World Interest Rate and Emerging Market Spread: A Tale of Two Shocks

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Research Question and Motivation

- How does world interest rate affect EM spread and default risk?
- Why important?
  - Interest rate rise may lead to debt crises (e.g., Latin America debt crisis in 1980s)
  - World interest rate correlated with common movements in EM spread (Longstaff et al, 2011, Aguiar et al, 2016)

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  - World interest rate correlated with common movements in EM spread (Longstaff et al, 2011, Aguiar et al, 2016)
- Not all world interest rate movements are alike
  - $\beta(\Delta\text{spread}, \Delta\text{world rate change}) \approx 0$
  - Identified monetary tightening raises EM spread significantly

What We Do: Empirics

- Measuring the risk-free cost of financing for EMs
  - World (US) risk-free rate r_f
  - Inconvenience yield η_t : intermediary frictions, etc
    - Measured as Bond-CDS basis
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- Use SVAR with sign restrictions to decompose r_f fluctuations into two components
  - Procyclical: high interest rate, high US output
  - Countercyclical: high interest rate, low US output
- Different responses of EM spread to two structural shocks
  - Procyclical: increase $r_f \rightarrow$ lower spread (higher EM output)
  - Countercyclical: increase $r_f \rightarrow$ higher spread (lower EM output)
- More pronounced effect among high-credit-risk economies

What We Do: Quantitative Model

- An Eaton-Gersowitz model with
  - Long term debt
  - Risk-averse lenders
  - Recovery value of default
  - Three structural shocks: US procyclical, US countercyclical, EM output

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- Use model to quantify channels through which world interest rate affects EM spreads and default risk

Findings

- Model replicates responses of EM spread to two structural shocks
  - Countercyclical: increase $r_f \rightarrow$ righer spread
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  - More pronounced responses when credit risk high

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- Quantify importance of refinancing cost: Absent EM output effect
  - Spread response to countercyclical: halved
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  - Spread response to countercyclical: halved
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  - Risk premia turn negative
- Decompose spread into default prob, inconvenience yield and risk premia
  - Despite sizable risk premium, spread response to interest rate mostly from default prob, while risk premia moves little

Related Literature

- World interest rate and emerging market
  - Neumeyer and Perri (2005), Uribe and Yue (2006), Fernandez-Villarverde et al (2011), Guimaires (2011), Foley-Fisher (2013), Johri et al (2022), Gilchrist et al (2022), Almeida et al (2024)
  - Contribution: Different structural shocks that drive world interest rate
- Global and local drivers of sovereign spreads
  - Longstaff et al (2011), Jeanneret (2015, 2017), Augustin and Tedongap (2016), Agrippino and Rey (2020), Augustin et al (2022), Moretti et al (2022), Andrade et al (2023), Bai et al (2025)
  - Contribution: Examine channels of world interest rate through a quant model
- Quantitative models of sovereign default
  - Eaton and Gersowitz (1981), Arellano (2008), Chatterjee and Eyigungor (2012), Bocola, Bornstein and Dovis (2018), Bocola and Dovis (2020)
  - Contribution: Focus on world interest rate driver of sovereign default risk

Empirics

World Interest Rate and Inconvenience Yield

- The risk-free cost of financing for EM

$$r_f^* = r_f + \eta$$

where

- r_f is world interest rate free of convenience yield
- η is inconvenience yield for EM bond

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- Measure r_f using US swap rate (Fleckenstein and Longstaff, 2024)
- Measure η using Bond-CDS basis
  - Let y^* and s bond yield and CDS spread, y the risk-free rate
  - Combine a defaultable bond with a CDS creates a synthetic risk-free asset with yield $y^* - s$
  - Inconvenience yield $\eta = y^* - s - y$

