Risk Aversion in Sovereign Debt and Default

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Macro-financial separation

- In most RBC models, macro-financial separation holds
  - Elasticity of intertemporal substitution determines allocations
  - Risk aversion determines asset prices

- Sovereign debt literature typically inherits this line of thinking
  - CRRA preferences frequent, typically $\gamma = 2$

- If MFS holds in sovereign debt, macro outcomes robust to different preferences
  - In particular, calibration of output/utility costs of default
  - Less clear about welfare effects
    - … losses from default, debt dilution
    - … welfare effects of banning debt, introducing state-contingent bonds

Wanting risk prices in sovereign debt

This paper

- Show that macro-financial separation breaks in the sovereign debt model
- Understand the impact of preferences consistent with significant risk premia

- Risk aversion
  1. affects higher-order moments of equilibrium
     … cautious behavior: stay away from default but use debt for insurance
  2. has limited impact on welfare comparisons
     … default costs adjust in calibration
  3. has some impact on optimal fiscal rules

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Model

Framework

- Sovereign default model without default [reduces to an income-fluctuations problem]

$$v(b,z) = \max_{b'} u^{-1}\left((1-\beta)u(c) + \beta u\left(\underbrace{g^{-1}\left(\mathbb{E}\left[g\left(v(b',z')\right)\,\middle|\,z\right]\right)}_{=\mathbb{T}(v(b',z')|z)}\right)\right)$$

$$\text{subject to} \quad c + \kappa b = q(b',z)(b' - (1-\delta)b) + y(z)$$
$$b' \leq \bar{b}$$
$$\text{with} \quad q(b',z) = 1 \qquad \kappa = r + \delta$$

- We consider parametrizations of the model to vary risk aversion
  - ... with CRRA preferences $g(x) = u(x) = x^{1-\sigma}$ so $\mathbb{T} = \mathbb{E}$
  - ... with robustness, $u(c) = \log c$; $g(x) = x^{1-\gamma}$, so that $\mathbb{T}[X \mid \mathcal{F}] = \mathbb{E}\left[X^{1-\gamma}\,\middle|\,\mathcal{F}\right]^{\frac{1}{1-\gamma}}$

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Domestic risk premia

- Price of Lucas tree [dividend $y(z)$]:

$$q_L(b,z;d) = \beta \mathbb{E}\left[\left(\frac{c(b',z';d')}{c(b,z;d)}\right)^{-\sigma}\left(\frac{v(b',z';d')}{\mathbb{T}\left[v(b',z';d') \mid z,d\right]}\right)^{\sigma-\gamma}\left(y(z';d') + q_L(b',z';d')\right) \,\middle|\, z,d\right]$$

- Turn into yields

$$r(b',z';d') = \frac{y(z';d') + q_L(b',z';d')}{q_L(b,z;d)}$$

- Compare with the yield of a risk-free asset [dividend 1]

Macro-financial separation without default

CRRA

- Start from log-log [$\sigma = \gamma = 1$]: RA moves asset prices and welfare, not the macro

	loglog	$\gamma = 2$	$\gamma = 5$	$\gamma = 10$	$\gamma = 15$
Corr. NX, y (%)	-2.02	-2.01	-1.98	-1.92	-1.86
Rel. vol. cons	1.1	1.1	1.1	1.1	1.11
Risk premium (p.p.)	1.03	1.1	1.29	1.63	1.97
Debt-to-GDP (%)	30.5	30.5	30.5	30.5	30.5
Corr. deficit, y (%)	-1.64	-1.65	-1.68	-1.73	-1.78
Default freq. (%)	0	0	0	0	0
Welfare	1.028	1.027	1.024	1.019	1.015

... welfare in autarky at $\gamma = 15$ is 1.5pp lower than loglog or CRRA

Models with default

- Option value of default (with small pref. shocks for numerical performance)

$$\mathcal{V}(b,z) = \max\{v_R(b,z) + \epsilon_R, v_D(b,z) + \epsilon_D\}$$

- Similar equation for value of repayment v_R, debt prices reflect default probabilities

$$q(b',z) = \frac{1}{1+r}\mathbb{E}\left[(1 - \mathbb{1}_{\mathcal{D}'})\left(\kappa + (1-\delta)q(b'',z')\right) \,\middle|\, z\right]$$

