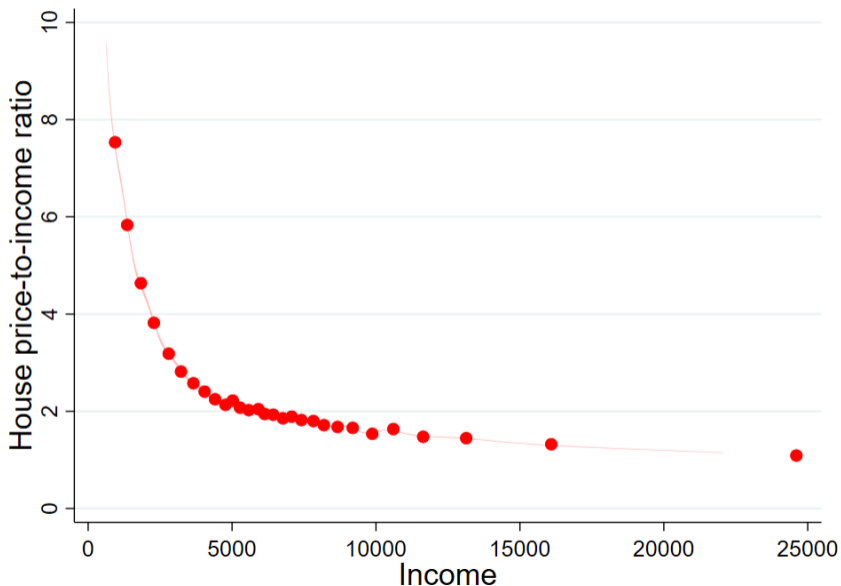# Racial Segmentation in the US Housing Market

Brian Higgins
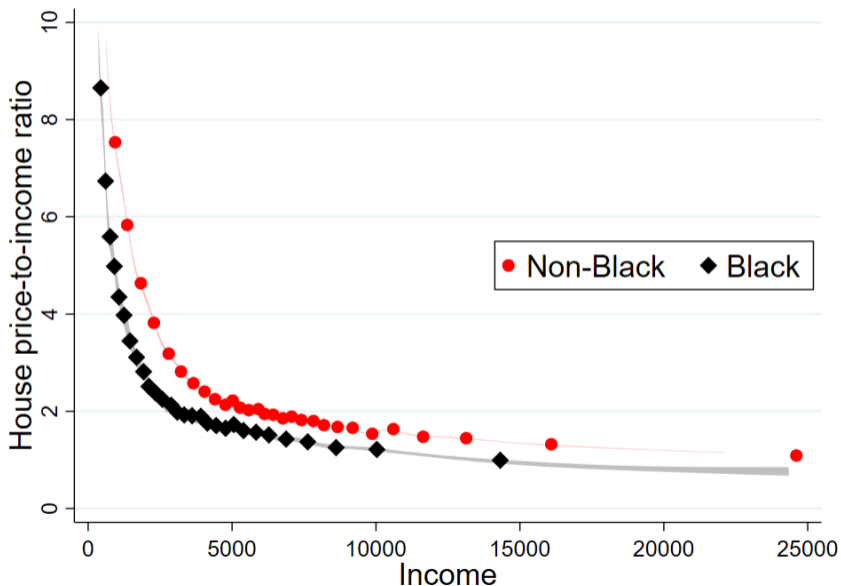
Harvard University

August 2023
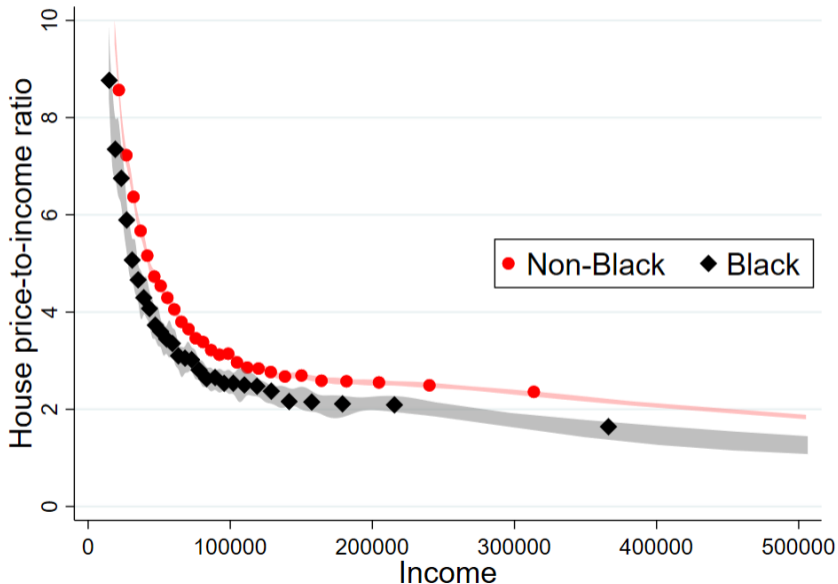
In 1960 Black households had lower house price-to-income ratios

In 1960 Black households had lower house price-to-income ratios

House price-to-income ratios are still lower in 2019

Motivation

- Discrimination may segment markets by distorting
    - what house to rent, what house to buy, and whether to buy or rent

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CODE OF ETHICS

of the

National Association of Real Estate Boards

- **Article 34.** (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.*"

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  members of any race or nationality, ...
  whose presence will clearly be detrimental to property values in that neighborhood.*"

- **Question:** What is the total effect of these types of barriers?
  - How have they changed since 1960?
  - What are the implications for welfare?

