Housing Price and Fundamentals in A Transition Economy: The Case of Beijing Market

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2016 Conference on the Chinese Economy

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Motivation: the Unusual Beijing Market

► Extremely high house price
  ► price-income ratio ≈ 30
  ► price-rent ratio ≈ 40
  ► price up by 500% in the past decade. FIGURE

► Questions:
  ► Can the high house price be consistent with economic fundamentals?

  ► In general, how to understand the link between house price and economic fundamentals?

Price and Fundamentals

- ▶ Tradition approach (Case and Shiller (2003))
  - ▶ "normal" relation between price and fundamentals in the data
  - ▶ regression-based, using historical data

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"China is in such a rapid growth period. It is very hard to price assets when growth is at the high level. The future matters more. In a stable economy that is not going anywhere, you have a pretty good idea of what they are worth."

—— Robert Shiller, April 2014

Price and Fundamentals

- ▶ Our approach: rely less on historical data but impose a lot of structure
  - ▶ a dynamic rational expectation general equilibrium model
  - ▶ forward-looking and utility-maximizing households
  - ▶ a value-maximizing home builder
  - ▶ endogenous paths of house price and rent

What are the fundamentals?

- income growth rate: high but declining

- large scale immigration FIGURE

- restricted land supply FIGURE

- high household savings rate
  - savings rate: 25% (NBS)
  - 80% of urban household wealth in housing (CHFS2012)

- Rent is not considered fundamental.

map of Beijing

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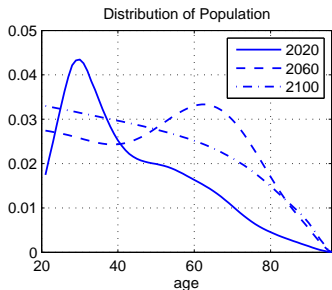 - ▶ Constant price-income and price-rent ratios
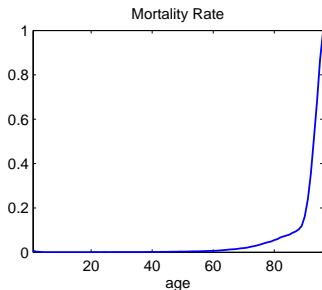 - ▶ Everything can be re-scaled

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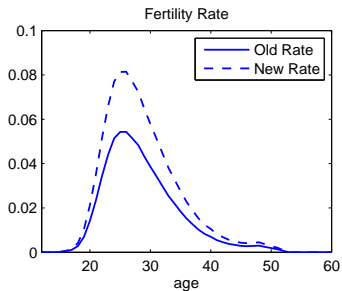 - ▶ Everything can be re-scaled

- ▶ a reference city that operates in a BGP
  - ▶ to pin down parameters
  - ▶ Hong Kong, DC, SF

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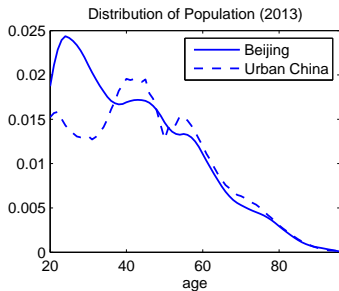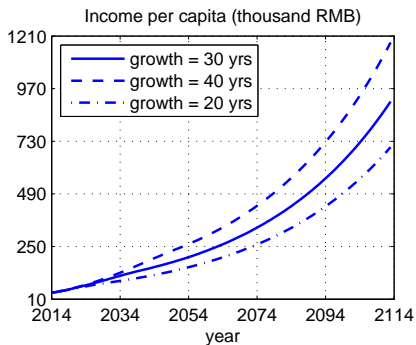   - Constant price-income and price-rent ratios
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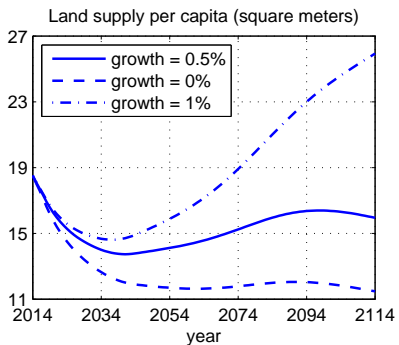   - to pin down parameters
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- During the economic transition, there are changes in
    - income growth
    - birth rate
    - age distribution
    - migration

Projection of Population Distribution

Projection of Land Supply and Income

Land supply per capita (square meters)

- growth = 0.5%
- growth = 0%
- growth = 1%

Income per capita (thousand RMB)

- growth = 30 yrs
- growth = 40 yrs
- growth = 20 yrs

Model Elements

- A representative firm (developer)