- Costs of default

$$v_D(b,z) = u^{-1}\left((1-\beta)u(h(y(z))) + \beta\mathbb{T}\left[\mathbb{1}_R\mathcal{V}(B(b,z'),z') + (1-\mathbb{1}_R)v_D(b,z') \,\middle|\, z\right]\right)$$

$$h(y) = y(1 - d_0 - d_1 y)$$

- Risk aversion $\implies$ lack of smoothing in default costly $\implies$ no macro-fin separation

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Quantitative properties

Comparative statics: robustness

- Increasing RA: lower debt tolerance, slightly lower volatilities

	loglog	$\gamma = 2$	$\gamma = 5$	$\gamma = 10$	$\gamma = 15$
Avg. spread (bps)	746	760	800	873	884
Corr. NX, y (%)	-21.1	-20.7	-19.2	-15.1	-9.71
Rel. vol. cons	1.29	1.29	1.27	1.24	1.19
Risk premium (p.p.)	2.43	2.55	2.96	3.54	3.72
Debt-to-GDP (%)	17.5	17.3	16.7	15.5	13.3
Corr. deficit, y (%)	41.9	41.5	39.8	36.7	33.5
Default freq. (%)	8.33	8.47	9	10.1	11.5
Std. dev. spreads (bps)	311	321	351	408	447
Welfare	1.009	1.008	1.004	0.9988	0.9935

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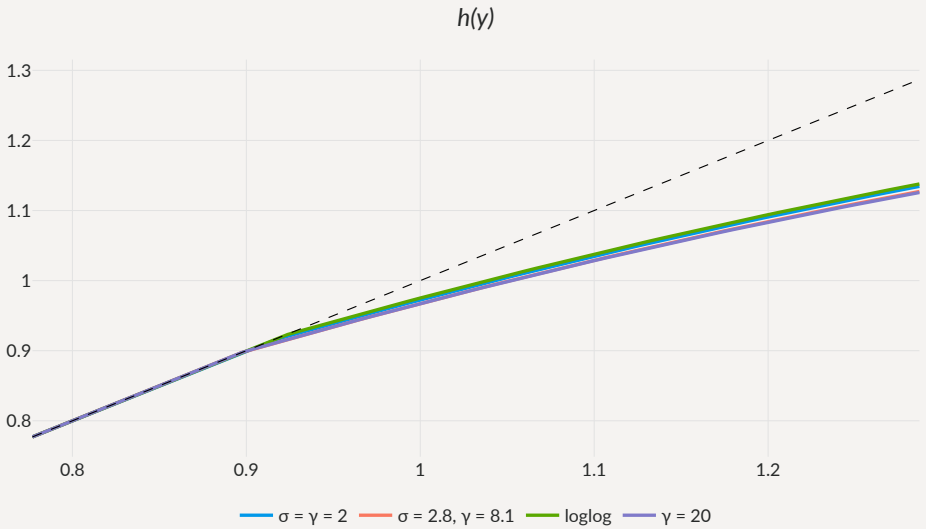
Calibration

