Everything in Moderation: The Currency-Maturity Composition of Sovereign Debt

Raymond He

University of Texas at Austin

October 16, 2026

Motivation

How should emerging market economies (EMEs) borrow?

Conventional Prescription:

- **Currency**:
  - Domestic currency (DC) debt provides **insurance** benefits
  - Foreign currency (FC) debt provides **disciplining** benefits
- **Maturity**:
  - Long-term (LT) debt provides **insurance** benefits
  - Short-term (ST) debt provides **disciplining** benefits

This paper

1. **Empirical:** What is the portfolio composition of debt issued by EMEs?
   ▸ Descriptive Stats
2. **Empirical:** When do EMEs issue each type of debt?
   - Analyze panel data on bond issuance & spreads
3. **Quantitative:** How should EMEs borrow in different states of the world when both aspects are considered jointly?
   - Present & solve a sovereign debt model with portfolio choice
   - Calibrate to Türkiye

Overview of Findings

1. EMEs' DC debt is often of shorter maturity than their FC debt
   - DC average maturity: 4.7 years
   - FC average maturity: 12.5 years
2. Increased riskiness is associated sovereigns issuing more:
   - FC debt
   - ST debt (both DC and FC)
3. Standard mechanisms can rationalize my stylized fact
4. LD debt & SF debt are specialized assets:
   - Costly to issue in most states
   - Valuable in only empirically rare states

Literature Review

1. **Portfolio choice**
   - Arellano (2008), Hatchondo and Martinez (2009), Chatterjee and Eyigungor (2012), Aguiar et al. (2013), Hurtado et al. (2023)
   - **Maturity Choice**: Arellano and Ramanarayanan (2012), Hatchondo et al. (2016), Bocola and Dovis (2019), Mihalache (2020)
   - **Currency Choice**: Ottonello and Perez (2019), Du et al. (2020), Sunder-Plassmann (2020), Lee (2021), Engel and Park (2022), Maeng (2025)

   First to examine both aspects of sovereign debt **jointly**.
2. **Computational**
   - Chatterjee and Eyigungor (2012), Hatchondo et al. (2016), Jang and Lee (2026), Mateos-Planas et al. (2026)

   Present steps to solve multi-bond sovereign debt models.

Roadmap

Empirical Analysis

Model

Optimal Portfolio

Quantitative Analysis

Empirical Analysis

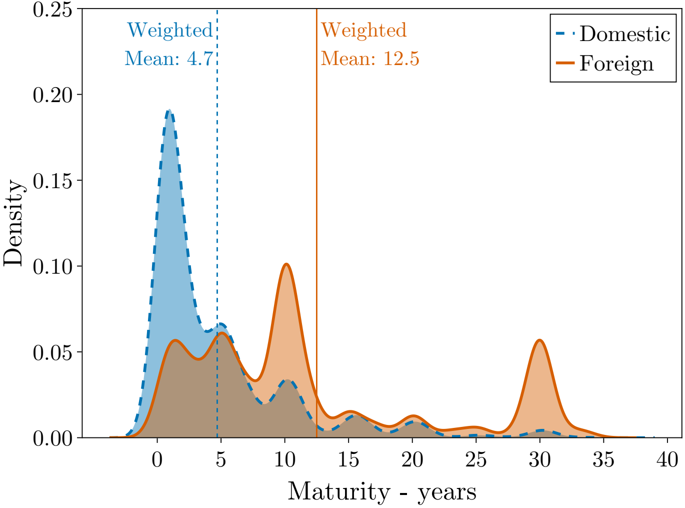
Data

1. **Issuance:** Bloomberg ▸ Data Cleaning ▸ Issuance Summary Stats
   - 1990 - 2024
   - 19 EMEs
   - 24,910 bonds
2. **Spreads:** Datastream & Du and Schreger (2016) ▸ Spread Summary Stats

$$y^{DC}_{i,n,t} - y^{USD}_{US,n,t}$$

   - $y^{DC}_{i,n,t}$: n-year domestic currency government bond yield in country i
   - $y^{USD}_{US,n,t}$: n-year U.S. Treasury yield
   - 12 EMEs

Distribution of Maturities



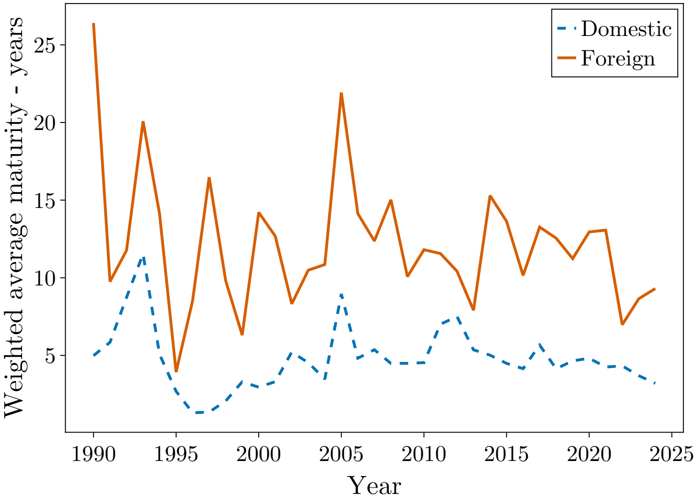
Consistent Across Countries

Country	Domestic	Foreign
Angola	3.4 years	10.6 years
Argentina	6.5 years	13.5 years
Colombia	11.2 years	15.8 years
Egypt	1.6 years	6.6 years
Hungary	4.7 years	10.6 years
Indonesia	10.0 years	14.0 years
Jamaica	8.8 years	6.1 years
Jordan	3.7 years	6.8 years
Mexico	3.8 years	18.4 years
Philippines	5.2 years	15.1 years
Poland	5.6 years	11.6 years
Qatar	4.9 years	15.3 years
Romania	4.8 years	10.2 years
Russia	6.7 years	17.5 years
Tunisia	5.7 years	9.5 years
Türkiye	3.5 years	7.5 years
Ukraine	5.7 years	6.6 years
Uruguay	11.6 years	18.0 years
Venezuela	2.6 years	17.2 years
Average	5.8 years	12.2 years
Median	5.2 years	11.6 years

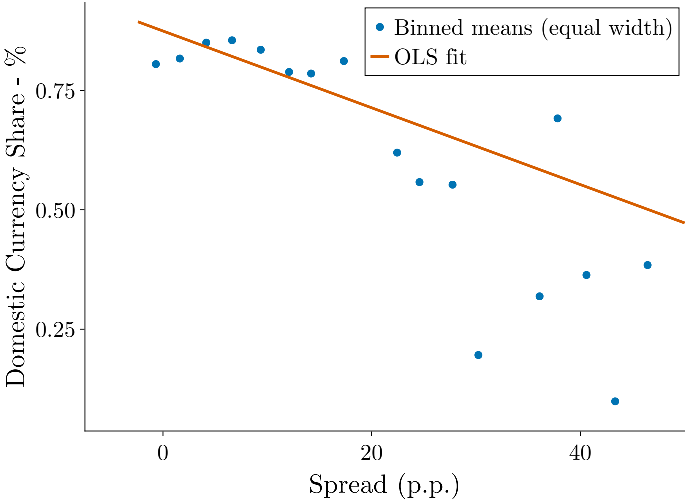
- FC debt is issued at **longer** maturities than DC debt
- Holds for nearly every country in the sample

