

HOME CONSTRUCTION FINANCING AND SEARCH FRICTIONS IN THE HOUSING MARKET

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UC Irvine, Macro/Urban seminar
April 27, 2022

MOTIVATION

- Important to understand dynamics in housing markets, especially liquidity
 - ▶ Majority of households hold most of their wealth in housing
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- Important driver of supply → **construction**
- Financing/debt, very important for real estate development
 - ▶ Debt/Equity ratio $\approx 94\%$
- Question: how do credit frictions faced by developers affect the housing market?
 - ▶ Prices, time-to-sell (TTS), sales, vacancies/houses for sale?

THIS PAPER

- Novel channel that links credit frictions faced by developers to housing market
- Search frictions in credit market, Wasmer Weill (2006)
Gabrovski Ortego-Martí (2021)
 - ▶ Developers must secure financing for construction project
 - ▶ Costly, time consuming process
- Search frictions in housing market
 - ▶ Takes time to find/sell house
 - ▶ Entry of *both* buyers and sellers
 - upward-sloping Beveridge Curve (Gabrovski Ortego-Martí, 2019)

PREVIEW OF RESULTS

- Quantify the importance of credit channel
- Decompose
 - contribution of housing & credit shocks to recovery 2012-2019
 - vacancy costs into construction and financing
- Model able to match changes in vacancy rate & construction
- Counterfactual, shut down credit shock
 - ▶ Credit shocks larger effect on liquidity rel to prices

LITERATURE

■ Search and housing market

- ▶ Wheaton (1990 JPE), Arnott (1989 JREFE), Burnside et al (2016 JPE), Caplin Leahy (2011 JMCB), Diaz Jerez (2013 IER), Gabrovski Ortego-Marti (2019 JET), Genesove Han (2012 JUE), Han et al (2021), Head et al (2014 AER), Kashiwagi (2014 RED), Kotova Zhang (2019), Krainer (2001 JUE), Ngai Tenreyro (2014 AER), Ngai Sheedy (2020 JEEA), Novymarx (2009 REE), Piazzesi Schneider Stroebel (2020 AER), Smith (2020 RED)

■ Credit frictions and search

- ▶ den Haan et al (2003 JME) Dell'Ariccia Garibaldi (2005 REStud) Wasmer Weill (2006 AER) Petrosky-Nadeau Weill (2017) Hedlund Garriga (2020 AER) Gabrovski Ortego-Marti (2021 EER)

ENVIRONMENT

- Time continuous
- Agents, infinitely lived, risk-neutral
 - ▶ Households: homeowners, buyers, idle (don't participate)
 - ▶ Developers
 - ▶ Financiers
 - ▶ Real estate agents
- Discount future at rate r

CREDIT MARKET

- Developers \rightarrow build house at cost k
- Credit frictions: developers must secure financing from financier
- Search & matching frictions
 - ▶ Wasmer Weil (2007) Gabrovski Ortego-Marti (2021)
 - ▶ Supported empirically, den Haan et al (2003), Dell'Araccia Garibaldi (2005)
- Once match formed
 - ▶ Financier covers cost k
 - ▶ Developer pays financing fee ρ until house sold
 - ▶ Sale \rightarrow developer repays loan principal k

CREDIT MARKET

- Financing fee ρ determined by Nash Bargaining
 - ▶ Bargaining strength developer: η
- Free entry
 - ▶ Developers
 - ▶ Financiers
- Flow costs
 - ▶ Developers: c^D
 - ▶ Financiers: c^F

CREDIT MARKET: MATCHING

- Developers: \mathcal{D}
- Financiers: \mathcal{F}
- Matching function (Pissarides, 2000)
 - ▶ Matches: $M^C(\mathcal{D}, \mathcal{F})$
 - ▶ Satisfies usual properties
- Market tightness, credit market: $\phi = \mathcal{D}/\mathcal{F}$
- Finding rates
 - ▶ Developers: $q(\phi) \equiv \frac{M^C(\mathcal{D}, \mathcal{F})}{\mathcal{D}}$
 - ▶ Financiers: $\phi q(\phi) \equiv \frac{M^C(\mathcal{D}, \mathcal{F})}{\mathcal{F}}$

HOUSING MARKET

- Search & matching frictions
- Matching function $M^H(b, v)$
 - ▶ Buyers: b
 - ▶ Sellers/vacancies: v
- Housing market tightness $\theta = b/v$
- Finding rates
 - ▶ buyers: $m(\theta) = M^H(b, v)/b$
 - ▶ sellers: $\theta m(\theta) = M^H(b, v)/v$
- Separation shock at exogenous rate s
- Houses destroyed at rate δ (depreciation)

