Managing a Housing Boom

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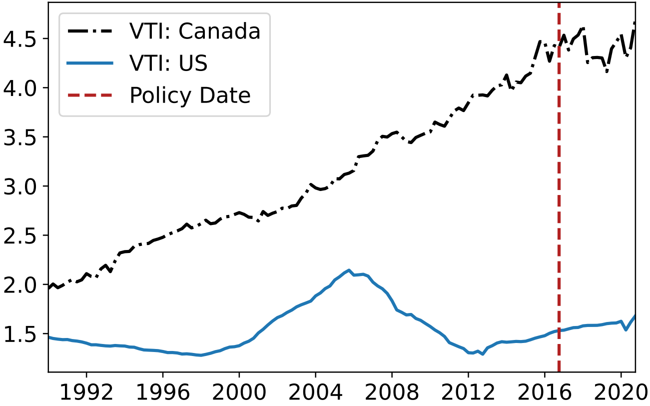
Disclaimer: Views presented are the authors' and not those of the Bank of Canada.

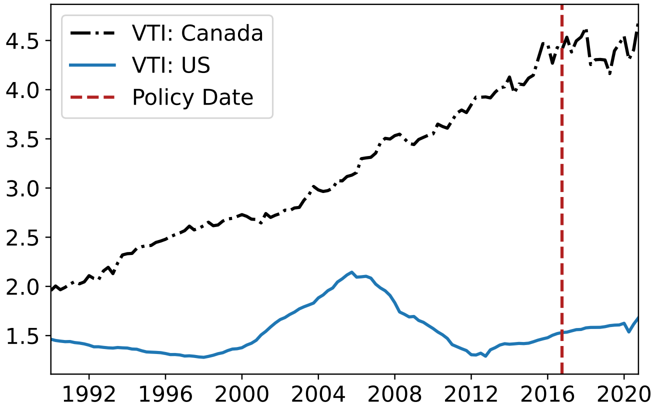
Motivation

- Canada undergoing sustained housing boom.
- Below: Value-to-Income (VTI) ratios in Canada and US.



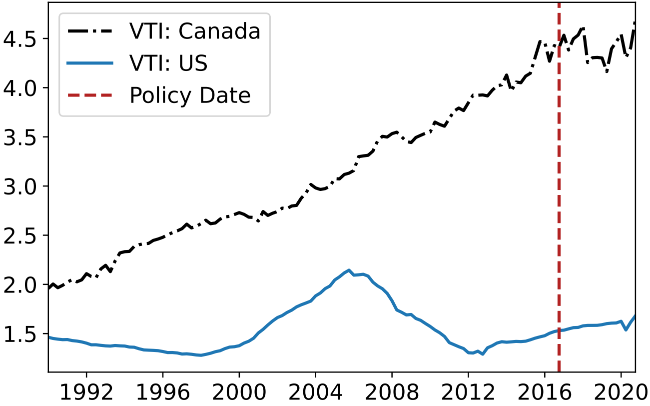
Motivation

- Canadian policymakers have been actively using macroprudential tools.
- Ex: 2016 policy tightened payment-to-income (PTI) limits by over 16%.



Motivation

- Good laboratory for theory (Justiniano et al. 2015, Greenwald 2018).
- Predict that tight PTI limits should be highly effective at dampening boom.



This Paper

- **Main question:** how can macroprudential policy effectively control a housing boom?
- **Approach:** develop a GE model with main policy tools (LTV, PTI limits) and a key institutional feature: **segmented submarkets**.
  - **Government Insured** market: low down payments, tight PTI.
  - **Uninsured** market: high down payments, loose PTI.
  - Not specific to Canada (e.g., FHA vs. Fannie/Freddie in the US housing boom).
- **Main insights:**
  1. Multi-market structure allows for larger housing booms due to market switching.
  2. Substitution between markets dampens effectiveness of PTI policy.
  3. Effects of LTV (down payment) policy depend crucially on which submarket is targeted.

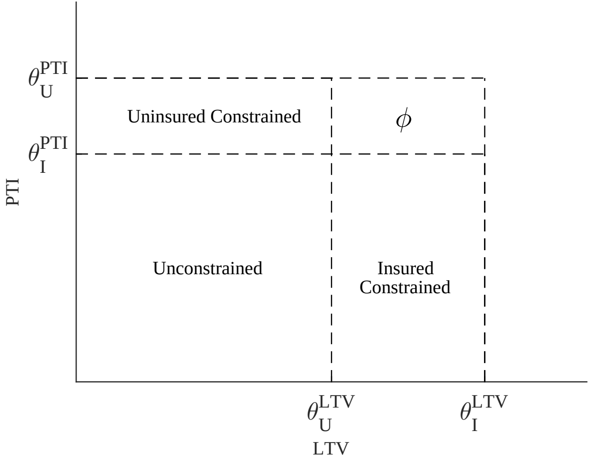
Institutional Background

Credit Limits

- Two credit limits applied at origination in submarket j:
  1. Loan-to-Value (LTV) limit: $m \leq \theta_j^{LTV} p^h h$.
  2. Payment-to-Income (PTI) limit: $qm \leq \theta_j^{PTI} y$, where q is coupon (interest + principal).
- Two submarkets:
  1. **Insured Market:** loose LTV limit ($\theta_I^{LTV} = 95\%$), tight PTI limit ($\theta_I^{PTI} = 44\%$).
  2. **Uninsured Market:** tight LTV limit ($\theta_U^{LTV} = 80\%$), tight PTI limit ($\theta_U^{PTI} \sim \infty$).

