Limiting Fiscal Procyclicality: Evidence from Resource-Rich Countries

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UCY

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Introduction

- Fiscal policy has been identified as a potential source for volatility in Resource-Rich countries (Frankel, 2010)
- There are a limited number of studies on the behaviour of fiscal policy in resource-rich countries (Sinnot, 2009, Arezki and Bruckner, 2012)
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Revisit this analysis with richer data set and address endogeneneity concerns
Sample of 84 resource-rich countries out of 192.
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Resource-rich definition (COMTRADE data):

\[ \frac{X^{COM}}{GDP} \geq 8\% \]
\[ \frac{X^{COM}}{X} \geq 60\% \]
\[ \frac{X^{COM}_1 + X^{COM}_2}{X} \geq 40\% \]
Sample of 84 resource-rich countries out of 192.

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\]

These restrictions give for our sample a set of resource-rich countries very similar to that of other studies; last condition ensures importance of a restricted number of resource prices.
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Data: Fiscal Policy and Output Growth

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- Real government consumption scaled by GDP
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- Real GDP: Nominal GDP from the World Bank database (WDI), deflated using the GDP deflator
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  1. real commodity price growth for the country’s main commodity export
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- Commodity prices are converted to local currency using the WDI US$ exchange rate, and deflated using the local CPI
- All growth rates are calculated taking the difference of the natural logarithm.
Data: Institutions

- Control of Corruption: World Bank World Governance Indicators Index

Democracy: dummy which takes the value 1 if the average of “Polity2” index is strictly positive and zero otherwise (Alesina et al., 2008)

Checks: Keefer and Stasavage (2003) “Checks” index, which counts the number of veto players

SWFs: average of a dummy variable that takes 1 if in year t country i has an operational fund engaged in the management of revenues from non-renewable natural resources

Fiscal Rules: average of a dummy variable constructed by Schaechter et al. (2012) that takes the value 1 if in year t country i has imposed long lasting constraints on fiscal policy through numerical limits on budgetary aggregates - different types considered.
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### Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample</th>
<th>Resource Rich</th>
<th>SWF</th>
<th>Fiscal Rules</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>mean</td>
<td>sd</td>
<td>mean</td>
<td>sd</td>
</tr>
<tr>
<td>GDP Growth</td>
<td>3.77</td>
<td>4.86</td>
<td>3.72</td>
<td>5.37</td>
</tr>
<tr>
<td>Real Government Consumption Growth</td>
<td>4.09</td>
<td>13.26</td>
<td>3.52</td>
<td>15.43</td>
</tr>
<tr>
<td>Government Consumption (% GDP) Growth</td>
<td>0.27</td>
<td>11.95</td>
<td>-0.20</td>
<td>13.93</td>
</tr>
<tr>
<td>Price Growth of 1st Commodity</td>
<td>-</td>
<td>-</td>
<td>1.59</td>
<td>27.14</td>
</tr>
<tr>
<td>Price Growth of 2nd Commodity</td>
<td>-</td>
<td>-</td>
<td>0.71</td>
<td>25.40</td>
</tr>
<tr>
<td>Rest of Region GDP Growth</td>
<td>4.1</td>
<td>5.59</td>
<td>4.21</td>
<td>4.77</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>5334</td>
<td>2228</td>
<td>398</td>
<td>305</td>
</tr>
</tbody>
</table>
Figure 1: Volatility of GDP Growth and Resource Dependency

Panel A: Full Sample

Panel B: Resource Rich
Motivation

Figure 2: Volatility of Real Government Consumption Growth and Resource Dependency

Coutinho et al. (2013) (UCY and Europrism)
Motivation

Figure 3: Volatilities of Real Government Consumption Growth and GDP Growth
Figure 4: Volatilities of Real Government Consumption Growth and GDP Growth with and without SWF
Figure 5: Volatilities of Real Government Consumption Growth and GDP Growth with and without Fiscal Rules