HOUSING MARKET

- Buyers search for houses using a realtor

- ▶ Profit max

- \Rightarrow buyers' search cost: $c^B(b) = \bar{c}b^\gamma$

- Free entry of buyers

- ▶ Matches stylized facts housing market (Gabrovski Ortego-Marti, 2019)

HOUSING MARKET

- Sellers

- ▶ **Existing** house → from homeowner separations
- ▶ **New** house → newly built house (free entry)

- Houses are identical

- Vacancy posting costs: c^S

HOUSING MARKET

- Prices determined by Nash Bargaining
 - ▶ assume bargaining sequential, take financial contract ρ as given
- Price of existing house: p^E
- Price if new house: p^N
- Distribution of houses: π fraction of existing
- Seller bargaining strength: β

BELLMAN EQUATIONS: DEVELOPERS & FINANCIERS

- Stage 0: search in credit market
- Stage 1: active lending arrangement, dev searches for buyer
- V_0, V_1 : Value developer, stages 1, 0
- F_0, F_1 : Value financier, stages 1, 0

$$rV_0 = -c^D + q(\phi)(V_1 - V_0)$$

$$rF_0 = -c^F + \phi q(\phi)(F_1 - k - F_0)$$

$$(r + \delta)V_1 = -\rho - c^D + \theta m(\theta)(p^N - k - V_1)$$

$$(r + \delta)F_1 = \rho - c^F + \theta m(\theta)(k - F_1)$$

BELLMAN EQUATIONS: SELLER, EXISTING HOUSE

- V^E : value of existing house vacancy

$$(r + \delta)V^E = -c^S + \theta m(\theta)(p^E - V^E).$$

BELLMAN EQUATIONS: HOUSEHOLDS

■ H : Value household

■ B : Value buyer

$$(r + \delta)H = \varepsilon + s(V^E + \max\{B, 0\} - H)$$

$$rB = \max\{0, -c^B(b) + m(\theta)[\pi(H - p^E - B) + (1 - \pi)(H - p^N - B)]\}$$

EQUILIBRIUM SUMMARY

- Key ingredients

- ▶ Free entry developers, financiers, buyers
- ▶ Bargaining over prices, credit & housing
- ▶ Distribution: new vs existing houses

ENTRY IN CREDIT MARKET

- Free entry, financiers & developers

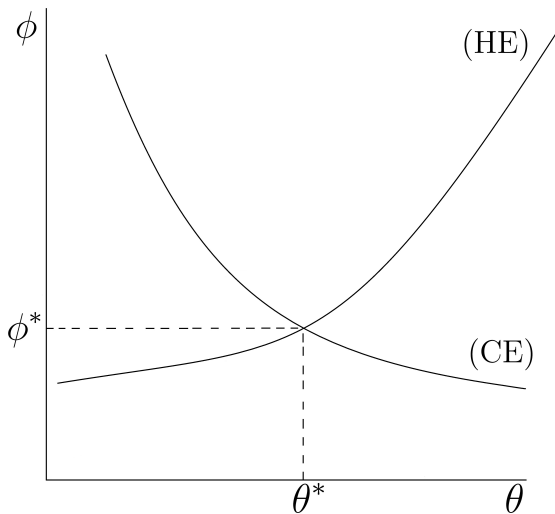
- ▶ Housing Entry (HE) condition, $V_0 = 0$

- ▶ Credit Entry (CE) condition, $F_0 = 0$

$$\text{HE: } \frac{c^D}{q(\phi)} = \eta \left(\frac{-c^F - c^D + \theta m(\theta) p^N}{r + \delta + \theta m(\theta)} - k \right)$$

$$\text{CE: } \frac{c^F}{\phi q(\phi)} = (1 - \eta) \left(\frac{-c^F - c^D + \theta m(\theta) p^N}{r + \delta + \theta m(\theta)} - k \right)$$