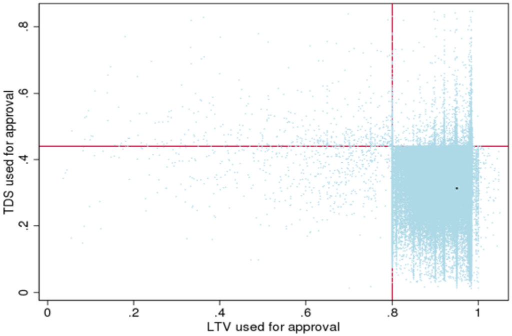
Constraint Structure by Submarket

- Constraint space:

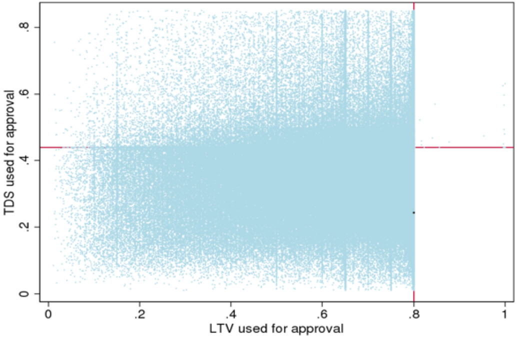


Constraint Structure by Submarket

- Data equivalent:



(a) Insured Sector



(b) Uninsured Sector

Model(s)

Simple Model

- One-time house purchase with quasi-linear preferences. Borrower maximizes

$$V_0 = \max_h \underbrace{\alpha \log(h)}_{\text{PV benefit}} - \underbrace{(h - \mu \bar{m}(h))}_{\text{PV cost}}$$

where $\bar{m}(h)$ is debt limit and $\mu > 0$ represents marginal value of credit.

- Marginal benefit and cost

$$MB(h) = \alpha h^{-1}$$
$$MC(h) = 1 - \mu \bar{m}'(h)$$

- Note: $MC < 1$ when $\mu > 0$ and **debt limit is increasing in h**.
- $\bar{m}'(h) > 0$ when LTV-constrained ($\bar{m} \propto h$), not when PTI-constrained ($\bar{m} \propto y$).

Full Model

- Extension of Greenwald (2018) allowing for multiple submarkets.
- Borrowing $\implies$ impatient borrowers/patient savers.
- Mortgage debt $\implies$ durable housing.
- Realistic mortgages $\implies$ long-term, fixed-rate, renew with prob. ρ.
- Endogenous interest rates, output, inflation $\implies$ labor supply, sticky prices, Taylor rule.

Full Model

- Extension of Greenwald (2018) allowing for multiple submarkets.
- Borrowing $\implies$ impatient borrowers/patient savers.
  - Preferences: $V_{j,t} = \log(c_{j,t}/\chi_j) + \xi \log(h_{j,t}/\chi_j) - \eta_j \frac{(n_{j,t}/\chi_j)^{1+\varphi}}{1+\varphi} + \beta_j \mathbb{E}_t V_{j,t+1}$
- Mortgage debt $\implies$ durable housing.
- Realistic mortgages $\implies$ long-term, fixed-rate, renew with prob. ρ.
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Full Model

- Extension of Greenwald (2018) allowing for multiple submarkets.
- Borrowing $\Longrightarrow$ impatient borrowers/patient savers.
- Mortgage debt $\Longrightarrow$ durable housing.
  - Divisible, cannot change stock without renewing mortgage.
- Realistic mortgages $\Longrightarrow$ long-term, fixed-rate, renew with prob. ρ.
- Endogenous interest rates, output, inflation $\Longrightarrow$ labor supply, sticky prices, Taylor rule.

Full Model

- Extension of Greenwald (2018) allowing for multiple submarkets.
- Borrowing $\implies$ impatient borrowers/patient savers.
- Mortgage debt $\implies$ durable housing.
- Realistic mortgages $\implies$ long-term, fixed-rate, renew with prob. ρ.
  - At renewal, update balance and interest rate.
  - LTV + PTI limits imposed at origination only.
  - Borrowers choose submarket that gives them bigger loan.
- Endogenous interest rates, output, inflation $\implies$ labor supply, sticky prices, Taylor rule.

Full Model

- Extension of Greenwald (2018) allowing for multiple submarkets.
- Borrowing $\Longrightarrow$ impatient borrowers/patient savers.
- Mortgage debt $\Longrightarrow$ durable housing.
- Realistic mortgages $\Longrightarrow$ long-term, fixed-rate, renew with prob. ρ.
- Endogenous interest rates, output, inflation $\Longrightarrow$ labor supply, sticky prices, Taylor rule.

