Housing and Pecuniary Externalities

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Motivation

(1) Macroprudential policies aimed at decreasing the probability of future crises by affecting lending practices and household leverage

- Ex-ante interventions evaluation: how the intertwined housing and financial decisions lead to socially inefficient outcomes in general?

$\Rightarrow$ Rationale for the design and implementation of efficient policies that does not only rely on the occurrence of adverse aggregate events

Motivation

(1) Macroprudential policies aimed at decreasing the probability of future crises by affecting lending practices and household leverage

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⇒ Rationale for the design and implementation of efficient policies that does not only rely on the occurrence of adverse aggregate events

(2) Positive literature emphasizes the relevance of liquid wealth:

  - Heterogeneity is a key microeconomic feature,
  - Crucial for aggregate consumption responses to shocks.

- From a normative perspective, possible ex-ante inefficiency of households' decisions and of the resulting liquid wealth distribution?

Research Questions

Evaluate if and how a social planner could Pareto improve upon equilibrium allocation when facing, as the market participants, **binding borrowing constraints** and **market incompleteness**:

- What implications does the presence of an asset as housing bear for the optimal corrective **taxation of liquid financial assets**?
- Specifically, how do housing **illiquidity** and its **collateralizable nature** affect taxation?

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Evaluate if and how a social planner could Pareto improve upon equilibrium allocation when facing, as the market participants, **binding borrowing constraints** and **market incompleteness**:

- What implications does the presence of an asset as housing bear for the optimal corrective **taxation of liquid financial assets**?
- Specifically, how do housing **illiquidity** and its **collateralizable nature** affect taxation?

$\Rightarrow$ Insight into (1) whether uninsurable idiosyncratic risk and borrowing constraints already justify policy intervention and if so of what kind, and (2) the social desirability of households' illiquid and liquid assets decisions and, consequently, of the resulting wealth distribution

Analysis in a Nutshell

- Restrict planner's control and instruments:
  - Control over financial asset market only, housing market remains open for trading
  - Do not allow lump-sum transfers of the numeraire good

  $\Rightarrow$ Minimal intervention letting price formation be the indirect instrument
- Infer how deviations from laissez-faire financial decisions impact eq. prices/households & solve the social planner problem

Analysis in a Nutshell

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- Infer how deviations from laissez-faire financial decisions impact eq. prices/households & solve the social planner problem

$\Rightarrow$ Sufficient statistics for constrained efficiency of three environments:

  (a) Illiquid Housing & Non-Collateralized Borrowings

  (b) Liquid Housing & Non-Collateralized Borrowings

  (c) Illiquid Housing & Collateralized Borrowings

- Distributive (a,b,c) and collateral externalities (c)

Main Results

- *PI can be achieved by taxing borrowings and savings to different degrees*

(a-b) Illiquidity limits how insurance can be implemented: *The efficient level of aggregate capital is lower than that of the laissez-faire outcome*

(a-c) Collateralizability introduces a trade-off: *More important to improve households' insurance, instead of enlarging their credit opportunities*

$\Rightarrow$ Micro take-away: *Overborrowing and oversaving*

$\Rightarrow$ Macro take-away: *Lower housing price and less capital*

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Households & Preferences

- There are two periods $t = 1, 2$ and two types of households $i = b, l$, which we will call initially poor and initially rich, each of measure one.

- Households' preferences are defined over non-durable consumption c, the numeraire, and housing h, and are characterized by

$$U_i = \mathbb{E} \sum_{t=1}^{2} \beta^{t-1} \mathbf{u}(c_{ti}, h_{ti}),$$

  where $\mathbf{u}(c, h) = u(c) + v(h)$, c and h are assumed to be normal goods, $u(\cdot)$ and $v(\cdot)$ satisfy

  - $u'(c) > 0$, $u''(c) < 0$,
  - $v'(h) > 0$, $v''(h) < 0$,
  - $\lim_{c \to 0} u'(c) = \infty$, $\lim_{h \to 0} v'(h) = \infty$.