- Add moments as more free parameters are included

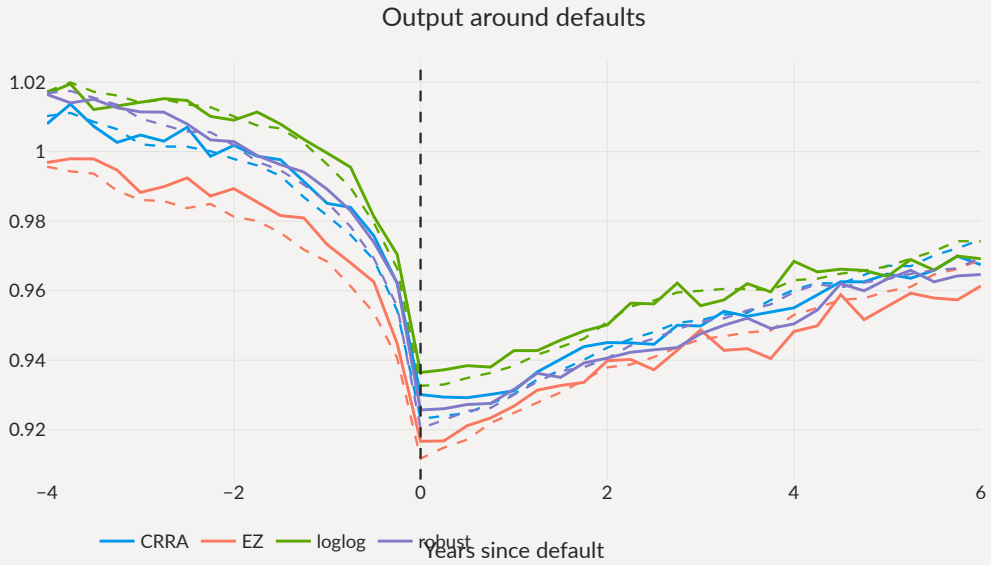
	Parameter	loglog	CRRA	robust	EZ
Sovereign's discount factor	β	0.9665	0.9671	0.9711	0.9685
Sovereign's risk aversion	γ	1	2	19.78	8.145
Sovereign's EIS	σ	1	2	1	2.813
Default output cost: linear	d_1	−0.2923	−0.2891	−0.2896	−0.2859
Default output cost: quadratic	d_2	0.3171	0.3168	0.3224	0.3186
	Data	loglog	CRRA	robust	EZ
Avg. spread (bps)	815	834	800	783	722
Rel. vol. cons	0.94	1.47	1.32	1.43	1.21
Risk premium (p.p.)	3	1.03	1.82	2.78	2.93
Debt-to-GDP (%)	17.4	17.2	17.4	18.4	17.5
Std. dev. spreads (bps)	443	402	461	497	529

Calibrated output costs of default with robustness

- Calibrations with risk aversion need *higher* costs



Event-study of defaults



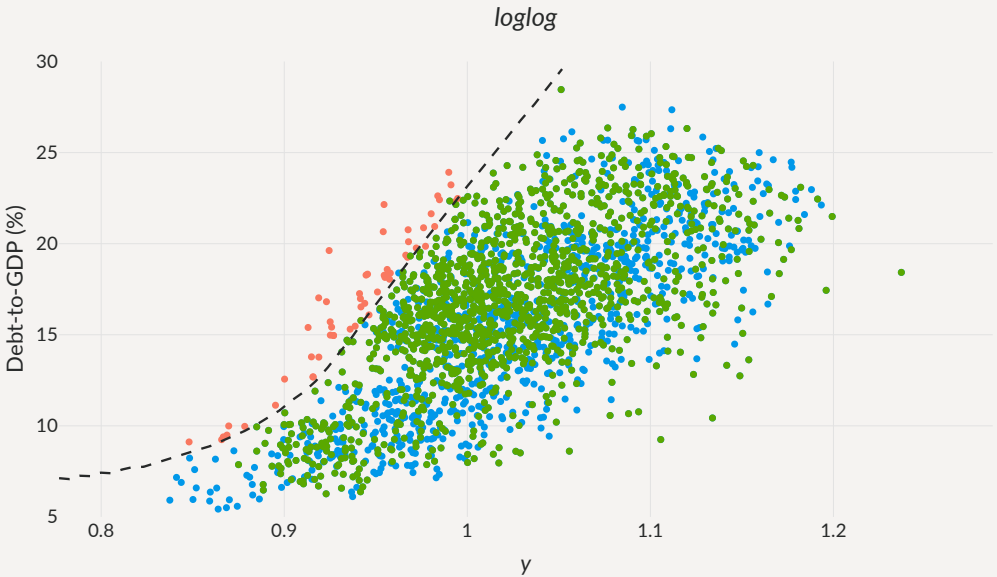
Untargeted moments

- Calibrations with robustness: not really helpful with untargeted moments

	Data	loglog	CRRA	robust	EZ
Corr. NX,y (%)	−69	−31	−28.8	−22.2	−16.9
Std. NX (%)	1.35	2.6	2.06	2.72	1.82
Corr. spr,y (%)	−65	−65.4	−78.7	−71.5	−81.3
Corr. c,y (%)	97	84.9	88.7	82.2	89.7
Corr. spr,NX (%)	56	23.5	21	11.7	10.3

