The Effects of Local Risk on Homeownership

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Motivation

- Dual Role of Housing Asset
  - Financial Asset
    Earn the capital gain; higher return and lower risk is preferable.
  - Consumption Goods
    Durable goods; Insure their consumption if the housing price grows faster and is more fluctuated.
- "Location, Location, Location." Housing is a local good.
  - Fluctuations in local housing prices vary across different localities since local economic and demographic conditions are heterogeneous
- The income dynamics (local risk) varying across regions capture the local difference.

Local Risk

- The Decomposition of Local Risk
  - Local Alpha
    the idiosyncratic component of growth
    the expected growth of the region
  - Local Beta
    the systematic risk
    the Synchronization of the fluctuation of income growth in this region with that in the whole economy
  - Local Sigma
    the idiosyncratic risk
    the independent fluctuation of income growth in this region.

Main Findings

- Financial Investment Effect
  - Risk-averse households will prefer a house in a region with lower risk.
- Consumption Hedging Effect
  - If the region has higher systematic risk, to purchase a house first can hedge against the future housing consumption cost.

Main Findings

- The housing price could be predicted by the local risk factors. The idiosyncratic growth of local income (local alpha) is highly related to regional housing price growth; and housing price is more procyclical in a region with higher local beta and more fluctuant in a region with higher local sigma.
- Households living in a county with higher local alpha and higher local beta are more likely to own a home, while households living in a lower local sigma county has a lower probability of owning a home.
- The relation between local risk factors and tenure choice is stronger in a housing market with tighter land supply constraint
- Local risk factors explain about 20% of the variation in housing price to rent ratio
- Our results are robust under different model specifications (Probit or OLS), different geographical definition (county or MSA), and different sample (CPS or ACS).

Literature

- Tenure choice of households
  - Investment Incentives and Consumption Incentives
    Henderson and Ioannides, 1983; Fu, 1991; Fu, 1995.
  - Labor income dynamic and tenure status
    Dynarski and Sheffrin, 1985; Haurin, 1991; Robsta, Deitzb and McGoldrickc, 1999; Davidoff, 2005.
- Housing wealth composition in the portfolio of households
  Case, Quiegley and Shiller, 2005; Yao and Zhang, 2005; Ortalo-Magne and Rady, 2006
- Housing consumption risk:Housing investment to hedge the future consumption risk
  Ortalo-Magne and Rady, 2006; Han, 2010; Sinai and Souleles, 2005
- Cross-market housing price dynamics:Incorporates different housing supply and demand factor to explore the housing price in local market
  Rosen, 1974; Roback, 1982; Han, 2013

Model: Household

- Household utility is generated from consumption of numeraire goods, C_t, and a consumption of housing space, H_t. The utility function at time t is $u_t(C_t, H_t)$.
- Household receives an uncertain income I_t at time t, and decides its consumption of C_t and H_t, together with assets holding S_t, and homeownership θ_t.
- The intertemporal budget constraint is

$$C_t+Q_tH_t(1-\theta_t)+P_tH_t\theta_t+S_t = I_t+P_t\theta_{t-1}H_{t-1}(1-\mu)+S_{t-1}(1+R_t)$$

- R_t is the return of assets at time t; Q_t is the rents of rented housing at time t; and μ is the depreciation rate of housing asset.

Model: Housing Market

- Aggregatedly, θ_t could be understood as the homeownership rate in one city.

$$\theta_t \in [0, 1]$$

- Housing supply is constrained by land availability. An elasticity of housing, ξ, captures heterogeneity across cities.

$$P_t = H_t^{\xi}$$

- We assume a risk neutral firm provide the rental houses. No arbitrage condition implies

$$Q_t = P_t(R_t + \mu)$$

Model: Household's Problem

- The value function of the household's intertemporal problem is

$$V_t\left(I_t, H_{t-1}, \theta_{t-1}, S_{t-1}\right) = \max_{C_t, H_t, \theta_t, S_t} \{u_t\left(C_t, H_t\right) \\ + \delta E\left[V_{t+1}\left(I_{t+1}, H_t, \theta_t, S_t\right)\right]\}$$

- We assume the household solve its problem at $A^*(t) = (C_t, H_t, \theta_t, S_t)$.
- How the value function changes in response to the homeownership as following

$$\frac{\partial V_t}{\partial \theta_t} = P_t H_t\left(R_t + \mu - 1\right)\frac{\partial u_t}{\partial C_t} + \delta E\left[P_{t+1} H_t (1-\mu)\frac{\partial u_{t+1}}{\partial C_{t+1}}\right]$$

Model: Decision of Homeownership

- The above equation can be written as

$$\frac{\partial V_t}{\partial \theta_t} = \Lambda_t E\left[\Delta p_{t+1} - \Delta R_{t+1}\right]$$

  where $\Lambda_t = P_t H_t \left(1 - \mu - R_t\right) \frac{\partial u_t}{\partial C_t}$ and $x_{t+1} = \ln X_{t+1}$.
- If the expected housing price growth larger than the increment of aggregate asset returns, households would be more likely to purchase their home.

