Segmentation and Returns on Rental Housing

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The views expressed in this paper are solely those of the authors and do not necessarily reflect the opinions of the Federal Reserve Board, or the Federal Reserve System.

Motivation

- Widespread reports & evidence on declining affordability esp for low-income households
- Could be landlords battling increasing costs: "slumlords" vs. service-providers

The New York Times

The Typical American Renter Is Now Rent-Burdened, a Report Says

Moody's Analytics finds that renters in the U.S. now pay 30 percent of the median income for the average rent.

Inflation Has Hit Tenants Hard. What About Their Landlords?

Publicly traded corporate landlords are reporting some of their highest margins ever, while smaller operators say rent increases are eaten up by costs.

The Washington Post

Democracy Dies in Darkness

Soaring rent prices have advocates calling on White House to intervene

A coalition of tenant unions, community organizations and legal groups is calling on the Biden administration to launch a full government response to lower rent inflation.

By Rachel Siegel

Updated August 9, 2022 at 3:15 p.m. EDT | Published August 9, 2022 at 8:00 a.m. EDT

The New York Times

NEWSLETTER

Debatable

OPINION

Is Wall Street Really to Blame for the Affordable Housing Crisis?

THE WHITE HOUSE

MAY 16, 2022

President Biden Announces New Actions to Ease the Burden of Housing Costs

› BRIEFING ROOM › STATEMENTS AND RELEASES

- Need evidence on landlords' actual returns and costs!

Questions

- Are rents rising more for low-quality properties?
- Are landlords capturing these gains? Or just passing through increasing marginal costs?
- How do we explain changing returns and widening affordability gap?

This Paper

1. Establish **new facts on housing rents and returns** across quality segments
   - Assemble panels *by quality segment*: asking rents, net rental income, and valuations
   - Low-end asking rents **rise 12% more**; annual returns **grow 2-4pp more** for low-end

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   - Assemble panels *by quality segment*: asking rents, net rental income, and valuations
   - Low-end asking rents **rise 12% more**; annual returns **grow 2-4pp more** for low-end
2. Propose a **mechanism** consistent with these facts
   - Most new supply enters at top-end, **57% above 75th pctile,** and competes down returns
   - Model w segmented rental market, fixed costs of development

     → **more elastic high-end supply, low-end responds more to demand shocks**

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     → **more elastic high-end supply, low-end responds more to demand shocks**
3. Use local demand shocks to **establish empirical relevance** of this mechanism
   - Low-end returns respond **3-4x more** to local demand shocks
   - **40% of this difference** is explained by local supply growth

Contributions and Related Literature

- Construct new data & evidence on rents and real estate returns by segment
  - Prior work, often showing higher rents or returns at high-end in other contexts Molloy (2023); Eisfeldt & Demers (2015); Peng (2019); Peng & Thibodeau (2013, 2017); Hartman-Glaser & Mann (2016); Peng & Zhang (2019); Halket et al. (2023)
- Explaining variation in and dynamics of landlord returns, connections to new supply
  - Damen, Korevaar & Van Nieuwerburgh (2025); Buechler, Ehrlich, et al. (2021)
  - Mark-ups & market power Watson & Ziv (2024); Anagol et al. (2025); Quality & rent inflation Reher (2021)
- New evidence on segmented rental housing markets
  - Assignment models Nathanson (2023); Wang (2023); Landvoigt, Piazzesi & Schneider (2015); Anenberg & Kung (2020); IO model Ma (2025)

Data and Measurement

Goal to Measure Actual Returns: Internal Rates of Return (IRR) Link

The discount rate that equates the present value of hold-period cash flows with upfront costs:

$$Price_{i0} = \sum_{\tau=0}^{H} \left[\frac{NOI_{i\tau}}{(1 + IRR)^{\tau}} \right] + \frac{Price_{iH}}{(1 + IRR)^{H}}$$

- Hold periods demarcated by ‘capital events’ (purchase/sale, refinancing)
- $Price_{i,0}$ and $Price_{i,H}$: value at origination and sale/refinance
- NOI_{τ}: panel of net operating income (revenue less expenses)

Goal to Measure Actual Returns: Data

$$Price_{i0} = \sum_{\tau=0}^{H} \left[\frac{NOI_{i\tau}}{(1+IRR)^{\tau}} \right] + \frac{Price_{iH}}{(1+IRR)^{H}}$$

- Trepp CMBS servicing data: H, P_0, NOI_τ
  - Annual financials: total revenue, operating expenses, net operating income
  - 64k multi-family properties
  - Drop obs w $>$ 20% observations missing; interpolate when nec w segment-specific growth
- Yardi apartment data: P_H
  - Transaction values primarily over 2000-2022
  - Broad coverage: 100k+ market-rate and affordable properties nationwide
  - Prices from Yardi, Trepp, or hedonic CBSA-by-segment price index (Yardi)

Data: Summary Statistics by Segment

Defining quality segments

- Tercile of property i's per-unit revenue
- Overall CBSA-year distribution
- Fixed at start of the hold period
- Estimation sample covers 3.3% U.S. multifamily (raw Trepp covers 20%) ▸ Link