Back

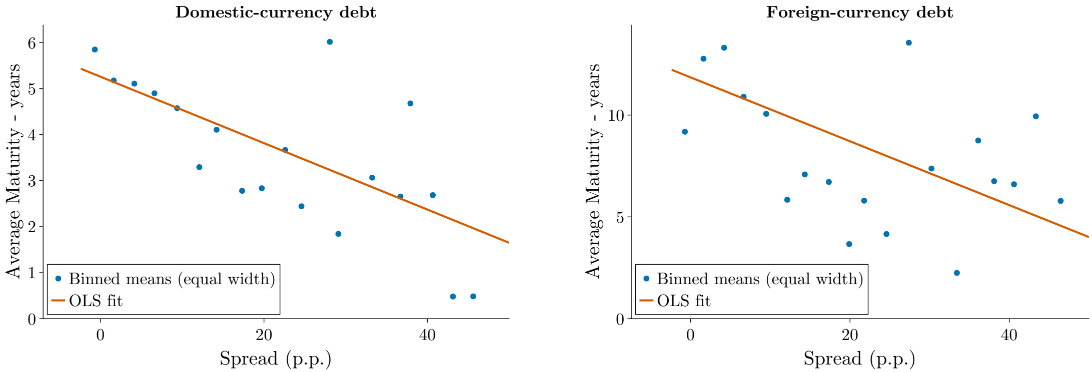
Consistent Across Time



Relationship Between Spreads & Currency Choice



Relationship Between Spreads & Maturity Choice



Empirical Summary

- EMEs' FC debt is of significantly longer maturity than their DC debt
- Increased riskiness is associated with EMEs tilting their portfolio towards
    1. More FC debt
    2. More ST debt (both DC & FC)

Model

Environment

- Small-open economy model
- Three agents:
  - Risk-averse household
  - Benevolent sovereign
  - Foreign lenders
- Two sources of uncertainty, $\mathbb{X}_t = \{\mathcal{Y}_t, \mathcal{E}_t\}$:
  1. $\mathcal{Y}_t$: endowment shock, and
  2. $\mathcal{E}_t$: real exchange rate shock
- Two consumption goods - domestic and foreign
- De-trended, real economy

Agent 1: Households

Preferences:

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \left[u(C_t) - l(\Pi_t - \Pi^*) \right] \right] \tag{1}$$

- $\beta \in (0, 1)$: discount factor
- $u(\cdot)$: utility from consumption
- $l(\cdot)$: disutility from inflation deviations
- Π^*: target inflation rate

Budget Constraint:

$$C_t = \tau_t \tag{2}$$

Agent 2: Benevolent Sovereign

- Lacks commitment in:
  1. Repaying debt,
  2. Monetary policy,
  3. Borrowing decisions
- 5 choice variables:
  1. Inflation,
  2. 4-bond portfolio: $\mathbb{B}_t = \left\{b_t^{SF}, b_t^{LF}, b_t^{SD}, b_t^{LD}\right\}$
- $b_t > 0$: borrowing, $b_t < 0$: saving

Currencies

Foreign currency:

- Sovereign receives $q^{SF} \times b^{SF}_{t+1}$ today,
- Repays b^{SF}_{t+1} tomorrow

Domestic currency:

- Sovereign receives $q^{SD} \times b^{SD}_{t+1}$ today,
- Repays b^{SD}_{t+1}/Π_{t+1} tomorrow

Long-term debt

Long-term debt's law of motion, following Hatchondo and Martinez (2009):

$$i_t^{LF} = b_{t+1}^{LF} - (1-\delta)b_t^{LF} \tag{3}$$

- $\delta \in (0, 1]$: fraction of LT debt that matures each period
- $i_t > 0$: net borrowing
- $i_t < 0$: net buy-back

Sovereign's budget constraint

$$
\begin{aligned}
&\tau_t + \mathcal{E}_t\left[b_t^{SF} + b_t^{LF}\right] + \frac{b_t^{SD} + b_t^{LD}}{\Pi_t} = \\
&\quad q^{SD}(\mathbb{B}_{t+1}, \mathbb{X}_t) b_{t+1}^{SD} + q^{LD}(\mathbb{B}_{t+1}, \mathbb{X}_t)\left[b_{t+1}^{LD} - (1-\delta)\frac{b_t^{LD}}{\Pi_t}\right] \\
&\quad + \mathcal{E}_t\left[q^{SF}(\mathbb{B}_{t+1}, \mathbb{X}_t) b_{t+1}^{SF} + q^{LF}(\mathbb{B}_{t+1}, \mathbb{X}_t)\left[b_{t+1}^{LF} - (1-\delta) b_t^{LF}\right]\right] + \mathcal{Y}_t \qquad (4)
\end{aligned}
$$

Default

- All debt obligations set to 0
- No selective default
- Punishments from defaulting:
  1. Output loss:
  $$C_t = h(\mathcal{Y}_t), \quad h(\mathcal{Y}_t) \leq \mathcal{Y}_t \tag{5}$$
  2. Financial autarky: regain access with i.i.d. probability θ

Value Functions

Beginning-of-period value function:

$$V(\mathbb{B}_t, \mathbb{X}_t) = \max_{\{D,R\}} \left\{ V^D(\mathbb{X}_t), V^R(\mathbb{B}_t, \mathbb{X}_t) \right\} \tag{6}$$

Repayment policy function:

$$r(\mathbb{B}_t, \mathbb{X}_t) = \mathbb{1} \left\{ V^R(\mathbb{B}_t, \mathbb{X}_t) \geq V^D(\mathbb{X}_t) \right\}. \tag{7}$$

Value function for defaulting:

$$V^D(\mathbb{X}_t) = u(h(\mathcal{Y}_t)) + \mathbb{E}_{\mathbb{X}_{t+1}|\mathbb{X}_t} \left[\theta V(\mathbf{0}, \mathbb{X}_{t+1}) + (1-\theta) V^D(\mathbb{X}_{t+1}) \right] \tag{8}$$

Value function for repaying:

$$V^R(\mathbb{B}_t, \mathbb{X}_t) = \max_{\{\mathbb{B}_{t+1}, \Pi_t\}} \left\{ u(C_t) - l(\Pi_t - \Pi^*) + \beta \mathbb{E}_{\mathbb{X}_{t+1}|\mathbb{X}_t} \left[V(\mathbb{B}_{t+1}, \mathbb{X}_t) \right] \right\} \tag{9}$$