Model: Decomposition of Income Dynamics

- If a housing demand function $h_{t+1} = h(i_{t+1})$, we have

$$\frac{\partial V_t}{\partial \theta_t} = \Lambda_t E\left[\xi h_{t+1}\left(i_{t+1}\right) - \xi h_t\left(i_t\right) - \Delta R_{t+1}\right]$$

- we decompose the income trend of the representative household as

$$\Delta i_{t+1} = \alpha + \beta \Delta R_{t+1} + \varepsilon_{t+1}$$

- where α is constant indicating the idiosyncratic growth of income; and ΔR_{t+1} is the change of asset returns reflecting the aggregate shock in our model; and ε_{t+1} is a random variable representing the idiosyncratic uncertainty. ε_{t+1} follows a normal distribution with variance σ^2.

Model: Decomposition of Income Dynamics(cont'd)

- The decomposotion illustrates that the homeownership is driven by different effects in our analysis.

$$\frac{\partial V_t}{\partial \theta_t} = \Lambda_t \left\{ \underbrace{\xi h'\left(i_t\right)\alpha + \frac{\xi h''\left(i_{t+1}\right)}{2}\sigma^2}_{\text{Financial Investment Effect}} + \overbrace{\left[\xi h'\left(i_t\right)\beta - 1\right] E\left(\Delta R\right)}^{\text{Consumption Hedging Effect}} \right\}$$

- When α and β is large or σ is small, homeownership increase the value of household.
- Specifically, $\xi h'(i_t)\beta - 1 = 0$, aggregate risk is perfectly hedged.
- Housing elasticity ξ amplifies the effects of α, β and σ on homeownership.

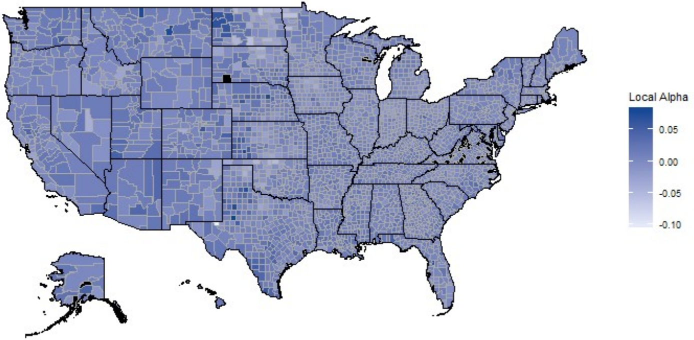
Construction of Local Risk Measures

- Local risk measures are built based on historical data.
- We use income both at the county level and at the national level from BEA. We deflate income into 2014 dollars and then calculate the annual growth rate for each county and the whole nation.
- The regression model is

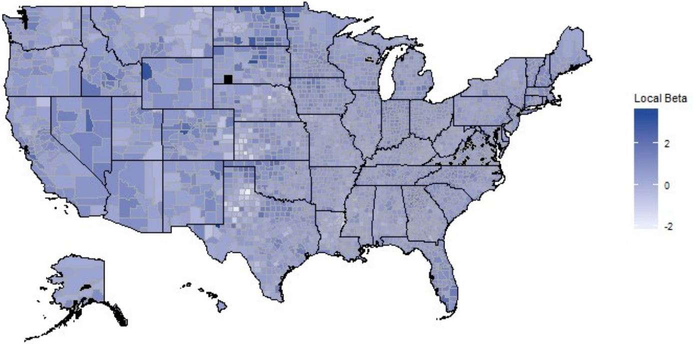
$$r_{i,t} = \alpha_i + \beta_i R_{i,t} + \varepsilon_{i,t}, \text{and } \varepsilon_{i,t} \sim N\left(0, \sigma_i\right)$$

  where $r_{i,t}$ is the income growth of region i at year t ; $R_{i,t}$ is the national income growth at year t.
- To obtain the time-varying estimates,a 30-year rolling window is applied to our sample. We get estimates of local alpha α_i, local beta β_i, and local sigma σ_i in the above equation at year t by using the income growth between $t - 29$ and t.

