Equilibrium Evictions

Dean Corbae, Andy Glover, and Michael Nattinger [1]

UW Madison and NBER, FRB KC, UW Madison

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[1] Disclaimer: The views expressed in this paper are those of the authors and they do not necessarily reflect the views of the Federal Reserve Bank of Kansas City or the Federal Reserve System.

Micro Data: Financial Lives of Low Income Renters

- 35% of U.S. households rent rather than own their homes (CPS 2018-2019)
- Liquidity: Renters have few liquid assets - about $1000 for median renter and $250 for those with below median (low) income (SCF 2019)
  - Among low income, more than 70% are hand-to-mouth (defined as liquid wealth less than half of bi-weekly income in Kaplan, Violante, and Weidner (2014)) Hand-to-mouth
- Income Dynamics: Some low income renters have frequent and persistent unemployment spells while others are almost always employed (CPS 2018-19) Income
- Rental Burden: Rent is nearly 50% of income for lowest quartile of renters, 30% for second quartile (SCF) Rental Burden
- In a typical year, between $2-3\%$ of renters are evicted (Eviction Lab)

Data Sources

Micro Data: Low Income Rental Market Conditions

- Rent-to-quality: In RHFS, higher quality units are worth three times as much as lower-quality, but rent is only 40% higher ▸ Rental Quality
  - Unit-level parallel to Desmond and Wilmers (2019) finding that rent is similar between poor and nonpoor neighborhoods, while property values are substantially higher in nonpoor neighborhoods.
- Landlords face various operating costs associated with units being occupied. 2018 RHFS: average monthly cost of $250 and standard deviation of $260.
- Housing Supply Elasticity: Use census-tract elasticity estimates from Baum-Snow and Han (2024) Merge with American Community Survey to calculate average elasticity of housing supply was roughly 0.14 for census tracts with many renters and low median incomes. ▸ Elasticity
- Infer neighborhood externalities based on Autor, Palmer, and Pathak (2014): policy inducing 10% increase in value of treated units raises untreated values by 5%. ▸ Externality
  - Broader qualitative ideas of externalities in sociology, Desmond and An (2015) for example

Questions

- Positive: Are there inefficiencies in the low income rental market? What are their sources? How big are they?
- Normative: What policies should be implemented to help correct inefficiencies?

What We Do

- Develop an equilibrium directed search model of rental housing supply and quality with two-sided lack of commitment and neighborhood externalities. ▸ Literature
- Characterize first best planner's allocation: Positive surplus matches are not destroyed (*no inefficient evictions*)
- Competitive search equilibrium with full history dependent rent contracts generically unable to implement first-best due to two-sided lack of commmitment (*inefficient evictions*).
- Calibrate model with constant rent contracts and conduct commonly discussed Eviction and Rental Subsidy Policy Counterfactuals.
- Consider policy in response to an aggregate shock like Covid.

Population and Preferences

- Unit measure of renters who can be of two types $i \in \{H, L\}$ with μ_i of each type.
- Can be employed $e = 1$ or unemployed $e = 0$ generating income $y_{i,e}$
  - If $e = 1$, create y_i units of good with $y_H > y_L > \alpha$. If $e = 0$, $y_i = \alpha$
- Differ in job finding and separation rates:
  - Unemployed find jobs at rate $p_{i,e=0,e'=1}$ and employed separate at rate $p_{i,e=1,e'=0}$
  - $H-$types find jobs faster, separate slower, and have higher lifetime income than $L-$types as estimated in our data.
- Preferences: hhs have linear utility over non-housing consumption above subsistence and housing given by $C - \alpha + \mathcal{U}_j$, $j \in \{h, u\}$ with discount factor β
  - $C \geq \alpha$ is non-housing consumption and α is subsistence consumption
  - $\mathcal{U}_h = q\mathcal{E}(Q)$ where q is own rental quality, Q is total neighborhood quality, $\mathcal{U}_u = 0$
  - Positive externality $\mathcal{E}'(Q) > 0$ captures that people like to be surrounded by high-quality housing in their neighborhood

Matching and Housing Technologies

- Unhoused $j = u$ in t can become housed $j = h$ in $t + 1$ depending on the number of vacant units created V and the number of unhoused hhs U
  - Constant returns to scale matching technology $M(U, V)$
  - Tightness: $\theta = \frac{U}{V}$ so "tight" rental market has many unhoused searching for few units
  - Finding rate: $\phi(\theta) = \frac{M(U,V)}{U}$ with $\phi'(\theta) < 0$: hard to find a rental in tight market
  - Filling rate: $\psi(\theta) = \frac{M(U,V)}{V}$ with $\psi'(\theta) > 0$: easy to fill a rental in tight market
- Flow operational cost of person occupying a rental unit is f (measured in utils drawn from logistic distribution with mean $\overline{f}$ and variance σ_f^2).
- Creating a vacancy costs κ and the unit's quality requires one-time convex investment cost $c(q)$ after the match occurs, both measured in utils
- Housed become unhoused with exogenous probability σ and unit requires new posting and investment. Timing

Constant Rent Contracts

- Motivated by the data: renters have limited ability to repay missed rent or post large upfront collateral
- We approximate this with hand-to-mouth renters with subsistence consumption: $C \geq \alpha \longleftrightarrow r_i \leq y_i - \alpha$ (constrains ability to pay rent especially for type L)
- Landlords post contracts $(r_{i,e}, q_{i,e})$ to which unhoused people direct their search to a submarket with tightness $\theta_{i,e}$
- With probability λ (a policy parameter), landlords can choose whether or not to evict $\epsilon_{i,e} \in \{0, 1\}$ after observing a tenants' employment status and operating cost draw f.