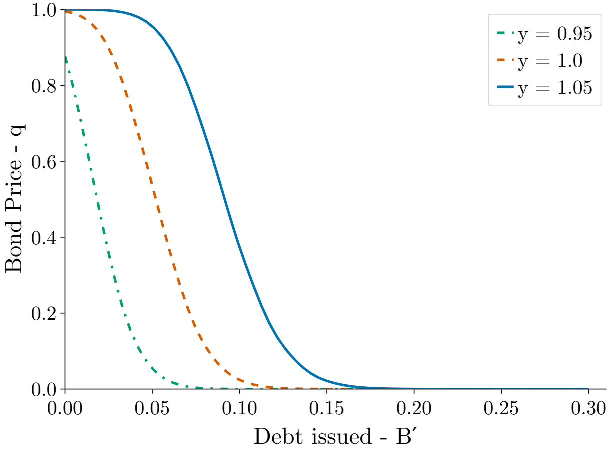
Agent 3: Foreign Lenders

- Risk-neutral,
- Perfectly competitive,
- Can access riskless security that pays R^*

$\implies$ break even in expectation

Bond Prices: Short-Foreign

$$q^{SF}(\mathbb{B}_{t+1}, \mathbb{X}_t) = \frac{1}{R^*}\mathbb{E}_{\mathbb{X}_{t+1}|\mathbb{X}_t}\left[r(\mathbb{B}_{t+1}, \mathbb{X}_{t+1})\right] \tag{10}$$



Compensation for:

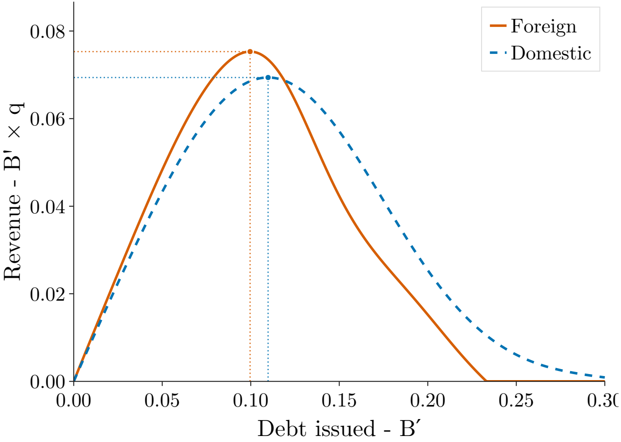
1. Default risk

Repayment probability:

- decreases w.r.t. b_{t+1}
- decreases w.r.t. y_t

Bond Prices: Short-Domestic

$$q^{SD}(\mathbb{B}_{t+1}, \mathbb{X}_t) = \frac{1}{R^*}\mathbb{E}_{\mathbb{X}_{t+1}|\mathbb{X}_t}\left[r(\mathbb{B}_{t+1}, \mathbb{X}_{t+1}) \times \frac{\mathcal{E}_t}{\mathcal{E}_{t+1}} \times \frac{1}{\Pi_{t+1}}\right] \tag{11}$$

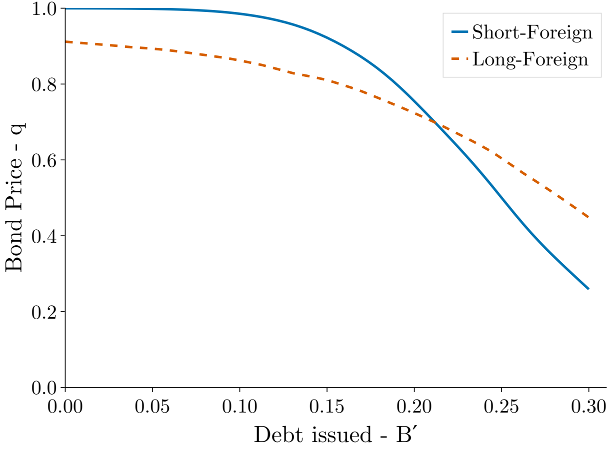


Compensation for:

1. Default risk
2. Currency risk

Bond Prices: Long-Foreign

$$q^{LF}(\mathbb{B}_{t+1}, \mathbb{X}_t) = \frac{1}{R^*} \mathbb{E}_{\mathbb{X}_{t+1}|\mathbb{X}_t} \left[r(\mathbb{B}_{t+1}, \mathbb{X}_{t+1}) \times \left[1 + (1-\delta) q^{LF}(\mathbb{B}_{t+2}, \mathbb{X}_{t+1}) \right] \right] \tag{12}$$

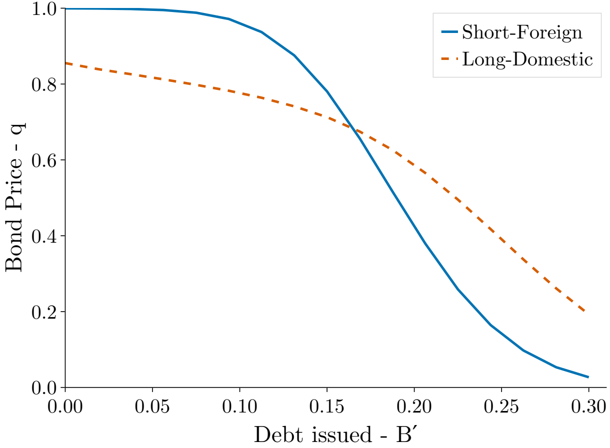


Compensation for

1. Default risk
2. Dilution risk

Bond Prices: Long-Domestic

$$q^{LD}(\mathbb{B}_{t+1}, \mathbb{X}_t) = \frac{1}{R^*}\mathbb{E}_{\mathbb{X}_{t+1}|\mathbb{X}_t}\left[r(\mathbb{B}_{t+1}, \mathbb{X}_{t+1}) \times \frac{\mathcal{E}_t}{\mathcal{E}_{t+1}} \times \frac{1}{\Pi_{t+1}} \times \left[1 + (1-\delta)q^{LD}(\mathbb{B}_{t+2}, \mathbb{X}_{t+1})\right]\right] \tag{13}$$



Compensation for

1. Default risk
2. Currency risk
3. Dilution risk

Markov-Perfect Equilibrium

A MPE for this economy consists of a set of:

1. value functions $\{V(\mathbb{B}_t, \mathbb{X}_t), V^D(\mathbb{X}_t), V^R(\mathbb{B}_t, \mathbb{X}_t)\}$,
2. pricing functions $\{q^{SF}(\mathbb{B}_{t+1}, \mathbb{X}_t), q^{LF}(\mathbb{B}_{t+1}, \mathbb{X}_t), q^{SD}(\mathbb{B}_{t+1}, \mathbb{X}_t), q^{LD}(\mathbb{B}_{t+1}, \mathbb{X}_t)\}$, and
3. policy functions $\left\{\hat{b}^{LD}(\mathbb{B}_t, \mathbb{X}_t), \hat{b}^{LF}(\mathbb{B}_t, \mathbb{X}_t), \hat{b}^{SD}(\mathbb{B}_t, \mathbb{X}_t), \hat{b}^{SF}(\mathbb{B}_t, \mathbb{X}_t), \hat{\Pi}_{t+1}(\mathbb{B}_t, \mathbb{X}_t)\right\}$

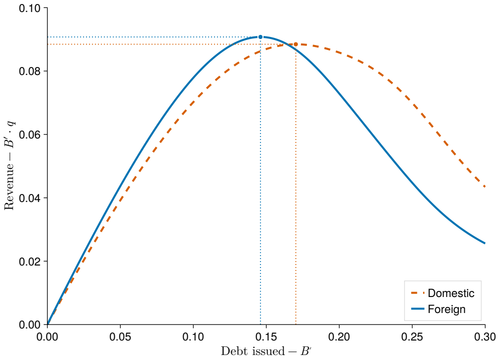
such that the following conditions hold:

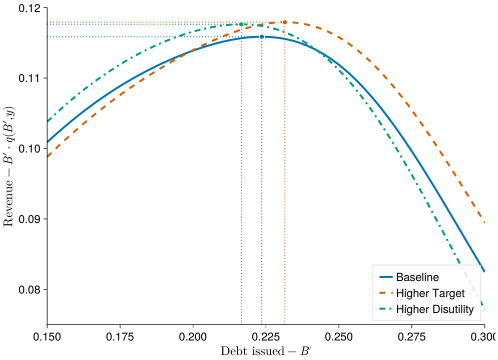
1. Taking the bond price functions as given, the sovereign's policy functions and value functions solve the sovereign's dynamic programming problem, and
2. The bond price functions $q^{SF}(\mathbb{B}_{t+1}, \mathbb{X}_t), q^{LF}(\mathbb{B}_{t+1}, \mathbb{X}_t), q^{SD}(\mathbb{B}_{t+1}, \mathbb{X}_t), q^{LD}(\mathbb{B}_{t+1}, \mathbb{X}_t)$ satisfy (10), (12), (11), and (13) respectively.

Optimal Portfolio

Foreign currency's incentive benefit

▸ Comparative statics





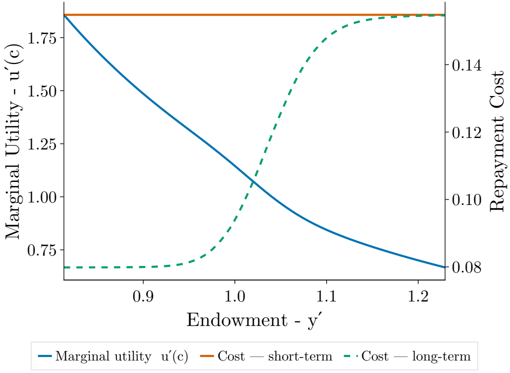
Foreign currency's hedging cost

$$u_C(C_t) \times [\text{Marginal Revenue}] = \beta \int_{R_{t+1}} u_C(C_{t+1}) \mathcal{E}_{t+1} f(\mathbb{X}_t, \mathbb{X}_{t+1}) d\mathbb{X}_{t+1} \tag{14}$$

- $\text{corr}(\mathcal{Y}_{t+1}, \mathcal{E}_{t+1}) < 0$
- $\text{cov}(u_C(C_{t+1}), \mathcal{E}_{t+1}) > 0$

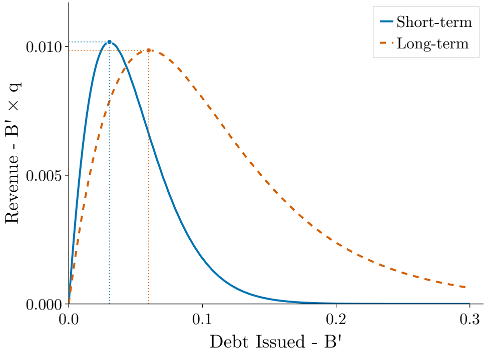
Long-term debt's hedging benefit

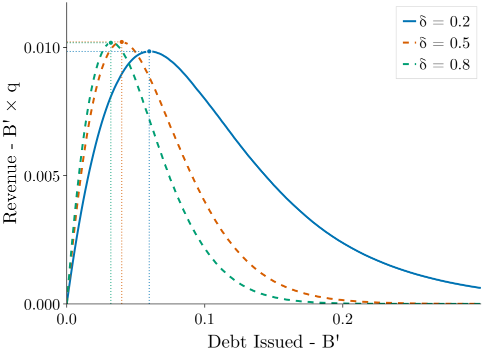
$$u_C(C_t) \times [\text{Marginal Revenue}] = \beta \int_{R_{t+1}} u_C(C_{t+1}) \left[1 + (1-\delta) q_{t+1}^{LF}\right] \mathcal{E}_{t+1} f(\mathbb{X}_t, \mathbb{X}_{t+1}) d\mathbb{X}_{t+1} \tag{15}$$



Long-term debt's incentive costs

Comparative statics

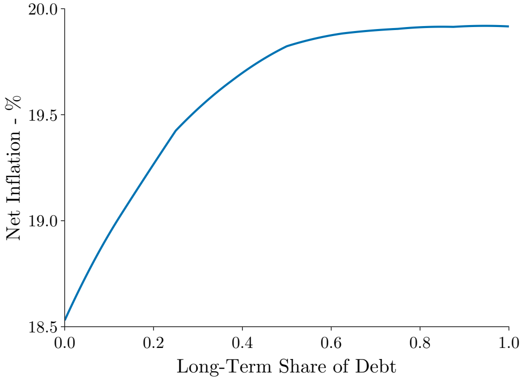




Long-term domestic currency's incentive costs

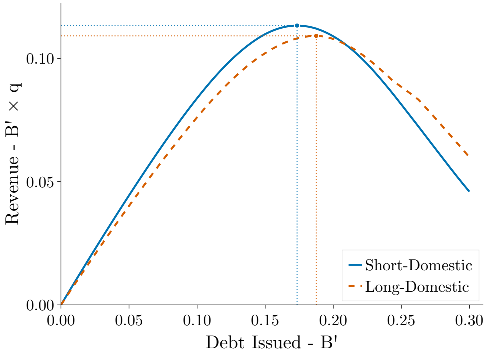
▸ Comparative statics

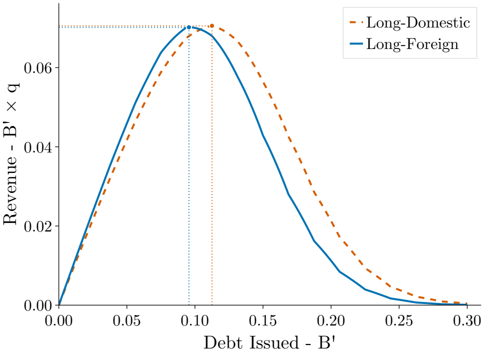
$$u_C(C_t)\left[\frac{1}{\Pi_t^2}\right]\left[b_t^{LD} + b_t^{SD} + q^{LD}(1-\delta)b_t^{LD}\right] = l_\Pi(\Pi_t - \Pi^*) \tag{16}$$



