

Dealing with Heterogeneous Bondholders in Sovereign Restructurings: The Aggregation Dilemma

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European Stability Mechanism


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Introduction

- Collective Action Clauses (CACs) key pillar of sovereign debt architecture
- In a bond restructuring, the sovereign makes an offer to bondholders
 - CACs allow qualified majority of consenting creditors to bind dissenting minority
⇒ alleviate 'holdout' problem in sovereign debt workouts
- Adoption
 - in NY/UK-law EM sovereign bonds since 2003
 - in euro area domestic law bonds since 2013
- Since 2015, new issues of EM sovereign bonds incorporate 'enhanced' version of CACs

Voting Rules under Enhanced CACs

When restructuring **multiple bond series**, sovereign can choose among **two voting rules**:

- **Two-limb aggregation:** restructuring binds all creditors if
 - approved by $\geq 2/3$ of face value across all series; **and**
 - approved by $\geq 1/2$ of face value within each series
 - **Single-limb aggregation:** restructuring binds all creditors if
 - approved by $\geq 3/4$ of face value across all series; **and**
 - offer satisfies '**uniform applicability condition**' 
- no threshold within series

Motivation

- **Single-limb aggregation** introduced in 2015, viewed as key innovation
 - two-limb CACs adopted since Uruguay 2003
 - single-limb method used effectively (retroactively) in Greek 2012 PSI
 - no *within*-series thresholds → more robust defence against holdouts
- **Enhanced CACs** first tested in August 2020 by Argentina and Ecuador
 - both **opted for two-limb aggregation**, making \neq offers to \neq bond series
- Meanwhile in euro area: ongoing project to **replace** two-limb with single-limb

► Ecu ► Arg

This Paper

- **Part 1:** Formulate problem & solve for government's optimal restructuring method
 - key ingredients: multiple bonds + creditor heterogeneity within & across bonds
 - discuss recent case studies through the lens of our theory
- **Part 2:** Show how CACs design & expected use affect
 - a) potential entry of large player with blocking capacity (vulture)
 - b) equilibrium model of endogenous investor sorting into bonds

Related Literature

- Eichengreen and Portes (1995)
“Loan contracts and bond covenants should specify that a majority of creditors be entitled to alter the terms of the debt agreement [...]”
- Theoretical: single bond restructurings
 - Haldane et al. (2005); Engelen and Lambsdorff (2009); Pitchford and Wright (2012, 2017); Bi, Chamon and Zettelmeyer (2016)
- Empirical: bond-level restructuring outcomes
 - Fang, Schumacher and Trebesch (2021); Asonuma, Niepelt and Ranciere (2023)
- Empirical: effects of CACs on bond prices
 - Becker et al. (2003); Eichengreen and Mody (2004); Carletti et al. (2016, 2021); Picarelli et al. (2019); Chung and Papaioannou (2020)

Outline

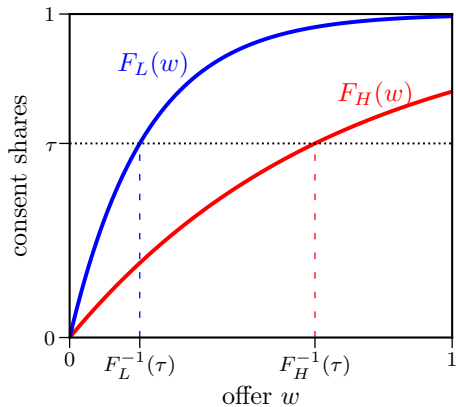
- **Part 1:** Optimal restructuring strategy, *given* creditor heterogeneity within & across bonds
 - Case studies: Greece 2012, Argentina 2020, Ecuador 2020
- Part 2: CACs design and endogenous investor entry
 - Vulture funds
 - Endogenous investor sorting
- Conclusion

A Simple Two-Bond Model

- Two bonds to be restructured: bonds H and L , relative size λ and $1 - \lambda$
- Restructuring offer by sovereign = recovery rates (w_H, w_L) per unit of face value
- Each bond is held by continuum of atomistic investors
 - holders of bond i have reservation values distributed according to cdf F_i
 - bondholder accepts if offer $>$ individual reservation value
 - given restructuring offer w_i , consent share within bond i is $F_i(w_i)$
- Heterogeneity
 - within bond: investors differ wrt discount rates, litigation skills, etc.
 - across bonds: different bond payment terms and bondholder bases
 - govt learns F_i 's during preliminary talks

Heterogeneity Across Bonds

Assume holders of bond H have higher reservation values:



Government Problem

- The government wants to minimize the restructuring payout

$$\min_{w_H, w_L} \lambda w_H + (1 - \lambda) w_L$$

under constraints that depend on the voting rule

- Two-limb

$$\begin{aligned} \lambda F_H(w_H) + (1 - \lambda) F_L(w_L) &\geq \tau_2^a && \text{(aggregate)} \\ F_i(w_i) &\geq \tau_2^s && \text{for } i \in \{H, L\} \quad \text{(series-by-series)} \end{aligned}$$

- Single-limb

$$\begin{aligned} \lambda F_H(u) + (1 - \lambda) F_L(u) &\geq \tau_1 && \text{(aggregate)} \\ w_H = w_L = u &&& \text{(uniform applicability)} \end{aligned}$$

- Assume $\tau_2^s < \tau_2^a \leq \tau_1 \Rightarrow$ aggregate constraint is always binding

Single-Limb Aggregation

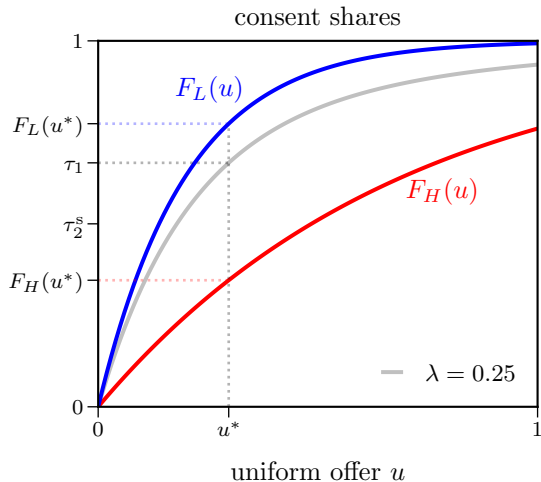
- Optimal uniform offer u^* is such that