Full Model

- Representative borrower housing optimality condition:

$$p_t^h = \frac{u_{b,t}^h / u_{b,t}^c + \mathbb{E}_t \left\{ \Lambda_{b,t+1} p_{t+1}^h \left[1 - \delta - (1-\rho) \mathcal{C}_{t+1} \right] \right\}}{1 - \mathcal{C}_t}$$

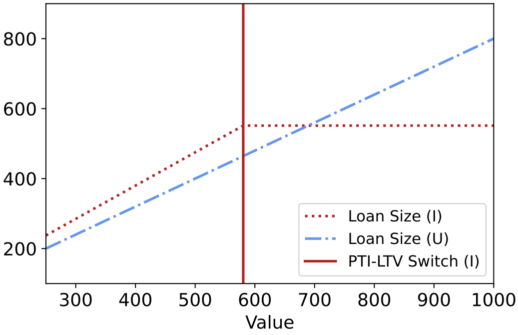
- $\mathcal{C}_t$ is population average of $\mu_t \bar{m}_t'(p^h h)$, generalization of simple example.
  - Unconstrained borrowers: $\mathcal{C}_t = \mu_t = 0$, p_t^h = PV of implied rents
  - Single market, LTV constraint: $\mathcal{C}_t = \mu_t \theta^{LTV}$
  - Single market, LTV and PTI constraints: $\mathcal{C}_t = \mu_t F_t^{LTV} \theta^{LTV}$
  - **Dual market, LTV and PTI constraints:** $\mathcal{C}_t = \mu_t \left(F_{U,t}^{LTV} \theta_U^{LTV} + F_{I,t}^{LTV} \theta_I^{LTV} \right)$

- Housing demand increases when more borrowers are LTV-constrained at the margin.
  - Uninsured PTI limits are loose $\implies$ increase in uninsured share can boost house prices.

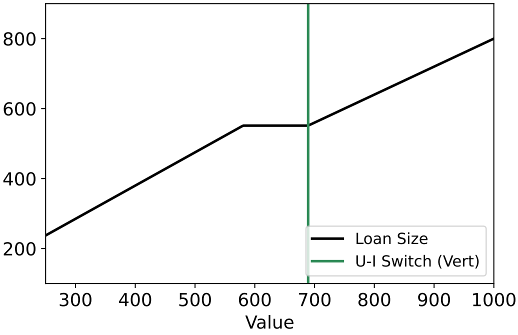
Results

Simple Model: Baseline

- **Insured Market:** debt limit increasing with slope 0.95 until PTI limit reached.
- **Uninsured Market:** debt limit increasing with slope 0.8 indefinitely.
- Overall limit is upper envelope. Borrower switches market at green line in Panel (b).



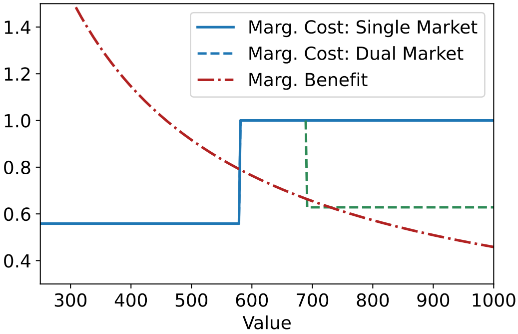
(a) Debt Limit by Submarket



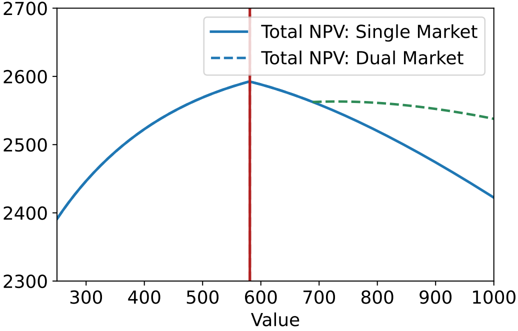
(b) Overall Debt Limit

Simple Model: Baseline

- For housing demand, compare marginal benefit to marginal cost $(1 - \mu \bar{m}'(h))$.
- Single market: switch to PTI-constrained causes discrete drop in $\bar{m}'(h)$, jump in MC.
- Many borrowers have MC = MB at point where both constraints bind (Greenwald, 2018).



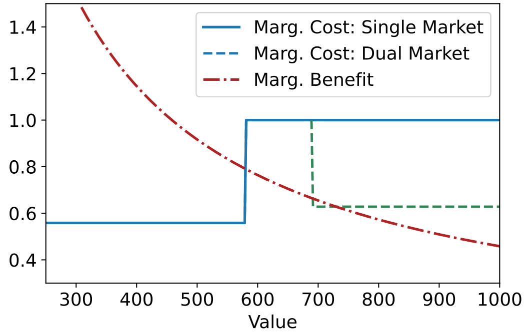
(a) Cost/Benefit



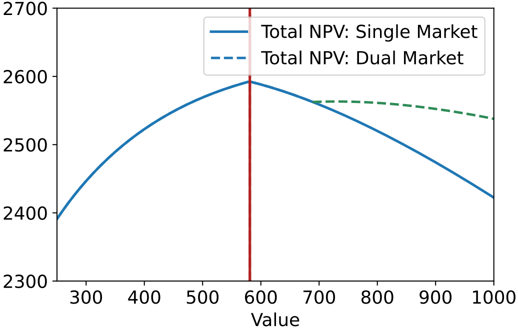
(b) Total NPV

Simple Model: Baseline

- Dual market: $\bar{m}'(h) \uparrow$ when borrowers switch to **Uninsured**, becoming LTV-constrained.
- Causes marginal cost to drop, allowing for two intersections with MB (local optima).
- This parameterization: lower (**Insured**) optimum is higher.



