Demystifying the Chinese Housing Boom

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Construction Boom across China

Ghost Town in Inner Mongolia

Concerns about Chinese Housing Markets

Granular questions:

- Is China experiencing a housing bubble #2 after the US?
- Will China follow the footstep of Japan to have a lost decade?

Specific questions:

- How much have housing prices in China appreciated in the last decade?
- How did the price appreciation vary across the country?
- Did the soaring prices exclude low-income households from participating in the housing markets?
- How much financial burden did households face in buying homes?

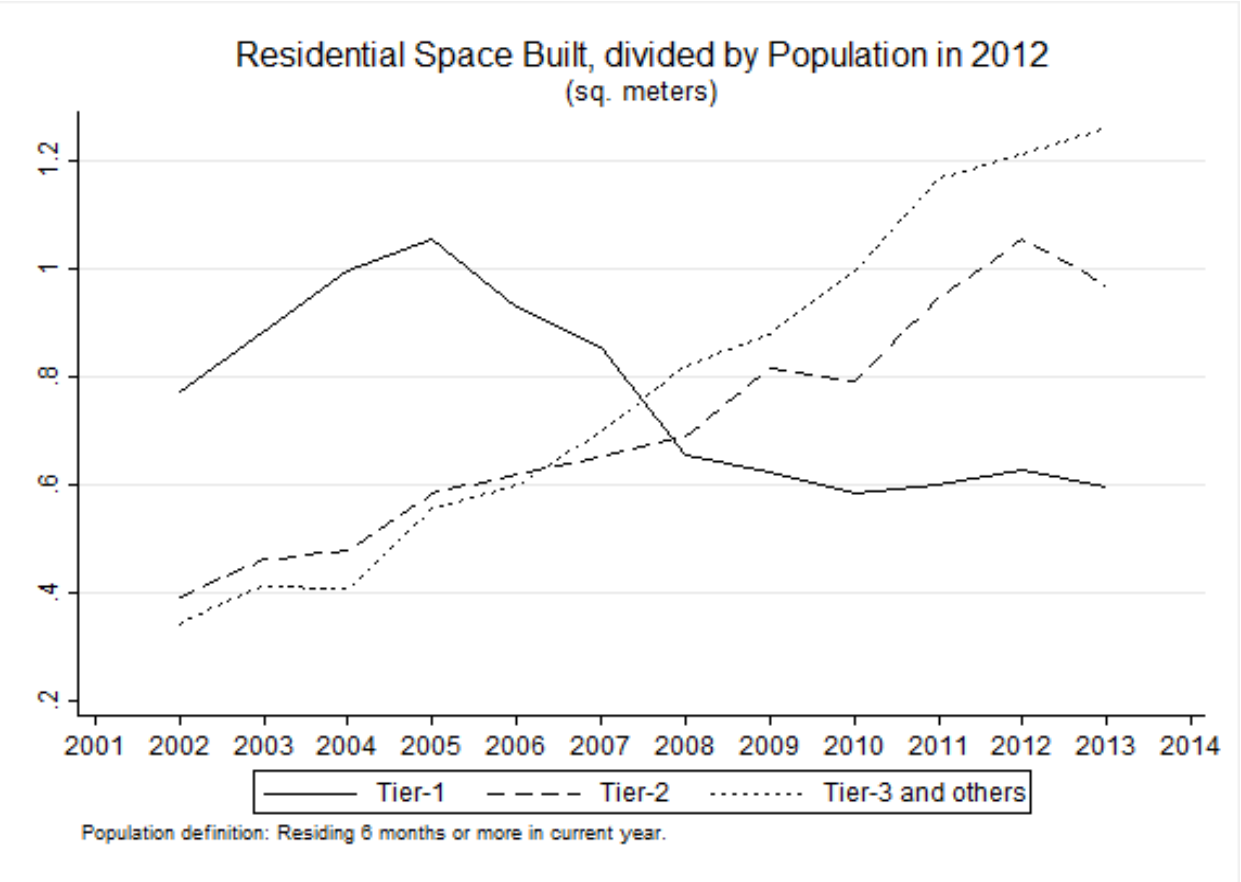
Institutional Background

- Markets for housing emerged only after late 1990s
  - Housing used to be assigned to employees by state enterprises
  - Various reforms in 1990s (legalizing property rights to housing and abolishing housing allocation as in-kind benefit)
  - In response to 1997 Asian Financial Crisis, Chinese government established the real estate sector as a new engine of economic growth
    - PBC outlined procedures for residential mortgage loans at subsidized interest rates in 1998
    - By 2005, China has the largest residential mortgage market in Asia
    - In 2012, 8.1 trillion RMB in mortgage loans, accounting for 16% of all bank loans

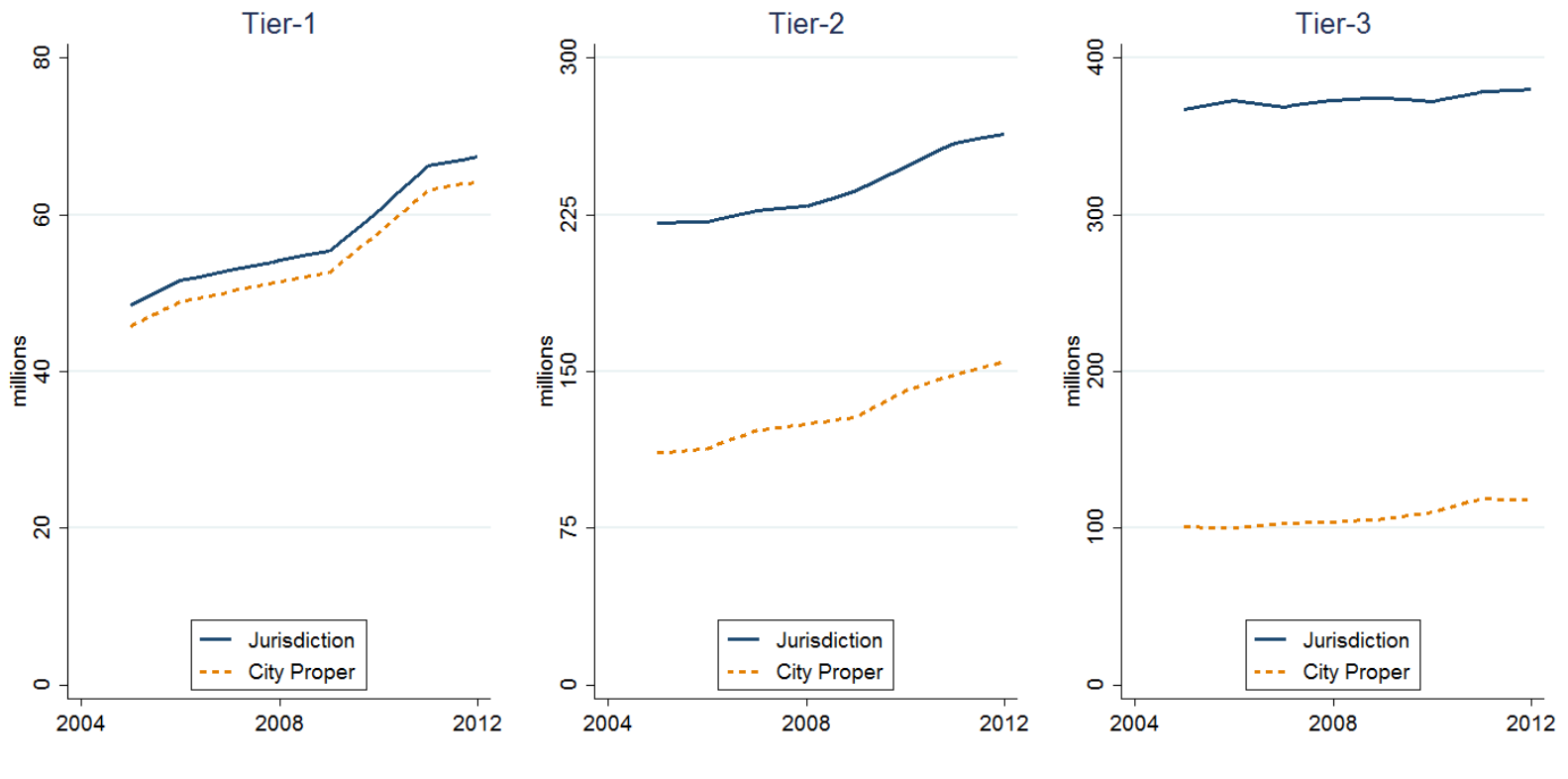
List of Cities

- First tier: Beijing, Shanghai, Guangzhou, and Shenzhen
- Second tier (35 cities): 2 autonomous municipalities, capital cities of 24 provinces, and 9 vital industrial and commercial centers
  - Our sample covers 31 of them
- Third tier: regional industrial or commercial centers
  - 85 in our sample

Supply of New Homes



Population Growth in Cities



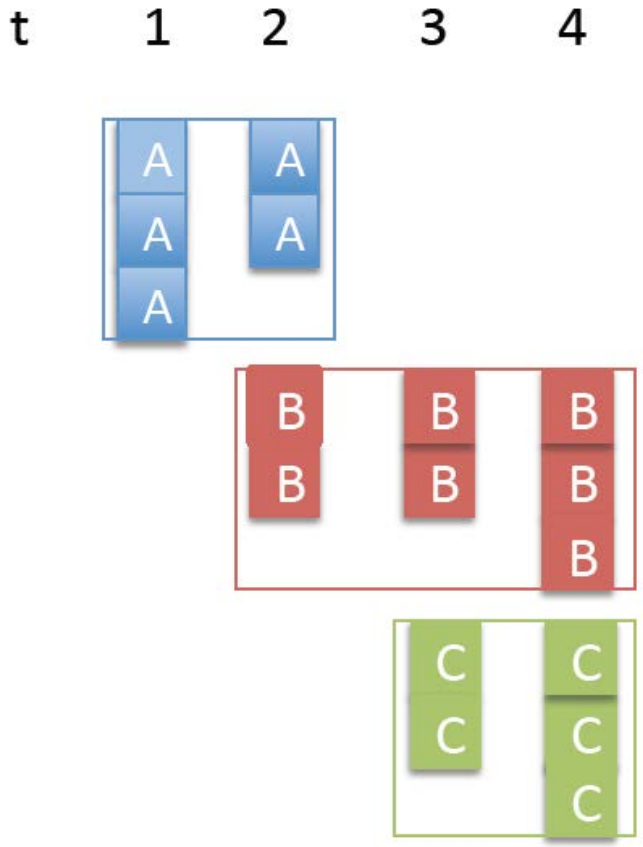
Constructing Housing Price Index

Two standard approaches

- Hedonic price regressions, e.g., Kain and Quigley (1970)
  - Unobserved characteristics may lead to biased estimate
  - Rapid expansion of Chinese cities makes it especially hard to fully capture all characteristics
- Repeated sales approach, e.g., Baily, Muth and Nourse (1963) and Case and Shiller (1987)
  - Does not require measurement of quality
  - wastes a large fraction of transaction data; repeated sales may not be representative of the general population of homes
  - Not so many repeated sales in the nascent Chinese housing markets

A Hybrid Approach for Chinese Housing Markets

- A large number of new home sales in each city
  - Typically apartments in development projects
  - Within a development complex, the unobserved apartment amenities are similar
  - It takes 1-2 years to sell all units in one complex



A Hybrid Approach for Chinese Housing Markets

- Jan 2003 to March 2013, a regression *for each city*:

$$\ln P_{i,c,t} = \beta_{c,0} + \sum_{s=1}^{T} \beta_{c,s} \cdot 1\{s = t\} + \theta_c \mathbf{X}_i + DP_i + \varepsilon_{it},$$

