Democracy and Growth Volatility

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Background

- Volatility of growth rate differs substantially across the countries
- Most volatile country is 7 times more volatile than the least volatile country
• Volatility of growth rate differs substantially across the countries
• Most volatile country is 7 times more volatile than the least volatile country
• Why is the growth rate in some countries more volatile than in others?
Reasons for difference

A variety of reasons for differences in volatility proposed in the literature:

- Pure chance—Acemoglu and Zilibotti (1997), Easterly et. al. (1993)
- Initial income or poverty—Acemoglu and Zilibotti (1997), Kraay and Ventura (2000)
- Inequality—Rodrik (1998)
- Conflicts—Rodrik (1999)
- Openness—Harrison (1995)
What we do

• Empirically show that volatility of growth rate and the polity of the country are negatively related

• The relationship is significant even with a variety of controls, including the list of variables mentioned earlier

• Provide a link between polity and volatility through optimal tax-transfer policy

• Build a model of optimal taxation with embedded political structure

• Show in that model: Polity $\Rightarrow$ tax and redistribution $\Rightarrow$ volatility
Polity Data

- Polity IV project: Political Regime Characteristics and Transitions, 1800-2002
- Polity data: scale of -10 (strongly autocratic) to +10 (strongly democratic)
- Democracy if
  - political participation is fully competitive
  - executive recruitment is elective
  - constraints on chief executive are substantial
Examples of Average Polity Scores for 1962-1996

<table>
<thead>
<tr>
<th>Country</th>
<th>Polity Score</th>
<th>Country</th>
<th>Polity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>10.0</td>
<td>Argentina</td>
<td>0.0</td>
</tr>
<tr>
<td>Ghana</td>
<td>-4.0</td>
<td>Syria</td>
<td>-8.0</td>
</tr>
</tbody>
</table>
Regression Results: No Control Variable

Dependent variable (Y): Standard deviation of growth rates

<table>
<thead>
<tr>
<th>X</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polity Score</td>
<td>-0.0541</td>
<td>-0.0513</td>
<td>-0.0393</td>
<td>-0.0457</td>
<td>-0.0498</td>
<td>-0.0430</td>
</tr>
<tr>
<td></td>
<td>(-7.0194)</td>
<td>(-4.2786)</td>
<td>(-5.1301)</td>
<td>(-4.7491)</td>
<td>(-6.5991)</td>
<td>(-3.3199)</td>
</tr>
<tr>
<td>Initial Income</td>
<td></td>
<td>-0.0014</td>
<td></td>
<td></td>
<td></td>
<td>0.0007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-0.3064)</td>
<td></td>
<td></td>
<td></td>
<td>(0.1895)</td>
</tr>
<tr>
<td>Inequality</td>
<td></td>
<td></td>
<td>0.0003</td>
<td></td>
<td></td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.2574)</td>
<td></td>
<td></td>
<td>0.9395</td>
</tr>
<tr>
<td>Durability of Regimes</td>
<td></td>
<td></td>
<td></td>
<td>0.0001</td>
<td></td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.5660)</td>
<td></td>
<td>(0.5960)</td>
</tr>
<tr>
<td>Openness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0003</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.7842)</td>
<td>(1.7701)</td>
</tr>
</tbody>
</table>
Regression Results: With Control Variables

- Control Variables: Initial Income, Average Population Growth Rate, Human Capital, Average Investment Rate
- None of the variables except polity is significant
- We also use Gastil Scale instead of polity, different years of analysis, the result is the same
Regressing in Stages

• First:
  - We regress volatility on variable X (with and without controls)
  - In the second stage we regress the residuals on polity
  - The coefficient on polity is always significant

• Then we do the reverse:
  - We regress volatility on polity and find the residuals (with and without controls)
  - In the second stage we regress the residuals on variable X
  - Only openness is significant without controls, none significant with controls
Regressing in Stages

• First:
  
  • We regress volatility on variable X (with and without controls)
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Volatility of growth rates and polity are negatively correlated - less democratic countries are more volatile
Model: Basic Idea

- Less democratic country $\Rightarrow$ less representative
- Government cares about the welfare of a fraction of the population
- It maximizes the welfare of that fraction and not the whole population
- Taxes are uniform across the population, but the government gives transfer only to the favored group
- Smaller is the size of that fraction, less democratic is the country
Model: The Setup

