House Price Beliefs and Mortgage Leverage Choice

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- **Objective:** Explore relationship between beliefs about house prices and leverage choices

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     - **Main Result**: Ambiguous relation between optimism and leverage

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- **Key parameter:** Willingness/ability to adjust property size
  - High return sensitivity of housing investment: (1) dominates
    $\rightarrow$ Optimists (appropriately defined) have higher leverage;
  - Low return sensitivity of housing investment: (2) dominates
    $\rightarrow$ Optimists (appropriately defined) have lower leverage;
  - Which forces restrict adjustment of exposure to asset?
    - Owner-occupied housing: family size, neighborhood, etc.

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     - **Main Result:** Ambiguous relation between optimism and leverage
  2. **Empirically**
     - Cross-sectional relationship between homebuyers' beliefs and leverage
     - **Main Result:** More optimistic households choose lower leverage

Environment

- Two dates $t = \{0, 1\}$
- Borrower i's preferences (+ housing target zone)

$$u_i(c_{0i}) + \beta \mathbb{E}_i[w_{1i}]$$

- Borrowers choose
  - Initial consumption c_{0i}
  - House size h_{0i}
  - **Leverage** $\delta_i = \frac{b_{1i}}{p_0 h_{0i}}$

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- Heterogeneous beliefs about house price growth rates

$$g = \frac{p_1}{p_0}, \text{ where } \quad g \sim F_i(\cdot)$$

Homebuyers' problem

- Homebuyers choose c_{0i}, h_{0i} and $\delta_i = \frac{b_{1i}}{p_0 h_{0i}}$ (leverage) to solve

$$\max_{c_{0i},\delta_i,h_{0i}} u\left(c_{0i}\right) + \beta p_0 h_{0i} \int_{\delta_i}^{\overline{g}} \left(g - \delta_i\right) dF_i\left(g\right)$$

s.t.

$$c + p_0 h_{0i}\left(1 - \Lambda\left(\delta_i\right)\right) = n_{0i} \qquad \left(\lambda_{0i}\right)$$

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- **Lenders** LTV schedule
  - LTV ratio $\Lambda(\delta_i)$ schedule determined by competitive, risk-neutral lenders
    - Depends only on lenders' beliefs

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$$c + p_0 h_{0i} (1 - \Lambda(\delta_i)) = n_{0i} \qquad (\lambda_{0i})$$

$$\underline{h_i} \leq h_{0i} \qquad (\nu_{0i})$$

- **Return Sensitivity of Housing Investments**: Captures "consumption forces" on property size choice (e.g., family size)
  - Allows to explore polar cases.

Optimality conditions

- $c_{0i}: \quad \lambda_{0i} = u_i'(c_{0i})$

$$h_{0i}: \quad \underbrace{-\lambda_{0i} p_0 (1 - \Lambda(\delta_i))}_{\text{Mg. Cost}} + \underbrace{\beta p_0 \int_{\delta_i}^{\overline{g}} (g - \delta_i)\, dF_i(g)}_{\text{Mg. Benefit}} + \nu_{0i} = 0$$

$$\delta_i: \quad \underbrace{\lambda_{0i} p_0 h_{0i} \Lambda'(\delta_i)}_{\text{Mg. Benefit}} - \underbrace{\beta p_0 h_{0i} \int_{\delta_i}^{\overline{g}} dF_i(g)}_{\text{Mg. Cost}} = 0$$

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- Two channels through which homebuyer beliefs matter
  1. Expected return of investment
  2. Marginal cost of borrowing/saving

Variable House Size Scenario

- Housing target constraint is slack
  - House size determined by investment aspect of housing
- Leverage pinned down by:

$$\frac{\Lambda'\left(\delta_i^*\right)}{1-\Lambda\left(\delta_i^*\right)} = \frac{1}{\mathbb{E}_i\left[g \middle| g \geq \delta_i^*\right] - \delta_i^*}$$

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- If $\mathbb{E}_j\left[g|\, g \geq \delta\right] > \mathbb{E}_i\left[g|\, g \geq \delta\right], \forall \delta \quad \Longrightarrow \quad \delta_j^* > \delta_i^*$
  - Optimism = **"Truncated Expectation Dominance"**
  - "Expected return" force > "Mg. cost of borrowing" force
  - Disagree about return to investment conditional on repayment

Fixed House Size Scenario

- Housing target constraint is binding
  - House size determined by considerations such as family size
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- If $1 - F_j(\delta) > 1 - F_i(\delta)$, $\forall \delta \quad \Longrightarrow \quad \delta_j^* < \delta_i^*$
  - Optimism = **First-Order Stochastic Dominance**
  - Only "Marginal cost of borrowing" force
  - Disagree about probability of repayment