Endowments & Choices – **Period 1**

- Exogenous aggregate amount of housing $\bar{H}$, constant over time.
- No production, households are endowed with liquid wealth $\bar{\omega}_i$ and housing $\bar{h}_i$, exogenously given and type-dependent so that:
  - $\bar{\omega}_b < \bar{\omega}_l$
  - $\bar{h}_b < \bar{h}_l$
- Resources can be used to:
  - Consume non-durable goods c_{1i}
  - Purchase housing h_{1i} at the price p_1 in units of c
  - Invest in a financial asset a

$$c_{1i} + a_i + p_1 h_{1i} = \bar{\omega}_i + p_1 \bar{h}_i$$

Endowments & Choices – **Period 2**

- Households are endowed with 1 unit of time, inelastically supplied.
- There are type-independent idiosyncratic shocks: households receive either e_1 with probability π or e_2 with probability $1-\pi$, with $0 < e_1 < e_2$.
- There is no pure insurance instrument to reduce the idiosyncratic risk.
- Households are not able to adjust their housing position over time, so that they consume the same amount of housing in both periods: $\Rightarrow h_{2si} = h_{1i}$

$$c_{2si} = (1+r)a_i + we_s, \; \forall i \in \{b,l\}, s \in \{1,2\},$$

Firms & Technology

- Output is produced by perfectly competitive firms.
- Firms sell output to households and rent capital and labor at rates r and w.
- There is a constant return to scale technology $F(K, L)$, with $F_K > 0$, $F_L > 0$, $F_{KL} > 0$, $F_{KK} < 0$, $F_{LL} < 0$.
- An aggregate investment of K units in the first period delivers $F(K, L) + (1 - \delta)K$ in the second period.
- Aggregate labor is constant at $L = 2(\pi e_1 + (1 - \pi)e_2)$.

Model (a) Equilibrium

Definition 1

A competitive equilibrium is a vector $(a_b, a_l, h_b, h_l, K, L, \bar{H}, r, w, p)$ such that:

1. For $i \in \{b, l\}$, a_i and h_i solve

$$\max_{\{a_i, h_i\}} u\big(\bar{\omega}_i + p(\bar{h}_i - h_i) - a_i\big) + (1+\beta)v(h_i) + \beta\mathbb{E}\Big[u((1+r)a_i + we)\Big]$$

$$\text{subject to} \quad a_i \geq -\frac{we_1}{1+r},$$

2. $a_b + a_l = K$,
3. $r = F_K(K, L) - \delta$ and $w = F_L(K, L)$, with $L = 2(\pi e_1 + (1-\pi)e_2)$,
4. $h_b + h_l = \bar{H}$,

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Main Results (a): Illiquid Housing & Natural Borrowings

Constrained efficiency of the competitive equilibrium characterized by:

$$|A| = \underbrace{(\bar{h}_b - h_b)}_{<0} \underbrace{[\Phi_{a,b} - \Phi_{a,l}]}_{<0} \underbrace{\{u'(c_{1b})\Theta_K^{r,w} + u'(c_{1l})\Psi_K^{r,w}\}}_{<0} < 0.$$

Competitive equilibrium is constrained inefficient as long as:

$(A1)$ there is trading in the market for houses,

$(A2)$ households' housing Engel curves exhibit curvature,

$(A3)$ markets incompleteness is relevant, i.e. $\pi \in]0,1[$ and $e_2 > e_1$.

Main Results (a): Illiquid Housing & Natural Borrowings

- PI can be achieved by mandating lower borrowings, $da_b > 0$, and lower savings, $da_l < 0$, compared to the competitive equilibrium
- The social planner mandates a decrease in savings of larger magnitude than the reduction in borrowings, $|da_l| > |da_b|$, so to achieve:
  - decrease in the housing price, $dp < 0$
  - interest rate rise, $dr > 0$, and wage drop, $dw < 0$.

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  - interest rate rise, $\boldsymbol{dr > 0}$, and wage drop, $\boldsymbol{dw < 0}$.

- Improvement from the risk rescaling of income for all:

$\Rightarrow$ Part of positive utility impact to lenders transferred to borrowers via the housing market, making both better off.