Matched Values

Landlord value matched with an (i, e) renter in contract (r, q) :

$$L_{i,e}(r, q, f) \quad = \quad \max_{\epsilon \in \{0,1\}} \hat{\lambda}(\epsilon)\Bigg[e \cdot r - f + \beta(1-\sigma) \sum_{e' \in \{0,1\}} p_{i,e,e'} \mathbb{E}[L_{i,e'}(r, q, f')]\Bigg],$$

where $\hat{\lambda}(\epsilon) = \lambda(1-\epsilon) + 1 - \lambda$

- Endogenous eviction occurs $(\epsilon_{i,e}(r, q, f) = 1)$ if expected discounted profits are negative since posting a new vacancy has zero net profit for landlord, i.e.:

$$f > e \cdot r + \beta(1-\sigma) \sum_{e' \in \{0,1\}} p_{i,e,e'} \mathbb{E}[L_{i,e'}(r, q, f')]$$

- Eviction more likely for unemployed $(e = 0)$ L-types since $p_{L,0,e'} < p_{H,0,e'}$

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Renter (i, e) in contract (r, q) matched value:

$$\begin{aligned} R_{i,e}(r, q, f) \quad &= \quad \left(1 - \hat{\lambda}(\epsilon_{i,e})\right) V^*_{i,e} + \hat{\lambda}(\epsilon_{i,e}) \Big[y_{i,e} - \alpha - e \cdot r + q\mathcal{E}(Q) \\ &+ \quad \beta(1-\sigma) \sum_{e' \in \{0,1\}} p_{i,e,e'} \mathbb{E}[R_{i,e'}(r, q, f')] + \beta\sigma \sum_{e' \in \{0,1\}} p_{i,e,e'} V^*_{i,e'} \Big], \end{aligned}$$

Search Equilibrium

- The equilibrium allocations maximize hh utility subject to landlord participation:

$$V^*_{i,e} = y_{i,e} - \alpha \tag{1}$$
$$+ \max_{r \leq y_i - \alpha, q, \theta} \beta \Big[\phi(\theta) \sum_{e' \in \{0,1\}} p_{i,e,e'} \mathbb{E}[R_{i,e'}(r, q, f')]$$
$$+ (1 - \phi(\theta)) \sum_{e' \in \{0,1\}} p_{i,e,e'} V^*_{i,e'} \Big]$$

s.t.

$$\kappa \geq \beta \psi(\theta) \Big[\sum_{e' \in \{0,1\}} p_{i,e,e'} \mathbb{E}[L_{i,e'}(r, q, f')] - c(q) \Big] \tag{2}$$

- Definition: A *steady state competitive search equilibrium* is
  - rents $r_{i,e}$ on units of quality $q_{i,e}$
  - vacancy posting for those contracts with tightness $\theta_{i,e}$ which satisfies free entry
  - eviction choices $\epsilon_{i,e}$
  - fractions of the population over employment and housing states $\mu^j_{i,e}$ solve fixed point of their law of motion. Law Of Motion

- Conditional Block Recursive: $(r_{i,e}, q_{i,e}, \theta_{i,e}, \epsilon_{i,e})$ depend only on $\mu^j_{i,e}$ through Q.

Quantitative Experiments: Parameterization

Monthly model. $M(U,V) = \frac{U \cdot V}{(U^\nu + V^\nu)^{\frac{1}{\nu}}}$, $\mathcal{E}(Q) = e^{\eta Q}$, and $c(q) = c_0(q - \bar{f})^2$.

Table: Calibration Outside of Model

Earnings Process	
$p_{L,1,1}$	0.48
$p_{L,0,1}$	0.11
$p_{H,1,1}$	0.98
$p_{H,0,1}$	0.23
y_H	4.26
y_L	2
μ_L	0.19
μ_H	0.81
Other	
β	$0.96^{1/12}$
σ	$1/36$
α	1
λ	0.5

Table: Parameters Calibrated in Model

Parameter	Value	Moment	Data	Model
η	0.088	spillover (Autor, et al.)	0.5	0.53
ν	1.519	vacancy rate (Census Bureau)	6.60	6.32
κ	0.341	eviction rate (Eviction Lab)	0.50	0.40
c_0	10.636	r_H/y_H (SCF)	0.33	0.37
$\bar{f}$	0.392	mean f (SCF)	0.55	0.39
σ_f	0.33	var f (SCF)	0.32	0.36
		r/q slope (RHFS)	0.45	0.32
		supply elasticity	0.14	0.13

- Job finding $p_{H,0,1} > p_{L,0,1}$, keeping $p_{H,1,1} > p_{L,1,1}$ and $y_H > y_L$ imply higher lifetime income for type H.
- Note: Calculate housing elasticity from model counterfactual which imposes rent cap for each type yielding new fraction of population who are housed. elasticity

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Properties of Decentralized Equilibrium

Targetted:

- Type H renters pay higher rent, enjoy higher quality, and have higher rental finding rates than type L CE Allocation
- Type L have higher rent-to-quality $(r_{i,e}/q_{i,e})$ and higher rental burdens $(r_{i,e}/y_i)$ than type H

Untargetted:

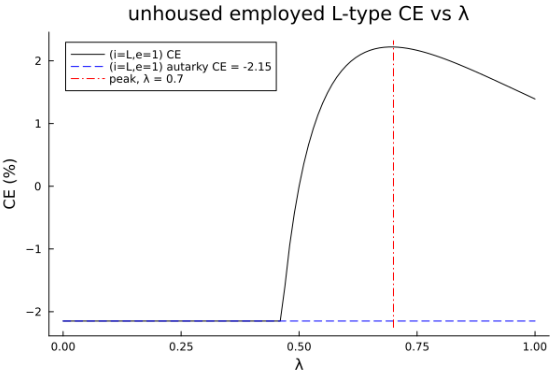
- Type H are almost never evicted while type L are frequently evicted when unemployed (and even occasionally when employed)
- Unemployed type L are shut out of the market due to low job finding rate $p_{L,0,1} = 0.11$ (about 9 month duration)
- Type L have a binding subsistence consumption constraint (i.e. $r_L = y_L - \alpha$) while type H do not
- Decentralized outcomes (q, θ) are very different from egalitarian planner's allocation (absence of "type insurance"). Comparison of CE and SPE
- 27.3% CE loss relative to planner's problem;
  - accounting exercise: 84% due to two-sided commitment problem, 16% due to externality.

Optimal Eviction Policy

- Introduce eviction restriction: landlord who wants to evict allowed to do so with probability $\lambda \in [0, 1]$
  - Calibrated policy is $\lambda = 0.5$ (legal restrictions delay eviction for 2 months on average)
  - Laissez-Faire would be $\lambda = 1$
  - Eviction moratorium $\lambda = 0$ (no evictions allowed)
- A policy maker who sets λ trades off two forces:
  - Social surplus from maintaining a match $\rightarrow$ benefit of low λ
  - Lower landlord profits (which induces lower quality and/or vacancies) if they can't evict an unemployed person $\rightarrow$ cost of low λ

Effect of loosening constraint on policy | Aggregate Shocks

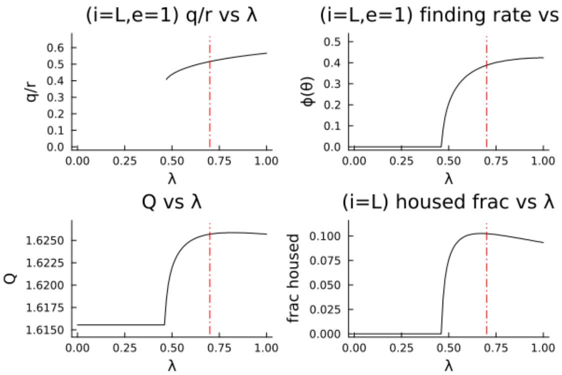
Optimal Eviction Policy: Unhoused Value



- Black line: $V^*_{L,1}$ evaluated at equilibrium $(q_{L,1}, \theta_{L,1})$ computed for given $\lambda \in [0,1]$. Peak at $\lambda = 0.7$ (red line).
- Blue line: unhoused value $y/(1 - p_{L,1}\beta)$ with zero finding rate for all type L ($\phi(\theta_{L,1}) = 0$)
- Some restrictions on eviction are optimal since eviction destroys matches with positive social surplus, but optimal restriction is less strict than calibrated (and Laissez-Faire better than calibrated)

Optimal Eviction Policy: Quality and Tightness

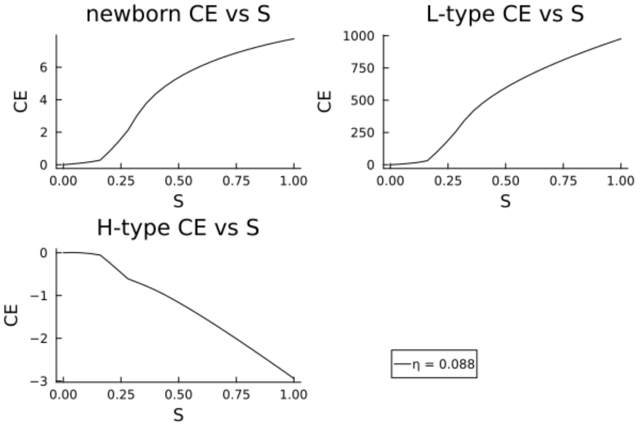
Figure: Unhoused Employed Low-type Renter Policies



- Quality-to-rent $q_{L,1}/r_{L,1}$ falls as evictions are restricted
- Rental finding rates $\phi(\theta_{L,1}))$ fall as evictions are restricted
  - Unintended consequence as in Hopenhayn and Rogerson (1993)
- Total quality is non-monotonic because share of $L-$type housed
  - Low λ: no $L-$type housed because finding rate is zero
  - High λ: highest $L-$type finding rate, but high eviction rate