Key takeaways

- **Document racial gaps in housing outcomes using Census data**
  - Black households have lower **house values**, **rent expenditures**, and **ownership rates** ... conditional on income and other characteristics

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      ... but the ownership gap is unchanged

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      ...and sort into lower quality homes
    - A higher cost of owning homes accounts for the lower ownership rate

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    ... but the ownership gap is unchanged

- **Black households pay higher quality-adjusted rents and prices**
    ...and sort into lower quality homes
  - A higher cost of owning homes accounts for the lower ownership rate

- **Welfare:** consumption equivalent welfare loss of 4.5% in 1960 and 1% in 2019
  - richest Black households lose out by living in lower quality homes
  - ... while poorer Black households lose from higher prices

This paper

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- **Estimate a dynamic housing assignment model**
    - **households** differ in income, age, wealth
    - **multidimensional assignment** to **indivisible houses** differing in quality and tenure

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  - Assuming preferences are the same
  - ... model uses data on **differences in choices** of Black and White households
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    ... and to infer distortions in savings and homeownership choices

- **Integrated markets counterfactual quantifies the effect on welfare**

1. **Empirical evidence**

2. Simplified model
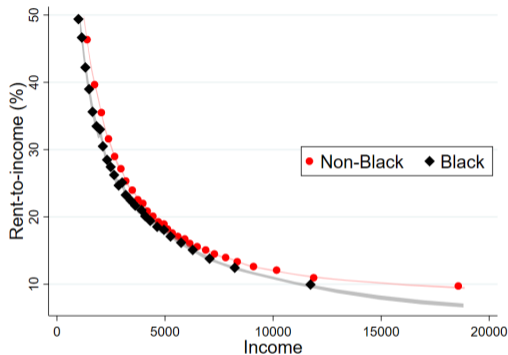
3. Quantitative model

Three empirical facts

Data

- Census micro data, household level
- Years: 1960 and 2019
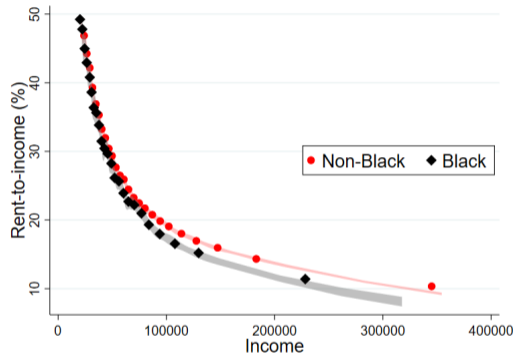
Conditional on income (and other characteristics):

1 Black household have lower house price-to-income ratios

2 **Black household have lower rent-to-income ratios**

3 Black household have lower ownership rates

Rent-to-income ratio is lower for Black households

- **Sample**: Nationwide, renters only

- In 1960, Black households are 6 percentiles behind in distribution of rents
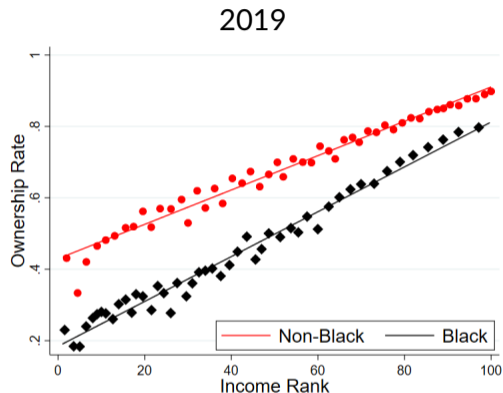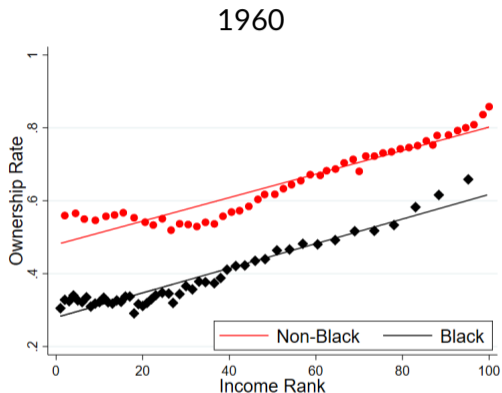
- ... and 4 percentiles in 2019
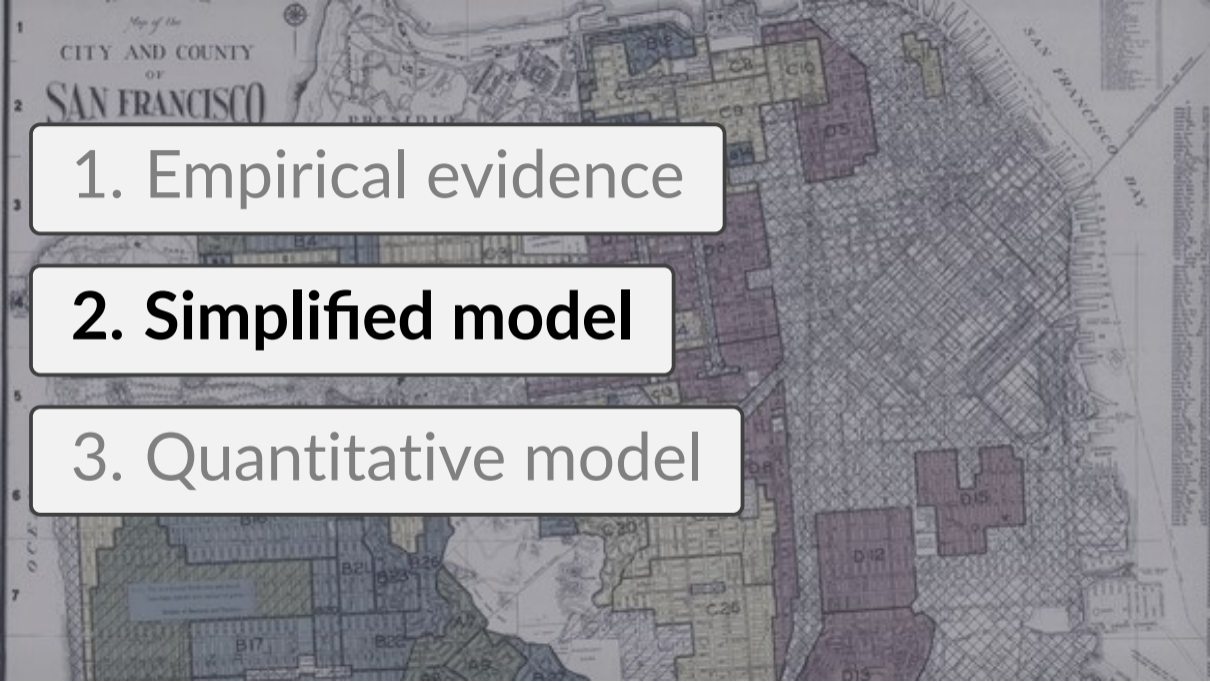
[rank]