- Note $\boldsymbol{da_b > 0}$ and $\boldsymbol{da_l < 0}$ put opposite pressure on housing price:

$\Rightarrow$ Aggregate housing demand more sensitive to shifts in debt

Model (b) Equilibrium

Definition 2

A competitive equilibrium is a vector $(a_b, a_l, h_{1b}, h_{1l}, h_{21b}, h_{22b}, h_{21l}, h_{22l}, K, L, \bar{H}, r, w, p_1, p_2)$ such that:

1. For $i \in \{b, l\}$ and $s \in \{1, 2\}$, a_i, h_{1i} and h_{2si} solve

$$\max_{\{a_i, h_{1i}, h_{2si}\}} \mathbf{u}\big(\bar{\omega}_i + p_1(\bar{h}_i - h_{1i}) - a_i, h_{1i}\big) + \beta\mathbb{E}\Big[\mathbf{u}\big((1+r)a_i + we + p_2(h_{1i} - h_{2i}), h_{2i}\big)\Big]$$

$$\text{subject to} \quad a_i \geq -\frac{we_1 + p_2 h_{1i}}{1+r},$$

2. $a_b + a_l = K$,
3. $r = F_K(K, L) - \delta$ and $w = F_L(K, L)$, with $L = 2(\pi e_1 + (1-\pi)e_2)$,
4. $h_{1b} + h_{1l} = \bar{H}$,
5. $\sum_i \sum_s \pi_s h_{2si} = \bar{H}$.

Main Results (b): Liquid housing & Natural Borrowings

Constrained efficiency of the competitive equilibrium characterized by:

$$|\widehat{A}| = \underbrace{|A|}_{<0} + \underbrace{\beta(\widehat{\Phi}^2_{a,b} - \widehat{\Phi}^2_{a,l})\Big[\Theta_K \mathbb{E}\Big\{u'(c_{2b})(h_{1b} - h_{2b})\Big\} - \Psi_K \mathbb{E}\Big\{u'(c_{2l})(h_{1l} - h_{2l})\Big\}\Big]}_{\gtreqless 0}$$

$$+ \underbrace{\beta(\bar{h}_b - h_{1b}) \sum_{i \neq j \in \{b,l\}} u'(c_{1i})\mathbb{E}\Big\{u'(c_{2j})(h_{1j} - h_{2j})\Big\}\Big(\widehat{\Phi}^1_{a,b}\widehat{\Phi}^2_{a,l} - \widehat{\Phi}^1_{a,l}\widehat{\Phi}^2_{a,b}\Big)}_{\gtreqless 0} \gtreqless 0.$$

Competitive equilibrium is generally constrained inefficient as long as:

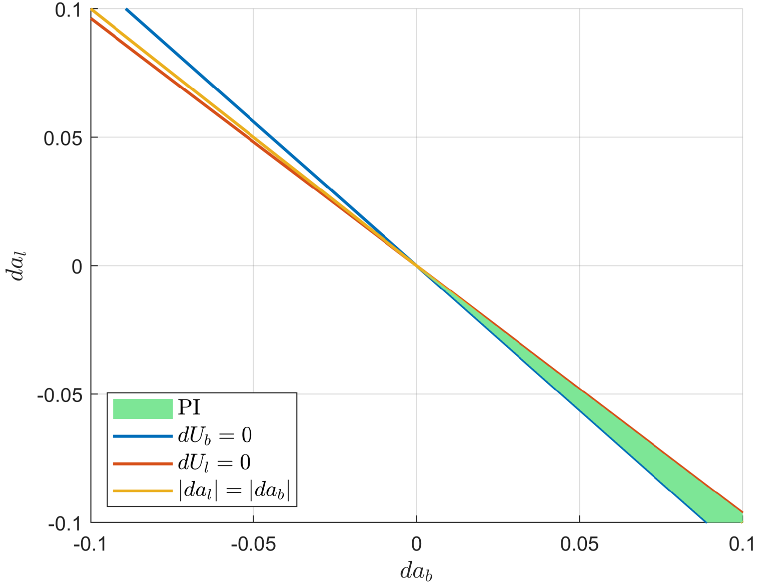
($\widehat{A1}$) Non-zero $p_1 \leftrightarrow (r, w)$ distributive externalities cross-interaction,

($\widehat{A2}$) Non-zero $p_2 \leftrightarrow (r, w)$ distributive externalities cross-interaction,

($\widehat{A3}$) Non-zero $p_1 \leftrightarrow p_2$ distributive externalities cross-interaction.

