Democratic development and the resource curse in Latin American & Caribbean economies: A panel data analysis

Lars Sorge $^{1,2}$

$^1$DIW Berlin, Department of Energy, Transportation, Environment

$^2$Berlin University of Technology, Workgroup for Infrastructure Policy (WIP)

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Motivation

Relevance (Sinnott et al., 2010):

- Latin America is one of the resource richest regions of the world
- 4 out of the 20 largest oil producing countries in the world are located there (Venezuela, Mexico, Brazil, and Colombia)
- some of the largest producers of other mineral resources are part of the region

“It is fair to say that as a general conclusion, there is currently no consensus regarding the existence of a natural resource curse.”

(Badeeb et al., 2017)
Contribution

Research question:

Does resource dependence have a negative impact on economic growth and if so, can a certain level of democratic quality diminish the detrimental effect of resource richness on economic growth?

- focus on Latin American & Caribbean (LAC) economies
- application of heterogeneous dynamic panel estimation techniques
- transparent documentation of data and method
Agenda

1. Resource curse
2. Literature
3. Data and empirical strategy
   - Data
   - Empirical specification
   - Cross-section dependence test
   - Second-generation panel unit root test
   - Panel ARDL approach
4. Empirical results
5. Conclusions
Natural resources from an economic perspective

Natural resource wealth (Humphreys et al., 2007):
- does not need to be produced but only extracted
- can occur relatively independent of other economic activities
- many natural resources are nonrenewable
- rather like an asset than like a source of income

Advantages for long-term economic development (Sachs, 2007):
- boost real living standards by financing higher levels of public and private consumption
- finance higher levels of investment out of natural resource revenues
- compensate the lack of fiscal resources needed to finance core public goods
The evolution of the resource curse

Figure: Own illustration based on Badeeb et al. (2017)

“One of the surprising features of modern economic growth is that economies with abundant natural resources have tended to grow less rapidly than natural-resource-scarce economies.”

(Sachs and Warner, 1995)
Related literature

The role of institutional quality:
- Arezki and van der Ploeg (2007), Boschini et al. (2007), Horvath and Zeynalov (2014), Isham et al. (2005), Mehlum et al. (2006), Kolstad and Wiig (2009), Sarmidi et al. (2014)
- resource curse can be avoided if institutional quality is sufficiently high

Natural resources and democracy in Latin American:
- Dunning (2008), Ross (2009), and Haber and Menaldo (2011)
- positive relationship between natural resources and democracy

Latin American (Blanco and Grier, 2012):
- What is the effect of resource dependence on factor accumulation?
- 17 Latin American countries from 1975 to 2004
- resource dependence has no significant direct effect on physical and human capital
Variables

Commonly used indicators within the resource curse framework:

- resource dependence: rents from natural resources over GDP or share of mineral/fuel exports in total exports
- resource abundance: subsoil wealth or deposits of natural resources

Variables:

- $GDP$: GDP per capita (constant 2010 USD)
- $C$: Gross capital formation (billion constant 2010 USD)
- $L$: Labor force, total (million)
- $NR$: Total natural resources rents (% of GDP)
- $INS$: Polity2 index (Haber and Menaldo, 2011)
- $T$: Trade (% of GDP)
- $FDI$: Foreign direct investment, net inflows (billion current USD)
## Data

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP</th>
<th>NR</th>
<th>INS</th>
<th>C</th>
<th>L</th>
<th>T</th>
<th>FDI</th>
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</table>

**Notes:** The arithmetic mean is displayed; data is obtained from the World Development Indicators (WDI) database from The World Bank (last updated 21 May 2018).
Empirical specification

Model 1: \( GDP_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 L_{it} + \beta_3 N_{R_{it}} + \beta_4 I_{NS_{it}} + \beta_5 (N_{R_{it}} \times I_{NS_{it}}) + \epsilon_{it} \)

Model 2: \( GDP_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 L_{it} + \beta_3 N_{R_{it}} + \beta_4 I_{NS_{it}} + \beta_5 (N_{R_{it}} \times I_{NS_{it}}) + \beta_6 T_{it} + \epsilon_{it} \)

Model 3: \( GDP_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 L_{it} + \beta_3 N_{R_{it}} + \beta_4 I_{NS_{it}} + \beta_5 (N_{R_{it}} \times I_{NS_{it}}) + \beta_6 T_{it} + \beta_7 FDI_{it} + \epsilon_{it} \)