Three empirical facts

Conditional on income (and other characteristics):

1 Black household have lower house price-to-income ratios

2 Black household have lower rent-to-income ratios

3 **Black household have lower ownership rates**

... similar pattern with lower ownership rate for Black households

- Gap in ownership rates is largely unchanged since 1960

1. Empirical evidence

2. Simplified model

3. Quantitative model

Model set up

- Model of single segment

- Unit mass of **households** with **income** y and strictly increasing **CDF** $F(y)$

- Unit mass of **houses** with **quality** $h \in [\underline{h}, \bar{h}]$, **rent** $\rho(h)$ and strictly increasing **CDF** $G(h)$
  - Quality captures everything about the house and neighborhood

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$$\max_{c,h} \quad \log c + \theta \log h$$
$$s.t. \quad y = c + \rho(h)$$

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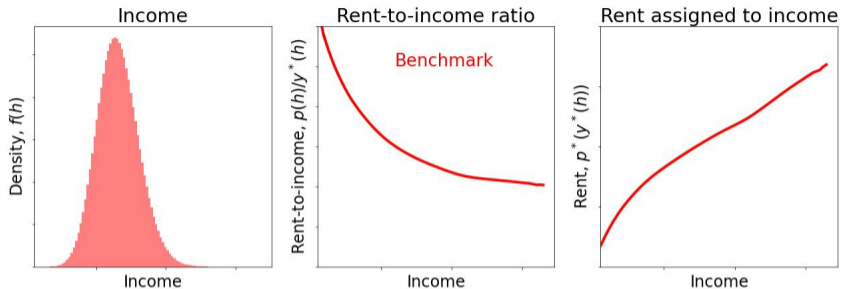- Households choose a single house quality and consumption to solve

$$\max_{c,h} \quad \log c + \theta \log h$$
$$s.t. \quad y = c + \rho(h)$$

- Equilibrium is rent function $\rho(h)$ and allocations $h^*(y)$
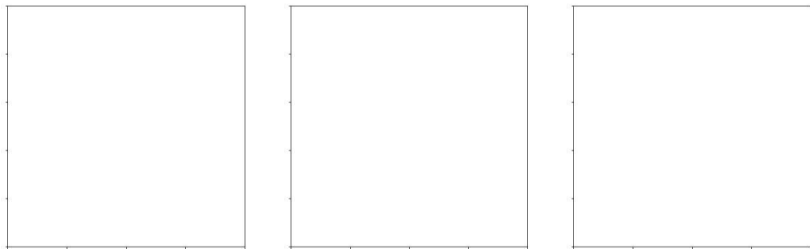 s.t. agents optimize and markets clear at every quality

$$G(h) = \int_0^\infty \mathbf{1}\{h^*(y) \leq h\}\, dF(y) \qquad \forall h$$

Example: inferring quality in a segment

DATA:

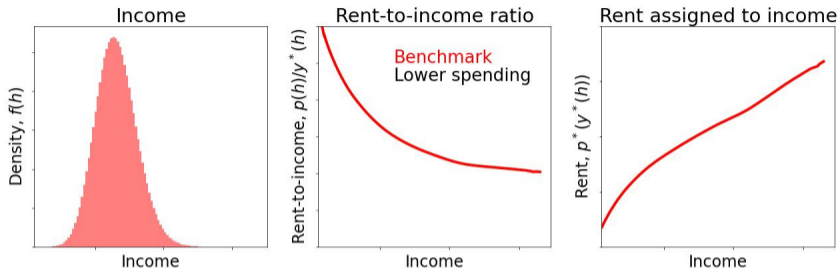| Income	Rent-to-income ratio	Rent assigned to income

