

# **Learning about Housing Cost**

**Survey Evidence from the German House Price Boom**

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joint with

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Central Bank of Ireland, December 2019

# Motivation

- ▶ How are expectations formed in housing booms?
- ▶ Many theories of housing booms,  
but we don't have much micro/survey data on booms!

# This paper

- ▶ Study German house price boom 2010–now
- ▶ Rich new data
  - ▶ survey expectations
  - ▶ household characteristics and choices
  - ▶ regional disaggregation
- ▶ Stylized facts on expectations:
  - ▶ forecasts lower than realized price growth
  - ▶ forecasts in line with local housing market conditions
  - ▶ cross section of forecasts: only region & tenure matter
  - ▶ renters always expect higher price growth than owners!

# An explanation: learning about housing cost

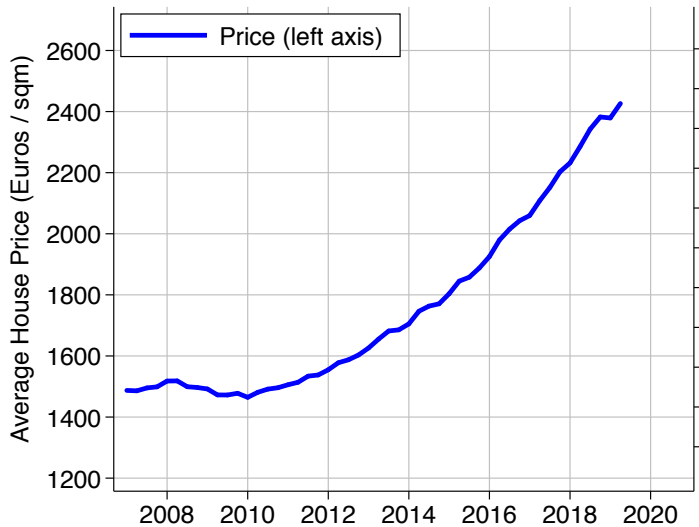
- ▶ Special feature of housing as an asset
  - ▶ non-owners (= renters) pay rent, talk to renter neighbors  
→ receive cheap signals of dividend
  - ▶ owners consume dividend directly, as do owner neighbors  
→ need not know dividend
- ▶ Model of asset valuation & learning from prices
  - ▶ renters better informed about rents than owners  
→ booms with renters who expect higher price growth
- ▶ Direct evidence on learning mechanism
  - ▶ new data on rent forecasts and long-term expectations
  - ▶ signals about housing markets are cheap
  - ▶ renters look more to rents, owners more to prices

## **Stylized Facts**

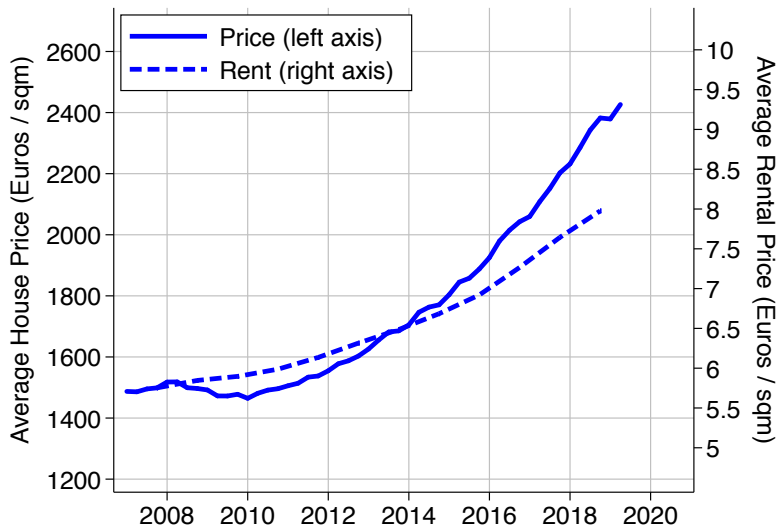
# Primary data sources

- ▶ We merge three data sources
- ▶ Panel on Household Finances (PHF)
  - ▶ Detailed data on household characteristics and portfolios
  - ▶ Asks households to make forecasts of future prices
  - ▶ House price expectations in 2014 and 2017
- ▶ Online Survey of Consumer Expectations (SCE)
  - ▶ House price and rent expectations 2019
- ▶ House price data
  - ▶ bulwiengesa AG / destatis / vdp
  - ▶ data on sqm house prices and rents (transaction prices)
  - ▶ on detailed regional level (Kreise/counties)

