Geographical Analysis of Poverty – Growth and Inequality in Developing Countries

by

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Introduction

- Poverty reduction and acceleration of economic growth have been primary targets of policy makers in many developing countries.

- Millennium Development Goal (2015) is a good example.

- Poverty trend: In the past two decades, there has been a decline in the number of extreme poor (living on less than $1 per day) by 200 million (Dollar and Kraay, 2003; Bourguignon and Morrisson, 2001; Chen and Ravallion, 2001).

- Mostly in East and South Asia compared to Sub-Saharan Africa (Dollar and Kraay, 2003; Easterly and Levine, 1998).
Some purported reasons for the variation in poverty reduction include differences in:

- Quality of economic and political institutions
- Levels of Urbanization and access to urban areas (World Bank, 2009; Partridge and Rickman GAP 2006, JRS, 2008a, CJRES, 2008b)
- Trade policies
- Level of income disparity
- Geography and difference in natural resource endowments
- Level of foreign aid
- Ethno-demographic composition
Introduction Ctd:

- Growth is the core driving factor in reducing poverty
  - Understanding cross country determinants of economic growth is key—
  - YET, MORE WORK NEEDED ON WITHIN COUNTRY CAUSES—E.G., Brazil, Chile, Argentina—á la the work by Partridge and Rickman & Chokie and Partridge for Canada and the U.S.

- Focus on the cross-country own socio-economic and policy variables avoiding the importance of “place” in shaping the level of growth (Partridge and Rickman, 2006; Abrue et al., 2005)

- Attention shifted towards economic institutions (Acemoglu et al., 2004; Hall and Jones 1999; Glassier and et al., 2004)
  - Recent attention: historical instruments as a proxy for current institutions

- Major question: should “Place-based” or “People-based” policies be used?
Introduction ctd.

- Objective: to model Poverty-growth and inequality interaction across countries

- Spatial simultaneous equation model of these endogenous variables (Two Steps)

- First address the cross country determinants of growth and income inequality

- Expand this to the issue of poverty determinants with particular attention on growth and income inequality in a spatial fashion
Context

- Development is not a purely an economic phenomenon.
- Prevalence of countries in the world mired in poverty despite achieving significant economic growth is an indication.
- Reorganization and Reorientation of entire economic and social system (Todaro and Smith, 2003)

Conceptually and Empirically Link
- Poverty-Growth
- Poverty-Inequality
- Poverty-Institutions, Geography and Aid assistance
Context Ctd..

Growth is fundamental (Pro-poor ?)

- Yes. If increase in average income is coupled with a high sensitivity of poverty to growth in average income (Kraay, 2005)

- Ravallion and Chen (1997) found the growth elasticity of poverty around 3

- Bourguignon (2002): There is cross-country heterogeneity behind the average figure.
  - Cautionary Note: growth per se is not the panacea for global poverty, it is still the main central driving force for reducing poverty (Dollar and Kraay, 2002)
Inequality affects poverty in two Channels:

- Effect on the level of growth; the second channel is the post growth distribution pattern

- Partridge (JRS, 2005) : rich Versus poor countries, regions versus nations, cross sectional versus time series evidence

- Barro (1999)- increases growth in rich countries and retards growth in poor countries

- With regards to poverty, Chen and Ravallion (2001) : Inequality does not put a brake to poverty
Context ctd…


- Transportation costs, disease burdens and agricultural productivity etc. (Sachs et al., 1998)

Institutions and Poverty:

North (1981) as “a set of rules, compliance procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals in the interest of maximizing the wealth or utility of principals”

- Index of Civil Liberties

Poverty and Aid (effective everywhere?)