LATENT
FUNDAMENTALS:

Example: inferring quality in a segment

DATA:

LATENT FUNDAMENTALS:
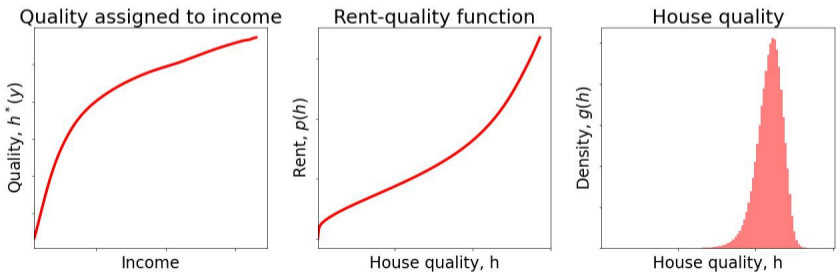
Example: inferring quality when rental expenditures are lower

DATA:
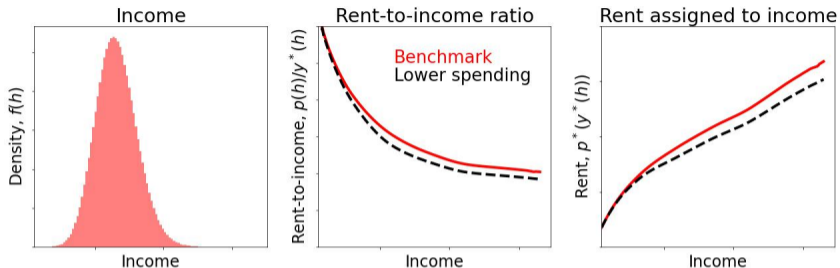
LATENT FUNDAMENTALS:
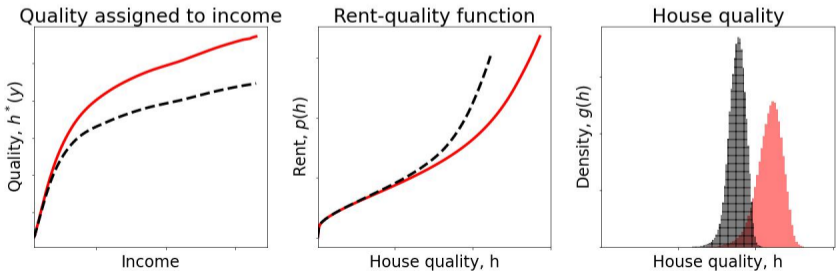
Example: segmenting by income infers the same fundamentals

DATA:
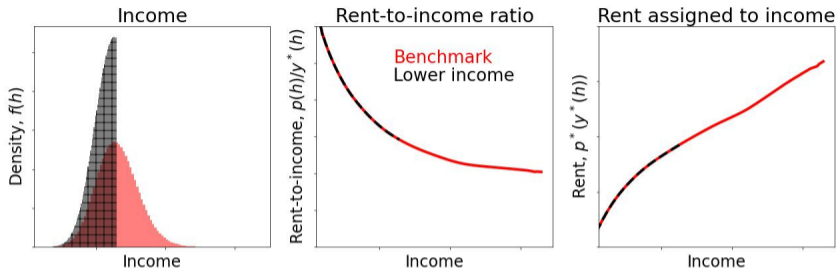
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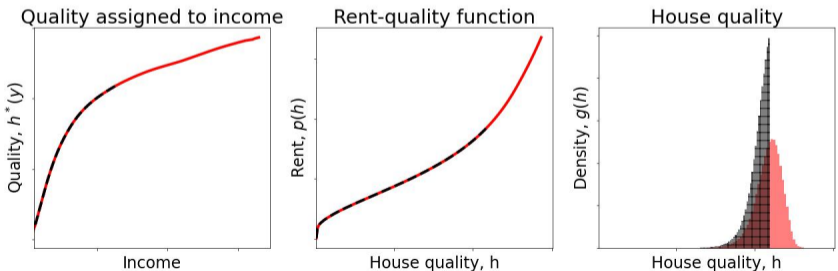
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Quantitative model overview

Q How do **housing gaps** in rents, prices and ownership affect **welfare**?

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Simplified model

- Static

- Household demand depends on income

- Supply of houses can be rented

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    - → bequests
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- Supply of houses can be rented

- Supply of houses can be rented or owned
  - → household buy-rent decision
  - → infer quality: rents $\rho(h)$ and prices $p(h)$
  - → also infer cost of homeownership
    ... and difference in returns on savings

