Search and Credit Frictions in the Housing Market

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Motivation

- Housing market subject to search frictions
  - Takes time to find/sell house: $\approx 6$ months to sell, US
  - Large fluctuations in time to buy/sell over the business cycle

- Housing market affected by credit frictions
  - Liquidity constraints: during 2016 88% of buyers use mortgage
  - Finding mortgage is costly and time consuming
This paper

- Model with search frictions on both housing and credit market

- Credit frictions ⇒ multiple equilibria
  - Housing Entry: price and tightness negatively related
  - Price curve: downward sloping due to credit frictions
    - Buyer agreement point decreasing in time-to-buy
    - Tightness ↑ ⇒ time-to-buy ↑ ⇒ liquidity costs for financier ↑
      ⇒ financing fee ↑ ⇒ gains from trade b/w buyer and seller ↓
      ⇒ price ↓

- Quantitative importance of credit frictions channel
  - Low impact on prices
  - Matter more for housing liquidity and mortgage debt
**Literature**

- **Search and housing market**

- **Housing search + credit constraints**
  - Guren McQuade (2018, WP), Hedlund (2016, JME), Head *et al.* (2016, WP)

- **Credit market search**

- **Housing market, no search**
  - Davis Heathcote (2005 IER), Piazzesi Schneider (2016 Handbook Macro)
ENVIRONMENT

- Continuous time, discount rate $r$

- Agents, risk neutral
  - Households: own house, search for credit/house, or idle
  - Realtor
  - Sellers: households, construction/new housing
  - Financiers: search for applicants, wait for buyers

- Houses identical

- Buyers need
  - Realtor to purchase home
  - Mortgage to finance purchase

- Sellers post vacancy, search for buyers
Environment

- Depreciation rate $\delta$
- Exogenous separations $s$
- Search for houses/buyers $\rightarrow$ matching function, Pissarides

- $b$ buyers, $v$ vacancies, $\theta = b/v$ tightness
  - Matches: $M(b, v) = \mu b^{1-\alpha} v^\alpha$
  - House finding rate: $m(\theta) = \frac{M(b,v)}{b}$
  - House selling rate: $\theta m(\theta) = \frac{M(b,v)}{v}$
Credit market frictions \textit{a la} Wasmer Weil (2004, AER)

a applicants, \( \hat{f} \) financiers, \( \phi = a/\hat{f} \) tightness

Matches: \( \mathcal{F}(a, \hat{f}) = \mu_f a^{1-\alpha_f} \hat{f}^{\alpha_f} \)

Mortgage finding rate: \( f(\phi) = \frac{\mathcal{F}(a, \hat{f})}{a} \)

Applicant finding rate: \( \phi f(\phi) = \frac{\mathcal{F}(a, \hat{f})}{\hat{f}} \)
Endogenous Entry

- Free entry of sellers: can build new houses at cost $k$
- Free entry of applicants at 0 cost
  - Realtor, cost of service: $\frac{c b^\gamma + 1}{\gamma + 1}$ (Gabrovski Ortego-Marti 2019 JET; Sirmans Turnbull 1997 JUE)
  - Competitive market, charges buyers fee $c^B$
- Free entry of financiers at 0 cost
- Steady state: $af(\phi) = bm(\theta)$
Bellman Equations

- Financiers liquidity cost: $c^F$
  - Provide mortgage $\Rightarrow$ miss out on investing in illiquid assets
  - Cost of marketing, servicing applicants

- Financiers
  \[ rF_0 = -c^F + \phi f(\phi)(F_1 - F_0) \]

- Applicants
  \[ rB_0 = -c_0 + f(\phi)(B_1 - B_0) \]
Bellman Equations

- Realtor profit max \( \Rightarrow c^B(b) = \bar{c}b^\gamma \)
  - Includes realtor fee, related search costs (congestion externalities, etc.)
  - If constant or decreasing
    \( \Rightarrow \) baseline model with no buyers entry (everyone buyer/applicant)

- Buyers

\[
\begin{align*}
    rB_1 &= -c^B(b) + m(\theta) \left( H - B_1 - dp - \frac{\rho}{r + \delta} \right)
\end{align*}
\]

- Financiers (with matched buyer)

\[
\begin{align*}
    rF_1 &= -c^F + m(\theta) \left( \frac{\rho}{r + \delta} - F_1 - p(1 - d) \right)
\end{align*}
\]
Bellman Equations

- Utility flow of home ownership: $\varepsilon$

- Homeowners

$$rH = \varepsilon - s(H - V) - \delta H$$

- Vacancy

$$rV = -c^S + \theta m(\theta)(p - V) - \delta V$$
Bargaining

- Search frictions → surplus

- Credit Market
  - Applicant surplus $S^A = B_1 - B_0$
  - Financier surplus $S^F = F_1 - F_0$

- Housing Market
  - Buyer surplus $S^B = H - dp - \frac{\rho}{r+\delta} - B_1$
  - Seller surplus $S^V = p - V$
Bargaining

- Sequential Nash Bargaining
  - Applicant and financier bargain over repayment schedule $\rho(p)$
  - Buyer and seller take mortgage contract as given

- Credit market
  $$\rho = \arg\max_{\rho} (S^F)^\beta (S^A)^{1-\beta}$$
  $$\Rightarrow \beta = \text{bargaining strength of financier}$$

