Foreign Reserves, Fiscal Capacity, and Lender of Last Resort

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Build up in foreign reserves stock since the 90s

**Figure:** Official Foreign Reserves Holdings (% of GDP)
In this paper → Precautionary role of reserves

**RQ:** Why do some governments hold foreign reserves while others do not?
In this paper → Precautionary role of reserves

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▷ I develop a novel theoretical framework to study this question
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▷ Fiscal Capacity as a novel motive behind reserves accumulation
Precautionary role of reserves

RQ: Why do some governments hold foreign reserves while others do not?

▷ I develop a novel theoretical framework to study this question
▷ Fiscal Capacity as a novel motive behind reserves accumulation
▷ Empirical supporting evidence - 98 countries (1991-2016)
Non-linear relationship: Reserves and Fiscal Capacity

**Figure:** Foreign Reserves and Fiscal Capacity in Equilibrium
Sketch of Theoretical Framework

- Liquidity instrument $\rightarrow$ Liquidity literature (Holmström and Tirole, 1998) (Farhi and Tirole, 2012)
- *Small open economy* (SOE) borrows from international markets
- Global financial cycle drives international interest rates
- Financial Frictions
  - Wedge between total expected output and *pledgeable* expected output
- *High* international interest rates $\rightarrow$ *Sudden Stop* (SS) to this SOE
- Under SS: economy cannot finance production $\rightarrow$ domestic crisis
How can a government protect its economy from a SS?

- Offer substitute funding source (transfer)
- To cover transfer, it can issue bonds or use foreign reserves
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- Foreign reserves similar to an insurance
  - Prepay to use it → Potentially wasteful investment
  - Annual Premium of 1% of GDP (Rodrik, 2006)
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Sovereign borrowing should be welfare improving (Holmström and Tirole, 1998)
  - Credible government
  - Exclusive right to tax → backed up by total output
  - Overcomes financial frictions
  - No need to hoard liquidity ex-ante
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Why do some governments hoard liquidity in the form of reserves?
Fiscal Capacity is a key variable

- Level of development of economic institutions for tax compliance (Besley and Persson, 2014)
- Degree to which tax collection (sovereign borrowing) is limited by financial frictions
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  - Fiscal Space Channel $\rightarrow$ bounds sovereign borrowing below natural limit
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- Degree to which tax collection (sovereign borrowing) is limited by financial frictions

- Low fiscal capacity impairs ex-post liquidity supply
  1. Fiscal Space Channel → bounds sovereign borrowing below *natural* limit
  2. Crowding out Channel → As sovereign borrowing ↑, ↑ future taxes → ↓ net pledgeable expected output to back up private borrowing
Summary of Theoretical Results

1. Governments *only* accumulate reserves if their fiscal capacity is *underdeveloped*.

2. Governments with very low fiscal capacity → don’t accumulate reserves (it is too costly).

3. Reserves → provide liquidity without *crowding out* private liquidity.
Empirical Exercise

- Unbalanced sample of 98 countries between 1991-2016
- 29 AEs, 69 EMEs and LICs
- Data is publicly available: WDI, IFS, BIS, etc.

\[
\log\left(\frac{Res_{j,t}}{GDP_{j,t}}\right) = \beta_0 + \beta_1 \log\left(\frac{IncTaxRev_{j,t-1}}{TotTaxRev_{j,t-1}}\right) + \beta_2 Z_{j,t-1} + \alpha_t + \varepsilon_{j,t} \tag{1}
\]

- \( \log\left(\frac{IncTaxRev_{j,t-1}}{TotTaxRev_{j,t-1}}\right) \rightarrow \) Proxy for fiscal capacity \((\beta_1 < 0)\)
- \( Z_{j,t-1} \rightarrow \) Other motives for FX accumulation
  (Aizenman and Lee, 2007) (Obstfeld et al., 2010) (Ghosh et al., 2017)
### Foreign Reserves and Fiscal Capacity - OLS Regression

<table>
<thead>
<tr>
<th></th>
<th>Whole Sample</th>
<th>EME</th>
<th>Pre-GFC</th>
<th>Post GFC</th>
<th>Balanced Panel</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>Tax Revenue (% GDP, log)</td>
<td>-0.004</td>
<td>0.131</td>
<td>0.205</td>
<td>-0.428</td>
<td>0.413</td>
<td>2.081***</td>
</tr>
<tr>
<td></td>
<td>(0.202)</td>
<td>(0.151)</td>
<td>(0.180)</td>
<td>(0.295)</td>
<td>(0.251)</td>
<td>(0.548)</td>
</tr>
<tr>
<td>Income Tax Revenue (% TR, log)</td>
<td>-0.161**</td>
<td>-0.146**</td>
<td>-0.175</td>
<td>-0.169**</td>
<td>-0.477***</td>
<td>-1.588**</td>
</tr>
<tr>
<td></td>
<td>(0.081)</td>
<td>(0.064)</td>
<td>(0.108)</td>
<td>(0.081)</td>
<td>(0.114)</td>
<td>(0.503)</td>
</tr>
<tr>
<td>Observations</td>
<td>1681</td>
<td>1162</td>
<td>915</td>
<td>605</td>
<td>507</td>
<td>152</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.40</td>
<td>0.52</td>
<td>0.47</td>
<td>0.39</td>
<td>0.66</td>
<td>0.82</td>
</tr>
<tr>
<td>Countries</td>
<td>98</td>
<td>69</td>
<td>93</td>
<td>92</td>
<td>20</td>
<td>9</td>
</tr>
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**Note:** *** $p<0.01$, ** $p<0.05$, * $p<0.10$. Standard errors in parenthesis. Observations clustered by country. Time fixed effects are not reported but are included in every regression.
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<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>Original Sin Index (0-1)</td>
<td>1.617***</td>
<td>-1.150***</td>
<td>1.069**</td>
<td>2.076***</td>
<td>0.737</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.339)</td>
<td>(0.427)</td>
<td>(0.456)</td>
<td>(0.356)</td>
<td>(0.468)</td>
<td>(1.109)</td>
</tr>
<tr>
<td>Tax Revenue (% GDP, log)</td>
<td>-0.215</td>
<td>-0.108</td>
<td>-0.161</td>
<td>-0.414</td>
<td>0.809**</td>
<td>2.354***</td>
</tr>
<tr>
<td></td>
<td>(0.238)</td>
<td>(0.213)</td>
<td>(0.258)</td>
<td>(0.276)</td>
<td>(0.383)</td>
<td>(0.544)</td>
</tr>
<tr>
<td>Income Tax Revenue (% TR, log)</td>
<td>-0.227***</td>
<td>-0.166**</td>
<td>-0.222**</td>
<td>-0.222**</td>
<td>-0.372***</td>
<td>-1.744***</td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(0.074)</td>
<td>(0.103)</td>
<td>(0.087)</td>
<td>(0.129)</td>
<td>(0.396)</td>
</tr>
<tr>
<td>Observations</td>
<td>1029</td>
<td>606</td>
<td>397</td>
<td>505</td>
<td>312</td>
<td>144</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.54</td>
<td>0.56</td>
<td>0.62</td>
<td>0.53</td>
<td>0.67</td>
<td>0.84</td>
</tr>
<tr>
<td>Countries</td>
<td>84</td>
<td>55</td>
<td>69</td>
<td>80</td>
<td>20</td>
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Non-linearity between reserves and fiscal capacity implies a challenge for fixed effects.