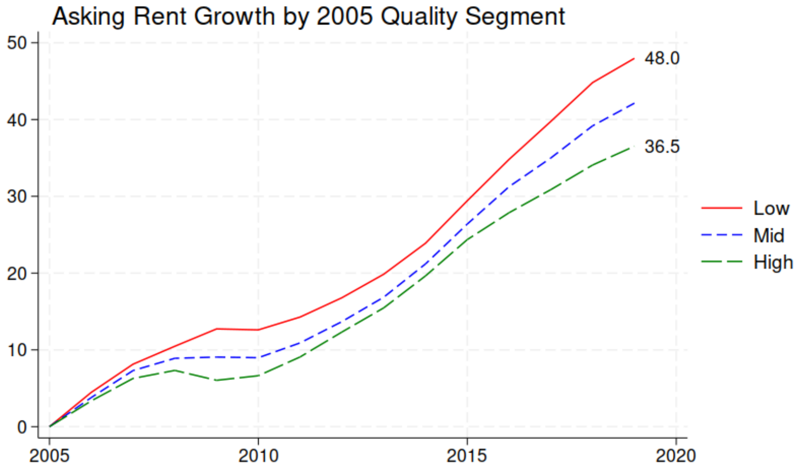
	Low	Mid	Top
Revenue Per Unit	758.14	976.46	1303.07
	(238.59)	(337.93)	(672.78)
Expenses Per Unit	383.43	447.43	563.68
	(104.30)	(131.80)	(319.72)
Value at Origination (m)	9.37	16.69	30.69
	(12.1)	(17.9)	(37.8)
Value at Sale (m)	12.19	22.14	38.44
	(15.7)	(26.0)	(45.9)
Length of Hold Period	6.35	6.61	6.19
	(3.60)	(3.54)	(3.43)
IRR	0.16	0.14	0.12
	(0.14)	(0.13)	(0.09)
Observations	3848	3535	3351

Other Data

- REIS (Moody's CRE) market-rate apartment property data
  - Annual panel of Q4 asking rents from 2005-2019 (37k properties, 50 metros)
- Employment (QCEW) and housing (ACS)

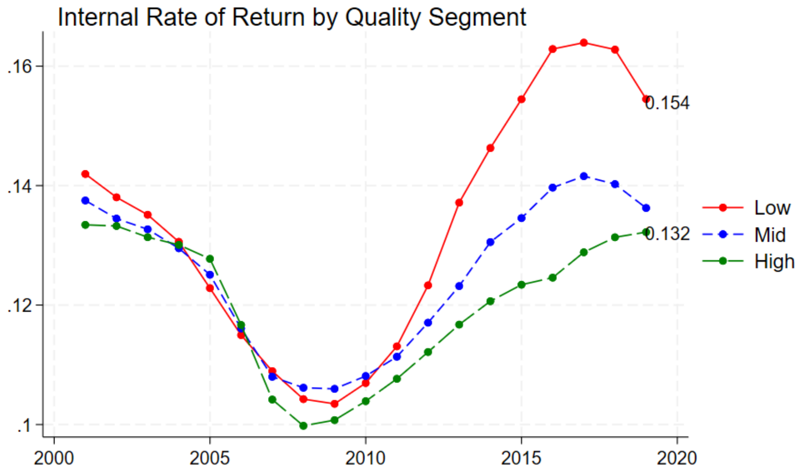
Facts

1. Rents are lower (by defn), but grew more at the low-end of the market



Low-end asking rents grew 11.5% more in long-run balanced panel (REIS)

2. Returns are *higher*, but grew more at the low-end of the market



Low-end returns grew 2-4pp more in panel of financials (Trepp) & transactions (Yardi)

New Facts

1. Rents are lower, but *grew more at the low-end* of the market between 2005 and 2019
2. Returns (IRR) are *higher*, but *grew more at the low-end* of the market
    - Both NOI growth and cap rate compression contribute to low-end return growth ▸ Link

New Facts

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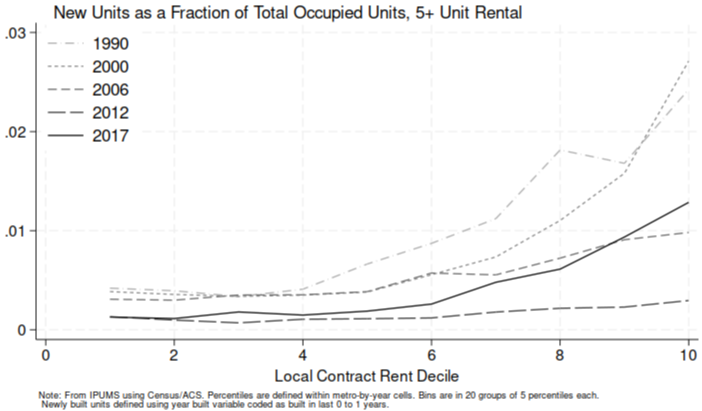
Return to question:

- How do we explain changing returns between low and high-end rental segments?
  - fundamentals → outsized low-end rent growth → our focus
  - Δ expectations for rent growth → our focus
  - decline in cost of capital: relative drop in risk premia with efficient capital markets

→ related work (e.g., Bezy, Levy and McQuade 2025, Abramson and Van Nieuwerburgh 2024)

Mechanism

New supply typically enters at the high-end of the market



Post-GFC, 57% of new rental housing enters top quartile of local rent distribution

Market Rate in REIS

Model linking these facts: set-up and key result

- Population M resides in buildings of **quality** $k \in \{H, L\}$ or an outside good
- Construction **requires a unit of land and** K^k **capital per unit of housing,** $K^H > K^L$
  - Developers enter a sector, draw random productivity and choose whether to build
  - There is free entry into both sectors and profits dissipate into land prices
  - A **zoning cap** restricts quantity to $\bar{h}$
- More high-quality developers can build profitably when expected the high-end price premium (net of effective unit land cost) exceeds the relative capital requirement:

$$\frac{\mathbb{E}\left[P^H_{t+1}\right] - P^l_t/\bar{h}}{\mathbb{E}\left[P^L_{t+1}\right] - P^l_t/\bar{h}} > \frac{K^H}{K^L}.$$

$\rightarrow$ High-end supply is more elastic to positive demand shocks

$\rightarrow$ Rent and price growth on high-end mitigated during expansions ▸ More