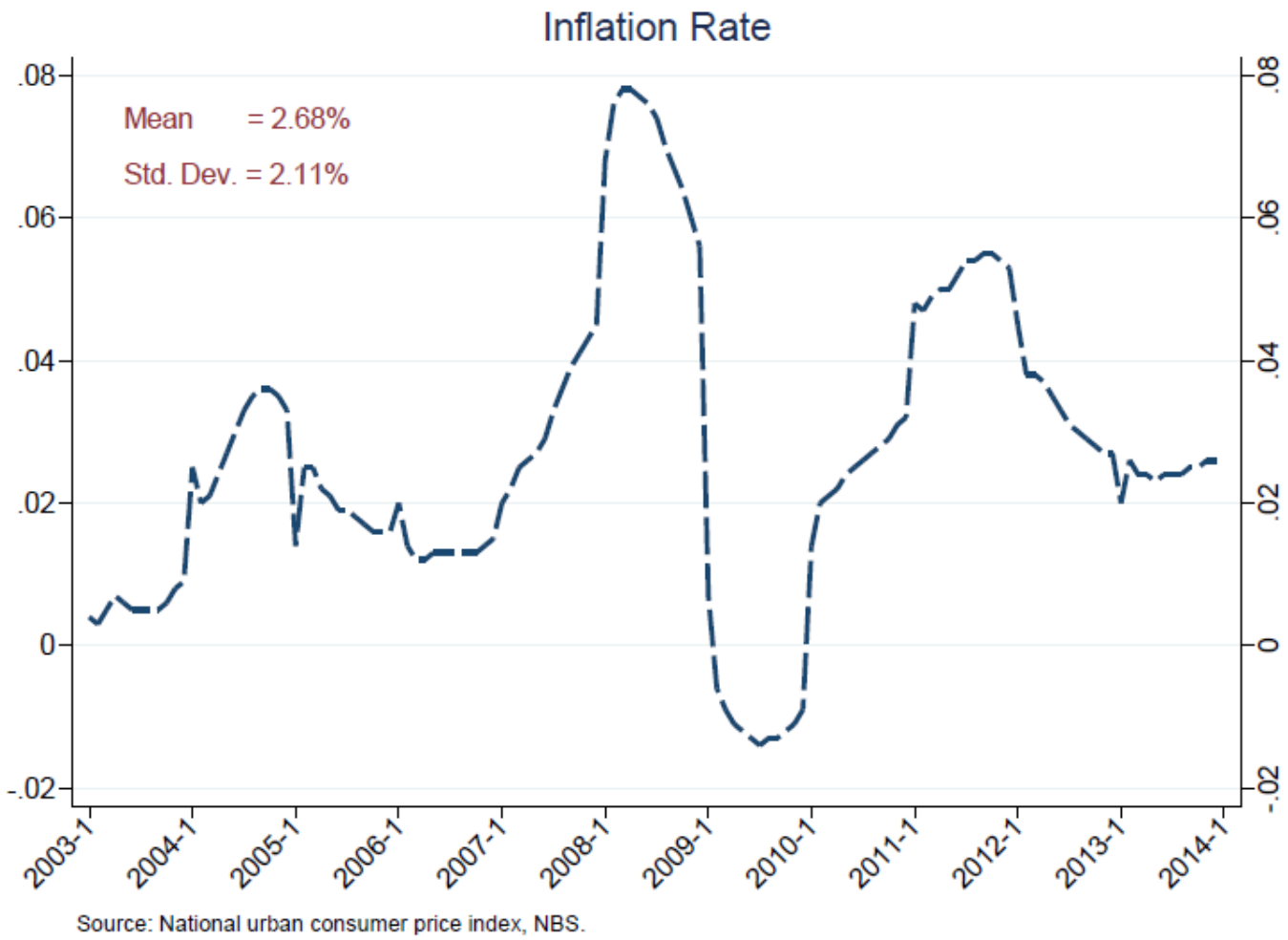
$$PI_{c,t} = \begin{cases} 1 & \text{if } t = 0 \\ \exp(\beta_{c,t}) & \text{for } t = 1, 2, \ldots \end{cases}$$

Data

- A detailed mortgage data set for 120 major cities
  - a large commercial bank with 15% market share
  - restrict sample to mortgages for new, residential properties
  - one million mortgage loan contracts dating from the first quarter of 2003 to the first quarter of 2013

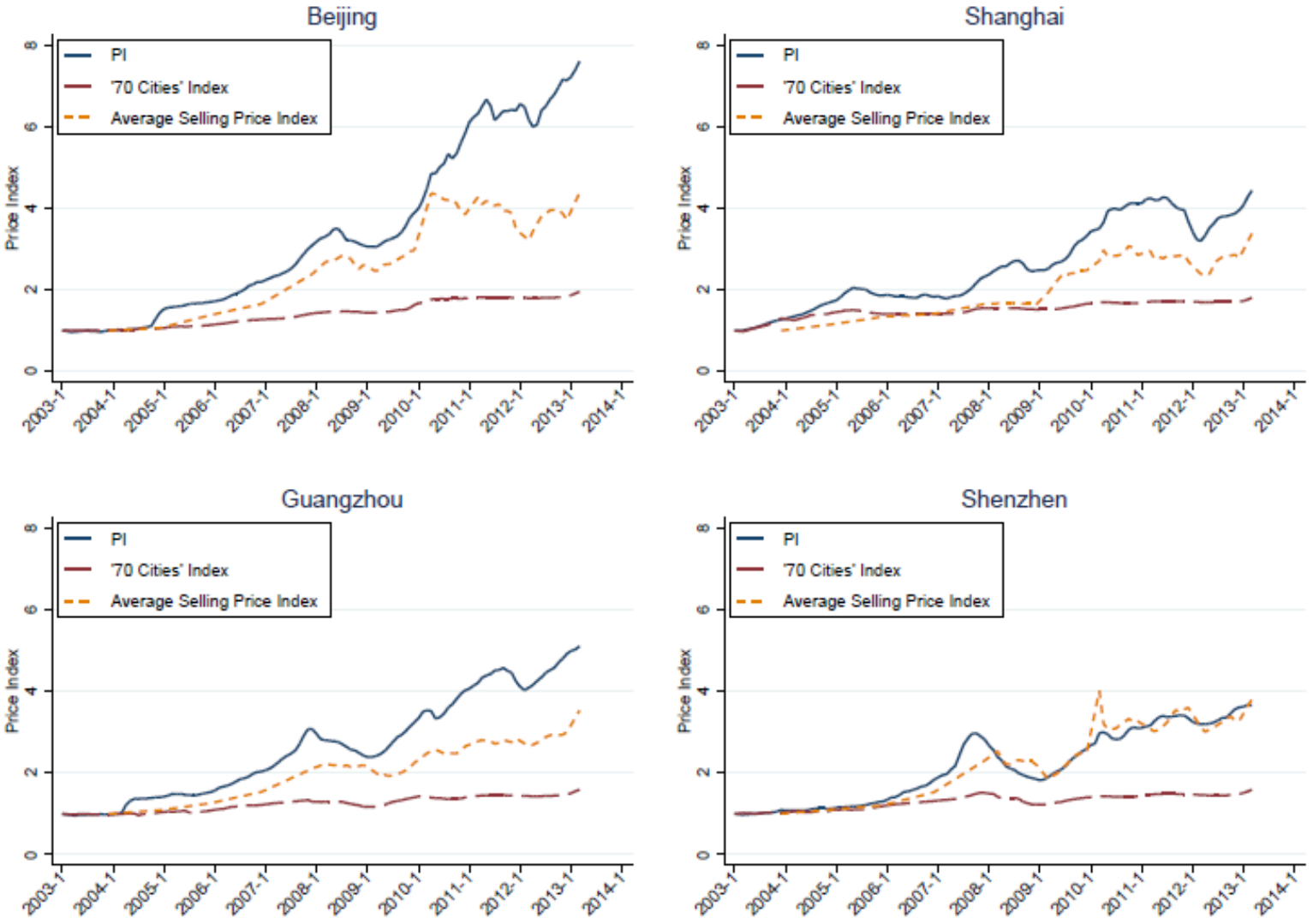
- A typical mortgage contract contains information on
  - personal characteristics of home buyers (e.g., age, gender, marital status, income, work unit, education, occupation, and region and address of residence)
  - housing price and size, apartment-level characteristics (e.g., complex location, floor level, and room number)
  - loan-level characteristics (e.g., maturity, loan to value ratio, and down-payment)

Inflation Rate

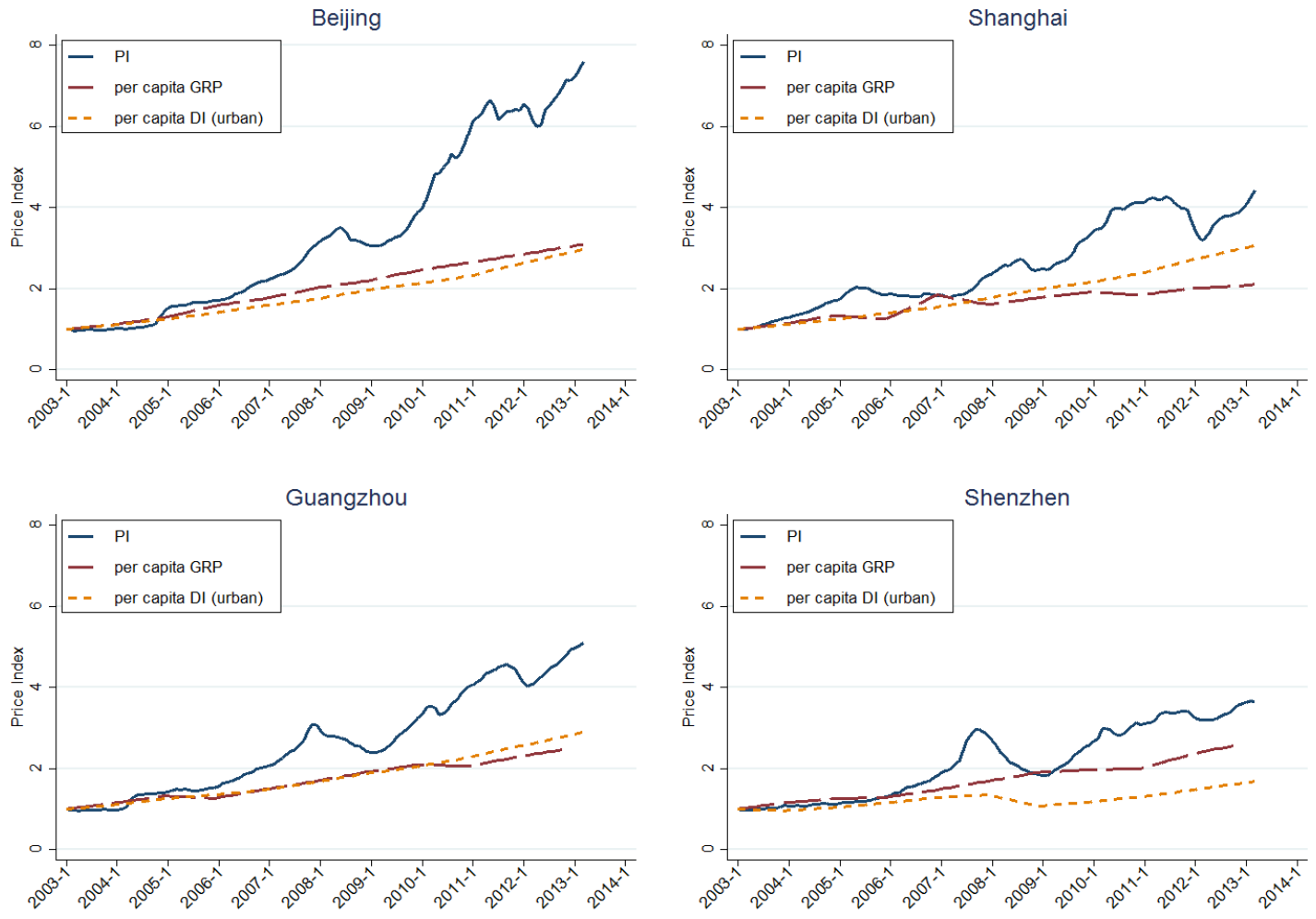


Source: National urban consumer price index, NBS.

