.

6.3.1 Homophily, Segregation and Inequality

This section sketches a model that may be applied readily to express the contribution of homophily to the determination of neighborhood income inequality. Suppose that in (2), utility u_i is defined in terms of $\mathcal{L}(\ell)$ only and there exist only two types of individuals:

$i \in \{A, B\}$. In addition, i's evaluation of ℓ is defined as:

$$\mathcal{L}_i(\ell) := \mathbf{Y}_\ell b_i + \alpha_i \xi(X|\ell) + \psi_{i,\ell}, \tag{17}$$

where $\xi(X|\ell)$ denotes the share of individuals in neighborhood ℓ with a particular characteristic X, such as higher education, or the share of individuals of a particular type, denoted by $\xi(X|\ell)$, and $\psi_{i,\ell}$ is a shock, as defined in (1) and assumed to be i.i.d. extreme-value distributed over all individuals and neighborhoods. With two types of households $i \in \{A, B\}$, let their shares in the population be $p_A, p_B, p_A + p_B = 1$, respectively. Suppose that the distribution of X varies within the two populations: $f(X|A) \neq f(X|B)$. We examine a pure case of homophily: individuals value the share of households of their own particular type who choose the same neighborhood: $\xi(X|\ell) = \text{Prob}(A|\ell)$. Under the above assumptions, the choice probabilities are given by:

$$\text{Prob}(i|\ell) = \frac{\exp[\mathbf{Y}_\ell b_i + \alpha_i \text{Prob}(i|\ell)]}{\sum_{j \in \Lambda} \exp[\mathbf{Y}_j b_i + \alpha_i \text{Prob}(i|j)]}, \ \forall \ell \in \mathcal{N}. \tag{18}$$

Assuming that neighborhoods A and B do not differ in terms of contextual effects, that is, $\mathbf{Y}_\ell = \mathbf{Y}$, it follows that $\text{Prob}(A|\ell) > \text{Prob}(B|\ell)$, if $\alpha_A > \alpha_B$. This may be generalized via stronger self-segregating preferences by assuming a positive value of α_i and a negative value of α_B. The intensity of preference for self-segregation could then be measured by $\alpha_A - \alpha_B$. In general, we may obtain the equilibrium neighborhood choice probabilities via a system of functional fixed points along the lines of (18), which may exhibit multiplicity. Analytical and estimation properties of a more general sorting model, of which equations (17)–(18) are a bare-bones version, are provided by Bayer and Timmins (2005, 2007), for the static, and by Davis et al. (2021) for the dynamic cases.

6.3.2 The Schelling Model and Segregation

Current research on residential segregation has benefited from modernization of Schelling's models of neighborhood location decisions and neighborhood tipping (Schelling, 1971). In Schelling's own words, "[this] kind of analysis explores the relationship between the behavior characteristics of the *individuals* who comprise some social aggregate, and the characteristics of the *aggregate*" [*ibid.*, p. 13]. Schelling's use of evocative ideas along with the mechanics of self-organization demonstrate how aggregate social outcomes that

reflect magnification of individual propensities may well be unintended.[27]

Zhang (2004) modernizes Schelling's model using the theory of stochastic stability and proves that segregation emerges and persists even if every person in a society prefers to live in an integrated neighborhood. That is, residential location patterns that are most resistant to tipping are equivalent to stochastically stable equilibria. Bruch and Mare (2006) use Schelling's location model to show computationally that high levels of segregation occur only when individuals' preferences follow a threshold function.

Card et al. (2008, 2011) test the Schelling model of neighborhood tipping using regression discontinuity methods with US Census tract data from 1970 through 2000 in order to detect discontinuities in the dynamics of neighborhood racial composition. They show that white population flows exhibit tipping-like behavior in most cities, with a distribution of tipping points ranging from 5% to 20% in terms of the minority share. They find large, significant discontinuities in the white population growth rate at the identified tipping points. They do not find systematic evidence that rents or housing prices exhibit non-linearities around the tipping point. Estimated tipping points persist and imply attitudes of white residents. Across US cities, Memphis, TN, and Birmingham, AL, have the strongest, and San Diego, CA and Rochester, NY the weakest attitudes against racial contact. Card et al. (2008, 2011) provide the first direct evidence of the nonlinear dynamic behavior predicted by social interaction models of the Schelling type: segregation is driven at least in part by preferences of white families over the (endogenous) racial and ethnic composition of neighborhoods. Using the same US Census tract data, Card et al. (2011) delve deeper into the racial dynamics and find that tipping behavior is one-sided, and that neighborhoods with minority shares below the tipping point attract both white and minority residents.

Caetano and Maheshri (2021) test Schelling-type models by identifying whether neighborhoods are observed in transition or at steady states. They work with monthly data on all transactions during 1990-2004 for all San Francisco Bay Area neighborhoods (defined as populations of 10,000 households). They find, using novel instrumental variable methods, that sorting based on unobserved neighborhood amenities is the most important factor generating segregation. By mitigating endogenous sorting, moving costs play an important role as frictions in their dynamic choice models.

[27]Simple versions of Schelling (1971) may be accommodated by the model of the preceding section, that is, (17)–(18). For further details, see Ioannides (2013), Ch. 2, 3.

Recalling the visualization of the persistence of racial and income segregation by means of the patterns of neighborhood context, as defined in section 4.4.1, we note that, conditional on household income, black and Hispanic US households live in neighborhoods with median incomes substantially lower than otherwise similar white households; Asian households live in higher-income neighborhoods than similar White households. These patterns of neighborhood context have changed little over time, except for a small decline in the differences in median neighborhood incomes among highly affluent white and Black households. Thus, blacks and Hispanics in the US must have household incomes that are substantially higher than whites and Asians in order to live in neighborhoods with the same median income; see Reardon et al. (2015). Fogli et al. (2022) draw attention to the fact that the US has experienced increasing income inequality and residential segregation by income but decreasing racial segregation. Using the neighborhood exposure effects estimated by Chetty and Hendren (2018b), they find that residential segregation contributes to one fourth of the increase in inequality between 1980 and 2010 after an unexpected permanent skill premium shock.

6.3.3 Long-Run Outcomes: Intergenerational Transfers and Separation

Boerma and Karabarbounis (2022) show that assuming no innate racial differences in ability, preferences, or beliefs between white and Black households and their descendants ("dynasties"), the exclusion of Black dynasties from labor and capital markets can predict current and historical racial gaps in wealth, income, entrepreneurship, and mobility. Housing explains 15% of the racial wealth gap while private equity plays the largest role. They argue that centuries-long exclusion feed pessimistic beliefs about risky returns, discourage risky investments, and indeed make it impossible for reparations today (direct wealth transfers to Black households) to eliminate the racial wealth gap in the long run. They argue that investment subsidies and strengthened information networks do offer hope. Sabelhaus and Thompson (2023), however, emphasize that race alone does not explain much of the wealth gap, when they look specifically at the role of housing and intergenerational transfers. Using similar data for 1860–2020 and similar arguments, Derenoncourt et al. (2022) emphasize that in spite of alternating epochs of convergence and divergence, because Black households hold nearly two thirds of their wealth in housing and very little in equity, the wealth gap has widened again since 1980 as capital gains

have predominantly benefited white households, and income convergence has stopped.

7 Policy Impacts on Housing and Inequality

In addition to explicit housing policies, a broad set of public policies adopted worldwide to tackle inequality, also impact housing outcomes either directly or indirectly. There are three broad categories. First are fiscal policies that explicitly aim at reducing housing consumption inequality, such as cash subsidies, in-kind subsidies (public or social housing), and tax policies that affect access to housing wealth, such as tax-deductibility of mortgage interest or taxes on transfers of property. Second are place-based policies and housing regulations that are driven by a mixture of objectives that sometimes conflict with each other, or have unintended consequences, such as rent control, zoning and housing supply restrictions. And third are monetary and credit policies that although aim at macroeconomic stabilization do impact inequality, and especially housing inequality. E.g., raising interest rates affect mobility and the cost of mortgage debt. They may be assessed by means of the basic framework of Section 2, and of our classification of forces of housing and inequality as operating via housing as source of consumption services (section 3), as location asset (section 4) and as housing capital (section 5). From among the vast housing policy literature, we have selected to review some key papers that we think best inform housing and inequality along the lines of our approach.