Data Stylized Facts

Interpretations of η_t

- Segmented financial markets and intermediary constraints
  - Morelli, Ottonello and Perez (2022)
- Convenience yields in domestic credit market
  - Perez (2018)
- Financial repression and regulatory requirement
  - Chari, Dovis and Kehoe (2019); Perez (2018)
- Liquidity value of EM bond
  - Chaumont (2024); Passadore and Xu (2022)

Structural VAR

$$Y_t = \Phi Y_{t-1} + A\varepsilon_t$$

where $Y_t = \begin{bmatrix} \Delta y_t \\ r_{ft} \\ EM_t \end{bmatrix}$ and $A = \begin{bmatrix} 1 & a_{12} & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix}$

- Sign restriction: $a_{21} > 0, a_{12} < 0$
  - ε_1 moves GDP growth and real rate in the same direction (procyclical)
  - ε_2 moves GDP growth and real rate in the opposite direction (countercyclical)
- EM_t may include EM real GDP growth, spread, inconvenience yield, etc
- a_{31}, a_{32} captures the two structural shocks' impact on the EM variable
- Estimate using Bayesian methods (Baumeister and Hamilton, 2019)

▸ Estimation details

Shock Interpretations

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- Examples of procyclical interest rate fluctuations
  - Aggregate demand shock (government spending shock): $r_t \nearrow y_t \nearrow$
  - Uncertainty shock: $r_t \searrow y_t \searrow$
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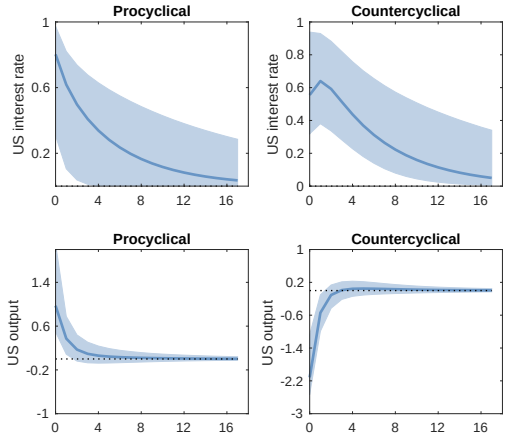
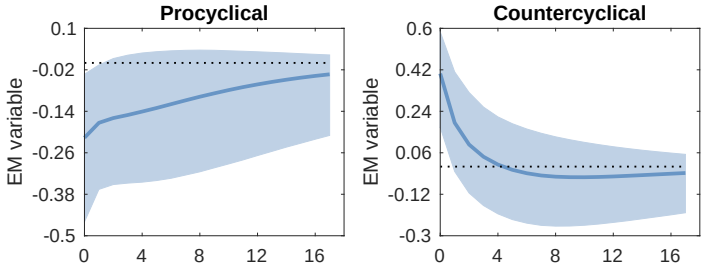
  - Flight to safety shock: $r_t \searrow y_t \searrow$
- Examples of countercyclical interest rate fluctuations
  - Monetary policy shock: $r_t \nearrow y_t \searrow$
  - Markup shock: $r_t \nearrow y_t \searrow$

Impulse Response: US Output and Real Rate



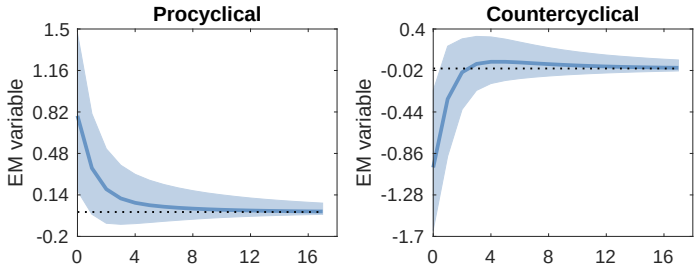
- Procyclical (countercyclical) shock raises world interest rate and increases (decrease) US output

