U.S. Housing as a Global Safe Asset: Evidence from China Shocks

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Federal Reserve Board

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Motivation and Research Questions

Motivation

▷ Anecdotes about Chinese buyers playing an important role in housing markets in cities around the world
▷ Policy-makers in several jurisdictions have introduced restrictions or taxes on foreign purchases of residential real estate
▷ However, most countries do not collect data on foreign purchases of residential real estate

Research Questions

1. Are cross-border capital flows data consistent with substantial Chinese purchases of U.S. residential real estate?
2. Has demand from Chinese buyers affected house prices in U.S. cities?
Motivation

Wealthy Chinese home buyers boost suburban L.A. housing markets

By E. SCOTT RECKARD AND ANDREW KHOURI  MARCH 24, 2014  |  5 AM

Wealthy Chinese buyers are a growing force in U.S. real estate markets

By Troy McMuilen  October 14, 2016

Chinese investors mess with Texas in hunt for cheaper property

FTCR survey finds demand for global real estate recovers from capital controls shock

THE WALL STREET JOURNAL

Foreign Buyers Pump Up U.S. Home Prices

Canadian and Chinese buyers help fuel 50% jump to a new record

By Laura Kusisto
Methodology

**Macro evidence:** Assess whether the available capital flows data from the U.S. and China are consistent with substantial purchases of residential real estate.

**Micro evidence**

1. Use web traffic from a real estate listings site to identify areas of the U.S. that are relatively heavily exposed to Chinese demand for residential real estate

2. Match China-exposed areas (“treatment group”) with otherwise similar non-exposed areas (“control group”).

3. Calculate the average difference in house price growth between treatment and control group (ATET)

**Linking Micro to Macro:** How does the estimated treatment effect co-move with capital inflows from China?
Summary of the Findings

1. Aggregate capital flows data are consistent with inflows to U.S. residential real estate market from China.
   - These flows follow periods of economic stress in China, suggesting they are safe haven flows.

2. Price growth is significantly faster in “treated” China-exposed postal codes than in matched controls
   - Price growth gap widens by a cumulative 7-14% over 2010-2016, or 1-2% annually

3. Time variation in the average price gap is significantly related to aggregate capital inflows from China.
   - The timing of the peak effect is consistent with the timing of real estate transactions.
Interpretation of Results

1. Capital controls constrain Chinese households’ holdings of foreign assets
   - Substantial pent-up demand for portfolio diversification via foreign assets

2. Chinese capital controls constrain holdings of U.S. financial assets more than holdings of U.S. residential real estate

3. Demand for U.S. assets rises when benefits of international portfolio diversification increase, as in periods of stress in China
Related Literature

1. International capital flows and house prices
   - **Macro evidence:** Aizenman & Jinjark (JIMF 2014); Cesa-Bianchi, Cespedes, and Rebuccion (JMCB 2015); Sa, Towbin, & Wieladek (JEEA 2014).
   - **Micro evidence** from
     - London (Badarinza & Ramadorai JFE 2018),
     - Germany (Bednarek et al 2019)
     - California (Li, Shen, and Zhang 2019)
     - Gorback & Keys (2020)

2. Foreign Assets and Liabilities
   - Lane & Milesi-Ferretti (JIE 2007); Curcuru, Thomas, and Warnock (2008)
Plan for the talk

Introduction

Macro Evidence: Aggregate Cross-Border Flows Data

Micro Evidence: Chinese Demand and Post Code-level House Prices

Linking Micro to Macro

Robustness

Conclusions
Macro Evidence (1): Comovement between private Chinese capital outflows and U.S. statistical discrepancy

Source: Haver, authors’ calculations. Graph plots correlation between 4–quarters rolling sum of net private outflows from China and US statistical discrepancy.
Macro Evidence (2):
Bank inflows from China and unrecorded U.S. inflows

Correlation: 0.472

Hard landing fears
Surprise devaluation

Inflows to U.S. from China, USD billion
3-quarter ahead US statistical discrepancy, excl. CLOs (RHS)

Change in Chinese & HK deposits in US banks (LHS)

Not the case for most other countries
Macro Evidence: Why is this consistent with real estate purchases?

