Debt Limit and Fiscal Space: Analysis for Colombia and Other Emerging Markets

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Outline

1. Objective and Approach
2. Empirical Strategy: Data and Estimate Technique
3. Results: Debt Limit and Fiscal Space for Colombia and other LA Countries
4. Final Remarks and Future Agenda
1. Objective, Motivation and Approach ......

✓ The paper assesses the public Debt Limit (DL) and the Fiscal Space (FS) for Colombia and other EM (6-AL) under the “fiscal fatigue” approach (Ghosh, Kim, Mendoza, Ostry & Qureshi, E.J. 2013). Paper Applied to 23 AE: 1980-2007

Why the DL & FS are important?

✓ DL: must be understood as a reference indicator beyond which fiscal solvency is in doubt. The calculus is important at least for two reasons.

First, to prevent government liabilities from approaching such level, and, 

Second, to know the potential fiscal space available for the government

✓ FS: is defined as the difference between current debt and the debt limit
A country could present this problem when, in the face of continuous increases in DEBT and INTEREST PAYMENTS, the EFFORTS of a Govt to maintain primary surpluses FAIL. Consequently, fiscal efforts suffer a state of fatigue that drives the debt to a limit.

To estimate the DL we need to know the Govt’s FRF which comes from IBC:

IBC-LT:

\[ b_{t-1} = \sum_{l=0}^{\infty} \left( \frac{1 + r_t}{1 + g_t} \right)^{(l+1)} E_t(s_{t+l}) \]

IBC –ST (Two Periods):

\[ b_t = \left( \frac{1 + r}{1 + g} \right) b_{t-1} - s_t \quad \text{if, } b_t - b_{t-1} = 0 \]

Gov’t Reaction Function

\[ s_t = \mu_t + f(b_{t-1}) \]

Gosh et al… → \( f \): Non-linear Reaction Function betw Primary Balance and Debt
The Fiscal Fatigue Model (Ghosh, A., Kim J., Mendoza E., Ostry J., y Qureshi, E.J. 2013)

\[ s_{i,t+1} = f(c_i, b_{it}, b_{it}^2, b_{it}^3, \mu_{i,t}) \]
The Fiscal Fatigue Model (Relevant Area of previous Figure)

- The DL is found when the FRF (demand side) cross the interest payment with risk premium (Supply side).

- If the primary balance (in Blue) is smaller than the interest payment, as debt rises, there will be some debt level (DL) above which the debt dynamics become explosive.
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2. Empirical Strategy: Three Steps to estimate DL

1st: To estimate the govt's reaction function in a panel environment → Non linear with an important set of macro-controls

Demand Side: \[ s_{i,t+1} = f(c_i, b_{it}, b^2_{it}, b^3_{it}, \mu_{it}) \]

2th: To estimate the spread between the real interest rate and the per capita economic growth

Supply Side \[ (r_{it} - g_{it})b_{i,t} > 0 : \text{ It's required to be positive for have a stable path of debt} \]

3th: With parameters from FRF (1st) and the Spread (2th), the Debt Limit and the corresponding Fiscal Space were determined:

Equilibrium: DL \[ f \left( \hat{c}_i, \hat{b}_{it}, \hat{b}^2_{it}, \hat{b}^3_{it}, \hat{\mu}_{i,t} \right) = (\hat{r}_{it} - \hat{g}_{it})b_{i,t} \]

Controls (Suggested by literature): Output gap; Govt expend. gap; Openness; Inflation; Population dependence and Dummy for countries with fiscal rules and agreements with the IMF: Sources IMF, WB and Web-Countries

To estimate the DL for each country, we use

- Parameters of the unbalanced panel (with controls)
- The country fix effect
- Data on $b, r, g$, and sovereign risk (EMBI) for each economy
1st STEP: FRF → Estimated by Non-Parametric Technique: Cubic B-spline (We deviated from Ghosh’s paper in this first aspect)

• Because data distribution, the Cubic-FRF is estimated by debt segments, through “Cubic Spline” (De Boor; 2001)

\[ s_{i,t+1} = \mu_{i,t+1} + f(b_{i,t}) + \varepsilon_{i,t+1} \]

• f is proxied by applying a cubic B-spline → How?
  