- Infinite horizon model with two groups: group A of measure \( \lambda \) and group B of measure \( (1 - \lambda) \)
- Each group maximizes their own life-time utility given the policies
- \( Y = \theta K^\alpha L^{1-\alpha} \), \( \theta \): a two-state Markov chain
- Government chooses
  - Uniform tax rate, \( \tau \), for the whole population
  - Transfer, \( T \), to group A only
- Policy chosen to maximize group A’s utility subject to equilibrium conditions & govt. budget
- Here \( \lambda \) is a measure of democracy. Perfect democracy means \( \lambda = 1 \)
Model: Timing of Events

- Current productivity shock $\theta_t$ is realized. This determines current wage and rate of return to capital:

  $$w_t = (1 - \alpha)\theta_t K_{t-1}^{\alpha}$$
  $$r_t = \alpha \theta_t K_{t-1}^{\alpha-1}.$$  

- Current income tax rate $\tau_t$ is determined according to the rule $\tau_t = \Phi(\theta_t|s^{t-1})$ set in the previous period.

- Transfers and after tax incomes are determined as:

  $$I_t^A = (w_t + r_t k_{t-1}^A)(1 - \tau_t) + T_t$$
  $$I_t^B = (w_t + r_t k_{t-1}^B)(1 - \tau_t)$$
  $$T_t = \frac{1}{\lambda} \tau_t \theta_t K_{t-1}^{\alpha}.$$
Model: Timing of Events – continued

- The government sets and announces income tax rate rule 
  \( \tau_{t+1} = \hat{\Phi}(\theta_{t+1}|s^t) \) to be applied next period.

- Agents of both types \((j = A, B)\) divide their after-tax income into consumption and (non-negative) investment: \( c^j_t + k^j_t = l^j_t \).

- Agents derive utility from current consumption \( u(c^j_t) \), and carry \( k^j_t \) over to the next period.

- The aggregate capital to be carried over to the next period is:
  \[
  K_t = \lambda k^A_t + (1 - \lambda)k^B_t.
  \]

- End of period \( t \).
Model: Expectations about Policy

- When forming expectations of the future the government and agents of both types assume that from period $t + 2$ onward the government will follow policy $\Phi$:

\[
\begin{align*}
\tau_{t+2} &= \Phi(\theta_{t+2}|s^{t+1}) \\
\tau_{t+3} &= \Phi(\theta_{t+3}|s^{t+2}) \ldots
\end{align*}
\]

- We are solving for a stationary Markov-perfect equilibrium, i.e.:

\[
\hat{\Phi} = \Phi
\]
Agents’ Problem

Agent A’s problem:

\[
V^A(I_t^A, I_t^B, \theta_t | \Phi) = \max_{c_t^A, k_t^A} \left\{ u(c_t^A) + \beta E_t[V^A(I_{t+1}^A, I_{t+1}^B, \theta_{t+1} | \Phi)] \right\}
\]

subject to:

\[
\begin{align*}
    c_t^A + k_t^A & \leq I_t^A \\
    I_{t+1}^A & = (w_{t+1} + r_{t+1} k_t^A)(1 - \tau_{t+1}) + T_{t+1}
\end{align*}
\]

Given,

\[
\begin{align*}
    I_{t+1}^B & = (w_{t+1} + r_{t+1} k_t^B)(1 - \tau_{t+1}) \\
    T_{t+1} & = \frac{1}{\lambda} \tau_{t+1} \theta_{t+1} K_t^\alpha \\
    \tau_{t+1} & = \Phi(\theta_{t+1} | I_t^A, I_t^B, \theta_t).
\end{align*}
\]

Agent B solves similar problem, but gets no transfers.
Government’s Problem

The government sets next period taxes to solve:

$$W(I_t^A, I_t^B, \theta_t|\Phi) = \max_{\tau_{t+1}^H, \tau_{t+1}^L} \{u(c_t^A) + \beta E_t[W(I_{t+1}^A, I_{t+1}^B, \theta_{t+1}|\Phi)]\}$$

subject to:

$$c^j_t + k^j_t = I^j_t$$

$$u'(c^j_t) \geq \beta E_t\{u'(c^j_{t+1})r_{t+1}(1 - \tau_{t+1})\}$$

$$I_{t+1}^A = (w_{t+1} + r_{t+1}k_t^A)(1 - \tau_{t+1}) + T_{t+1}$$

$$I_{t+1}^B = (w_{t+1} + r_{t+1}k_t^B)(1 - \tau_{t+1})$$

$$T_{t+1} = \frac{1}{\lambda} \tau_{t+1} \theta_{t+1} K_t^\alpha$$

$$K_t = \lambda k_t^A + (1 - \lambda)k_t^B$$

where $j = \{A, B\}$. 
Simulation

- \( u(c) = c^{1-\nu} / (1 - \nu) \)