Chinese resident deposits funds in a U.S. bank
⇒ Bank’s foreign liabilities increase
⇒ U.S. records a banking inflow in the balance of payments

Chinese resident uses those funds to purchase a house
⇒ Bank’s foreign liabilities fall
⇒ U.S. records a banking outflow in the balance of payments
⇒ Purchase of a house *should* be recorded as an offsetting FDI inflow, but is not
⇒ Positive U.S. statistical discrepancy

3-quarter lag consistent with time needed to search for a house and finalize the transaction
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Introduction

Macro Evidence: Aggregate Cross-Border Flows Data

Micro Evidence: Chinese Demand and Post Code-level House Prices
  - Data
  - Matching
  - Results: The Average Treatment Effect on the Treated

Linking Micro to Macro

Robustness

Conclusions
Micro Evidence: Measuring Chinese Demand for U.S. Residential Real Estate

We obtain page views data from Juwai.com ("living abroad"), which lists U.S. properties on a website catering to residents of mainland China

- 670,000 views of properties in 7,000 U.S. ZIP codes, located in 917 cities ("Core-based Statistical Areas’,’ CBSAs)
- Cross sectional snapshot: Nov 2016-Jan 2017

⇒ We use the Juwai views data to measure the demand for U.S. residential real estate originating from China at the ZIP code level
Chinese Views of U.S. Properties

Figure 2: Chinese Views of U.S. Listed Properties, by CBSA

Views
- 10 - 279
- 279 - 974
- 974 - 2093
- 2093 - 4149
- 4149 - 6626
- 6626 - 13235
- 13235 - 37753
- 37753 - 52175
Validation (1): Airline Passenger Arrivals

![Graph showing the relationship between log passenger arrivals from China and log Juwai Views.]

Log passenger arrivals from China vs. Log Juwai Views

Source: Juwai and FAA.

$r = 0.539^{***}$
Validation (2): Share of Cash Sales


Sources: Juwai and CoreLogic.
Matching Methodology: Overview

1. Define a treatment group of U.S. ZIP codes heavily exposed to Chinese demand and a control group with relatively little exposure

2. Match each treated ZIP code with five control ZIP codes based on observables

3. Calculate average treatment effect on the treated

\[ ATET = \sum_{z=1}^{N_{treated}} \omega_z \left( \Delta price_z^{untreated} - \Delta price_z^{control} \right) \]

Where

\[ \Delta price_z^{untreated} = \text{average of price growth in the five matched control areas.} \]
Treatment and Control Groups

**Treatment Group**: In each city, top 10 percent of ZIP codes in terms of views

- 370 ZIP codes in 20 CBSAs
- Account for 43 percent of U.S. employment
- Median home price is $500,000 (as of Dec 2016)

**Control Group**: Bottom 50 percent in terms of views in each city

To control for unobserved local effects, match each treated ZIP only with other ZIPs in the same CBSA:

- “Apples-to-apples” but limits us to CBSAs with many ZIPs
- We also match nationally and find very similar results (in the paper)
Matching Procedure

Nearest neighbor matching methodology based on Abadie and Imbens (2006)
Match on

- Population size in 2010
- Percent of ethnic Chinese population in 2010
- Log median house price in 2010
- Distance from the nearest college
- Average commute time in 2010
- Average house price appreciation, 2001-2006

For each treated ZIP, select the 5 control ZIPs which have smallest sum of squared differences from the treated ZIP in terms of these six variables
Matching Results: House price growth 7% faster over the period 2010-2016
Time variation of the price growth gaps reveal local peaks around times of China economic distress after 2010.
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Introduction

Macro Evidence: Aggregate Cross-Border Flows Data

Micro Evidence: Chinese Demand and Post Code-level House Prices

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Conclusions
Linking Micro Results to Macro Data:
Price growth gap comoves with bank inflows from China

Treatment effect is the difference in 2-year house price growth between China-exposed ZIP codes and matched controls, calculated using Treatment Definition 1.
Sources: TIC system, authors' calculations.
Linking Micro Results to Macro Data: Local Projections