Equilibrium in 1960

Note: Quality h is normalized to price in White segment $\rho^W(h)$
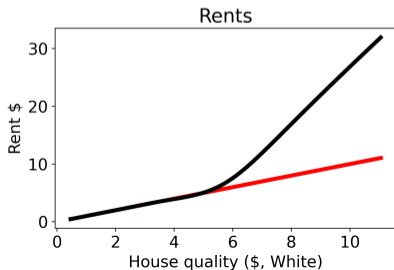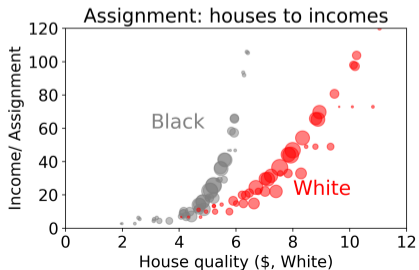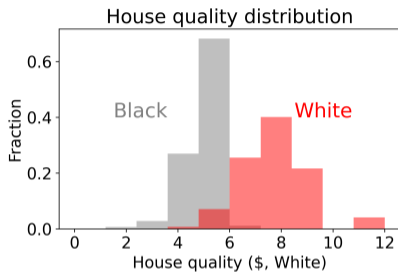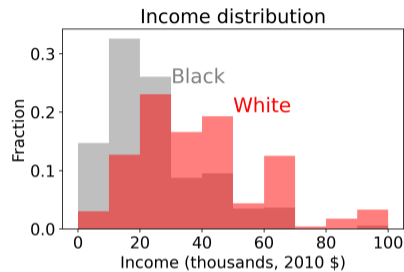
1960

- **Prices:**
- 18% higher without substitution;
- 3% higher with
- **Homeownership cost gap:** 3%

2019:
- **Prices:**
  3% higher prices

Black households are worse off in segmented equilibrium

Q How does welfare compare in segmented market (relative to integrated market)?

- **Welfare:** percentage increase in consumption at every state and time to compensate

Black welfare

Black households are worse off in segmented equilibrium
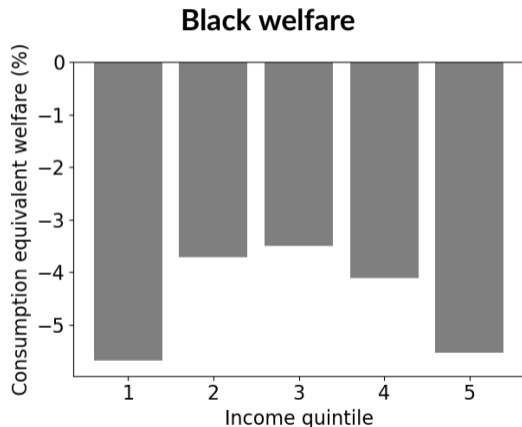
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Black welfare

White welfare
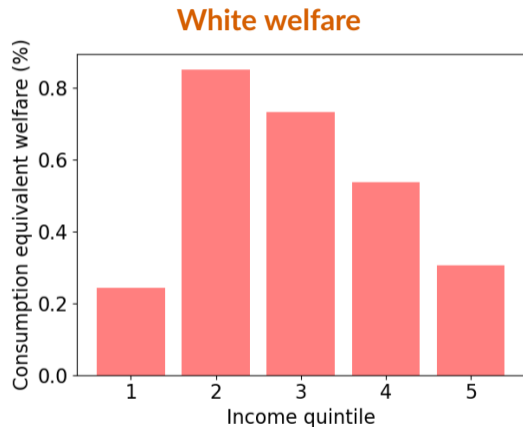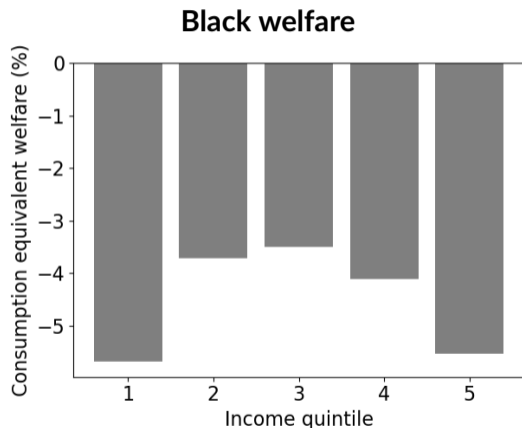
- **2019:** 1% welfare loss for Black households

Conclusion

- Documented large gaps in **housing outcomes** by race
  - Black households have lower rents, prices and ownership rates
  - Rent and price gaps have declined while ownership rate gap has stayed the same

- Model with segmented markets finds that
  - Black households pay **higher quality-adjusted rents**,
    ... and sort into **lower quality homes**
    ... and have a higher cost of owning

- Market segmentation impacts both rich and poor Black households
  - In 1960, households need $\approx 4.5\%$ more consumption to compensate
  - ... and still 1% in 2019

Appendix: Longer Talk

Related literature

- **Racial Differences in Housing Markets.**
    - Muth 69; Schelling 69; Kain-Quigley 75; Cutler-Glaeser 97; Cutler-Glaeser-Vigdor 99; Card-Mas-Rothstein 08; Boustan 10; Bayer-Fang-McMillan 14; Bayer-Casey-Ferreira-McMillan 17; Logan-Parman 17a 17b; Christensen-Timmins 21a, 21b; Akbar-Shertzer-Li-Walsh 20; Bayer-Charles-Park 21; Kahn 21; Kermani-Wong 21; Gupta-Hansman-Mabille 22.

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- **Racial Differences in Income and Wealth.**
    - Blau-Graham 90; Munnell-Browne-McEneaney-Tootell 96; Charles-Hurst 02; Woodward-Hall 12;
      Bayer-Charles 18; Hsieh-Hurst-Jones-Klenow 19; Kuhn-Schularick-Steins 19;
      Aliprantis-Carroll-Young 21; Derenoncourt-Kim-Kuhn-Schularick 21;
      Gordon-Jones-Neelakantan-Athreya 21; Hurst-Rubinstein-Shimizu 21; Brouillette-Jones-Klenow
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- **Models of Housing Assignment.**
  - Sweeney 74a 74b; Braid 81; Arnott 87; Landvoigt-Piazzesi-Schneider 14; Määttänen-Terviö 14; Landvoigt-Piazzesi-Schneider 15; Epple-Quintero-Sieg 20; Nathanson 20; Abramson 21.