$$\lambda F_H(u^*) + (1 - \lambda)F_L(u^*) = \tau_1$$

- Remark

$$F_H(u^*) < \tau_1 < F_L(u^*)$$

- Low λ : $F_H(u^*) < \tau_2^s$



Single-Limb Aggregation

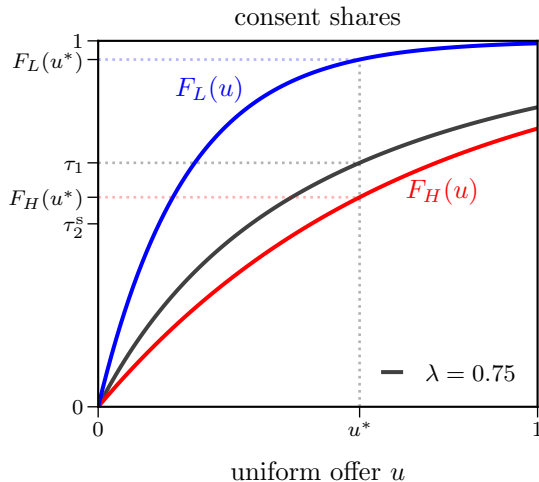
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- Remark

$$F_H(u^*) < \tau_1 < F_L(u^*)$$

- Low λ : $F_H(u^*) < \tau_2^s$
- High λ : $F_H(u^*) > \tau_2^s$



Two-Limb Aggregation

- Consider **auxiliary** problem without series-by-series constraints

$$\min_{w_H, w_L} \lambda w_H + (1 - \lambda) w_L \quad \text{s.t.} \quad \lambda F_H(w_H) + (1 - \lambda) F_L(w_L) = \tau_2^a$$

- Auxiliary solution (\hat{w}_H, \hat{w}_L) pinned down (assuming convex problem) by

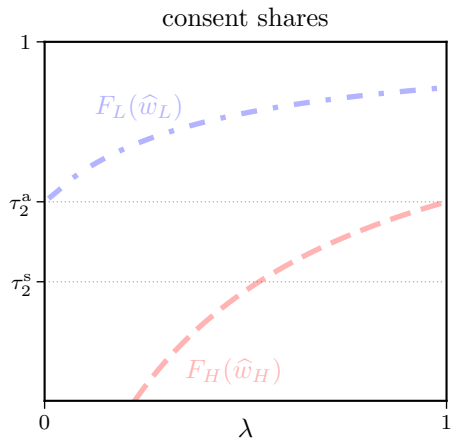
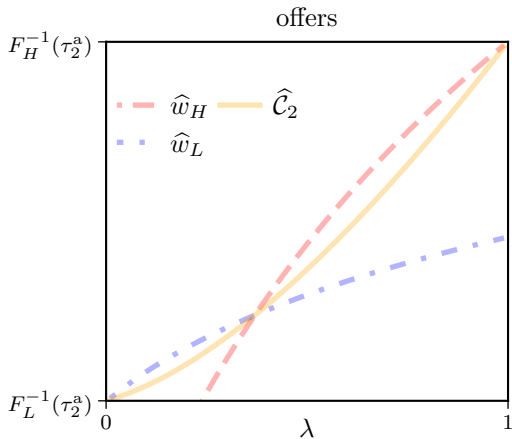
$$f_H(\hat{w}_H) = f_L(\hat{w}_L) \quad (\text{FOC})$$

$$\lambda F_H(\hat{w}_H) + (1 - \lambda) F_L(\hat{w}_L) = \tau_2^a \quad (\text{aggregate constraint})$$

- Check series-by-series constraints: $F_i(\hat{w}_i) \geq \tau_2^s$
 - if satisfied, optimal offer = auxiliary solution
 - if not satisfied, optimal offer s.t. *one* constraint binds, e.g. $w_H = F_H^{-1}(\tau_2^s) > \hat{w}_H$
- Optimal method (single- or two-limb) \Leftrightarrow **closest** to auxiliary problem solution

Illustration

two-limb, auxiliary problem solution

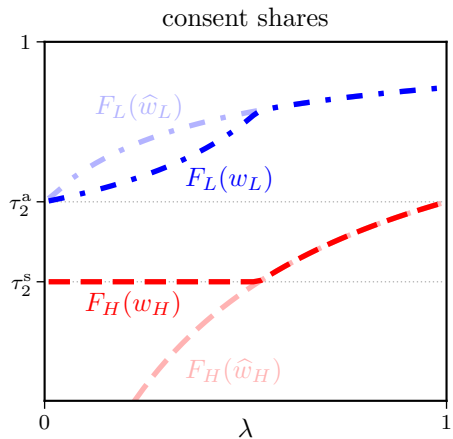
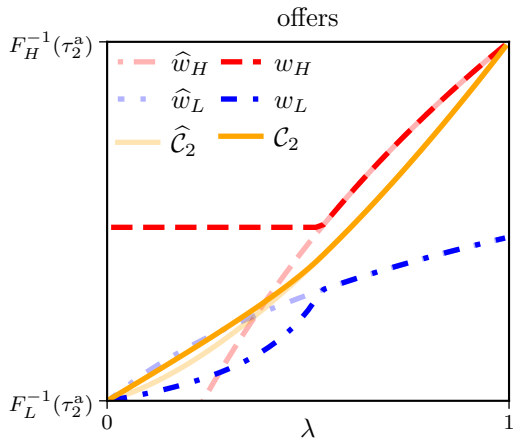


Assume $F_i(w) = 1 - e^{w/\phi_i}$, with $\phi_H = 0.7, \phi_L = 0.2$. Thresholds $\tau_1 = \tau_2^a = 2/3, \tau_2^s = 1/2$.

► Lemma

Illustration

two-limb, full solution

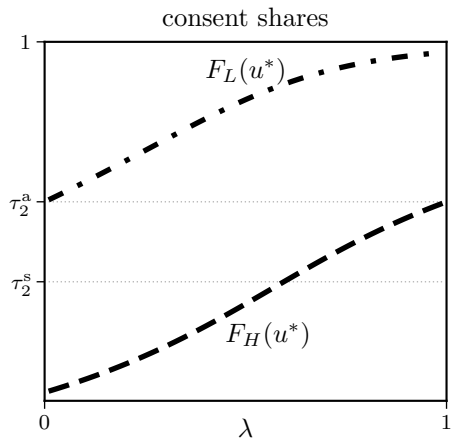
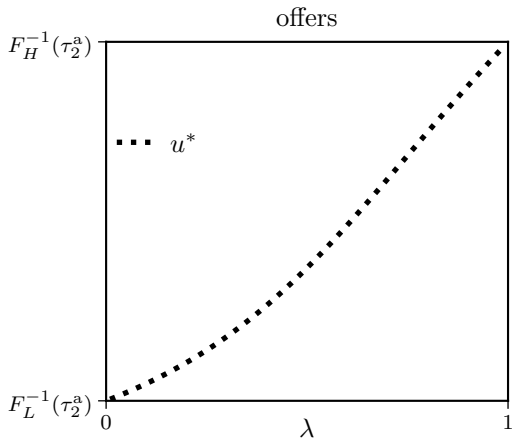


