Sovereign Bond Premium and Global Macroeconomic Conditions

Sandro Andrade[1]; Adelphe Ekponon[2]; Alexandre Jeanneret[3]
[1]University of Miami, [2]University of Cambridge, [3]HEC Montréal

Abstract

This paper studies how global macroeconomic conditions affect sovereign bond prices.

Weak and volatile economic performance during recessions increases a country's default probability more than strong and stable performance during expansions reduces it, leading to countercyclical and unconditionally high sovereign credit spreads.
We identify the sovereign bond premium arising from this exposure to severe but low-frequency changes in global macroeconomic conditions.

Our model predicts that this bond premium is higher for countries that are more exposed to the global business cycle, particularly around recessions. We find support for this prediction using emerging market sovereign bond data over the 1994Q1-2018Q2 period.

Introduction

The 2007-9 crisis has renewed interest in understanding the role of business cycles in finance (e.g., Bloom et al., 2018).

Empirically, we observe that:
➢ Most countries are exposed to the global business cycle.
- Lower output growth and higher volatility during global recessions
- Strong heterogeneity across countries

➢ This exposure is known to affect sovereign risk.
- Higher probability of sovereign default in recession
- Greater sovereign credit spreads (Augustin and Tedongap, 2016)

How does it impact expected excess bond returns?

Economic environment

The stream of **consumption** follows:

$$\frac{dC_t}{C_t} = \mu_{c,s_t}dt + \sigma_{c,s_t}dZ_{c,,t}, \qquad s_t = \{L,H\}$$

where $\mu_{c,H} > \mu_{c,L}$ and $\sigma_{c,H} < \sigma_{c,L}$. s_t is the state of the economy expansion (H) or recession (L). The agent has **Epstein-Zin preferences** with a state-price density π_t :

$$\pi_t = \left(\beta e^{-\beta t}\right)^{\frac{1-\gamma}{1-\frac{1}{\psi}}} C_t^{-\gamma}\left(p_{C,t}e^{\int_0^t p_{C,u}^{-1}du}\right)^{\frac{\gamma-\frac{1}{\psi}}{1-\frac{1}{\psi}}}$$

where γ is the RRA's coefficient, ψ the EIS of consumption, β the time discount factor, and $p_{C,t}$ the price-consumption ratio. When $\psi > 1$, $p_{C,t}$ is procyclical.

The **dynamic of country *i*'s revenue** :

$$\frac{dY_{i,t}}{Y_{i,t}} = \mu_{Y,s_t}dt + \sigma_{Y,s_t}dZ_t, \qquad s_t = \{L,H\}$$

where $\mu_{Y,s_t} = \mu_{X,s_t}$ and $\sigma_{Y,s_t} = \eta\sigma_{X,s_t}$, μ_{X,s_t} and σ_{X,s_t} are the conditional expected growth rate and the conditional volatility of output, and $\eta > 1$ amplifies the volatility of government revenue relative to output growth volatility.

Sovereign Bond Valuation

The government defaults on its debt when its revenue $Y_{i,t}$ falls to a state-dependent default thresholds Y_{D,i,s_D}, $s_D = \{L,H\}$. When the government defaults on its bond, at a time denoted by $t_{D,i}$ the coupon c_i is reduced by a fraction $\kappa \in (0,1)$ due to debt restructuring. The **bond value** is:

$$B_{i,s_t} = E_t\left[\int_t^{t_{D,i}} c_i\frac{\pi_u}{\pi_t}du\middle|s_t\right] + E_t\left[\int_{t_{D,i}}^{\infty}(1-\kappa)c_i\frac{\pi_u}{\pi_t}du\middle|s_t\right], \qquad s_t = \{L,H\}$$

Optimal decisions: Find c_{i,s_0} and Y_{D,i,s_D}

$$Sovereign\ wealth = W_{i,s_t}(Y_{i,s_t})$$
$$= Return\ on\ public\ in\ investment + fiscal\ revenue$$

$$c_{i,s_0} = \arg\max W_{i,s_0} \text{ s.t. } \left.\frac{\partial(W_{i,s_t}-B_{i,s_t})}{\partial Y_{i,t}}\right|_{Y_t=Y_{D,i,s_D}} = \frac{\partial}{\partial Y_{D,i,s_t}}\left(W_{i,s_t} - B_{i,s_t}|_{Y_t=Y_{D,i,s_D}}\right)$$

Sovereign Bond Premium

The **sovereign bond premium** BP_{i,s_t} in state s_t:

$$BP_{i,s_t} = \underbrace{\rho_{i,s_t}\theta^B_{i,s_t}\sigma^B_{i,s_t}}_{\substack{due\ to\ conso\ shocks \\ or\ \textbf{Short-run risk}}} + \underbrace{\lambda_{s_t}\theta^J_{i,s_t}\sigma^J_{i,s_t}}_{\substack{due\ to\ changes\ of\ state \\ or\ \textbf{Long-run risk}}}, \qquad s_t = \{L,H\}$$

- ρ_{i,s_t} is the output-consumption correlation, $\theta^B_{i,s_t} = \gamma\sigma_{c,s_t}$ the price of consumption shocks, σ^B_{i,s_t} the volatility of sovereign bond returns;
- λ_{s_t} is the probability of leaving state s_t, $\theta^J_{i,s_t} = 1 - \frac{\pi_j}{\pi_{s_t}}$ is the price of risk due to the change of state from s_t to j, $\sigma^J_{i,s_t} = \frac{B_{i,j}}{B_{i,s_t}} - 1$ the change in bond valuation caused by the change of state.