Motivation
Empirical Strategy

Baseline Specification

\[ G_{it} = \alpha_i + \mu_t + \beta Y_{it} + \gamma G_{it-1} + \epsilon_{it} \]  \hspace{1cm} (1)

\[ i = 1, 2, \ldots N \]

\[ t = 1, 2, \ldots T_i \]
Baseline Specification

\[ G_{it} = \alpha_i + \mu_t + \beta Y_{it} + \gamma G_{it-1} + \varepsilon_{it} \]  \hspace{1cm} (1)

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where \( G_{it} \) is the measure of changes in fiscal policy; \( Y_{it} \) is output growth
Empirical Strategy

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- \( \beta > 0 \) when \( G_{it} \) is the growth rate of real government consumption implies that government consumption is procyclical
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(1)

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- \( \beta > 0 \) when \( G_{it} \) is the growth rate of real government consumption implies that government consumption is procyclical
- \( \beta > 0 \) when \( G_{it} \) is the growth rate of the government consumption to GDP ratio implies that government consumption is strongly procyclical (moves in the same direction and by more than GDP)
Estimation Strategy: Baseline

- Endogeneity of GDP growth:

  - Instrumental Variables
    - Typical instruments: the GDP of the rest of the region, the GDP of trading partners
    - For resource-rich countries, an ideal instrument to address the endogeneity problem: the change in the resource price
    - Two instruments considered: GDP growth of rest of the region; growth in the main commodity price
    - Tests point to the second as a better instrument in this case

Coutinho et al. (2013) (UCY and Europrism)
Estimation Strategy: Baseline

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  - Instrumental Variables

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### Table 2: Cyclicality of Real Government Consumption Growth

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>IV Prices</td>
<td>IV RR GDP</td>
<td>IV Prices + RR GDP</td>
</tr>
<tr>
<td>GDP Growth</td>
<td>0.778*** (0.057)</td>
<td>2.674*** (0.745)</td>
<td>3.806* (1.978)</td>
<td>2.615*** (0.721)</td>
</tr>
<tr>
<td>Real Government Consumption Growth (t-1)</td>
<td>0.103*** (0.019)</td>
<td>0.019 (0.040)</td>
<td>0.008 (0.051)</td>
<td>0.014 (0.037)</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>2317</td>
<td>2153</td>
<td>2275</td>
<td>2113</td>
</tr>
<tr>
<td>Number of Groups</td>
<td>76</td>
<td>72</td>
<td>74</td>
<td>71</td>
</tr>
<tr>
<td>Average Group</td>
<td>30.49</td>
<td>29.90</td>
<td>30.74</td>
<td>29.76</td>
</tr>
<tr>
<td>R² overall</td>
<td>0.11</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>First Stage F</td>
<td>-</td>
<td>21.10</td>
<td>4.209</td>
<td>10.74</td>
</tr>
<tr>
<td>AP (p-value)</td>
<td>-</td>
<td>0.0000</td>
<td>0.0403</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cragg-Donald F-statistic</td>
<td>-</td>
<td>21.10</td>
<td>4.209</td>
<td>10.74</td>
</tr>
</tbody>
</table>
Table 3: Cyclicality of Government Consumption (% of GDP) Growth

<table>
<thead>
<tr>
<th></th>
<th>(1) OLS</th>
<th>(2) IV Prices</th>
<th>(3) IV RR GDP</th>
<th>(4) IV Prices + RR GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Growth</td>
<td>-0.319***</td>
<td>1.124*</td>
<td>0.396</td>
<td>1.058*</td>
</tr>
<tr>
<td></td>
<td>(0.0472)</td>
<td>(0.640)</td>
<td>(0.570)</td>
<td>(0.628)</td>
</tr>
<tr>
<td>Government Consumption (% of GDP) Growth (t-1)</td>
<td>-0.060***</td>
<td>-0.055**</td>
<td>-0.071***</td>
<td>-0.071***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Observations</td>
<td>2980</td>
<td>2161</td>
<td>2889</td>
<td>2116</td>
</tr>
<tr>
<td>Number of Groups</td>
<td>80</td>
<td>72</td>
<td>78</td>
<td>71</td>
</tr>
<tr>
<td>Average Groups</td>
<td>37.25</td>
<td>30.01</td>
<td>37.04</td>
<td>29.80</td>
</tr>
<tr>
<td>R² overall</td>
<td>0.02</td>
<td>0.006</td>
<td>0.004</td>
<td>0.005</td>
</tr>
<tr>
<td>First stage F</td>
<td>-</td>
<td>23.07</td>
<td>21.42</td>
<td>11.61</td>
</tr>
<tr>
<td>AP (p-value)</td>
<td>-</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cragg-Donald F-statistic</td>
<td>-</td>
<td>23.07</td>
<td>21.42</td>
<td>11.61</td>
</tr>
</tbody>
</table>
Augmented Specification