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► Lemma

Illustration

single-limb

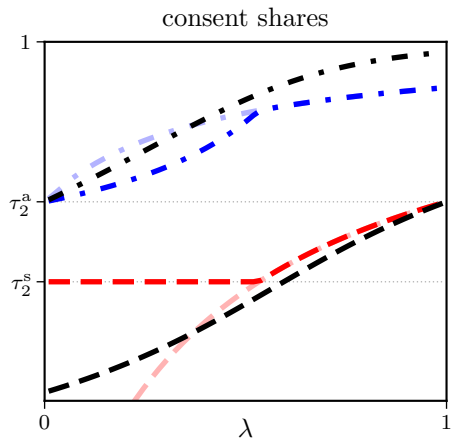
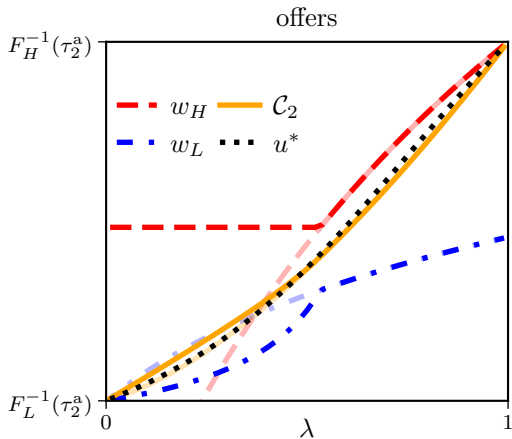


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► Lemma

Illustration

both methods

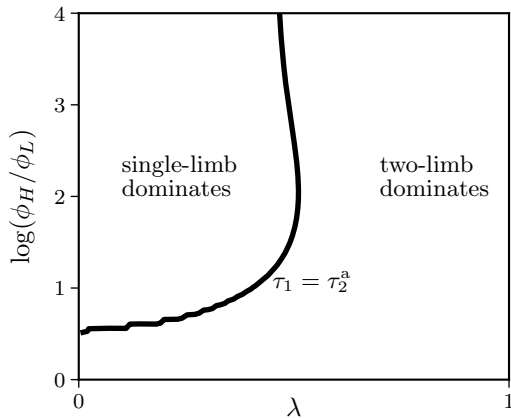


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► Lemma

Optimal Voting Rule

parametric example



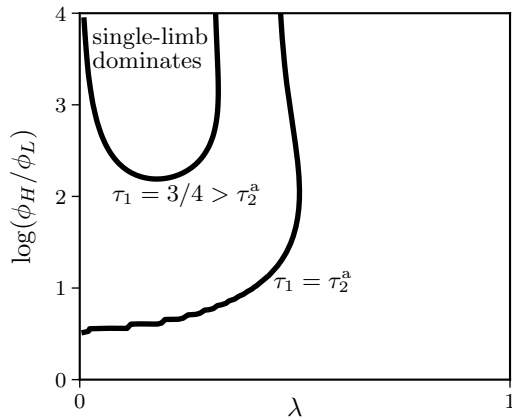
Distribution $F_i(w) = 1 - e^{w/\phi_i}$. Two-limb thresholds $\tau_2^s = 1/2$ and $\tau_2^a = 2/3$.

► more

► Prop.

Optimal Voting Rule

parametric example



Distribution $F_i(w) = 1 - e^{w/\phi_i}$. Two-limb thresholds $\tau_2^s = 1/2$ and $\tau_2^a = 2/3$.

▶ more

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Aggregated CACs in Action

Greece 2012

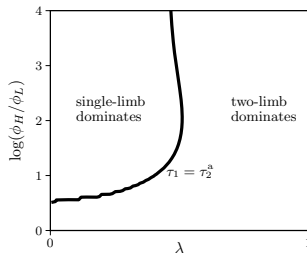
117 bonds, face value 206bn EUR

Greek-law bonds (90% of total)

- no CACs in original bond contracts
- Greek Bondholder Act (Feb '12): set agg. threshold at 66.7%
- uniform exchange offer, all bonds restructured

Why single-limb? (Zettelmeyer et al. (2013))

- simpler and faster, to avoid imminent, large redemption
- low aggregate threshold
- large heterogeneity: maturities 2012-2040, coupons 2.30%-6.50%
- small (subjective) weight of demanding creditors
 - creditor committee (banks & institutional investors) held long-term bonds
 - distressed debt investors held short-term bonds



Aggregated CACs in Action

Argentina 2020

Bonds face value: 65bn USD

8 “Kirchner” bonds, 1/3 of total

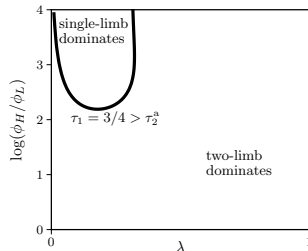
- old two-limb CACs with higher thresholds
- large heterogeneity, Discount vs Par bonds
- exchange offer: 40% better offer to Discount

17 “Macri” bonds, 2/3 of total

- enhanced CACs
- two-limb exchange offer, 11% better for short-term bonds, all bonds restructured

Why two-limb?

- large heterogeneity, 2020-2117 maturities, not accelerated
- large weight of short-term bonds ($\approx 80\%$ of total)
- lower aggregate threshold (carry-over clause)



Aggregated CACs in Action

Ecuador 2020

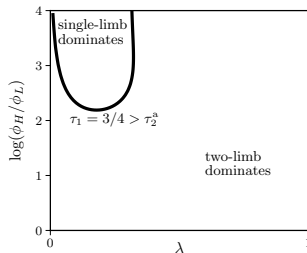
Bonds face value: 17bn USD

9/10 bonds with enhanced CACs

- maturities 2022-2030, coupons 7.875% – 10.75%
- two-limb exchange offer, 3 different baskets of new bonds
- all bonds restructured
- basket duration increasing in maturity of old bond
- basket values at exit prices: 66.4, 64.8, 63.9

Why two-limb?