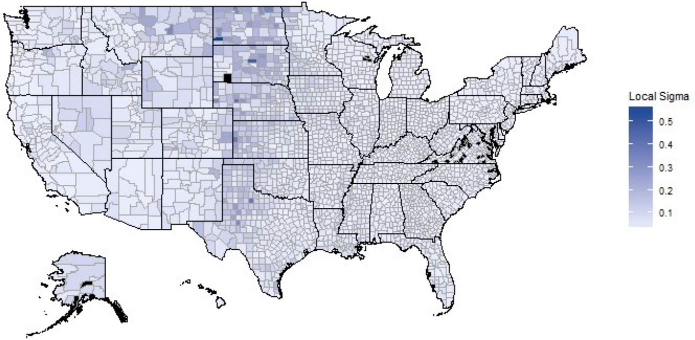
Local Alpha, in 2014



Local Beta, in 2014



Local Sigma, in 2014



Local Risk and Housing Market

- As our model above shown, the local housing demand is driven by the local income dynamic. When housing market clearing, the housing price is related to local risk.
- The local risk factor used in our research is generated from the historical data, but it can predict the future housing demand.
- We test the predictability of our local risk factor and housing price using FHFA data.
- Local Alpha can predicted the future housing price change.

$$r^i_{t,t+n} = \delta + \gamma_1 \alpha_{i,t} + \tau_t + \mu_i + \epsilon_{i,t}$$

where $r^i_{t,t+n}$ is the housing price growth in county i from year t to $t+n$, $\alpha_{i,t}$ are local alpha in county i at year t, τ_t is year fixed effect; μ_i is county fixed effect; δ is constant term; and $\varepsilon_{i,t}$ is the residual.

Local Risk and Housing Market (cont'd)

- Local Beta can predicted the future housing price change conditional on aggregate shock.

$$r^{i}_{t,t+n} = \delta + \gamma_1 \beta_{i,t} + \gamma_2 \beta_{i,t} \times shock_{t,t+n} + \tau_t + \mu_i + \epsilon_{i,t}$$

  where $\beta_{i,t}$ are local beta at county i in year t, and $shock_{t,t+n}$is the aggregate shock proxied by real GDP growth from year t to $t+n$.

- Local Sigma can predicted the volatility of housing price.

$$VOL_{i,t+n} = \delta + \gamma_1 \sigma_{i,t} + \tau_t + \mu_i + \epsilon_{i,t}$$

  where $VOL_{i,t+n}$ is the housing price volatility in county i at year $t+n$. We measure it by the standard deviation of annual housing price growth rate from year $t+n-14$ to $t+n$. $\sigma_{i,t}$ is the estimated local sigma in county i at year t.

Predictability of Local Alpha

Dependent Variable	Housing Price Growth					
Time Period	1 Year		2 Years		3 Years	
	(1)	(2)	(3)	(4)	(5)	(6)
Local Alpha	0.147	0.251	0.301	0.353	0.448	0.43
	(0.010)	(0.020)	(0.016)	(0.031)	(0.023)	(0.046)
County Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,423	41,423	41,356	41,356	38,691	38,691
R-squared	0.367	0.41	0.453	0.513	0.475	0.551

All coefficients are significant at 1% level.

Predictability of Local Beta

Dependent Variable	Housing Price Growth					
Time Period	1 Year		2 Years		3 Years	
	(1)	(2)	(3)	(4)	(5)	(6)
Local Beta	-0.007	-0.013	-0.014	-0.023	-0.021	-0.034
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Local Beta*Shock	0.123	0.118	0.075	0.066	**0.052**	**0.04**
	(0.023)	(0.023)	(0.024)	(0.024)	**(0.026)**	**(0.025)**
County Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,803	38,803	36,135	36,135	33,472	33,472
R-squared	0.383	0.429	0.474	0.538	0.499	0.578

All coefficients are significant at 1% level except the number in bold. The coefficients in bold are significant at 5% level.

Predictability of Local Sigma

Dependent Variable	Housing Price Growth Volatility					
Time Period	1 Year		2 Year		3 Year	
	(1)	(2)	(3)	(4)	(5)	(6)
Local Sigma	0.098	0.094	0.091	0.099	0.085	0.112
	(0.007)	(0.015)	(0.007)	(0.015)	(0.007)	(0.015)
County Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,388	26,388	25,506	25,506	24,489	24,489
R-squared	0.076	0.756	0.077	0.775	0.077	0.797

All coefficients are significant at 1% level.