The economics literature on housing related fiscal policies, place-based policies and housing regulations is massive. Motivated by the global housing affordability crisis, Saiz (2023) surveys 290 papers and details thirty particular economic strategies from throughout the world leading to policies that aim at durable solutions. For the United States alone, Olsen and Zabel (2015) reference more than 200 papers related to two key objectives, namely low-income rental assistance and promotion of homeownership. We do not provide a comprehensive review of this literature. Instead, here we focus on recent studies that are specifically related to inequality, which we assess through our basic framework and its applications above.

7.1 Affordable Housing Consumption

The growing global concerns about housing affordability are in effect about inequality in housing consumption but not often phrased as such; see section 3.2. Housing provides

shelter; like food housing is widely viewed as a necessity by the public. Such a view is supported by the estimates of income elasticity of housing, discussed in 3.2. Government presence in housing is ubiquitous.

7.1.1 Cash and In-kind Housing Benefits

Milton Friedman and James Tobin, two early pillars of microeconomic and macroeconomic policy, held strong but opposing views on how governments should deal with housing consumption inequality. Friedman argued that cash incomes are most effective; Tobin suggested that subsidized housing not only mitigates bad neighborhood effects but also as direct support to the poor, is much less transferable and tangible than other forms.

In-kind housing benefits can take many forms. In several European countries, private non-profits develop and manage large portions of the housing stock. For example Dutch Housing Associations account for 75% of three million rental homes, or 35% of the total housing stock. They lease 80% of the vacant stock to low-income families and 10% to intermediate-income ones. Housing cooperatives are popular in Scandinavian countries. In Sweden, they have been in operation since 1923. They now account for 23% of the total housing stock. Residents are tenant-owners. In the UK, Local government authorities have had a massive presence in the housing market providing rental council housing after World War II. It was only after the late 1950s that the stock of private-owned rental housing surpassed council housing. Privatization since the late 1980s and credit market deregulation have shrunk the social housing stock. It nowadays disproportianately accommodates certain disadvantaged demographic groups in dense urban developments. Other initiatives, such as liberalizing the legal rights of leaseholders were intended to improve housing supply. However, the "superstar" cities phenomenon that also affects London and certain other locations in the UK has contributed to increased rents and prices.

Using harmonized data from the EU Statistics on Income Living Conditions and Household Budget Surveys for 27 European countries, Berard and Trannoy (2023) assess the effectiveness of cash housing benefits versus social housing in reducing inequality and poverty. Starting from a counterfactual situation with a distribution of disposable income without housing benefits, they then include the cash benefits and their estimates of imputed rent from social housing one by one to derive an actual distribution. They find

that cash housing benefits are both more effective than in-kind housing benefits and are more effective in reducing poverty than inequality. Germany, France, Ireland, the Czech Republic but especially Finland achieve a higher reduction in inequality and poverty and spending only half as much as the UK. They show that housing policies are most effective for the poorest households, making inequality in housing expenses comparable to non-housing consumption expenditure. They praise the overall effectiveness of housing policies in Europe, in spite of their inefficiencies, in reducing inequality in housing services to much below inequality in housing expenses (by 10 Gini points on average). Their accounting exercise abstracts from behavioral responses, equilibrium effects on house prices and rents, and from the dynamic prospects of housing as location and asset investment. For example, cash housing benefits could accrue to landlords due to rises in rents which increase the marginal cost of public funds. Social housing could influence location choice and hinder mobility. A general equilibrium version of this study would be a major challenge but could be a real contribution to our understanding the distributional impact of housing policies.

7.1.2 Homelessness, Foreclosures and Evictions

Homelessness is an extreme form of housing consumption inequality. Its causes are numerous and its incidence is particularly acute in high cost metropolitan areas in the US and increasingly in European cities. Many of the homeless have jobs. In California's San Francisco area, many are also unsheltered.[28] This pernicious problem has attracted the attention of decision makers. A new US government program plans to reduce homelessness by 25% by 2025 [`https://tinyurl.com/2p3um298`].

Policies on foreclosures and evictions are also relevant for homelessness. The legal framework of foreclosures is an important force of inequality during downturns of the business cycle, especially when they are associated with interest rate increases. Mortgages may be recourse or no-recourse, meaning that lenders may or may not have the right to demand further payment from the borrower (or guarantor) after a foreclosure sale. Since twelve of the fifty US states and territories mandate no-recourse mortgage loans, the spatial variation of the incidence of foreclosures may reflect pronounced spatial inequality resulting from foreclosures.[29] Diamond et al. (2020) detail the differential impact of

[28] Homeless Individuals, 582462, US, 2022. Details: https://tinyurl.com/yffujunw

[29] Indeed, the Great Recession and the associated foreclosure crisis had sharp geographic incidence.

foreclosures: landlords suffer a financial shock, tenants an eviction shock, and home owners are far more profoundly affected by suffering both shocks. These shocks result in housing instability, reduced homeownership in the future (in part because of lingering effects of reduced credit scores), financial distress, moves to inferior neighborhoods and family instability. Foreclosures propagate in their immediate neighborhoods (Towe and Lawley, 2013). See also the discussion of Kermani and Wong (2021) in section 6.

7.2 Affordable Housing Locations

As discussed in Section 4, the impact of housing location on inequality makes location as important of a necessity, if not more, as housing consumption. Tackling inequality requires not only affordable housing but affordable housing in opportunity-rich neighborhoods, as forcefully put by Raj Chetty in his Testimony to the US Congress.[30].

In the US, both explicit "affordable-housing" policies and others that affect housing affordability are enacted at the federal, state, or local level, making for a patchwork of ideas and initiatives. They generate vast amounts of data. As Olsen and Zabel (2015) state in their thorough review, they are a potential resource for other countries. Originating during the Great Depression, they have been reaffirmed by experience with the civil rights campaigns and explicit fair housing legislation efforts (starting with the Fair Housing Act of 1968 and beyond). They have also aimed at tackling institutionalized racism (Ioannides, 2017).

In the US housing becomes unaffordable to the poor for many reasons, including high urban land values in US central cities, where low-skill jobs are often located. Exclusionary zoning and land use restrictions, due to local control of land use, make living near better jobs and schools expensive. Thus, the income distribution along with expensive housing reinforce income segregation patterns, with poor people living disproportially near low-paying jobs. The local political process itself can, because of local control of schools, produce feedbacks reinforcing income and racial segregation, which in turn may sustain under-investment in human capital by minority groups (Durlauf, 1996).

In a large and spatially diverse economy like the U.S., economic growth is often sharply localized, causing spatially skewed housing price inflation. As we discussed earlier, this

See Figure 3. In https://www.stlouisfed.org/publications/regional-economist/july-2011/the-foreclosure-crisis-in-2008–predatory-lending-or-household-overreaching

[30]See https://tinyurl.com/mpw3sh6k

hampers relocation of skilled individuals to pursue job opportunities in fast-growing sectors and therefore harms aggregate growth (Hsieh and Moretti, 2019). However, most recently, the Covid-19 pandemic may be reversing the "superstar cities" phenomenon, whose extraordinarily high housing costs were producing a flight to less expensive locations.[31]

7.2.1 Housing Vouchers and Housing Mobility Policies in the US

A particularly suitable setting for examining policies that address both the consumption and location aspects of housing is the *Moving to Opportunity* (MTO) program. MTO was funded by the US Department of Housing and Urban Development and aimed at better understanding of policy designs for improving living conditions for underpriliveged urban populations.[32] There is strong evidence that the outcomes for children that moved when young are positive (Chetty et al., 2016; Davis et al., 2021). In a recent overview of findings by MTO-based studies, Chyn and Katz (2021) assess as generally mixed the totality of findings on beneficial neighborhood effects. Neighborhoods defined in terms of Census tracts do matter for adult health and well-being, but have little causal impact on contemporaneous adult labor market outcomes. As discussed in section 6.2, Bergman et al. (2023) provide evidence from a field experiment conducted among housing voucher recipients to argue that informational barriers are critical in explaining why poor households tend to live in neighborhoods that afford them low mobility prospects.