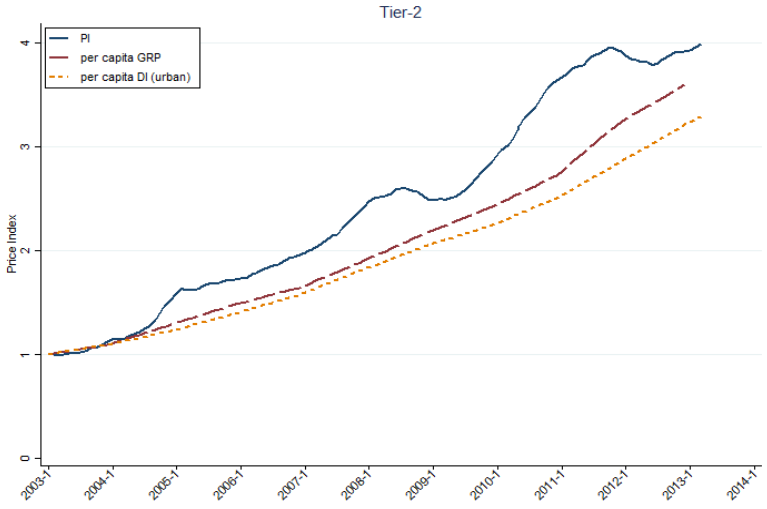
Price Indices for First Tier Cities

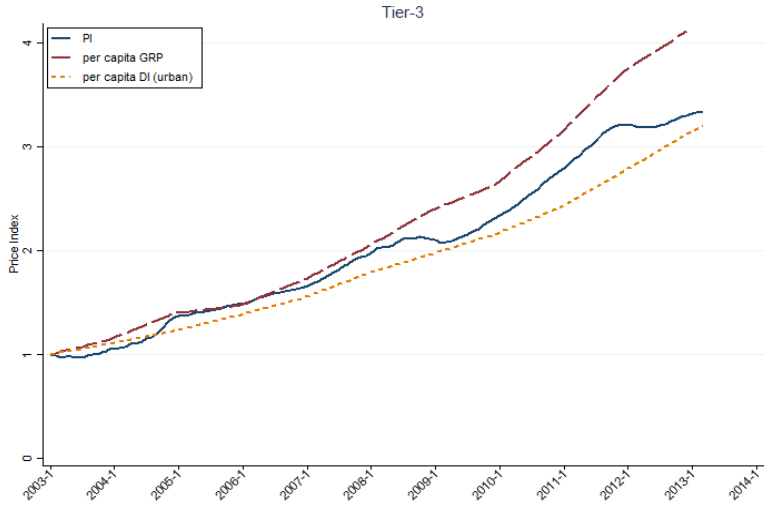


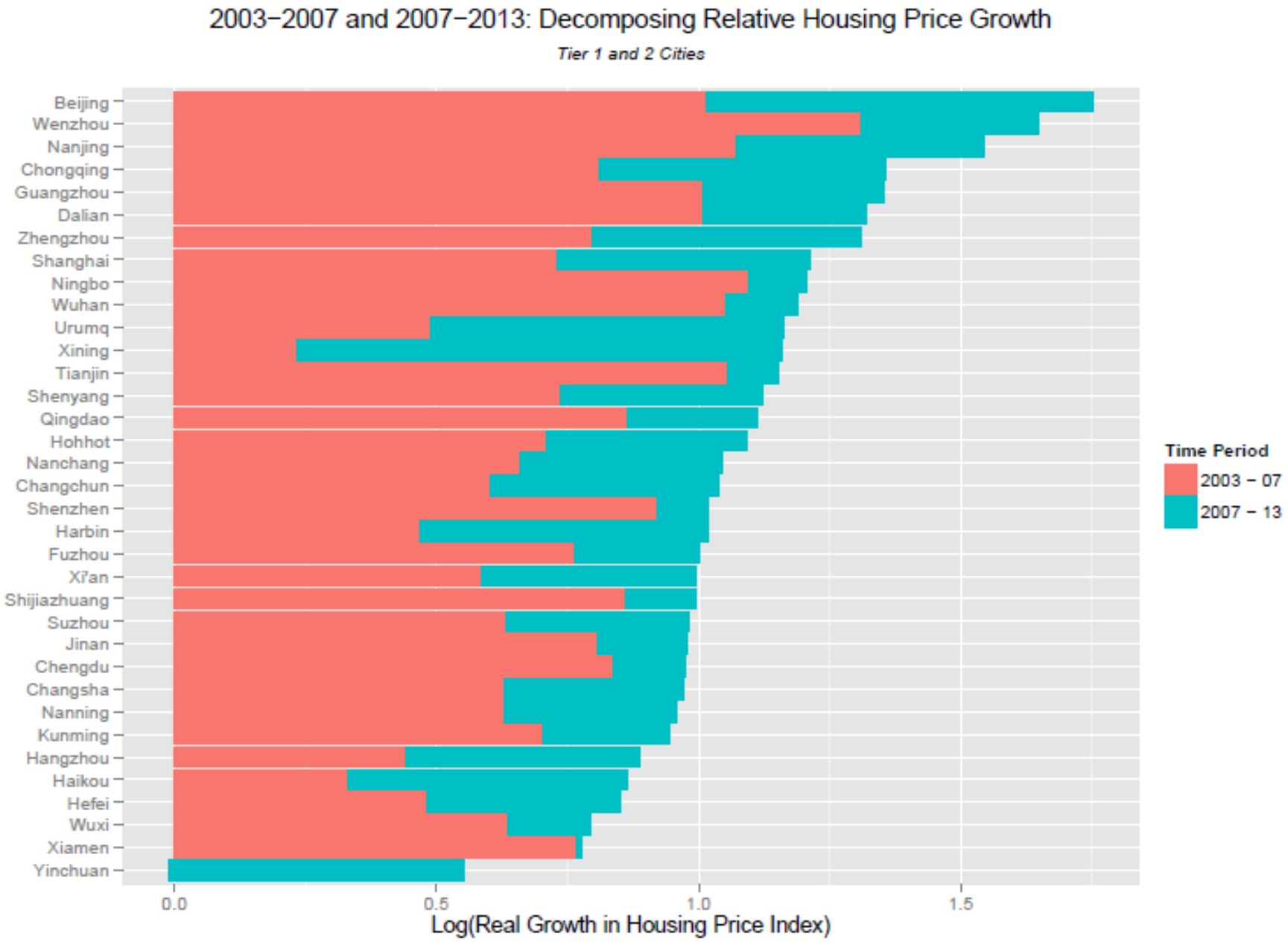
Price Indices for First-Tier Cities



Housing Price Indices for Second and Third Tier Cities






2003−2007 and 2007−2013: Decomposing Relative Housing Price Growth
Tier 1 and 2 Cities
Beijing
Wenzhou
Nanjing
Chongqing
Guangzhou
Dalian
Zhengzhou
Shanghai
Ningbo
Wuhan
Urumq
Xining
Tianjin
Shenyang
Qingdao
Hohhot
Nanchang
Changchun
Shenzhen
Harbin
Fuzhou
Xi'an
Shijiazhuang
Suzhou
Jinan
Chengdu
Changsha
Nanning
Kunming
Hangzhou
Haikou
Hefei
Wuxi
Xiamen
Yinchuan
0.0
0.5
1.0
1.5
Log(Real Growth in Housing Price Index)
Time Period
2003 – 07
2007 – 13


2003−2007 and 2007−2013: Decomposing Relative Housing Price Growth
Tier 3 Cities
Ningde
Baoding
Changji
Chuzhou
Huzhou
Luzhou
Pingxiang
Jinhua
Taizhou
Xuzhou
Langfang
Jiujiang
Dazhou
Wuludao
Chaoyang
Xuancheng
Baotou
Zhenjiang
Yancheng
Tangshan
Huai'an
Zaozhuang
Shaoxing
Wuhu
Nantong
Qinhuangdao
Fuyang
Yichun
Suqian
Dandong
Qingyuan
Fuzhou
Xingtai
Yangzhou
Yingkou
Nanchong
Rizhao
Jiangyan
Shantou
Quanzhou
Zhangjiakou
Luohe
Zhangzhou
Anqing
Xinyu
Jiaxing
Anshan
Changde
Kaifeng
Puyang
Huizhou
Xuchang
Shaoguan
Yuncheng
Mianyang
Shangrao
Jiangmen
Bengbu
Shanwei
Jingdezhen
Foshan
Zhaoqing
Changzhou
Nanyang
Zhumadian
Qiqihar
Xinxiang
Songyuan
Leshan
Luoyang
Deyang
Zhongshan
Dongguan
Hengshui
Dezhou
Tieling
Jilin
Jieyang
Xilingol
Liaocheng
Heyuan
Yangjiang
Jiamusi
Huangshan
Lianyungang
Panjin
−0.5
0.0
0.5
1.0
1.5
Log(Real Growth in Housing Price Index)
Time Period
2003 − 07
2007 − 13

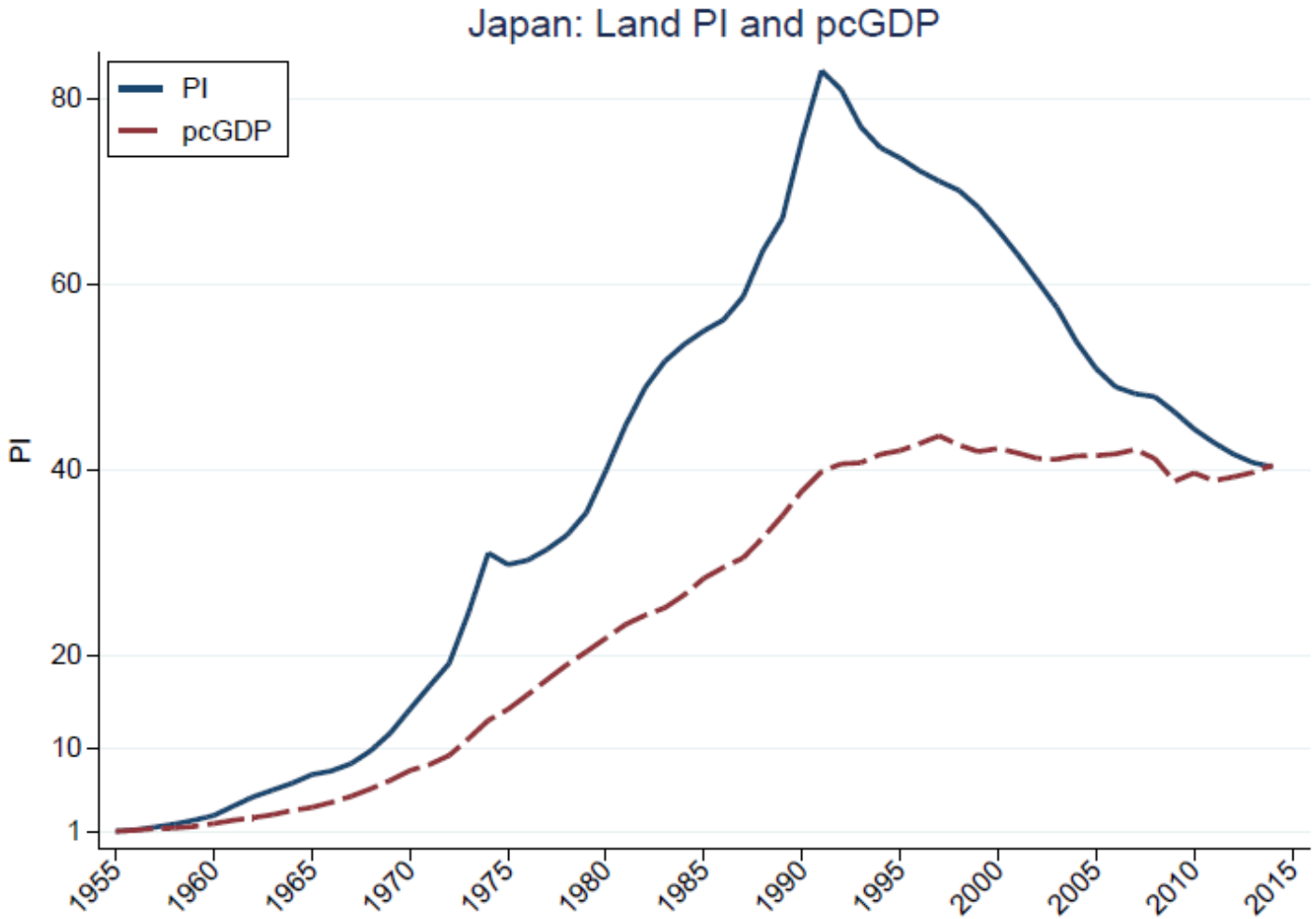
Summary Statistics (Nominal)