Empirical Predictions

Variable House Size

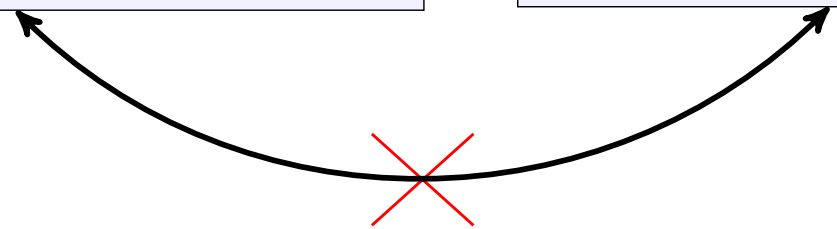
$$\mathbb{E}_j\left[g|\, g \geq \tilde{\delta}\right] \geq \mathbb{E}_i\left[g|\, g \geq \tilde{\delta}\right], \forall \tilde{\delta} \;\Rightarrow\; LTV_j \geq LTV_i$$

Truncated Expectation Stochastic Dominance

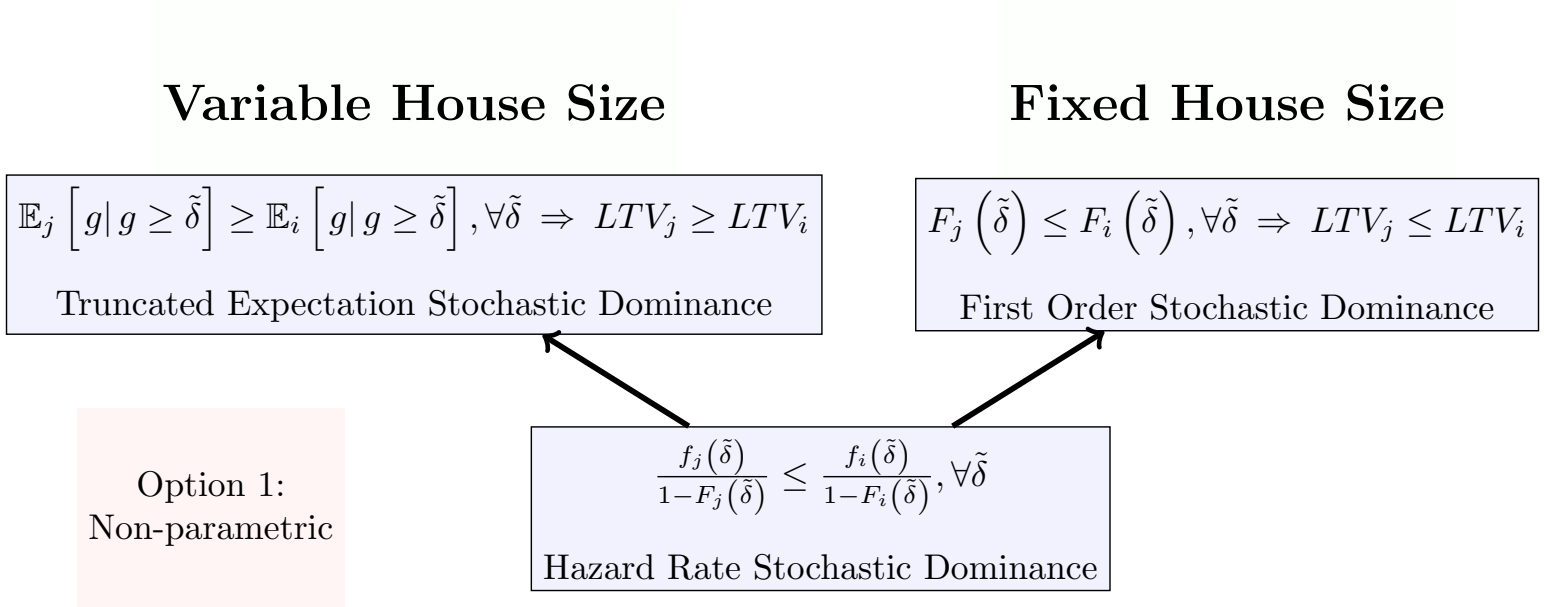
Fixed House Size

$$F_j\left(\tilde{\delta}\right) \leq F_i\left(\tilde{\delta}\right), \forall \tilde{\delta} \;\Rightarrow\; LTV_j \leq LTV_i$$