Predictions

	Short-run risk	Long-run risk	Total
Risk premium (bps)	4.76	55.53	60.29
Percentage (%)	7.90	92.10	100

Table 1. Sovereign bond premium decomposition.

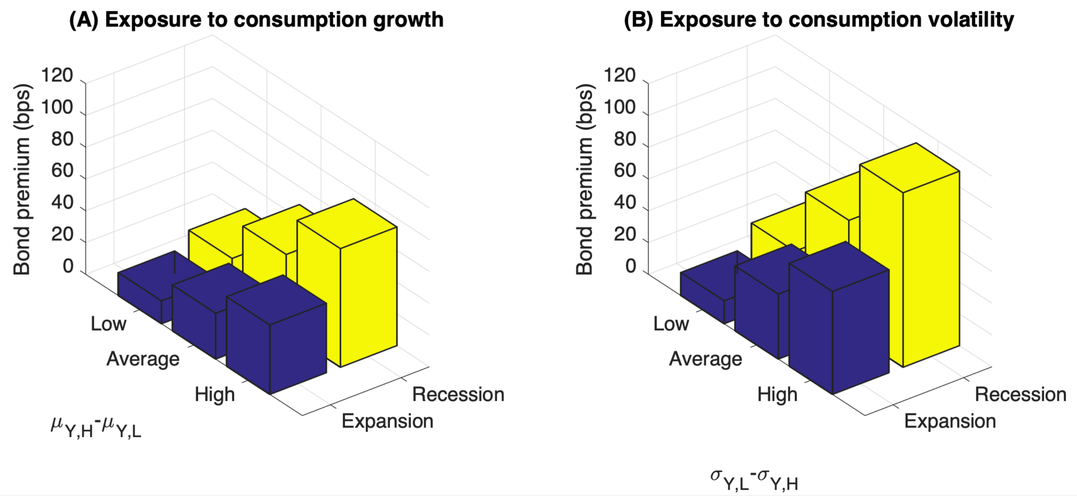

Figure 1. Sovereign bond premium and cross-sectional predictions.

Empirical evidence

Regression

$$R^e_{i,t} = \alpha_{i,t} + \beta^c_{i,t}\Delta\hat{c}_t + \beta^\mu_{i,t}\Delta\hat{\mu}_{c,t} + \beta^\sigma_{i,t}\Delta\hat{\sigma}_{c,t}$$

- $R^e_{i,t}$ is the country *i*'s bond excess returns, $\Delta\hat{\mu}_{c,t}$ is the consumption shocks, $\Delta\hat{\mu}_{c,t}$ the change in expected conso growth and $\Delta\hat{\sigma}_{c,t}$ the change in expected conso volatility.

Exposure		Low			High	High - Low
β^c	Excess returns	2.87	1.61	1.67	2.26	-0.61
	t-stat	*3.41*	*4.31*	*4.85*	*4.58*	*-0.67*
β^μ	Excess returns	2.09	1.59	1.75	3.02	0.94
	t-stat	*3.67*	*3.65*	*4.81*	*5.19*	*1.91*
β^σ	Excess returns	3.52	1.90	1.70	1.35	-2.17
	t-stat	*4.23*	*4.68*	*4.56*	*3.80*	*-2.87*

Table 2. Portfolio formed on exposure to each source of risk (annualized individual estimation).

Conclusions

We uncover a new sovereign bond premium arising from a country's exposure to the global business cycle, which differs from the exposure to higher-frequency global economic shocks.

Investors buying bonds with high long-run macro risk and selling bonds with low long-run macro risk obtain a sizable excess return.

Contact

Adelphe Ekponon
University of Cambridge
Email: a.ekponon@jbs.cam.ac.uk
Website: https://sites.google.com/site/adelpheekponon/
Phone: +44 7305 593941

References

1. Bloom, N., Floetotto, M., Jaimovich, N., Saporta-Eksten, I., and Terry, S. J. 2018, Really Uncertain Business Cycles, Econometrica 86(3), 1031–1065.
2. Augustin, P., and Tédongap, R., 2016, Real Economic Shocks and Sovereign Credit Risk, Journal of Financial and Quantitative Analysis 51(2), 541–587.