\[ G_{it} = \alpha_i + \mu_t + \beta_1 Y_{it} + \beta_2 (Y_{it} \times I_i) + \gamma G_{it-1} + \epsilon_{it} \]  

\( i = 1, 2, \ldots N \)

\( t = 1, 2, \ldots T_i \)
Augmented Specification

\[ G_{it} = \alpha_i + \mu_t + \beta_1 Y_{it} + \beta_2 (Y_{it} * I_i) + \gamma G_{it-1} + \varepsilon_{it} \]  

where \( Y_{it} * I_i \) is the interaction between the GDP growth and the time-invariant institutional variable \( I_i \) (corruption, democracy, checks, SWF, Fiscal Rules).
Augmented Specification

\[ G_{it} = \alpha_i + \mu_t + \beta_1 Y_{it} + \beta_2 (Y_{it} * I_i) + \gamma G_{it-1} + \varepsilon_{it} \] (2)

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\[ t = 1, 2, \ldots T_i \]

where \( Y_{it} * I_i \) is the interaction between the GDP growth and the time-invariant institutional variable \( I_i \) (corruption, democracy, checks, SWF, Fiscal Rules)

\( (\beta_1 + \beta_2 I_i) \) measures the fiscal cyclicality in country \( i \), and may be different across countries to the extent that institutions are different depending on the significance of \( \beta_2 \).
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
- Interactions instrumented in two ways:
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
- Interactions instrumented in two ways:
  - growth rate of the main commodity price $\times I_i$
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
- Interactions instrumented in two ways:
  - growth rate of the main commodity price \( \times I_i \)
  - growth rate of the main commodity price \( \times \) instrument for institution \( I \).
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
- Interactions instrumented in two ways:
  - growth rate of the main commodity price $\times I_i$
  - growth rate of the main commodity price $\times$ instrument for institution $I$.
- Instruments for institutions (picked the best according to IV testing):
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
- Interactions instrumented in two ways:
  - growth rate of the main commodity price $\times I_i$
  - growth rate of the main commodity price $\times$ instrument for institution $I_i$
- Instruments for institutions (picked the best according to IV testing):
  - Control of Corruption: Ethnic Fractionalization Index
Estimation Strategy: Augmented Model

- GDP growth instrumented with the growth in the main commodity price
- Interactions instrumented in two ways:
  - growth rate of the main commodity price \( \times I_i \)
  - growth rate of the main commodity price \( \times \) instrument for institution \( I_i \).
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  - Control of Corruption: Ethnic Fractionalization Index
  - Democracy: Landlocked Dummy
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  - Checks: Religion Fractionalization
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  - growth rate of the main commodity price $\times$ instrument for institution $I_i$
- Instruments for institutions (picked the best according to IV testing):
  - Control of Corruption: Ethnic Fractionalization Index
  - Democracy: Landlocked Dummy
  - Checks: Religion Fractionalization
  - SWF and Rules: Ethnic Fractionalization Index
Table 4b: Corruption, Democracy and Cyclicality of Real Government Consumption Growth - Instrumenting Corruption, Democracy, and Checks

