DEMYSTIFYING THE CHINESE HOUSING BOOM

Wei Xiong, Princeton University

Joint work with
Hanming Fang, University of Pennsylvania
Quanlin Gu, Peking University
Li-An Zhou, Peking University

September 12, 2015
CONSTRUCTION BOOM ACROSS CHINA
GHOST TOWN IN INNER MONGOLIA
GRAVE CONCERNS

- A gigantic housing bubble in China is about to crash and eventually trigger a world economic crisis

The lack of reliable statistics about basic questions:
- How much have housing prices in China appreciated in the last decade?
- Were home buyers deep in debt?
- Was housing out the reach of typical households?
ROAD MAP

- Background information
- Construct a housing index to characterize the housing market boom
  - 2003-2013 for 120 cities
- Analyze mortgage borrowers to understand the demand side
- Some discussion
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
POPULATION GROWTH IN CITIES

Tier-1

Tier-2

Tier-3

- Jurisdiction
- City Proper

2004 2008 2012

0 40 80

0 75 150

0 100 200

0 150 300

0 200 400
INSTITUTIONAL BACKGROUND

- Housing market emerged only after late 1990s

  - Various reforms in 1990s
    - legalizing property rights to housing
    - abolishing housing allocation as in-kind benefit

  - 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
SUPPLY OF NEW HOMES
CONSTRUCTING HOUSING PRICE INDEX

Two standard approaches

- Hedonic price regressions, e.g., Kain and Quigley (1970)
  - Unobserved characteristics may lead to biased estimates
  - 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; but 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

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

A panel regression for each city:

\[
\ln P_{i,j,c,t} = \beta_{c,0} + \sum_{s=1}^{T} \beta_{c,s} \cdot 1\{s = t\} + \theta_c X_i + DP_j + \varepsilon_{iit},
\]

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

- A detailed mortgage data set for 120 major cities
  - a large commercial bank with 15% market share
  - one million mortgage loans, on new residential properties, 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

Mean = 2.68%
Std. Dev. = 2.11%

Source: National urban consumer price index, NBS.
PRICE INDICES FOR FIRST-TIER CITIES

A. Beijing

B. Shanghai

C. Guangzhou

D. Shenzhen
FIRST-TIER CITIES

A. Beijing

B. Shanghai

C. Guangzhou

D. Shenzhen
SECOND- AND THIRD-TIER CITIES

A. Tier-2 Cities

B. Tier-3 Cities
## Summary Statistics (Nominal)

<table>
<thead>
<tr>
<th>Nominal Growth</th>
<th>January 2003 - March 2013</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs</td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tier-1 Cities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing Price Index</td>
<td>4</td>
<td>0.159</td>
<td>0.031</td>
<td>0.128</td>
<td>0.2</td>
</tr>
<tr>
<td>Per capita GRP index</td>
<td>4</td>
<td>0.094</td>
<td>0.016</td>
<td>0.074</td>
<td>0.112</td>
</tr>
<tr>
<td>Per capita DI index (urban)</td>
<td>4</td>
<td>0.093</td>
<td>0.028</td>
<td>0.051</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Tier-2 Cities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing Price Index</td>
<td>31</td>
<td>0.132</td>
<td>0.022</td>
<td>0.082</td>
<td>0.189</td>
</tr>
<tr>
<td>Per capita GRP index</td>
<td>30</td>
<td>0.134</td>
<td>0.033</td>
<td>0.042</td>
<td>0.189</td>
</tr>
<tr>
<td>Per capita DI index (urban)</td>
<td>30</td>
<td>0.117</td>
<td>0.015</td>
<td>0.078</td>
<td>0.152</td>
</tr>
<tr>
<td><strong>Tier-3 Cities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing Price Index</td>
<td>85</td>
<td>0.106</td>
<td>0.036</td>
<td>0.007</td>
<td>0.178</td>
</tr>
<tr>
<td>Per capita GRP index</td>
<td>85</td>
<td>0.15</td>
<td>0.032</td>
<td>0.03</td>
<td>0.231</td>
</tr>
<tr>
<td>Per capita DI index (urban)</td>
<td>74</td>
<td>0.117</td>
<td>0.012</td>
<td>0.079</td>
<td>0.154</td>
</tr>
</tbody>
</table>
National Average