- Over-lapping generations of households

    - Own **s** share of the firm $\Rightarrow$ housing investment

    - Rent **h** unit of housing from the firm $\Rightarrow$ housing consumption

    - Let d=down payment, $s \geq d \times h \Rightarrow$ owner

The Representative Firm

- Production technology:

$$H_t = ZL_t^\theta K_t^{1-\theta}$$

- L: land

- K: capital

- Z: scaling parameter

- θ: land share in housing production

- considered labor/construction cost $\Rightarrow$ similar results

Firm's Optimization Problem

$$\max_{K_t, L_t} \quad r_t H_t - [\overbrace{K_t - (1-\delta)K_{t-1}}^{\text{capital purchase}}] - \overbrace{q_t(L_t - L_{t-1})}^{\text{land purchase}} + \frac{1}{R_{t+1}}p_{t+1}H_t$$

$$s.t. \quad H_t = ZK_t^{1-\theta}L_t^\theta$$

where

- ▶ r = housing rental rate
- ▶ q = land price
- ▶ p = house price
- ▶ R = firm's financing cost (household's investment return)

Housing Supply Function

$$H_t = Z^{1/\theta} \left[\frac{(1-\theta)r_t}{1 - (1-\delta)/R_{t+1}} \right]^{(1-\theta)/\theta} L_t$$

Housing supply increases with

- land provision (L_t)
- rental rate of houses (r_t)

Housing supply decreases with

- financing cost of the firm (R_{t+1})

Households

- ▶ overlapping generations of households

- ▶ Works for J years, then retires

- ▶ Lives up to T years. Before age T, death probability is taken from the data

- ▶ Two decisions
  - ▶ inter-temporal allocation: save/dis-save
 - ▶ intra-temporal allocation: housing vs non-housing

Equilibrium

- ▶ Need to find the trajectories of price and rent to clear two markets:
    - ▶ rental market
    - ▶ equity market

- ▶ Efficient numerical solution strategy
    - ▶ Need to solve paths of price and rent, each has 100 years!
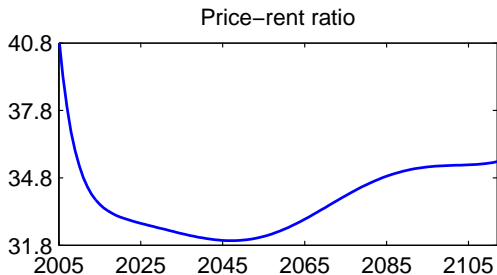
Results

- ▶ baseline results
  - ▶ Hong Kong as reference city
  - ▶ using income per capita as reported
  - ▶ exogenous migration

- ▶ robustness

- ▶ results with endogenous migration

Results: Prices and Rent

House price (thousand RMB per m^2)

Rental rate (thousand RMB per m^2)

year
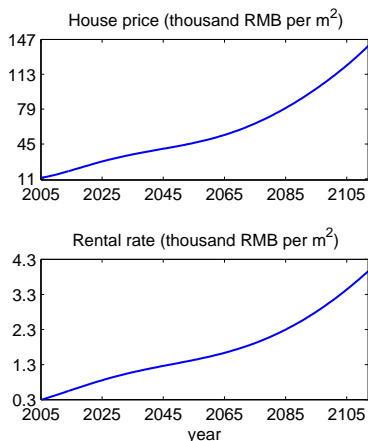
- Price in 2014 = 14,920 RMB per square meter (30,000 in the data)
- Annual rent in 2014 = 459 RMB per square meter (700 in the data)

Results: Ratios

Price−income ratio

Price−rent ratio
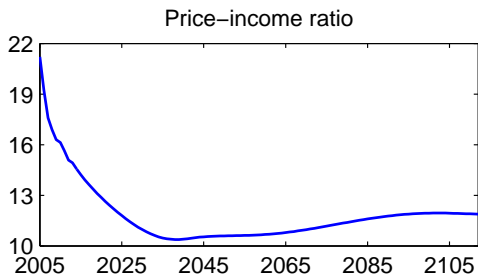
Regression Results

Dependent Variable: growth of price and rent

Dependent variable:	$log(G_p)$		$log(G_r)$	
	income	land	income	land
2005-2040	0.710	-0.797	0.670	0.321
2041-2080	1.161	-3.020	0.761	-1.135
2081-2114	0.807	0.140	0.856	-0.916