Aliprantis and Richter (2020) provide evidence of neighborhood effects associated with the MTO experimental evidence. In contrast to previous assessments, as by Kling et al. (2007), they focus on smaller population groupings within those affected than earlier studies. Aliprantis and Richter (2020) also focus on more neighborhood attributes and establish the role of MTO moves in improving adult labor market outcomes and reducing welfare receipt. Aliprantis et al. (2023) discuss housing mobility programs (HMP) aiming at giving residents of neighborhoods with racialized concentrated poverty in the US housing choice vouchers together with support for moving to low-poverty areas. They argue that HMP success is aided by portability of vouchers across jurisdictions, *inter alia.*

[31] Emily Badger *et al.* New York Times, May 1, 2022.

[32] For several studies, see https://scholar.harvard.edu/lkatz/publications/term/6149 The program randomly assigned groups of households with children, who were eligible to live in low income housing projects in five US cities, to three different groups: (1) those given housing vouchers with location restrictions; (2) those given housing vouchers with no location restrictions; and, (3) control group with no voucher.

Davis et al. (2021) seek to design housing vouchers that may be redeemed only in neighborhoods that promise to provide beneficial effects for children. Using the framework of a dynamic model of optimal location choice, they estimate the preferences over neighborhoods of likely recipients of housing vouchers in Los Angeles. They combine simulations of the model with estimates of how locations affect adult earnings of children. They seek to determine how a voucher policy that restricts neighborhoods in which recipients may redeem their vouchers can induce them to choose "good" neighborhoods. They show that the model can nearly replicate the impact of the MTO experiment on the adult wages of children. Their granular model of neighborhood choice contains some methodological innovations that avoid tedious computational steps. They conclude that a policy that restricts housing vouchers to the top 20% of neighborhoods maximizes expected aggregate adult earnings of children of households offered such vouchers.

Chyn and Daruich (2021) compare long-run and large-scale impacts of vouchers and place-based subsidies within a general equilibrium model. They show that both policies reduce inequality and improve average skills. They bring about a net gain in welfare because the associated higher levels of taxes are offset by productivity gains. They find that a voucher program generates larger long-run welfare gains relative to place-based policies. The main channel is through housing as location asset which allows housing vouchers to make up for the absence of intergenerational borrowing, i.e. parents' inability to borrow against their child's future income. Governments can use housing vouchers to promote investment in children's skills and tax adults after the benefits from the neighborhood externalities have accrued in the form of higher incomes.

7.3 Accessible Housing Wealth: Homeownership

Housing wealth is both a source of and an amplification mechanism for wealth inequality; see section 5. Housing wealth inequality is directly affected by policies aimed at promoting homeownership, such as assistance in obtaining mortgages or fiscal policies such as tax-deductible mortgage interest and first-time-buyer subsidies. Homeownership and housing wealth are indirectly affected by monetary policies that are not deliberately designed to address housing wealth inequality. On the revenue side, governments raise revenue through taxes on real property, such as transaction taxes on property transfers, capital gain taxes, and local real estate taxes. Two impacts stand out. One, their effects on

tenure choice, which impacts inequality through its effect on housing wealth (section 5). Two, their effects on mobility which affects inequality through the location asset choice (section 4). And three, through asset portfolio reshuffling (Section 5). Sakong (2022) suggests that in particular the timing of policies promoting homeownership should be sensitive to housing market volatility.

7.3.1 Tax-deductibility of Mortgage Interest

Section 5.4 argues that mortgage debt is an important part of housing markets across the OECD countries, accounting for more than half of all household debt. Home equity-based borrowing has played a growing role in recent decades. Fiscal policies such as mortgage interest deductibility (present in many countries) have a direct impact in lowering the cost of homeownership. It was intended to promote homeownership rate.[33] Because mortgage interest payments are typically in nominal terms, inflation and thus monetary policy also play an important role. The length of mortgage loans is also important.

Motivated by the housing boom of the 1970s in the U.S., Poterba (1984) argued that the coexistence of high inflation rates and the tax deductibility of nominal mortgage payments was an important factor in making homeownership more attractive. As higher inflation rates pushed up nominal interest rates, they also increased both homeowners' interest charges and their nominal capital gains. When mortgage interest payments are deductible from income taxes, and if tax tax provisions make capital gains essentially untaxed, homeowners gain on balance relative to renters: they receive the full value of home appreciation but bear only a fraction of higher interest payments. A related but under-explored issue is the fact that the implicit income in the form of housing services from owner-occupied homes (a form of asset income) is rarely taxed; that too favors owner-occupancy over renting (Figari et al., 2017).

There have been ongoing debates about eliminating the mortgage interest deduction in the US[34] and in Europe. Arguments in favor are that it generates a large tax revenue loss and is effectively a regressive tax: as it interacts With progressive taxation, the value of the deduction increases with household income and the associated marginal tax rates. Arguments against eliminating are that it will reduce the homeownership rate. Consid-

[33]For example, for the U.S., see earlier discussion on President Clinton's National Homeownership Strategy in 1995 and President Bush's American Dream Downpayment Initiative in 2003.

[34]Since 2002, this deduction is limited; IRS Publication 936.

ering its general equilibrium effect through endogenous house prices and rents, Sommer and Sullivan (2018) challenge this view by showing that eliminating the mortgage interest deduction can reduce house prices by increasing the relative cost of homeownership. However, lower house prices imply that low-wealth, credit-constrained households would more likely become homeowners. Overall, the elimination of the mortgage interest deduction can actually increase homeownerhip. More importantly, such a reform would shift housing consumption from higher-income to lower-income households.

Figari et al. (2017) investigate the distributional implications of abolishing mortgage interest tax relief (and other special tax treatments of expenses related to the main residence), and include the imputed rents as taxable income of homeowners. They look at six European countries that exhibit variations in terms of tax treatment of homeowners. They argue that removing the 'homeownership bias' generates revenues which can lighten taxation of labor without inequality-increasing side effects. As highlighted by Kiyotaki et al. (Forthcoming), a clear distributional impact of removing homeownership subsidies is the welfare loss to older generations who are more likely to be homeowners, which could be one reason why it is likely to be politically difficult to implement.

7.3.2 Transactions Taxes on Property Transfers

Several sources of tax revenues are also levied on the housing sector. Taxes on real estate assets are a common feature of tax systems throughout the world. They are an important source especially in countries where local governments finance the provision of local public services, such as local schools and other public services. Two of the most common form of taxes on property are transaction taxes on transfer of properties and taxes on the value of properties or housing consumption.

A growing concern among policy makers and researchers about the efficiency cost of transaction taxes has led to reviews commissioned by the Australian government (*Henry Review*) and by the UK government (*Mirrlees Review*); see also a brief review by Määttänen and Terviö (2022). Using data from Europe and US, this literature has shown that transaction taxes reduce homeowners' mobility, transactions volume and house prices in the ownership market. A more recent literature considers the distributional effects of transaction taxes through its general equilibrium effect on tenure decision.

Using micro data on leasing and transaction records from the Greater Toronto Area,

Han et al. (2022) study the introduction of a city-level transaction tax in the City of Toronto, but not in other parts of Greater Toronto Area. This feature makes it possible to estimate the effects of transaction taxes by comparing housing market outcomes before and after the new tax across neighbourhoods that are adjacent to, but on opposite sides of the City of Toronto border. They estimate that a higher transaction tax leads to lower buy-to-own but higher buy-to-rent transactions, lowering the homeownership rate. They quantify the effects using a housing search model with both rental and ownership markets and find substantial welfare loss both within and across the two markets and significant distributional effects across new home-buyers, renters, and existing homeowners. They show that an alternative way of raising revenue, a property tax on all owners, has a negligible effect on welfare because all property owners pay a tax independent of their transaction frequency.