Ergodic distribution for debt

CRRA EZ



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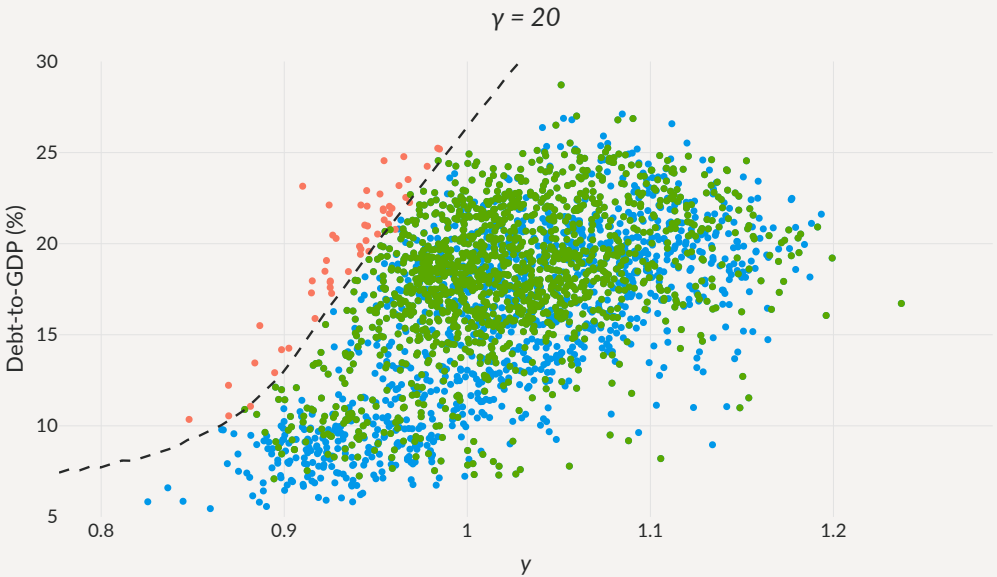
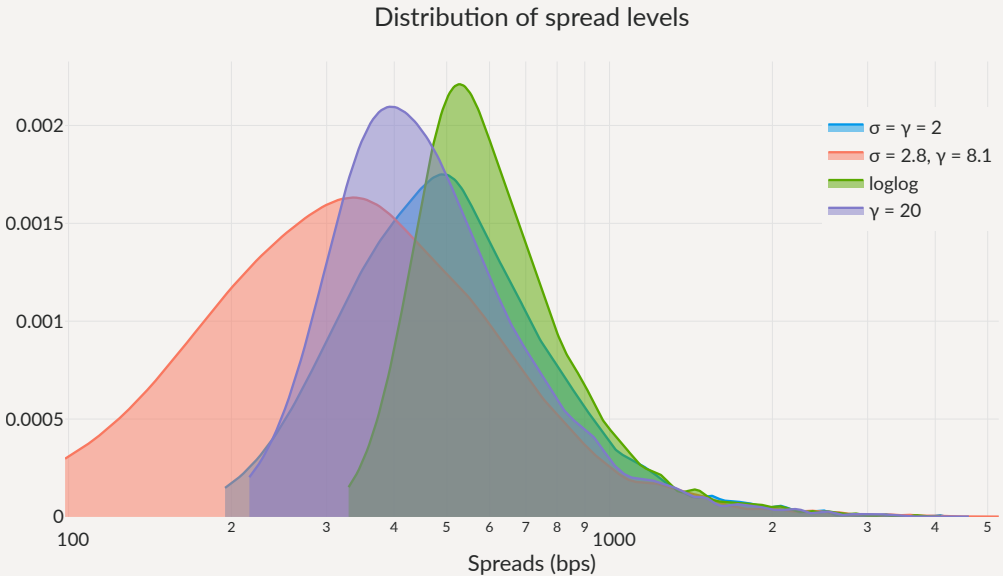
CRRA EZ