We estimate the following local projection

\[
ATET_{t+h} = \alpha^h + \beta^h \text{China Deposit Inflows}_t + \gamma^h_1 \Delta NFP_t + \gamma^h_2 r^{mort}_t \\
+ \sum_{j=1}^{9} X_{t-j} \Lambda_j^h + \varepsilon_t
\]

Where

\(ATET_{t+h}\) = Average gap between price growth in China-exposed U.S. ZIP codes and matched non-exposed ZIP codes at time \(t + h\)

\(\text{China Deposit Inflows}_t\) = Deposit inflows to the U.S. from China and HK at time \(t\), \% of Chinese and HK deposits at \(t - 1\)

\(\Delta NFP_t\) = Growth in U.S. nonfarm payrolls, seasonally adjusted, month-on-month

\(r^{mort}_t\) = 30-year U.S. mortgage rate

\(X_{t-j}\) = vector of lagged dependent variable and controls
Local Projection Results:
Chinese Inflows and the Price Growth Gap

Response of treatment effect to one percentage point increase in deposit inflows from China

All regressions include 9 lags of the treatment effect, as well as contemporaneous values and 9 lags of China_Deposit_Inflows and the domestic control variables (nonfarm payrolls and 30-year mortgage rates.)
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Introduction

Macro Evidence: Aggregate Cross-Border Flows Data

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Linking Micro Results to Macro Data: Robustness Tests

1. Construct same matching estimator for placebo ZIP codes
   ▶ Identify as treated “hot” areas with a recent history of rapid house price appreciation.
   ▶ Resulting price growth gap (significant by construction) is unrelated to any China shocks.

2. Treatment effect is not significantly related to U.S. domestic variables in the local projections.

3. Test relationship between our estimated treatment effect and capital inflows from countries other than China
   ▶ Confirm that the relationship we uncover is not simply a reflection of a global financial or global housing cycle.
Conclusions

Relationship between U.S. capital inflows from China and the U.S. statistical discrepancy consistent with unrecorded flows into residential real estate

▶ These flows peak following periods of economic stress in China, suggesting they are safe haven flows.

Areas of the U.S. exposed to Chinese demand see significantly higher house price appreciation than matched control areas.

Local projections show

▶ A significant relationship between aggregate deposit inflows to the U.S. from China and the estimated gap in price growth between treated and control areas

▶ Timing consistent with real estate transactions.
Macro Evidence: Substantial share of Chinese capital outflows placed in U.S. banking system

Correlation: 0.625

Money and deposit outflows from China (LHS)
Change in Chinese & HK deposits in US banks (RHS)
Macro Evidence: China-U.S. Correlation is an Outlier