- Long-term debt increases inflation incentives **more** than short-term
- The longer-term the LD bond, the greater the incentive to inflate

Long-term domestic currency's incentive costs





Quantitative Analysis

Full quantitative model

Gaussian Process Regression Details | Bayesian Active Learning | Iterative Strategy

Additional Ingredients:

- Sovereign receives taste shocks to the repayment-default decision Taste shocks

$$\varepsilon^D, \varepsilon^R \sim \text{Gumbel}(-\alpha(\gamma + \ln(2)), \alpha), \quad \gamma \approx 0.57$$

- ST bonds pay coupon: $\kappa^S = R^*$ & LT bonds pay coupon: $\kappa^L = \delta + R^* - 1$ Pricing functions

Iterative Strategy:

- Value function iteration
- Backward iteration from terminal period where sovereign buys back all un-matured LT debt
- Approximate all equilibrium functions as Gaussian Processes

Functional Forms

- **Period utility:**

$$u(C_t) - l(\Pi_t - \Pi^*) = \frac{C_t^{1-\sigma}}{1-\sigma} - \frac{\psi}{2}(\Pi_t - \Pi^*)^2$$

- **Output cost of defaulting:** ▸ Output cost

$$h(\mathcal{Y}_t) = \mathcal{Y}_t - \max\left\{0, \lambda_0 \mathcal{Y}_t + \lambda_1 \mathcal{Y}_t^2\right\}, \quad \lambda_0 < 0 < \lambda_1$$

- **Stochastic Process:**

$$\begin{pmatrix} \log(\mathcal{Y}_t) \\ \log(\mathcal{E}_t) \end{pmatrix} = \begin{pmatrix} \rho_y & 0 \\ 0 & \rho_e \end{pmatrix} \begin{pmatrix} \log(\mathcal{Y}_{t-1}) \\ \log(\mathcal{E}_{t-1}) \end{pmatrix} + \begin{pmatrix} \varepsilon_t^y \\ \varepsilon_t^e \end{pmatrix}, \begin{pmatrix} \varepsilon_t^y \\ \varepsilon_t^e \end{pmatrix} \sim N\left(0, \begin{pmatrix} \sigma_y^2 & \rho_{y,e}\sigma_y\sigma_e \\ \rho_{y,e}\sigma_y\sigma_e & \sigma_e^2 \end{pmatrix}\right)$$

Calibration

▸ Turkiye

Parameter	Description	Value	Source
σ	risk aversion	5	standard value
R^*	risk-free rate	1.04	1-year US Treasury yield
δ	perpetuity decay factor	0.1	10 year maturity
θ	re-entry probability	0.17	6-year exclusion
ρ_y	output persistence	0.70	data
σ_y	output volatility	0.028	data
ρ_e	real exchange rate persistence	0.85	data
σ_e	real exchange rate volatility	0.09	data
$\rho_{y,e}$	shock correlation	-0.32	data
β	discount factor	0.92	Moment Matching
λ_0	default cost - linear	-0.71	Moment Matching
λ_1	default cost - quadratic	0.77	Moment Matching
ψ	inflation disutility	1.1	Moment Matching
Π^*	inflation target	8.3	Moment Matching

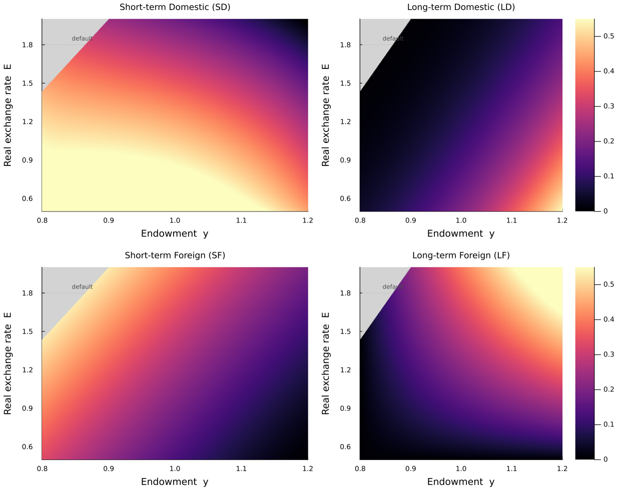
Model Fit - Targeted Moments

Statistics	Data	Model
Mean debt:GDP ratio	12.6%	8.9%
Mean spread (1 year, domestic currency)	10.3%	11.8%
Std. spread (1 year, domestic currency)	3.0%	4.1%
Mean inflation	8.6%	8.7%
Std. inflation	1.8%	1.4%

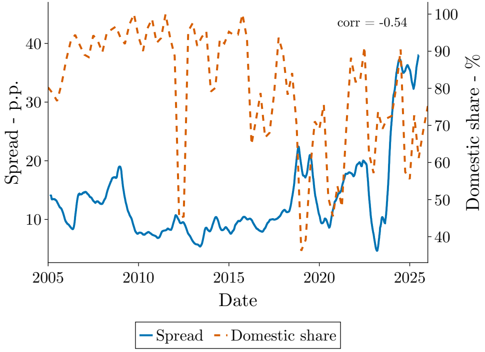
Model Fit - Untargeted Moments

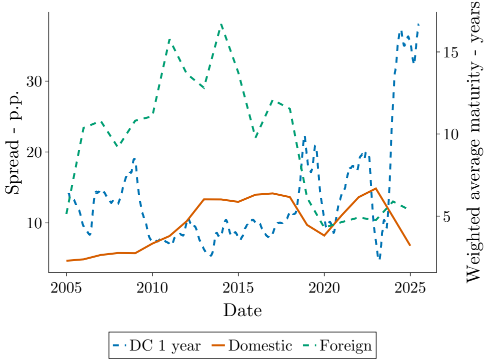
Statistics	Data	Model
corr(NX/y, y)	-0.12	-0.26
Domestic currency share	89.7%	82.4%
Mean maturity (domestic currency)	3.1 years	2.2 years
Mean maturity (foreign currency)	8.6 years	5.8 years
Mean spread (1 year, foreign currency)	2.55%	2.8%
Mean spread (10 year, foreign currency)	4.74%	6.3%
Mean spread (10 year, domestic currency)	7.16%	12.9%

There is a time for everything



Turkiye's 2018 Lira Crisis





Conclusion

1. Analyze issuance data and spread data
   - EMEs mostly issue SD and LF bonds
   - Increased riskiness is associated with a shift towards more FC debt and shorter maturities
2. Solve a sovereign debt model with rich portfolio choice
   - Computational contributions
   - Formalize & quantify each bond's economic trade-offs
   - SF & LD bonds are only optimal in extreme states of the world

Thank you!