- mild heterogeneity (in fact, similar offers and approval rates)



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Extended Setup

- Vulture fund (VF) may acquire share μ_i in bond i from bondholders
 - VF holds blocking minority if
 - $\mu_i > 1 - \tau_2^s$ under two-limb
 - $\sum_i \lambda_i \mu_i > 1 - \tau_1$ under single-limb
 - Costs and payoffs
 - Fixed entry cost ϵ_i if $\mu_i > 0$
 - If CACs are triggered: entry cost $q_i = w_i$, VF payoff w_i
 - If bond i is blocked: entry cost $q_i = F_i^{-1}(\mu_i)$, VF payoff h_i (reservation value, large)
- ⇒ VF entry only profitable if it blocks something, otherwise negative profits

Results Overview

- Assume:

$$\begin{array}{ccccc} \text{cost of blocking bond } i & & & & \text{cost of blocking both bonds} \\ \text{(two-limb)} & < & \text{VF's resources} & < & \text{(single-limb)} \end{array}$$

Aggregate blocking minority (face value): 62bn Greece, 11bn Argentina, 4bn Ecuador

- With *both* methods available, **single-limb** is a **credible off-equilibrium threat**
VF blocks bond $i \Rightarrow$ govt uses single-limb \Rightarrow VF makes a loss \Rightarrow
 \Rightarrow VF does not enter \Rightarrow govt chooses optimal method (Part 1), may be two-limb
- Takeaways
 - single-limb** as an effective off-equilibrium threat, but maybe suboptimal absent VF
 - two-limb** likely optimal absent VF, but less effective in preventing VF entry

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Equilibrium Model

setup

- Continuous-time stationary environment
- Continuum of risk-neutral investors with heterogeneous discount rates
 - Discount rate $r \sim G$ on $\mathcal{R} = [r_{\min}, r_{\max}]$.
- Two bonds S and L with exponentially decaying face values
 - decay rate δ_i , with $\delta_S > \delta_L$
 - coupon rate c_i
- Relative face values λ_S and $\lambda_L = 1 - \lambda_S$, constant over time
- A restructuring of both bonds may occur, with (exogenous) arrival rate η

Restructuring and Sorting Stages

- Restructuring stage

- Holder of bond i with discount rate r has reservation value

$$h_i(r) = \frac{c_i}{r + \delta_i + \kappa}, \quad \kappa \geq 0$$

and accepts restructuring offer if $w_i \geq h_i(r)$

- Sorting stage

- Prior to restructuring, investor r values bond i at

$$Q_i(r, w_i) = \frac{c_i + \eta w_i}{r + \delta_i + \eta}$$

- Assumption: each investors holds one unit of face value of either bond
- The set of investors who sort into bond S is

$$\mathcal{R}_S(\Delta q, \mathbf{w}) = \{r \in \mathcal{R} : Q_S(r, w_S) - Q_L(r, w_L) \geq \Delta q\}, \quad \Delta q := q_S - q_L$$

Reservation Value Distributions and Equilibrium

- Given sorting partitions $(\mathcal{R}_S, \mathcal{R}_L)$, the distribution of reservation values for bond i is

$$F_i(w) = \text{Prob}(h_i(r) \leq w \mid r \in \mathcal{R}_i)$$

- Equilibrium given by:
 - (i) price differential Δq^*
 - (ii) modification method and offers $\mathbf{w}^* = (w_S^*, w_L^*)$

such that

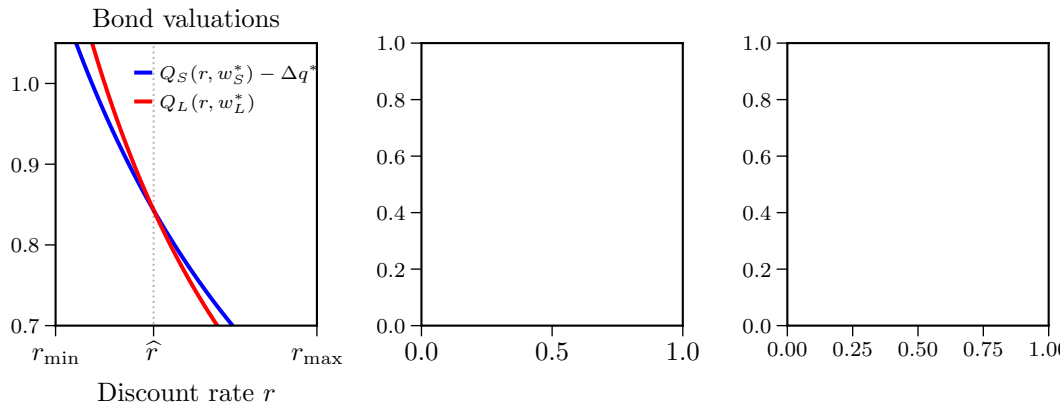
- method and offers are optimal given F_i
- investors sort optimally into bonds
- the bond market clears

► full def.

Equilibrium Example

- Consider parametrisation where more patient investors hold the long-term bond
- Market clearing requires $G(\hat{r}) = \lambda_L$

► F_i

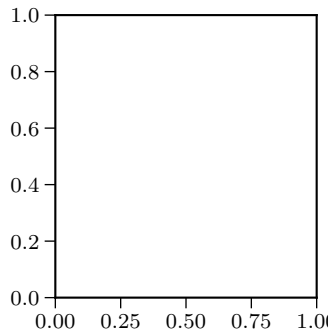
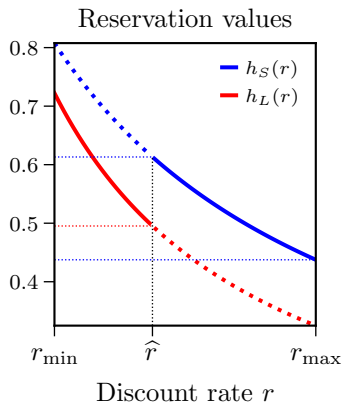
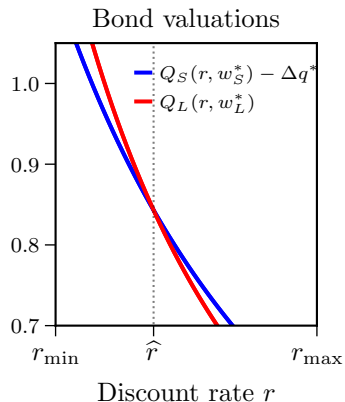


Assumptions: $r \sim U([0, 0.55])$, $(\delta_L, \delta_S) = (0.05, 0.25)$, $c_i = \mathbb{E}[r] + \delta_i$, $\lambda_L = 37\%$, $\eta = \kappa = 0.4$

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► F_i

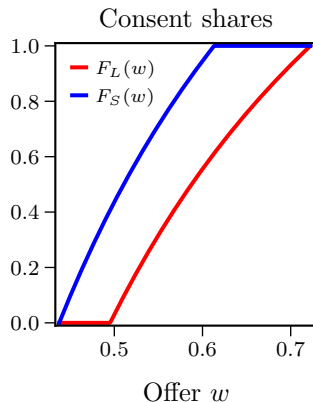
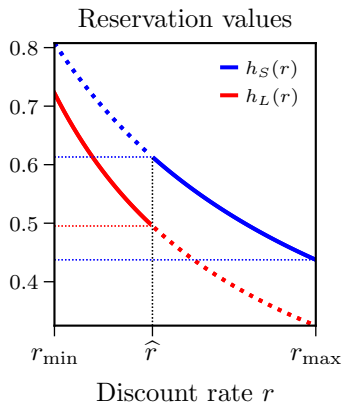
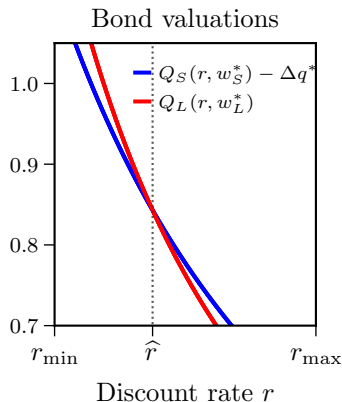