# The German house price boom



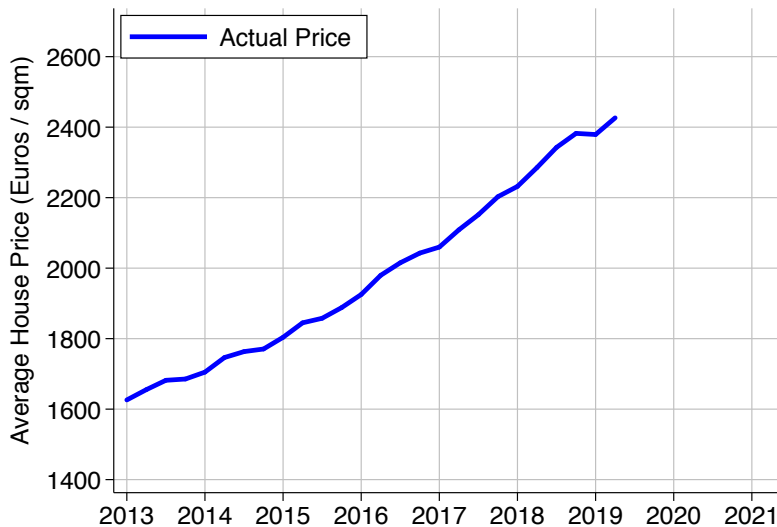
# The German house price boom



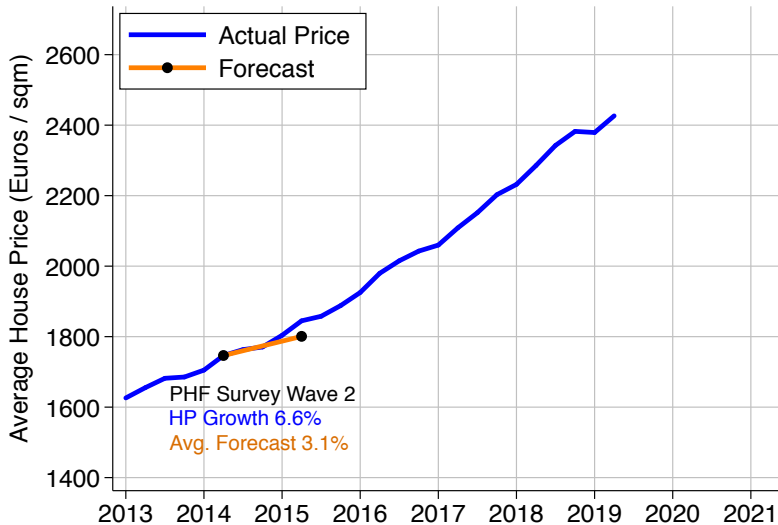
► Rents grow before prices



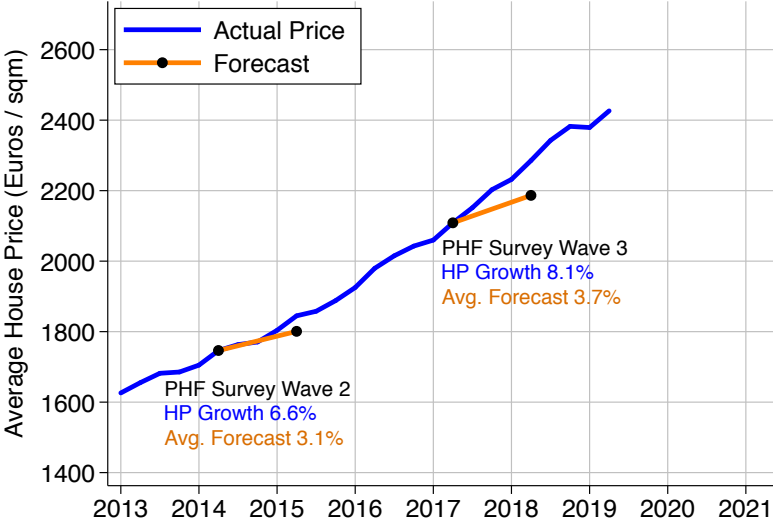
# Prices and forecasts



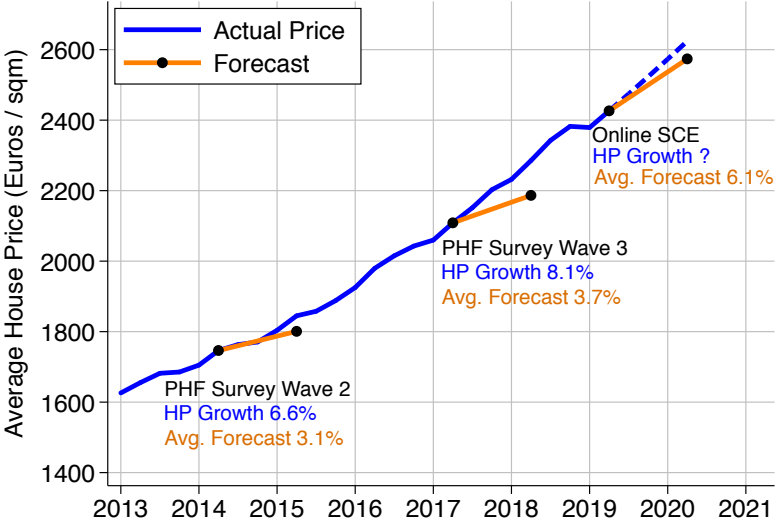
# Prices and forecasts



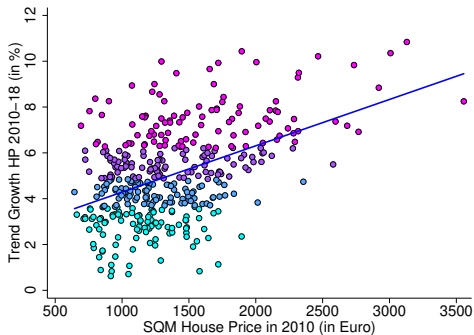
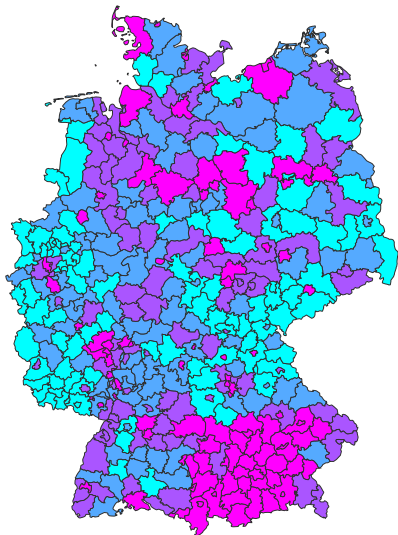
# Prices and forecasts



# Prices and forecasts



# Regional heterogeneity (growth regions)



 low growth     medium low growth     medium high growth     high growth

Details

# What predicts house price forecasts?

1. Demographics, wealth and income:
  - ▶ Age, household composition
  - ▶ Wealth and income quartiles
2. Behavioral traits:
  - ▶ Financial literacy, risk aversion, patience
3. Tenure:
  - ▶ Being an owner or a renter
4. Regional and housing characteristics:
  - ▶ Local house price growth
  - ▶ City center vs. outskirts, house size

# Predicting house price forecasts

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## **Demogr., Inc., Wealth**

Age Group 40–49

5+ HH members

Wealth Q3

Wealth Q4

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## **Behavioral Traits**

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### **Tenure**

Renter

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### **Growth Region**

Medium Low

Medium High

High

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### **Housing and Regional**

Sqm size/100

$(\text{Sqm size}/100)^2$

---

Number of Cases

R-Square

---

# Predicting house price forecasts

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## Demogr., Inc., Wealth

Age Group 40–49	-1.348**
5+ HH members	-0.436
Wealth Q3	-1.830***
Wealth Q4	-1.569**

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## Behavioral Traits

---

### Tenure

Renter

---

### Growth Region

Medium Low  
Medium High  
High

---

### Housing and Regional

Sqm size/100  
(Sqm size/100)<sup>2</sup>

---

Number of Cases	3647
R-Square	0.037

---



# Predicting house price forecasts

---

<b>Demogr., Inc., Wealth</b>		
Age Group 40–49	-1.348**	-1.348**
5+ HH members	-0.436	-0.388
Wealth Q3	-1.830***	-1.840***
Wealth Q4	-1.569**	-1.545

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<b>Behavioral Traits</b>	yes	
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<b>Tenure</b>		
Renter		

---

<b>Growth Region</b>		
Medium Low		
Medium High		
High		

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<b>Housing and Regional</b>		
Sqm size/100		
(Sqm size/100) <sup>2</sup>		

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Number of Cases	3647	3647
R-Square	0.037	0.041

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# Predicting house price forecasts

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<b>Demogr., Inc., Wealth</b>			
Age Group 40–49	-1.348**	-1.348**	-0.898
5+ HH members	-0.436	-0.388	0.317
Wealth Q3	-1.830***	-1.840***	-0.022
Wealth Q4	-1.569**	-1.545	0.517

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<b>Behavioral Traits</b>	yes	yes	
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<b>Tenure</b>			
Renter			2.488***

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<b>Growth Region</b>			
Medium Low			
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Sqm size/100			
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Number of Cases	3647	3647	3647
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# Predicting house price forecasts

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<b>Demogr., Inc., Wealth</b>				
Age Group 40–49	-1.348**	-1.348**	-0.898	-0.773
5+ HH members	-0.436	-0.388	0.317	0.679**
Wealth Q3	-1.830***	-1.840***	-0.022	0.064
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<b>Behavioral Traits</b>		yes	yes	yes
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<b>Tenure</b>				
Renter			2.488***	2.372***

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<b>Growth Region</b>				
Medium Low				0.826***
Medium High				1.795***
High				3.631***

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<b>Housing and Regional</b>				
Sqm size/100				
(Sqm size/100) <sup>2</sup>				

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Number of Cases	3647	3647	3647	3647
R-Square	0.037	0.041	0.064	0.121

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# Predicting house price forecasts

<b>Demogr., Inc., Wealth</b>					
Age Group 40–49	-1.348**	-1.348**	-0.898	-0.773	-0.454
5+ HH members	-0.436	-0.388	0.317	0.679**	1.245**
Wealth Q3	-1.830***	-1.840***	-0.022	0.064	0.390
Wealth Q4	-1.569**	-1.545	0.517	0.213	0.486
<b>Behavioral Traits</b>		yes	yes	yes	yes
<b>Tenure</b>					
Renter			2.488***	2.372***	2.071***
<b>Growth Region</b>					
Medium Low				0.826***	0.685**
Medium High				1.795***	1.309***
High				3.631***	2.903***
<b>Housing and Regional</b>					
Sqm size/100					-1.801**
(Sqm size/100) <sup>2</sup>					0.469***
Number of Cases	3647	3647	3647	3647	3598
R-Square	0.037	0.041	0.064	0.121	0.145