  • The full range of debt is divided into smaller subintervals (6, selected arbitrarily)
  
  • In each sub-interval is used a polynomial of lower degree, trying to the piecewise function have a suitable final cubic form
  
  • f properties: continuous in slope and curvature throughout the space generated by data

• f representation: \( f(b_{i,t}) = \sum_{k=1}^{6} \varphi_{kt}(b_{i,t}) \),

  where \( \varphi_{kt} = 6 \) vectors (column) estimated with debt data, sorted in ascending
Subsequently, the controls are included

\[
s_{i,t+1} = c_i + \sum_{k=1}^{6} \beta_k \varphi_{kt}(b_{it}) + \Theta \mu_{i,t+1} + \varepsilon_{i,t+1}
\]

c_i: country fix effect, \( \beta_k \): parameters for each vector spline; \( \Theta \): control parameters.

FRF is estimate for (FGMS) Feasible Generalized Minimum Squares

Autocorrelation of 1st grade one allowed: Errors follows  
\[
\varepsilon_{i,t+1} = \rho \varepsilon_{i,t} + \nu_{i,t+1}
\]

Joint significance: Depends on at least one being statistically significant
Results: Spline Estimates of the FRF - 13 Countries: 1980-2016

<table>
<thead>
<tr>
<th></th>
<th>All Controls</th>
<th>Significative Controls &amp; Non-Correlated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dep Variable: Primary Balance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-20.54***</td>
<td>-0.15</td>
</tr>
<tr>
<td>Coef. Spline 1</td>
<td>-3.88*</td>
<td>-3.29</td>
</tr>
<tr>
<td>Coef. Spline 2</td>
<td>1.61</td>
<td>2.92</td>
</tr>
<tr>
<td>Coef. Spline 3</td>
<td>-1.38</td>
<td>-2.26</td>
</tr>
<tr>
<td>Coef. Spline 4</td>
<td>-4.77</td>
<td>-2.96</td>
</tr>
<tr>
<td>Coef. Spline 5</td>
<td>-13.11**</td>
<td>-7.93•</td>
</tr>
<tr>
<td>Coef. Spline 6</td>
<td>-11.82***</td>
<td>-4.55</td>
</tr>
<tr>
<td>GAP GDP</td>
<td>0.42***</td>
<td>0.42***</td>
</tr>
<tr>
<td>GAP Gov. Spending</td>
<td>-0.27***</td>
<td>-0.27***</td>
</tr>
<tr>
<td>IMF Agreement (Yes = 1)</td>
<td>-0.98•</td>
<td></td>
</tr>
<tr>
<td>Fiscal Rule (Yes =1)</td>
<td>1.88*</td>
<td>1.41*</td>
</tr>
<tr>
<td>Openness</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>Dependent Population</td>
<td>0.41***</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>-7.88•</td>
<td></td>
</tr>
</tbody>
</table>

Signif. Levels: ‘***’ 0.001, ‘**’ 0.01, ‘*’ 0.05, ‘•’ 0.1, ‘’ 1.
The Cubic Function (by Splines) revels a good fitted to data

→ Observed primary balances (on average) sorted by debt ranges (red dots) and the FRF estimated (blue line)
2th STEP: Spread betw real interest rate and per capita economic growth

\[(r_{it} - g_{it}) > 0\]

Sovereign Risk Premium is part of the interest rate. We endogenize it to the debt level

\[r_{i,t} = \begin{cases} \frac{\gamma_i}{(\tilde{b}_i - b_{i,t})} - \delta_i & \text{if } b_{i,t} < \tilde{b}_i \\ \infty & \text{Otherwise} \end{cases} \]

\(\delta_i\) is the debt limit; \(\gamma_i\), \(\delta_i\) and \(\beta\) are calibrated

\(\delta_i\) such that the risk premium for country \(i\) is zero, when \(b = 0\)

\(\beta\) and \(\gamma_i\) are calibrated under the double condition:

(i) for each \(i\), the risk premium must be equal to that recorded in 2017
(ii) consistent with debt observed in 2017.

STEP 3th: Equalizing \(\rightarrow\) DL is calculated:

\[c_i + \sum_{k=1}^{6} \beta_k \varphi_{kt} (b_{it}) + \Theta \mu_i + \epsilon_{i,t+1} = (r_{i} - g_{i})b_{i,t}\]
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L.D. ≈ 56% of GDP;  Current Debt = 49% of GDP → Fiscal Space ≈ 7% of GDP

This FS looks narrow, especially because the sensitivity of this indicator to external shocks

Of course, results do not tell us nothing about how time would take to touch this DL
How much is the debt-limit sensitivity to macroeconomic changes?