Property taxes amount to one-third of combined state and local taxes in the US and are the principal source of financing local public services, such as school, public safety etc. The power of local governments as an exclusionary force, as via zoning, is reinforced by the local control over the property tax, which in turn reinforces sorting.

7.3.3 Monetary Policies and The Interest Rate Channel

Monetary policies are rarely if ever deliberately designed to address housing inequality. The effects on inequality are incidental, though not negligible and of concern to monetary policy makers.

In addition to effects addressed by Poterba (1984), another important way for monetary policy to have distributional impacts on housing markets is through the interaction of interest rates and alternative types of mortgages: adjustable-rate versus fixed-rate.[35]. Focusing on the features of mortgages as long-term loans with nominal payment, Garriga et al. (2017) focus on the effect of monetary policy under adjustable-rate mortgages (ARMs) versus fixed-rate mortgages (FRMs). They find that persistently higher inflation gradually benefits homeowners under FRMs but hurts homeowners under ARMs immediately. Auclert (2019) analyses three redistribution channels of monetary policy and highlights the importance of the interest rate exposure channel for homeowners with

[35]Another way for interest rate effects as emphasized by Ngai and Sheedy (2020) is through its impact on households' mobility, which is an investment in match quality; see section 4.1. Monetary policies that increase interest rates can potentially worsen inequality by lowering mobility.

ARMs and FRMs. This interest rate channel focuses on duration of assets versus liabilities: monetary expansions tend to raise inflation and lower real interest rates, which redistribute away from those with positive unhedged interest rate exposures (UREs) to those with negative UREs, where the UREs is the difference between maturing assets and liabilities. ARM holders tend to have a negative URE, while the FRM holders have a URE of about zero. Sakong (2022) argues that the timing of government policies aiming at increased homeownership by poorer households must be chosen appropriately.

7.4 Housing Market Regulations: conflicts of objectives

Tackling the housing affordability crisis is important in many countries, but as the reasons for the crisis vary, policy prescriptions will vary and also depend on other objectives. Affordable housing interventions everywhere must confront such issues as dedicated low-income vs. income-mixing, location within urban areas, tradeoffs with local economic development, working-class vs. low-income, new construction (which is capital-intensive and has a fiscal/monetary aspect), vs. facilitation of filtering (which may be impeded by gentrification), and supply-related issues including mode of construction (modular/prefabricated),

Saiz (2023) looks in depth at nine case studies and evaluates them against 30 affordable housing economic strategies. These case studies include successful initiatives by NGOs, like Habitat for Humanity. That NGO has built 1.6 million homes in 70 countries since 1976; small rural local authorities in China taking advantage of rapid urbanization to venture real-estate development projects; community land trusts in the US (but also the Singapore Housing Authority). All these aim at reducing the cost of land for housing developments and are designed as to capture capital gains from land appreciation. Saiz also discusses various modalities of public and private partnerships with successful projects in various countries, all typically managed at the local level. The conclusion is that housing programs should target the poor, and that policymakers must understand their goals and their country-specific context and use a combination of policy tools.

In economies with substantial spatial differentiation and free movement of labor spatial equilibrium and the associated sorting pose special constraints for housing policy with respect to inequality. Place-based policies are complicated to evaluate, because they affect the location decisions of households. Local (and occasionally national) governments

tempted to intervene in the housing market, sometimes resort to rent control, supply regulation and affordability policies that can be counterproductive. Aiming at improving the welfare of certain groups, like residents of subsidized housing or sitting tenants, impacts not only the intended beneficiaries, but the entire market through spillovers and general equilibrium effects.

7.4.1 Zoning

In the US, zoning regulates the density of urban land use; it is under local control and inevitably affects housing supply and hence both public and social housing policies. It is typically criticized for promoting low-density residential developments in US cities far more than in other countries, and thus limiting housing opportunities for those who cannot afford large homes or lots. A proposed introduction of zoning in the U.K. has been criticised as likely increasing housing inequality; see https://tinyurl.com/mr23u8bm.

Lens (2022) argues that zoning policies in the US have racist and classist origins, make housing more expensive, and reinforce segregation patterns. The role of exclusionary zoning laws in placing restrictions on the types of homes that can be built in particular neighborhoods has been emphasized by policy makers; see Rouse et al. (2021). In an effort to dampen the effects of exclusionary zoning on the lowest-income residents, Bilmes and de Benedicts-Kessner (2023) propose a concept of inclusionary zoning, and develop an analytic framework which in turn they apply to two Greater Boston cities, Revere and Lynn. Recognizing it as not a panacea, they identify the potential for various policy levers to create affordable housing, and emphasize its value for creating rental units for low to moderate income residents. Trounstine (2023) argues that 'whiter' US local governments implement more stringent land use regulations which help preserve racial homogeneity.[36]

Favilukis et al. (2023) develop a dynamic stochastic spatial equilibrium model and use it to evaluate the effects of zoning changes, rent control, housing vouchers, and tax credits, the main levers employed by policymakers. Calibrating the model to the New York metropolitan statistical area, they show that housing affordability policies "carry substantial insurance value" but affect aggregate housing and labor supply. Housing affordability policies that enhance access to this insurance (especially for the neediest

[36]Similar to the effect of zoning is a finding by Kulkarni and Malmendier (2022) that the upward mobility of children from low-income families is not predicted by homeownership rates, but by homeownership segregation. Higher residential segregation between homeowners and renters predicts lower upward mobility of children from low-income families, while not affecting high-income families.

households) create substantial net welfare gains.

7.4.2 Codes

Housing and building code restrictions often typically state or locally controlled policies in the US (and also elsewhere), affect the cost of new housing and its provision through the use of existing stock through remodeling and filtering. Both aspects of housing stock maintenance affect both lower- and middle income-households and the demographic composition of central cities. Gentrification, reoccupation of central cities by higher-income households when the central city becomes more attractive, depends on the age composition of the housing stock. Filtering, the process through which dwelling units as they age and depreciate in quality and prices, "filter" down to occupancy by lower-income households, has been a frequent source of affordable housing. Rosenthal (2014) using a "repeat-income" model with American Housing Survey (AHS) data estimates that owner-occupied housing units filter at a rate of 0.5 percent per year, while rental dwellings filter at higher rates, typically 1.8–2.5 percent per year. Both processes are slowed by real house price inflation. Thus filtering, influenced by building codes, has been a robust source of affordable urban housing. The process of gentrification, however, is a source of the spatial pattern of filtering upward as higher-income households are drawn to old but centrally located and/or heavily renovated dwelling units (Brueckner and Rosenthal, 2009).

Faigelbaum and Gaubert (2020) examine theoretically optimal spatial policies in the presence of sorting. By endogenizing housing supply elasticity as a function of local supply regulations, they allow the planner to change those regulations. Spatial efficiency requires redistribution to low-wage cities and a higher share of high-skill workers in such locations. It also requires that the currently largest metropolitan areas shrink and become more skill intensive, but with lower wage inequality. Interestingly, their prescription of discouraging moves to superstar cities seems to be realized as an outcome of the Covid-19 era; see Badger et al. *op. cit.*

7.4.3 Rent Control

In efforts to arrest spiraling housing costs, local and national governments have in the past instituted various rent control schemes. Many were designed to tackle the severe shortage

of housing after World War II; some have continued in existence in many countries; see OECD Housing Database. Ordering rents to stay put and granting rights to sitting tenants (itself a source of inequality) has a plethora of effects. In the short run, it hinders residential mobility, causing both misalignment of demand with consumption as households' circumstances change, and even reducing labor mobility. In the long run it causes misallocation of capital. Hardman and Ioannides (1999) is among the few studies that have addressed the impact of rent control at the aggregate level. It persists in many countries because it looks like an effort to mitigate the "housing problem."