# Predicting house price forecasts

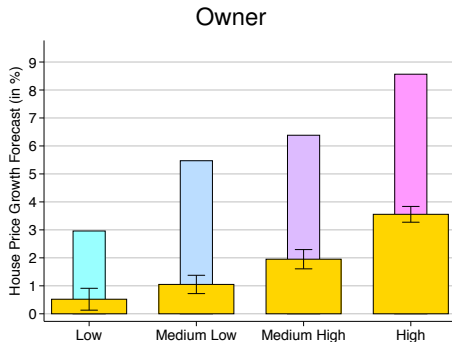
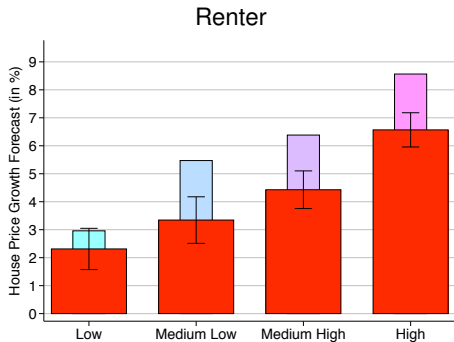
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## Stylized fact

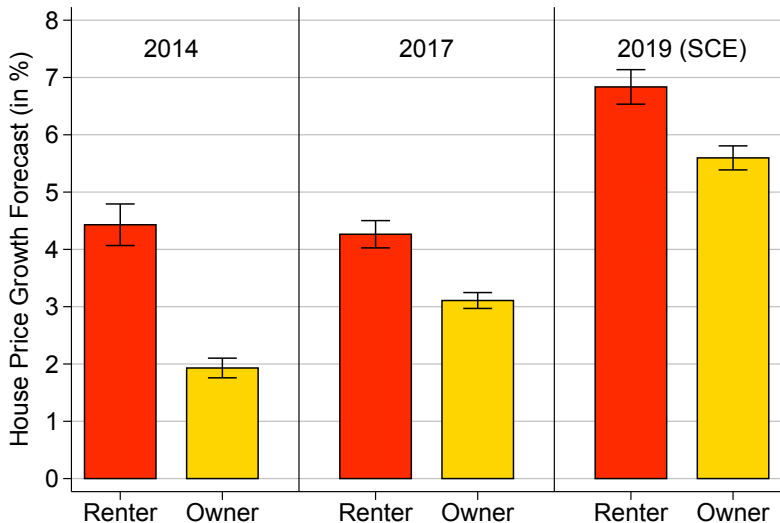
- ▶ Central determinants of house price forecasts
  - ▶ tenure
  - ▶ local house price growth

# Stylized fact

- ▶ Central determinants of house price forecasts
  - ▶ tenure
  - ▶ local house price growth



## Difference persists over time



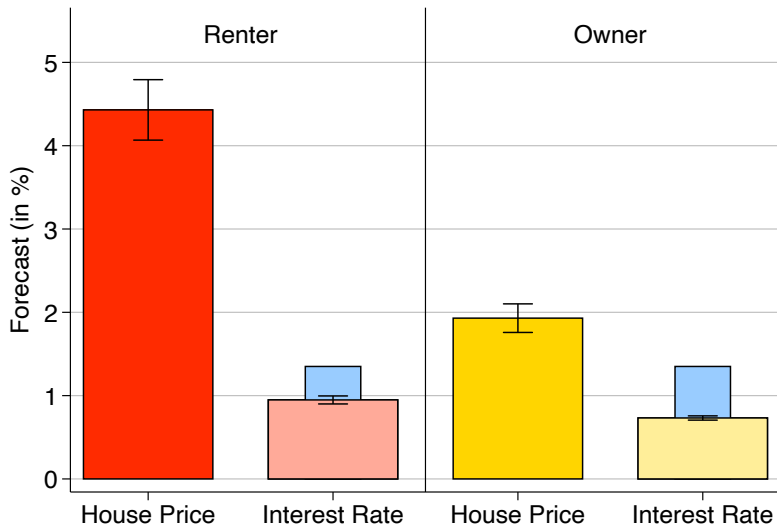


## Potential Stories

# Potential Stories

1. Respondents report risk-neutral forecasts
2. Respondents report what they fear
3. Respondents learn about prices from what they observe

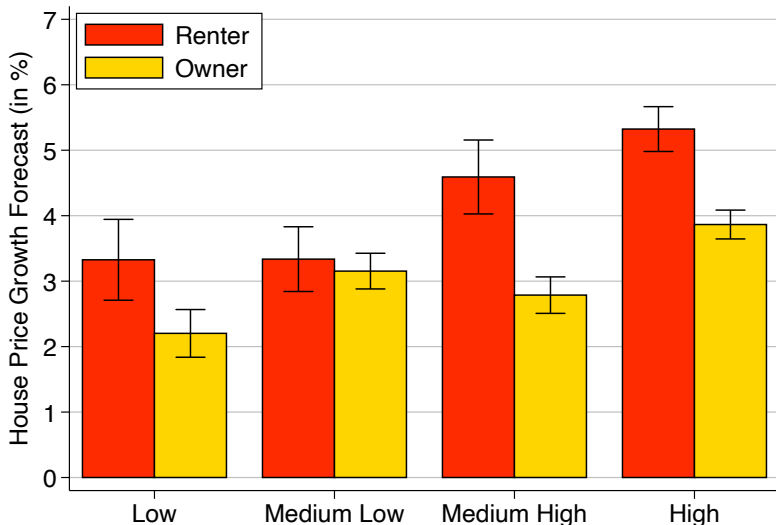
# Risk-Neutral Forecasts



► see also Adam/Matveev/Nagel (WP, 2019) for stock prices

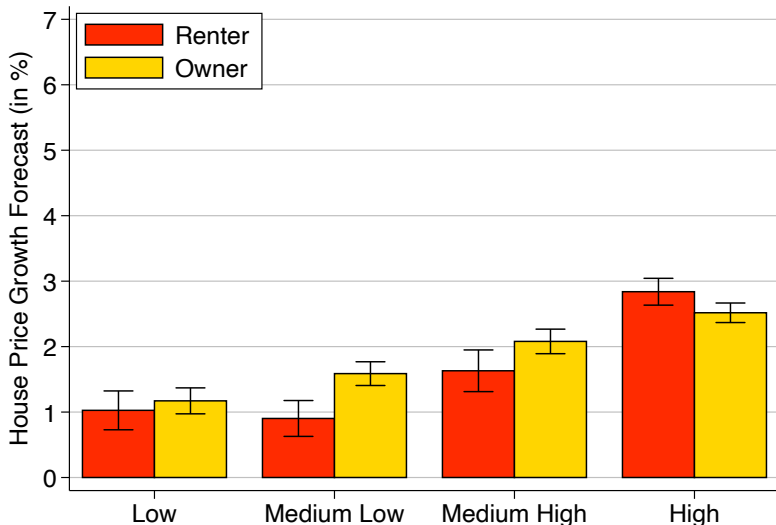
# Fear Hypothesis

Wave 3 forecasts of regional house price growth



# Fear Hypothesis

Wave 3 forecasts of **primary residence** price growth



# **A Model of Learning About Housing Cost**

# Prices, rents & forecasts: a simple framework

## ▶ Developers

- ▶ active in both house and rental markets
- ▶ value houses at price  $P_t =$  present value of rents  $R_t$ :

$$P_t = E_t [M_{t+1} (P_{t+1} + R_{t+1})]$$

- ▶ stochastic discount factor  $M_{t+1}$   
→ may capture financial frictions faced by developers

## ▶ Two types of households

- ▶ renters observe (histories of) both rent & price (for now)
- ▶ owners observe only price

## ▶ In equilibrium

- ▶ pricing equation of developer holds
- ▶ evaluate equation using info set of renters and owners

# Functional forms

- ▶ Valuation equation of developer

$$P_t = E_t [M_{t+1} (P_{t+1} + R_{t+1})]$$

- ▶ Rewrite with  $V_t = P_t/R_t$  and  $G_t = R_t/R_{t-1}$

$$V_t = E_t [M_{t+1} (V_{t+1} + 1) G_{t+1}]$$

- ▶ Price dynamics

- ▶ mean-reverting log price/rent:  $v_{t+1} = (1 - \alpha)\bar{v} + \alpha v_t + \epsilon_{t+1}^v$
- ▶ iid log rent growth:  $g_{t+1} = \log G_{t+1} = \bar{g} + \epsilon_{t+1}^g$
- ▶ orthogonal normally distributed shocks  $\epsilon_{t+1}^v, \epsilon_{t+1}^g$