Rental Support Dominates Eviction Restrictions

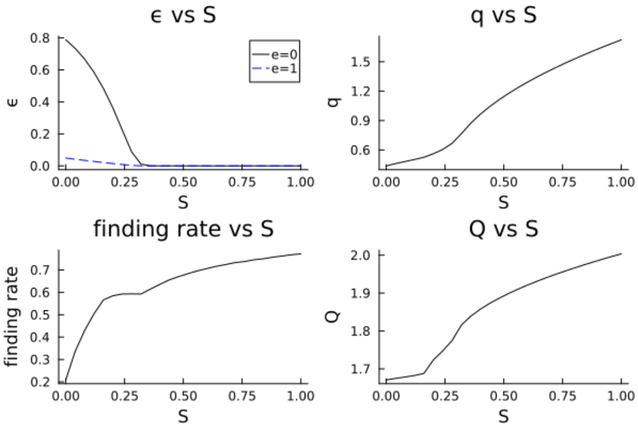
Consider a tax on employed $H-$types that finances a partial rental payment to landlords of unemployed $L-$types. Welfare effects as subsidy increases:



Rental support reduces inefficient evictions without hurting $L-$type supply. $H-$types lose from taxes, but L-types gain 100x more so newborn welfare rises.

Rental Support and Evictions

- Big lesson: even partial replacement rate ($S = 0.3$) can effectively eliminate evictions, delivering large welfare gains.
- Importance of endogenous eviction choice. Compare to Abramson and Van Nieuwerburgh (2024) who assume landlords evict unless they get entire rent payment.
- $S > 0.3$ further improves $L-$type supply by raising landlord profits



Conclusion

- Many people rent in the United States, especially amongst lower income households, and between $2-3\%$ of renting households are evicted in a typical year

- Our very simple equilibrium model allows us to
  - Calibrate model to stylized facts in rental markets about rent-to-quality ratios and tightness
    - Rent-to-quality is higher for low-quality units because of non-payment risk, expected profits equalized
  - Identify and quantify market failures
    - Two-sided lack of commitment leads to inefficient separations through evictions (23.2% welfare loss relative to first-best)
    - Externalities in housing quality exacerbate gap between first-best and market outcomes (additional 4.1% welfare loss in CE)

- Practical policy takeaways: tradeoff between protecting positive-surplus matches ex-post and incentivizing supply ex-ante
  - Eviction restrictions hurt supply.
  - Rent support can eliminate evictions and improve supply, even if replacement rate is significantly less than 100%

APPENDIX

Equilibrium Results

Table: Calibrated Equilibrium

Policies	Baseline
$(r_{H,1}, q_{H,1})$	(1.546,2.128)
$(r_{H,0}, q_{H,0})$	(1.713,2.14)
$(r_{L,1}, q_{L,1})$	(1.0,0.438)
$(r_{L,0}, q_{L,0})$	$\emptyset$
$(\epsilon_{H,1}(r_{H,1}, q_{H,1}), \epsilon_{H,0}(r_{H,1}, q_{H,1}))$	(7.46e-44,1.22e-36)
$(\epsilon_{H,1}(r_{H,0}, q_{H,0}), \epsilon_{H,0}(r_{H,0}, q_{H,0}))$	(2.59e-50,2.57e-42)
$(\epsilon_{L,1}(r_{L,1}, q_{L,1}), \epsilon_{L,0}(r_{L,1}, q_{L,1}))$	(0.049,0.788)
$(\epsilon_{L,1}(r_{L,0}, q_{L,0}), \epsilon_{L,0}(r_{L,0}, q_{L,0}))$	$\emptyset$
$(\theta_{H,1}, \phi(\theta_{H,1}))$	(0.571,0.791)
$(\theta_{H,0}, \phi(\theta_{H,0}))$	(0.69,0.743)
$(\theta_{L,1}, \phi(\theta_{L,1}))$	(4.499,0.209)
$(\theta_{L,0}, \phi(\theta_{L,0}))$	$\emptyset$

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Inefficiency of CE

Table: Allocations in Planner's and Competitive Equilibrium

Variable	Competitive Equilibrium	Planner
Q	1.668	2.654
$\left(q_{H,1}, \phi(\theta_{H,1})\right)$	(2.128,0.791)	(2.743,0.821)
$\left(q_{H,0}, \phi(\theta_{H,0})\right)$	(2.14,0.743)	(2.743,0.821)
$\left(q_{L,1}, \phi(\theta_{L,1})\right)$	(0.438,0.209)	(2.743,0.821)
$\left(q_{L,0}, \phi(\theta_{L,0})\right)$	$\emptyset$	(2.743,0.821)
L-type frac housed	0.076	0.967
H-type frac housed	0.966	0.967

Table: Aggregate Welfare Loss From Competitive Equilibrium Relative to Planner

Allocation	Aggregate Welfare Loss
Planner Q	-23.4
Baseline Q	-27.3

$$\text{Baseline } Q = \frac{W^{base}_{\mathcal{E}(Q)} - W^{sp}_{\mathcal{E}(Q^{sp})}}{W^{sp}_{\mathcal{E}(Q^{sp})}}, \quad \text{Planner } Q = \frac{W^{base}_{\mathcal{E}(Q^{sp})} - W^{sp}_{\mathcal{E}(Q^{sp})}}{W^{sp}_{\mathcal{E}(Q^{sp})}}.$$