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Risk Premium (b.p.)</td>
<td>94</td>
<td>194</td>
<td>294</td>
</tr>
<tr>
<td>Debt Limit, GG (% GDP)</td>
<td>57.9</td>
<td>55.6</td>
<td>53.3</td>
</tr>
<tr>
<td>Fiscal Space, GG (% GDP)</td>
<td>8.5</td>
<td>6.2</td>
<td>3.9</td>
</tr>
</tbody>
</table>

- We consider a 100-b.p increase /decrease in the risk premium w.r.t. value recorded in 2017

- ↓ 100 p.b ... “relative good times” → The DL increases by 2.3% of GDP (from 55.6% to 57.9%)

- ↑ 100 p.b ... “relative bad times” → The DL decreases by 2.3% of GDP (from 55.6% to 53.3%)
Evidence of DL & FS for the Other Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Spread between Real Interest Rates and Economic Growth Per capita ($r-g$)</th>
<th>Debt 2017 (% GDP)</th>
<th>Risk Premium 2017 (b.p.)</th>
<th>Debt Limit (% GDP)</th>
<th>Fiscal Space (% GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5 = 4 - 2)</td>
</tr>
<tr>
<td>Brazil</td>
<td>9.35</td>
<td>83.9</td>
<td>263</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Chile</td>
<td>2.27</td>
<td>23.5</td>
<td>130</td>
<td>69.0</td>
<td>45.5</td>
</tr>
<tr>
<td>Colombia</td>
<td>3.07</td>
<td>49.4</td>
<td>194</td>
<td>55.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Ecuador</td>
<td>2.49</td>
<td>44.9</td>
<td>621</td>
<td>46.4</td>
<td>1.5</td>
</tr>
<tr>
<td>México</td>
<td>0.63</td>
<td>54.1</td>
<td>256</td>
<td>59.5</td>
<td>5.4</td>
</tr>
<tr>
<td>Peru</td>
<td>-0.61</td>
<td>25.4</td>
<td>145</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Australia</td>
<td>1.77</td>
<td>40.8</td>
<td>31</td>
<td>60.2</td>
<td>19.4</td>
</tr>
<tr>
<td>Belgium</td>
<td>1.00</td>
<td>103.1</td>
<td>-161</td>
<td>135.9</td>
<td>32.8</td>
</tr>
<tr>
<td>Korea</td>
<td>-1.77</td>
<td>39.5</td>
<td>-5</td>
<td>191.1</td>
<td>151.6</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.23</td>
<td>36.4</td>
<td>-185</td>
<td>62.3</td>
<td>25.9</td>
</tr>
<tr>
<td>Iceland</td>
<td>0.70</td>
<td>39.9</td>
<td>-11</td>
<td>79.9</td>
<td>40.0</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.33</td>
<td>237.6</td>
<td>-236</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2.22</td>
<td>26.4</td>
<td>66</td>
<td>74.6</td>
<td>48.2</td>
</tr>
</tbody>
</table>
Results: The cases of Brazil and Peru:

Brazil (r-g) > 0 large differential

Peru, ... Japon: (r-g) < 0
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Final Remarks

✓ The DL and the FS are a multidimensional forward-looking concepts. Their complete analysis require to see for each country the current and future economic conditions: as credit market access, financing needs, debt profiles, liquidity and solvency concerns, fiscal position etc.

✓ In this paper we try to give an idea on these regards (a narrow but important empirical assessment) for some LA Economies, based on long term historical data and the recent literature

✓ Estimates of DL are crucial (i) to prevent public debt from approaching to critical level and, (ii) to know the possible fiscal space availability.

✓ Results suggest that Chile has the greatest FS while Colombia, Mexico and Ecuador seem to have a really small FS. For Brazil and Peru, the DL cannot be estimated due to the unusual margin between real interest rate and economic growth

✓ From these unusual cases, we call attention on the negative spreads because the low interest rates along the recent years (Peru, Korea, Japan...). Theoretically it means an unstable debt dynamic?..... Maybe the current negative differential → allows a bigger indebtedness, temporarily (recent debate, Blanchard & Summers, 2019).
To extend the sample for a large number of economies, including emerging and advanced to identify differences between them → We are working now with 39 economies (17 L.A.; 22 Advanced)
Future Agenda (Preliminary Advances)

Advanced (22 Economies)

- Estimated primary balance
- Interest payment without risk
- Interest payment with risk