- Parameter values

<table>
<thead>
<tr>
<th>( \nu )</th>
<th>( \beta )</th>
<th>( \alpha )</th>
<th>( \theta^H )</th>
<th>( \theta^L )</th>
<th>( \rho )</th>
<th>( \delta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.95</td>
<td>0.34</td>
<td>1.05</td>
<td>1</td>
<td>0.95</td>
<td>1</td>
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</table>
# Simulation Results

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Cons.A</th>
<th>Cons.B</th>
<th>Tax rate</th>
<th>Gr. rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>λ = 0.1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.609</td>
<td>0.083</td>
<td>0.648</td>
<td>0.000</td>
</tr>
<tr>
<td>Std.D.</td>
<td>0.320</td>
<td>0.039</td>
<td>0.119</td>
<td>4.004</td>
</tr>
<tr>
<td>Max</td>
<td>10.361</td>
<td>5.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>λ = 0.9</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.397</td>
<td>0.324</td>
<td>0.119</td>
<td>0.000</td>
</tr>
<tr>
<td>Std.D.</td>
<td>0.014</td>
<td>0.011</td>
<td>0.003</td>
<td>1.276</td>
</tr>
<tr>
<td>Min</td>
<td>-4.762</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>5.001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Simulation Results

St.Dev. of growth rates against lambda (model)
## Simulation Results

<table>
<thead>
<tr>
<th>$\lambda$</th>
<th>St. Dev. of gr. rates</th>
<th>Corr. of output &amp; optimal tax rate</th>
<th>Corr. of output &amp; cons. of A</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>4.004</td>
<td>-0.1442</td>
<td>0.3278</td>
</tr>
<tr>
<td>0.9</td>
<td>1.276</td>
<td>0.0087</td>
<td>0.9998</td>
</tr>
</tbody>
</table>
Model: How it Works

- Government uses fiscal policy to insure group A at the expense of group B
- When there is a bad shock, marginal utility of group A is high → gains from a higher transfer outweigh distortionary costs of additional tax
- Implies taxes are higher for a bad shock compared to a good shock - pro-cyclical tax rates
- Pro-cyclic tax rates lead to higher volatility
- Per capita gain from a given transfer is decreasing in $\lambda$, but cost of a given tax is unchanged
- More pro-cyclic in less democratic countries (low $\lambda$) ⇒ non-democratic countries are more volatile than democratic countries
# Simulation Results - Autocorrelation

<table>
<thead>
<tr>
<th>$\lambda$</th>
<th>Autocorrelation of Growth Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>-0.332</td>
</tr>
<tr>
<td>0.2</td>
<td>-0.293</td>
</tr>
<tr>
<td>0.3</td>
<td>-0.197</td>
</tr>
<tr>
<td>0.4</td>
<td>0.024</td>
</tr>
<tr>
<td>0.5</td>
<td>0.203</td>
</tr>
<tr>
<td>0.6</td>
<td>0.236</td>
</tr>
<tr>
<td>0.7</td>
<td>0.289</td>
</tr>
<tr>
<td>0.8</td>
<td>0.314</td>
</tr>
<tr>
<td>0.9</td>
<td>0.321</td>
</tr>
</tbody>
</table>
Polity and Autocorrelation of Growth rates - Model

Autocorrelation of growth rates against lambda (model)
Polity and Autocorrelation of Growth Rates - Data

Autocorrelation coefficient of RGDP growth rates, 1962–1996

1962–1996 Average Polity Index

Data
Conclusions

- Volatility of growth rate is negatively related to the polity of the country
- Optimal fiscal policy depends on the political structure of the country
- Differences in the optimal fiscal policy lead to higher volatility in non-democratic countries compared to democratic countries