Glaeser and Luttmer (2003) emphasize that in New York City, where some rental housing is "rent-stabilized," a significant fraction of apartments is misallocated across demographic subgroups. Enström-Öst and Johannson (2023) employ a unique randomized rental apartment lottery in the Stockholm metropolitan area, which also has rent control, to analyse behavioral effects on individuals receiving a rent-controlled contract. They find that receiving such a contract leads to a reduction in the annual labor income by 13 to 20 percent and employment by 8 to 13 percent. Rent control deregulation has complex effects on distinct groups. Donner et al. (2017) show that the distributional effects of deregulating the Stockholm rental housing market: rent increases for Stockholm's wealthy center (of around 30-70 percent), while most suburban neighborhoods might experience smaller increases and some neighborhoods even rent decreases. Rent control deregulation has complex effects on several distinct groups.

Rent control prevents displacement of some renters in the short-run; its long-run consequences undermine the original intentions. The complexity of the distributional effects of rent deregulation was studied by Autor et al. (2014) for Cambridge, Massachusetts. The increase in property values and improvement in amenities that resulted from deregulation benefited both existing and new owners but hurt tenants. Diamond et al. (2019) rely on a 1994 law change in San Francisco to show that introducing rent control limited renters' mobility by 20 percent and lowered renters' displacement from San Francisco. Landlords reduce rental housing supply by 15 percent by selling to occupants and by redeveloping buildings.

7.4.4 Place-Based Policies

Policies that aim at improving housing conditions at specific locations are often controversial because they may generate spillovers that do not benefit primarily the intended beneficiaries. Programs that seek to improve public housing can cause improvements in surrounding areas and may gain political support. Koster and van Ommeren (2019) show that a program that improved public housing in 83 impoverished neighborhoods throughout the Netherlands raised surrounding owner-occupied house prices by 3.5%, which amounted to at least half of the cost of investment in public housing. Almagro et al. (2022) show that public housing demolitions in Chicago reduced the welfare of low-income minority households and improved that of White households. Their counterfactual analysis allows them to identify public housing site redevelopments as the most effective policy for reducing racial inequality.

8 Conclusion

The housing literature has exploded during the last two decades. There are several reasons. First, a search for a deeper understanding of the critical role of housing and all of its facets in the Great Recession of 2007-2009, where subprime mortgages were held responsible for the financial crisis that led to it. Second, an explosion of interest in urban and regional economics, where the economics of housing has always played an important role. Third, an interest in quantitative housing policy design, as increasing welfare inequality that has taken hold in many countries has drawn attention to housing inequality and has challenged traditional approaches. This review samples a vast amount of high-quality research; it has dual objectives. One is to demonstrate how income and wealth inequality have led to sharply unequal housing outcomes; two, how particular features of housing, such as its neighborhood dimension, the location asset, and the prominence of housing in household asset portfolios contribute to overall inequality.

Among the numerous areas that deserve attention in future research we may highlight a few. A full understanding of the forces that lead to residential segregation is critically important for the feasibility of urban policies aiming at creating stable, economically and racially mixed neighborhoods. The role of policy tools like zoning and mandates of mixed income housing while market forces work in favor of segregation deserve attention, especially in the context of place-based policies. Housing vouchers, operating on

the demand side, and supply side regulations should be explored in general equilibrium contexts. Both are employed in various combinations worldwide. Impacts of fiscal policy tools that affect the operation of the housing market are still poorly understood. The fiscal policy impact of major reforms such as taxing the implicit income from owner-occupied homes deserves attention. Many of the policies have general equilibrium effects, but such analyses (some of which we review) have only just began. The consequences of reduced mobility for aggregate growth, while mitigated in part by working-from-home, also appear to be important.

The paper argues that understanding the impact on inequality of the multitude of policies entertained throughout the world is facilitated by exploring them via the three features of housing., that is consumption, location and asset. Last, one overarching theme cries out for attention, that is, to link life cycle events of households, with their residential and financial decisions, the role of attributes of neighborhoods where they reside, the importance of search frictions and the increased reliance of intermediation on web-based technologies. They all impact human and financial capital accumulation and the distribution of income and wealth.

References

Accardo, Jerome, Sylvain Billot, and Buron Mael-Luc, "Household Income, Consumption and Saving per Broad Category between 2011 and 2015, French Economy," Report, INSEE 2017.

Aladangady, Aditya, David Albouy, and Mike Zabek, "Housing Inequality," Working Paper, University of Illinois 2017.

Albouy, David, "What Are Cities Worth? Land Rents, Local Productivity, and the Total Value of Amenities," *The Review of Economics and Statistics*, 2016, *98*, 477–487.

_ **, Gabriel Ehrlich, and Yingyi Liu**, "Housing Demand, Cost-of-living Inequality, and the Affordability Crisis," Working Paper 22816, NBER 2016.

Aliprantis, Dionissi and Francisca Richter, "Evidence of Neighborhood Effects from Moving to Opportunity: LATEs of Neighborhood Quality," *The Review of Economics and Statistics*, 2020, *102*, 633–647.

_ **, Daniel R. Carroll, and Eric R. Youno**, "What Explains Neighborhood Sorting by Income and Race?," *Journal of Urban Economics*, Forthcoming.

_ **, Hal Martin, and Kristen Tauber**, "What determines the success of housing mobility programs," Working Paoer, Federal Reserve Bank of Cleveland 2023.

Almagro, Milena and Tomas Dominguez-Iino, "Location Sorting and Endogenous Amenities: Evidence from Amsterdam," WP 162, Becker Friedman Institute 2022.

_ , **Eric Chyn, and Bryan Stuart**, "Urban Renewal and Inequality: Evidence from Chicago's Public Housing Demolitions," WP 163, Becker Friedman Institute 2022.

Amaral, Francisco, Martin Dohmen, Sebastian Kohl, and Moritz Schularick, "Interest Rates and the Spatial Polarization of Housing Markets," Discussion Paper 17780, CEPR 2022.

Andersen, Henrik Yde and Soren Leth-Petersen, "Housing Wealth or Collateral: How Home Value Shocks Drive Home Equity Extraction and Spending," *Journal of the European Economic Association*, 2021, *19*, 403–440.

Arrondel, Luc and Bruno Lefebvre, "Consumption and Investment Motives in Housing Wealth Accumulation: A French Study," *Journal of Urban Economics*, 2001, *50*, 112–137.

Arrow, Kenneth J, "What Has Economics to Say about Racial Discrimination?," *Journal of Economic Perspective*, 1998, *12*, 91–100.

Attanasio, Orazio, Matthew Wakefield, and Andrew Leicester, "Do house prices drive consumption growth? The coincident cycles of house prices and consumption in the UK," *Journal of European Economic Association*, 2011, *9*, 399–435.

Auclert, Adrien, "Monetary Policy and the Redistribution Channel," *American Economic Review*, 2019, *109*, 2333 – 67.

Autor, David, Christopher Palmer, and Parag Pathak, "Housing Market Spillovers: Evidence from the End of Rent Control," *Journal of Political Economy*, 2014, *122*, 661–717.

Baum-Snow, Nathaniel, "Constraints on City and Neighborhood Growth: The Central Role of Housing Supply," *Journal of Economic Perspectives*, 2023, *37*, 1–22.

Bayer, Patrick and Christopher Timmins, "On the Equilibrium Properties of Locational Sorting Models," *Journal of Urban Economics*, 2005, *117* (518), 462–477.

_ **and** _ , "Estimating Equilibrium Models of Sorting Across Locations," *Economic Journal*, 2007, *117*, 353–374.

_ **, Marcus Casey, Fernando Ferreira, and Robert McMillan**, "Racial and ethnic price differentials in the housing market," *Journal of Urban Economics*, 2017, *102*, 91–105.

Belfield, Chris, Daniel Chandler, and Robert Joyce, "Housing: Trends in Prices, Costs and Tenure," Briefing Note BN161, IFS 2015.