Correlation, Foreign deposit outflows vs U.S. Statistical Discrep., 2005–2018

# Share of Juwai Views by City

<table>
<thead>
<tr>
<th>Rank</th>
<th>CBSA</th>
<th>State</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Los Angeles-Long Beach-Anaheim</td>
<td>CA</td>
<td>18.9%</td>
</tr>
<tr>
<td>2</td>
<td>New York-Newark-Jersey City</td>
<td>NY-NJ-PA</td>
<td>12.3%</td>
</tr>
<tr>
<td>3</td>
<td>Seattle-Tacoma-Bellevue</td>
<td>WA</td>
<td>5.5%</td>
</tr>
<tr>
<td>4</td>
<td>Riverside-San Bernardino-Ontario</td>
<td>CA</td>
<td>4.3%</td>
</tr>
<tr>
<td>5</td>
<td>San Jose-Sunnyvale-Santa Clara</td>
<td>CA</td>
<td>3.0%</td>
</tr>
<tr>
<td>6</td>
<td>Houston-The Woodlands-Sugar Land</td>
<td>TX</td>
<td>2.8%</td>
</tr>
<tr>
<td>7</td>
<td>San Francisco-Oakland-Hayward</td>
<td>CA</td>
<td>2.8%</td>
</tr>
<tr>
<td>8</td>
<td>Orlando-Kissimmee-Sanford</td>
<td>FL</td>
<td>2.6%</td>
</tr>
<tr>
<td>9</td>
<td>Chicago-Naperville-Elgin</td>
<td>IL-IN-WI</td>
<td>2.2%</td>
</tr>
<tr>
<td>10</td>
<td>Miami-Fort Lauderdale-West Palm Beach</td>
<td>FL</td>
<td>2.2%</td>
</tr>
<tr>
<td>11</td>
<td>Boston-Cambridge-Newton</td>
<td>MA-NH</td>
<td>2.0%</td>
</tr>
<tr>
<td>12</td>
<td>San Diego-Carlsbad</td>
<td>CA</td>
<td>2.0%</td>
</tr>
<tr>
<td>13</td>
<td>Washington-Arlington-Alexandria</td>
<td>DC-VA-MD-WV</td>
<td>2.0%</td>
</tr>
<tr>
<td>14</td>
<td>Sacramento–Roseville–Arden-Arcade</td>
<td>CA</td>
<td>1.9%</td>
</tr>
<tr>
<td>15</td>
<td>Philadelphia-Camden-Wilmington</td>
<td>PA-NJ-DE-MD</td>
<td>1.4%</td>
</tr>
<tr>
<td>16</td>
<td>Urban Honolulu</td>
<td>HI</td>
<td>1.4%</td>
</tr>
<tr>
<td>17</td>
<td>Atlanta-Sandy Springs-Roswell</td>
<td>GA</td>
<td>1.4%</td>
</tr>
<tr>
<td>18</td>
<td>Oxnard-Thousand Oaks-Ventura</td>
<td>CA</td>
<td>1.2%</td>
</tr>
<tr>
<td>19</td>
<td>Dallas-Fort Worth-Arlington</td>
<td>TX</td>
<td>0.9%</td>
</tr>
<tr>
<td>20</td>
<td>Detroit-Warren-Dearborn</td>
<td>MI</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Determinants of Demand from Foreign Chinese Buyers

City (CBSA) level:

$$\Delta \ln \text{views}_i = \alpha + \beta_1 \text{chinese\_share\_init}_i + \beta_2 \text{dist\_to\_china}_i + \beta_3 \text{univ}_i$$
$$+ \beta_4 \ln \text{pop\_init}_i + \beta_5 \ln \text{med\_price\_init}_i$$
$$+ \gamma_1 \text{temp}_i + \gamma_2 \text{unemp}_i + \gamma_3 \text{commute\_time}_i$$
$$+ \delta \text{hist\_apprec}_i + \theta_i + u_i$$

ZIP level, with CBSA fixed effect:

$$\Delta \ln \text{views}_i = \alpha + \beta_1 \text{chinese\_share\_init}_z + \beta_2 \text{dist\_to\_china}_z + \beta_3 \text{univ}_z$$
$$+ \beta_4 \ln \text{pop\_init}_z + \beta_5 \ln \text{med\_price\_init}_z$$
$$+ \delta \text{hist\_apprec}_s + \theta_i + u_i$$
## Determinants of Demand from Foreign Chinese Buyers