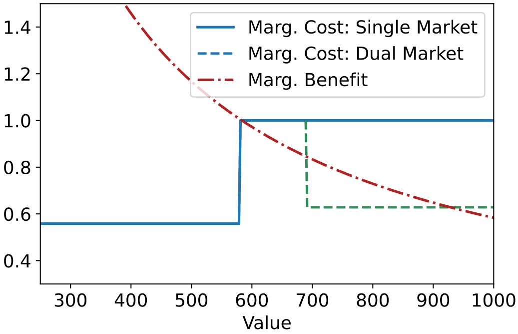
(a) Cost/Benefit



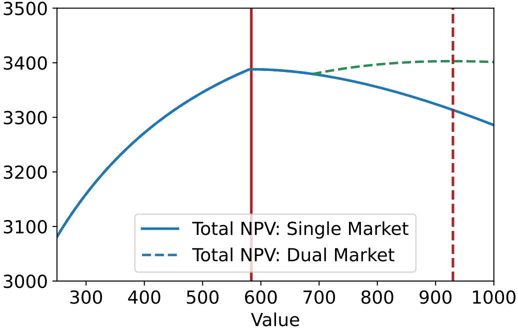
(b) Total NPV

Simple Model: Housing Boom

- Now consider boom scenario with increased housing preference (α). Shifts MB curve up.
- Because of discontinuous jump in MC, lower (**Insured**) local optimum unchanged.
- In single market setting, this implies that PTI limits can dampen housing demand in booms.



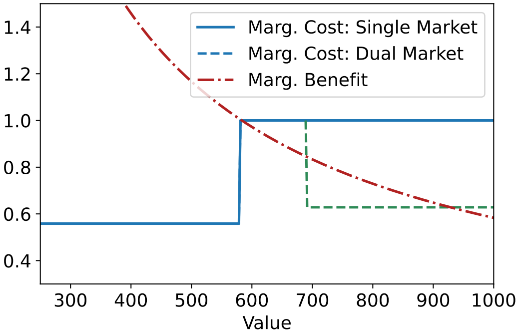
(a) Cost/Benefit



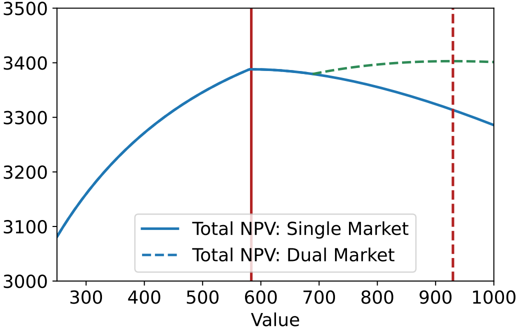
(b) Total NPV

Simple Model: Housing Boom

- Dual market: ranking of local optima can flip, borrowers switch to **Uninsured** market.
- Causes large increase in housing demand and loan size.
- Implies PTI limits less effective at dampening booms in dual market setting.



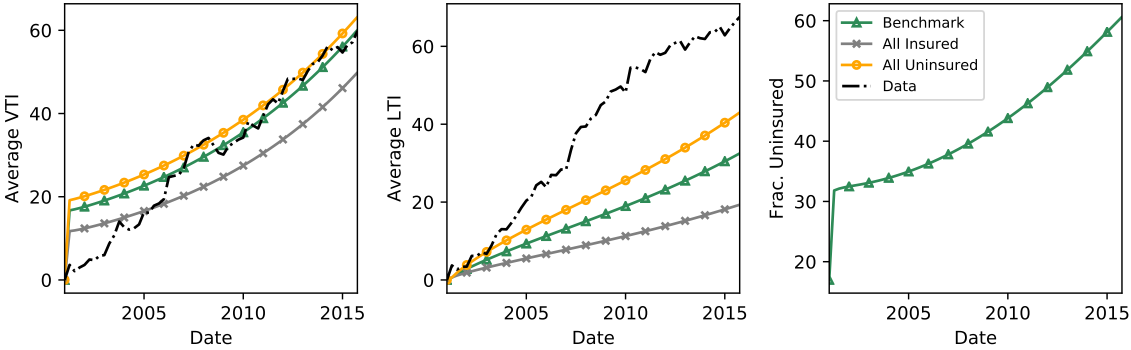
(a) Cost/Benefit



(b) Total NPV

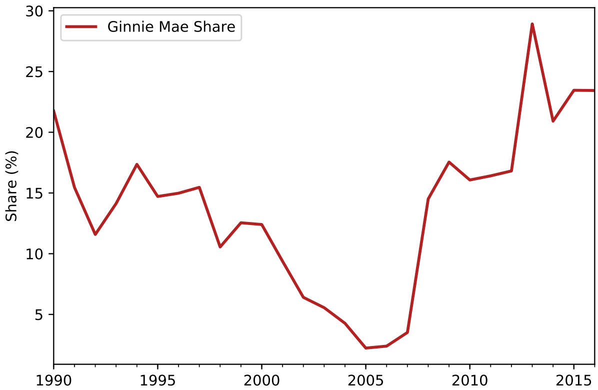
Full Model: Housing Boom

- Generate boom using anticipated increase in housing utility.
  - Compare Benchmark to economies with only insured or uninsured sectors.
- With two markets, substitution allows for much higher house price and credit growth.
  - Closer to world with all uninsured than all insured, even though $>$ 80% insured in steady state.