Price Index

- PI
- per capita GRP
- per capita DI (urban)
LAND PRICE AND GDP GROWTH IN JAPAN

Japan: Land PI and pcGDP
HOUSING PRICE AND GDP GROWTH IN SINGAPORE

Singapore: PI and pcGDP

[Graph showing the relationship between housing prices (PI) and GDP growth (pcGDP) in Singapore from 1975 to 2010.]
SUPPLY AND DEMAND SIDES

- Housing supply is ultimately determined by the local government
  - A monopolist of land supply, whose fiscal budget heavily relies on land sales

- Housing demand is determined by household income, expectations, and investment need
  - Has housing been out of reach of typical households?
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
Income of Mortgage Borrowers: First-Tier Cities

A. Income of Bottom and Median Mortgage Borrowers in Tier-1 Cities

(a) Income (Thousand RMB)

(b) Position in Population


Graphs showing income trends and position in population for different years.
INCOME OF MORTGAGE BORROWERS
SECOND-TIER CITIES

B. Income of Bottom and Median Mortgage Borrowers in Tier-2 Cities

(a) Income (Thousand RMB)

(b) Position in Population

[Graphs showing income and position over years for p10 and p50]
MORTGAGE DOWN PAYMENT

Ratio of Down Payment

(a) Bottom Income Group

(b) Middle Income Group
PRICE-TO-INCOME RATIO OF MORTGAGE BORROWERS

A. Price-to-Income Ratio in Full Sample

(a) Bottom Income Group

(b) Middle Income Group
**Financial Burden**

- Consider a price-to-income ratio of 8
  - 40% down payment implies a saving of 3.2 years of household income
    - Young people typically rely on parents or other family members to pay the down payment
  - 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)
Why would (bottom-income) borrowers endure such financial burden?

Suppose an income growth rate of 10%
- Such expectation is irresistible based on observations of the past 30 years
- Income will grow to 1.6 times in 5 years
- A price-to-income ratio of 8 will be only 5 in 5 years

Is the expectation of 10% income growth rate sustainable?
- Pritchett and Summers (2014): regression to the mean may come soon
- Then, the price-to-income multiple will crash with the households’ expectation
UNDERSTANDING THE HIGH PRICE-TO-INCOME MULTIPLE

- Housing is commonly used as an investment vehicle
- Housing is widely regarded as too important to fall
HOUSING AS AN INVESTMENT VEHICLE

- High savings rate in China
  - 35% of GDP in 1980s, 41% in 1990s, and over 50% in 2000s

- Limited savings vehicles due to stringent capital controls
  - Bank deposit ~100 trillion RMB in 2013
    - Zero real deposit rate
  - Stocks ~ 20 trillion RMB in 2013
  - Government and corporate bonds
  - Housing
## Shanghai Stock Market Index

![Shanghai A-Share Index, 2003-2013](image)

<table>
<thead>
<tr>
<th>Period</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2013</td>
<td>0.073</td>
<td>0.515</td>
<td>-0.153</td>
</tr>
<tr>
<td>2003-2008</td>
<td>0.0898</td>
<td>0.662</td>
<td>-0.337</td>
</tr>
<tr>
<td>2009-2013</td>
<td>0.053</td>
<td>0.339</td>
<td>1.182</td>
</tr>
</tbody>
</table>
The Roles of Government

- Housing market is widely perceived to be too important to fall
  - Helps explain the robust expectations about housing prices

- The central government frequently intervened in housing market
  - Tightened down payment requirement and increased mortgage rates when the market was considered too hot, and reversed these measures when the market faltered

- Local government controls land supply
  - Land sales are a key source of fiscal revenue for local municipalities
SHARE OF LAND REVENUE IN CITY BUDGET

Tier-1  Tier-2  Others
Enormous housing price appreciation across Chinese cities
- Comparable household income growth, except in the first-tier cities
- Steady participation by low-income households

Household leverage is not a particular concern

Housing market is unlikely a trigger for a financial crisis in China
- It may crash with an economic downturn and amplify the downturn
CONCEPTUAL ISSUES

- Is it reasonable to have housing prices rising with household incomes?
  - Not the experience in the U.S. and many other European countries
  - Not unusual in Asian countries

- Important to understand strategic behavior of the supply side