Berard, Guilliaume and Alain Trannoy, "Housing policy impacts on poverty and inequality in Europe," WP 640, Society for the Study of Economic Inequality 2023.

Bergman, Peter, Eric Chan, and Adam Kapor, "Housing search frictions: evidence from detailed search data and a field experiment," WP 27209, NBER 2020.

_ **, Raj Chetty, Nathaniel Hendren, Stefanie DeLuca, Lawrence Katz, and Christopher Palmer**, "Creating Moves to Opportunity: Experimental Evidence on Barriers to Neighborhood Choice," Working paper, Harvard University 2023.

Besbris, Max, Ariela Schachter, and John Kuk, "The unequal availability of rental housing information across neighborhoods," *Demography*, 2021, pp. 1197–1221.

Bilal, Adrien and Esteban Rossi-Hansberg, "Location as an Asset," *Econometrica*, 2021, *89*, 2459–2495.

Bilmes, Linda and Justin de Benedicts-Kessner, "Can Inclusionary Zoning Be an Effective Housing Policy in Greater Boston? Evidence from Lynn and Revere," Working paper RWP23-006, Harvard Kennedy School 2023.

Blanden, Jo, Andrew Eyles, and Stephen Machin, "Trends in Intergenerational Home Ownerhip and Wealth Transmission," Discussion Paper 1756, CEP 2021.

Boerma, Job and Loukas Karabarbounis, "Reparations and Persistent Racial Wealth Gaps," *NBER Macroeconomics Annual*, April 2022.

Bonnet, Odran, Bono Pierre-Henri, Chapelle Guillaume, and Etienne Wasmer, "Does housing capital contribute to inequality? A comment on Thomas Piketty's Capital in the 21st Century," Discussion Paper 2014-07, Sciences Po 2014.

Borri, Nicola and Pietro Reichlin, "The Housing Cost Disease," *Journal of Economic Dynamics and Control*, 2018, *87*, 106–123.

Bruch, Elizabeth E. and Robert D. Mare, "Neighborhood Choice and Neighborhood Change," *American Journal of Sociology*, 2006, *112* (3), 667–709.

Brueckner, Jan, "Consumption and Investment Motives and the Portfolio Choices of Homeowners," *Journal of Real Estate Finance and Economics*, 2017, *5* (2), 159–180.

_ **and Stuart Rosenthal**, "Gentrification and Neighborhood Housing Cycles: Will America's Future Downtowns Be Rich?," *Review of Economics and Statistics*, 2009, *91* (4), 725–743.

Brueckner, Jan K., Matthew E. Kahn, and Gary C Lin, "A New Spatial Hedonic Equilibrium in the Emerging Work-from-Home Economy?," *American Economic Journal: Applied Economics*, 2023, *15* (2), 285–319.

Caetano, Gregorio and Vikram Maheshri, "A Unified Empirical Framework to Study Segregation.," Working Paper, University of Georgia 2021.

Card, David, Alexandre Mas, and Jesse Rothstein, "Tipping and the Dynamics of Segregation," *Quarterly Journal of Economics*, 2008, *123* (1), 177–218.

_ **,** _ **, and** _ , "Are Mixed Neighborhoods Always Unstable? Two-Sided and One-Sided Tipping," in Susan Wachter, Eugenie Birch, and Harriet Newburger, eds., *Handbook of Regional And Urban Economics*, University of Pennsylvania Press, 2011.

_ **, Jesse Rothstein, and Moises Yi**, "Location, location, location," Working Paper, University of Berkeley 2022.

Causa, Orsetta, Nicolas Woloszko, and David Leite, "Housing, Wealth Accumulation and Wealth Distribution: Evidence and Stylized Facts," Working Paper 1588, OECD Economics Department 2019.

Chambers, Matthew, Carlos Garriga, and Don E Schlagenhauf, "Accounting For Changes in the Homeownership Rate," *International Economic Review*, 2009, *50* (3), 677–726.

Chetty, Raj and Nathaniel Hendren, "The Impacts of Neighborhoods on Intergenerational Mobility I: Childhood Exposure Effects," *Quarterly Journal of Economics*, 2018, *133* (3), 1107–1162.

_ **and** _ , "The Impacts of Neighborhoods on Intergenerational Mobility II: County-Level Estimates," *Quarterly Journal of Economics*, 2018, *133* (3), 1163–1228.

_ **, László Sándor, and Adam Szeidl**, "The Effect of Housing on Portfolio Choicet," *Journal of Finance*, 2017, *72*, 1171–1211.

_ **, Nathaniel Hendren, and Lawrence Katz**, "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment," *American Economic Review*, 2016, *106* (4), 855–902.

Christensen, Peter and Christopher Timmins, "The Damages and Distortions from Discrimination in the Rental Housing Market," Working Paper 29049, NBER 2021.

_ **and** _ , "Sorting or Steering: The Effects of Housing Discrimination on Neighborhood Choice," *The Journal of Political Economy*, 2022, *130*, 2110 – 63.

_ **, Ignacio Sarmiento-Barbieri, and Christopher Timmins**, "Racial Discrimination and Housing Outcomes in the United States Rental Market," Working Paper 29516, NBER 2021.

Chyn, Eric, "Moved to Opportunity: The Long-Run Effects of Public Housing Demolition on Children," *American Economic Review*, 2018, *108*, 3028–56.

_ **and Diego Daruich**, "An Equilibrium Analysis of the Effects of Neighborhood-based Interventions on Children," Working Paper 29927, NBER 2021.

_ **and Lawrence Katz**, "Nighborhoods Matter: Assessing the Evidence for Place Effects," *Journal of Economic Perspectives*, 2021, *35*, 197–222.

Cloyne, James, Kilian Huber, Ethan Ilzetzki, and Henrik Kleven, "The Effect of House Prices on Household Borrowing: A New Appraoch," *American Economic Review*, 2019, *109*, 2104 – 2136.

Courant, Paul N, "Racial Prejudice in a Search Model of the Urban Housing Market," *Journal of Urban Economics*, 1978, *5*, 329–345.

Crossley, Thomas, Peter Levell, and Hamish Low, "House Price rises and borrowing to invest," Working Paper 15, Institute for Financial Studies 2022.

Davis, Morris A., Andra C. Ghent, and Jesse M. Gregory, "The work-from-home technology boon and its consequences," Working Paper 28461, NBER 2023.

Davis, Morris and Francois Ortalo-Magne, "Household expenditures, wages and rents," *Review of Economic Dynamics*, 2011, *14*, 248–261.

_ **and Stijn Van Nieuwerburgh**, "Housing, Finance, and the Macroeconomy," in Gilles Duranton, J Vernon Henderson, and William Strange, eds., *Handbook of Regional and Urban Economics*, Vol. 5, North Holland, 2015, chapter 12, pp. 753–811.

_ **, Jesse Gregory, Daniel Hartley, and Kegon Tan**, "Neighborhood Choices, Neighborhood Effects and Housing Vouchers," *Quantitative Economics*, 2021, *12*, 1307–1346.

DeLaRoca, Jorge and Diego Puga, "Learning by Working in Big Cities," *The Review of Economic Studiess*, 2017, *84*, 106–142.

Derenoncourt, Ellora, Chi Hyun Kim, Moritz Kuhn, and Moritz Schularick, "Wealth of Two Nations: The U.S. Racial Wealth Gap, 1860-2020," Working Paper 296, Griswold Center for Economic Policy Studies 2022.

Diamond, Rebecca, "The Determinants and Welfare Implications of US Workers," *American Economic Review*, 2016, *106* (3), 479–524.

_ **, Adam Gureny, and Rose Tan**, "The Effect of Foreclosures on Homeowners, Tenants, and Landlords," Working Paper 28357, NBER 2020.

_ **and Cecile Gaubert**, "Spatial Sorting and Inequality," *Annual Review of Economics*, 2022, *14*, 795–819.

_ **and Enrico Moretti**, "Where is Standard of Living the Highest? Local Prices and The Geography of Consumption," Working Paper 29533, NBER 2022.