Ergodic distribution for spreads



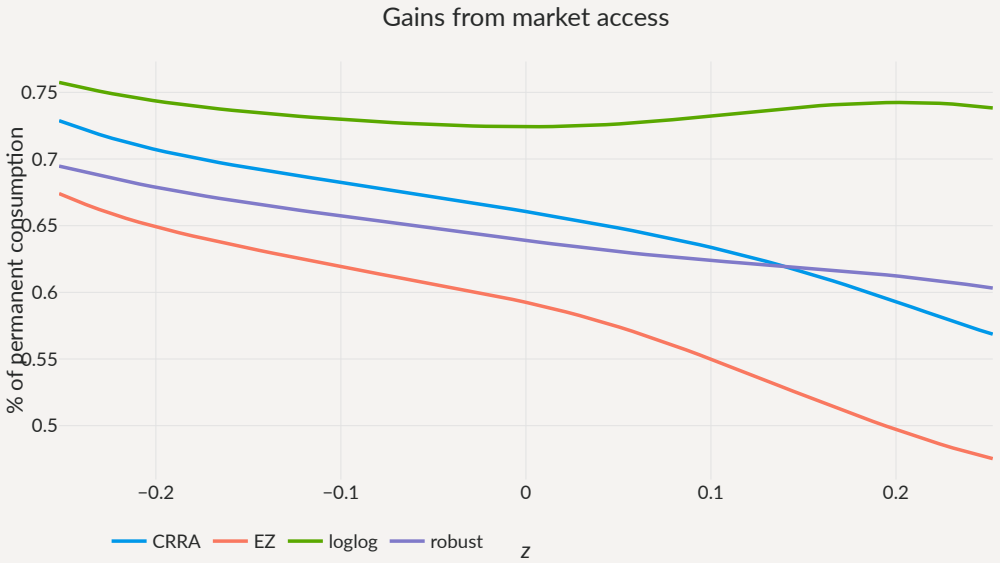
Takeaways

With preferences consistent with significant risk premia

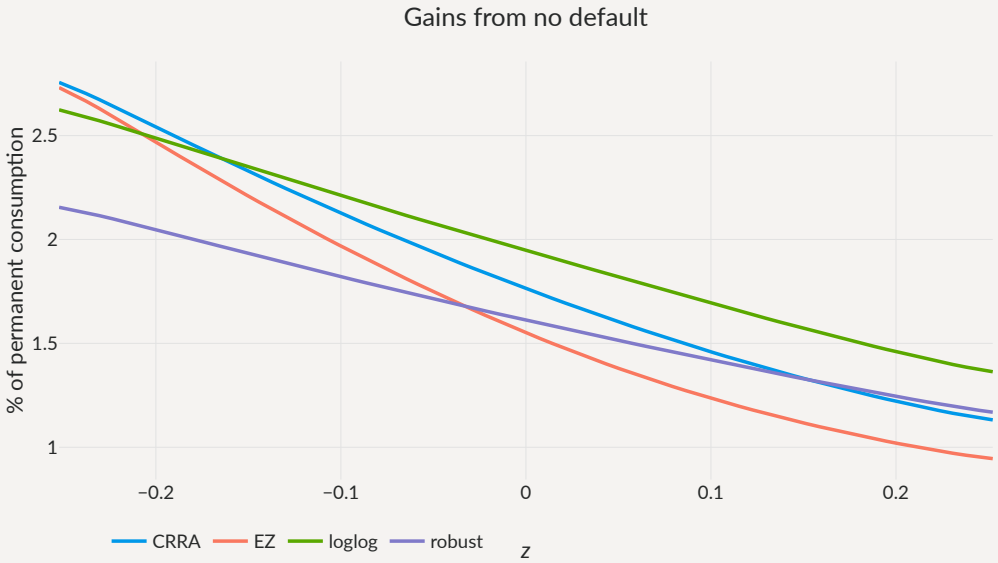
- *Lower* debt tolerance
  - … Larger default costs required
- Less staying at the edge of default
  - … More skewness in the distribution of debt and spreads
  - … Larger differences between ergodic distribution and pre-default samples
- More use of the debt for insurance
  - … Larger swings in debt to smooth shocks

Welfare effects

Welfare effects of access to debt



Welfare effects of banning defaults



Fiscal rules

- Overall deficit [= current account]