Three empirical facts

Conditional on income (and other characteristics):

1 Black household have lower house price-to-income ratios
   - Gap (in percentiles) has declined about half since 1960

2 Black household have lower rent-to-income ratios
   - Gap (in percentiles) has declined about half since 1960

3 Black household have lower ownership rates
   - Gap is slightly larger than in 1960

Bonus facts:

- **Cross section:** Gaps are negative in every state   [rent]   [price]   [owner]
- **Quality:** Black houses have worse **observable quality**   [link]
- **Placebo:** Smaller gaps by gender and for Asian Americans   [gender]   [AAPI]

Data

- **Census micro data 1940-2019:**
    - Household level

    - Nationwide, 1-5% samples

    - Primary variables (self reported):
        - Income
        - Prices
        - Rents
        - Race of household head

    - Covariates:
        - Education, age, gender, household size and structure, location (metro/state)

- **Survey of Consumer Finance (SCF+) 1949-2016**   [Kuhn-Schularick-Steins 19]
    - Net wealth

Black households have lower price-to-income ratio

1960
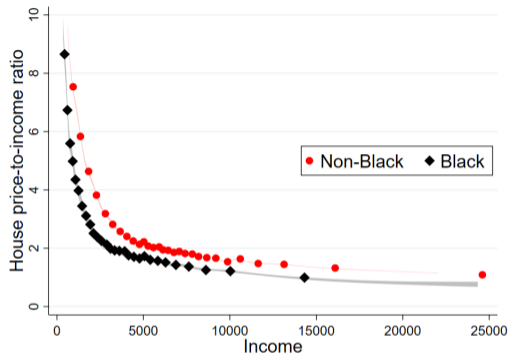
2019
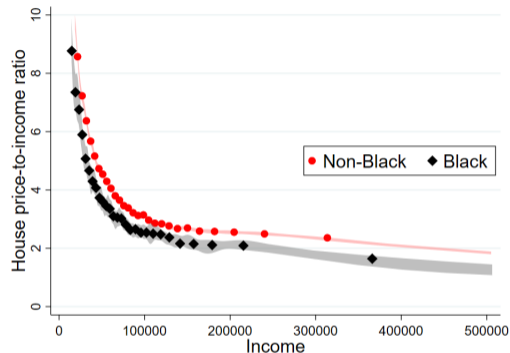
- **Sample**: Nationwide, owners only
- Robust to including household and location controls
- In 1960, Black households are 13 percentiles behind in distribution of house prices
- ... and 6 percentiles in 2019

[rank]

Simplified model overview

Quantitative model

- Dynamic

Simplified model

- Static

Simplified model overview

Quantitative model	**Simplified model**
- Dynamic	- Static
- Household demand depends on income, age, wealth	- Household demand depends on income

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- Supply of houses can be rented or owned

Simplified model

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Simplified model overview

Quantitative model	**Simplified model**
- Dynamic	- Static
- Household demand depends on income, age, wealth	- Household demand depends on income
- Supply of houses can be rented or owned	- Supply of houses can be rented

Simplifications allow me to

- explicitly show how housing quality is inferred from data

- show when exercise infers differences in quality and when it doesn't

Identification of quality

- **Define:** Engel curve $\rho^*(y)$
- **Quality is identified**

$$\log h^*(\tilde{y}) \;\; = \;\; \underline{h} + \int_{\underline{y}}^{\tilde{y}} \frac{1}{\theta} \frac{\rho^{*\prime}(y)}{y - \rho^*(y)} \, dy$$

(conditional on $\underline{h}$ and θ) because right-hand side is **observable**

Counterfactual: integrating markets in 1960
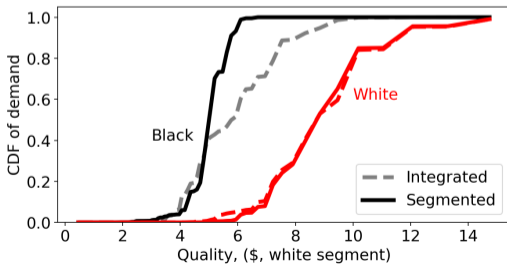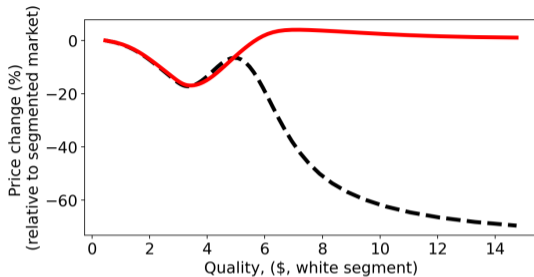
Equilibrium in 2019
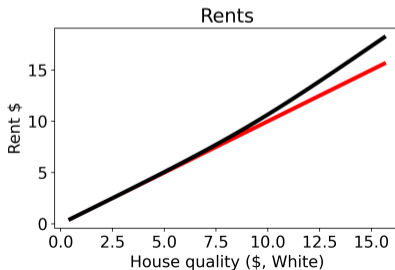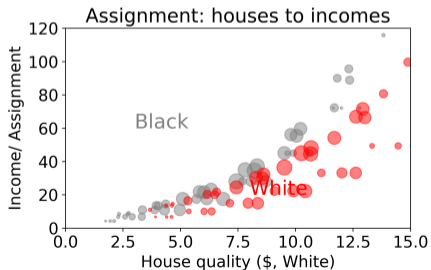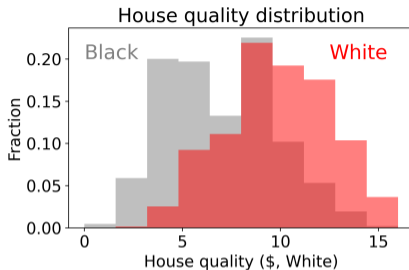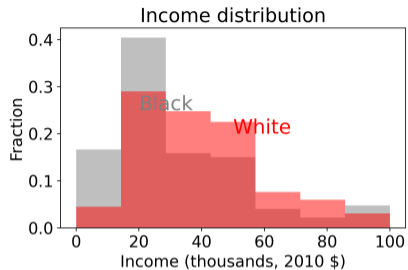
- Homeownership cost gap still 2.4%