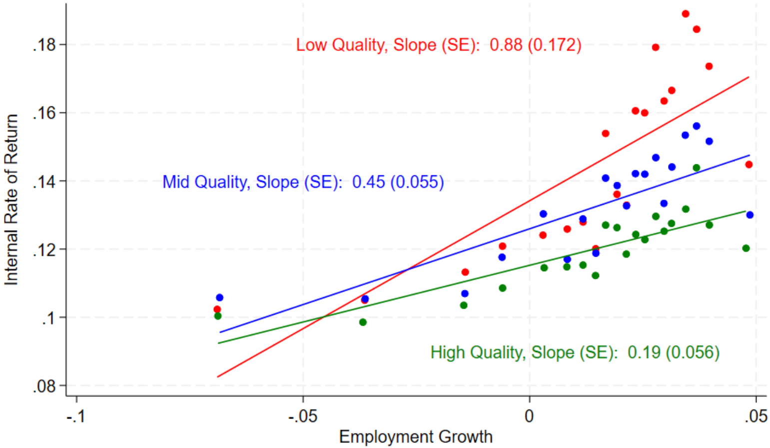
Testing implications: Low- vs high-end response to demand growth

Show segment-specific effects of CBSA-level employment growth on property-level cash flows:

$$\Delta y_{it} = \gamma_{c(i)} + \gamma_t + \beta^{q(i)} \times \Delta emp_{c(i)t} + e_{it}$$

- i is a property-level holding period
- Δy_{it} is average returns over the hold IRR_{it}
- $\Delta emp_{c(i)t}$ is annual employment growth in CBSA $c(i)$ (or a Bartik shift-share)
- Coefficient of interest, $\beta^{q(i)}$ is tercile-specific response to demand

Do demand shocks affect low- vs high-end returns differently?



Low-end returns respond 4x more to employment growth

▸ Table NOI (RF/IV) ▸ Table IRR (RF/IV) ▸ Figures w Bartik

Exploring implications: Does supply explain why low-end responds more?

$$\Delta y_{it} = \gamma_c + \gamma_t + \beta^q \times \Delta emp_{ct} + e_{it}$$

- Suppose construction responds to demand growth, especially at the high-end:
  - $Corr(\Delta new_{ct}, \Delta emp_{ct} | c, t) > 0$ for new_{ct} the new construction share of the housing stock
  - $Corr(\Delta topnew_{ct}, \Delta emp_{ct} | c, t) > 0$ for $topnew_{ct}$ the top quartile share of new construction
- We add (endogenous) controls to address omitted variable bias on β^q:

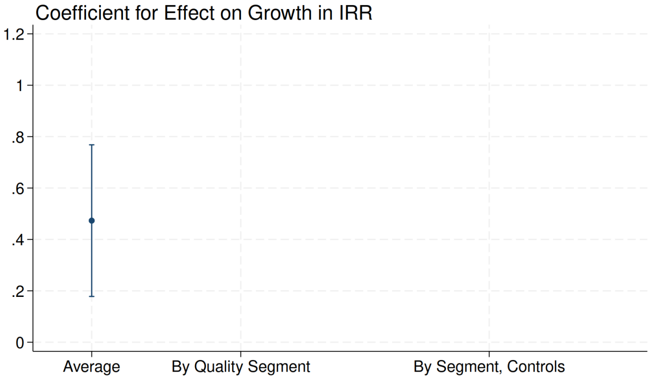
$$\Delta y_{it} = \gamma_c + \gamma_t + \kappa^q \times \Delta emp_{ct} + \eta^q \times \Delta new_{ct} + \zeta^q \times \Delta topnew_{ct} + e_{it}$$

How much of the gap in response to employment is due to differential supply elasticities?

Compare $\beta^{low} - \beta^{high}$ vs $\kappa^{low} - \kappa^{high}$

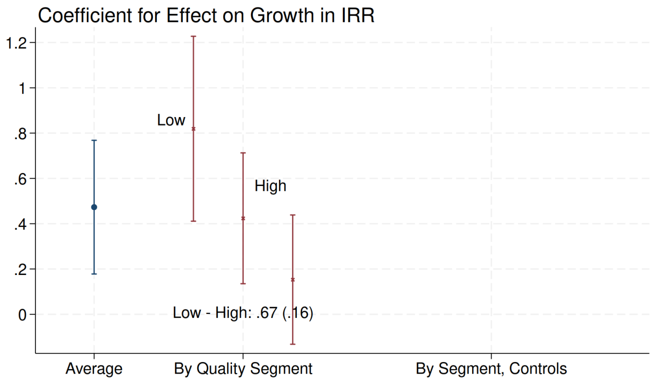
Average employment growth effect

$$\Delta y_{it} = \gamma_c + \gamma_t + \beta \times \Delta emp_{ct} + e_{it}$$



Heterogeneous employment growth effect

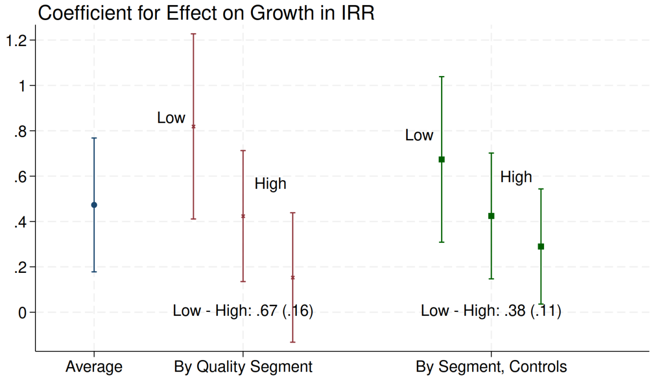
$$\Delta y_{it} = \gamma_c + \gamma_t + \beta^q \times \Delta emp_{ct} + e_{it}$$



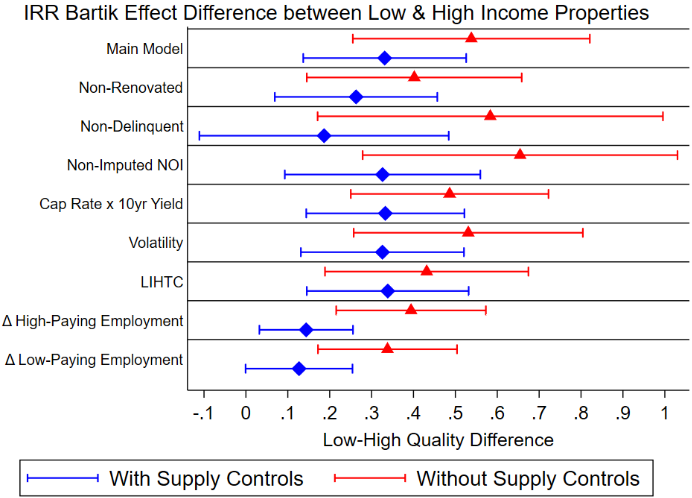
Heterogeneous effect, controlling for supply channels

$$\Delta y_{it} = \gamma_c + \gamma_t + \kappa^q \times \Delta emp_{ct} + \eta^q \times \Delta new_{ct} + \zeta^q \times \Delta topnew_{ct} + e_{it}$$

where Δnew_{ct} is newly built share of the rental stock & $\Delta topnew_{ct}$ is share new rentals in top quartile