Impulse Response: EM Spread



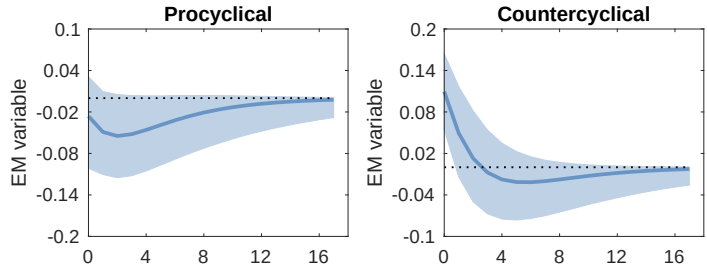
- Procyclical shock decreases sovereign bond spread
- Countercyclical shock increases sovereign bond spread
- Stronger for high-spread countries Results

Impulse Response: EM Output



- Procyclical shock increases EM output
- Countercyclical shock decreases EM output

Impulse Response: Inconvenience Yield



- Procyclical shock decreases inconvenience yield
- Countercyclical shock increases inconvenience yield

Model

Environment

- Small open economy with a single consumption good
- Aggregate macro states s
- Stand-in household's preferences

$$E_0\left[\sum_{t=0}^{\infty}\beta^t u\left(c\left(s^t\right)\right)\right]$$

- Borrows from the rest of the world
- International lenders are risk-averse with SDF $M(s_t, s_{t+1})$
- Government cannot commit to repay
- Incomplete markets
  - Long-term non-contingent defaultable bonds that pay coupon κ and mature at rate λ

Macroeconomic Dynamics

- World real interest rate

$$r_{f,t} = \psi_1 u_t + \psi_2 v_t$$

  - $M(s_t, s_{t+1})$ satisfies $E_{s_{t+1}|s_t} M(s_t, s_{t+1}) \exp(r_f(s_t)) = 1$

- US output

$$y_t^{US} = \theta_1 u_t + \theta_2 v_t$$

- EM output

$$y_t = \xi_1 u_t + \xi_2 v_t + w_t$$

- u_t, v_t, w_t are structural shocks as in SVAR
  - u_t: Procyclical interest rate $\psi_1, \theta_1, \xi_1 > 0$
  - v_t: Countercyclical interest rate $\psi_2 > 0, \theta_2 < 0, \xi_2 < 0$
  - w_t: EM idiosyncratic output

Recursive Equilibrium

- State is $s = (u, v, w)$ and debt b
- Government value is $V(s, b) = \max\{V^C(s, b), V^D(s, b)\}$
  - The value of repaying

$$V^C(s, b) = \max_{c, b'} u(c) + \beta E_{s'|s} \max\left[V^C(s', b'), V^D(s', b')\right]$$

    subject to

$$c \leq y - (\lambda b + \kappa(1 - \lambda)b) + q(s, b')(b' - (1 - \lambda)b)$$

  - The value of default

$$V^D(s, b) = u(\phi(y)) + \beta E_{s'|s}\left[\theta V^C(s', \zeta b) + (1 - \theta)V^D(s', b)\right]$$

    - Output on default $\phi(y) = y - (a_1 y + a_2 y^2)$
    - Exclusion from the financial market with reentry prob θ
    - ζ is the recovery fraction

Recursive Equilibrium, cont.

- The pricing of sovereign debt

$$q(s,b') = E_{s'|s}\left[M(s,s')\left[(1-\mathcal{I}(s',b'))\left(\lambda+(1-\lambda)(\kappa+q(s',b''(s',b'))\right)+\mathcal{I}(s',b')\Omega(s',b')\right]\right]\exp(-\eta(s))$$

- $\mathcal{I}(s',b') = 1$ if default
  - $\Omega(s,b)$ is the recovery value

$$\Omega(s,b) = \theta q(s,\zeta b)\zeta + (1-\theta)E_{s'|s}M(s,s')\Omega(s',b),$$

  - $\eta(s)$: inconvenience yield for the sovereign bond

Roadmap

- Show model accounts for relation between world interest rate and EM spread
- Study how two structural shocks affect EM spread through
  - Financing cost: world interest rate, default prob, inconvenience yield, risk premium
  - EM output
- To do so, we calibrate the model
  - Process for u, v, w from SVAR
  - Standard calibration for other parameters

