The Impact of Macroprudential Housing Finance Tools in Canada: 2005-2010

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1The views presented in this paper are those of the authors and not necessarily those of the Bank of Canada.
Motivation

- Since the financial crisis governments have increased intervention in mortgage markets
  - Stimulate or dampen credit demand and house prices

- Evidence on the impact of macroprudential policies is mixed; Consultative Council of Americas joint project aimed at studying the effectiveness of macroprudential policies across 8 countries

- Canada has extensive experience with macroprudential policies in the mortgage market
  - Implemented via mortgage insurance requirements
Research question

What are the impacts of macroprudential housing-finance policies on mortgage demand?

- Direct impact on household borrowing of first-time-home-buyers through wealth and income constraints

  - **Wealth constraint**: house purchase constrained by the down-payment requirement
  - **Income constraint**: house purchase constrained by monthly mortgage payment requirement
Policies

- **Loosening: 2006-2007**
  - Amortization: 25 to 40 years in 5 year increments
  - Loan-to-Value: 95 to 100

- **Tightening: 2008-2010**
  - Amortization: 40 to 35 years
  - Loan-to-Value: 100 to 95
  - Minimum credit score requirements introduced

Substantially more tightening since 2010. Lower amortization, price caps, nonlinear LTV requirements, etc. All used to dampen mortgage demand.
Methodology

- **Descriptive**
  - Use transactions-level data to estimate the impact of policy changes on mortgage and borrower characteristics

- **Microsimulation model (HRAM)**
  - Use the model to estimate the impact of policy changes on mortgage demand
  - Model allows us to quantify impacts of macroprudential policy changes and conduct counterfactual policy analysis
> 50% of mortgages are gov’t insured (publicly or privately)

Require insurance if LTV at origination is 80 or higher; Mortgage insurance is for the life of the amortization; Gov’t sets mortgage insurance guidelines.
  - Source of macroprudential authority

Applies to all regulated and un-regulated lenders

Amortization: 25 years

Contract term: 5 years with balloon payment

LTV: 2/3 mortgages in the insured space have an LTV of 95%

Typical Total-Debt-Service ratio is 30%-33%
Data

- Population of insured mortgages from public insurer (CMHC)
- Transaction-level data from 24 February 2005 to 19 April 2010

**Key variables:** (i) contract terms, (ii) household financial characteristics, (iii) lender, (iv) location, (v) prior relationship with lender.

**Sample selection:**
- First-time home-buyers
- Mortgage terms of 1-10 years
- Fixed-rate mortgage contracts
Average TDS and LTV for first-time home-buyers

(a) Average TDS

(b) Average LTV
Average household income and mortgage payment for first-time home-buyers

(a) Household income

(b) Average payment to income
Results: Impact of macroprudential changes on key borrower characteristics

\[ y_{it} = \alpha + \beta X_{it} + \phi I(MP) + \theta_m + \gamma_l + \nu_b + \epsilon_{it} \]

- 10 separate regressions

<table>
<thead>
<tr>
<th></th>
<th>I(LTV ≥ 95)</th>
<th>log(tds)</th>
<th>log(mp/inc)</th>
<th>log(HP)</th>
<th>rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>loose (2006-07) v '05</td>
<td>0.043***</td>
<td>0.045***</td>
<td>0.106***</td>
<td>0.194***</td>
<td>0.695***</td>
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<td></td>
<td>(0.003)</td>
<td>(0.006)</td>
<td>(0.003)</td>
<td>(0.007)</td>
<td>(0.004)</td>
</tr>
</tbody>
</table>

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<th>log(tds)</th>
<th>log(mp/inc)</th>
<th>log(HP)</th>
<th>rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>tight (2008-10) v '06-'07</td>
<td>0.007***</td>
<td>0.002**</td>
<td>-0.044***</td>
<td>0.099***</td>
<td>-1.265***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.004)</td>
</tr>
</tbody>
</table>

- Increasing fraction of households at the LTV constraint
- Loan size constrained by LTV, not income (ambiguity in the income constraint)
Renters and Home-owners
A three-stage approach is used to determine if a renter will be a FTHB in period $t$:

1. Determine whether a household is a potential FTHB.
2. Determine whether a potential FTHB qualifies for a mortgages.
3. Determine the down payment a household will make, and whether a qualified FTHB actually purchases a house.
Three conditions for a household to be a potential FTHB:

- must be under fifty years old
- must not currently own housing assets
- must be employed.

### Key characteristics of potential FTHBs

<table>
<thead>
<tr>
<th>Variables</th>
<th>2007-2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
</tr>
<tr>
<td>Income</td>
<td>67,614</td>
</tr>
<tr>
<td>Age</td>
<td>35</td>
</tr>
<tr>
<td>Financial assets</td>
<td>29,224</td>
</tr>
<tr>
<td>Consumer debt/income</td>
<td>4.32</td>
</tr>
</tbody>
</table>
Model: Qualified FTHB

- All renters receive a preference mortgage payment shock:

\[ \omega_{i}^{GDS} \sim N \left( \mu \left( x_{i,0}^{Y} \right), \sigma \right). \]