→ log price  $p_t = \log P_t = v_t + r_t$

= mean-reverting + permanent component



# When do renters make higher price forecasts?

- ▶ Household forecasts of log price  $p_t = v_t + r_t$

- ▶ renter knows price & rent, hence also  $v_t$ :

$$E_t[p_{t+1}] = (1 - \alpha) \bar{v} + \alpha v_t + r_t + \bar{g}$$

- ▶ owner relies only on price history

$$E_t[p_{t+1}] = E_{t-1}[p_t] + \kappa (v_t + r_t - E_{t-1}[p_t]) + \bar{g}$$

- ▶ owner compromises, adjusts by  $\kappa \in (\alpha, 1)$

- ▶ Positive shock to rents

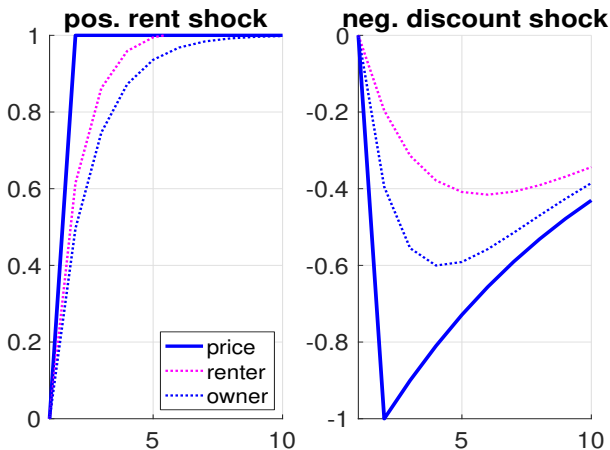
- ▶ renter responds 1-1, owner underreacts since  $\kappa < 1$
  - ▶ renter has higher forecast, owner gradually catches up

- ▶ Negative shock to price-rent ratio

- ▶ renter responds by  $\alpha$ , owner overreacts since  $\kappa > \alpha$
  - ▶ again renter has higher forecast in "boom" as price recovers

# Impulse responses

- Generalize by adding noise to observation of rents, prices  
Everybody observes rents & prices, but with different precision



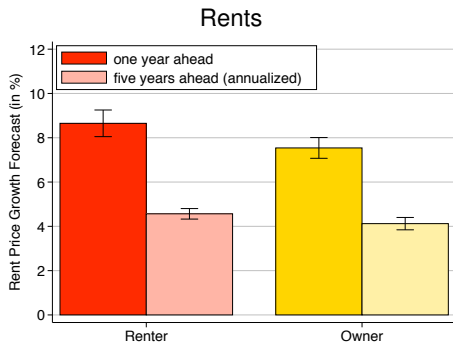
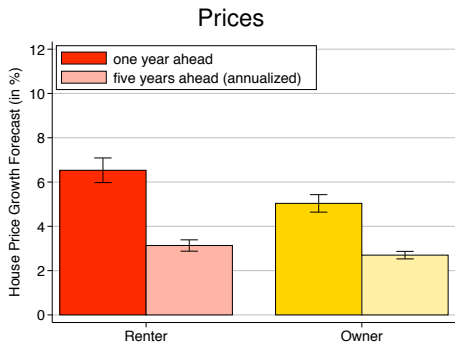
## **Direct Evidence for Modeling Assumptions**

# Direct evidence for modeling assumptions

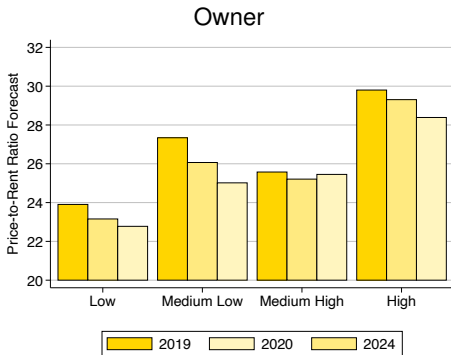
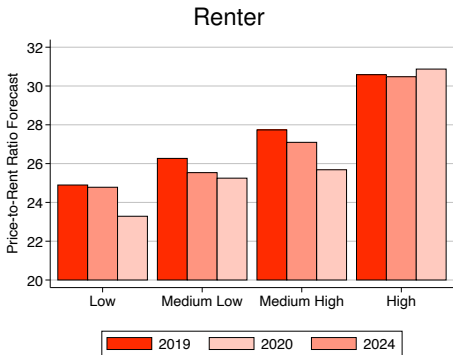
1. New data on rent forecasts and long-term expectations
  - ▶ Strong mean reversion in 5yr ahead forecasts
  - ▶ Reversion in price-to-rent ratio forecasts
  - ▶ Strong correlation between rent and price forecasts
2. Signals about housing markets are cheap
  - ▶ Do non-owners of assets have opinion about future price?
    - ▶ Yes for housing, no for stocks
  - ▶ Owners are aware of past price movements
3. Survey evidence on households' information sources
  - ▶ Renters look more to rents, owners more to prices
  - ▶ Quality of forecasts independent of incentives

# Rent Forecasts and Long-Term Expectations

# House price and rent growth forecasts in 2019



# Price-to-Rent Ratios



# Factor Analysis

## First principal component factor loadings

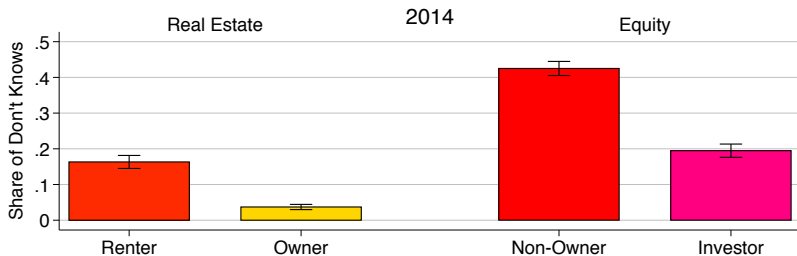
	Full Sample	Renter	Owner
HP growth 1yr	0.7536	0.6790	0.7956
RP growth 1yr	0.7176	0.7586	0.6944
HP growth 5yr	0.7690	0.7438	0.8008
RP growth 5yr	0.6523	0.7873	0.5753
Variance explained	0.5250	0.5524	0.5218
Eigenvalue	2.0998	2.2095	2.0874

- ▶ High correlation between all forecasts
- ▶ Suggests that there is **one common underlying component**

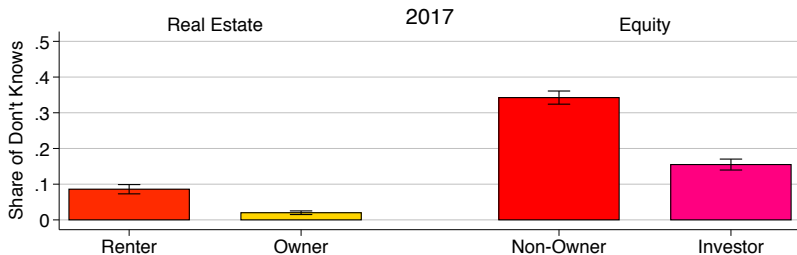
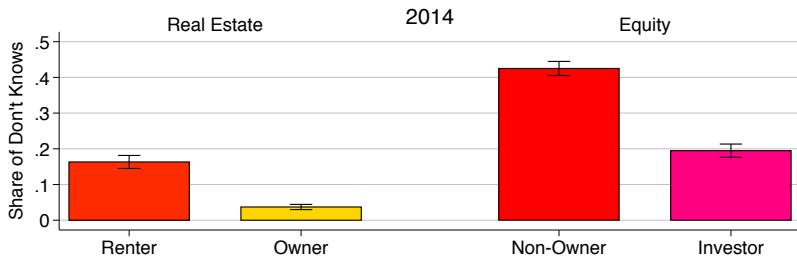