$\Rightarrow$ Theoretically anything goes, but quantitatively?

Main Results (b): Liquid housing & Natural Borrowings



Model (c) Equilibrium

Definition 3

A competitive equilibrium is a vector $(a_b, a_l, h_b, h_l, K, L, \bar{H}, r, w, p)$ such that:

1. For $i \in \{b, l\}$, a_i and h_i solve

$$\max_{\{a_i, h_i\}} u\big(\bar{\omega}_i + p(\bar{h}_i - h_i) - a_i\big) + (1+\beta)v(h_i) + \beta\mathbb{E}\Big[u((1+r)a_i + we)\Big]$$

subject to $\quad a_i \geq -\xi p h_i,$

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4. $h_b + h_l = \bar{H},$

Main Results (c): Illiquid housing & Collateral

Constrained efficiency of the competitive equilibrium characterized by:

$$|\widetilde{A}| = \underbrace{\left[\widetilde{\Phi}_{a,b} - \widetilde{\Phi}_{a,l}\right]}_{\gtreqless 0, <0} \underbrace{\left\{ \left(\overbrace{u'(c_{1b})\left(\bar{h}_b - h_b\right)}^{<0} + \overbrace{\lambda \xi h_b}^{>0} \right) \Theta_K^{r,w} + u'(c_{1l})\left(\bar{h}_b - h_b\right) \Psi_K^{r,w} \right\}}_{\gtreqless 0} \gtreqless 0.$$

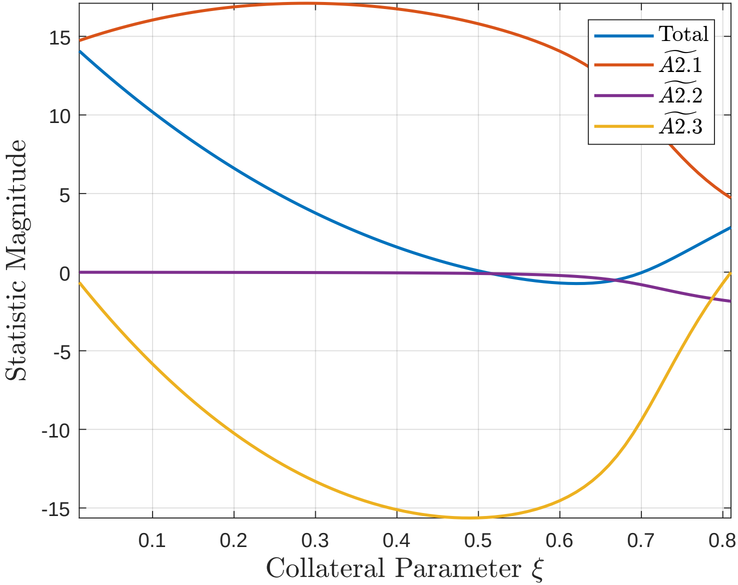
Market equilibrium is generally constrained inefficient, but unclear sign:

($\widetilde{A1}$) With a binding constraint, the properties of households' Engel curves only will not suffice

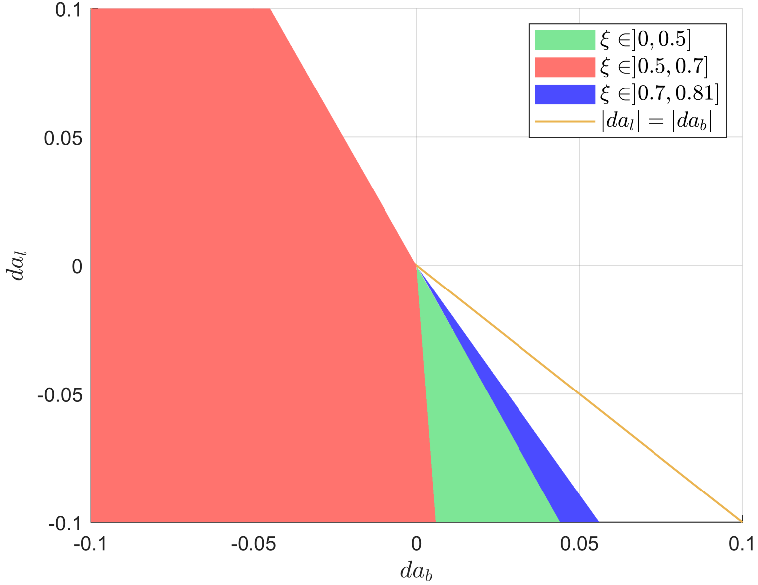
($\widetilde{A2.1}$-$\widetilde{A2.3}$) Collateral externalities are always antithetical to housing distributive externalities

