**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 counter-cyclical 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:

$$\frac{dC_t}{C_t} = \mu_{C,t} dt + \sigma_{C,t} dZ_{C,t}, s_1 = \{L, H\}$$

where $\mu_{C,t} > \mu_{L,t}$ and $\sigma_{C,t} < \sigma_{L,t}$. $s_1$ is the state of the economy expansion (H) or recession (L). The agent has Epstein-Zin preferences with a state-price density $\pi_t$:

$$\frac{1}{\pi_t} = \left(1 - e^{-\gamma y}\right)^{\frac{1}{\gamma}} \left(p_{C,t} e^{\psi} \rho_{C,t} d\bar{u}_{C,t}\right)^{-\frac{1}{\psi}}$$

where $\gamma$ is the RRA’s coefficient, $\psi$ the EIS of consumption, $\beta$ 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:

$$\frac{dY_{it}}{Y_{it}} = \mu_{Y_{it}} dt + \sigma_{Y_{it}} dZ_{Y_{it}}, s_1 = \{L, H\}$$

where $\mu_{Y_{it}} = \mu_{Y_{it}, H} \gamma \alpha_{Y_{it}, H} \mu_{X_{it}, H} \sigma_{X_{it}, H}$ and $\sigma_{Y_{it}} = \mu_{Y_{it}, H} \gamma \sigma_{Y_{it}, H} \mu_{X_{it}, H} \sigma_{X_{it}, H}$ 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 $Y_{it}$ falls to a state-dependent default threshold $Y_{D, i,t}$, $s_2 = \{L, H\}$. When the government defaults on its bond, at a time denoted by $t_0$, the coupon $c_t$ is reduced by a fraction $\kappa \in (0, 1)$ due to debt restructuring. The bond value is:

$$B_{ij,t} = E_t \left[\int_{t_0}^{\infty} \frac{u_t}{\pi_t} \frac{\pi_t d\bar{u}_t}{\pi_t} | \tau_{t_0} \right] + E_t [\int_{t_0}^{\infty} (1 - \kappa) \frac{\pi_t d\bar{u}_t}{\pi_t} s_1 | \tau_{t_0}]. \quad s_1 = \{L, H\}$$

Optimal decisions: Find $Y_{D, i,t}$ and $Y_{D, i,t}$.

Sovereign wealth: $W_{ij,t}(Y_{ij,t})$ = Return on public in investment & fiscal revenue $c_{ij,t} = \arg \max W_{ij,t} s.t. \frac{\partial(W_{ij,t} - B_{ij,t})}{\partial Y_{ij,t}}|_{Y_{ij,t} = \hat{Y}_{D, i,t}} = \frac{\partial}{\partial Y_{ij,t}}(W_{ij,t} - B_{ij,t})|_{Y_{ij,t} = \hat{Y}_{D, i,t}}$

**Sovereign Bond Premium**

The sovereign bond premium $BP_{ij,t}$ in state $s_1$:

$$BP_{ij,t} = \rho_{ij,t} y_{ij,t} + \lambda_{ij,t} \sigma_{Y_{ij,t}}$$

due to consumption shocks or Short-run risk

due to changes of state or Long-run risk

- $\rho_{ij,t}$ is the output-consumption correlation, $y_{ij,t}$ is the price of consumption shocks, $\sigma_{Y_{ij,t}}$ the volatility of sovereign bond returns;
- $\lambda_{ij,t}$ is the probability of leaving state $s_1$, $\theta_{ij,t} = 1 - \frac{\pi_t}{\pi_t}$ is the price of risk due to the change of state from $s_1$ to $s_2$, $\sigma_{Y_{ij,t}} = \frac{\pi_t}{\pi_t} - 1$ the change in bond valuation caused by the change of state.

**Predictions**

<table>
<thead>
<tr>
<th></th>
<th>Short-run risk</th>
<th>Long-run risk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk premium (bps)</td>
<td>4.76</td>
<td>55.53</td>
<td>60.29</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>7.90</td>
<td>92.10</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1. Sovereign bond premium decomposition.

**Empirical evidence**

Regression

$$R_{ij,t}^c = \alpha_{ij,t} + \beta_{ij,t} \Delta x_i + \beta_{ij,t} \Delta y_i + \beta_{ij,t} \Delta z_i$$

- $R_{ij,t}^c$ is the country $i$’s bond excess returns, $\Delta x_i$ is the consumption shocks, $\Delta y_i$ the change in expected conso growth and $\Delta z_i$ the change in expected conso volatility.

**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.

**References**