Robustness: $\beta^{low} - \beta^{high}$ vs $\kappa^{low} - \kappa^{high}$ w Bartik; controls; samples

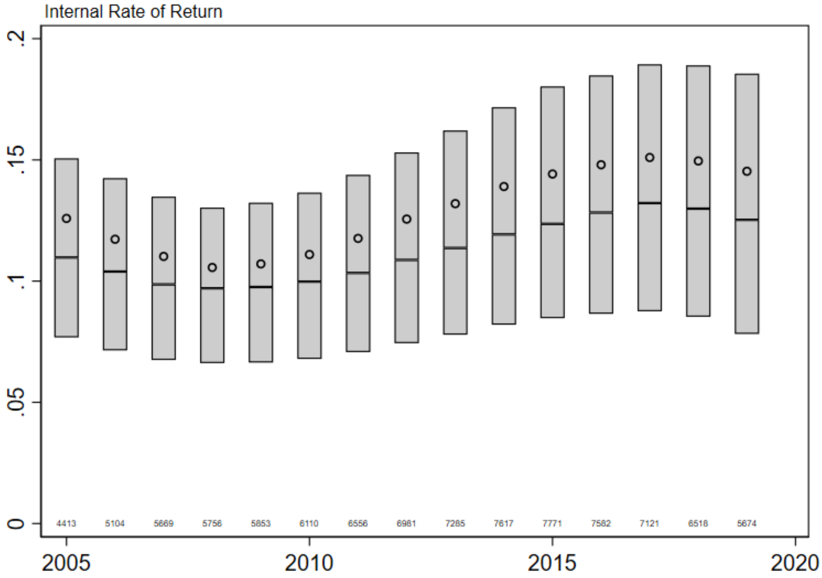


Conclusion

- Granular data showing growth in multifamily returns from the GFC to COVID
- New evidence that returns vary by quality: lower-quality real estate yields *higher* returns
- Measure incidence of labor demand shocks:
  - Labor demand shocks increase returns more on lower quality properties, moreso where supply is less elastic and/or skews high-end
  - Suggests large role for limited new entry in landlord returns

Thank you! Comments & thoughts, email us at `samuel.k.hughes@frb.gov`

Appendix

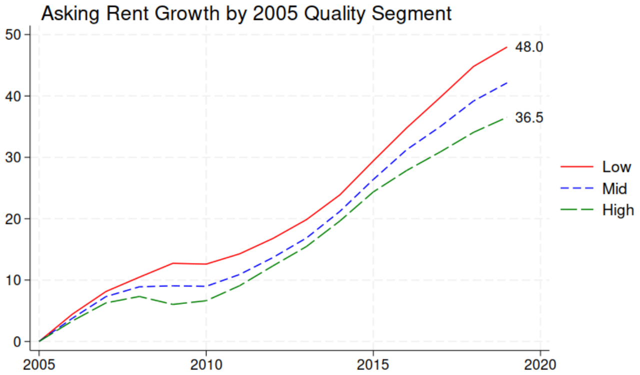


Cross-section

Rents have grown faster in lower-end buildings

- Take all existing buildings in 2005, separate in quartiles
- Calculate average within-property asking rent growth by quartile
- Rents in lower-end buildings have grown faster over these 15 years (matches Census data