First Order Stochastic Dominance

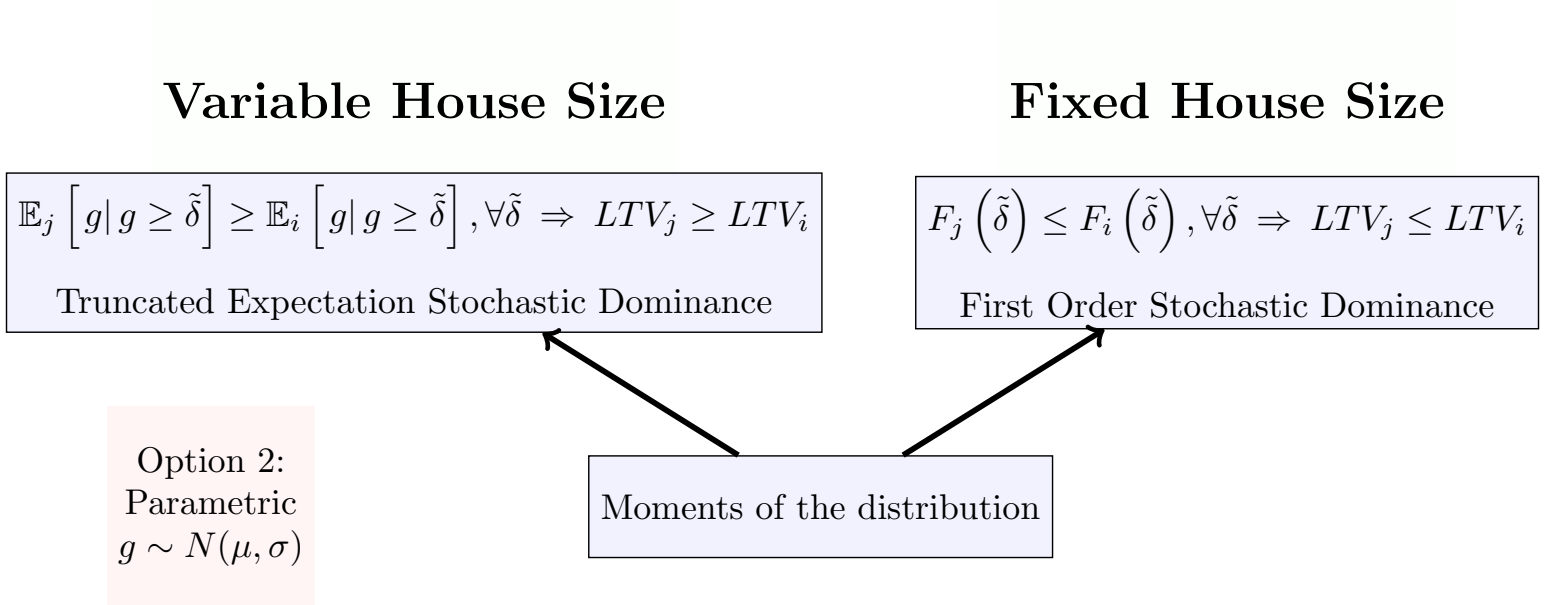


Empirical Predictions



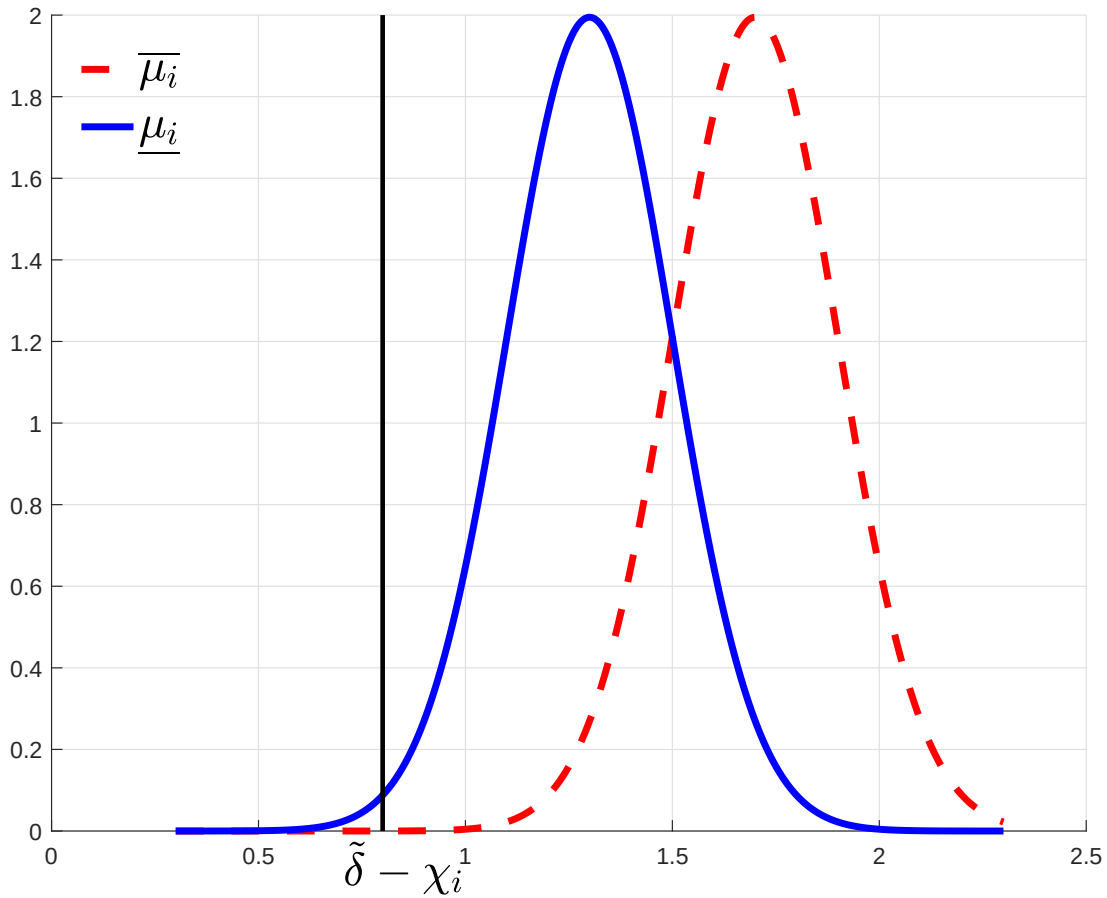
- Pro: No distributional assumptions
- Con: No complete ordering

Empirical Predictions



- Pro: Complete order
- Pro: Additional predictions
- Con: Requires distributional assumptions

Parametric predictions: $g \sim N\left(\mu_i, \sigma_i^2\right)$



- Variable house size: $\uparrow \mu \rightarrow \uparrow \mathbb{E}_i\left[g | g \geq \delta_i\right] \rightarrow \uparrow$ LTV
- Fixed house size: $\uparrow \mu \rightarrow \uparrow \left(1 - F_i\left(\delta_i\right)\right) \rightarrow \downarrow$ LTV

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- **Approach**
  - Belief shifters, as in Bailey, Cao, Kuchler, Stroebel (JPE, 2017)
  - House price experiences of geographically-distant friends affect beliefs about future house price changes
  - Orthogonal to
    - Homebuyer characteristics
    - Other factors influencing leverage decision

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- **Two steps**
  1. Survey: Friends' experiences $\Rightarrow$ beliefs
  2. Regression: Friends' experiences $\Rightarrow$ leverage

Data

- **Anonymized snapshot of Facebook Social Graph (2015)**
  - Observe number of friends in each county-location
  - On average, ~ 400 friendship links, spread over $50+$ counties
- **Belief Survey**
- **Public Records Housing Transaction Data**
  - 1.35 million housing transactions in 2,900 zip codes (33 states)
  - Property details, transaction price, mortgage information
  - Transactions from 2008 to 2014
  - Caveat: Can only match buyers for owner-occupied properties.

Summary Statistics

Constructing Belief Shifters

$$FriendHPMean_{i,t,t-24m} = \sum_{c} ShareFriends_{i,c} \times \Delta HP_{c,t,t-24m}$$