References 1

Aguiar, M., M. Amador, E. Farhi, and G. Gopinath (2013): "Crisis and Commitment: Inflation Credibility and the Vulnerability to Sovereign Debt Crises," Tech. Rep. w19516, National Bureau of Economic Research, Cambridge, MA.

Arellano, C. (2008): "Default Risk and Income Fluctuations in Emerging Economies," *American Economic Review*, 98, 690–712.

Arellano, C. and A. Ramanarayanan (2012): "Default and the Maturity Structure in Sovereign Bonds," *Journal of Political Economy*, 120, 187–232.

Bocola, L. and A. Dovis (2019): "Self-Fulfilling Debt Crises: A Quantitative Analysis," *American Economic Review*, 109, 4343–4377.

Chatterjee, S. and B. Eyigungor (2012): "Maturity, Indebtedness, and Default Risk," *American Economic Review*, 102, 2674–2699.

References 2

Du, W., C. E. Pflueger, and J. Schreger (2020): "Sovereign Debt Portfolios, Bond Risks, and the Credibility of Monetary Policy," *The Journal of Finance*, 75, 3097–3138, _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.12965.

Du, W. and J. Schreger (2016): "Local Currency Sovereign Risk," *The Journal of Finance*, 71, 1027–1070.

Engel, C. and J. Park (2022): "Debauchery and Original Sin: The Currency Composition of Sovereign Debt," *Journal of the European Economic Association*, 20, 1095–1144.

Hatchondo, J. C. and L. Martinez (2009): "Long-duration bonds and sovereign defaults," *Journal of International Economics*, 79, 117–125.

Hatchondo, J. C., L. Martinez, and C. Sosa-Padilla (2016): "Debt Dilution and Sovereign Default Risk," *Journal of Political Economy*, 124, 1383–1422.

References 3

Hurtado, S., G. Nuño, and C. Thomas (2023): "Monetary Policy and Sovereign Debt Sustainability," *Journal of the European Economic Association*, 21, 293–325.

Jang, Y. and S. Lee (2026): "A Generalized Endogenous Grid Method for Default Risk Models," *Journal of Money, Credit and Banking*, 58, 1131–1166.

Lee, A. S. (2021): "Why Do Emerging Economies Borrow in Foreign Currency? The Role of Exchange Rate Risk," *SSRN Electronic Journal*.

Maeng, F. S. (2025): "Default, Inflation Expectations, and the Currency Denomination of Sovereign Bonds," Tech. rep., Nanyang Technological University.

Mateos-Planas, X., S. McCrary, J.-V. Rios-Rull, and A. Wicht (2026): "The Generalized Euler Equation and the Bankruptcy-Sovereign Default Problem," Tech. rep., Working Paper.

References 4

MIHALACHE, G. (2020): "Sovereign default resolution through maturity extension," *Journal of International Economics*, 125, 103326.

OTTONELLO, P. AND D. J. PEREZ (2019): "The Currency Composition of Sovereign Debt," *American Economic Journal: Macroeconomics*, 11, 174–208.

SUNDER-PLASSMANN, L. (2020): "Inflation, default and sovereign debt: The role of denomination and ownership," *Journal of International Economics*, 127, 103393.

Appendix

Data Cleaning

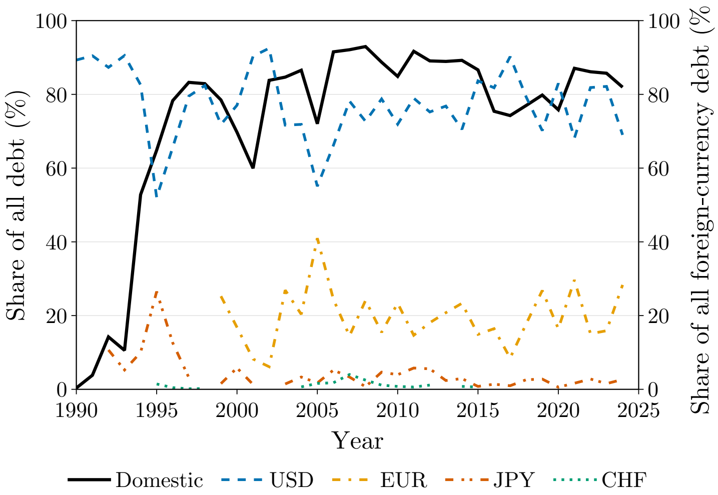
1. Remove bonds that are likely to be bought by domestic investors
   - Bonds with maturities less than 3 months
   - Bonds issued by central banks
2. Remove bonds issued by municipal or sub-national entities

Back

Country	Sample Period	Number of Bonds	FC Share	Weighted Average Maturity
Angola	Nov. 2005 - Dec. 2024	2,344	9.8%	4.1 years
Argentina	Mar. 1991 - Dec. 2024	874	62.1%	10.9 years
Colombia	Dec. 1990 - Dec. 2024	763	11.8%	11.7 years
Egypt	Dec. 1993 - Dec. 2024	2,715	9.5%	2.0 years
Hungary	Jul. 1993 - Dec. 2024	2,246	13.8%	5.5 years
Indonesia	Jul. 1990 - Dec. 2024	1,146	14.5%	10.6 years
Jamaica	Sep. 1991 - Dec. 2024	778	55.5%	7.3 years
Jordan	Aug. 1993 - Nov. 2024	1,229	17.8%	4.3 years
Mexico	Mar. 1990 - Dec. 2024	2,450	7.2%	4.9 years
Philippines	May. 1990 - Dec. 2024	2,066	12.5%	6.5 years
Poland	Dec. 1993 - Nov. 2024	1,242	13.7%	6.4 years
Qatar	Feb. 1999 - Sep. 2024	238	55.0%	10.6 years
Romania	Jun. 1997 - Dec. 2024	888	38.0%	6.9 years
Russia	May. 1993 - May. 2024	571	12.4%	8.1 years
Tunisia	Sep. 1990 - Dec. 2024	281	21.7%	6.5 years
Türkiye	Mar. 1990 - Dec. 2024	992	15.8%	4.1 years
Ukraine	Mar. 1995 - Dec. 2022	1,813	42.8%	6.1 years
Uruguay	Jan. 1990 - Dec. 2024	348	52.2%	14.9 years
Venezuela	Dec. 1990 - Nov. 2018	1,926	35.0%	7.7 years