▸ Back

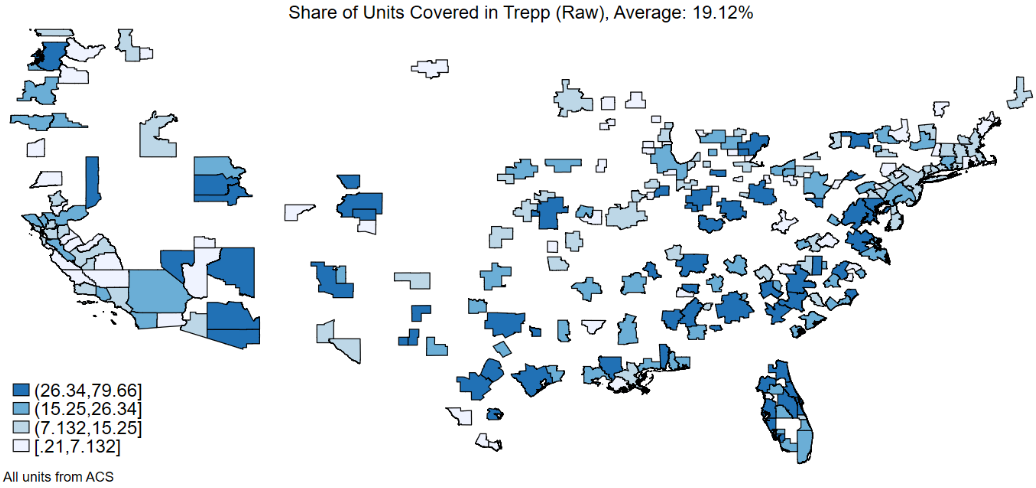


Summary Statistics

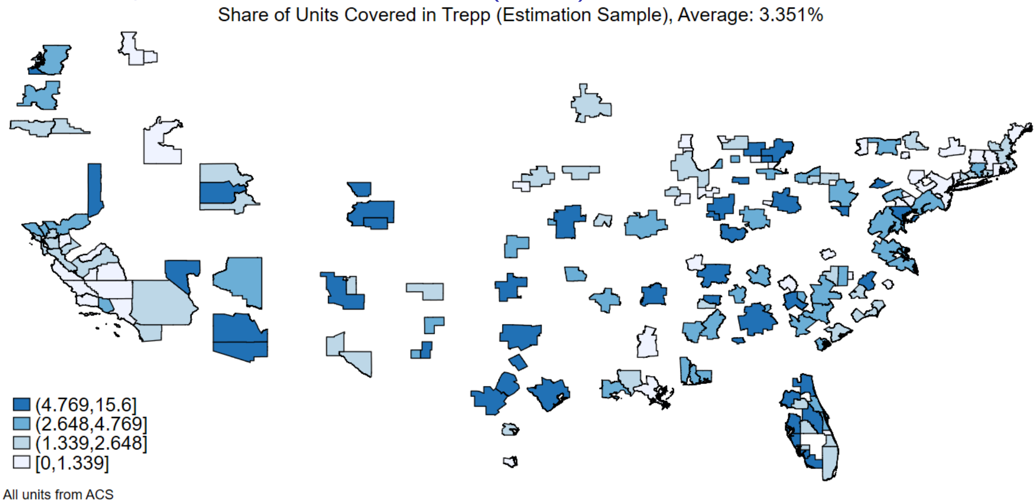
	All	Low	Mid	Top
Δ NOI Per Unit	0.036	0.048	0.035	0.024
	(0.093)	(0.115)	(0.081)	(0.075)
IRR	0.14	0.16	0.14	0.12
	(0.12)	(0.14)	(0.13)	(0.09)
CBSA Employment (thousands)	1403.13	1399.45	1406.08	1405.33
	(1471.83)	(1501.02)	(1529.08)	(1371.34)
Δ CBSA Employment	0.013	0.014	0.013	0.014
	(0.015)	(0.015)	(0.015)	(0.015)
Share of New Units (%), CBSA	0.90	0.89	0.86	0.94
	(0.55)	(0.56)	(0.531)	(0.57)
Share of New Units >75pctile (%), CBSA	56.8	57.3	56.6	56.4
	(12.7)	(13.3)	(12.1)	(12.4)
Observations	10756	3848	3535	3351

▸ Back

Data coverage: Trepp (2019)



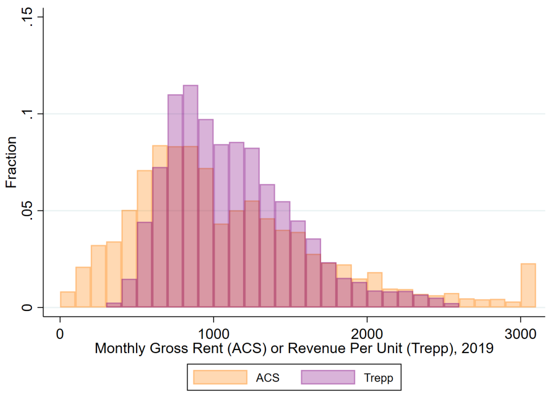
Data coverage: Estimation sample (2019)



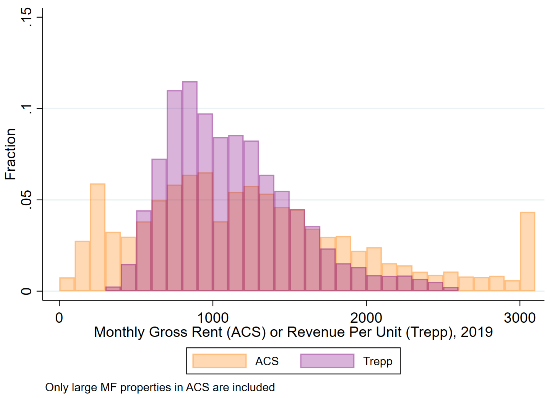
▸ Summary Stats

Trepp vs ACS rent distribution coverage in 2019

All Properties



Properties with 5 or More Units



▸ Summary Stats

IRR Computation Using TREPP and Yardi

Back

1. Construct Yardi price index by regressing sale prices on year and property fixed effects. Sample is restricted to property with repeated sales.

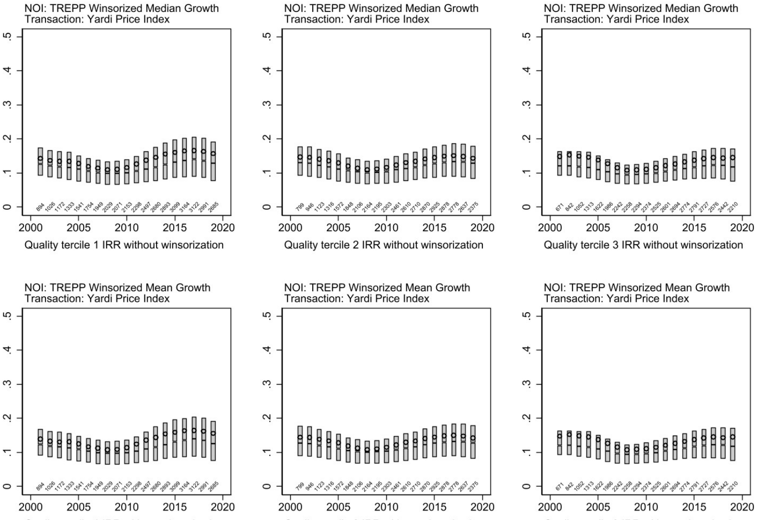
2. Impute transaction values for the last year observed in the dataset, then identify hold periods.

3. Interpolate NOI using TREPP. Keep the interpolation if
   - NOI is not missing for more than 20% of the time during each hold period if the hold period is greater than 5 years.
   - OR NOI is not missing for more than 50% of the time during each hold period if the hold period is less than 5 years.

4. For the missing NOI, use mean NOI growth rates (winsorized at 5th and 95th percentiles) by quality tercile for imputation.