Signals About Housing Markets are Cheap

# Households who "Don't Know" about house prices



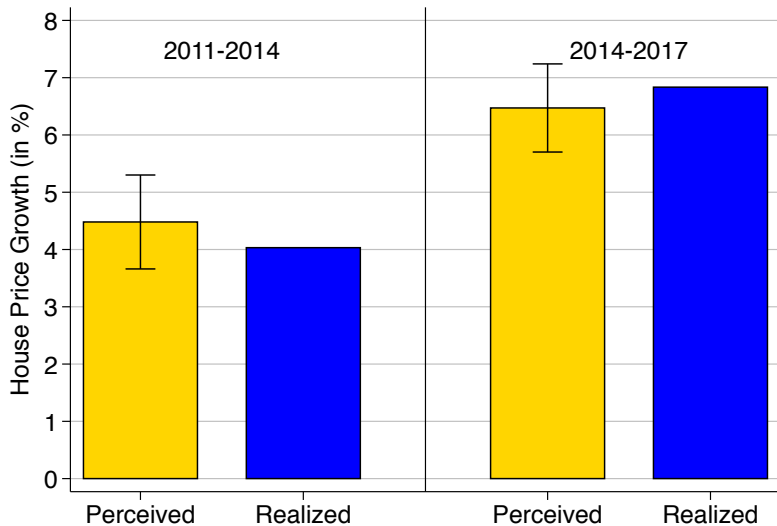
# Households who "Don't Know" about house prices



# Price perceptions of owners

- ▶ Exploit panel dimension of the PHF
- ▶ Evaluate how homeowners quantify **value of their house**
- ▶ Number of panel homeowners
  - ▶ 1,043 from 2010 to 2014
  - ▶ 1,620 from 2014 to 2017
- ▶ Calculate **perceived price growth**
- ▶ Contrast with **realized price growth**

## Owners know what is going on



Renters Look More to Rents,  
Owners More to Prices

# Information sources

- ▶ Online Survey of Consumer Expectations (2019)
- ▶ *"How important are each of the following sources of information for you to evaluate future house prices?"*
  - ▶ Direct observations of rents in your neighborhood
  - ▶ Direct observations of house prices in your neighborhood
  - ▶ Online real estate platforms
  - ▶ Financial Consultants
  - ▶ Relatives, Friends and Neighbors
  - ▶ Classical Media (newspapers, tv, etc.)
  - ▶ Social Media (like Facebook and Twitter)

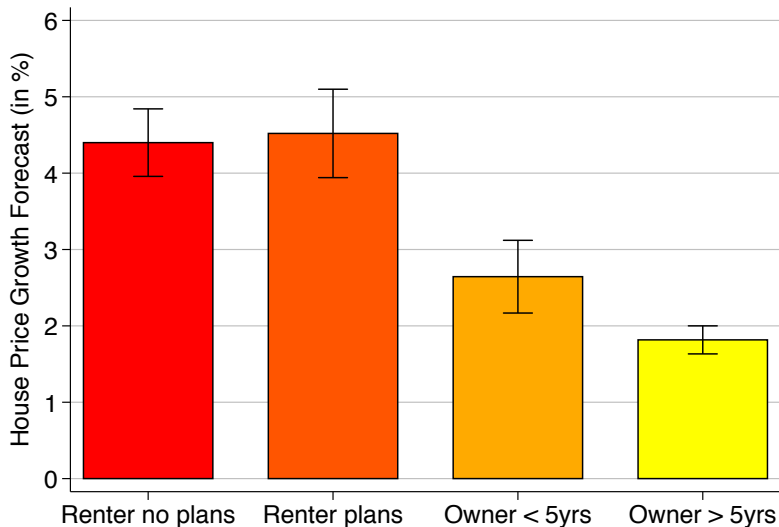
## Information sources

Source	Renters	Owners	Difference
Direct obs. rents	71.9	69.5	-2.45**
Direct obs. prices	65.9	69.9	3.99***
Classical Media	60.3	60.4	0.12
Online Real Estate Portals	57.9	55.4	-2.47**
Friends	52.7	48.1	-4.68***
Financial Advisors	44.7	45.6	0.90
Social Media	23.8	21.0	-2.77***

- ▶ Primary source of information is price observations
- ▶ Owners look more to house prices
- ▶ Renters more to rents, online and through social channels



# Forecasts and incentives



## **Conclusion**

# Summary

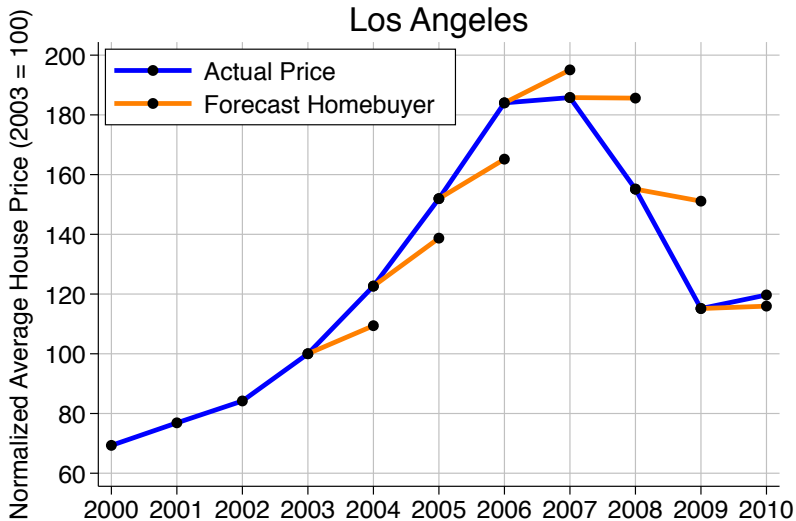
- ▶ New mechanism for German boom:
  - ▶ Learning about housing cost
- ▶ Stylized facts on expectations:
  - ▶ forecasts lower than realized price growth
  - ▶ forecasts in line with local housing market conditions
  - ▶ cross section of forecasts: only region & tenure matter
  - ▶ renters have higher price forecasts than owners!
- ▶ “Standard” learning model explains stylized facts

# Summary: Direct evidence for learning mechanism

1. New data on rent forecasts and long-term expectations
  - ▶ Strong mean reversion in 5yr ahead forecasts
  - ▶ Reversion in price-to-rent ratio forecasts
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2. Signals about housing markets are cheap
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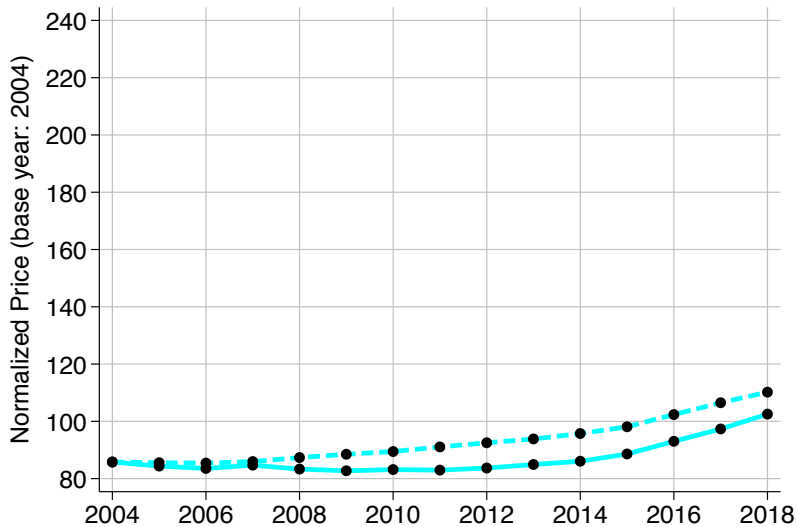
# Appendix