_ **, Tim McQuade, and Franklin Qian**, "The Effects of Rent Control Expansion on Tenants, Landlords, and Inequality: Evidence from San Francisco," *American Economic Review*, 2019, *109* (9), 3365–94.

Donner, Herman, Peter Englund, and Mats Persson, "Distributional Effects of Deregulating the Stockholm Rental Housing Market," Report 2017/1, The Swedish Fiscal Policy Council 2017.

Duca, John V., John Muellbauer, and Anthony Murphy, "What Drives House Price Cycles? International Experience and Policies," *Journal of Economic Literature*, 2021, *59* (3), 773–864.

Durlauf, Steven N., "A Theory of Persistent Income Inequality," *Journal of Economic Growth*, 1996, *1* (1), 75–93.

Dusansky, Richard and Cagatay Koç, "The capital gains effect in the demand for housing," *Journal of Urban Economics*, 2007, *61*, 287–298.

Dustmann, Christian, Bernd Fitzenberger, and Markus Zimmermann, "Housing Expenditure and Income Inequality," *The Economic Journal*, 2022, *132*, 1709–1736.

Eggum, Terje and Erling Larsen, "Is the Housing Market an Inequality Generator?," Working Paper Series 2, Housing Lab 2021.

Englund, Peter, Thomas Jansson, and Todd Sinai, "How Parents Influence the Wealth Accumulation of their Children," WP, Wharton School 2013.

Enström-Öst, Cecilia and Per Johannson, "The consequences of the Swedish rent control system on labor income: Evidence from a randomized apartment lottery," *Journal of Public Economics*, May 2023, *221*.

Fagereng, Andreas, Matthieu Gomez, Emilien Gouin-Bonenfant, Martin Holm, Benjamin Moll, and Gisle Natvik, "Asset-Price Distribution," Working Paper, LSE 2022.

Faigelbaum, Pablo and Cecile Gaubert, "Optimal Spatial Policies, Geography, and Sorting," *Quarterly Journal of Economics*, 2020, *135* (2), 959–1036.

Favilukis, Jack and Gen Li, "The Great Resignation was caused by the Covid-19 housing boom," Working Paper, University of British Columbia 2023.

_ , Pierre Mabille, and Stijn van Nieuwerburgh, "Affordable Housing and City Welfare," *Review of Economic Studies*, 2023, *90* (1), 293–330.

Figari, Francesco, Alari Paulus, Holly Sutherland, Panos Tsakloglou, and Gerlinde Verbist, "Removing Homeownership Bias in Taxation: The Distributional Effects of Including Net Imputed Rent in Taxable Income," *Fiscal Studies*, 2017, *38* (4), 525–557.

Finlay, John and Trevor C. Williams, "Housing Demand, Inequality and Spatial Sorting," Working Paper, Imperial College 2022.

Flavin, M. and Shinobu Nakagawa, "A Model of Housing in the Presence of Adjustment Costs," *American Economic Review*, 2008, *98* (1), 474–495.

_ and T. Yamashita, "Owner-Occupied Housing: Life-Cycle Implications for the Household Portfolio," *American Economic Review: Papers and Proceedings*, 2011, *101* (3), 609–614.

Fogli, Alessandra, Veronica Guerrieri, and Mark Ponder, "The End of the American Dream? Inequality and Segregation in US cities," WP, Chicago Booth 2022.

Fu, Yuming, "Three Essays in Real Estate Economics," Ph.D. Dissertation, University of British Columbia 1993.

Garriga, Carlos, Finn Kydland, and Roman Sustek, "Mortgages and Monetary Policy," *The Review of Financial Studies*, 2017, *30* (10), 3337–3375.

Ghent, Andra and David Leather, "Is America's Housing Affordability Problem a Housing Problem?," Working Paper, University of Utah 2021.

Gilraine, Michael, James Graham, and Angela Zheng, "Public Education and Intergenerational Housing Wealth Effects," WP 31345, NBER 2023.

Glaeser, Edward L. and Erzo L. P. Luttmer, "The Misallocation of Housing Under Rent Control," *American Economic Review*, 2003, *93*, 1027–1046.

Goodman, Laurie S and Christopher Mayer, "Homeownership and the American Dream," *Journal of Economic Perspective*, Winter 2018, *32* (1), 31–58.

Graham, Bryan S., "Identifying and Estimating Neighborhood Effects," *Journal of Economic Literature*, 2018, *56*, 450–500.

Grossman, Sandford and Guy Laroque, "Asset Pricing and Optimal Portfolio Choice in the Presence of Illiquid Durable Consumption Goods," *Econometrica*, 1990, *58*, 25–51.

Grossmann, Volker, Benjamin Larin, Hans Torben Lofflad, and Thomas Steger, "Distributional Consequences of Surging Housing Rents," *Journal of Economic Thoery*, September 2021, *196*.

Gyourko, Joseph, Christopher Mayer, and Sinai Todd, "Superstar Cities," *American Economic Journal: Economic Policy*, 2013, *5*, 167–199.

Han, Joel Kaiyuan, "Parental involvement and neighborhood quality: evidence from public housing demolitions in Chicag," *Review of Economics of the Household*, 2022, *20*, 1193–1238.

Han, Lu and William Strange, "The Microstructure of Housing Markets: Search, Bargaining, and Brokerage," in Gilles Duranton, Vernon Henderson, and William Strange, eds., *Handbook of Regional And Urban Economics*, Vol. 5, North Holland, 2015, chapter 13, pp. 813–886.

_ , L. Rachel Ngai, and Kevin D. Sheedy, "To Own or to Rent? The Effects of Transaction Taxes on Housing Markets," Working Paper 17520, CEPR 2022.

Hardman, Anna M. and Yannis M. Ioannides, "Residential Mobility and the Housing Market in a Two-Sector Neoclassical Growth Model," *Scandinavian Journal of Economics*, 1999, *101*, 315–335.

_ and _ , "Neighbors' income distribution: economic segregation and mixing in US urban neighborhoods," *Journal of Housing Economics*, 2004, *13*, 368–382.

He, Alex and Daniel le Maire, "Household liquidity constraints and labor market outcomes: Evidence from a Danish Mortgage Reform," *Journal of Financial Economics*, Forthcoming, *145*.

Henderson, J.V. and Y. M. Ioannides, "A Model of Housing Tenure Choice," *The American Econmic Review*, 1983, *73*, 98–113.

Higgins, Brian, "Racial Segmentation in the US Housing Market," Working Paper, Stanford University 2022.

Hoffman, Florian, David Lee, and Thomas Lemieux, "Growing Income Inequality in the United States and Other Advnaced Economies," *Journal of Economic Perspective*, 2020, *34*, 52–78.

Hsieh, Chang-Tai and Enrico Moretti, "Housing Constraints and Spatial Misallocation," *American Economic Journal: Macroeconomics*, 2019, *11*, 1–39.

Ioannides, Yannis, "Review of Climbing Mount Laurel: The Struggle for Affordable Housing and Social Mobility in an American Suburb by Douglas S. Massey et al.," *Journal of Economic Literature*, 2017, *55*, 609–620.

_ **and Stuart S. Rosenthal**, "Estimating the Consumption and Investment Demands for Housing and Their Effect on Housing Tenure Status," *The Reveiw of Economics and Statistics*, 1994, *76*, 127–141.

Ioannides, Yannis M., *From Neighborhoods to Nations: The Economics of Social Interactions*, Princeton University Press, 2013.

_ **and Jeffrey E. Zabel**, "Interactions, Neighborhood Selection and Housing Demand," *Journal of Urban Economics*, 2008, *63*, 229–252.

_ **and** _ , "Housing and Labor Market Vacancies and Beveridge Curves: Theoretical Framework and Illustrative Statistics," in Yannis M. Ioannides, ed., *Recent Developments in the Economics of Housing*, Vol. II, Edward Elgar, 2019.