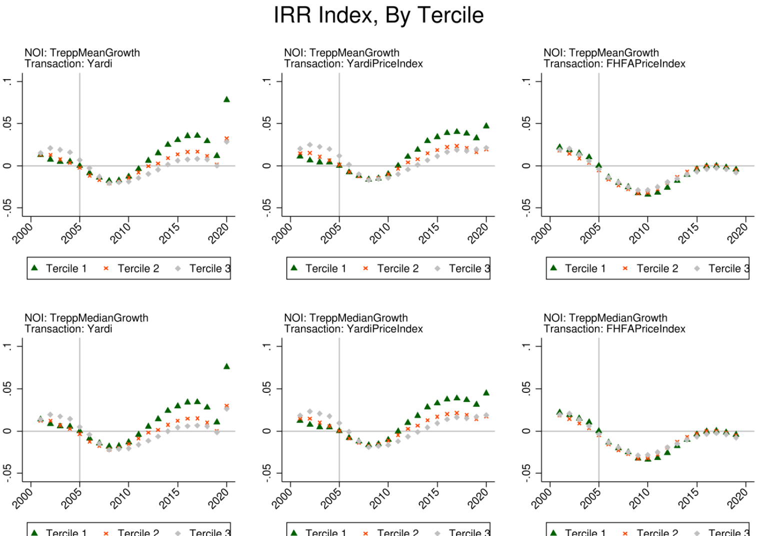
IRR Using Different NOI Imputation Methods, TREPP

Winsorized at the 90th percentile. Imputed with Yardi price index. ▸ Back



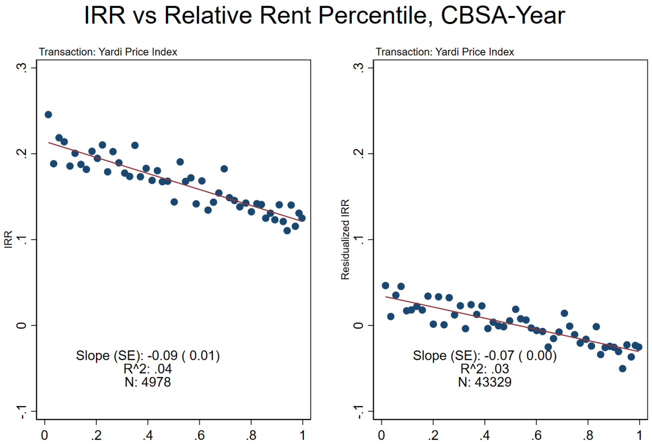
IRR Index Using Different NOI Imputation Methods, TREPP

Transaction prices imputed with Yardi price index. ‣ Back



Relationship between unlevered IRR & property quality

- IRR is computed using NOI (imputed with TREPP growth rate by NOI tercile) and transaction prices (imputed with Yardi price index) over each of 4,978 hold periods.
- Relative rent percentile is assigned in the first year per holding period.
- Residualized IRR residualizes by mean IRR in each year.



Missing NOI imputed with trepp winsorized mean growth rate.
Quality percentile assigned in the first year per holding period.
IRR: holding period level. Residualized IRR: holding period-year level.

▸ IRR Computation ▸ IRR ▸ IRR Index ▸ IRR over time

Quasi-IRR Computation Using TREPP and Yardi

Back

The quasi-IRR is constructed to understand the contributions of the appreciation and income components to the IRR.

1. The constant NOI quasi-IRR keeps NOI constant to abstract away the income component and looks at the appreciation component of IRR. The constant NOI is the NOI in the first year of each hold period.

2. The constant cap rate quasi-IRR keeps cap rate constant to abstract away the appreciation component and looks at the income component of IRR. The constant cap rate is the entry cap rate of each hold period. The sale price is thus the NOI in the last period divided by the constant cap rate.

What drives the outsized IRR growth at the low-end of the market?

- Commercial real estate prices are often expressed as forward NOI divided by a "cap rate":

$$Price_\tau = NOI_{\tau+1} / cap_\tau$$

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- Commercial real estate prices are often expressed as forward NOI divided by a "cap rate":

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- IRR is the yield that solves:

$$NOI_1 / cap_0 = PV(NOI_1, ..., NOI_H) + PV(NOI_{H+1} / cap_H)$$

What drives the outsized IRR growth at the low-end of the market?

- Commercial real estate prices are often expressed as forward NOI divided by a "cap rate":

$$Price_{\tau} = NOI_{\tau+1} / cap_{\tau}$$

- IRR is the yield that solves:

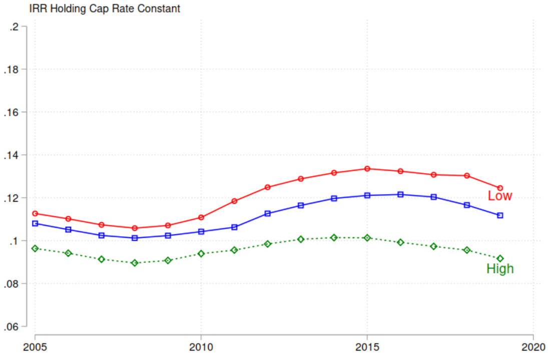
$$0 = \underbrace{PV(NOI_1, ..., NOI_H)}_{\text{operating income}} + \underbrace{PV(NOI_{H+1} / cap_H) - NOI_1 / cap_0}_{\text{appreciation}}$$

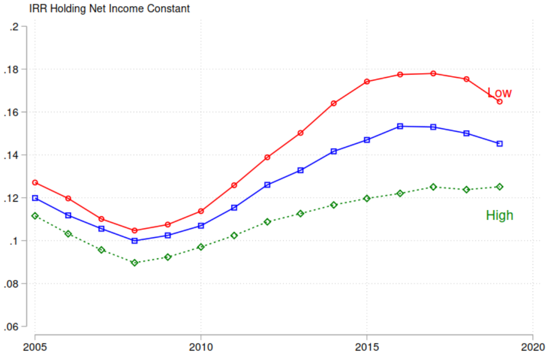
Outsized IRR growth is mechanically explained by either:

- differential NOI growth (NOI $=$ rents - expenses)
- differential cap rate compression ($cap_H < cap_0$)

Facts

3. IRR growth reflects both cash flow growth and cap rate compression.





IRR(Constant Cap) equates NOI_1 / cap_0 with

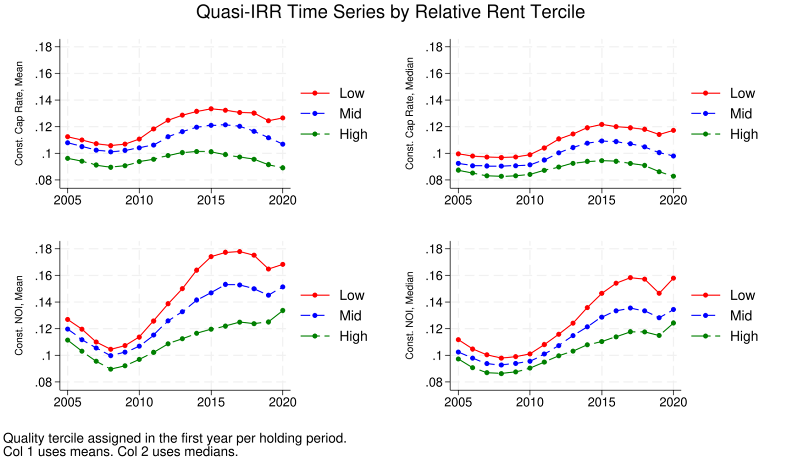
$$PV(NOI_1, ..., NOI_H) + PV(NOI_{H+1} / cap_0)$$

IRR(Constant NOI) equates NOI_1 / cap_0 with

$$PV(NOI_1, ..., NOI_1) + PV(NOI_1 / cap_H)$$

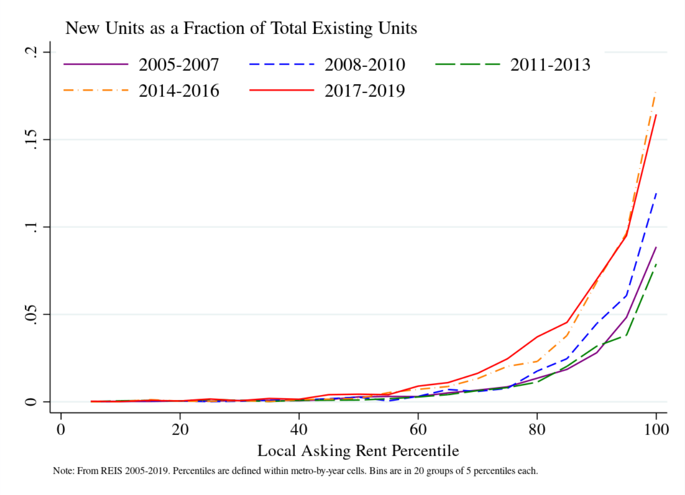
▸ Facts

Low tier's cap rates: expanded by a lot more during the Great Recession then rebounded more dramatically



Where new buildings enter the existing rent distribution (REIS)

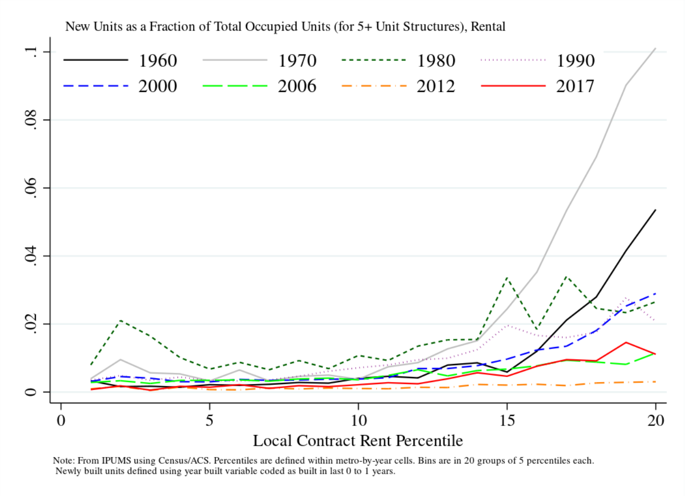
- Look at new buildings as a share of total units in current rent decile in REIS



▸ Census

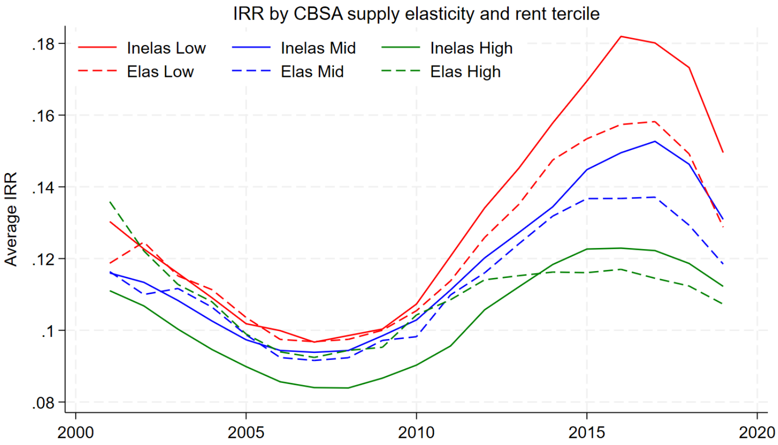
Where new buildings enter the existing rent distribution (Census)

- Look at new buildings as a share of total units in current rent decile in Census

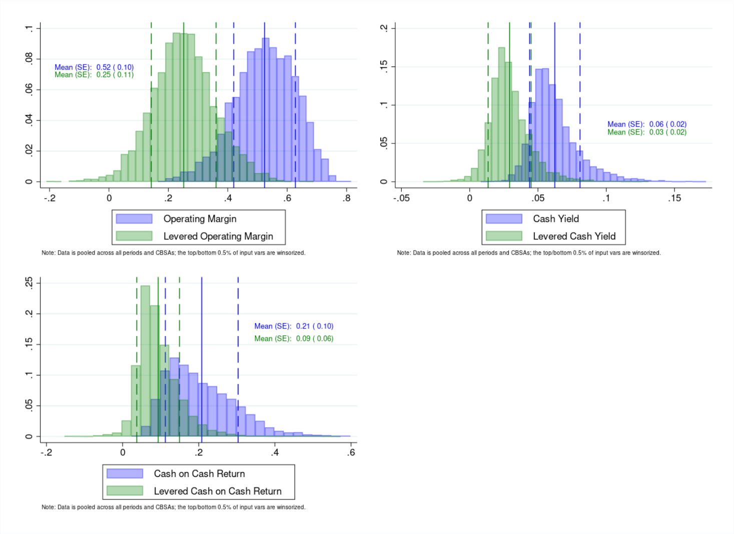


Back

IRRs grew in low quality housing & in supply inelastic cities!