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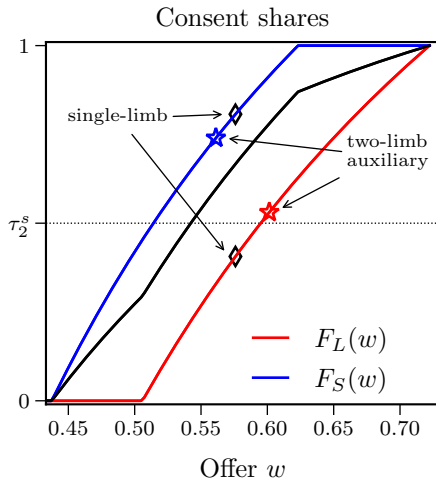
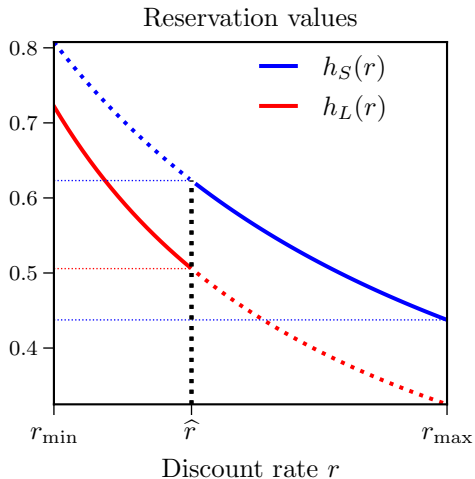
► F_i



Assumptions: $r \sim U([0, 0.55])$, $(\delta_L, \delta_S) = (0.05, 0.25)$, $c_i = \mathbb{E}[r] + \delta_i$, $\eta = \kappa = 0.4$, $\lambda_L = 37\%$

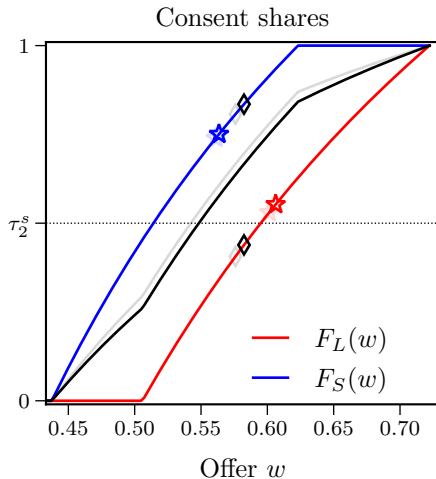
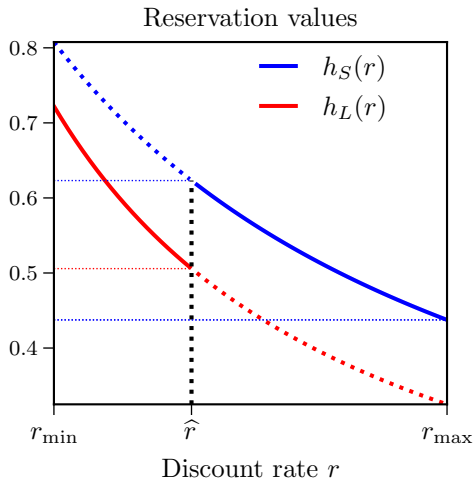
Comparative Statics wrt λ_L (1)

Baseline: auxiliary solution feasible \Rightarrow two-limb dominates



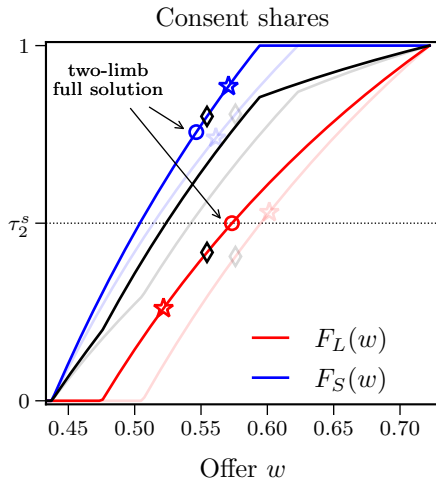
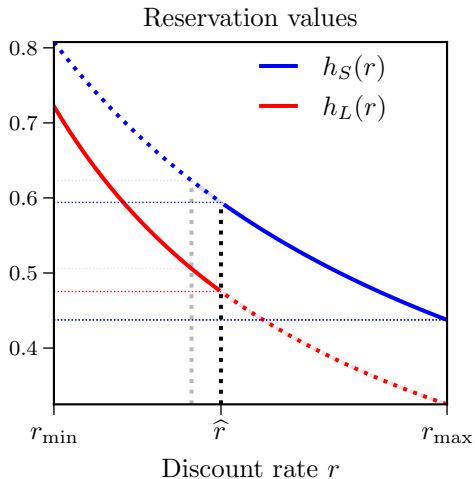
Comparative Statics wrt λ_L (2)

Size effect of $\uparrow \lambda_L$: offers increase, two-limb still optimal



Comparative Statics wrt λ_L (3)

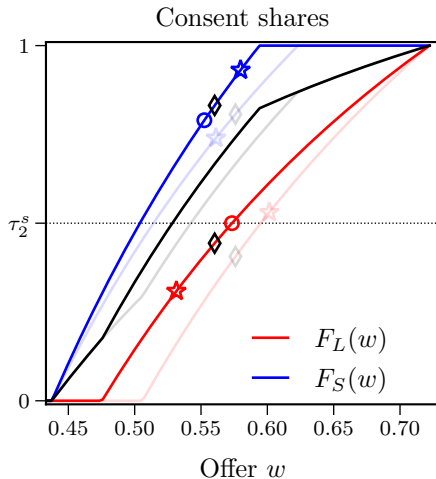
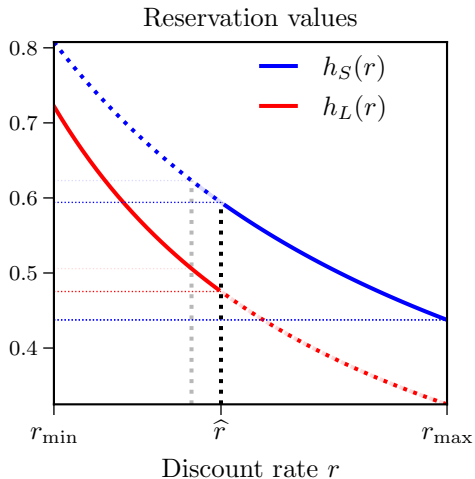
Sorting effect (new) of $\uparrow \lambda_L$: \hat{r} and F_i change, auxiliary offers diverge
 \Rightarrow heterogeneity \uparrow and single-limb dominates