Back

Currency Composition of Sovereign Debt



Country	Sample Period	Number of Observations	Source
Colombia	Aug. 2003 - Dec. 2024	5,381	Du and Schreger (2016)
Egypt	Jan. 1997 - Oct. 2024	112	Datastream
Hungary	Jan. 2000 - Dec. 2024	6,450	Du and Schreger (2016)
Indonesia	Feb. 2003 - Dec. 2024	5,488	Du and Schreger (2016)
Jamaica	Jan. 1989 - Oct. 2024	144	Datastream
Mexico	Sep. 2002 - Dec. 2024	5,724	Du and Schreger (2016)
Philippines	Dec. 2000 - Dec. 2024	5,901	Du and Schreger (2016)
Poland	Jan. 2000 - Dec. 2024	6,452	Du and Schreger (2016)
Romania	Jan. 1994 - Oct. 2024	116	Datastream
Russia	Apr. 2006 - Feb. 2022	4,136	Du and Schreger (2016)
Türkiye	Feb. 2005 - Dec. 2024	5,107	Du and Schreger (2016)
Uruguay	Oct. 1991 - Oct. 2024	116	Datastream

Back

Relationship BW Spreads & Portfolio - Correlations

Country	Domestic Share	Maturity (All)	Maturity (Domestic)	Maturity (Foreign)
Colombia	-0.090	-0.055	0.016	-0.388
Egypt	-0.386	0.241	0.136	-0.164
Hungary	-0.091	-0.064	-0.085	0.132
Indonesia	-0.135	-0.051	-0.125	-0.117
Jamaica	-0.136	0.047	-0.023	0.065
Mexico	-0.091	-0.124	-0.097	-0.195
Philippines	-0.147	-0.185	-0.179	-0.436
Poland	0.169	-0.350	-0.318	-0.123
Romania	-0.042	-0.323	-0.392	-0.314
Russia	-0.129	-0.274	-0.306	-0.031
Türkiye	-0.224	-0.067	-0.032	-0.277
Uruguay	-0.384	-0.172	-0.055	-0.275

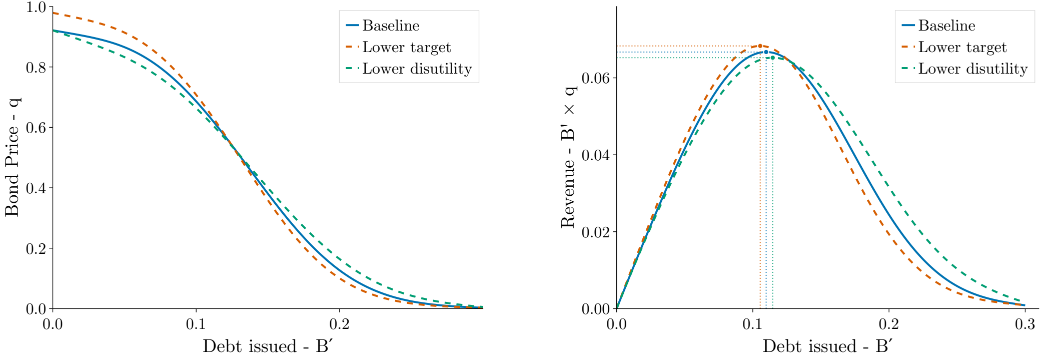
Back

Relationship BW Spreads & Portfolio - Regression

	(1)	(2)	(3)	(4)
	$\mathbb{1}$ {Domestic Currency}	Maturity (Years)		
	(Logit)	All	Domestic	Foreign
Spread	-0.023^{***}	-0.054^{**}	-0.050^{**}	-0.097^{*}
	(0.005)	(0.022)	(0.023)	(0.053)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	12,696	1,077	1,018	561
R^2	–	0.271	0.251	0.245