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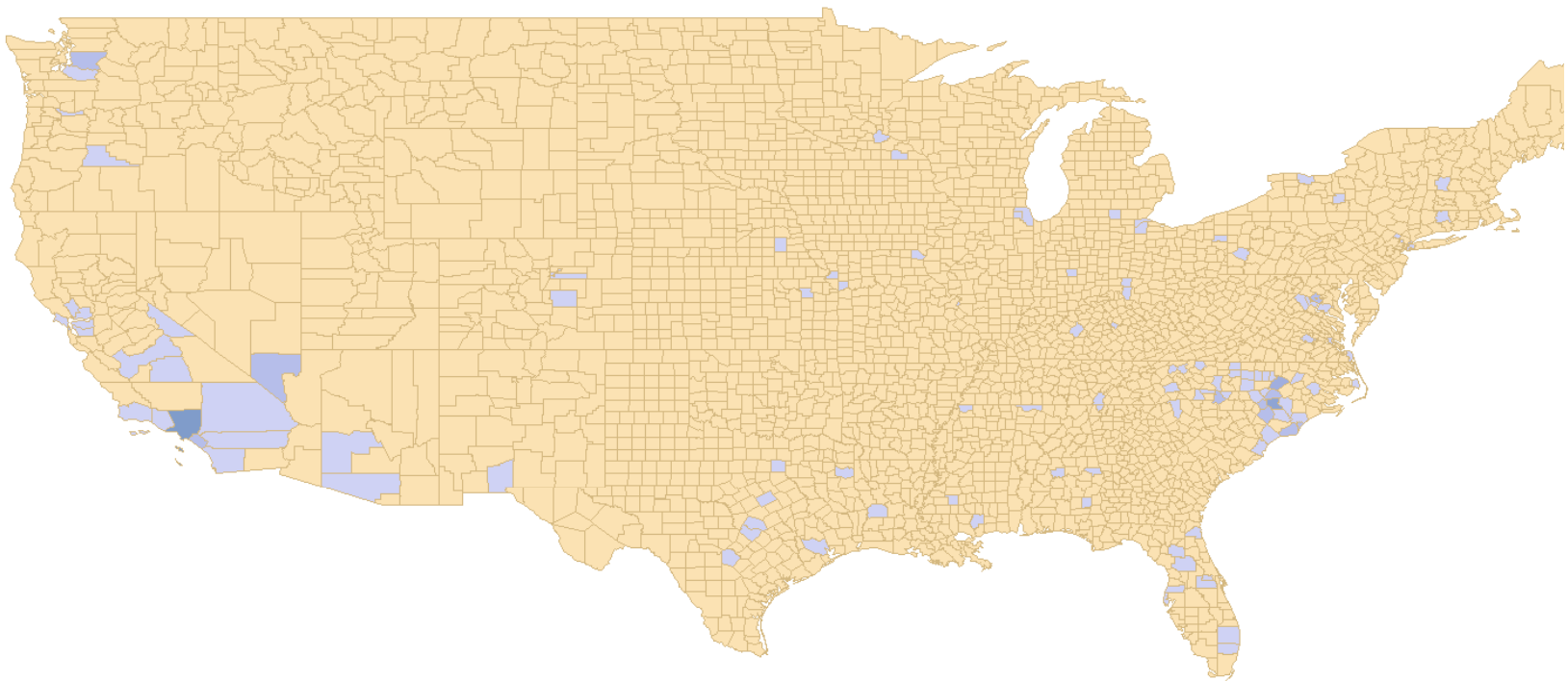

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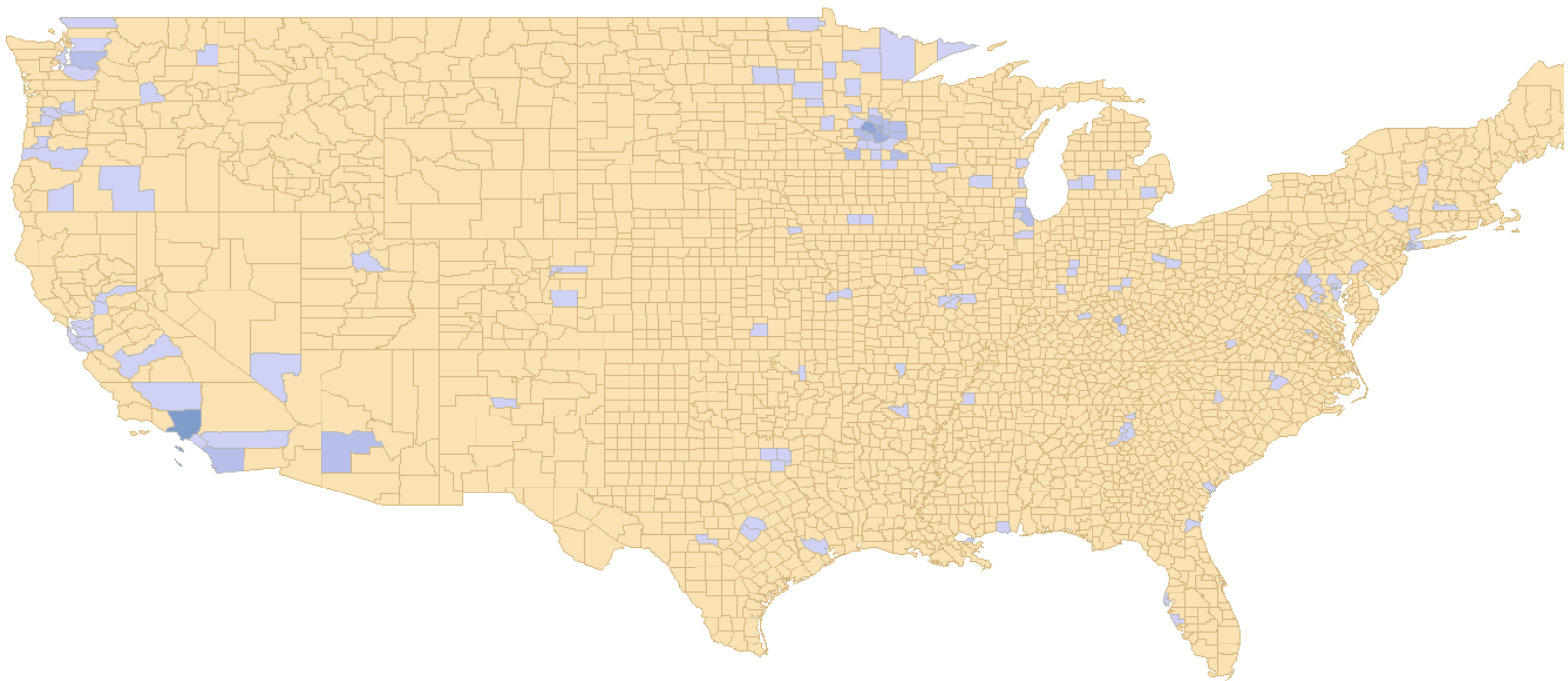