▸ Planner's Problem ▸ Back to Properties ▸ Specifics

Equilibrium Results - Aggregate Welfare Comparison

Table: Aggregate Welfare Comparison

	Crisis Moratoria	Full Moratoria
CE_L	0.001	-1.32
CE_H	-0.08	-0.09

- Note: H-types lose because Q falls marginally

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Equilibrium Results - Equilibrium Policies and Quantities

	No Moratoria		Crisis Moratoria		Full Moratoria	
	$s = g$	$s = b$	$s = g$	$s = b$	$s = g$	$s = b$
$(r_{H,1}, q_{H,1})$	(1.572,2.148)	(1.709,2.158)	(1.572,2.148)	(1.709,2.158)	(1.572,2.148)	(1.709,2.158)
$(r_{H,0}, q_{H,0})$	(1.694,2.122)	(1.786,2.143)	(1.694,2.122)	(1.786,2.143)	(1.694,2.122)	(1.786,2.143)
$(r_{L,1}, q_{L,1})$	(1.0,0.438)	$\emptyset$	(1.0,0.437)	$\emptyset$	$\emptyset$	$\emptyset$
$(r_{L,0}, q_{L,0})$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$
$\phi(\theta_{H,1})$	0.758	0.751	0.758	0.751	0.758	0.751
$\phi(\theta_{H,0})$	0.781	0.768	0.781	0.768	0.781	0.768
$\phi(\theta_{L,1})$	0.208	0.0	0.206	0.0	0.0	0.0
$\phi(\theta_{L,0})$	0.0	0.0	0.0	0.0	0.0	0.0
Q	1.679	1.676	1.679	1.678	1.673	1.673

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Related Papers

- Abramson (2022):
  - Model of a renter with income fluctuations, consumption and savings decisions, and choice of whether to pay rent
  - No decision making by landlord on whether to evict a delinquent tenant
- Imrohoroglu and Zhao (2023)
  - Model of homeowners, renters, and unhoused
  - Income and health shocks drive people to default on rent payments
  - No landlord decisions
- Abramson and Van Niewerburgh (2024)
  - Use Abramson's framework to study the gains from both public and private rental insurance.
  - Private insurance is difficult to support but public insurance can raise welfare significantly by subsidizing at-risk tenants.

- Relative to these papers, we:
  - Focus on landlord decisions to evict delinquent renters and how that affects their incentives to supply and invest in rental units
  - Use a tractable search and matching framework
  - Characterize efficient allocations and study how lack of commitment and externalities lead to market failures

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Timing

The timing in any given period is as follows:

1. Employment status e is realized determining their income $y_{i,e} \in \{y_i, \alpha\}$
2. Landlords with occupied housing draw fixed cost f from a logistic distribution.
3. Landlords decide whether to evict. Evicted tenants are unhoused this period and can search for new housing.

The rest of the period unfolds for housed people according to:

H.1 Housed people receive utility $q \cdot \mathcal{E}(Q)$ from housing services while unhoused people receive zero utility from housing services.

H.2 Share σ exogenously separate and will be unhoused in the next period.

For the unhoused, the following events occur

U.1 New housing vacancies are created at cost κ.

U.2 Unhoused match with landlords according to $M(U, V)$ and will start the next period with a rental.

U.3 Newly matched housing units receive quality investment q at cost $c(q)$.

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Censoring

- Fundamental challenge to estimating employment and income processes for people who are likely to be evicted due to attrition.
- The CPS interviews members from a given address from month to month, which means that somebody who is evicted will not be in the same housing unit for a follow up interview.
- Therefore, we will miss people who report being unemployed and move before being interviewed again.
- This attrition likely biases our job-finding rates upward, since we are oversampling those with relatively short unemployment durations who find a job quickly enough to avoid eviction before their next interview.
- While over-estimating the job-finding rate of individuals at risk for eviction could affect our precise quantitative results, a lower job-finding rate for type L individuals would only strengthen the incentive for landlords to evict them.
- We are less concerned about bias in the separation rate, since somebody who is interviewed the month before losing their job is likely to remain in the same unit the following month as well.

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Decomposition

- Differences between planner and competitive allocations translate to large differences in aggregate discounted social surpluses.
- In Table 5 we calculate the losses from using the competitive equilibrium allocations of housing quality, tightness, and eviction decisions rather than the planner's optimal choices.
- We can then perform a simple accounting exercise to decompose how far the competitive allocation is from the efficient one both due to lack of commitment and to the externality.
- The row labeled "Baseline Q" reports the loss in steady-state aggregate social surplus, relative to the planner's optimum, using the tightnesses and qualities from the competitive equilibrium and assuming that matches are destroyed for type L tenants whenever they lose their jobs.
- The row labeled "Planner Q" is similar, except that we fix the externality term at its value from the planner's allocation ($\mathcal{E}(Q) = \mathcal{E}(Q^{sp})$).
- This calculation isolates the loss in welfare from the competitive equilibrium's lack of commitment from the difference in the externality term.
- We find that three quarters of the loss (-13.8 percent) from the competitive equilibrium is due to lack of commitment, while another 4.5 percent is due to the externality (-18.3 percent in total).