Nominal Growth	Obs	January 2003 - December 2007 Mean	Std. Dev.	Min	Max	January 2009 - March 2013 Mean	Std. Dev.	Min	Max	January 2003 - March 2013 Mean	Std. Dev.	Min	Max
Panel A: Tier 1 Cities													
Housing Price Index	4	.210	.027	.172	.230	.177	.033	.139	.219	.159	.031	.128	.200
Per capita GRP index	4	.114	.020	.097	.144	.066	.020	.038	.081	.094	.016	.074	.112
Per capita DI index (urban)	4	.099	.025	.061	.116	.102	.003	.098	.105	.093	.028	.051	.110
Panel B: Tier 2 Cities													
Housing Price Index	31	.168	.056	.021	.290	.116	.034	.043	.216	.132	.022	.082	.189
Per capita GRP index	30	.136	.050	.010	.235	.129	.031	.052	.191	.134	.033	.042	.189
Per capita DI index (urban)	30	.119	.025	.055	.178	.113	.013	.098	.164	.117	.015	.078	.152
Panel C: Tier 3 Cities													
Housing Price Index	85	.113	.067	-.099	.250	.114	.036	.041	.242	.106	.036	.007	.178
Per capita GRP index	85	.154	.045	.006	.260	.140	.036	.037	.214	.150	.032	.030	.231
Per capita DI index (urban)	74	.118	.020	.059	.186	.117	.011	.087	.141	.117	.012	.079	.154

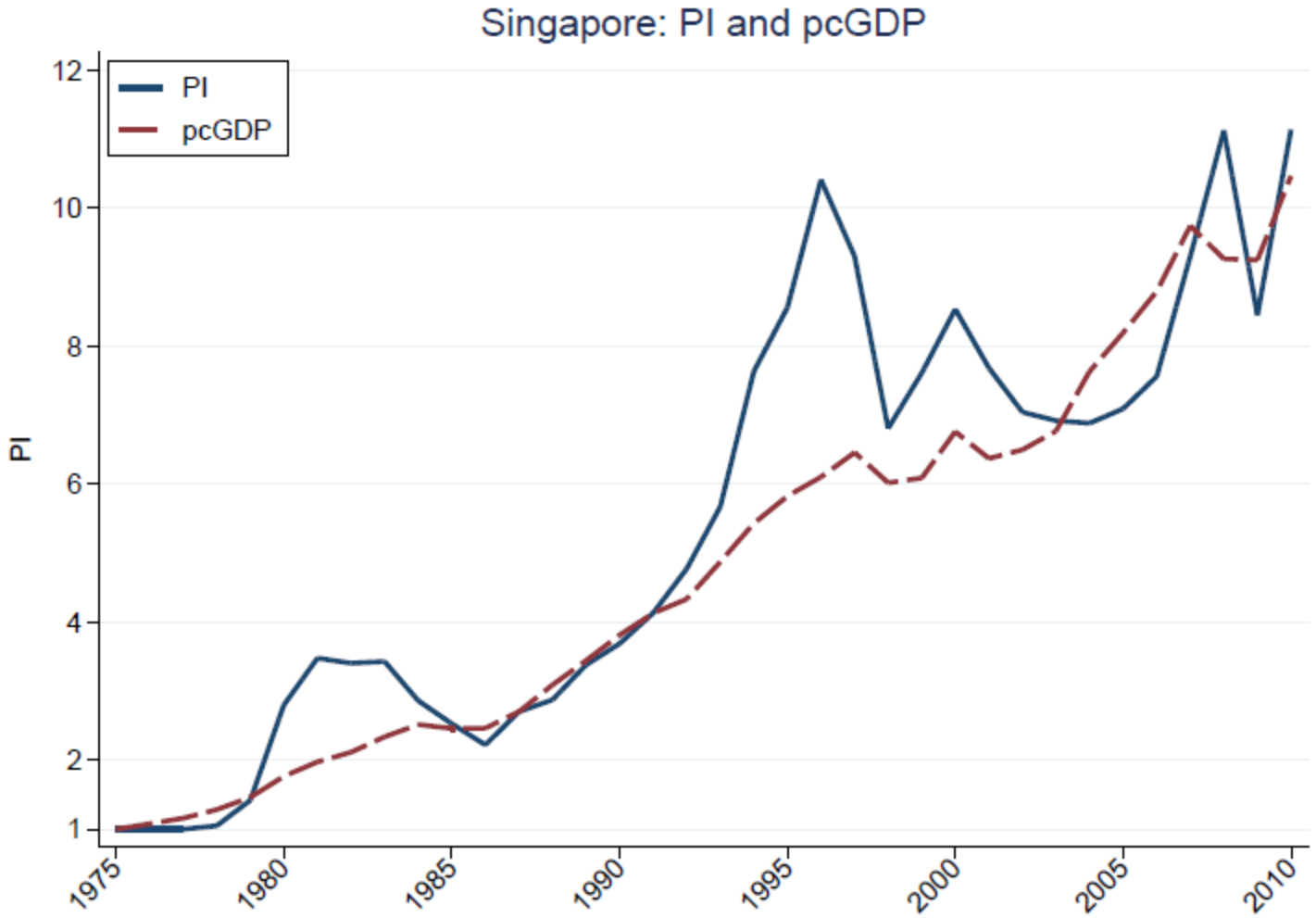
Summary Statistics (Real)

Real Growth	Obs	January 2003 - December 2007 Mean	Std. Dev.	Min	Max	January 2009 - March 2013 Mean	Std. Dev.	Min	Max	January 2003 - March 2013 Mean	Std. Dev.	Min	Max
Panel A: Tier 1 Cities													
Housing Price Index	4	.187	.027	.148	.206	.151	.033	.113	.193	.131	.031	.100	.172
Per capita GRP index	4	.090	.020	.074	.120	.040	.020	.012	.055	.067	.016	.046	.085
Per capita DI index (urban)	4	.075	.025	.038	.092	.076	.003	.072	.079	.066	.028	.024	.083
Panel B: Tier 2 Cities													
Housing Price Index	31	.145	.056	-.002	.266	.090	.034	.017	.190	.105	.022	.054	.162
Per capita GRP index	30	.113	.050	-.013	.212	.103	.031	.026	.165	.107	.033	.015	.161
Per capita DI index (urban)	30	.095	.025	.031	.154	.087	.013	.072	.138	.090	.015	.050	.125
Panel C: Tier 3 Cities													
Housing Price Index	85	.090	.067	-.123	.227	.089	.036	.015	.216	.079	.036	-.021	.150
Per capita GRP index	85	.131	.045	-.018	.236	.114	.036	.011	.188	.123	.032	.003	.204
Per capita DI index (urban)	74	.094	.020	.036	.162	.091	.011	.061	.115	.089	.012	.052	.127

Housing Price and GDP Growth in Japan



Housing Price and GDP Growth in Singapore

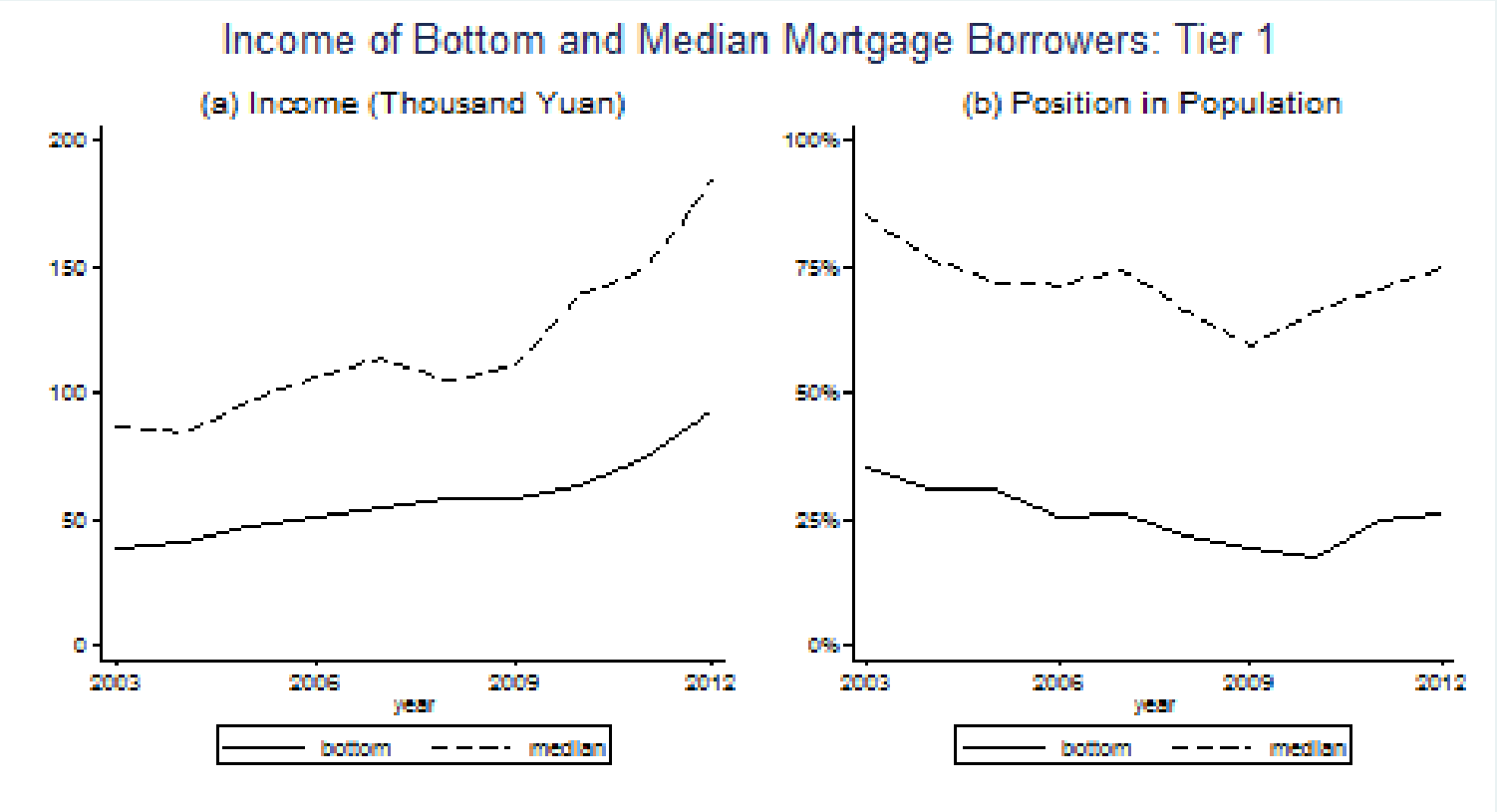


Mortgage Borrowers

- We focus on two groups of mortgage borrowers
  - Bottom-income group with household income in bottom 10% of borrowers in a city during a year
  - Middle-income group with household income in range [45%, 55%]

  - p10 denotes the borrower with income at the 10 percentile and p50 denotes the borrower at the median