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Growth</td>
<td>4.987** (2.141)</td>
<td>2.687*** (0.544)</td>
<td>5.191*** (1.978)</td>
</tr>
<tr>
<td>GDP Growth x Control of Corruption (WGI)</td>
<td>-11.94 (7.462)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP Growth x Democracy</td>
<td></td>
<td>-2.982** (1.369)</td>
<td></td>
</tr>
<tr>
<td>GDP Growth x Checks</td>
<td></td>
<td></td>
<td>-1.124 (0.875)</td>
</tr>
<tr>
<td>Government Consumption (Real) Growth (t-1)</td>
<td>0.080** (0.033)</td>
<td>0.041 (0.034)</td>
<td>0.018 (0.042)</td>
</tr>
</tbody>
</table>

Observations: 2129, 2153, 2087
Number of Groups: 70, 72, 69
Average Group: 30.41, 29.90, 30.25
R² overall: 0.03, 0.05, 0.07
F₁-statistic (first stage): 18.52, 13.21, 8.88
AP₁ (p-value): 0.3124, 0.0000, 0.1595
F₂-statistic (first stage): 10.72, 6.89, 8.16
AP₂ (p-value): 0.5099, 0.0001, 0.1848
Cragg-Donald F-statistic: 2.233, 6.513, 5.026
### Results: Strong Fiscal Procyclicality and Institutions

#### Table 5b: Corruption, Democracy and Cyclicality of Government Consumption (% of GDP) Growth – Instrumenting Corruption, Democracy, and Checks.

<table>
<thead>
<tr>
<th></th>
<th>(1) IV</th>
<th>(2) IV</th>
<th>(3) IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Growth</td>
<td>2.405</td>
<td>1.379***</td>
<td>4.210**</td>
</tr>
<tr>
<td></td>
<td>(1.996)</td>
<td>(0.529)</td>
<td>(1.830)</td>
</tr>
<tr>
<td>GDP Growth x Control of Corruption</td>
<td>-6.571</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.983)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP Growth x Democracy</td>
<td></td>
<td>-3.850***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.435)</td>
<td></td>
</tr>
<tr>
<td>GDP Growth x Checks and Balances</td>
<td>-1.407*</td>
<td></td>
<td>-1.407*</td>
</tr>
<tr>
<td></td>
<td>(0.824)</td>
<td></td>
<td>(0.824)</td>
</tr>
<tr>
<td>Government Consumption (% GDP) Growth (t-1)</td>
<td>-0.052**</td>
<td>-0.079***</td>
<td>-0.063**</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.028)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Observations</td>
<td>2137</td>
<td>2161</td>
<td>2095</td>
</tr>
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<td>Average Group</td>
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<td>R² overall</td>
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<td>Cragg-Donald F-statistic</td>
<td>2.068</td>
<td>6.019</td>
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### Table 6b: SWF and Fiscal Rules using additional instrument

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<th>(1) IV</th>
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<td>GDP Growth</td>
<td>2.701***</td>
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<td>2.318***</td>
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<td></td>
<td>(0.769)</td>
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<td>(0.797)</td>
<td>(0.704)</td>
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<td>-5.490**</td>
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<td>(2.651)</td>
<td>(1.799)</td>
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<td>GDP Growth x Rules (ER, BBR, DR)</td>
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<td>GDP Growth x Expenditure Rules</td>
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<td>(5.706)</td>
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<td>GDP Growth x Funds &amp; Rules (ER, BBR)</td>
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<td></td>
<td></td>
<td>2.677</td>
<td>(3.084)</td>
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<td>0.025</td>
<td>0.025</td>
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<td></td>
<td>(0.035)</td>
<td>(0.039)</td>
<td>(0.039)</td>
<td>(0.040)</td>
<td>(0.033)</td>
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<td>F₃-statistic (first stage)</td>
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<td>Cragg-Donald F-statistic</td>
<td>5.143</td>
<td>6.402</td>
<td>7.169</td>
<td>6.667</td>
<td>6.547</td>
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</table>
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Conclusions

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Coutinho et al. (2013) (UCY and Europrism)

Limiting Fiscal Procyclicality

December 16, 2013
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