Operating margins and cash yields/returns, with and without debt service



Model linking these facts: dynamics

- Aggregate demand shifts exogenously with local population M.
- Supply shifts exogenously through depreciation δ (filtering) and endogenously (with a lag) through new construction C^k:

$$S_t^H = (1-\delta)S_{t-1}^H + C_{t-1}^H \quad \text{and} \quad S_t^L = (1-\delta)S_{t-1}^L + \delta S_{t-1}^H + C_{t-1}^L$$

- During an **expansion**, demand growth in the face of fixed supply yields price growth and (relatively) more new construction at the high-end so - after a construction lag - $\Delta S^H > \Delta S^L$ mitigating growth in P^H during an expansion.
- Conversely, during a **contraction** that shuts down construction, the low-end continues to see supply growth via filtering so - after a construction lag - $\Delta S^L > \Delta S^H$ exacerbating decline in P_L during a downturn.

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Instrumenting for Employment Growth with Bartik Shift-Share

	NOI Growth (1)	NOI Growth (2)	Emp Growth (3)	NOI Growth (4)
Employment Growth	0.821***			1.066***
	(0.107)			(0.201)
Bartik (3-Digit, Log)		1.272***	1.193***	
		(0.346)	(0.245)	
Spec	OLS	RF	FS	IV
N	74727	74727	74727	74727
F Stats	59.27	13.53	23.68	
CBSA	176	176	176	176
Adjusted R-sq	0.06	0.05	0.86	0.01

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include CBSA and year fixed effects.

Back

Instrumenting for Employment Growth with Bartik Shift-Share

	IRR (1)	IRR (2)	Emp Growth (3)	IRR (4)
Employment Growth	0.473***			0.453***
	(0.151)			(0.151)
Bartik (3-Digit, Log)		0.523***	1.193***	
		(0.169)	(0.245)	
Spec	OLS	RF	FS	IV
N	65903	65903	74727	65903
F Stats	9.88	9.61	23.68	
CBSA	169	169	176	169
Adjusted R-sq	0.05	0.05	0.86	0.00

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, all specifications include CBSA and year fixed effects.

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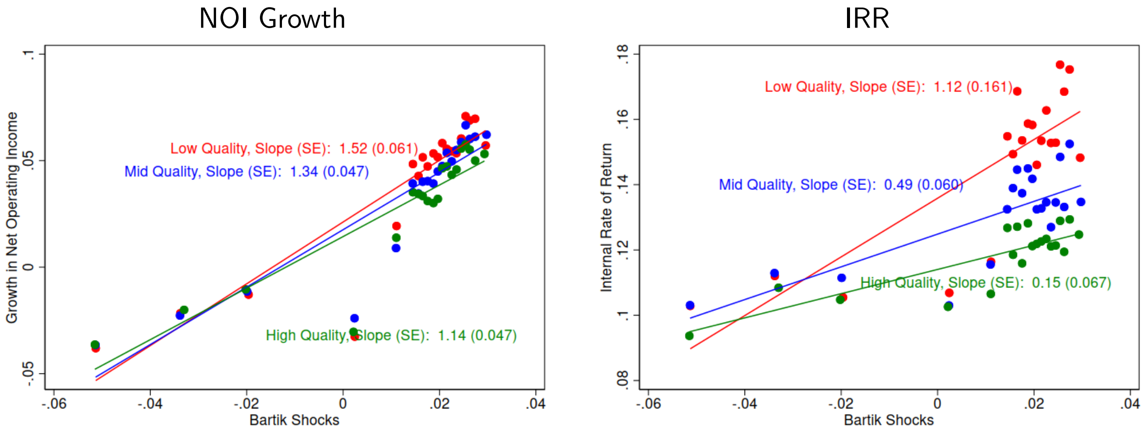
Do demand shocks affect low- vs high-end rents & returns differently?



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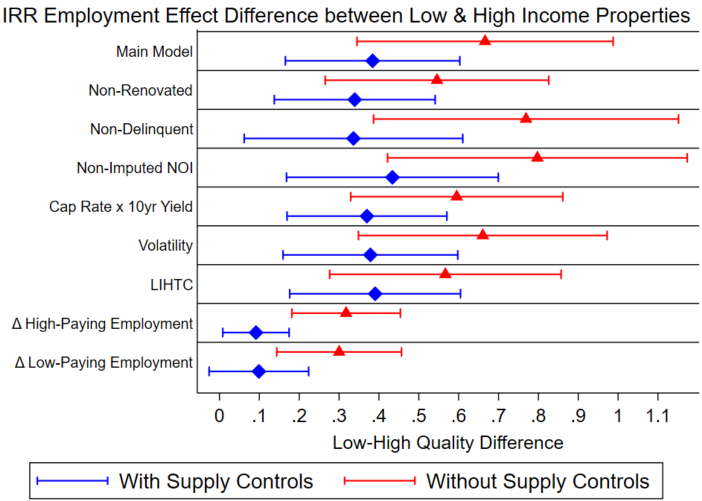
Robustness: $\beta^{low} - \beta^{high}$ vs $\kappa^{low} - \kappa^{high}$ with different controls/samples



Bartik Robustness