Annual Income of Mortgage Borrowers



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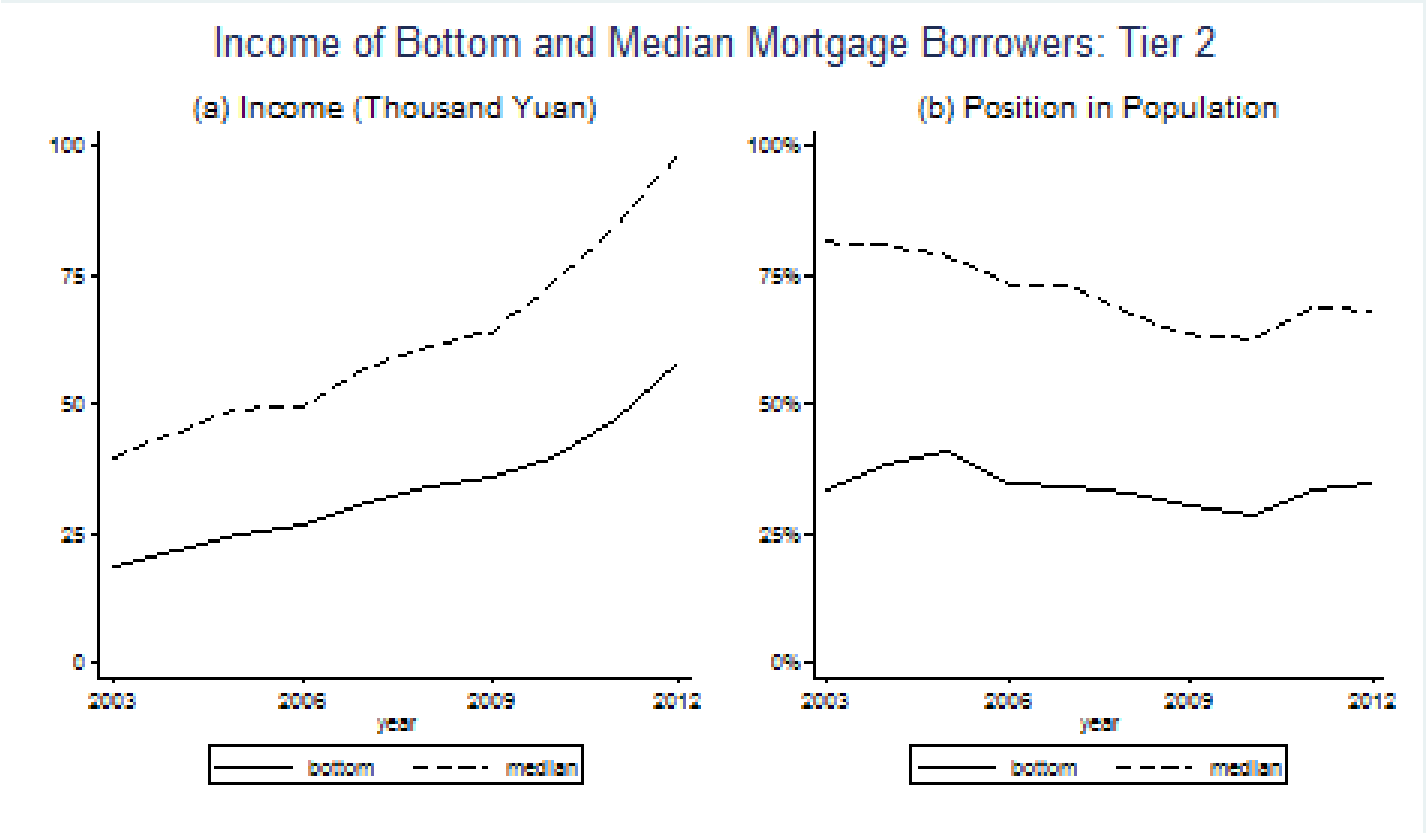
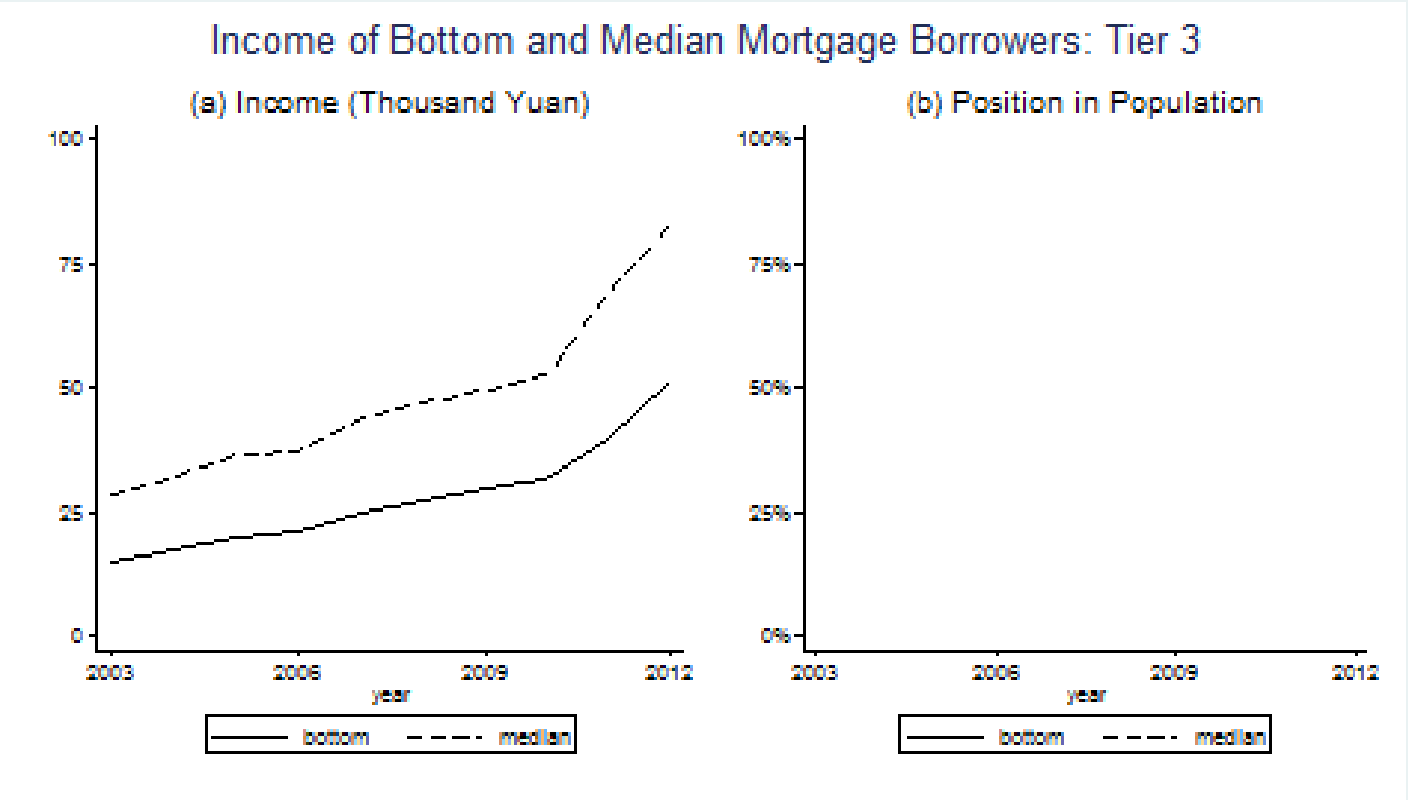
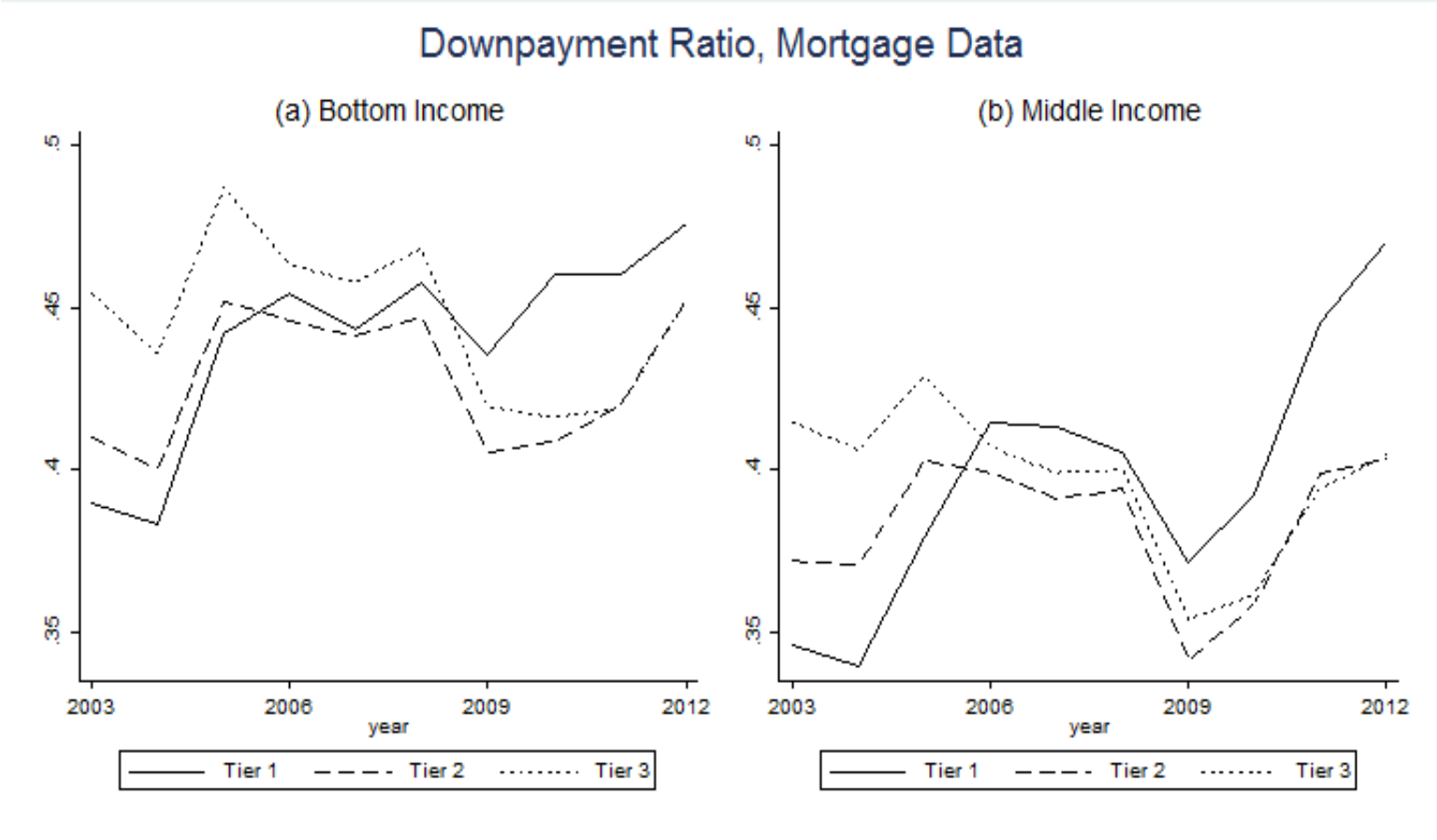