Aside: Parallel with US Boom/Bust

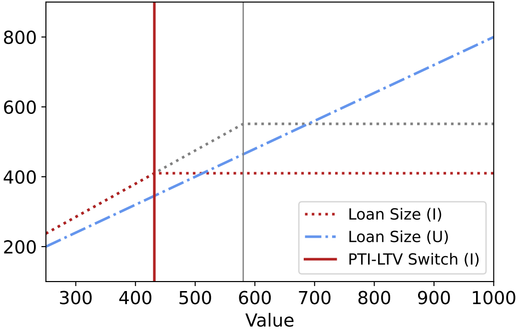
- Below: share of loans securitized by Ginnie Mae (FHA + VA).
  - Like **Insured** sector. Low down payments (3.5%) + strict income reqs.
- Below: huge substitution away from FHA + VA during housing boom.



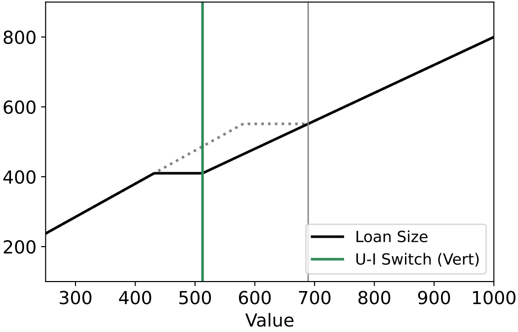
Source: HMDA

Simple Model: Change in PTI Limit

- Tightening PTI limit reduces maximum **Insured** loan size and pushes switch point left.
- Dual market: substitution into **Uninsured** occurs earlier, mitigates credit tightening.



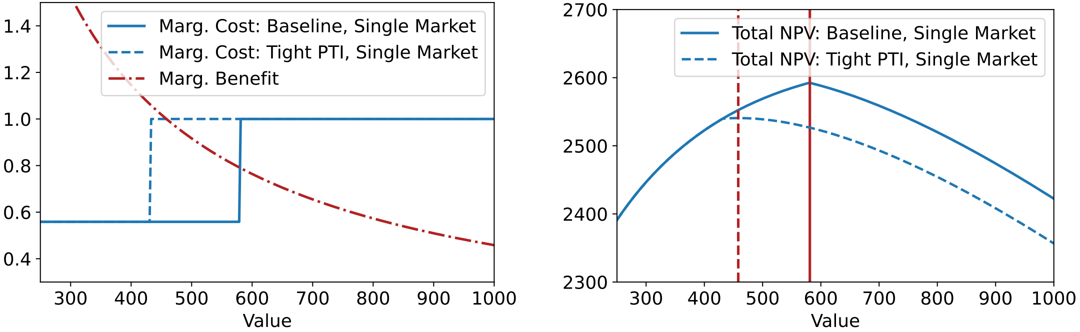
(a) By Submarket ($\theta_I^{PTI} \downarrow$)



(b) Overall ($\theta_I^{PTI} \downarrow$)

Simple Model: Change in PTI Limit

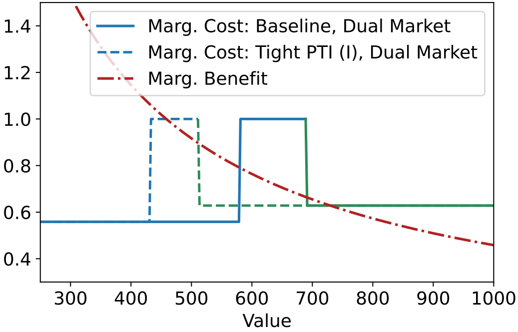
- Single market: MC now jumps at lower value, pushes housing demand down.
- Implies tightening PTI is effective macroprudential policy to dampen housing demand.



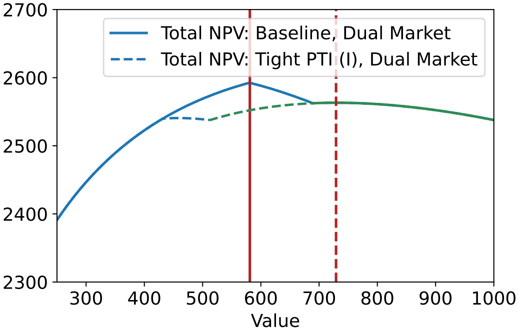
(a) Cost/Benefit (b) Total NPV

Simple Model: Change in PTI Limit

- Dual market: reduces NPVs in **Insured** sector, leading borrowers to switch to **Uninsured**.
- Market switchers **increase** housing and debt demand, weakening effects of policy.