- Welfare gaps are lower

- 2% for high income Black households (1% on average)

Appendix: empirical

Households

- Household race $s \in \{b, w\}$

- Small open economy with interest rate r_s

- **Overlapping generations** live at most J periods with survival probability $\phi_{s,j}$

Households

- Household race $s \in \{b, w\}$

- Small open economy with interest rate r_s

- **Overlapping generations** live at most J periods with survival probability $\phi_{s,j}$

- **Choose consumption** c, *single* **house quality** h, and whether to **buy/rent** $o \in \{\mathcal{O}, \mathcal{R}\}$ to maximize

$$\mathbb{E}_0 \left\{ \sum_{j=0}^{J-1} \beta^j \phi_{s,j}[u(c_j, h_j) + \varepsilon_j(o_j)] + \phi_{s,J} \beta^J v(c_J) \right\}$$

$$u(c_j, h_j) = \frac{[c_j^\alpha h_j^{1-\alpha}]^{1-\gamma}}{1-\gamma} \qquad v(c_J) = \frac{\nu[c_J]^{1-\gamma}}{1-\gamma}$$

- ε drawn from EV type I with scale $\sigma_\varepsilon \geq 0$, i.i.d each period

Income and taxes

- **Income.** Deterministic lifecycle profile $\bar{y}_j$ and persistent shocks η

$$\begin{aligned} \log y_{jt} &= \bar{y}_{s,j} + \eta_t \\ \eta_t &= \rho_s \eta_{t-1} + \varepsilon_t^y \qquad \varepsilon_t^y \sim \mathcal{N}(0, \sigma_s^y) \end{aligned}$$

- **Taxes on income**: progressive federal tax $T(y)$;   [Heathcote-Storesletten-Violante 17]
  and linear local τ^l and payroll τ^{ss} taxes   [detail]

- Taxes on **returns** τ^c, and **houses** τ^h

- **Tax benefit** of owning a house $TB(y, m, h)$ [Karlman-Kinnerud-Kragh-Sørensen 20]

- **Bequests** are both intended and accidental upon death
    - Distributed at birth

Assets

- Risk free **bonds** $a \geq 0$ at rate r

- **Housing** h rented at $\rho(h)$ or bought at $p(h)$
    - Supply $G(h) = \pi^{\mathcal{O}} G^{\mathcal{O}}(h) + (1 - \pi^{\mathcal{O}}) G^{\mathcal{R}}(h)$
    - where $\pi^{\mathcal{O}}$ is share in ownership market

- One period **mortgages** m at rate $r_s^m > r_s$ s.t. **borrowing constraint** $m \leq p(h)\psi$

- **Cost of owning:** depreciation δ, property tax τ^h and user-cost gap τ^{UC}

- **Return on housing**

$$R_t^h(h) = \frac{\rho_t(h) + TB(y, m, h) + p_{t+1}(h)}{\left(1 + \delta + \tau^h + \tau_s^{UC}\right) p_t(h)}$$

Value function

Stationary equilibrium

- **Solution to household:** state is age, income, wealth $\psi = [j, y, w] \in \Psi$
    - probability of buying $b^*(\psi) = Prob(o = \mathcal{O})$
    - policies conditional on ownership $o \in \{\mathcal{O}, \mathcal{R}\}$:
        - housing $h^*(o, \psi)$
        - consumption $c^*(o, \psi)$ and savings $w^*(o, \psi)$
    - Assigned rents $\rho^*(\psi) := \rho^*(h^*(\mathcal{R}, \psi))$ and prices $p^*(\psi) := p^*(h^*(\mathcal{O}, \psi))$
    - Stationary distribution of agents $F(\psi)$

Stationary equilibrium

- **Solution to household:** state is age, income, wealth $\psi = [j, y, w] \in \Psi$
  - probability of buying $b^*(\psi) = Prob(o = \mathcal{O})$
  - policies conditional on ownership $o \in \{\mathcal{O}, \mathcal{R}\}$:
    - housing $h^*(o, \psi)$
    - consumption $c^*(o, \psi)$ and savings $w^*(o, \psi)$
  - Assigned rents $\rho^*(\psi) := \rho^*(h^*(\mathcal{R}, \psi))$ and prices $p^*(\psi) := p^*(h^*(\mathcal{O}, \psi))$
  - Stationary distribution of agents $F(\psi)$