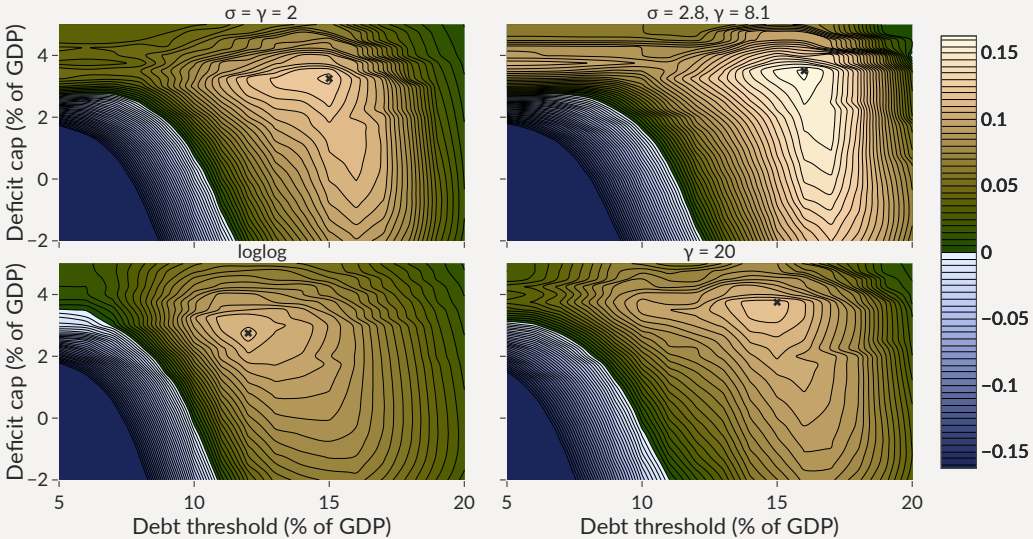
$$\begin{aligned} d_t &= c_t + \kappa b_t - y_t \\ &= q_t(b_{t+1} - (1-\delta)b_t) \end{aligned}$$

- Consider rules of the form

$$d_t \leq d^\star \mathbb{1}_{\frac{b_t}{y_t} \geq b^\star}$$

Optimal fiscal rules

Primary balance



Concluding remarks

Risk aversion in the sovereign debt model

- Risk aversion matters for macro outcomes in the sovereign debt model
  - … raises questions about inference, policy evaluation based on CRRA preferences
- Effect of robustness concentrated at higher-order moments
  - … makes crises look like more abrupt events
- Welfare effects of market access and default unchanged from standard preferences
  - … re-calibration of default costs weighs against change in risk attitudes
- Optimal fiscal rules affected by underlying preferences
  - … more risk aversion $\Longrightarrow$ looser fiscal rules
- No long-run risk

Macro-finanical separation without default

Back

	CRRA	$\gamma = 5$	$\gamma = 10$	$\gamma = 15$
Corr. NX, y (%)	-1.68	-1.58	-1.41	-1.22
Rel. vol. cons	1.06	1.06	1.06	1.06
Risk premium (p.p.)	2.26	2.58	3.05	3.53
Debt-to-GDP (%)	30.5	30.5	30.5	30.5
Corr. deficit, y (%)	-3.73	-3.85	-4.07	-4.32
Default freq. (%)	0	0	0	0
Welfare	1.024	1.021	1.016	1.011

Ergodic distribution for debt

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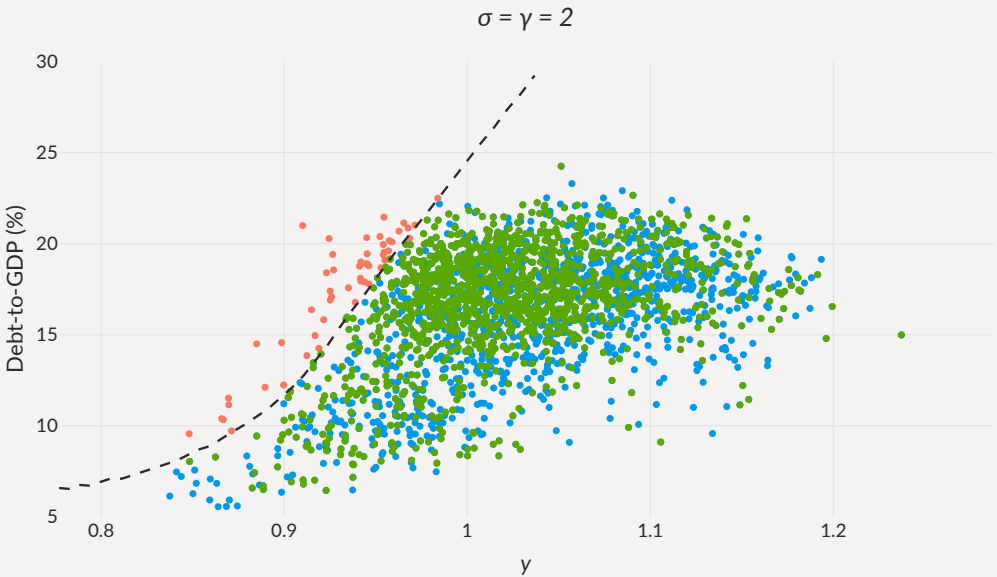