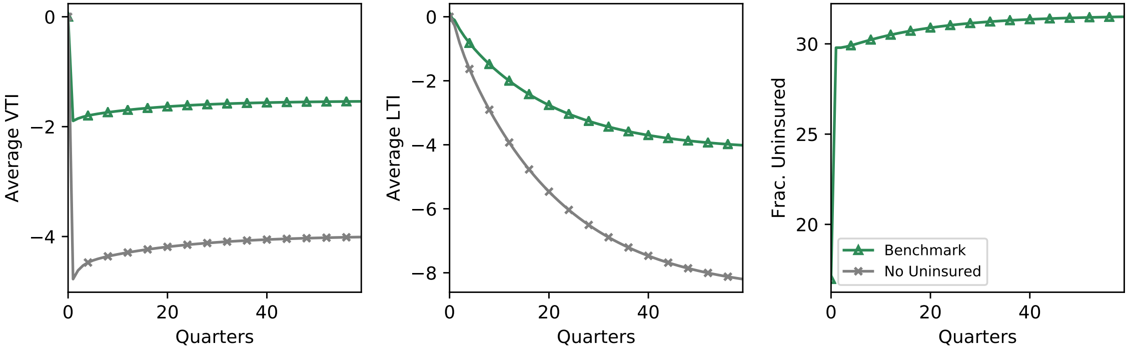
(a) Cost/Benefit



(b) Total NPV

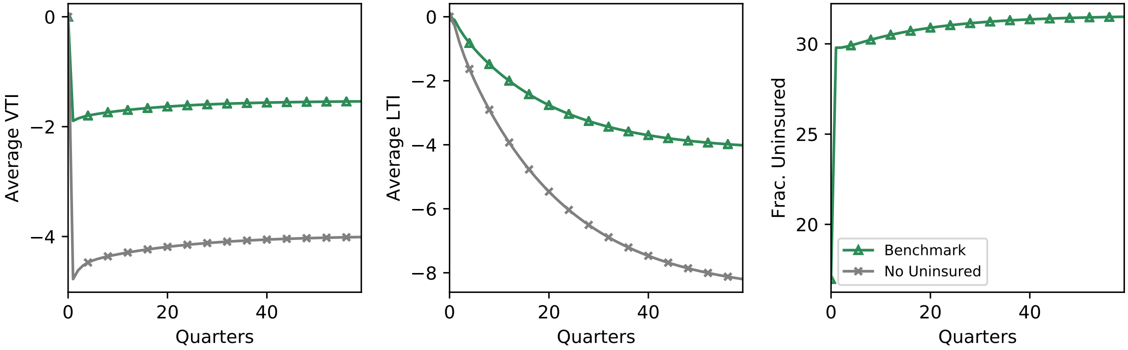
Full Model: Change in PTI Limit

- October 2016: new rule that PTI ratios must be evaluated at "posted" rate ($\sim$ 200bp higher).
- Effectively 16.5% tightening of PTI limit in **Insured market only**
- Compare benchmark to economy with single (insured) market.



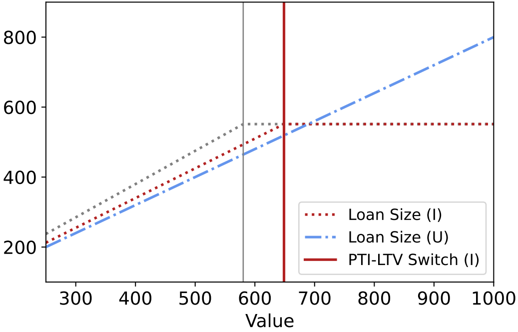
Full Model: Change in PTI Limit

- Single market (No Uninsured) economy: large decrease in house prices and debt.
- Dual market environment cuts effect of policy by more than half.
- Large substitution out toward **Uninsured** market boosts housing demand and credit.

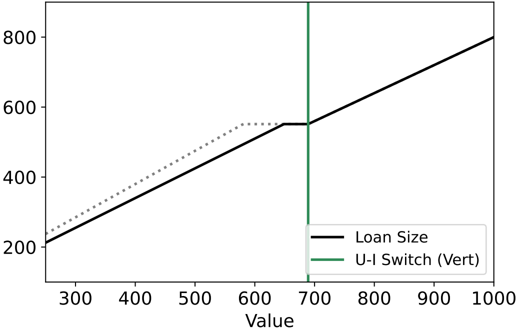


Simple Model: Shock to Insured LTV Limit

- Tight θ_I^{LTV} reduces debt limits, moving constraint switching point right.