# Expectations of Homebuyers

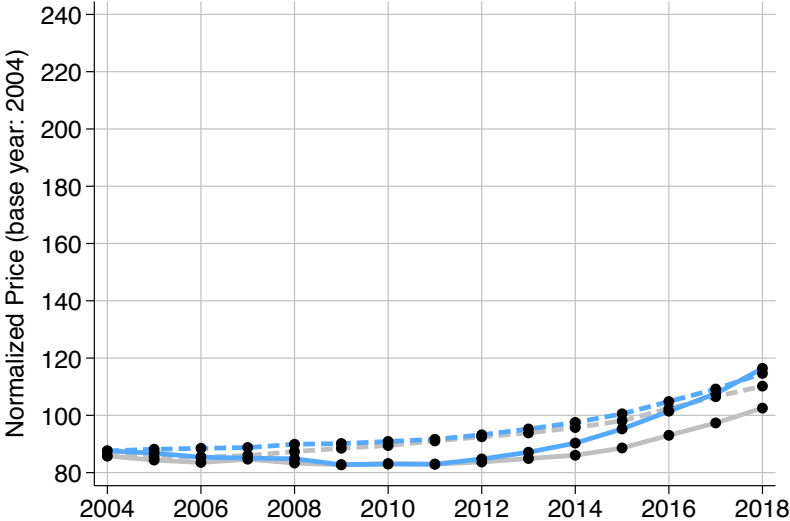


Source: Case-Shiller-Thompson (Brookings Papers, 2012)

## Regional Heterogeneity (Growth Regions)

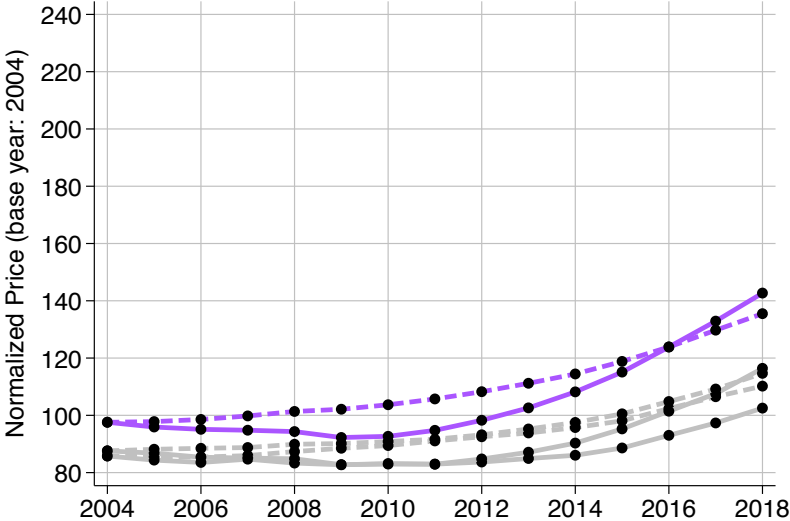


# Regional Heterogeneity (Growth Regions)

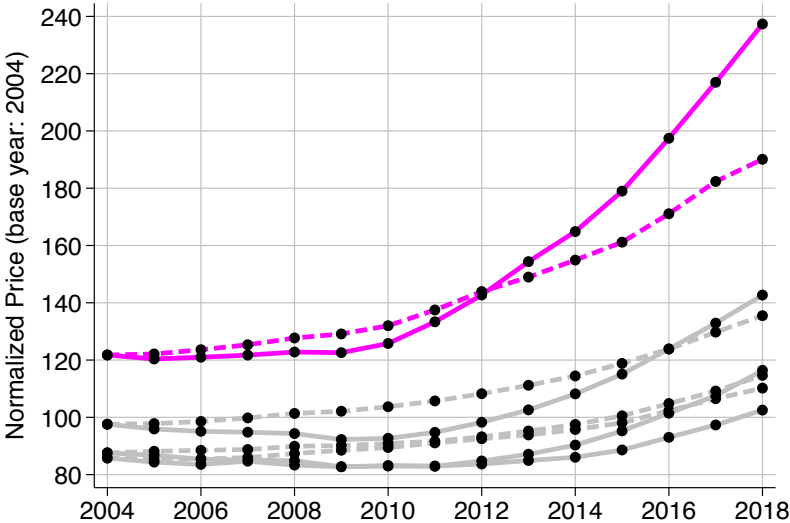




# Regional Heterogeneity (Growth Regions)



# Regional Heterogeneity (Growth Regions)



# Additional Details and Robustness

- ▶ Forecasts by growth region over time
- ▶ Reweighting and Aggregation
- ▶ Extreme observations

[Details](#)

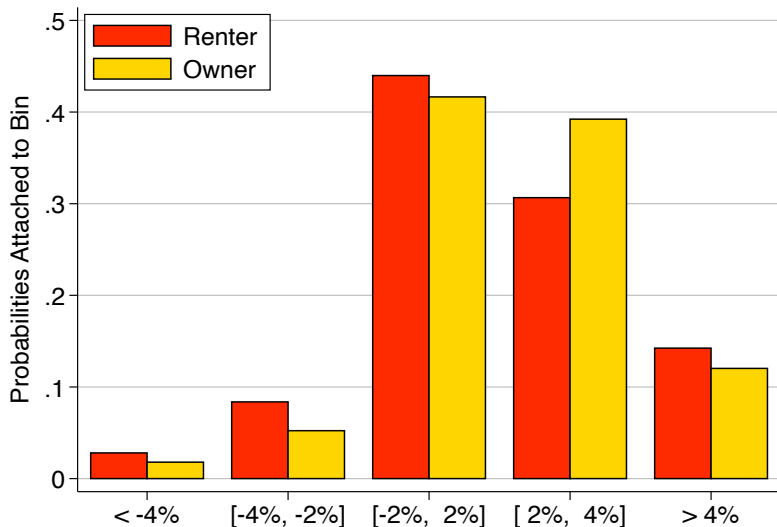
[Details](#)

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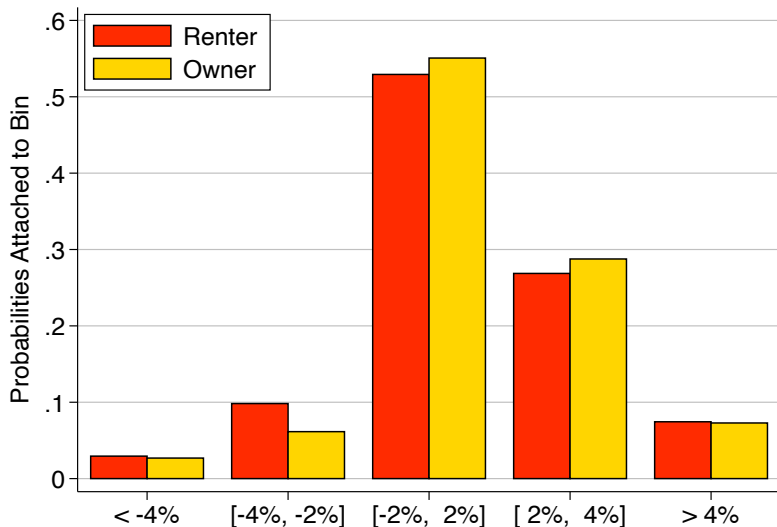
## Details on Fear Hypothesis

- ▶ Wave 3 question on own house price expectations:
  - ▶ less than -4% growth
  - ▶ between -4% and -2% growth
  - ▶ between -2% and 2% growth
  - ▶ between 2% and 4% growth
  - ▶ more than 4% growth
- ▶ Households can assign 10 points to indicate probabilities
- ▶ We use conditional means from point forecasts for coding