- Helps in developing policies, training of public and private sectors etc.
Methodology and Data

Following Ali and Elbadawi (1999)

Direct and Induced Effects:

\[ \text{Growth} : g_i = g(\theta_i, X_i, wX_i, wg_i) \]

\[ \text{Inequality} : \theta_i = \theta(\mu_i, X_i) \]

\[ \text{Poverty} : \ln(P_i) = \ln(P_i(\theta_i, X_i, wX_i, wg_i)) \]

\[ \frac{dP_i}{P_i} = \gamma(\mu_i, \theta_i) \frac{d\theta_i}{\theta_i} + \eta \left[ (I - \rho W)^{-1} [(\mu_i, \theta_i) \frac{d\mu_i}{\mu_i} + (\mu_i, \theta, X)(I + \rho W)] \right] \frac{d\mu_i}{\mu_i} \]
Methodology and Data Ctd..

Empirical Estimation:

**Growth**

\[
g_{i,1985-1990} = \alpha_2 + \kappa \text{Income}_{i,\text{initial}} + \phi_2 \cdot \theta^{**}_{i,1985-1990} + X_{i,1965-1985} \beta + \]

\[
\alpha_2 \cdot \text{insti}_{i,1965-1985} + \lambda_2 \cdot \text{Geog}_{i} + \xi \text{Cont}_{i} + \epsilon_{1i,t}
\]

**Inequality**

\[
\theta_{i,1985-1990} = \alpha_3 + \psi \theta^{\text{initial}}_{i,1985-1990} + \lambda_3 \cdot g^{**}_{i,1985-1990} + X^G_{i,1965-1985} \beta + \epsilon_{2i,t}
\]

**Poverty**

\[
P_{i,1985-1990} = \alpha_1 + \phi_1 \cdot \theta^*_{i,1990-1985} + \lambda_1 \cdot g^*_{i,1990-1985} + X^P_{i,1965-1985} \beta + \lambda_1 \cdot \text{Geog}_{i} + \epsilon_{i,t}
\]
Methodology and Data Ctd..

- **OLS: Growth and Inequality**
  \[ Y_i = \beta_0 + \sum_k \beta_k X_{i,k} + \epsilon_i \]
  \[ \beta = (X'X)^{-1}(X'Y) \]

- **GWR: Poverty**
  \[ Y_i = \beta_0(\omega, \bar{\omega}) + \sum_k \beta_k(\omega, \bar{\omega})X_{i,k} + \epsilon_i \]
  \[ \beta(\omega, \bar{\omega}) = (X'W(\omega, \bar{\omega})X)^{-1}(X'W(\omega, \bar{\omega})Y) \]

- **if** \( D_{ij} < h_i \)
- \( D_{ij} \) distance between geographic centroids of neighbors
- \( h \) is the cut-off distance or the bandwidth for observation \( i \)
- \((\omega_i, \bar{\omega}_i)\) are geographic co-ordinates of country \( i \).
Methodology and Data Ctd.

Growth Regression

- Gini (1985-1990), Other explanatory Variables (1965-1985)

- Instrumental Variable Regression (IV Regression)

- (Proxy Inequality: Measure of Societal heterogeneity)

- Ethnic Fraction (Two random individuals belong to two different ethnic groups)

- Linguistic Diversity ( % of population who do not speak the most commonly used language)

- Rationale: Polarization/ sub optimal public policy, financial repression and rent seeking
Methodology and Data Ctd..

Growth (1965-1985)

- Initial income (Convergence)
- Institutions (Index of Civil Liberties) (Not Democracy)
- Human Capital (Education Variables)
- Urbanization (Agglomeration), Foreign Assistance Level
  - Weakness is that lack of intra-country variables and attributes.
- Geography (Landlocked/ Tropics)
- Region Dummies
- Future research will consider New Economic Geography measures
Methodology and Data Ctd..

Inequality Regression

- Growth (Instruments)
- Distance of the country’s centroid to the nearest navigable river/ ice free seacoast
- Rationale: Openness to trade: Access to diffusion of information and technology
- Initial Level Inequality: higher initial level of inequality over time tends to propagate the initial distribution over time (Sylwester, 2003)
- Ethnic Fraction and Linguistic Fraction
Methodology and Data Ctd...

Poverty Regression (GWR and OLS Comparison)

- GWR: Ecological fallacy, modifiable aerial root, controlling for country fixed effects, mitigation of multicollinearity and offsets the presence of outlier estimates.