The resource curse will be eliminated \( (\frac{\delta GDP_{it}}{\delta N_{R_{it}}} = \beta_3 + \beta_5 I_{NS_{it}} \geq 0) \) when institutional quality is greater than the required threshold \( I_{NS_{it}} \geq -\frac{\beta_3}{\beta_5} \).
Empirical strategy

1. detect contemporaneous correlation among countries after controlling for individual characteristics (i.e. global shocks, local interactions)

2. test for unit roots in the presence of cross-section dependence from a single common factor

3. dynamic heterogeneous panel autoregressive distributed-lag (ARDL) approach to analyse if a resource curse in the LAC region is present
Cross-section dependence test

- contemporaneous correlation among countries that is left over after controlling for individual characteristics (Moscone and Tosetti, 2009)
- first-generation panel methods assume cross-sectional independence

Pesaran (2004) CD test is robust to the presence of

- nonstationary processes,
- parameter heterogeneity or structural breaks,
- ... and performs well in small samples.
Second-generation panel unit root test

- using nonstationary variables can lead to apparently significant regression results although the data is unrelated

Pesaran (2007) CIPS panel unit root test

- Cross-sectionally augmented Im-Pesaran-Shin (2003) (IPS) test

\[ \Delta y_{it} = \delta_i^t d_t + \rho_i y_{i,t-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^{J} d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^{J} \beta_{ij} \Delta y_{i,t-j} + \epsilon_{it} \]

- \( H_0 : \rho_i = 0 \) is tested against \( H_1 : \rho_i < 0 \) and \( H_1 : \rho_i = 0 \)
Panel ARDL approach I

- estimation of the effect of natural resources on economic growth
- identification of a threshold for democratic quality at which the resource curse vanishes

ARDL($p,q$) model

- variables which have a different order of integration can be used irrespective whether the variables of interest are $I(0)$ or $I(1)$
- inclusion of lags for the dependent and independent variables reduces problems resulting from endogeneity
Panel ARDL approach II

VECM representation of the ARDL($p,q$) model

$$
\Delta GDP_{it} = \beta_{0i} + \phi_i (GDP_{i,t-1} - \theta_i X_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta GDP_{i,t-1} + \sum_{j=0}^{q-1} \delta^*_{ij} \Delta X_{i,t-j} + \epsilon_{it}
$$

- $X_{it} = C_{it}, L_{it}, NR_{it}, INS_{it}, (NR_{it} \times INS_{it}), T_{it}, FDI_{it}$ is the set of regressors
- $\Delta$ denotes the first difference operator
- $j$ is the number of lags (set to one based on the SBIC criterion)
- $\phi_i$ is the error correction or speed of adjustment term
- a negative coefficient on the error-correction term not lower than $-2$ provides evidence for a long-run relationship and stability of the model (Loayza et al., 2006)
MG and PMG estimation techniques

Mean Group estimation (Pesaran and Smith, 1995)
- allows the country specific intercepts, the short- and long-run dynamics, and the error variances to differ across countries
- does not impose any homogeneity restrictions on the parameters for the cross-section members

Pooled Mean Group estimation (Pesaran et al., 1999)
- intercepts, short-run coefficients, and error variance are determined cross-section specific
- the long-run parameters are constrained to be equal across the groups

Which estimator to choose?
- the test of difference in these models is performed using the Hausman (1987) specification test
Empirical results I

Peasaran (2004) CD test:
- all series are highly dependent across the LAC panel

Pesaran (2007) panel unit root test:
- strong evidence that a panel unit root in the variables exists
- \( NR, T, \) and interaction term (\( NR \times INS \)) are stationary in levels (I(0)), all variables are stationary in their first difference I(1)

Implications
- first generation panel data methods are inappropriate
- mixed order of integration justifies panel ARDL approach
### Empirical Results II: PMG estimates