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AGS Sensitivity Matrix

Table: **Sensitivity Matrix Λ^***

	r_H/y_H	eviction rate	r/q slope	experiment	vacancy rate	mean f	var f	elasticity
η	-0.33	-0.0	-1.2	0.03	-0.38	-0.95	0.14	0.0
ν	0.12	-0.15	0.54	-0.0	0.25	0.45	0.06	-0.01
c_0	-0.14	0.11	-0.49	0.0	-0.05	-0.4	-0.04	0.01
κ	0.53	-0.05	1.77	-0.0	0.25	1.39	-0.19	-0.0
σ_f	0.02	-0.0	-0.0	-0.0	0.0	-0.0	-0.44	-0.0
$\bar{f}$	-0.19	0.08	-0.64	0.0	-0.07	-0.51	-0.02	-0.0

- Λ^* provides a local measure of how sensitive our parameter estimates are to a change in model moments based on Andrews et. al. (2017, QJE)
  - e.g. The upper-left element of the table implies that a 1% increase of rental burdens r_H/y_H would lead to a decrease of our estimate of η of 0.33%.

- Small changes in the match elasticity have the biggest effect on our estimates.

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Supply Elasticity Calculation

We impose rent ceilings on each type 1% below their baseline equilibrium values and recompute the stationary equilibrium. Then, we compute the finite-difference approximation to:

$$\text{elasticity} = \frac{\partial \text{ housing quantity}}{\partial \text{ housing value}} \times \frac{\text{housing value}}{\text{housing quantity}}$$

where:

$$\begin{aligned}
\text{housing value} &= Q\mathcal{E}(Q)/\text{housed mass} \\
\text{housed mass} &= \mathbb{E}_f\left[\sum_{i\in\{H,L\}}\sum_{e\in\{0,1\}}\sum_{k\in\{0,1\}}\Big(1-\epsilon_{i,e}(r_{i,k},q_{i,k},f),\Big)\mu^h_{i,e}(r_{i,k},q_{i,k})\right] \\
\text{housing quantity} &= \text{housed mass} + \text{vacancy mass}, \\
\text{vacancy mass} &= \sum_{i,e}\theta^{-1}(i,e)\mu^*(i,e),
\end{aligned}$$

where the contribution to vacancy mass for the $i = L, e = 0$ renter is zero.

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Operating Cost Calculation

- RHFS measure of operating costs includes utilities, insurance, landscaping, management company expenses, payroll expenses, maintenance, and security
- We add estimate of interest payments, which we compute using the RHFS information on mortgages (see paper for assumptions and imputations)
- Given most property taxes are 1% per year, add $\frac{1}{12}$% of the rental unit's market value to approximate the monthly property tax cost.

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Social Planning Problem

- The income process is exogenous + linear utility → only housing surplus value optimization is relevant
- Recursive formulation of problem (housing surplus function ($S(\mu_h, \mu_u)$)):

$$S(\mu_h, \mu_u) = \max \int\int (1 - \epsilon(s_h, f))(q \cdot \mathcal{E}(Q) - f) g(df)\mu_h(ds_h) - \int [\kappa + c(q(s_u))\psi(\theta(s_u))](\theta(s_u))^{-1}\widetilde{\mu}(ds_u) + \beta \cdot S(\mu_h'(s_h'), \mu_u'(s_u'))$$

subject to:

$$Q = \int\int (1 - \epsilon(s_h, f)) q g(df)\mu_h(ds_h)$$

where

$$\widetilde{\mu}(s_u) = \mu_u(s_u) + \int\int \epsilon(s_h, f)\mathbb{1}_{i'=i}\mathbb{1}_{e'=e} g(df)\mu_h(ds_h),$$

$$\mu_h'(s_h') = (1 - \sigma)\int\int p_{i,e,e'}\mathbb{1}_{i'=i}\mathbb{1}_{q'=q}(1 - \epsilon(s_h, f)) g(df)\mu_h(ds_h) + \int \phi(\theta(s_u)) p_{i,e,e'}\mathbb{1}_{i'=i}\mathbb{1}_{q'=q(s_u)}\widetilde{\mu}(ds_u),$$

$$\mu_u'(s_u') = \sigma \int\int p_{i,e,e'}\mathbb{1}_{i'=i}(1 - \epsilon(s_h, f)) g(df)\mu_h(ds_h) + \int (1 - \phi(\theta(s_u))) p_{i,e,e'}\mathbb{1}_{i'=i}\widetilde{\mu}(ds_u).$$

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Micro Data Used for Structural Model

- Survey of Consumer Finance (SCF 2019):
  - Renter defined as any person who paid rent over the last year
  - Detailed snapshot of financial wealth, income, and rent payments
- Current Population Survey (CPS 2018-2019 panel):
  - Renter defined as someone who reported renting in any of the interviews (up to eight months)
  - Can track employment status over time and some income information
- Rental Housing Finance Survey (RHFS 2021)
  - Nationally representative sample of rental units in 2021.
  - Detailed information on revenues and costs of landlords.
- Baum-Snow and Han (2024) micro estimates of housing supply elasticity
  - Merge BH elasticities at census tract with American Community Survey (ACS)
  - Use average elasticity for tracts with high-renter share ($>$ 50% of households) and low median income (below national median)

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Many Renters Have Little Relative to Rent

