How does the market react to cooling measures?  
The case of Singapore

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To buy or not to buy?
Macro-prudential Policies Post-crisis

- Monetary policy became a “blunt tool”
- Central banks turned to macro-prudential policies
  - e.g. loan-to-value ratio, stamp duties, etc
  - mostly aimed at housing market
- Objectives of MPPs
  1. to promote the resilience of the financial system by mandating higher levels of liquidity, capital and collateralisation
  2. to restrain the build-up of financial imbalances by slowing credit and asset price growth
Movements in house prices

Figure: House price movements in major cities since 2007.
How does macro-prudential policies work?

- Lean against the wind (Zhang and Zoli 2016)
- Discretion vs rule (Kuttner and Shim 2016)
- House price indices still show upward trends
Monetary vs macro-prudential policies

- Interest rate affects consumption and investments
  - hence the inflation
- LTV, DSTI ratios affect demand for loans
  - affect the demand for housing only indirectly
  - hence the house price more indirectly
Inelastic housing demand

Figure: No. of deals and property price indices.
Outline

- Motivation
- Singapore’s context
- Methodology and data
- Results
- Conclusion
Singapore’s housing market

- Public housing sector is dominant (Phang 2001)
  - Singapore citizens can afford their first homes
- Prone to foreign speculation (Chow and Xie 2016)
  - Free mobility of capital in and out of the real estate sector
  - Foreign investors have freedom in acquiring private properties in Singapore
- Challenge to policy makers
  - Housing market needs to remain attractive to investors
  - At the same time affordable to local residents and fundamentally healthy
Cooling measures in Singapore

Figure: Cooling measures and private property price index.
Cooling measures in Singapore

**Figure:** Cooling measures and private property price index.
Data

- SRX data for private and HDB transactions spanning from Jan 1, 2007 to Jun 30, 2016
  - Price
  - Size
  - Geo-location
  - Property type
- Monthly consumer price index from the CEIC Database
- We calculate the log real price per square foot
## Sampling periods

<table>
<thead>
<tr>
<th>$s$</th>
<th>Period</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Before cooling measures</td>
<td>Jan 1, 2007 – Sep 13, 2009</td>
</tr>
<tr>
<td>1</td>
<td>During cooling measures</td>
<td>Sep 14, 2009 – Dec 9, 2013</td>
</tr>
</tbody>
</table>
Hypothesis testing

- For a total of $S$ sampling periods, we define $\tau$ the conditional quantile $Q_s(\tau|x)$ of the log real house price psf $Y_s$ at period $s$ on the geo-location $X = x$:

$$P [Y_s \leq Q_s(\tau|x)|X = x] = \tau \quad (1)$$

- Null hypothesis:

$$H_0 : Q_s(\tau|x) = Q_{s'}(\tau|x) \quad (2)$$

for all $s \neq s'$.

- Acceptance of the null hypothesis implies stable house prices across the two periods
Uniform confidence bands (Chao et al. 2017)

- Bootstrapped simultaneous confidence bands
- For each period, and at location $x$, we compute an estimator of $Q_s(\tau|x)$ by

$$
\hat{Q}_s(\tau|x) = \arg\min_{q \in \mathbb{R}} \sum_{i=1}^{n_s} K_{h_s}(x - X_{i}^s) \rho_\tau(Y_{i}^s - q)
$$

(3)
Uniform confidence bands

- Härdle, Ritov, and Wang 2015 and Chao et al. 2017
- The simultaneous confidence set with nominal level $\alpha$:

$$
C_s (\mathcal{X}_0) := \left\{ (x, q) \in \mathcal{X}_0 \times \mathbb{R} : q \in \left[ \hat{Q}_s (\tau|x) \pm c_{\tau,n} \xi^*_\alpha \right] \right\}
$$

where $c_{\tau,n}$ is the scaling factor

$$
c_{\tau,n} := \sqrt{\frac{\tau(1 - \tau)}{n_s h_s |f_{Xs}(x)f_{Ys}|_{Xs} \left( \hat{Q}_s(\tau|x) \right)}}
$$

- The null hypothesis is rejected when two confidence sets ($s \neq s'$) are disjoint:

$$
C_s (\mathcal{X}_0) \cap C_{s'} (\mathcal{X}_0) = \emptyset
$$
A 250 × 250 grid of Singapore
From west to east
Price dynamics: West to east

(a) \( s = 1, \tau = 20\% \)

(b) \( s = 1, \tau = 50\% \)

(c) \( s = 1, \tau = 80\% \)

(d) \( s = 2, \tau = 20\% \)

(e) \( s = 2, \tau = 50\% \)

(f) \( s = 2, \tau = 80\% \)
Price dynamics: South to north

\begin{align*}
\text{(g)} \quad & s = 1, \tau = 20\% \\
\text{(h)} \quad & s = 1, \tau = 50\% \\
\text{(i)} \quad & s = 1, \tau = 80\% \\
\text{(j)} \quad & s = 2, \tau = 20\% \\
\text{(k)} \quad & s = 2, \tau = 50\% \\
\text{(l)} \quad & s = 2, \tau = 80\%
\end{align*}
Neighbourhood of an MRT station: Toa Payoh
Price dynamics: EW line

(m) $\tau = 20\%$

(n) $\tau = 50\%$

(o) $\tau = 80\%$
Price dynamics: NS line

(p) \( \tau = 20\% \)  

(q) \( \tau = 50\% \)  

(r) \( \tau = 80\% \)
Price dynamics: NE line

Real price per square foot period
07−09 10−13 14−16
Uniform confidence bands $\alpha = 0.05$ for $\tau = 0.2$ QR, public+private

(s) $\tau = 20\%$

(t) $\tau = 50\%$

(u) $\tau = 80\%$
Findings

- Cooling measures are more likely to suppress demand for loans, not for housing.
- We observe a pattern of substitution effect down the price distribution.
- Prices of the high-end houses are cooled first.
- Prices at the lower percentiles respond to cooling measures with lags.
Upcoming plan

- Use different independent variables:
  - E.g. distance from MRT stations
- Use specific policy tools as independent variables:
  - LTV ratio
  - Debt servicing ratio
  - Stamp duties
Thank you!