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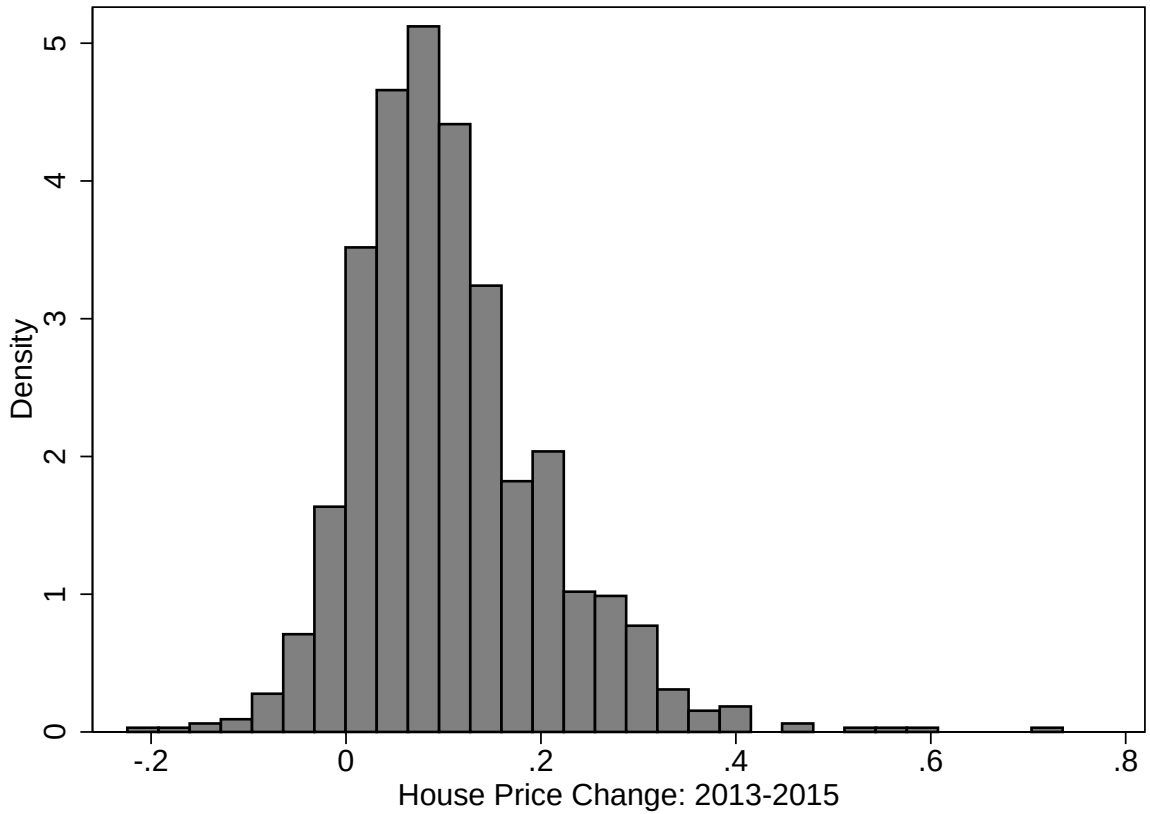

- Substantial variation in $ShareFriends_{i,c}$ and $\Delta HP_{c,t,t-24m}$

Validating Belief Shifters

- April 2017; targeted FB users through Newsfeed; 426 responses
- Focus on a few LA zip codes; representative demographics

Facebook is helping researchers understand what real people think about the economy. Your survey responses will be combined with the information that you publicly share on Facebook and average housing prices to help us better understand the housing economy. Help us out by answering the following questions, your responses will be kept anonymous:

How often do you talk to your friends about whether buying a house is a good investment?