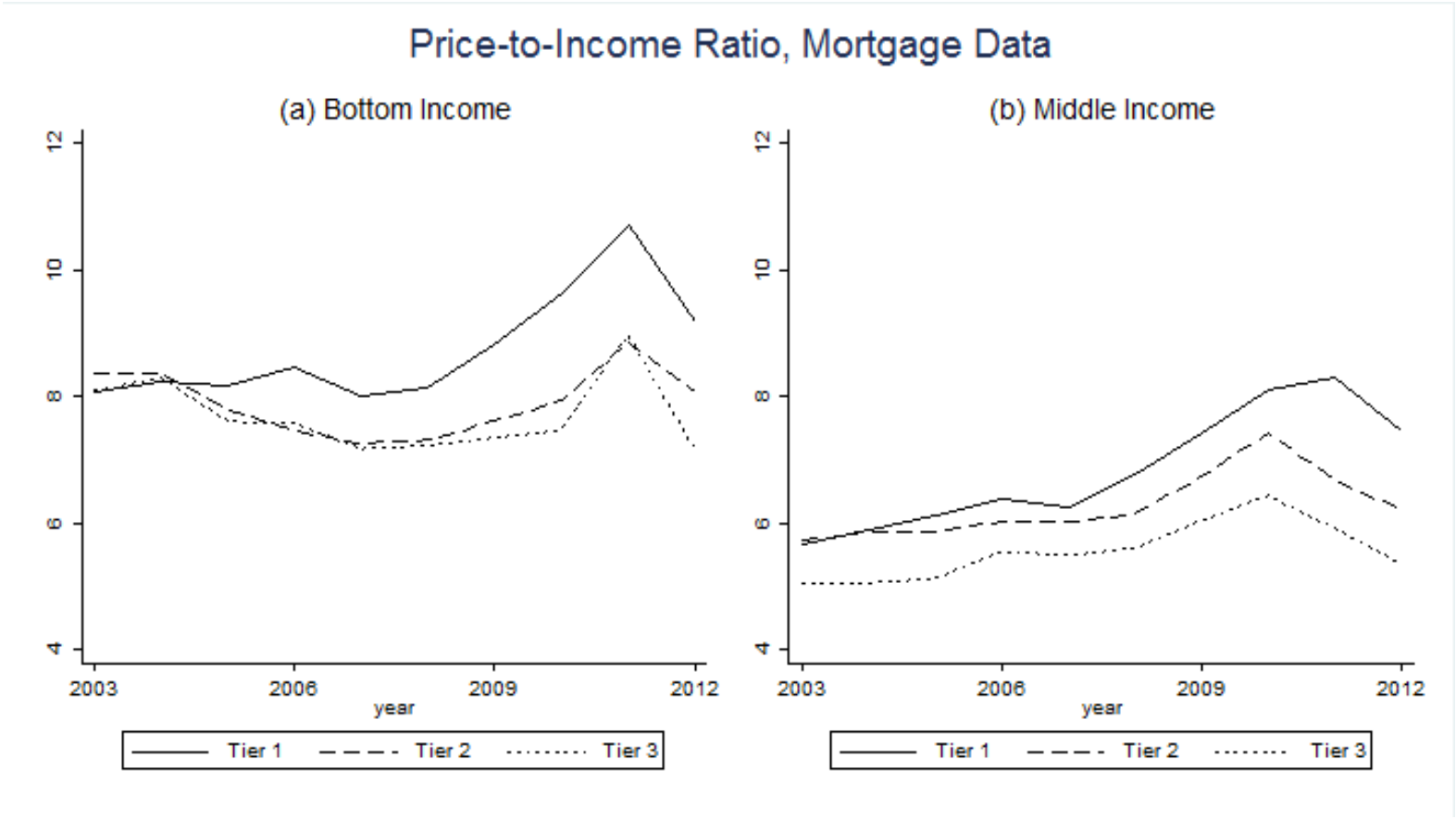
Annual Income of Mortgage Borrowers



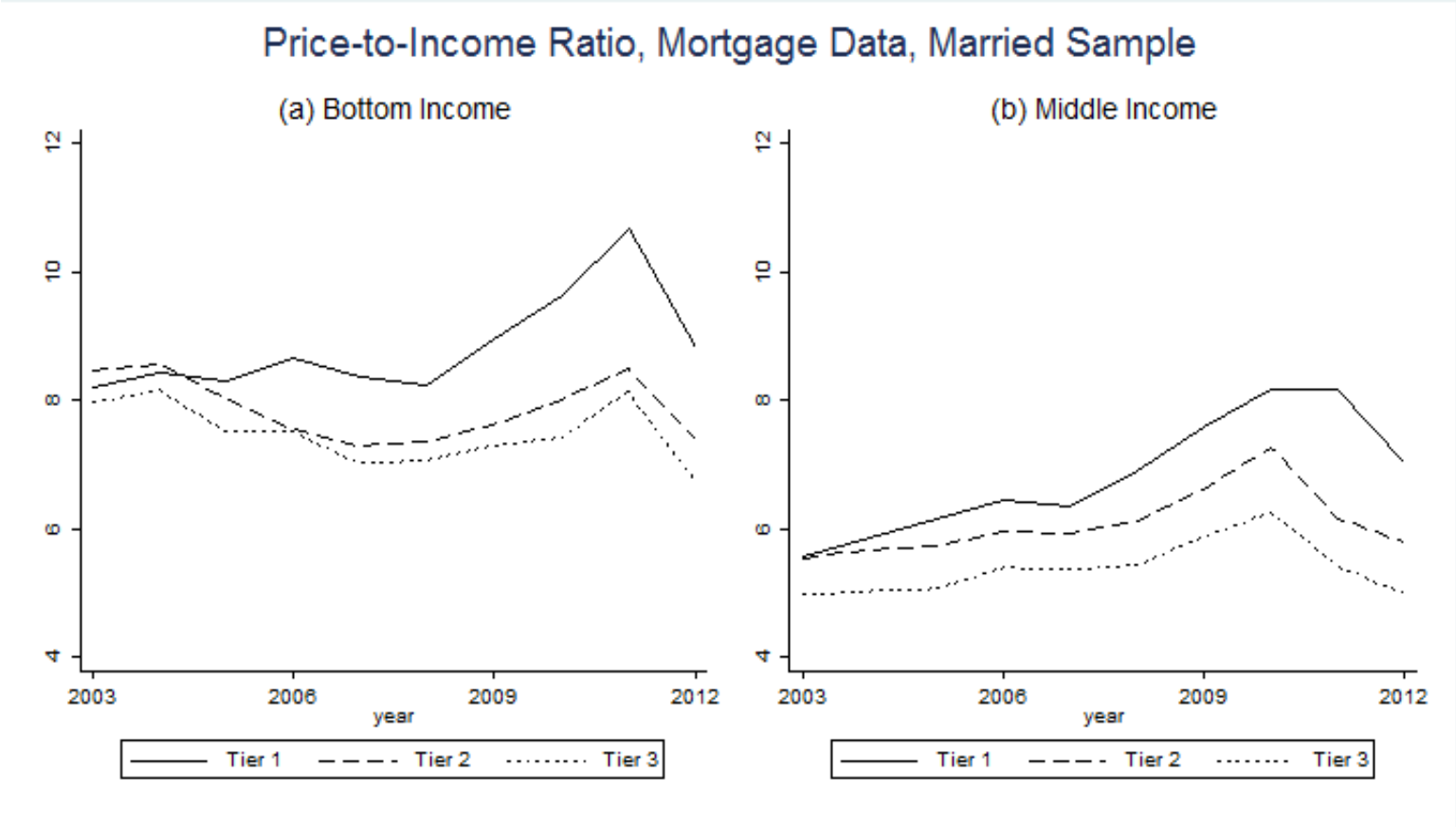
Mortgage Down Payment



Price-to-Income Ratio of Mortgage Borrowers



Price-to-Income Ratio of Mortgage Borrowers



Financial Burden of Mortgage Borrowers

- Consider a price-to-income ratio of 8
  - 40% down payment implies a saving of 3.2 years of household income
  - A mortgage loan at 4.8 times of annual income
    - 6% mortgage rate implies ~29% of income to pay mortgage interest
    - With a maximum 30 year mortgage maturity, 4.8/30=16% income to pay down mortgage (linear amortization)
- Hidden debt to pay for the mortgage down payment?
  - Banks are allowed to grant only one mortgage on one home
  - Young people typically rely on parents or other family members to pay the down payment

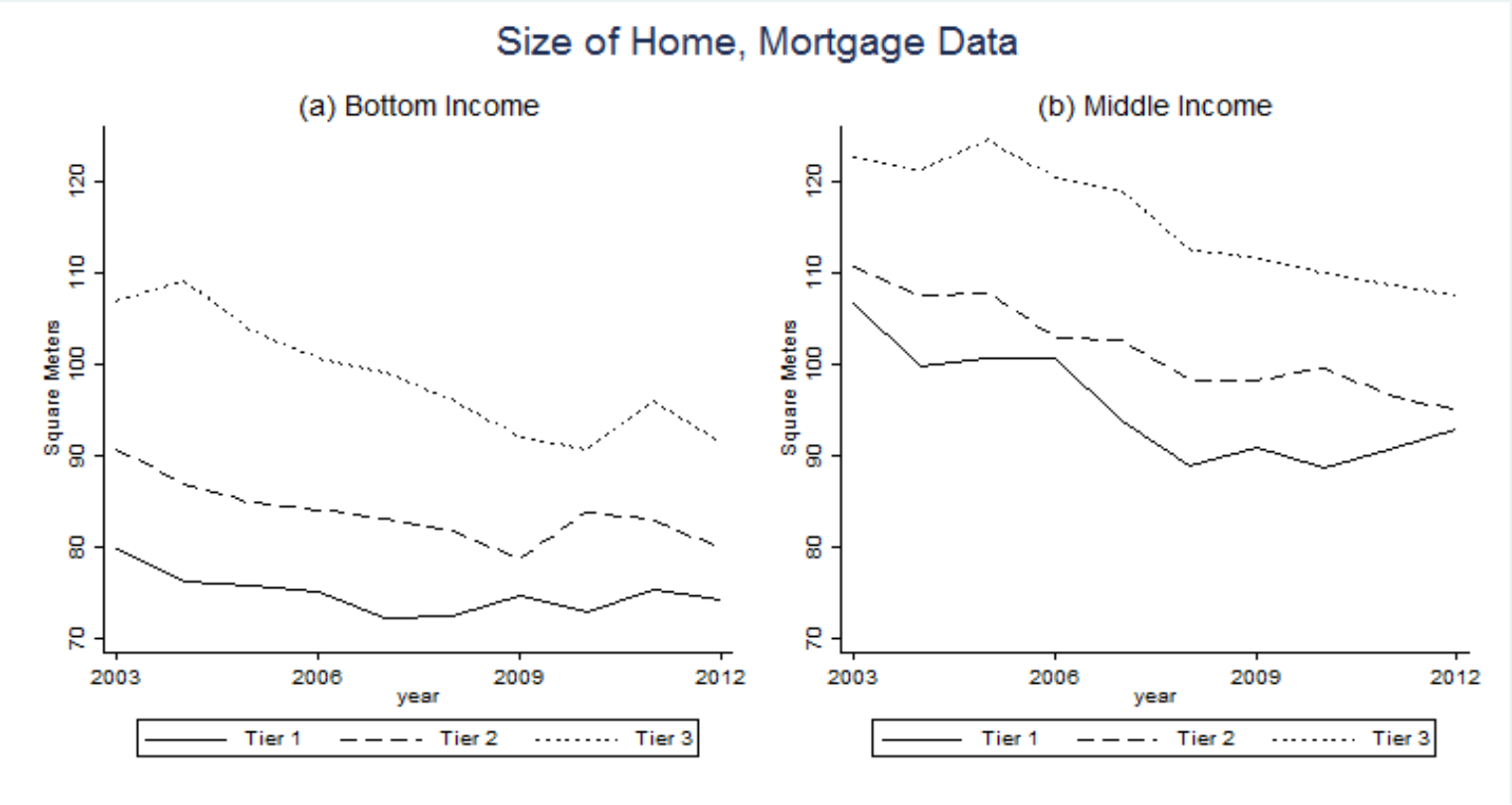
Financial Burden of Mortgage Borrowers

- Why would (bottom-income) borrowers endure such financial burden?

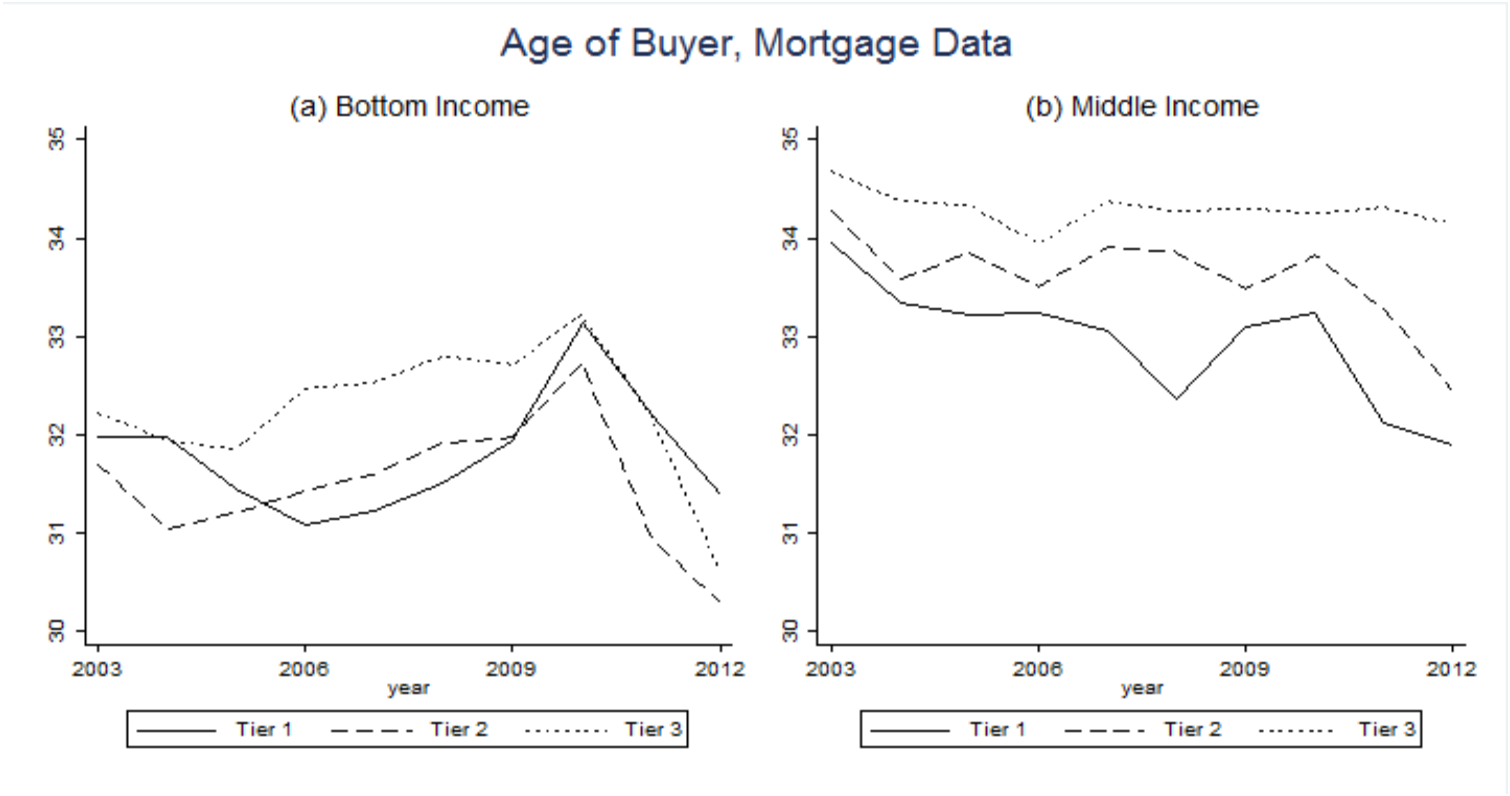
- Suppose an income growth rate of 10%
  - Income will grow to 1.6 times in 5 years
  - Current price to future income in 5 years is only 5!