Table: Summary Statistics for Renters in SCF

	Overall		Low Income	
Variable	Median	25th%	Median	25th%
Rent	\$860	\$600	\$690	\$500
Liquid Assets	\$1020	\$100	\$250	\$0
Networth	\$6700	\$10	\$2590	\$0
Income	\$38,688	\$21,380	\$21,380	\$14,254

- Low income defined as below renter median income
- Little variation in rent (median is 43% higher than bottom quartile) while large variation in income (80% higher) and liquid assets (over 10 times higher)
- Median renter's liquid assets just cover rent while low income (below median) cannot cover rent from liquid assets
- Takeaway: hand-to-mouth is a good approximation for low income renters (our simple model abstracts from savings decision)

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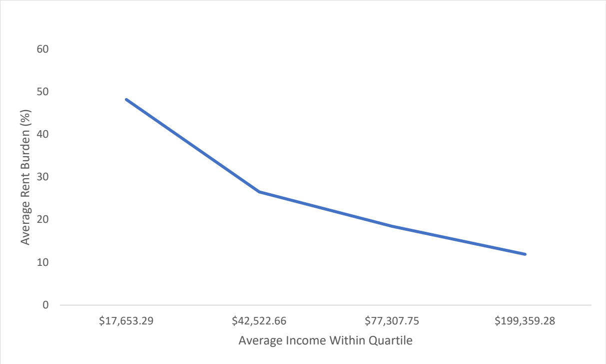
Rent Burden is Falling in Income

Figure: **Rent Burden by Income, 2019 SCF**



- Rent burden is ratio of rent to household income.
- Bottom quartile pays about 50% of income in rent while second quartile pays about 30% (calibrate model to match the slope)

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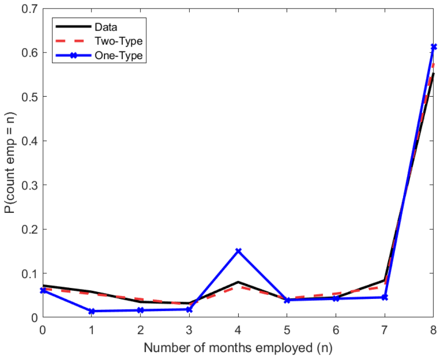
Renter Income Dynamics

Use Current Population Survey in 2018-2019

- Observe households for two four month periods, eight months apart
- Keep those that ever rent, ever in labor force, and below median earnings
- Matching mass of people with few months employed requires heterogeneous Markov chains over employment
- Estimate assuming latent types yielding transition probabilities $p_{i,e,e'}$ where $L-$types have low job-finding and high separation rates



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Rental Housing Supply Elasticity

Table: Housing Supply Elasticities

Variable	Mean	25^{th} Pctile	Median	75^{th} Pctile	Count
All Tracts	0.38	0.13	0.32	0.61	30,838
Model-Comparable Tracts	0.14	0.02	0.17	0.32	3,823

- Baum-Snow and Han (2024) estimate census-tract level housing supply elasticities.
- We use their 2011 estimates for the elasticity of total housing units to house prices.
- Model-Comparable Tracts are those with at least 50% of households renting and median tract-level income below the national median.

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Neighborhood Externalities

Table: **Spillover Estimates from Autor, Palmer, and Pathak (2014)**

Variable	Estimate
POST $\times$ RCI $\times$ RC	0.25
	(0.18)
POST $\times$ RCI $\times$ NON-RC	0.13
	(0.09)

Autor, Palmer, and Pathak (2014) estimate the positive spillover on neighboring untreated housing values from lifting rent controls on treated housing units:

- After rent controls were lifted (POST $= 1$),
- Units under rent control (RC $= 1$) in neighborhoods with high rent control intensity (RCI $= 1$) saw a 25% increase in value.
- But even those not under rent control (NON-RC$=$1) saw a 13% increase in value (i.e. positive 50% spillover).
- To calibrate the externality, we use our model to conduct a local policy experiment similar to APP imposing rent control on some units, remove it, and then calculate the relative change in value for NON-RC to RC to calibrate the semi-elasticity η.

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Rent-to-quality from RHFS

Table: Summary Statistics from RHFS

- Market value and rent are per unit in 2018 dollars.
- Rent rises by 40% but value by more than 200%.

Market Value Pctile	Rent	Market Value
Bottom 15	$456	$19,227
16 — 50	$640	$62,319

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Laws of Motion in Stationary Equilibrium

For simplicity, assume $\lambda = 1$. Laws of motion are

$$\mu^h_{i,e'}(r_{i,k}, q_{i,k}) = \mathbb{E}_f \Big[\sum_{e \in \{0,1\}} \Big(1 - \epsilon_{i,e}(r_{i,k}, q_{i,k}, f)\Big) p_{i,e,e'} (1-\sigma) \mu^h_{i,e}(r_{i,k}, q_{i,k}) \Big] \quad (3)$$

$$+ p_{i,k,e'} \phi(\theta_{i,k}) \Big(\mu^u_{i,k} + \widetilde{\mu}^u_{i,k} \Big)$$

$$\mu^u_{i,e'} = \sigma \mathbb{E}_f \Big[\sum_{e \in \{0,1\}} p_{i,e,e'} \sum_{k \in \{0,1\}} \Big(1 - \epsilon_{i,e}(r_{i,k}, q_{i,k}, f)\Big) \mu^h_{i,e}(r_{i,k}, q_{i,k}) \Big] \quad (4)$$

$$+ \sum_{e \in \{0,1\}} \Big(1 - \phi(\theta_{i,e})\Big) p_{i,e,e'} \big(\mu^u_{i,e} + \widetilde{\mu}^u_{i,e}\big)$$

where

$$\widetilde{\mu}^u_{i,e} = \sum_{k \in \{0,1\}} \mathbb{E}_f \Big[\epsilon_{i,e}(r_{i,k}, q_{i,k}, f) \mu^h_{i,e}(r_{i,k}, q_{i,k}) \Big].$$