Never — Rarely — Sometimes — Often

What would you say is the percent chance that over the next 12 months the average home price in your zip code will

0 %	increase by 12% or more
0 %	increase by 8% to 12%
0 %	increase by 4% to 8%
0 %	increase by 0% to 4%
0 %	decrease by 0% to 4%
0 %	decrease by 4% to 8%
0 %	decrease by more than 8%
0 %	**Total**

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	Dep. Var.: Mean of the Belief Dist		Dep. Var.: SD of the Belief Dist	
	(1)	(2)	(3)	(4)
Δ House Prices - Past 24 Months				
All Friends - Mean	0.326**	0.322**		-0.024
	(0.144)	(0.148)		(0.055)
All Friends - St. D		0.027	0.182**	0.184**
		(0.145)	(0.089)	(0.090)
Zip Code Fixed Effects	Y	Y	Y	Y
Demographic Controls	Y	Y	Y	Y
N	426	426	426	426

Empirical Analysis

$$CLTV_{i,t,c,l} = \alpha + \beta_1 MeanFriendHP_{i,t} + \beta_2 StDFriendHP_{i,t} + \beta_3 \mathbf{X}_{i,t} + \psi_{t,c,l} + \epsilon$$

- Controls
  - Purchase month $\times$ county $\times$ lender FE
  - Borrower characteristics: age, marital status, education, occupation, income, household size

Main Results

	(1)	(2)	(3)	(4)	(5)	(6)
Δ Friends' House Prices (24m)						
Mean	-0.087***	-0.107***	-0.136***	-0.060***	-0.144***	-0.027*
	(0.005)	(0.006)	(0.008)	(0.012)	(0.008)	(0.012)
St. D.	0.318***	0.319***	0.546***	0.276***	0.439***	-0.027
	(0.013)	(0.014)	(0.021)	(0.015)	(0.019)	(0.023)
Mean X Recourse			0.063***			
			(0.011)			
St. D. X Recourse			-0.451***			
			(0.031)			
Mean X Mean				0.0005*		
				(0.0002)		
St. D. X Mean				-0.004***		
				(0.00)		
Mean X Recovery					0.046***	
					(0.012)	
St. D. X Recovery					-0.268***	
					(0.027)	
Mean X HO-Rate						-0.103***
						(0.014)
St. D. X HO-Rate						0.463***
						(0.025)
Month x County x Lender FE	Y	Y	Y	Y	Y	Y
Demographic Controls	Y	Y, x Year	Y, x Year	Y, x Year	Y, x Year	Y, x Year

$$\uparrow 1 \text{ ppt Expected House Price Growth (12m)} \rightarrow \downarrow \frac{0.087}{0.326} = 27 \text{ bps LTV}$$

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Effect stronger in non-recourse states.

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Month x County x Lender FE	Y	Y	Y	Y	Y	Y
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Effect dampened at times of high expected house price growth.

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Effect stronger in areas with high homeownership rate.

Robustness Checks and Alternative Channels

- **Not driven by wealth through bequests effects**
  - Effect same across different networks: Employer, Family, College
- Using out-of-state friends as experiences as instruments for all friends' experiences
- Not driven by common shocks
  - Can control for income changes where friends live
  - Geographically non-clustered professions (teachers, lawyers)
- Control for friends' foreclosure rate

Ancillary Evidence

- Evidence for the mechanism
  1. NYFed Survey of Consumer Expectations
  2. Downpayment Motivation Survey
  3. Financial Advice Websites
  4. Beliefs about Default Costs
  5. Collateral Adjustment Friction