- I classify country-year observation into 5 quintiles → fiscal capacity.
- I run (2) whole-sample, then I exclude quintile 1, then quintile 1 and 2, so on.
- As I exclude lower quintiles, I expect $|\beta_1|$ to be larger and $\beta_1 < 0$. 

\[
\log\left(\frac{Res_{j,t}}{GDP_{j,t}}\right) = \beta_0 + \beta_1 \log\left(\frac{IncTaxRev_{j,t-1}}{TotTaxRev_{j,t-1}}\right) + \beta_2 Z_{j,t-1} + \alpha_j + \alpha_t + \epsilon_{j,t} 
\]
### Foreign Reserves, Fiscal Capacity - Fixed Effects

<table>
<thead>
<tr>
<th></th>
<th>(1) Q1-Q5</th>
<th>(2) Q2-Q5</th>
<th>(3) Q3-Q5</th>
<th>(4) Q4-Q5</th>
<th>(5) Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Revenue (% GDP, log)</td>
<td>0.274***</td>
<td>0.509***</td>
<td>0.553***</td>
<td>0.210</td>
<td>0.358</td>
</tr>
<tr>
<td></td>
<td>(0.084)</td>
<td>(0.121)</td>
<td>(0.146)</td>
<td>(0.160)</td>
<td>(0.239)</td>
</tr>
<tr>
<td>Income Tax Revenue (% TR, log)</td>
<td>-0.005</td>
<td>-0.076</td>
<td>-0.508***</td>
<td>-0.549***</td>
<td>0.631**</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.082)</td>
<td>(0.121)</td>
<td>(0.139)</td>
<td>(0.315)</td>
</tr>
<tr>
<td>Observations</td>
<td>1681</td>
<td>1344</td>
<td>1008</td>
<td>672</td>
<td>336</td>
</tr>
<tr>
<td>R2</td>
<td>0.24</td>
<td>0.19</td>
<td>0.24</td>
<td>0.34</td>
<td>0.06</td>
</tr>
<tr>
<td>R2-Between</td>
<td>0.23</td>
<td>0.14</td>
<td>0.11</td>
<td>0.28</td>
<td>0.06</td>
</tr>
<tr>
<td>R2-Within</td>
<td>0.23</td>
<td>0.23</td>
<td>0.28</td>
<td>0.42</td>
<td>0.48</td>
</tr>
<tr>
<td>Countries</td>
<td>98</td>
<td>90</td>
<td>78</td>
<td>56</td>
<td>35</td>
</tr>
<tr>
<td>Avg. Obs per country</td>
<td>17</td>
<td>15</td>
<td>13</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

**Note:** *** p<0.01, ** p<0.05, * p<0.10. Standard errors in parenthesis. Sample divided in quintiles according to fiscal capacity. Columns (1) and (6) are the results for the whole sample (1-5), Columns (2) and (7) for quantiles 2 to 5, Columns (3) and (8) for quantiles 3 to 5, Columns (4) and (9) for quantiles 4 and 5, and Columns (5) and (10) for quantile 5.
Relation to the literature

1. Novel motive for foreign reserves accumulation:
   - Sudden Stops and Capital Outflows: Aizenman and Lee (2007); Obstfeld et al. (2010); Jeanne and Ranciere (2011)
   - Currency Mismatch: Chang and Velasco (2001); Eichengreen et al. (2003); International Monetary Fund (2011); Bocola and Lorenzoni (2020)

2. Fiscal Capacity to liquidity literature: Holmström and Tirole (1998); Farhi and Tirole (2012); Tirole (2011)

3. Fiscal Space and Crowding Out channels: Tirole (2002); Calvo (2016)
Policy Takeaways

- Links fiscal capacity with resilience to global shocks
- **Domestic Perspective**
  - Fiscal capacity ≠ Fiscal sustainability/space
  - Countries should not shy away from strengthening institutions for tax compliance
- **Global Perspective**
  - Low fiscal capacity → choice between reserves or sudden stops
  - Both options carry costs for international monetary system
  - International Financial Assistance – How should resources be used?
Thank you!

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References I


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