Sensitivity

		Price		Rent	
		2014	2114	2014	2114
	Baseline	19.41	153.54	0.56	4.31
(1)	Growth of land supply = 1%	18.10	86.40	0.57	2.72
(2)	Growth of land supply = 0.0%	22.33	207.21	0.62	5.90
(3)	Income stabilizes in 20 years	18.55	128.87	0.54	3.64
(4)	Income stabilizes in 40 years	20.06	183.81	0.60	5.32
(8)	Initial Fin'l wealth = 2 M	20.01	161.07	0.59	4.42
(9)	FAR ≤ 3	21.43	289.87	0.61	7.94
(10)	Mortgage rate = 3%	21.96	176.41	0.62	4.65
(11)	Down payment = 30%	24.62	179.96	0.63	4.66
(12)	Minimum housing size = 20	19.41	148.06	0.56	4.19
(13)	Minimum housing size = 40	18.89	153.36	0.57	4.36
(14)	DC calibration	14.87	122.81	0.53	3.95
(15)	DC calibration (more land)	23.69	105.34	0.81	3.39
(16)	SF calibration	18.12	150.07	0.50	3.33
(17)	Less income risk	18.83	144.32	0.57	4.39
(18)	Less medical expense risk	19.37	151.79	0.57	4.31

What have we found?

- ▶ Price-income ratio declines over time as the economy converges. Housing becomes more affordable.

- ▶ The equilibrium house price in Beijing that can be justified by the fundamentals is around 19,410 RMB per square meter in 2014, much lower than 30,000 RMB in the data.

- ▶ Alternative assumptions on land supply, income growth and population structure do not help in narrowing the gap between the model-implied price and the observed price.
  ↬ detail

- ▶ However · · ·

What might explain the gap between the model and the data?

- Measurement error of fundamental variables

- Endogenous inflow of rich immigrants

- Features not captured by the current model

Extension 1: Underreported Income

- ► Evidence of officers' "grey incomes" from housing purchase behavior (Deng, Wei and Wu, 2016):
  - ► The higher the rank of government officials, the larger the percentage of unreported income:
    - ► FU-KE: 29.5%
    - ► ZHENG-KE: 55.8%
    - ► FU-CHU: 63.2%
    - ► ZHENG-CHU: 151.1%
    - ► FU-JU: 218.7%
    - ► ZHENG-JU: 694.7%

Price and Rent Given Higher Income

	Price		Rent	
	2014	2114	2014	2114
Baseline	19.41	153.54	0.56	4.31
Income = 2/3 times Hong Kong	32.40	252.47	0.97	7.18
Income = Hong Kong	42.40	369.02	1.30	9.95

- ▶ High price in Beijing can be rationalized if the Beijing resident income is about **70%** higher than reported.
- ▶ Actual income of government officials is **60%** higher than reported income on average (Deng, Wei and Wu 2016)

Extension 2: Migration of Rich Households

谁买走了北京的房子
不包含港澳台及外籍客户

Extension 2: Migration of Rich Households

- ▶ Migrants: Households in second and third tier cities
  - ▶ roughly 200 millions people in these cities

- ▶ Benefits:
  - ▶ higher utility (amenity)
    - ▶ benefit of migration $\approx$ 25% increase in consumption equivalence
  - ▶ potentially higher return to housing investment

- ▶ Costs:
  - ▶ high savings rate needed to afford down payment
  - ▶ higher living cost (rent)

Endogenous Migration: Price and Rent

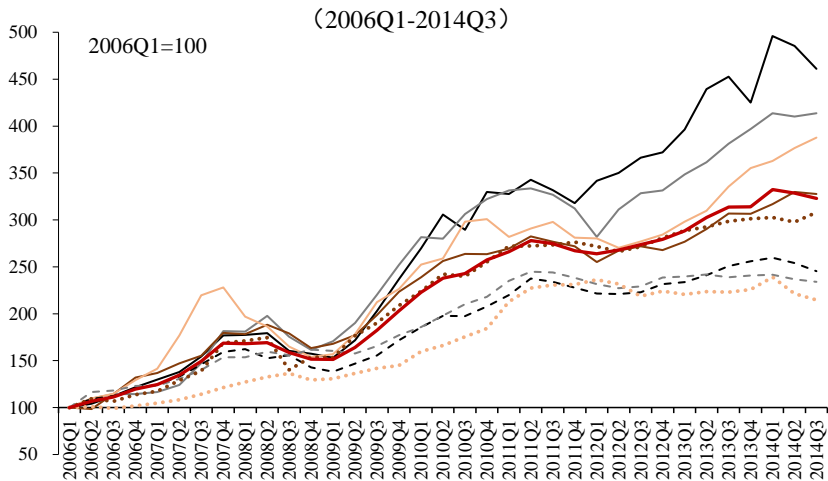|	Price		Rent	
	2014	2114	2014	2114
Baseline	19.41	153.54	0.56	4.31
Endogenous Migration	33.19	243.26	0.702	6.685