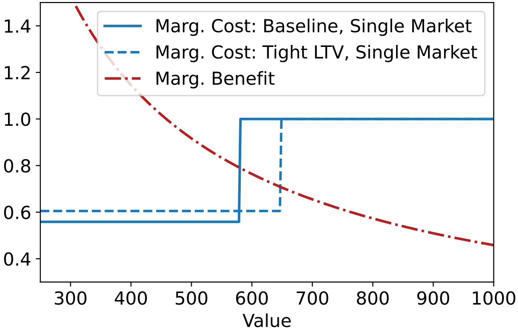
(a) By Submarket ($\theta_I^{LTV} \downarrow$)



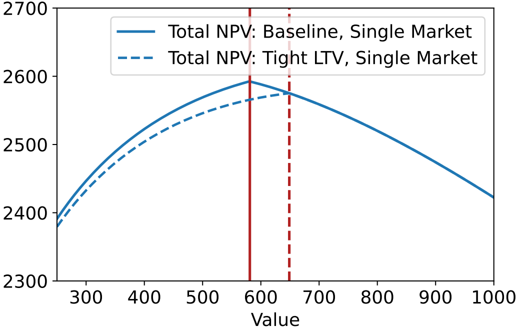
(b) Overall ($\theta_I^{LTV} \downarrow$)

Simple Model: Shock to Insured LTV Limit

- Single market: shift in MC jump to the right can increase housing demand.
- Implies LTV tightening is less effective policy for dampening house price growth.



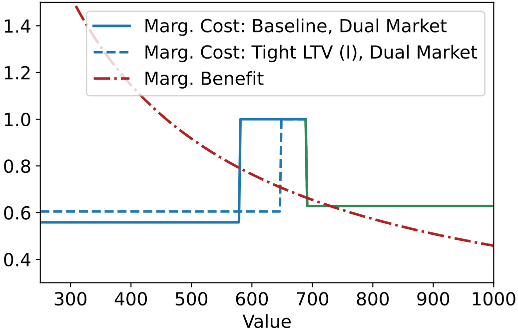
(a) Cost/Benefit



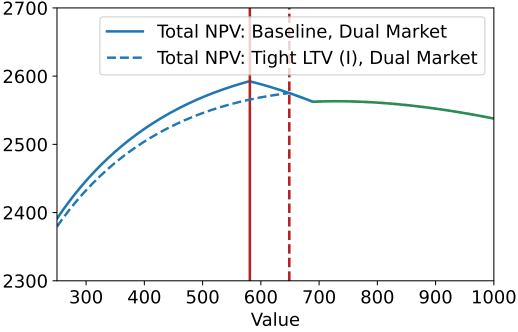
(b) Total NPV

Simple Model: Shock to Insured LTV Limit

- Dual market: basically the same effect.
- LTV limits are even tighter in **Uninsured** market, so outside option not relevant.



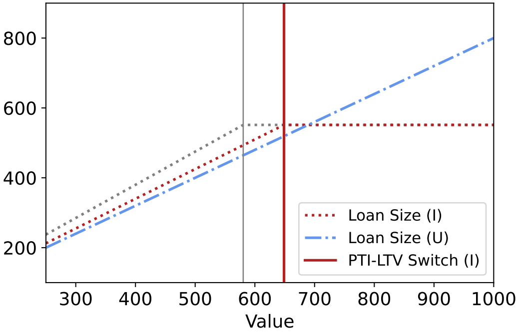
(a) Cost/Benefit



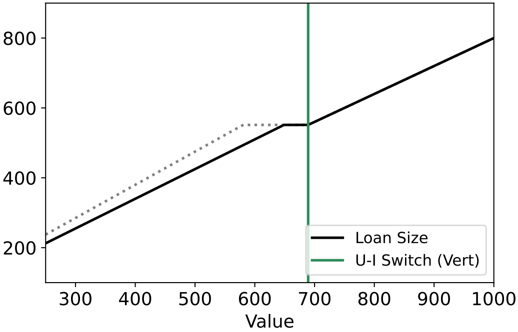
(b) Total NPV

Simple Model: Shock to Insured LTV Limit

- Borrowers unable to evade tightening by switching markets $\implies$ substantial effect on debt.



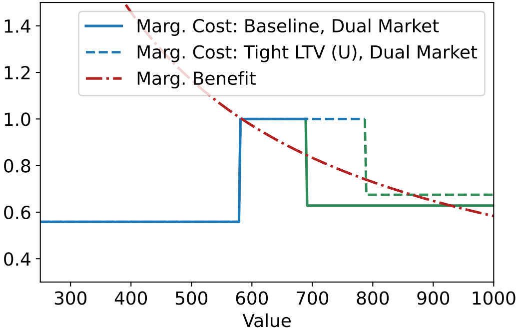
(a) By Submarket ($\theta_I^{LTV} \downarrow$)



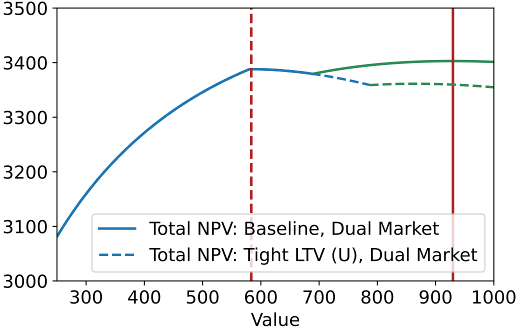
(b) Overall ($\theta_I^{LTV} \downarrow$)

Simple Model: Shock to Uninsured LTV Limit

- In contrast, tightening **Uninsured** LTV limit can cause borrowers to switch to **Insured**.
- If so, dramatically reduce housing demand. Potentially effective way to dampen HP growth.