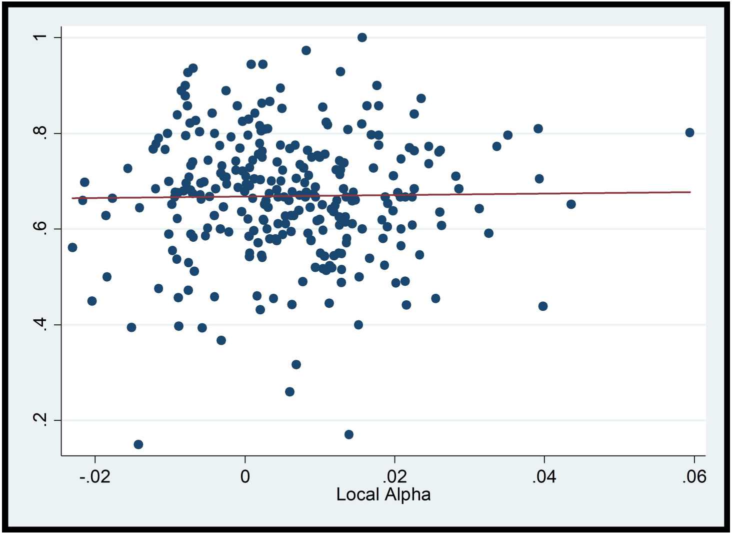
Local Risk and Homeownership

- To examine the relationship between local risk and homeownership, we use the March Current Population Survey (CPS) from 1999 to 2014.
- The empircial model is

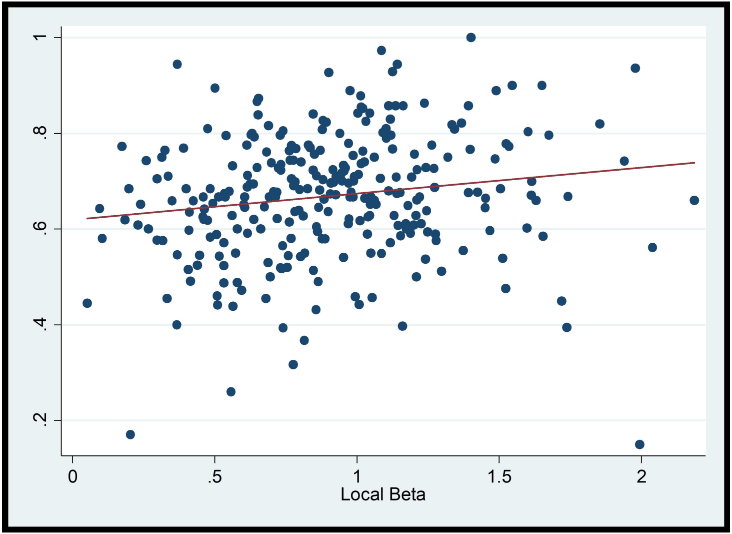
$$T_{i,j,t} = \delta + \gamma_1 \alpha_{i,t} + \gamma_2 \beta_{i,t} + \gamma_3 \sigma_{i,t} + \beta X_{j,t} + \tau_t + \mu_i + \epsilon_{i,j,t}$$

  where $T_{i,j,t}$ is the tenure status of household j in county i at year t;$_{j,t}$ is a vector of household characteristics, including education, children, race and ethnicity, income, household size, and head's age.
- We first plot the raw correlation between county-level homeownership rate in 2014 from CPS and local alpha, local beta, and local sigma.