Features We Have Not Captured Yet

- Cyclical variations in fundamentals

- Search frictions

- Aggregate uncertainty

- Illiquidity

Conclusions
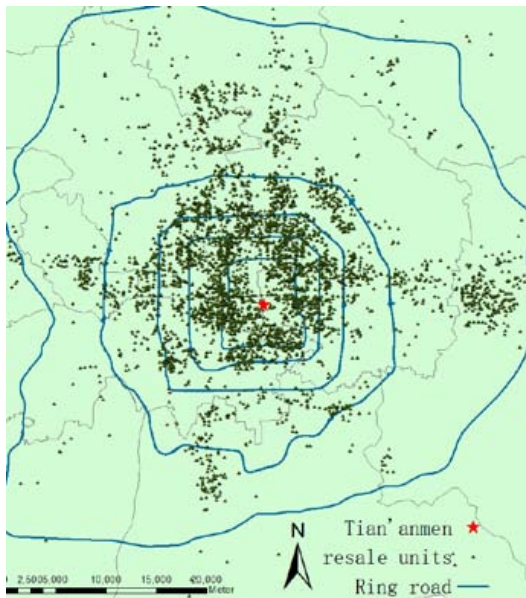
- ▶ Link house price and rent to fundamentals in a transition economy

- ▶ For Beijing market, we show
  - ▶ Price is too high unless...

- ▶ General lessons
  - ▶ Historical relation between price and fundamentals is unlikely to repeat itself during the transition periods
  - ▶ High price/income and price/rent may be consistent with the fundamentals.
  - ▶ Underreported income or migration of rich households can drive up house price a lot. (a lesson for Toronto?)

THANK YOU!

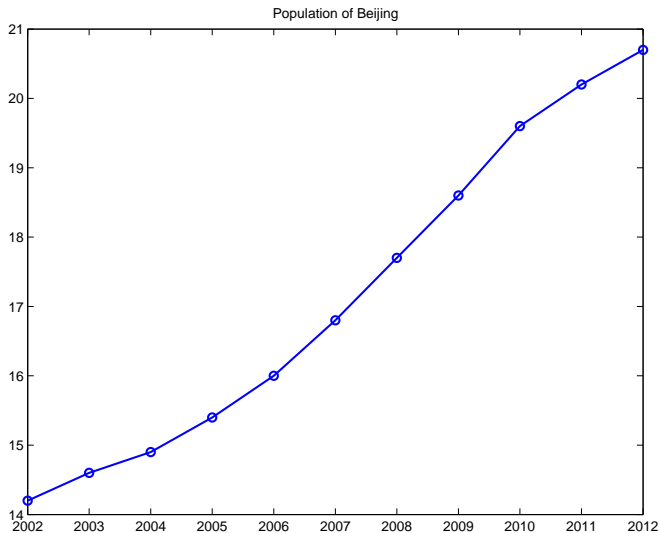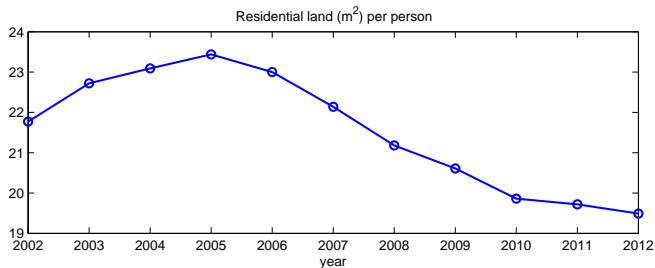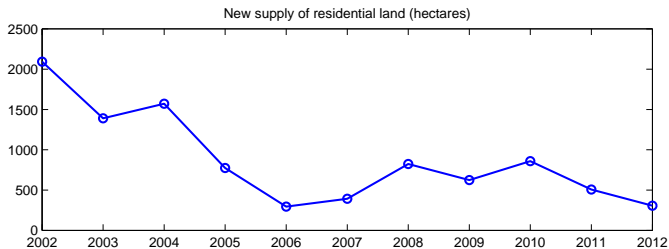# House Price Indices: Beijing, Shanghai, Shenzhen, Tianjian,Wuhan, Chengdu, Dalian and Xi'an

（2006Q1-2014Q3）

2006Q1=100

City of Beijing

Population of Beijing (millions)

Population of Beijing

Land Supply in Beijing

New supply of residential land (hectares)

Residential land (m^2) per person

year

Young home buyers badly need help from parents

A rich coal-mine owner owns 99 houses in Beijing, plus some commercial real estate(June 14, 2014, People's Daily Online).