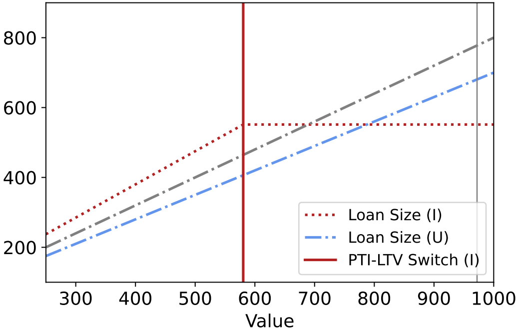
(a) Cost/Benefit



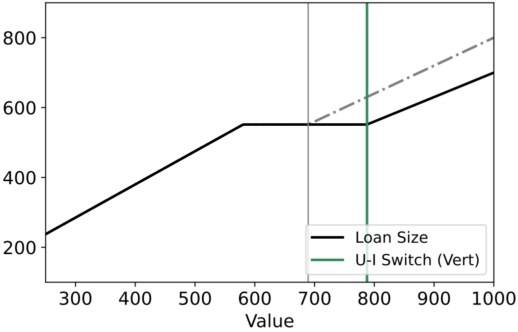
(b) Total NPV

Simple Model: Shock to Uninsured LTV Limit

- But switch largely occurs along flat (PTI-constrained) part of the overall debt limit.
- Overall: tight $\theta_U^{LTV} \implies$ large effect on housing demand, small effect on debt.



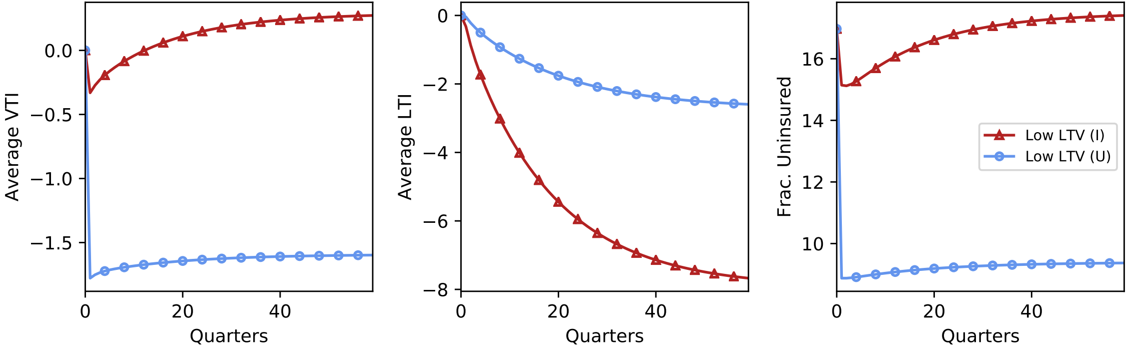
(a) By Submarket ($\theta_I^{LTV} \downarrow$)



(b) Overall ($\theta_I^{LTV} \downarrow$)

Full Model: Shock to LTV Limits

- Full model: reduce each LTV limit by 10ppt (Insured: 95% → 85%, Uninsured: 80% → 70%).
- **Low LTV (I)**: large effect on debt, almost no impact on house prices.
- **Low LTV (U)**: large effect on prices, 4x smaller impact on debt.

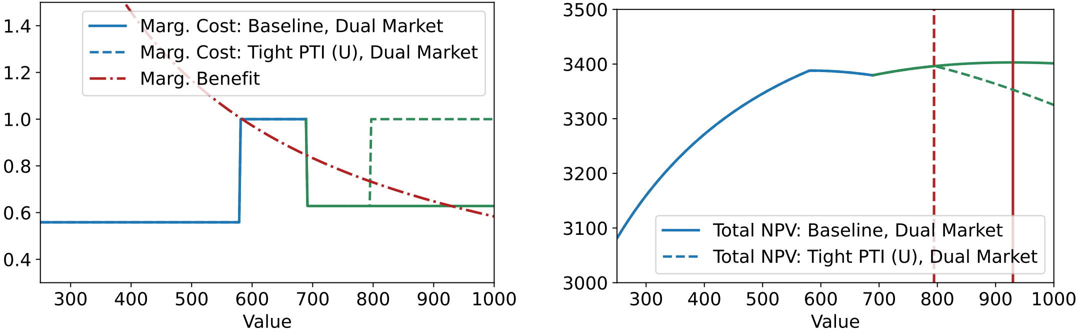


Conclusion

- GE model with key macroprudential tools and segmented submarkets.
- Dual markets allow larger booms holding debt limit ratios fixed.
  - Borrowers switch into **Uninsured** market.
  - Collateral incentives (low MC) lead to high housing demand.
- Dual market weakens effectiveness of PTI policy.
  - Single market: sharply reduces housing and credit demand.
  - Dual market: borrowers switching to **Uninsured** market can **increase** demand.
- Effects of LTV tightening depend on targeted submarket:
  - **Insured**: large reduction in debt, little effect on house prices.
  - **Uninsured**: smaller decline in debt, large fall in house prices.

Simple Model: Tight PTI (U)

- Text here.



(a) Cost/Benefit

(b) Total NPV