Downpayment Motivation Survey

Table: Reasons for Smaller Downpayment In Pessimistic Scenario

	Wave 1	Wave 2
Optimistic First	• Less money at risk when the chance of a decline in value increases • Less money invested in potential loss • No need to put more for a down payment if the value will drop. • If he defaults and housing prices decrease so that he cannot sell to recoup his investment, he loses less deposit if he puts less down. • Because the house MAY be worth less I would rather have cash on hand than tied up in the house	• Put down less money in case house prices go down. • Risk of losing equity with house devaluation. • Because I am anticipating that the friend may need to file for a bankruptcy and would want to be sure to be able to shield his or her equity in the property. • If the value of the home decreases substantially, he wouldn't have as much invested in the asset which is losing value, yet will still have a better interest rate than the first option.
Pessimistic First	• Cheaper rate so total cost is lower and down payment is not in jeopardy • Could be a chance he defaults on the loan in the first case to get out from under a mortgage. • If the house is not going to appreciate in value I wouldn't put too much money in	• Because if they think they are going to lose money, they shouldn't risk much. • So he would put less money/savings down on a house that could quickly decrease in value. • As long as the housing market (and his investment in the house) stays stable, he should go for the smaller monthly payments he'd have with the smaller interest rate.

Financial Advice Websites

- From Barron's #1 ranked financial adviser

  Have you noticed that your home is worth much more than it was 10 years ago?

  You might be worried that your home's value will fall. If you're afraid that your home's value might decline, you should sell the house before that happens.

  But you don't want to do that! It's your home, after all. You have roots in the community. Uproot the kids? And where would you move? No, selling is not a practical idea.

  Still, you fret that your home's equity is at risk. Can you protect it without having to sell? Yes! Simply get a new mortgage, and pull the equity out of the house. It's the same thing as selling, except that you don't have to sell!

Conclusion

- **Theoretically**
  - Effects of "optimism" on leverage choice are ambiguous
  - Housing dual role as consumption and investment good
  - Key: willingness of households to adjust property size based on investment considerations

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- **Note**: County-level social network data available to share with other researchers
  - "Measuring Social Connectedness"

LTV schedule

- LTV schedule

$$\Lambda(\delta_i) = \frac{\kappa \int_{\underline{g}}^{\delta_i - \chi_i} g dF_L(g) + \delta_i \int_{\delta_i - \chi_i}^{\overline{g}} dF_L(g)}{1 + r}$$

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Summary Statistics

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	Mean	Standard Deviation	P10	P50	P90
Purchase Characteristics					
Transaction price (k$)	302.3	237.8	125	225	550
Combined Loan-to-Value (CLTV) Ratio	88.5%	16.9%	69.2%	94.7%	100.0%
Network Statistics					
Number of Friends	353.9	408.3	63	241	733
Number of Out-of-Commuting Zone Friends	194.3	272.6	27	114	427
Number of Out-of-State Friends	155.7	241.3	19	83	351
Number of Counties with Friends	74.7	65.5	19	59	144
Neighborhood Statistics					
Homeownership Rate	74.3%	11.7%	58.7%	76.7%	87.2%
Recourse	0.54	0	0	1	1
Δ Friends' House Prices (24m)					
Mean - All Friends	-6.4%	13.3%	-22.6%	-7.7%	12.1%
Mean - Out-of-Commuting Zone Friends	-5.3%	10.3%	-16.3%	-7.4%	10.2%
St.Dev. - All Friends	8.0%	3.3%	4.2%	7.5%	12.5%
St.Dev. - Out-of-Commuting Zone Friends	9.0%	3.1%	5.1%	8.8%	13.2%
Other Friend Experiences					
Δ Friends' County Income (24m) - Mean	3.1%	6.5%	-4.4%	1.7%	11.3%
Δ Friends' County Income (24m) - St.Dev.	5.7%	3.3%	2.8%	5.0%	9.3%
Friends' Foreclosure Rate (24m, Share of Units) - Mean	3.7%	2.3%	1.1%	3.2%	7.1%
Friends' Foreclosure Rate (24m, Share of Units) - St.Dev	2.0%	0.9%	0.9%	1.9%	3.2%
Property Characteristics					
Home Size (sqft)	2,032	12,766	1,056	1,730	3,077
Lot Size (sqft)	12,033	12,549	2,500	7,500	25,000
Property Age (years)	29.0	24.0	3.0	23.0	62.0
SFR	0.82	0	0	1	1
Has Pool	0.19	0	0	0	1
Buyer Characteristics					
Age at Transaction (years)	37.7	12.7	24	35	56
Has Max High School Degree in 2010	0.64	0.48	0	1	1
Has Max College Degree in 2010	0.26	0.44	0	0	1
Has Max Graduate Degree in 2010	0.10	0.30	0	0	0
Income in 2010 ($)	82,116	49,413	25,000	62,500	175,000
Married in 2010	0.41	0.49	0	0	1
Household Size in 2010	2.55	1.51	1	2	5