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Decision Problem with Aggregate Uncertainty

Given the landlord $L_{i,e}(r,q;s)$ and renter $R_{i,e}(r,q;s)$ values conditional on matching, the unhoused renter solves the following:

$$
\begin{aligned}
V^*_{i,e}(s,\mu) &= y_{i,e} - \alpha + \max_{r \le y_i - \alpha, q, \theta} \beta \mathbb{E}_{s'|s} \Bigg[\phi(\theta) \Bigg(\sum_{e' \in \{0,1\}} p_{i,e,e'}(s) \mathbb{E}_{f'} R_{i,e'}(r,q,f';s',\mu') \Bigg) \\
&+ (1-\phi(\theta)) \Bigg(\sum_{e' \in \{0,1\}} p_{i,e,e'}(s) V^*_{i,e'}(s',\mu') \Bigg) \Bigg]
\end{aligned}
$$

s.t.

$$
\kappa \ge \beta \psi(\theta) \mathbb{E}_{s'|s} \Bigg[\sum_{e' \in \{0,1\}} p_{i,e,e'}(s) \mathbb{E}_{f'} L_{i,e'}(r,q,f';s') - c(q) \Bigg],
$$

- Argmax induces aggregate state dependent rents $r_{i,e}(s)$, qualities $q_{i,e}(s)$, and tightnesses $\theta_{i,e}(s)$.
    - In contractions, L-type finding rates fall in half (unhoused duration rises by 115 days) while H-type fall by only 4% (unhoused duration rises by 2 days).

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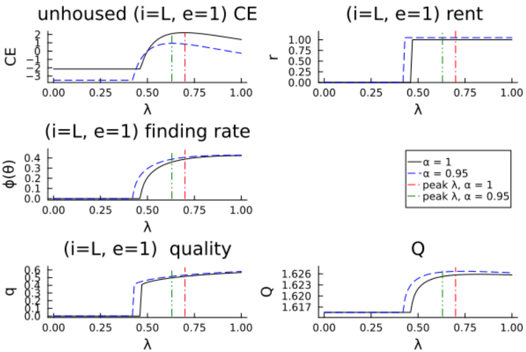
Impact of Subsistence Consumption on Optimal Eviction Policy

- Increasing y_i or decreasing α allows for higher rent when tenant is employed (i.e. loosens constraint $r \leq y_i - \alpha$)
- $L-$types can now pay more rent, allowing landlords to make more profit when $L-$types are employed inducing higher finding rates and quality for low types
- Since landlords can collect more rent, tighter eviction restrictions reduce supply less, leading policymakers to prefer a lower λ
- Lesson: Optimal restrictions are stricter in areas where lowest-income renters are better off

Effect of Loosening Rental Constraints on Evictions



- Experiment where α falls from 1 to 0.95 effectively relaxing constraint on rental payments; peak λ falls from 0.7 to 0.63
- *L*-type can pay more rent when employed, so policy can restrict evictions more without hurting ex-ante supply
- Optimal restrictions are stricter in areas where lowest-income renters are better off

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Decentralized Equilibrium with Aggregate Uncertainty

- Add exogenous aggregate state s representing baseline state $s = g$ and a crisis state $s = b$

- Baseline state $s = g$ is extremely persistent while crisis expected to last for four months on average (i.e. Markov transition sets $Pr(s' = g|s = b) = 0.25$)

- Baseline state has employment transitions $p_{i,e,e'}(g)$ as in 2018-2019 while crisis state has higher separation and lower finding rates (estimated during March-June of 2020).

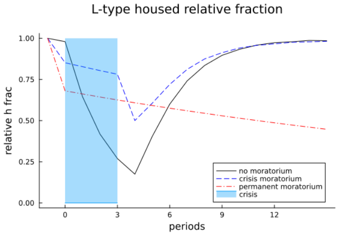
- Consider state-dependent eviction moratoria (i.e. $\lambda(s) \in \{0, 1/2\}$ with $s \in \{g, b\}$)

- Given conditional (on Q) block recursivity, use Krusell-Smith forecast of future Q necessary to find equilibrium rental postings.

▸ Welfare ▸ Policies and Quantities ▸ Problem

Housing Outcomes in Crisis Depend on Policy

Figure: Aggregate Uncertainty Experiment



- No-moratorium policy: λ remains at 0.5 throughout
- Permanent moratorium reduces $L-$type supply of housing and leads to worse long-run housed share
- Temporary moratorium keeps substantially more L-type tenants housed throughout the crisis and maintains original long-run housed share
- Delivers small welfare gain to $L-$types upon onset of crisis (those already housed benefit, those unhoused lose due to supply decline resulting in minimal net effect).

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