- Country specific poverty-growth and inequality interaction estimates

- Main focus: Growth and Inequality (Predicted Values)

- Demographic (Dependency ratio, Human Capital)

- Urbanization Rate, Aid, Geography (% land in Tropics)
Data Sources

56 Developing Countries (Asia, Africa & Latin America): 1965-1990

- Panel data for 138 Countries” (Barro and Lee, 1994)

- Poverty: Poverty Monitoring Database (PovcalNet)

- Inequality: United Nations University NU/WIDER World Income Inequality Database

- Easterly and Levine (1997) (Ethno-linguistic)

- Gallup et al., 1999 (Geography)

- Respective country statistics offices
Figute 1. Geographic Distribution of Poverty
(Percentage of Population Earning Less than $1 a day)

Note: The Data for poverty rate is 1985 - 1990 Average
Regression Results

Growth (IV Regression)

- Inequality retards growth

- Market imperfection, social unrest effects of inequality could be higher in LDCs

- Initial level of income (negative and significant) convergence (Barro and Sala Martin, 1995)

- Quality institutions spur growth: Property rights and Stability

- Negative Aid effect (Market distortion)

- Geography, Human capital, Urbanization and Black Market premiums (No effect)
Regression Results ctd..

- Validity of the ethno-linguistic variables used as instruments for income inequality
- Over-identification test (Sargan Test) is performed
- The instruments are orthogonal (Valid)
- Test instrumental relevance (weak instruments)
- Statistical significance based on the Stock-Yogo critical values
- Instruments are slightly strong
Regression Results Ctd.

Inequality IV Regression

- Growth (No explanatory power over inequality)
- Initial level of inequality (lagged adjustment)
- Ethnic Fraction (Negative and significant) Unexpected
- Language Diversity (Positive and Significant)
- Pay-offs fall as the quality of information declines due to language barriers, Leigh (2006)
- Instruments for growth are valid but marginally relevant
## Poverty Regression: Global and Geographic Weighted Regression Parameter Summary

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Lower Quartile</th>
<th>Median</th>
<th>Global (OLS)</th>
<th>Upper Quartile</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged Poverty (1965-85 Average)</td>
<td>-0.30</td>
<td>0.48</td>
<td>0.70</td>
<td>0.42↑↑</td>
<td>0.88</td>
<td>1.22</td>
</tr>
<tr>
<td>Growth (1985-90 Average)***</td>
<td>-1.62</td>
<td>-0.13</td>
<td>-0.09</td>
<td>-0.09↑↑</td>
<td>-0.04</td>
<td>0.11</td>
</tr>
<tr>
<td>Gini (1985-1990 Average)**</td>
<td>-0.22</td>
<td>-0.02</td>
<td>0.001</td>
<td>0.01↑↑</td>
<td>0.06</td>
<td>0.12</td>
</tr>
<tr>
<td>Primary Education Enrolment Rate (1965-1985 Average)***</td>
<td>-13.79</td>
<td>-1.13</td>
<td>0.06</td>
<td>-0.33</td>
<td>2.07</td>
<td>9.59</td>
</tr>
<tr>
<td>Secondary Education Enrolment Rate (1965-1985 Average)</td>
<td>-7.97</td>
<td>-5.96</td>
<td>0.49</td>
<td>-2.47↑↑</td>
<td>3.05</td>
<td>6.70</td>
</tr>
<tr>
<td>Higher Education Enrolment Rate (1965-1985 Average)</td>
<td>-7.04</td>
<td>2.07</td>
<td>8.29</td>
<td>7.48</td>
<td>8.80</td>
<td>16.32</td>
</tr>
<tr>
<td>% Aid -GDP (1965-1985 Average)</td>
<td>-5.50</td>
<td>-1.14</td>
<td>-0.37</td>
<td>0.97</td>
<td>0.79</td>
<td>3.02</td>
</tr>
<tr>
<td>Dependency Ratio (1965-1985 Average)</td>
<td>-2.93</td>
<td>-2.51</td>
<td>0.42</td>
<td>-1.21↑↑</td>
<td>0.92</td>
<td>1.21</td>
</tr>
<tr>
<td>Urbanization Rate (1965-1985 Average)</td>
<td>-0.06</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.02↑↑</td>
<td>-0.02</td>
<td>0.08</td>
</tr>
<tr>
<td>% Land Tropics</td>
<td>-1.51</td>
<td>-0.69</td>
<td>0.37</td>
<td>-0.06</td>
<td>1.88</td>
<td>3.31</td>
</tr>
<tr>
<td>No. of observations</td>
<td>56</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.85</td>
<td>0.74</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>F-stat of GWR improvement over OLS</td>
<td>4.05↑↑</td>
<td>n.a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The Variables growth and gini (1985-1990) in this poverty regression are the predicted values from the two stage least square growth and inequality regression respectively. Note that ***, **, or * on variables indicate significant spatial variations in GWR coefficients of these variables at 1%, 5%, or 10% levels respectively, as determined by the Monte Carlo test described in Fotheringham et al. (2002) and Charlton et al. (2003). A ↑↑↑, ↑↑, or ↑ indicate that the parameter is significantly different from zero at 1%, 5%, or 10% levels respectively.*
Regression Results cont...

