Are China’s Top 13 Cities Housing Markets in Bubbles?

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Motivation

- **Cover important period** from 2007Q2–2015Q3, incorporating the prosperity period of the “golden age” (2003 – 2013) and the “new normal” era (2014 onwards) in China’s real estate industry.

- **Top 13 important cultural, economic, developed cities’** house prices, contribute largely to China’s economy.

- Understanding bubble risk, main drivers of house prices important for business decision makers and government policy makers.

- **House prices, Bubble, Macroeconomy, OLS, VECM, business decision makings, policy implementations.**
Research questions

• RQ1: whether there are bubbles in China (top 13 cities) housing market?

• RQ2: what are the main drives of China (top 13 cities) housing prices?
China top 13 cities (First tier, 5)

1. **Beijing**: Political, economic, cultural center.
2. **Shanghai**: Biggest city, global financial hub
3. **Guangzhou**: Third biggest city, China’s biggest transport and trade hub
4. **Shenzhen**: One of the five largest and wealthiest cities, special economic zone
5. **Tianjin**: Major port city in Northern eastern China, one of the five national central cities
China top 13 cities (Second tier, top 8)

1. Hangzhou, **Nanjing**: Provincial capital cities, tourist cities.
3. **Chongqing**: Modern port city, the most economic developed city in West China. Biggest inland city in China.
5. **Ningbo**: A major port and industry hub in East China
6. Xiamen: A gate in South China, Port city and tourist city.
7. In 2015, count 25% of total GDP.
China top 13 cities house prices

Source: CitiRE
China top 13 cities house prices

- Calculated based on principal component methods

- National house prices have been through three troughs during the last eight years. (2007-2015), 2008Q4, GFC, 2011Q4 and 2014Q3, reflecting the cyclical nature of China’s housing markets.

- average house prices increased from RMB 29,358 per square meter in 2007Q2 to RMB 70,003 per square meter in 2015Q3, which is an increase by 138.45%, more than double over 8 years.
## Macroeconomic Variables Historical Statistics (National)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>St Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNIR (%)</td>
<td>6.01</td>
<td>0.75</td>
<td>4.60</td>
<td>7.47</td>
</tr>
<tr>
<td>Wages per yr (YMB)</td>
<td>41,115.10</td>
<td>11,643.55</td>
<td>22,966.5</td>
<td>60,862</td>
</tr>
<tr>
<td>CNSHARE</td>
<td>2776.30</td>
<td>845.04</td>
<td>1820.8</td>
<td>5552.30</td>
</tr>
<tr>
<td>CNUNEMPLOY (%)</td>
<td>4.11</td>
<td>0.09</td>
<td>4.00</td>
<td>4.30</td>
</tr>
<tr>
<td>CNGDP (USD billion)</td>
<td>10,076.03</td>
<td>1,764.30</td>
<td>6,767</td>
<td>12,557</td>
</tr>
</tbody>
</table>

Source: Trading economics database
Macroeconomic Variables (National)

- unemployment (CNUNEMPLOY) remains steady over the estimation period at approximately 4%. GFC time, RMB 4 trillion fiscal stimulus post GFC increased infrastructure and employment opportunities.
- Wages per annum increased by 165% from 2007Q2 to 2015Q3, reflecting the large annual GDP growth in China at this time.
- For share market performance (CNSHARE) suggests a cyclical trend. Real estate share important investment vehicles
- Lending rate of People’s Bank of China (CNIR), a cyclical trend. Continuous reductions stimulate economy.
- No regional macroeconomic variables, limitation.
Methodologically sound

- The estimation techniques used are ordinary least squares (OLS), and co-integration techniques Vector Error Correction (VECM) Models.

- Using advanced time series analysis techniques such as the variance inflation factor (Multicollinearity), Durbin–Watson statistic (autocorrelation), Glejser test (Homoscedasticity), Jarque-Beta statistic (normality assumption) to test OLS assumptions.

- VECM to test for house price bubbles, the long run economic equilibrium is a condition and economic forces are balanced, resolve the spurious correlation diagnostic concerns. Augmented Dickery-Fuller (ADF) is employed to test stationarity.

- Transformed empirical variables may be a better indicator for visualisation and interpretation.
Theoretical bases

- **Housing demand model**
  - Demand for residential real estate property obeys the fundamental law of demand, highlighting three main types of drivers: i) population, households and employment, or output, as determined by metropolitan growth processes; ii) income and wealth, which represent purchasing power; and iii) relative prices or expectations over prices and growth (Sivitanidou, 2011).