<table>
<thead>
<tr>
<th></th>
<th>CBSA-level</th>
<th>ZIP-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Chinese share</td>
<td>0.291*** (0.0620)</td>
<td>0.258*** (0.0623)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0504*** (0.0142)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0519*** (0.0144)</td>
</tr>
<tr>
<td>Distance to China</td>
<td>-0.0193 (0.0527)</td>
<td>-0.00689 (0.0538)</td>
</tr>
<tr>
<td></td>
<td>-1.599*** (0.326)</td>
<td>-1.715*** (0.329)</td>
</tr>
<tr>
<td>No.of/Distance to Univ</td>
<td>0.00101 (0.00633)</td>
<td>-0.000144 (0.00642)</td>
</tr>
<tr>
<td></td>
<td>-0.266*** (0.0218)</td>
<td>-0.255*** (0.0262)</td>
</tr>
<tr>
<td>Population</td>
<td>1.107*** (0.0378)</td>
<td>1.109*** (0.0385)</td>
</tr>
<tr>
<td></td>
<td>0.445*** (0.0282)</td>
<td>0.467*** (0.0281)</td>
</tr>
<tr>
<td>Initial median home price</td>
<td>0.469*** (0.118)</td>
<td>0.710*** (0.102)</td>
</tr>
<tr>
<td></td>
<td>0.532*** (0.122)</td>
<td>0.547*** (0.121)</td>
</tr>
<tr>
<td>Average temperature</td>
<td>-0.0174*** (0.00478)</td>
<td>-0.0148** (0.00479)</td>
</tr>
<tr>
<td>Initial unemployment rate</td>
<td>-0.0214 (0.0159)</td>
<td>0.00201 (0.0154)</td>
</tr>
<tr>
<td>Initial average commute</td>
<td>0.0155 (0.0106)</td>
<td>0.0177 (0.0108)</td>
</tr>
<tr>
<td>Ave. Δ home price, pre-crisis</td>
<td>0.0404*** (0.00958)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0222 (0.0132)</td>
<td></td>
</tr>
<tr>
<td>Ave. Δ home price, pre-2010</td>
<td>0.0271 (0.0164)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>556</td>
<td>556</td>
</tr>
<tr>
<td></td>
<td>7271</td>
<td>6564</td>
</tr>
<tr>
<td>R²</td>
<td>0.824</td>
<td>0.819</td>
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<tr>
<td></td>
<td>0.383</td>
<td>0.378</td>
</tr>
<tr>
<td>CBSA FE</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Share of Cash Sales, Major Cities

Seattle–Tacoma–Bellevue, WA

Log Juwai Views


Los Angeles–Long Beach–Anaheim, CA

Log Juwai Views


New York–Newark–Jersey City, NY–NJ–PA

Log Juwai Views


Washington–Arlington–Alexandria, DC–VA–MD–WV

Log Juwai Views


Sources: Juwai and CoreLogic.
Matching Results: Covariates in Treatment and Control

Indicator 1: CBSA=20, Juwai within cbsa percentile<.1 (treatment), >.5 (control)

Log Distance from nearest college

Mean commute time, 2010

Shr of ethnic Chinese in pop, 2010

Total population, 2010

Median Housing Price, 2010

2001-06 avg annual housing price growth,%

Note: The line represents a 45 degree line, i.e. points on the line have the same value for control and treatment group.
Alternative Definition of Treatment vs Control

Our main matching methodology matches treated ZIP codes with control ZIPs in the same city

▶ Downside: limits our analysis to cities with enough ZIP codes.

For robustness, we also perform the exercise matching nationally, not just within cities:

▶ Treatment: Top 5% of ZIPs in terms of views nationally
▶ Control: Bottom 30% in terms of views nationally

But add additional matching variable: CBSA’s rank in terms of Chinese views
Distribution 6-year House Price Growth, Treatment Definition 2

2000-2006

Kernel = epanechnikov, bandwidth = 14.0681

2010-2016

Kernel = epanechnikov, bandwidth = 6.5921
Indicator 2

No. of CBSA=33, Juwai across cbsa percentile: <.05 (treatment), >.3 (control)
House Price Levels, Treated vs. Control Areas

Indicator 1
No. of CBSA=20, Juwai within cbsa percentile<.1 (treatment), >.5 (control)
House Price Levels, Treated vs. Control Areas

Indicator 2

No. of CBSA=33, Juwai across cbsa percentile: <.05 (treatment), >.3 (control)

![Graph showing the comparison of house price levels between treated and matched control areas from 2002 to 2018. The green line represents the treated areas, and the red line represents the matched control areas. The graph indicates a significant increase in house prices for both treated and matched control areas over the years.](image-url)
Results:
Chinese Inflows and U.S. Domestic Variables

Response of treatment effect to a one-unit shock to:

Nonfarm Payrolls Growth (%)

30-year Mortgage Interest Rate

Regressions include 9 lags of the dependent variable and shock variable China_Deposit_Inflows as well as contemporaneous domestic control variables plotted here.

66pct confidence 95pct confidence

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Placebo Tests:
Other Countries’ Inflows and the Price Growth Gap