Poverty Regression (GWR vs. OLS)

- Comparison (Partial Elasticity)

- The OLS results are non-spatial; the coefficients show the average influence over all developing countries

- OLS: Lagged Poverty Rate (intergenerational nature of poverty)

- Urbanization inversely related to absolute poverty
  - Higher level of urbanization gives access to relatively higher paying jobs compared to the agriculture centered rural sector

- Human Capital (Only Secondary level Negative)
Regression Results ctd...

- Partial elasticity: Growth (-0.09), Inequality (0.01)
- Total elasticity (-3.2%) for growth and (0.01%) for inequality.
- That is a 10% growth in income will reduce poverty by slightly more than 30%, *ceteris paribus*
- Growth elasticity similar to: Adams (2003) and Chen and Ravallion (1997)
- Global mean, i.e., it puts all countries that have exhibited a decline in inequality and a growth in income as well as those with a rise in inequality and income
Regression Results ctd..

- GWR significantly improves adjusted $R^2$ from 0.74 to 0.85
- Focus on Spatial Heterogeneity (Median)
- Monte Carlo significance test (Fotheringham et al. (2002) and Charlton et. al. (2003)
- Growth, inequality and Primary Level Education exhibit systematic geographic variation
- Interestingly, lagged poverty higher effect in Sub-Saharan Africa
- Urbanization rate is positively related to growth only in 6 countries (Mexico, Bangladesh, Indonesia, Malaysia, Philippines and Thailand)
The Geographic Variation of the Coefficient of Economic Growth
Geographic Variation for the Coefficient of Income Inequality (Gini)
Figure 3. The Geographic Variation of the Coefficient of Primary Level Enrolment Rate

- **2.071 - 9.593**
- **0.057 - 2.071**
- **-1.131 - 0.057**
- **-13.789 - -1.131**
- **Not Used**

Countries are color-coded based on the coefficient range.
Conclusion and Policy Implications

- Does growth “Lift all Boats”?

- Inequality is bad for growth

- Institutions (Civil Liberties) matter more than geography

- Growth has a limited effect on the level of income inequality

- Growth alone cannot correct income disparity, calling for public policies designed to promote optimal reallocation of resources

- Augment economic growth by lifting the “inequality” brake
Conclusion and Policy Implications Ctd..

- Poverty: growth and inequality effects vary across developing countries
- Growth effect on poverty reduction higher in low inequality countries (Asia vs. Sub-Saharan African and Latin American)
- Addressing the problem of income inequality will have double dividends
- Pro-poor growth (rural oriented growth strategies that target in provision of education, and other infrastructure facilities in rural areas along with creation of labor intensive jobs for the poor to actively participate in the growth generation process)
Next Steps

- Better controls for urban growth and urban access—current controls are too aggregate to find an effect
- More within country work—e.g., Chile is not a homogenous block, but is a rich country with a different North-South and Santiago at the core.
Thank You!

Question/ Comments