- **Rational expectation model**
  - The assumptions of rational expectations are that firms maximize profits and individuals maximize utility (Chernoma and Hudson, 2017) which are bases for household purchase decisions.
Econometric specifications:

1. **OLS**

\[
CNHP = \beta_0 + \beta_1 CNIR + \beta_2 CNGDP + \beta_3 CNSHARE \\
+ \beta_4 CNUNEMP + \beta_5 CNHP(-1) + \mu
\]

2. **VECM**

\[
\Delta \ln (CNHP_t) = \alpha_0 + \gamma_0 \Delta \ln (X_t) + \delta (\ln (CNHP_{t-1}) - \beta_0 \ln (X_{t-1})) + \mu_t
\]
### OLS Result (main drivers):

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>t statistics</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNIR</td>
<td>-1552.96</td>
<td>-3.24</td>
<td>0.00a</td>
</tr>
<tr>
<td>CNGDP</td>
<td>1.41</td>
<td>4.55</td>
<td>0.00a</td>
</tr>
<tr>
<td>CNUNUNEMPLOY</td>
<td>-1559.73</td>
<td>-0.38</td>
<td>0.71</td>
</tr>
<tr>
<td>CNSHARE</td>
<td>1.13</td>
<td>3.79</td>
<td>0.00a</td>
</tr>
<tr>
<td>CNP (-1)</td>
<td>0.80</td>
<td>16.75</td>
<td>0.00a</td>
</tr>
<tr>
<td>C</td>
<td>-1.29</td>
<td>-1.49</td>
<td>0.15</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durbin – Watson</td>
<td>1.72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a, b significance at 1% and 5% levels respectively.
OLS result

• the p-values for residuals is $0.99$, 99% of the variations in the value of the house prices can be attributed to the four main drivers identified in the model

• A Durbin-Watson test statistic of $1.72$, minor first order linear autocorrelation in the regression residuals.

• Variance inflation factor (VIF) for the main drivers, except for the GDP of the house prices ranges between $1$ and $5$, suggesting moderate multicollinearity identified,

• Glejser test shows the p-values are $> 0.05$, homoscedasticity assumption met
OLS result

• A negative significant relationship between mortgage interest rates (CNIR) and China’s house prices (CNP).

• A positive significant relationship between China’s GDP (CNGDP) and China’s house prices (CNP).

• Unemployment (CNUNEMPLOY) in the main drivers of housing price equations are negative but insignificant.

• A positive significant coefficient from China’s share market index (CNSHARE). Real estate share important investment vehicles
ADF and Johansen co-integration results (bubble):

• Augmented Dickey–Fuller (ADF) unit root test was employed to test the stationarity of the variables affecting China’s house price.

• All variables are identified as stationary at first differences, that is at I (1). No unit root problems.

• Johansen test suggest a co-integration relationship between China’s house prices and the four main macroeconomic variables.

• long run co-integration relationships are identifiable through Johansen co-integration test, we can proceed to the VECM test.
### VECM Result:

<table>
<thead>
<tr>
<th>Error correction</th>
<th>D(ln(CNP))</th>
<th>Coefficient</th>
<th>t statistics</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoinEq1</td>
<td>-0.16</td>
<td>-2.93</td>
<td>0.01\textsuperscript{a}</td>
<td></td>
</tr>
</tbody>
</table>

Note: a \textsuperscript{a} significance at 1\% and 5\% levels respectively
VECM Results:

• The parameter estimates for the error correction term (ECT) are significant with the expected negative sign, suggesting the speed at which housing prices return to equilibrium after short-term disequilibrium correction.

• the ECT (-1) estimated coefficient is -0.16, suggesting that 16% of the short-term disequilibrium is corrected within 3 months by main drivers.
Contribution

• **Better understanding** of the house price dynamics and bubble risks in China’s top 13 cities.

• 13 cities house prices analysis **provides us with a unique opportunity** to study the major real estate markets, which has significant impacts in China’s overall economy and contribute to major implications on business decisions makings and policy setting.

• **Important data period** includes the prosperity period of the “golden age” (2003 – 2013) and the “new normal” era (2014 onwards)

• Devising of an OLS and VECM model using the **rigorous advanced time series econometric techniques and co-integration techniques**.

• **Theoretical continuity of** house price dynamic study and bubble analysis based on existing theories.
Policy implications

• Monetary policy shocks, may have a differential impact on the top 13 cities’ house prices performance and regional economic developments. Policy maker implement **balanced fiscal, monetary, other housing policies** to avoid the sensitivity of the economy to exogenous financial shocks, which may result in negative consequences for macroeconomic stability. **Achieve sustainable outcomes.**

• Continuous interest cutes lead to financial stability risks and volatility in business investors and financial institutional lenders setting business policies. **Businesses set industry policies to ease the volatility, avoid over focusing on financial levers, focusing on institutional, broad drivers.**

• Variations in affordability rates in top 13 cities in China may suggest government have **regional affordability measures.**