▸ Calibration ▸ Aggregate moments

World Interest Rate and EM Spread

	Data	Model
Spread	4.63	5.19
Risk premia		0.93
Pro. Δu	-0.27	-0.23
Count. Δv	0.73	0.76
Δr	0.04	-0.09

- Interest rate and spread weakly correlated
- Countercyclical (Procyclical) shock drives positive(negative) correlation
- Risk premia accounts for 20% of spread

High vs. Low Credit Risk

	High credit risk	Low credit risk
Spread	6.99	3.38
Risk premia	0.90	0.97
Pro. Δu	-0.24	-0.12
Count. Δv	1.07	0.18
Δr	-0.06	-0.08

- Spread response to both Δu and Δv is larger when credit risk is high

Mechanisms

		Data	Model	Cost of financing $\xi_1 = \xi_2 = 0$
Spread		4.63	5.19	5.10
Risk premia			0.93	-0.21
Pro. Δu	Δspread	-0.27	-0.23	0.16
Count. Δv	Δspread	0.73	0.76	0.35
Δr	Δspread	0.04	-0.09	0.19

- With only cost of financing channel
  - Spread response to Δv halved, to Δu switches sign
  - Risk premia turns negative and spread load more positively on Δr

Mechanisms

		Data	Model	Cost of financing $\xi_1 = \xi_2 = 0$	EM output $\psi_1 = \psi_2 = \eta_1 = \eta_2 = 0$
Spread		4.63	5.19	5.10	4.62
Risk premia			0.93	-0.21	0.99
Pro. Δu	Δspread	-0.27	-0.23	0.16	-0.32
Count. Δv	Δspread	0.73	0.76	0.35	0.57
Δr	Δspread	0.04	-0.09	0.19	-0.20

- With EM output effect only
  - Spread response to Δv about 80%, to Δu more negative
  - Risk premia slightly larger

Spread Decomposition: Default prob, Inconvenience yield and Risk Premium

- Default prob
  - Given $\mathcal{I}(s, b)$, use risk-neutral SDF to compute $q(s, b')|_{\text{rn}}$. Compute yield spread between $q(s, b')|_{\text{rn}}$ and $q^{rf}(s)|_{\text{rn}}$
- Inconvenience yield
  - Set $\eta = 0$ and recompute $q(s, b')|_{\eta=0}$, then compute difference between $q(s, b')$ and $q(s, b')|_{\eta=0}$
- Default risk premium is the residual

Spread Sensitivities

		Benchmark		Time-varying price of risk
		model	data	κ increase with r
pro. Δu	Δspread	-0.23	-0.27	-0.20
	default prob	-0.22		-0.21
	inconvenience	-0.02		-0.02
	risk premium	0.01		0.02
count. Δv	Δspread	0.76	0.73	0.79
	default prob	0.69		0.70
	inconvenience	0.13		0.13
	risk premium	-0.06		-0.04
Δr	Δspread	-0.09	0.04	-0.06
	default prob	-0.09		-0.08
	inconvenience	0.00		0.00
	risk premium	0.00		0.01

- Spread change mainly comes from default prob
- Risk premia moves little, even when allowing for time-varying price of risk

Conclusion

- What's the relation between world interest rate and EM spread?
  - Important to distinguish different sources of shocks of world interest rate
  - Pro/Count shocks have different impacts on EM spread
  - Larger effect when credit risk is high
- A quantitative model reproduces main facts
  - Shed light on the mechanism through EM output and cost of financing: a large part due to the correlation between EM output and world interest rate, rather than the cost of financing effect
  - Despite a sizable average risk premia, most spread response to structural shocks through default prob, negligible risk premia response