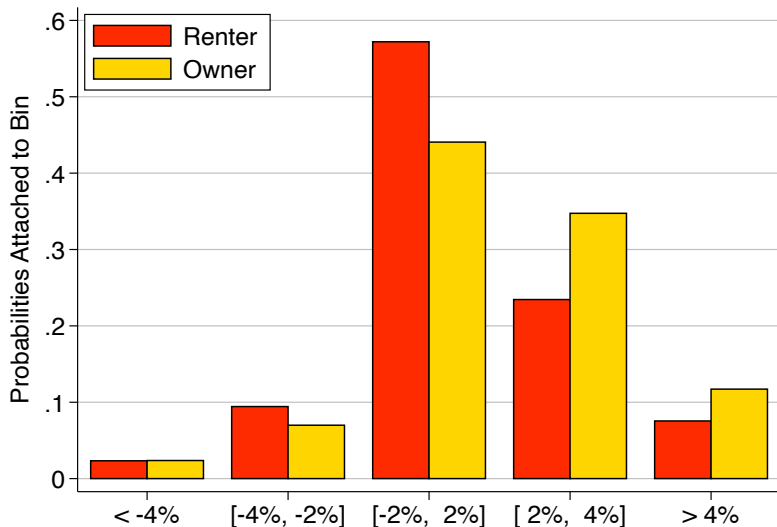
## Bin Distribution for Whole Sample



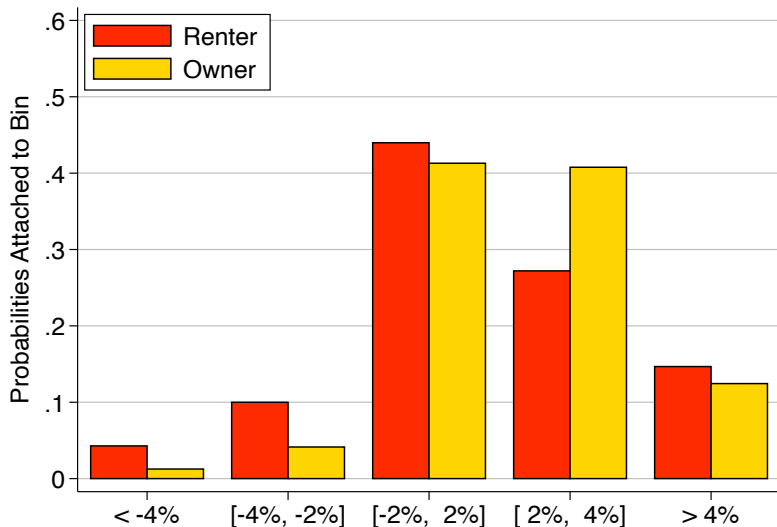
## Bin Distribution: Low Growth Region



## Bin Distribution: Medium Low Growth Region

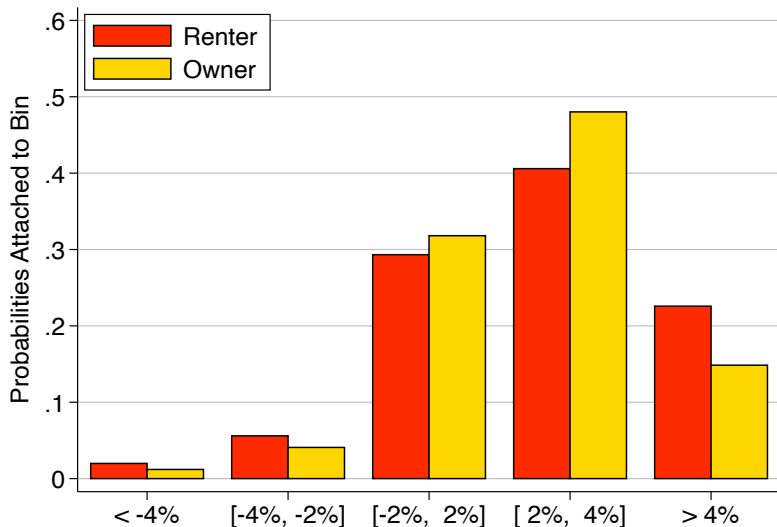


## Bin Distribution: Medium High Growth Region





## Bin Distribution: High Growth Region

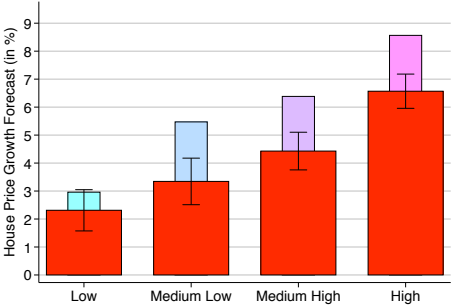


## Details on Fear Hypothesis

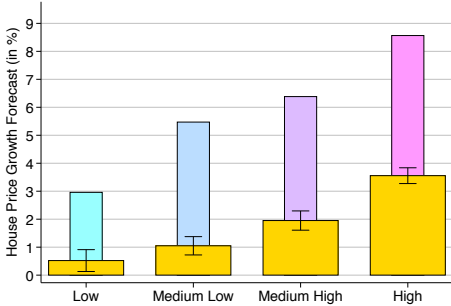
- ▶ Wave 3 question on own house price expectations:
  - ▶ less than -4% growth
  - ▶ between -4% and -2% growth
  - ▶ between -2% and 2% growth
  - ▶ between 2% and 4% growth
  - ▶ more than 4% growth
- ▶ Households can assign 10 points to indicate probabilities
- ▶ We use conditional means from point forecasts for coding