Same signs as in (a) $\Rightarrow$ ($\widetilde{A2.2}$) as before, key ambiguity from collateral externalities

Main Results (c): Illiquid housing & Collateral



Main Results (c): Illiquid housing & Collateral



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Conclusion

(1) Would it be socially desirable to constrain lending and borrowing even in the absence of crises? *Uninsurable idiosyncratic risk and borrowing constraints generally justify this*

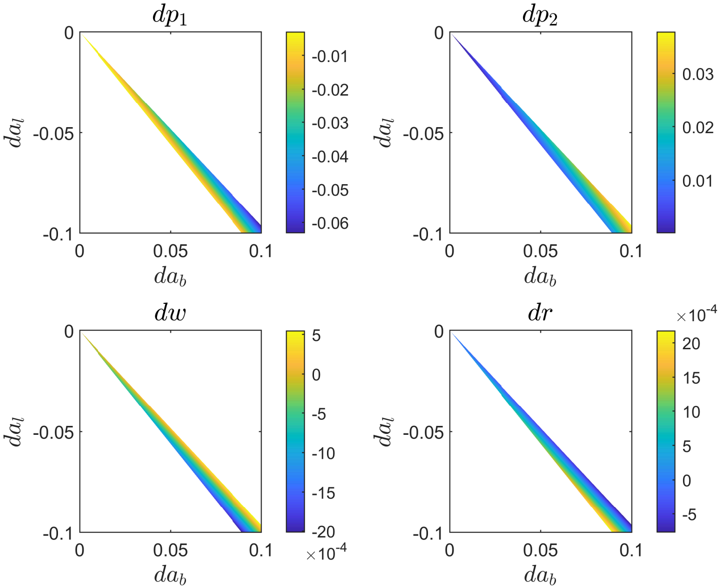
$\Rightarrow$ Policy recommendation aligns with macroprudential regulations, but different rationale: Could alleviate the necessary extent of macroprudential policies

(2) What do we learn about the social desirability of the wealth distribution? *Constrained efficient equilibrium has wealth-poor households holding more liquid wealth and wealth-rich households having more illiquid wealth*

$\Rightarrow$ Lower end of the distribution should hold less housing wealth and less debt, while the upper end should hold more housing wealth and less liquid assets

APPENDIX

Main Results (b): Liquid housing & Natural Borrowings



Constrained Efficiency (c)

Under illiquid houses and a collateral constraint, the constrained efficient allocation is the solution to the social planner problem

$$\max \sum_{i \in \{b,l\}} \gamma_i \Big\{ \mathbf{u}\left(c_{1i}, h_i(p,\mu_i)\right) + \beta \Big[\pi\, \mathbf{u}\left(c_{21i}, h_i(p,\mu_i)\right) + (1-\pi)\, \mathbf{u}\left(c_{22i}, h_i(p,\mu_i)\right) \Big] \Big\}$$