Data

- World real interest rate
  - US 3-month swap rate net of expected inflation
  - Expected inflation: Realized inflation in the past 4 quarters
- EM yield and CDS, by country
  - 5-year maturity, typically used in the EM debt literature
- EM spread: EMBI EM Index, a composite measure
- EM GDP growth: average over a sample of 18 countries

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Risk-free Cost of Financing: Measurement and Cyclicality

	Treasury	Swap	Treasury	Swap	r^*_{ft}	η_t
mean	1.02	1.05	0.35	0.28	0.49	0.21
st. dev.	1.63	1.75	1.25	1.34	1.31	0.37
corr. w/ Δc	0.43	0.41	0.17	0.13	-0.04	-0.61
sample	97Q2-20Q1		04Q1-20Q1			

- "World interest rate" procyclical, weaker for swap rate
- EM "risk-free" rate largely acyclical, due to a countercyclical wedge
- Countercyclical EM wedge
  - Consistent with Jiang et al. (2025): high-debt eurozone countries's debt less convenient in crises
  - Strong global factor structure: first PC explains more than 50%
- Takeaways
  - Procyclical r_f, weak cyclicality of r^*_f
  - Countercyclical η

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Bayesian Estimation Details

- Distributional assumption: $\varepsilon_i \sim N(0, d_i)$
- The prior $p(A)$ is a truncated t-distribution subject to the sign restriction
- The posterior distribution of A

$$p(A|Y_T) \propto p(A)p(Y_T|A) \propto \frac{p(A)\left[det(A\hat{\Omega}_T A')\right]^{T/2}}{\Pi_{i=1}^{n}\left[(2/T)\tau_i^*(A)\right]^{\kappa_i^*}}\Pi_{i=1}^{n}\tau_i(A)^{\kappa_i}$$

- The sign restriction naturally carries to the posterior. $\hat{\Omega}_T$ is the reduced-form VAR residual sample covariance
- Sampled through Metropolis Hasting
- Φ_i and d_i follows natural conjugate prior of normal-inverse-Gamma distribution (conditional on A)

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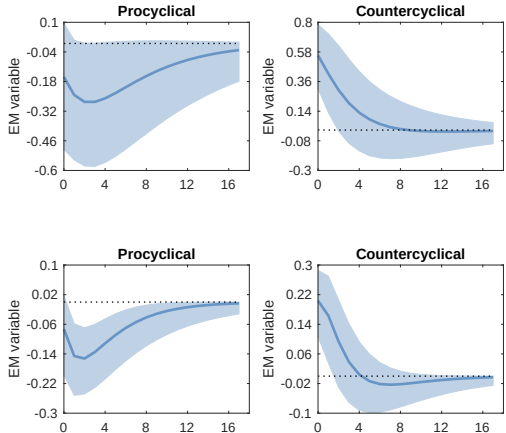
Impulse Response: Sovereign Spread of Countries with Different Credit Risk



- Spread responds more to both shocks for high-credit-risk countries

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Calibration

Time discount rate	β	0.954	Unconditional vol of u	$var(u)$	4.64
Risk aversion	σ	2	Unconditional vol of u	$var(v)$	2.66
Reentry prob	θ	0.0385	Unconditional vol of u	$var(w)$	4.60
Maturity	$1/\delta$	20	u on US output	θ_1	0.24
Coupon	κ	0.03	v on US output	θ_2	-0.53
Output cost	a_1	-0.36	u on US real rate	ψ_1	0.20
	a_2	0.46	v on US real rate	ψ_2	0.14
Persistence	ρ	0.933	u on EM output	λ_1	0.20
Price of risk	κ_0	30	v on EM output	λ_2	-0.25
			u on wedge	η_1	-0.0075
			v on wedge	η_2	0.0275

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Aggregate Moments

	Model	Data
b/y	0.44	0.45
default prob	3.92	
spread	5.19	4.63
risk premium	0.93	
std(c)/std(y)	1.47	1.09
corr(y,spread)	-0.27	-0.20

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