# Forecasts By Growth Region Over Time (2014)

## Renter

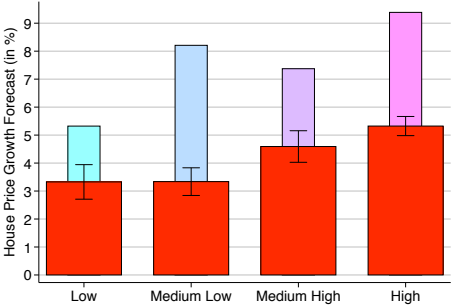


## Owner

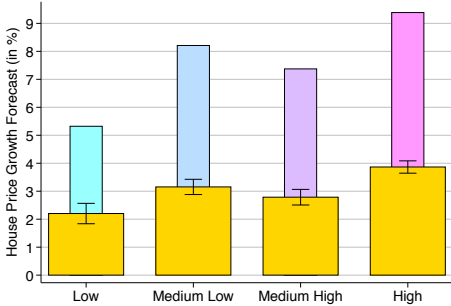


# Forecasts By Growth Region Over Time (2017)

### Renter

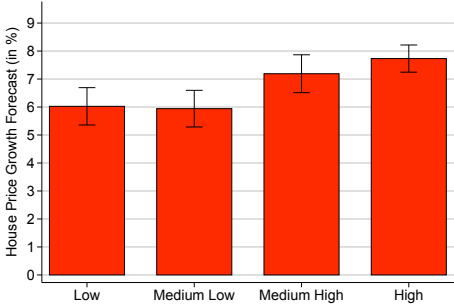


### Owner

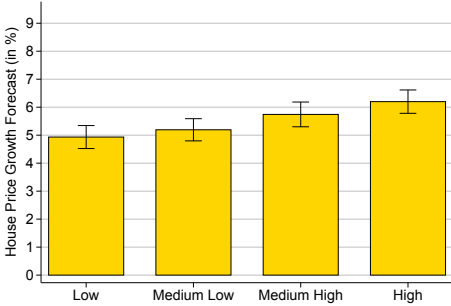


# Forecasts By Growth Region Over Time (2019)

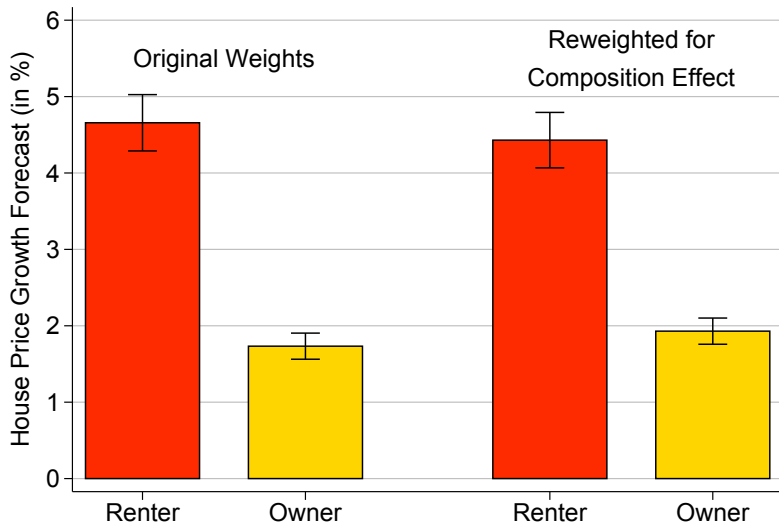
### Renter



### Owner



## Aggregation Across Tenure Types

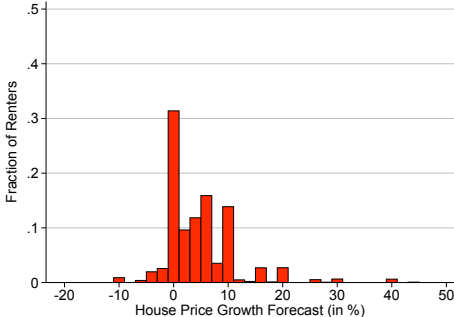


## Aggregation Across Tenure Types

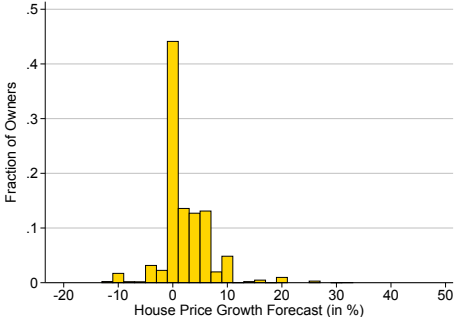
Growth Region	<i>Original Weights</i>		Total	<i>Reweighted for Composition Effect</i>	
	Renter	Owner		Renter	Owner
Low Growth	17.45	21.14	19.23	19.23	19.23
Medium Low Growth	20.44	28.92	24.51	24.51	24.51
Medium High Growth	24.90	28.79	26.77	26.77	26.77
High Growth	37.21	21.15	29.49	29.49	29.49
Sample Share	51.95	48.05	100.00	51.95	48.05

# Extreme Observations?

### Renter



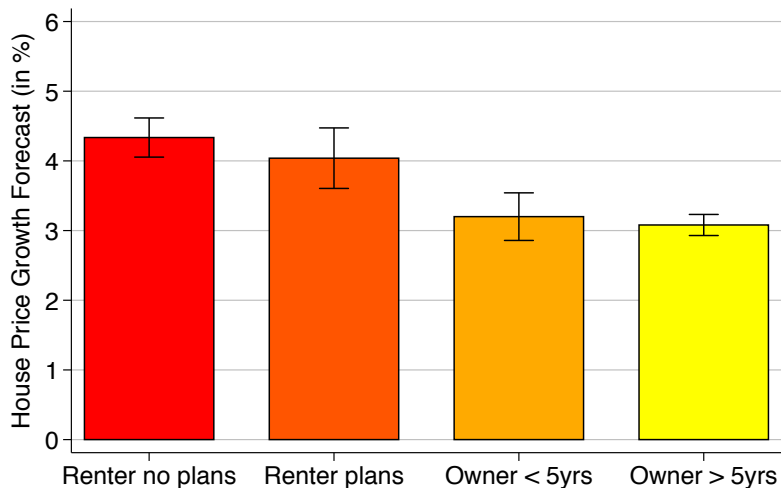
### Owner



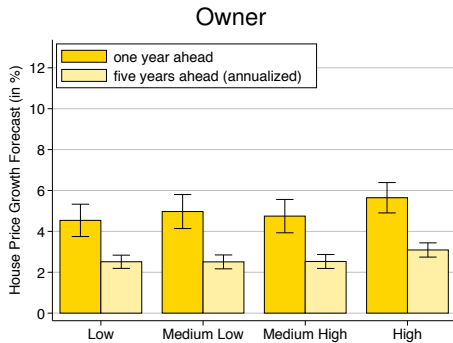
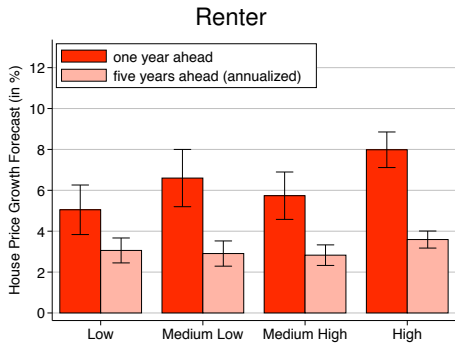


# Forecasts and incentives

2017

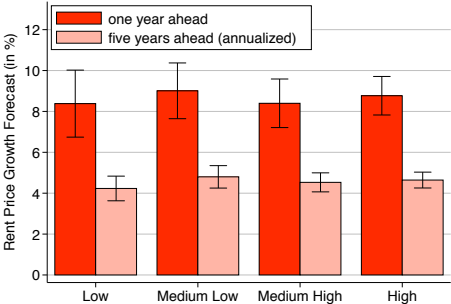


# House Price Growth Forecasts in 2019

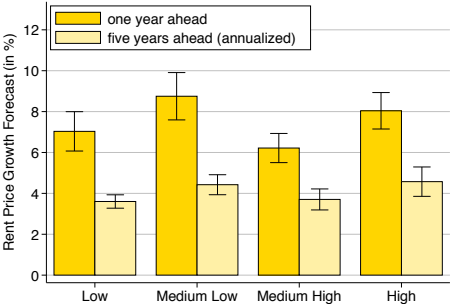


# Rent Price Growth Forecasts in 2019

### Renter



### Owner



# Factor Analysis: Low Growth Region

## First principal component factor loadings

	Full Sample	Renter	Owner
HP growth 1yr	0.7316	0.7329	0.7348
RP growth 1yr	0.8031	0.8364	0.7829
HP growth 5yr	0.7841	0.7350	0.8098
RP growth 5yr	0.8004	0.8426	0.7722
Variance explained	0.6089	0.6218	0.6012
Eigenvalue	2.4357	2.4871	2.4049

# Factor Analysis: Medium Low Growth Region

## First principal component factor loadings

	Full Sample	Renter	Owner
HP growth 1yr	0.7746	0.6637	0.7888
RP growth 1yr	0.6593	0.7163	0.6841
HP growth 5yr	0.8014	0.7350	0.7995
RP growth 5yr	0.6122	0.7487	0.5916
Variance explained	0.5129	0.5524	0.5218
Eigenvalue	2.0517	2.0544	2.0793

# Factor Analysis: Medium High Growth Region

## First principal component factor loadings

	Full Sample	Renter	Owner
HP growth 1yr	0.7376	0.6346	0.8181
RP growth 1yr	0.7205	0.8113	0.6408
HP growth 5yr	0.7208	0.6203	0.8193
RP growth 5yr	0.6590	0.7876	0.5866
Variance explained	0.5042	0.5165	0.5238
Eigenvalue	2.0169	2.0660	2.0952

# Factor Analysis: High Growth Region

## First principal component factor loadings

	Full Sample	Renter	Owner
HP growth 1yr	0.7524	0.6929	0.7836
RP growth 1yr	0.7229	0.7258	0.7220
HP growth 5yr	0.7629	0.7928	0.7696
RP growth 5yr	0.6211	0.7802	0.5144
Variance explained	0.5129	0.5524	0.4981
Eigenvalue	2.0565	2.2441	1.9922