- For each preference shock there is a corresponding mortgage payment:

\[ x_{i,t}^{MORT} = \omega_{i}^{GDS} \left[ \frac{x_{i,t}^{Y}}{12} \right] \left[ \frac{\left( (1 + r_{t}/2)^{1/6} - 1 \right) (1 + r_{t}/2)^{T*2}}{(1 + r_{t}/2)^{T*2} - 1} \right] \]
Model: Qualified FTHB

- (TDS constraint): Total household debt servicing must be below the total-debt-service threshold:

$$\omega_i^{GDS} + \frac{x_{i,t}^{CDPAY}}{x_{i,t}^{Y}} \leq \frac{TDS}{14 / 19}$$

- (Down payment constraint): The down payment by household $i$ must be above the regulatory minimum:

$$x_{i,t}^{DPMAX} \geq DP^{MIN}$$

- (Affordability constraint): Through a combination of down payment and servicing a mortgage, a household must be able to afford an entry level house:

$$x_{i,t}^{HPMAX} \geq HP^{STARTER}_{Regi,t}$$
Model: Buying FTHB and down payment decision

We assume that the probability that a qualified household will buy a house with down payment $dp_k$ depends upon a household’s maximum possible down payment as well as household income:

$$prob(dp_{i,t} = dp_k) = p(dp_k, x^Y_{i,t}, x^{DPMAX}_{i,t})$$

If $dp_k > x^{DPMAX}_{i,t}$, then $p(dp_k, x^Y_{i,t}, x^{DPMAX}_{i,t}) = 0$. For the other probabilities we perform a one-step GMM calibration to match the joint distribution of income and down payments.
<table>
<thead>
<tr>
<th>Income category ($)</th>
<th>Frequency (%)</th>
<th>mp/inc mean</th>
<th>LTV</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-24,999</td>
<td>0.5</td>
<td>18.1</td>
<td>9.9</td>
<td>49</td>
<td>25.1</td>
<td>16</td>
<td></td>
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<tr>
<td>25,000-34,999</td>
<td>2.8</td>
<td>18.2</td>
<td>12</td>
<td>45.7</td>
<td>23.4</td>
<td>19</td>
<td></td>
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<tr>
<td>35,000-44,999</td>
<td>7.3</td>
<td>18.9</td>
<td>14.5</td>
<td>41.4</td>
<td>25.1</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>45,000-54,999</td>
<td>11.7</td>
<td>18.9</td>
<td>14.5</td>
<td>39.3</td>
<td>27.2</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>55,000-59,000</td>
<td>6.8</td>
<td>18.7</td>
<td>14.7</td>
<td>39.8</td>
<td>26.4</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>60,000-69,999</td>
<td>14.5</td>
<td>18.6</td>
<td>14.9</td>
<td>39.1</td>
<td>27</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>70,000-84,999</td>
<td>19.0</td>
<td>18.1</td>
<td>14.4</td>
<td>40.2</td>
<td>28.4</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>85,000-99,999</td>
<td>14.2</td>
<td>17.6</td>
<td>13</td>
<td>37.6</td>
<td>27.5</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>100,000-119,000</td>
<td>11.3</td>
<td>16.6</td>
<td>12.2</td>
<td>36.7</td>
<td>28.0</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>120,000-149,999</td>
<td>7.2</td>
<td>15.3</td>
<td>10.7</td>
<td>34.9</td>
<td>29.4</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>150,000+</td>
<td>4.7</td>
<td>12.7</td>
<td>8.3</td>
<td>30.6</td>
<td>30</td>
<td>31</td>
<td></td>
</tr>
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## Results: Impacts of changes in macroprudential policy from the structural model

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Change in # of Qualified Households (%)</th>
<th>Change in # of FTHBs (%)</th>
<th>Change in FTHB Mortgage Debt (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amortization decrease 40 to 35</td>
<td>-3.4</td>
<td>-2.1</td>
<td>-5.3</td>
</tr>
<tr>
<td>Amortization decrease 35 to 25</td>
<td>-11.2</td>
<td>-7.8</td>
<td>-16.7</td>
</tr>
<tr>
<td>Amortization decrease 40 to 25</td>
<td>-14.0</td>
<td>-9.6</td>
<td>-21.0</td>
</tr>
<tr>
<td>LTV decrease 100 to 95</td>
<td>-51.4</td>
<td>-7.9</td>
<td>-8.1</td>
</tr>
</tbody>
</table>
Conclusions

- Canada has substantial experience with macroprudential housing-finance tools
- The most recent experience highlights that FTHBs are sensitive to changes to LTVs.
  - Most of these consumers do not have much savings
- Changes to amortization impact high wealth, low income consumers
- HRAM combines micro-data with household survey data with a structural model to inform macroprudential policy
### Results: Impacts of loosening in macroprudential policy from the structural model

<table>
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<tr>
<td>Amortization increase 25 to 30</td>
<td>6.5</td>
<td>4.4</td>
<td>11.3</td>
</tr>
<tr>
<td>Amortization increase 30 to 35</td>
<td>4.2</td>
<td>2.6</td>
<td>7.5</td>
</tr>
<tr>
<td>Amortization increase 25 to 35</td>
<td>10.2</td>
<td>6.9</td>
<td>19.0</td>
</tr>
<tr>
<td>Amortization increase 35 to 40 and LTV increase 95 to 100</td>
<td>164.8</td>
<td>135.0</td>
<td>149.9</td>
</tr>
</tbody>
</table>

**Loosening:** Calibrated to 2005 data