EQUILIBRIUM TIGHTNESSES ϕ^* , θ^*

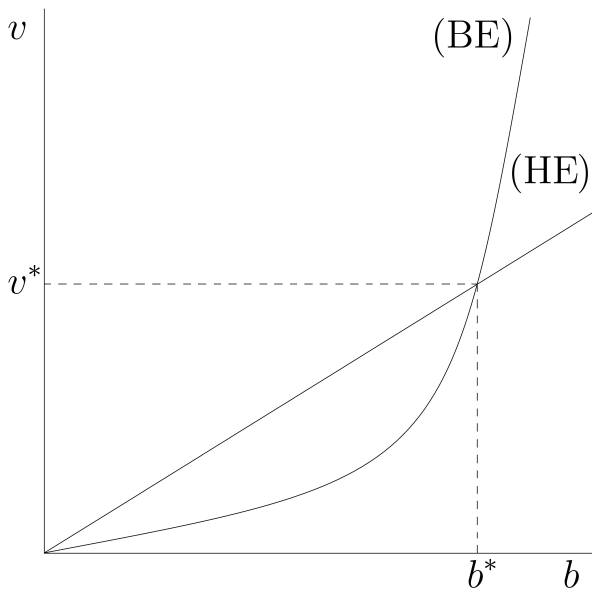


ENTRY OF BUYERS

- Free entry buyers, $B = 0$

$$\frac{c^B(b)}{m(\theta)} = (1 - \beta)[\pi(H - V^E) + (1 - \pi)(H - k - V_1^N)]$$

EQUILIBRIUM BUYERS b^* , VACANCIES v^*



BARGAINING, CREDIT MARKET

- Bargaining \Rightarrow Repayment (RR) condition

$$\text{RR: } \phi = \frac{\eta}{1 - \eta} \frac{c^F}{c^D}$$

- Alternatively, NB implies

$$\rho = (r + \delta)k + c^F + \frac{1 - \eta}{\eta} (r + \delta + \theta m(\theta)) \frac{c^D}{q(\phi)}$$

BARGAINING, HOUSING MARKET

■ Prices

$$p^E = \beta H + (1 - \beta)V^E$$

$$p^N = \beta H + (1 - \beta) \left(k + \frac{c^D}{q(\phi)} \right)$$

DISTRIBUTIONS

- From laws of motion, in steady state

$$\pi = \frac{s\theta m(\theta)}{(s + \delta)(\delta + \theta m(\theta))}$$

$$h = \frac{bm(\theta)}{s + \delta}$$

QUANTITATIVE RESULTS

- Novel channel that links credit frictions to the housing market through the liquidity constraints faced by real estate developers
- Quantitative importance of this channel?
- Relative contribution of housing and credit market shocks to observed housing market recovery in US, 2012–2019?

QUANTITATIVE RESULTS

- Use series on

- ▶ Prices
- ▶ Time-to-sell (TTS)
- ▶ Construction costs
- ▶ Fraction existing houses

- Shocks

- ▶ Utility ε
- ▶ Construction cost k
- ▶ Search costs c^D
- ▶ Separations s

CALIBRATION

Parameter	Value	Source/Target
r	0.0086	Annual interest rate= 3.5%
ε	1	Normalization
α	0.16	Genesove Han (2012)
α_f	0.5	TTB=TTS
δ	0.004	Van Nieuwerburgh Weill (2010)
s	0.0238	Tenure= 9 years
μ	0.7129	TTS= 1.4027 quarters
μ_f	0.0318	Equilibrium conditions
c^S	0.959	Average seller cost= 2% of price
c^D	3.4185	Average buyer cost= 8% of price
c^F	0.0648	Moody's AAA-Treasury Bill spread
β	0.5	
η	0.5	
k	14.019	Debt-to-equity ratio 94.7%
\bar{c}	0.1	Normalization

EMPIRICAL FACTS

Series	Percentage Change
Prices	44.82%
Time to Sell	−30.13%
Construction Costs	44.94%
Sales	22.17%
Construction	66.76%
Vacancy Rate	−34.35%
Existing to Total Home Sales	−4.6%

SIZE OF CALIBRATED SHOCKS

Variable	Percentage Change	Target Series	Percentage Change
ε	35.97%	Prices	
k	44.94%	Construction costs	
c^D	106.3%	Time-to-sell	
s	-25.77%	Existing to Total Home Sales	

UNTARGETED DATA MOMENTS

Moment	% Change Data	% Change Model
Construction	66.76%	52.81%
Vacancy Rate	-34.35%	-44.6%

THE IMPORTANCE OF CREDIT SHOCKS: COUNTERFACTUALS

No Change in Frictions Shock, c_D

Variable	Price	TTS	Construction	Vacancy Rate
Counterfactual Change	23.69%	119.34%	235.78%	66.53%

No Change in Separation Shock, s

Variable	Price	TTS	Construction	Vacancy Rate
Counterfactual Change	44.87%	-36.06%	-5.33%	-35.19%

Variable	Price	TTS	Construction	Vacancy Rate
Data	44.82%	-30.13%	66.76%	-34.35%

CONCLUSION

- Novel channel that links credit frictions faced by developers to housing market
 - ▶ Search frictions in credit & housing markets
 - ▶ Free entry
 - ▶ Bargaining over prices
- Model matches well housing market recovery 2012-2019
- Quantify the importance of credit channel
 - ▶ Credit shocks larger effect on liquidity rel to prices