- Housing market
  $$p = \arg\max_{p} (S^S)^\eta (S^B)^{1-\eta}$$
  $$\Rightarrow \eta = \text{bargaining strength of seller}$$
**EQUILIBRIUM**

- Credit Entry condition

\[
\phi = \frac{1 - \beta c^F}{\beta c_0}
\]

- Repayment Equation

\[
\frac{\rho}{r + \delta} = p(1 - d) + \frac{r + m(\theta) + \phi f(\phi) c^F}{m(\theta)\phi f(\phi)}
\]

- \(\theta \uparrow \Rightarrow\) Financing Fee \(\uparrow\)
  - Low \(m(\theta)\) ⇒ incur \(c^F\) for longer
  - Low \(m(\theta)\) ⇒ receive \(\rho\) later
**Equilibrium**

- **Buyer Entry condition**

\[
(BE) : \quad \frac{c^B(b)}{m(\theta)} + \frac{rc_0}{m(\theta)f(\phi)} = \frac{1 - \eta}{\eta} (p - k)
\]

- **Housing Entry condition**

\[
(HE) : \quad p = k + \frac{(r + \delta)k + c^S}{\theta m(\theta)}
\]

- (HE) downward sloping: \( \theta \uparrow \Rightarrow \) search costs \( \downarrow \Rightarrow p \downarrow \)
**EQUILIBRIUM**

- Use (RE) ⇒

\[
S^B = H - p - \frac{r + m(\theta) + \phi f(\phi)}{m(\theta)\phi f(\phi)}c^F - B_1
\]

- Agreement Point of buyer decreasing in \( \theta \)

- Price Equation

\[
(PP) : \quad p = k + \eta \left[ \frac{\varepsilon + sk}{r + s + \delta} - \frac{c_0}{f(\phi)} - \frac{r + m(\theta) + \phi f(\phi)}{m(\theta)\phi f(\phi)}c^F - k \right]
\]

- (PP) downward sloping: \( \theta \uparrow \Rightarrow \text{Fin Fee} \uparrow \Rightarrow S^B \downarrow \Rightarrow p \downarrow \)
Equilibrium price $p^*$, tightness $\theta^*$
Equilibrium buyers $b^*$, vacancies $v^*$
EQUILIBRIUM TIGHTNESS $\theta^*$, REPAYMENT $\rho^*$
NUMERICAL EXERCISE

- Prior to 2007 housing market crash:
  - Increase in prices

![Deflated Case-Shiller Price Index](image)
Numerical Exercise

- Prior to 2007 housing market crash:
  - Increase in Mortgage Debt-to-Price

![Mortgage Debt-to-Price Ratio Graph]
**Numerical Exercise**

- Prior to 2007 housing market crash:
  - No trend in Time-to-Sell
**Numerical Exercise**

- Decompose observed changes in data into 5 shocks
  - Housing market shocks
    - Demand: $\varepsilon$
    - Supply: $k$
  - Credit market shocks
    - Liquidity costs: $c^F$
    - Matching efficiency: $\mu_f$
    - Bargaining strength: $\beta$

- Study contribution of credit channel in counter-factual exercises
**Numerical Exercise: Shock Decomposition**

**Table: Shocks**

<table>
<thead>
<tr>
<th>Shock</th>
<th>Data Target</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\varepsilon$</td>
<td>Price</td>
<td>82.22%</td>
</tr>
<tr>
<td>$k$</td>
<td>Time-to-Sell</td>
<td>53.71%</td>
</tr>
<tr>
<td>$c^F$</td>
<td>Aaa bond yield relative to 10-y c.m. Treasury bond</td>
<td>$-12.66%$</td>
</tr>
<tr>
<td>$\mu_f$</td>
<td>Mortgage Originations to Applications Ratio</td>
<td>$-67.40%$</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Mortgage Debt to Price Ratio</td>
<td>60.14%</td>
</tr>
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($\varepsilon$, $k$, $c^F$, $\mu_f$, $\beta$)
**Counter-Factual Scenarios**

**Table: Impact of Credit Shocks**

<table>
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<tr>
<th>Variable Counter-factual Change</th>
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<th>Debt-to-Price</th>
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<tr>
<td>No Change in Credit Market Shocks $c^F, \mu_f, \beta$</td>
<td>64.91%</td>
<td>165.31%</td>
<td>$-1.99%$</td>
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<td>No Change in Liquidity Costs, $c^F$</td>
<td>50.45%</td>
<td>-6.11%</td>
<td>18.24%</td>
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<tr>
<td>No Change in Matching Efficiency, $\mu_f$</td>
<td>62.91%</td>
<td>141.51%</td>
<td>1.84%</td>
</tr>
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**Table: Impact of Credit Shocks**

No Change in Matching Efficiency, $\mu_f$
**Counter-Factual Scenarios**

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<tr>
<td>Variable</td>
<td>58.74%</td>
<td>92.10%</td>
<td>2.78%</td>
</tr>
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CONCLUSION

- Model with search frictions in both housing and credit market

- Credit friction channel → multiple equilibria
  - Tightness ↑⇒ Fin. Fee ↑⇒ Buyer’s agreement point ↓
  - ⇒ Price Curve downward sloping

- Numerical example: Credit shocks have sizable effect on housing market
  - Low impact on prices
  - Matter more for time-to-sell and mortgage debt