- Households may also expect housing prices to rise at high rates, as motivated by the expectations of high income growth in the cities

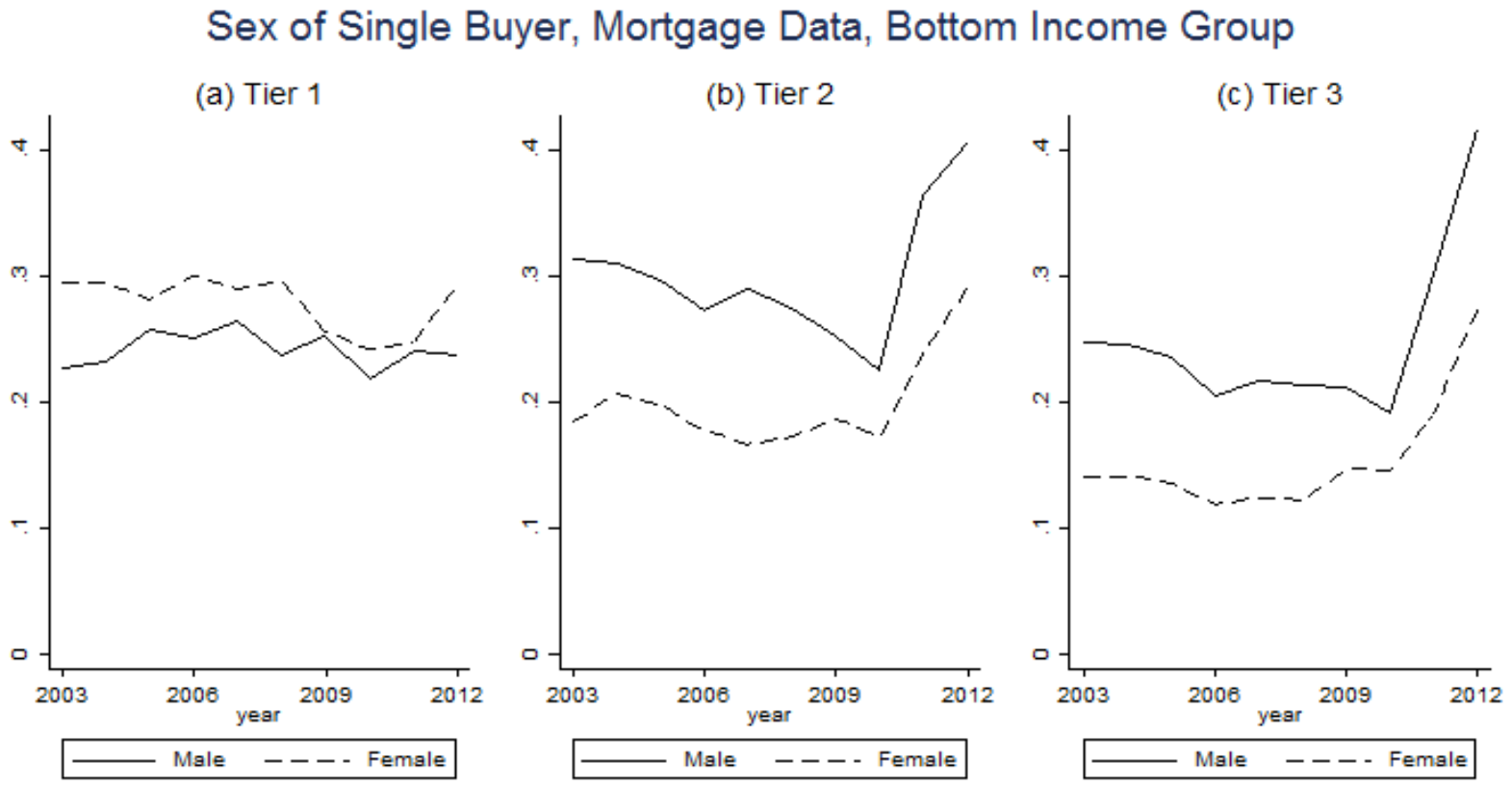
Home Size


Size of Home, Mortgage Data
(a) Bottom Income
(b) Middle Income
Square Meters
70
80
90
100
110
120
2003
2006
2009
2012
year
Tier 1
Tier 2
Tier 3

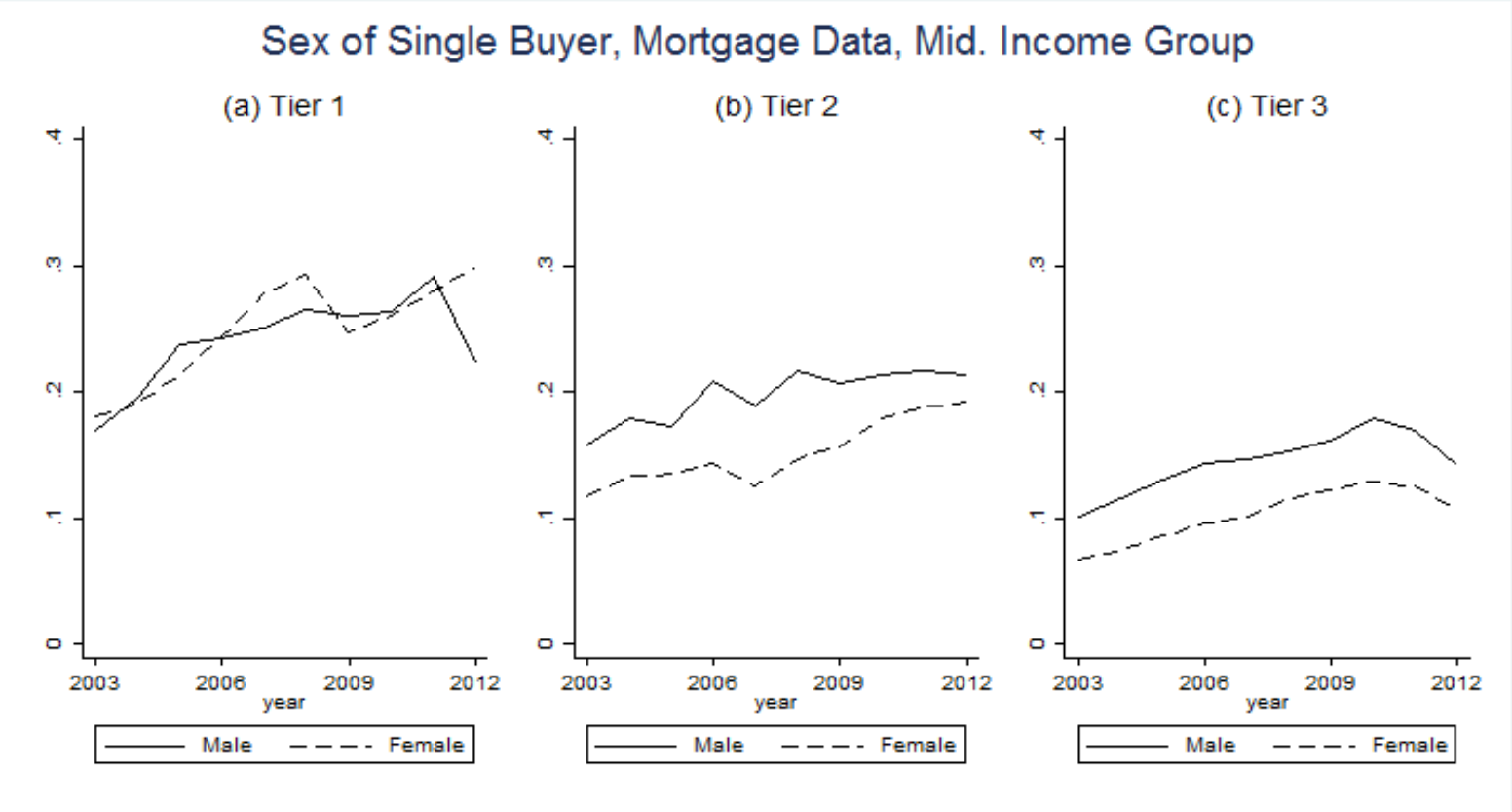
Age of Mortgage Borrowers



Marital Status of Mortgage Borrowers



Marital Status of Mortgage Borrowers



Fraction of Second Mortgages

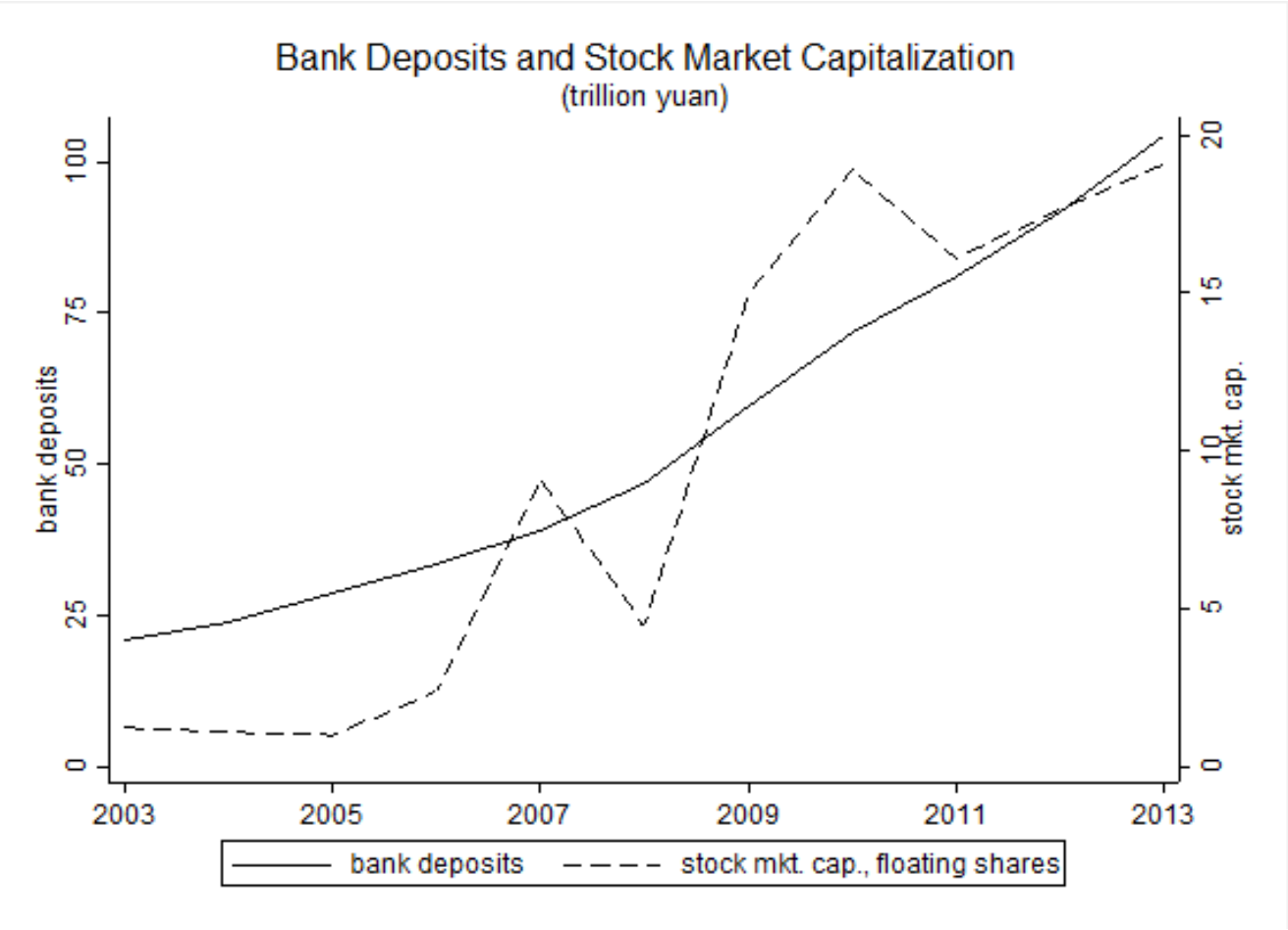
- Banks are allowed to grant only one loan on one home
- Second mortgages are used to buy non-primary homes