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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<td><strong>Long-run</strong></td>
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<tr>
<td>$C$</td>
<td>$0.441^{***}$</td>
<td>$0.451^{***}$</td>
<td>$0.415^{***}$</td>
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<td>$(12.28)$</td>
<td>$(21.30)$</td>
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<td>$L$</td>
<td>$0.117$</td>
<td>$0.128^{**}$</td>
<td>$-0.0170$</td>
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<td>$(1.90)$</td>
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<tr>
<td>$NR$</td>
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<td>$-1.378^{***}$</td>
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<td>$(-3.94)$</td>
<td>$(-4.82)$</td>
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<tr>
<td>$POL$</td>
<td>$-0.576^{***}$</td>
<td>$-0.459^{***}$</td>
<td>$-0.330^{***}$</td>
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<tr>
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<td>$(-4.76)$</td>
<td>$(-5.84)$</td>
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<tr>
<td>$(NR \times POL)$</td>
<td>$0.508^{***}$</td>
<td>$0.480^{***}$</td>
<td>$0.330^{***}$</td>
</tr>
<tr>
<td></td>
<td>$(4.12)$</td>
<td>$(5.06)$</td>
<td>$(3.80)$</td>
</tr>
<tr>
<td>$T$</td>
<td>$-0.126^{***}$</td>
<td>$-0.0939^{***}$</td>
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<td>$(-4.94)$</td>
<td>$(-4.18)$</td>
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<tr>
<td>$FDI$</td>
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<td></td>
<td>$0.0286^{***}$</td>
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<td>$(4.19)$</td>
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<td><strong>Short-run</strong></td>
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<tr>
<td>$EC$</td>
<td>$-0.0995^{***}$</td>
<td>$-0.125^{***}$</td>
<td>$-0.130^{***}$</td>
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<td></td>
<td>$(-5.58)$</td>
<td>$(-4.59)$</td>
<td>$(-4.13)$</td>
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<tr>
<td>$\Delta C$</td>
<td>$0.107^{***}$</td>
<td>$0.100^{***}$</td>
<td>$0.0983^{***}$</td>
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<tr>
<td></td>
<td>$(4.85)$</td>
<td>$(4.75)$</td>
<td>$(4.77)$</td>
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<td>$\Delta L$</td>
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<td>$-0.100$</td>
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<td>$\Delta NR$</td>
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<td>$\gamma_{\text{cons}}$</td>
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<td>$-0.180^{**}$</td>
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<tr>
<td></td>
<td>$(-2.84)$</td>
<td>$(-3.18)$</td>
<td>$(2.10)$</td>
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</table>

\[
\frac{\delta GDP_{i,t}}{\delta NR_{i,t}} \geq 0 \quad \exp\left(\frac{2.183}{0.508}\right) = 73.50 \quad \exp\left(\frac{2.052}{0.480}\right) = 71.88 \quad \exp\left(\frac{1.378}{0.330}\right) = 65.09
\]

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, $t$ statistics in parentheses.
Preliminary conclusion I

- coefficient for $NR$ is negative, thus confirming the resource curse
- level of democratic development is important to neutralize the effect of the resource curse in LAC economies
- estimated thresholds: 65 - 74
- only Venezuela, RB has insufficient institutional quality to insulate the economy from the resource curse
- How to improve the quality of democratic institutions?
Democracy itself is based on the principle of transparent governance: transparency is a key principle to resource management (Haufler, 2010)

- transparency in revenue allocations enables people to hold others accountable for their actions
- transparency is a way to lightly regulate extractive private sector activities
- disclosure by both firms and governments regarding:
  - details of the call for proposals and bidding process for natural resources exploration and development contracts
  - payments made by companies to governments
  - the location of resources and size of reserves
  - government budgets for distributing resource rents
- empowerment of civil society
Conclusions and future research

Preliminary conclusion III

Limitations:

- little variation in $INS$
- missing data for other resource dependent countries such as Chile, Guyana, and Suriname

Future research:

- link between corruption and the resource curse in LAC region
- high degree of corruption might explain negative sign of $POL$
- reducing corruption can improve unequal distribution from natural resource income

**Figure:** Transparency International (2018)
Thank you.

lars.sorge[at]diw.de
References I

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Ross, M., (2009). Oil and Democracy Revisited. Manuscript, Department of Political Science, University of California Los Angeles, http://www.sscnet.ucla.edu/polisci/faculty/ross/, access date: 3 July 2018


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<td>Mean VIF</td>
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</table>
Model 1

$$\Delta GDP_{it} = \phi_i(GDP_{i,t-1} - \theta_{0i} - \theta_{1i}C_{it} - \theta_{2i}L_{it} - \theta_{3i}NR_{it} - \theta_{4i}INS_{it} - \theta_{5i}(NR_{it} \times INS_{it})) + \delta_{11i}\Delta C_{it} + \delta_{21i}\Delta L_{it} + \delta_{31i}\Delta NR_{it} + \delta_{41i}\Delta INS_{it} + \delta_{51i}(\Delta NR_{it} \times \Delta INS_{it}) + \epsilon_{it}$$

- number of lags $j$ are determined using information criteria (SBIC)
- Important missing countries: Chile (10.49%), Guyana (19.31%), Suriname (29.02%)