subject to

$c_{1i} + a_i + ph_i(p,\mu_i) = \bar{\omega}_i + p\bar{h}_i$,

$a_i \geq -\xi p h_i(p,\mu_i)$,

$c_{2si} = (1+r)a_i + we_s$, for $s = 1,2$ and $prob(e = e_1) = \pi$,

$r = F_K(K,L) - \delta$, $w = F_L(K,L)$,

$K = a_b + a_l$, $L = 2(\pi e_1 + (1-\pi)e_2)$,

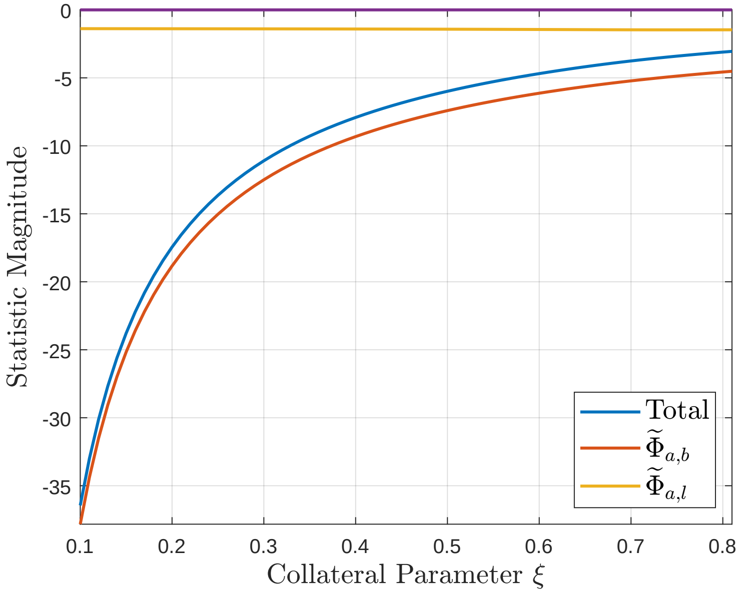
$\bar{H} = h_b(p,\mu_b) + h_l(p,\mu_l)$.

Constrained Efficiency (c)

Evaluating the planer's system of first-order conditions at the laissez-faire allocation, and rewriting the system in matrix form we obtain

$$\underbrace{\begin{bmatrix} \widetilde{\Psi}^{p}_{a,b} + \widetilde{\Psi}^{p}_{\lambda,b} + \Psi^{r,w}_{K} & \widetilde{\Theta}^{p}_{a,b} + \Theta^{r,w}_{K} \\ \widetilde{\Psi}^{p}_{a,l} + \widetilde{\Psi}^{p}_{\lambda,l} + \Psi^{r,w}_{K} & \widetilde{\Theta}^{p}_{a,l} + \Theta^{r,w}_{K} \end{bmatrix}}_{\widetilde{A}} \begin{bmatrix} \gamma_b \\ \gamma_l \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}.$$

Main Results (c): Illiquid housing & Collateral



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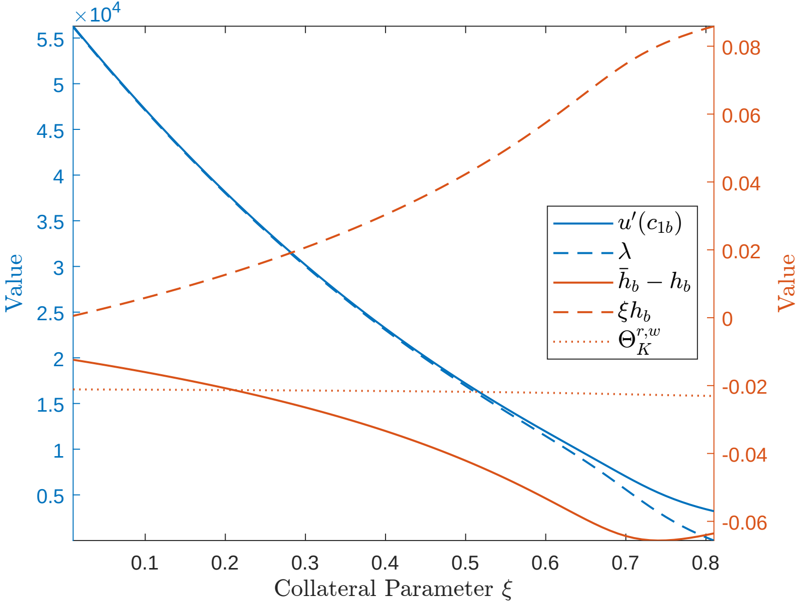

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