	2011	2012	2013
First-Tier Cities	5.3%	5.2%	11.8%
Second-Tier Cities	2.0%	2.4%	3.3%
Third-Tier Cities	1.0%	1.3%	1.8%

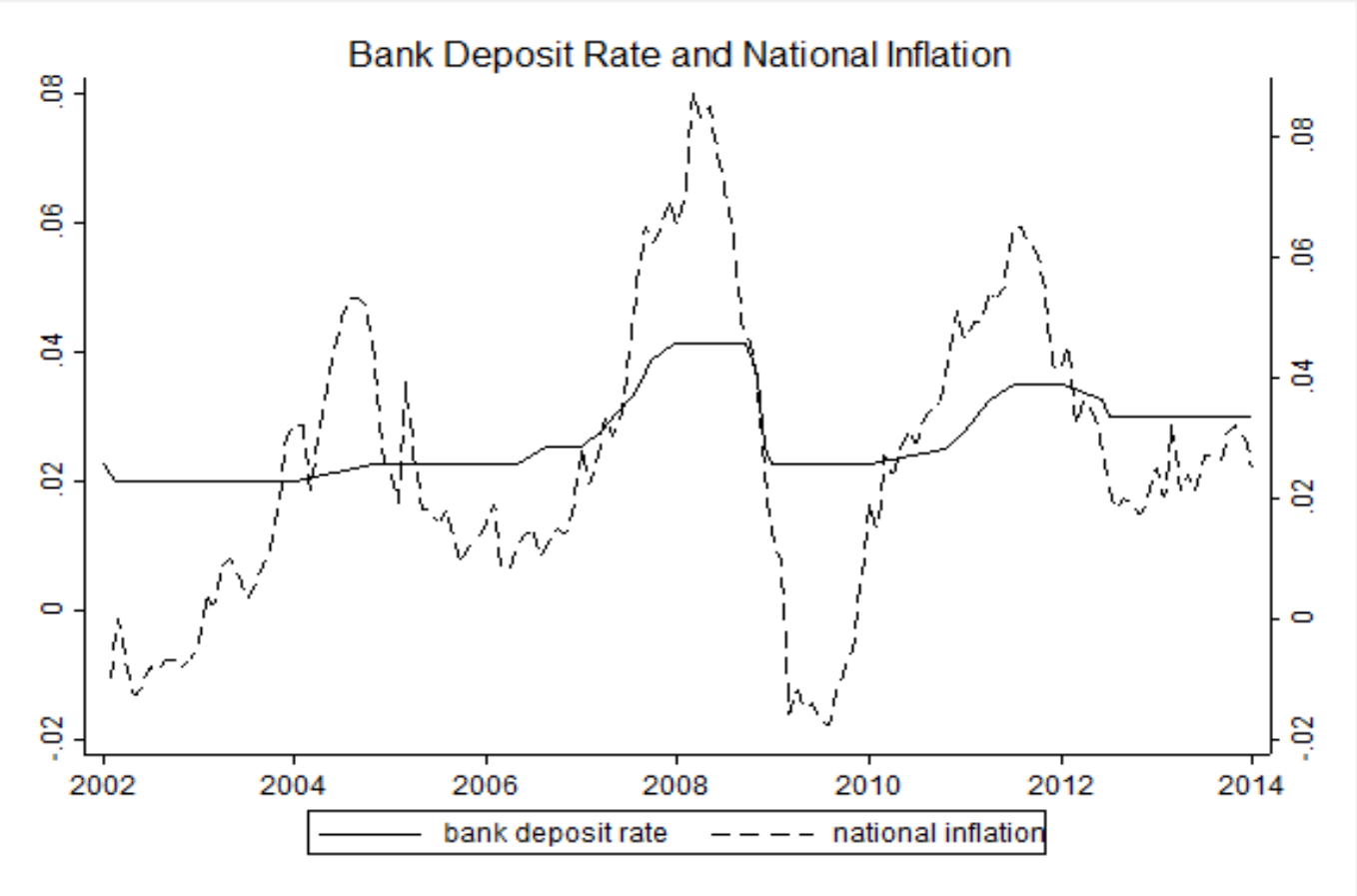
Housing as an Investment Vehicle

- High savings rate in China
  - 35% of GDP in 1980s, 41% in 1990s, and over 50% in 2000s
  - Households, firms and government have all contributed to the high saving rate
- Limited savings vehicles due to stringent capital controls
  - Bank deposit
  - Stocks
  - Government and corporate bonds
  - Housing

Bank Deposits and Stock Market Capitalization



Bank Deposit Rate and National Inflation



Shanghai Stock Market Index

	Mean	Std. Dev.	Skewness
2003-2013	.073	.515	-.153
2003-2008	.0898	.662	-.337
2009-2013	.053	.339	1.182

Annual Returns of Housing (2003-2013)

Full Sample (2003-2013)			
	Mean	Std. Dev.	Skewness
First-Tier Index	.157	.154	-.674
Second-Tier Index	.135	.0989	.564
Third-Tier Index	.110	.075	.092

Before 2009 (2003-2008)			
	Mean	Std. Dev.	Skewness
First-Tier Index	.204	.105	-.059
Second-Tier Index	.173	.099	.852
Third-Tier Index	.117	.095	-.028

After 2009 (2009-2013)			
	Mean	Std. Dev.	Skewness
First-Tier Index	.109	.191	-.249
Second-Tier Index	.097	.094	.474
Third-Tier Index	.103	.059	-.057

Challenges in Understanding the Housing Boom

- Several key facts:
  - Housing prices rising at an average annual rate of at least 10% in 2003-2013
  - Household income also rising at an average rate of 10%
  - Deposit rate around 2-4% and mortgage rate around 6-7%
  - Low-income households purchasing homes at 8 times their income

- A quantitative challenge
  - As an investment asset, housing return is determined by discount rate
    - High housing return and low interest rate imply substantial (perceived) risk in housing market, such as risk of income growth suddenly crashing despite income growth has been highly persistent over the past 30 years
  - On the other hand, the high price-to-income ratio endured by low-income households implies low income crashing risk perceived by these households

Challenges in Understanding the Housing Boom

- Divergent expectations reflected by housing prices and stock prices
  - Stock prices crashed after 2008 and haven't recovered yet---Shanghai stock market index is still half below its peak in 2007
  - Housing prices had a mild downturn in 2008 but rose back strongly after 2009 for at least 60%

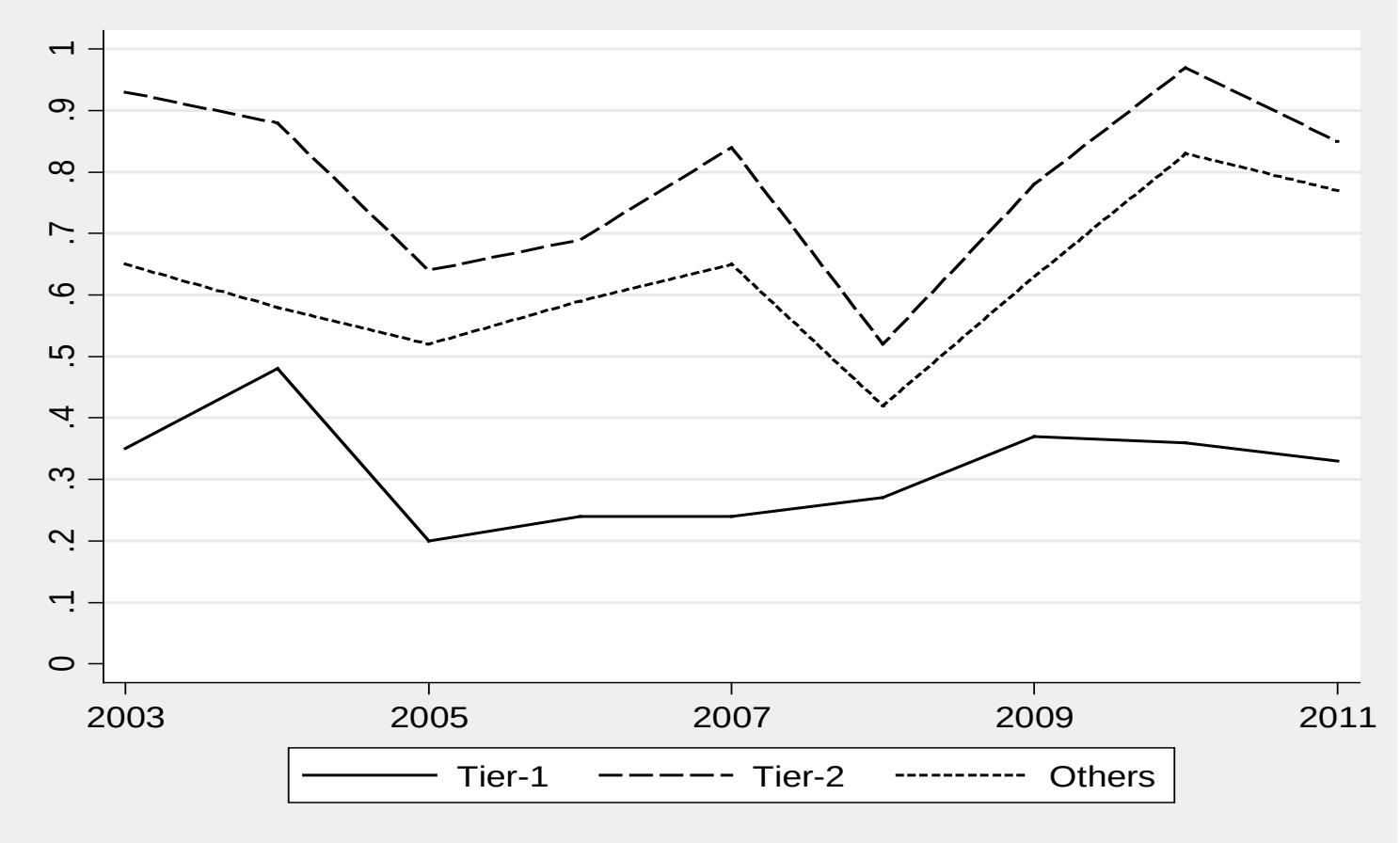
The Roles of Government

- Housing markets are widely perceived to be too important to fail
  - Helps explain the robust expectations about housing prices
- The central government frequently intervened in housing markets
- Land sales are a key source of fiscal revenue for local municipalities

Interventions by Central Government

- In September 2007, raised the minimum down payment ratio from 30 percent to 40 percent, and capped the monthly mortgage payment-to-income ratio at 50%.
- In April 2008, it imposed tax on capital gains from housing sales.
- In October 2008 it reversed these policies. It reduced the minimum mortgage rates to 70 percent of the benchmark rate and the down-payment ratio back to 30 percent.
- Starting from April 2010, following the guidelines of the central government, 39 of the 70 major cities in China introduced the *housing purchase restriction policies*.

Share of Land Revenue in City Budget



Risk in Chinese Housing Markets

- Banks are not exposed to severe risk in residential mortgages
  - Leverage might be a concern for real estate developers and local governments
- Housing markets are nevertheless fragile with respect to household expectation about future income growth
  - If economic growth slows down, households may not be willing to pay 8 times of their income to buy homes

Conclusion

- Construct pseudo repeated sales price indices for 120 Chinese cities
  - Accurately measure price appreciation in 2003-2013
- Enormous price appreciation accompanied by equally impressive household income growth in 2nd- and 3rd-tier cities
- Housing market participation of low-income households remained stable, although they endured great financial burdens with price-to-income ratios above 8
- Leverage is not a big concern for Chinese households, a key source of risk is households' expectations