Ergodic distribution for debt

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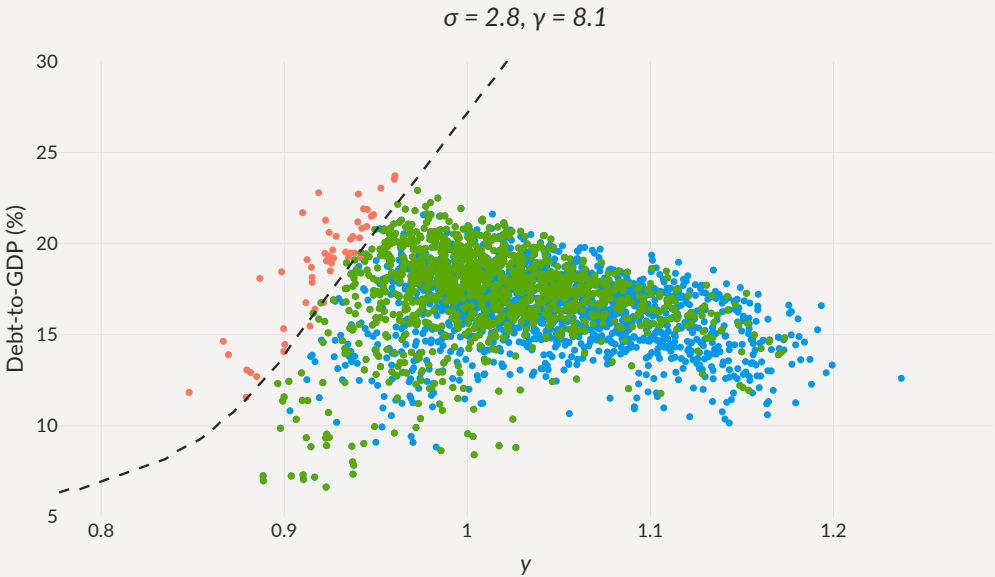

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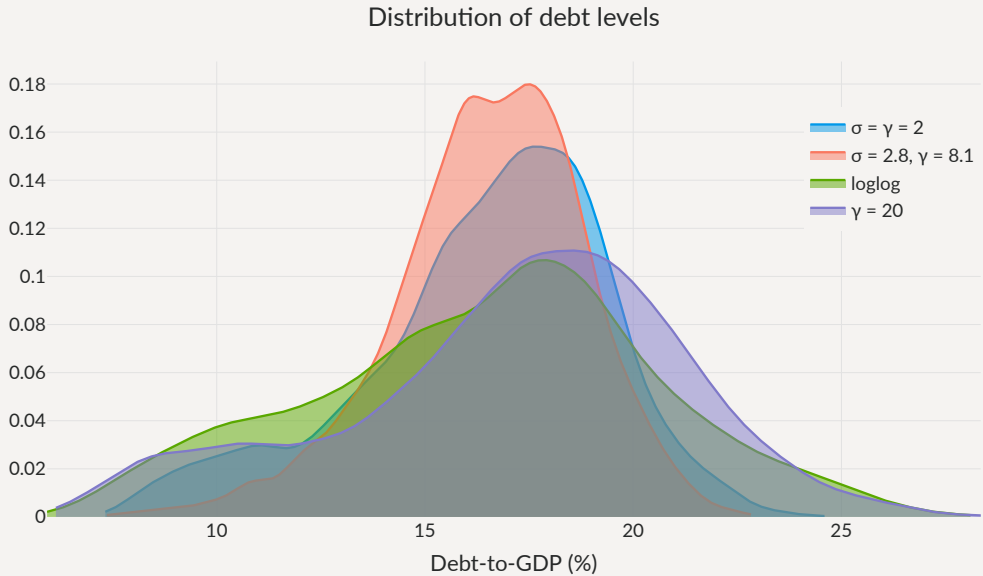

Optimal fiscal rules

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