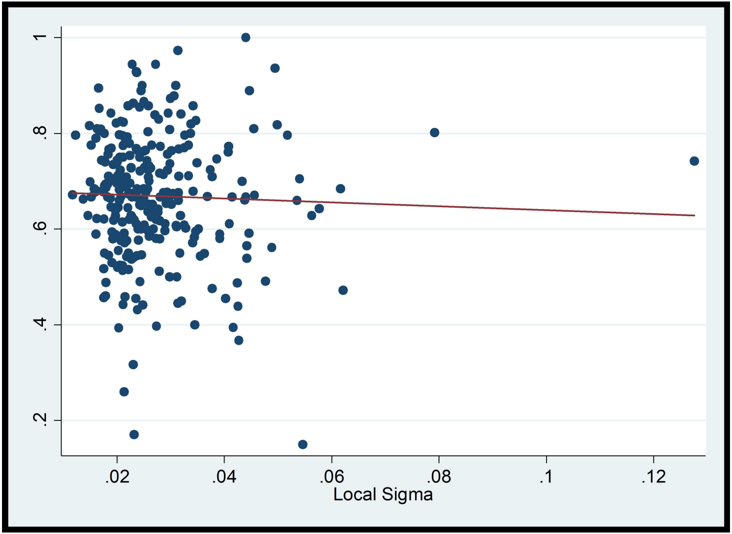
Local Alpha and Homeownership, in 2014



Local Beta and Homeownership, in 2014



Local Sigma and Homeownership, in 2014



Baseline Results

Dependent Variable	Homeownership					
	(1)	(2)	(3)	(4)	(5)	(6)
Local Alpha	1.669			3.451	1.618	1.368
	(0.040)			(0.053)	(0.210)	(0.183)
Local Beta		0.006		0.086	0.052	0.046
		(0.002)		(0.002)	(0.010)	(0.009)
Local Sigma			-1.066	-3.04	-0.915	-0.859
			(0.066)	(0.073)	(0.244)	(0.213)
Household Control	No	No	No	No	No	Yes
County Fixed Effect	No	No	No	No	Yes	Yes
Year Fixed Effect	No	No	No	No	Yes	Yes
Observations	468,716	468,716	468,716	468,716	468,716	468,716
Adjusted R-Square	0.004	0	0.001	0.009	0.08	0.297

All coefficients are significant at 1% level.

Land Supply Constraint

Dependent Variable	Homeownership			
	(1)	(2)	(3)	(4)
Local Alpha	-4.629***	-3.373***	3.068***	0.957***
	(0.211)	(0.906)	(0.072)	(0.320)
Local Alpha*Land Supply	2.625***	1.502***	3.254***	1.234**
	(0.067)	(0.273)	(0.108)	(0.487)
Local Beta	-0.088***	-0.120***	0.090***	0.047***
	(0.009)	(0.046)	(0.003)	(0.015)
Local Beta*Land Supply	0.056***	0.056***	0.028***	0.033
	(0.003)	(0.014)	(0.004)	(0.024)
Local Sigma	-1.185***	-2.422**	-2.572***	-1.082***
	(0.364)	(1.165)	(0.109)	(0.353)
Local Sigma*Land Supply	-0.636***	0.383	-4.458***	0.417
	(0.110)	(0.353)	(0.156)	(0.514)
Land Supply	-0.114***		0.022***	
	(0.003)		(0.006)	
Land Supply Constraint	undevelopable land		WRI index	
Household Control	Yes	Yes	Yes	Yes
County Fixed Effects	No	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	294,312	294,312	294,312	294,312

Price to Rent Ratio

- Our theoretical model simply assume rental houses in each city are provided a risk neutral firm. In reality, the market in one city is segregated. The price to rent ratio is decided by the demand of owning home.
- Housing price to rent ratio is calculated based on median home rent and median home value from Zillow 2010-2014.
- To this end, we estimate the following model,

$$PR_{i,t} = \delta + \gamma_1 \alpha_{i,t} + \gamma_2 \beta_{i,t} + \gamma_3 \sigma_{i,t} + \beta Z_{i,t} + \tau_t + \epsilon_{i,j,t}$$

where $PR_{i,t}$ is the housing price to rent ratio for county i at year t; and $Z_{i,t}$ is a vector of variables to control the heterogeneity of counties including county income level and income growth.

Price to Rent Ratio (cont'd)

Dependent Variable	Price to Rent Ratio				
	(1)	(2)	(3)	(4)	(5)
Local Alpha	19.624			68.229	69.544
	(2.732)			(2.860)	(2.823)
Local Beta		2.026		3.247	2.86
		(0.092)		(0.100)	(0.101)
Local Sigma			-17.868	-29.84	-25.761
			(2.201)	(2.035)	(2.048)
County Control	No	No	No	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.013	0.086	0.016	0.19	0.229
Observations	5,347	5,347	5,347	5,347	5,347

All coefficients are significant at 1% level.

Robustness

- Alternative Empirical Model
  - Probit vs. OLS
- Alternative Sample
  - American Community Survey vs. Current Population Survey
- Alternative Geographic Boundary
  - MSA vs. County

Conclusion and Remark

- As a financial asset, household chooses the asset with lower risk.
- As a consumption goods, household purchases a house to hedge against the future consumption risk.
- The future research would focuses on the source of income dynamic among different regions.

Thank you for listening!
Comments are welcome!