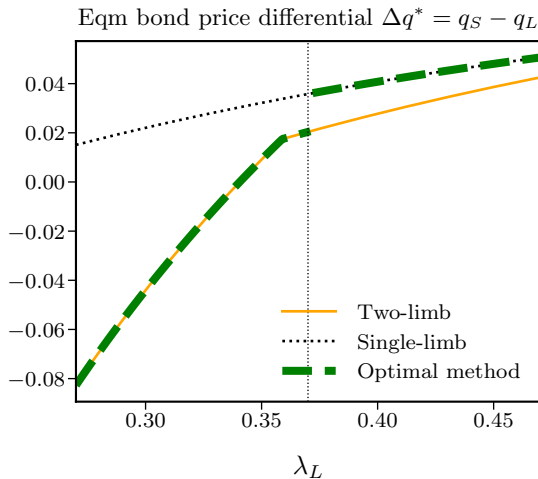
Comparative Statics wrt λ_L (4)

Total effect of $\uparrow \lambda_L$: sorting effect $>$ size effect

\Rightarrow heterogeneity \uparrow and single-limb dominates



Impact of CACs on Bond Market



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Conclusion

- Tradeoff between two aggregation methods
 - optimal procedure depends on bond heterogeneity, relative size, voting thresholds
 - single-limb can be optimal when small bond is held by tough creditors
 - ⇒ helps rationalise approach taken in Argentine and Ecuadorian workouts
- Off-equilibrium role of single-limb as deterrent against (non-atomistic) vulture
- Bond-specific reservation value distributions arise endogenously from investor sorting
 - anticipation of optimal use of CACs affects ex-ante bond market equilibrium
- Analysis of restructuring problem extends to N bonds + uncertainty
 - sub-aggregation, redesignation, bonds with different versions of CACs

Appendix

Uniform Applicability

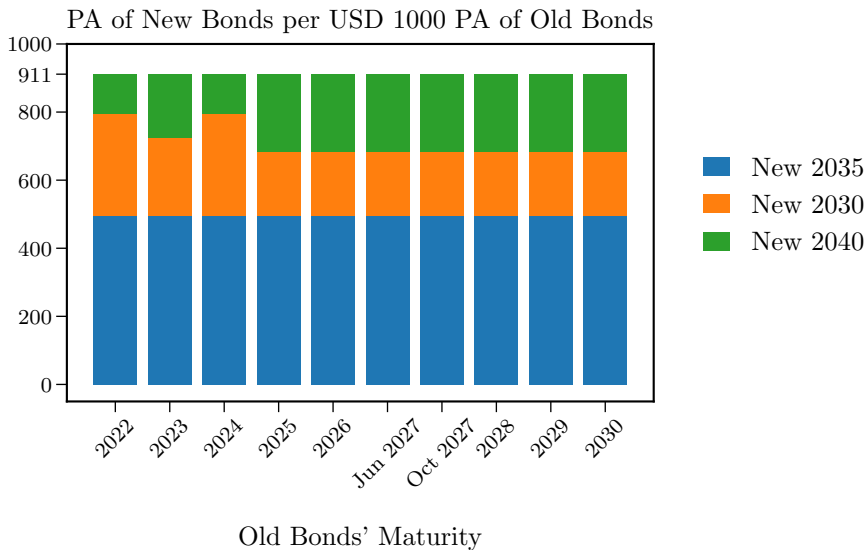
ICMA

- exchange, on the same terms, for the same (menu of) instrument(s)
- proposed amendments imply that new bonds have same provisions

Euro Area

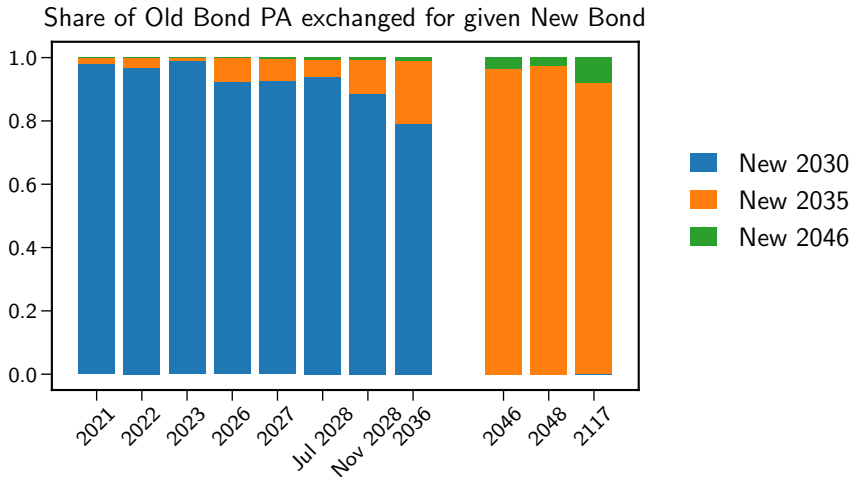
- exchange on the same terms, for the same (menu of) instrument(s)
- reduce face value by the same %
- extend maturity by the same time period or the same %

Ecuador 2020: Heterogeneous Offers



Argentina 2020: Heterogeneous Offers & Choices

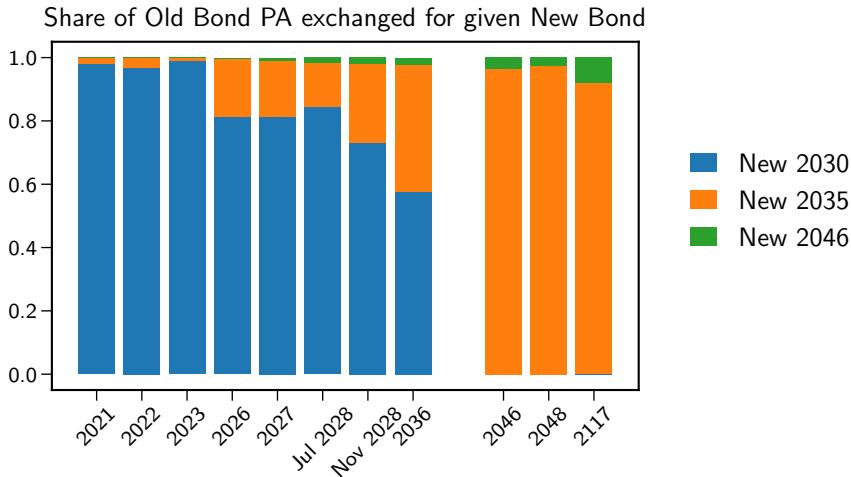
before Priority Acceptance Procedure



Old Bonds' Maturity (2016-Indenture (Macri) USD bonds)