- A **stationary recursive equilibrium** is a set of policies $b^*(\psi)$, $h^*(o, \psi)$, $c^*(o, \psi)$, $w^*(o, \psi)$, a rent function $\rho(h)$, a price function $p(h)$, and a distribution of households $F(\psi)$ s.t. agents optimize, the distribution of agents is stationary and markets clear at every quality

$$\pi^{\mathcal{O}} G^{\mathcal{O}}(h) = \int_{\Psi} \{(h^*(\mathcal{O}, \psi) \leq h) \cdot b^*(\psi)\} dF(\psi) \qquad \forall h$$

$$(1 - \pi^{\mathcal{O}}) G^{\mathcal{R}}(h) = \int_{\Psi} \{(h^*(\mathcal{R}, \psi) \leq h) \cdot (1 - b^*(\psi))\} dF(\psi) \qquad \forall h$$

Estimation strategy

- **Data:** Census and SCF+. **Time periods: Past**: 1960. **Recent:** 2019.

- **Sample:** Nationwide, separately for Black and White households

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1 **Set homogeneous preference parameters:** $u(), \beta$

2 **Estimate separately for Black and White:**
   - income process y, mortality risk ϕ
   - interest rate on savings r to match median wealth

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3 **Simulated Method of Moments (SMM):** [details]

Parameters:

    To match observed:

- Quality-rent function $h(\rho)$
- Quality-price function $h(p)$
- user-cost gap, τ^{UC}

- rents $\rho^*(\psi)$ by age and income
- prices $p^*(\psi)$ by age and income
- ownership rate $\pi^{\mathcal{O}}$

Note: With $h(\rho)$, $h(p)$ and $\pi^{\mathcal{O}}$ we can find quality distributions $G^{\mathcal{O}}(h)$ and $G^{\mathcal{O}}(h)$

Homogeneous preference parameters

	Description	Value	Source/Target
Preferences			
β	Discount factor	0.95	
γ	Inverse EIS	2	
α	Cobb-Dougas consumption share	0.8	Piazzesi-Schneider-Tuzel 06
σ_o	Variance of tenure shock	0.02	

Pre-estimated parameters in 1960

	Parameter	Description	Value	Source
Incomes (White)	ρ_y	Persistence of shocks	0.97	Heathcote-Storesletten-Violante 10
	σ_y	Variance of shocks	0.75	Census 1960
	$\exp(\bar{y}_0)$	Intercept of age profile	1.0	Census 1960
		Replacement rate	0.5	Munnell-Soto 05
Incomes (Black)	ρ_y	Persistence of shocks	0.97	Heathcote-Storesletten-Violante 10
	σ_y	Variance of shocks	0.89	Census 1960
	$\exp(\bar{y}_0)$	Intercept of age profile	0.64	Census 1960
		Replacement rate	0.5	Munnell-Soto 05
Mortality	ϕ_j	Survival probability (White)		Life tables 1960
	ϕ_j	Survival probability (Black)		Life tables 1960
Saving	r	Risk free rate (White)	0.03	Median wealth
	r	Risk free rate (Black)	0.005	Median wealth
Mortgages	r^m	Mortgage rate (White)	0.05	Chambers-Garriga-Schlagenhauf 16
	r^m	Mortgage rate (Black)	0.05	Chambers-Garriga-Schlagenhauf 16
	ψ	Max LTV (White)	0.60	Ownership age profile
	ψ	Max LTV(Black)	0.60	Ownership age profile

SMM estimates in 1960

- Model fits well with constant price rent ratio $p(h) = \bar{p} \cdot \rho(h)$
- → **Baseline:** estimate $\rho(h)$ and price-rent ratio $\bar{p}$

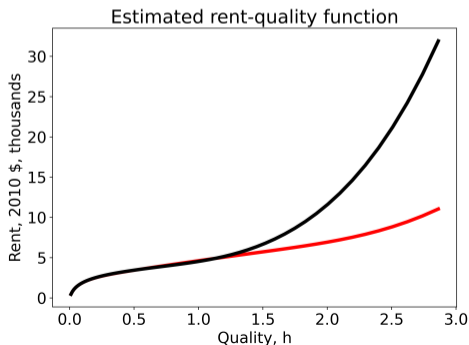|	Description	White	Black
$\bar{p}$	Price-rent ratio	11.6	11.5
τ^{UC}	User cost gap	–	0.03

SMM estimates in 1960

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Estimated rent-quality function

Model fit in 1960

**Rent share
by income group**

Income group	White		Black	
	Model	*Data*	*Model*	*Data*
Bottom 1/3	0.35	0.42	0.34	0.36
Middle 1/3	0.21	0.21	0.16	0.17
Top 1/3	0.14	0.13	0.12	0.12

Model fit in 1960

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House price (2010 $10,000s)

	White		Black	
Age group	*Model*	*Data*	*Model*	*Data*
<35	79	86	50	52
35- 64	89	118	57	63
≥ 65	80	95	48	42

Model fit in 1960

Rent share by income group

Income group	White Model	White Data	Black Model	Black Data
Bottom 1/3	0.35	0.42	0.34	0.36
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Age group	White Model	White Data	Black Model	Black Data
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Ownership rate by age

Income group	White Model	White Data	Black Model	Black Data
Overall	74%	67%	37%	42%
Age 25-34	53%	53%	13%	23%