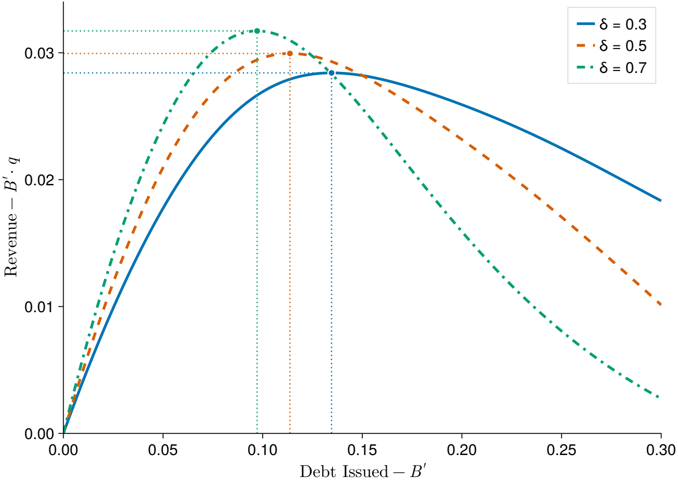
Back

Comparative statics - Currency



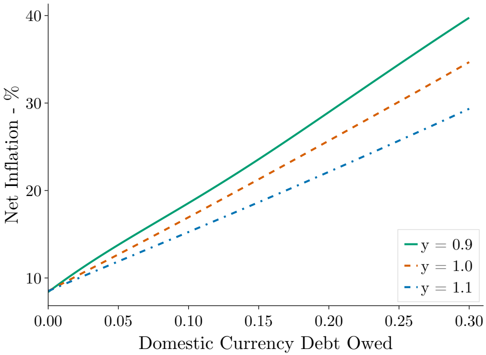
Back

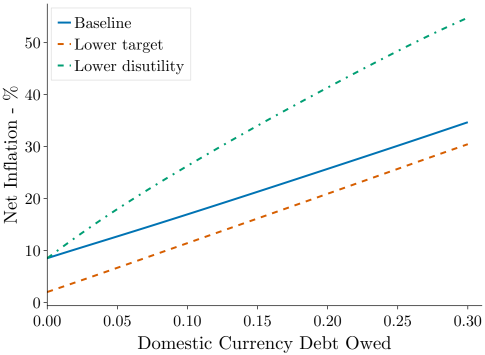
Comparative statics - Maturity



Back

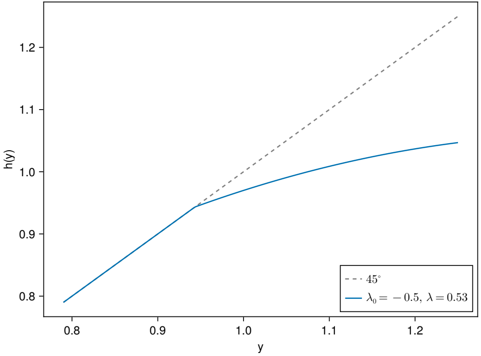
Comparative Statics - Inflation





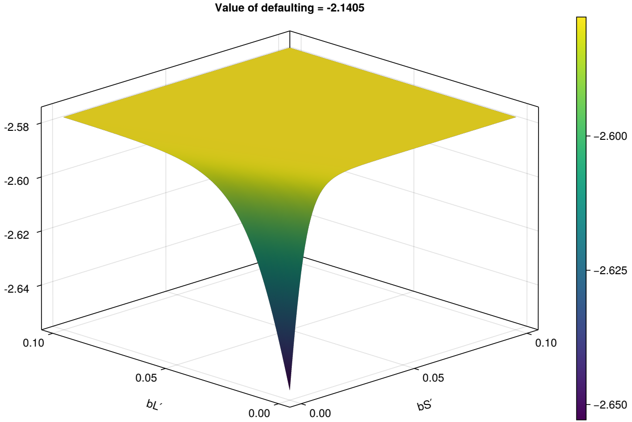
Back

Output Cost of Defaulting

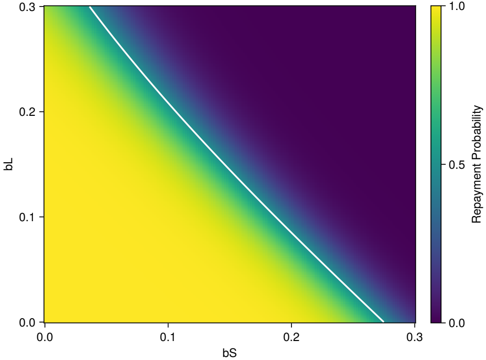


Back

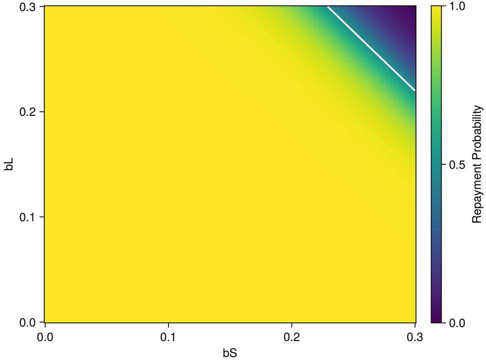
Spurious Optimal Portfolio



Repayment Sets



$y = 1.0$



$y = 1.2$

Taste Shock Details

- Sovereign receives taste shocks to the repayment-default decision

$$\varepsilon^D, \varepsilon^R \sim \text{Gumbel}(-\alpha(\gamma + \ln(2)), \alpha), \quad \gamma \approx 0.57$$

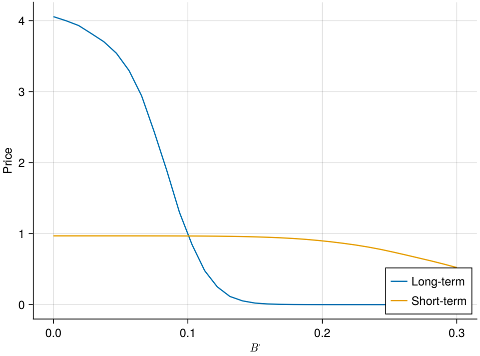
- α: scale parameter
- Ex-ante probability of repayment:

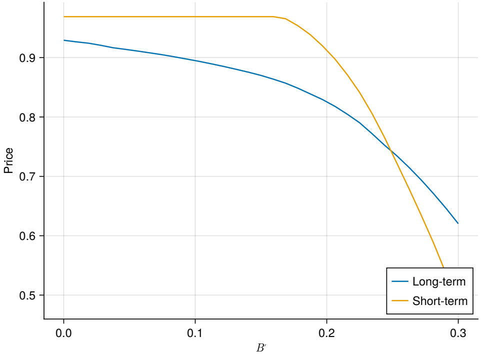
$$\begin{aligned} P(r = 1 | \mathbb{B}_t, \mathbb{X}_t) &= P(V^R(\mathbb{B}_t, \mathbb{X}_t) + \varepsilon^R > V^D(\mathbb{X}_t) + \varepsilon^D) \\ &= \frac{\exp\left(\frac{V^R(\mathbb{B}_t,\mathbb{X}_t)}{\alpha}\right)}{\exp\left(\frac{V^R(\mathbb{B}_t,\mathbb{X}_t)}{\alpha}\right) + \exp\left(\frac{V^D(\mathbb{X}_t)}{\alpha}\right)} \end{aligned}$$

$$V^O(\mathbb{B}_t, \mathbb{X}_t) = \alpha \ln\left[\exp\left(\frac{V^R(\mathbb{B}_t, \mathbb{X}_t)}{\alpha}\right) + \exp\left(\frac{V^D(\mathbb{X}_t)}{\alpha}\right)\right] - \alpha \ln(2)$$

Back

Bond prices with and without coupon payments





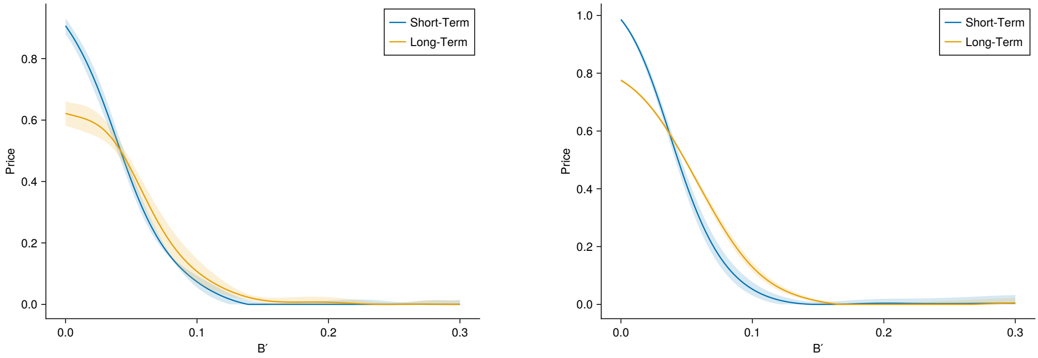
◂ Back

Gaussian Process Regression Details

- Matérn 3/2 kernel
- Noise $= 1e - 6$
- Automatic Relevance Determination
- Training points
  - $\mu = 5$ Smolyak grid for V^D (145 points)
  - $\mu = 3$ Smolyak grid (389 points) + 311 points via BAL for prices, V^R and $\hat{\Pi}$
  - Repayment frontier for portfolio policy functions

Back

Bayesian Active Learning



Back

Iterative strategy

- Initial guess: limit of finite-horizon game where sovereign buys back all unmatured LT debt
- Iterate backwards until convergence

$$T \to T-1 \to T-2 \ldots$$

1. Update pricing functions based on next period's objects
2. Update all value functions and policy function for inflation
3. Use this period's value functions to compute the repayment frontier
4. Generate training points within frontier and update the policy functions
5. Compute differences and repeat until stationarity

◂ Back

Türkiye's Inflation