Argentina 2020: Heterogeneous Offers & Choices

after Priority Acceptance Procedure



Old Bonds' Maturity (2016-Indenture (Macri) USD bonds)

Optimal Voting Rule

Sufficient Conditions

LEMMA

Two-limb dominates if *at least one of the following conditions holds*

- (i) *the optimal single-limb offer u^* satisfies all s.b.s. constraints: $F_i(u^*) \geq \tau_2^s$*
→ single-limb has no advantage vs two-limb
- (ii) *the auxiliary solution (\hat{w}_H, \hat{w}_L) satisfies all s.b.s. constraints: $F_i(\hat{w}_i) \geq \tau_2^s$*
→ two-limb has no disadvantage vs single-limb

Optimal Voting Rule

Comparative Statics

PROPOSITION

- **Two-limb is optimal**

- *if there is little heterogeneity across bonds*
- *if bond H is relatively large, i.e., λ is high*
- *when bond H is very small ($\lambda \approx 0$) and $\tau_1 > \tau_2^a$.*

► γ^s

► λ^s

- *Under some technical conditions on densities f_H and f_L , **single-limb is optimal***

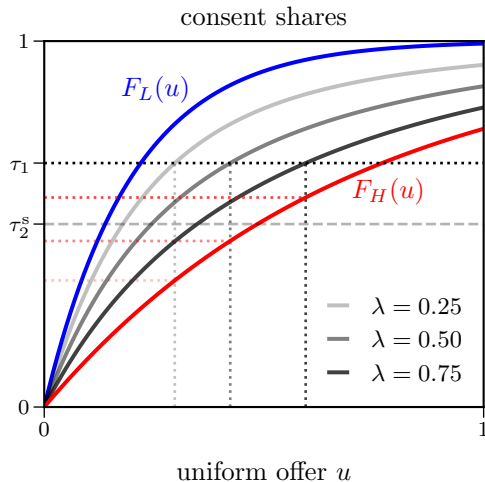
- *when $\lambda \approx 0$ and $\tau_1 = \tau_2^a$*
- *when $\lambda \approx \tilde{\lambda}$, where $\tilde{\lambda}$ is such that $\hat{w}_L(\tilde{\lambda}, \tau_2^a) = \hat{w}_H(\tilde{\lambda}, \tau_2^a) < F_H^{-1}(\tau_2^s)$, and $\tau_1 \approx \tau_2^a$.*

◀ Back

Comparative Statics in λ

Assuming $F_i(w) = 1 - e^{w/\phi_i}$, $\phi_H = 0.7$, $\phi_L = 0.2$ and $\tau_1 = \tau_2^a$

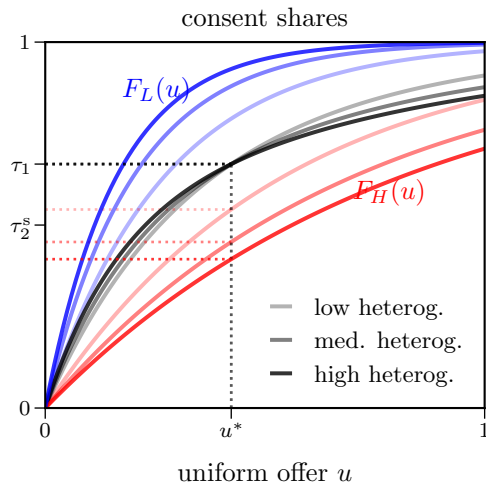
◀ back



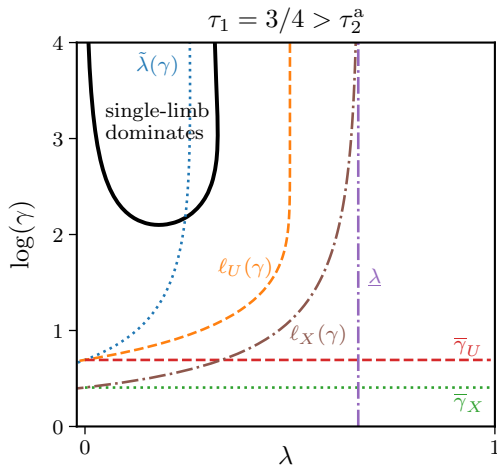
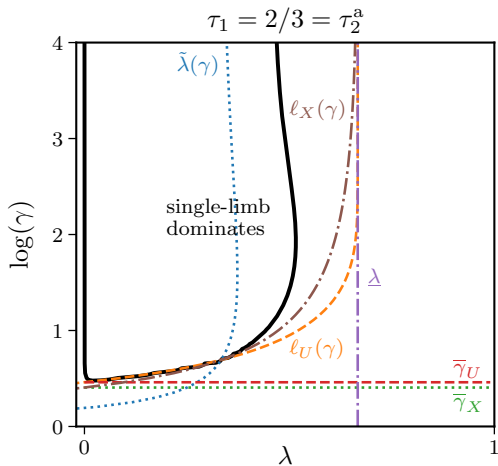
Comparative Statics: Role of Heterogeneity

Assuming $F_i(w) = 1 - e^{w/\phi_i}$ and $\tau_1 = \tau_2^a$, for various ϕ_H/ϕ_L

◀ back



Optimal Voting Rule



Equilibrium

DEFINITION

Given distribution G on \mathcal{R} , bond characteristics (c_i, δ_i) and relative sizes λ_S, λ_L , default arrival rate η , and parameter κ , an equilibrium consists of

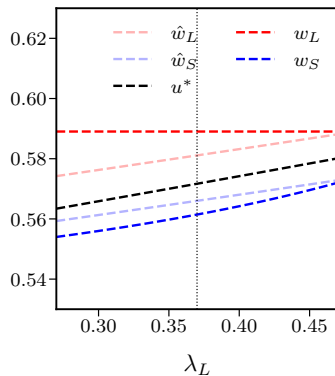
- (i) a price differential Δq^* and a partition $(\mathcal{R}_S, \mathcal{R}_L)$*
- (ii) a modification method and a pair of offers \mathbf{w}^**

such that

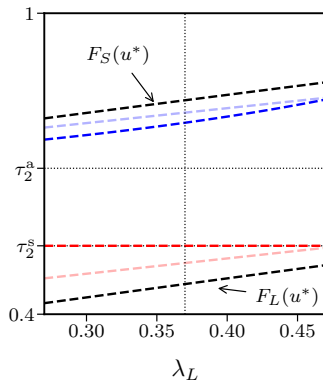
- 1. the government chooses the modification method and restructuring offers optimally given the implied distributions F_S and F_L ,*
- 2. investors optimally choose which bond to hold: $\mathcal{R}_i = \mathcal{R}_i(\Delta q^*, \mathbf{w}^*)$,*
- 3. the market clears for each bond, $\int_{\mathcal{R}_i} dG = \lambda_i$.*