Jensen, Thais, Soren Leth-Petersen, and Ramana Nanda, "Financing constraints, home equity and selection into entrepreneurship," *Journal of Financial Economics*, 2022, *145*, 318–337.

Karagiannaki, Eleni, "The Effect of Parental Wealth on Children's Outcomes in Early Adulthood," *The Journal of Economic Inequality*, 2017, *15*, 217–243.

Kennan, John and James R. Walker, "The Effect of Expected Income in Individuals' Migration Decisions," *Econometrica*, 2011, *79* (1), 211–251.

Kermani, Amir and Francis Wong, "Racial Disparities in Housing Wealth," Working Paper 29306, NBER 2021.

Kiyotaki, N., A. Michaelides, and K Nikolov, "Winners and Losers in Housing Market," *Journal of Money, Credit and Banking*, 2011, *43* (2/3), 255–296.

_ **,** _ **, and** _ , "Housing, Distrbution and Welfare," *Journal of Money, Credit and Banking*, Forthcoming.

Kling, Jeffrey, Jeffrey B. Liebman, and Laurence Katz, "Experimental analysis of Neighborhood Effects," *Econometrica*, 2007, *75*, 83–119.

Koster, Hans and Jos van Ommeren, "Place-Based Policies and the Housing Market," *The Review of Economics and Statistics*, 2019, *101*, 400–414.

Kuhn, Moritz, Moritz Schularick, and Ulrike Steins, "Income and Wealth Inequality in America, 1949 – 2016," *Journal of Political Economy*, 2020, *128*, 3469–3519.

Kulkarni, Nirupama and Ulrike Malmendier, "Homeownership Segregation," *Journal of Monetary Economics*, 2022, *129*, 123–149.

Lens, Michael, "Zoning, Land Use, and the Reproduction of Urban Inequality," *Annual Review of Sociology*, 2022, *48*, 421–439.

Leth-Petersen, Soren, "Intertemporal consumption and credit constraints: does total expenditure respond to an exogenous shock to credit?," *American Economic Review*, 2010, *100*, 1080–1103.

Lovenheim, Michael, "The effect of Liquid Housing Wealth on College Enrollment," *Journal of Labor Economics*, 2011, *29* (4), 741–771.

Määttänen, Niku and Marko Terviö, "Welfare effects of housing transaction taxes: a quantitative analysis with an assignment model," *Economic Journal*, May 2022, *644*, 1566–99.

Malmendier, Ulrike and Alexandra Wellsjo, "Rent or Buy? Inflation Experiences and Homeownership within and across Countries," *Journal of Financew*, Forthcoming.

Martinez-Toledano, Clara, "House Price Cycles, Wealth Inequality and Portfolio Reshuffling.," Working Paper, Imperial College 2022.

Nakamura, Emi, Josef Sigurdsson, and Jon Steinsson, "The Gift of Moving: Intergenerational Consequences of a Mobility Shock," *Review of Economic Studies*, 2022, *89*, 1557–92.

Ngai, L. Rachel and Kevin D. Sheedy, "The decision to move house and aggregate-market dynamics," *Journal of European Economic Association*, 2020, *18*, 2487–2531.

_ **and** _ , "Ins and Outs of Selling Houses: Understanding Housing-Market Volatility," Discussion paper 13, CFM 2022.

OECD, *Housing and Inclusive Growth*, Paris: OECD Publishing, 2020.

Oh, Sun Jung and John Yinger, "What Have We Learned From Paired Testing in Housing Markets?," *Cityscape*, 2015, *17* (3), 15–60.

Olsen, Edgar and Jeffrey Zabel, "US Housing Policy," in Vernon Henderson and William Strange, eds., *Handbook of Regional and Urban Economics*, Elsevier, 2015.

Ortalo-Magné, François and Andrea Prat, "Spatial Asset Pricing: A First Step," *Economica*, 2016, *83*, 130–171.

Patacchini, Eleonora and Yves Zenou, "Neighborhood effects and parental involvement in the intergenational transmission of education," *Journal of Regional Science*, December 2011, *51* (5), 987–1013.

Pfeffer, Fabian and Martin Hallsten, "Mobility Regimes and Parental Wealth: The United States, Germany, and Sweden in Comparison," Technical Report, DIW 2012.

Piazzesi, Monika and Martin Schneider, "Housing and Macroeconomics," in John B. Tayor and Harald Uhlig, eds., *Handbook of Macroeconomics*, Vol. 2B, North Holland, 2016, chapter 19, pp. 1547–1640.

Piketty, Thomas and Gabriel Zucman, "Capital is Back: Wealth – Income Raios in Rich Countries 1700 – 2010," *Quarterly Journal of Economics*, 2014, pp. 1255 – 1310.

Poterba, James M, "Tax Subsidies to Owner-Occupied Housing: An Asset-Market Approach," *Quarterly Journal of Economics*, November 1984, pp. 729–752.

Quigley, John M. and Steven Raphael, "Is Housing Unaffordable? Why Isn't It More Affordable?," *Journal of Economic Perspective*, 2004, *18*, 191–214.

Reardon, Sean F., Lindsay Fox, and Joseph Townsend, "Neighborhood Income Composition by Household Race and Income, 1990–2009," *Annals of the American Society of Political and Social Science*, 2015, *660*, 78–97.

Rosenthal, Stuart S., "Are Private Markets and Filtering a Viable Source of Low-Income Housing? Estimates from a 'Repeat Income' Model," *American Economic Review*, 2014, *104*, 687–706.

Rouse, Cecilia, Jared Bernstein, Helen Knudsen, and Jeffery Zhang, "Exclusionary Zoning: Its Effect on Racial Discrimination in the Housing Market," Technical Report, Council of Economic Advisers, the White House 2021.

Sabelhaus, John and Jeffrey P. Thompson, "The Limited Role of Intergenerational Transfers for Understanding Racial Wealth Disparities," Current Policy Perspectives, Federal Reserve Bank of Boston 2023.

Saiz, Albert, "The Global Housing Affordability Crisis: Policy Options and Strategies," Working Paper 23-01, MIT Center for Real Estate Research 2023.

Sakong, Jung, "Cyclical Transactions and Wealth Inequality," Working Paper 2022-05, Federal Reserve Bank of Chicago 2022.

Sampson, Robert J. and Brian L. Levy, "The Enduring Neighborhood Effect, Everyday Urban Mobility, and Violence in Chicago," *The University of Chicago Law Review*, 2022, *89*, 323–347.

Schelling, Thomas C, "Dynamic Models of Segregation," *Journal of Mathematical Sociology*, 1971, *1*, 143–186.

Schmidheiny, Kurt, "Income segregation from local income taxation when households differ in both preferences and incomes," *Regional Science and Urban Economics*, 2006, *36*, 270–299.

Sinai, Todd and Nicholas S. Souleles, "Owner-occupied Housing as a Hedge Against Rent Risk," *Quarterly Journal of Economics*, 2005, *120*, 763–789.

Sommer, Kamil and Paul Sullivan, "Implications of US Tax Policy for House Prices, Rents and Homeownership," *American Economic Review*, 2018, *108*, 241–274.

Stigler, George, "The Early History of Empirical Studies of Consumer Behavior," *Journal of Political Economy*, 1954, *62*, 95–113.

Towe, Charles and Chad Lawley, "The Contagion Effect of Neighboring Foreclosures," *American Economic Journal: Economic Policy*, 2013, *5*, 313–335.

Trounstine, Jessica, "The Geography of Inequality: How Land Use Regulation Produces Segregation," *American Political Science Review*, 2023, *114*, 443–455.

Wheeler, Christopher H. and Elisabeth A. La Jeunesse, "Trends in Neighborhood Income Inequality in the U.S.," *Journal of Regional Science*, 2008, *48*, 879–891.

Wood, John and Stephen Clarke, "House of the Rising Son (or Daughter)," Briefing, Resolution Foundation 2018.

Zhang, Junfu, "Residential segregation in an all-integrationist world," *Journal of Economic Behavior and Organization*, 2004, *54*, 533–550.