Size Effect of $\uparrow \lambda_L$

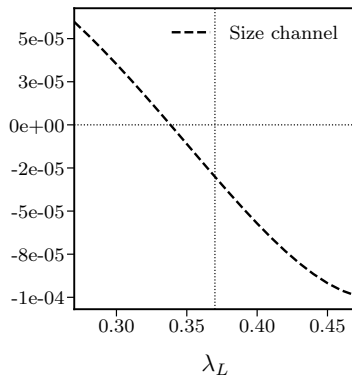
Offers



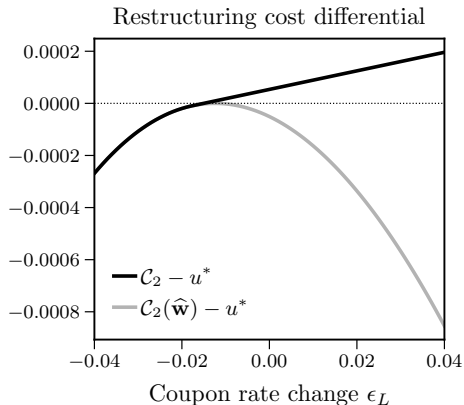
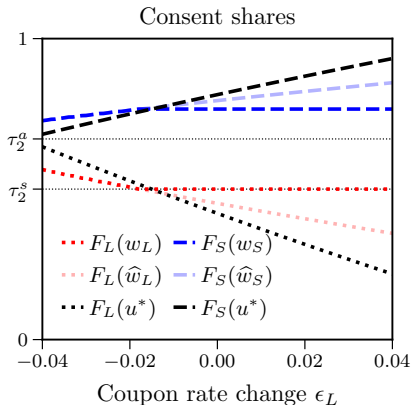
Consent shares



Cost differential $\mathcal{C}_2 - u^*$



Role of Bond Heterogeneity

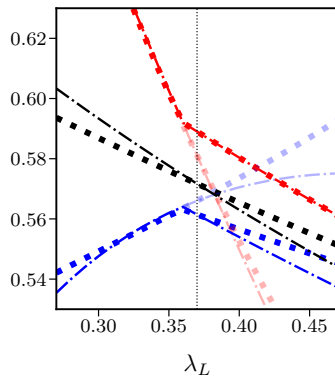


Assumptions: taking deviation around baseline $\tilde{c}_L = c_L + \epsilon_L$

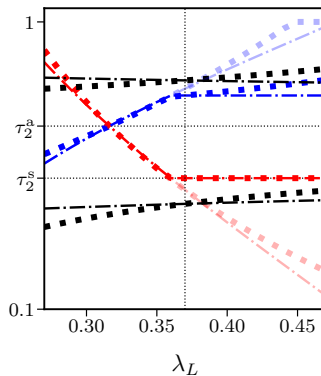


Sorting & Total Effect of $\uparrow \lambda_L$

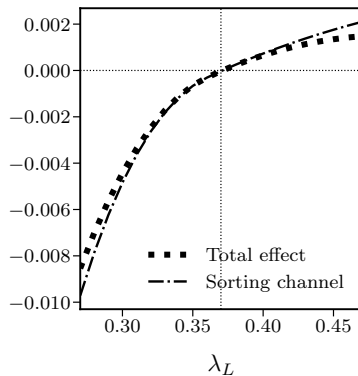
Offers



Consent shares

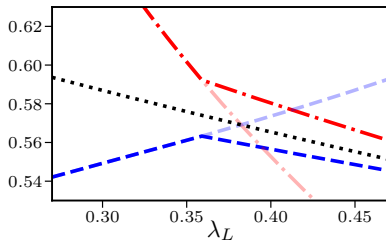


Cost differential $\mathcal{C}_2 - u^*$

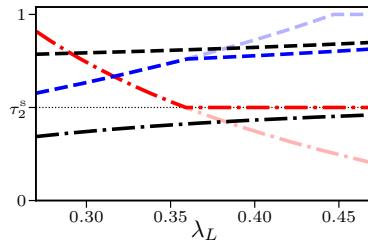


Full Comparative Statics wrt λ_L

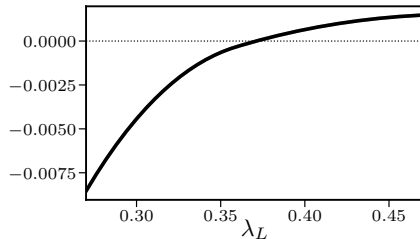
Offers



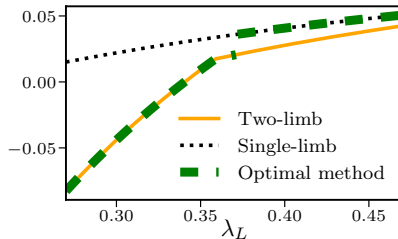
Consent shares



Cost differential $\mathcal{C}_2 - u^*$

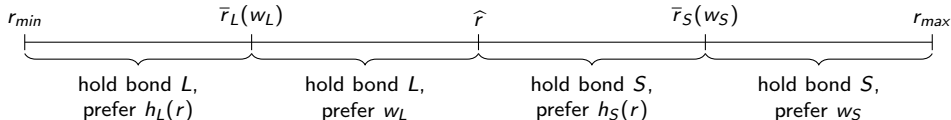


Bond price differential Δq^*



Equilibrium Example

- Investor r holding bond i accepts w_i iff $r \geq \bar{r}_i(w_i) := \frac{c_i}{w_i} - (\delta_i + \kappa_i)$



- With $r \sim \text{Uniform}[r_{\min}, r_{\max}]$, we get

[◀ back](#)

$$F_L = \frac{G(\hat{r}) - G(\bar{r}_L(w_L))}{\lambda_L} = \left(\frac{\lambda_L(r_{\max} - r_{\min}) + \delta_L + \kappa + r_{\min}}{\lambda_L r_{\max} - r_{\min}} \right) - \left(\frac{c_L}{\lambda_L(r_{\max} - r_{\min})} \right) \frac{1}{w_L}$$

$$F_S = \frac{1 - G(\bar{r}_S(w_S))}{\lambda_S} = \left(\frac{(r_{\max} - r_{\min}) + \delta_S + \kappa + r_{\min}}{\lambda_S(r_{\max} - r_{\min})} \right) - \left(\frac{c_S}{\lambda_S(r_{\max} - r_{\min})} \right) \frac{1}{w_S}$$

Auxiliary Problem SOC's

The objective function is strictly convex if

$$\frac{d \log f_L(w_L)}{dw_L} < \frac{d \log f_H[g(w_L)]}{dw_L}.$$

A sufficient condition is that the two densities f_H and f_L are strictly decreasing