Income Inequality, Trade and Financial Openness

G.C. Lim and Paul D. McNelis

January 2014
Order of Presentation

- Introduction
- Empirical analysis
  - data set of low to middle income countries (based on GDP per capita)
  - panel data results
- Model: DSGE model with income distribution
  - small open economy with natural resources
  - labour-rich, capital poor
- Simulation analysis
  - insights into relationships between openness and Gini
  - role of labour intensities
- Concluding remarks
Inequality: Changing Tolerance

- Hirschman and Rothschild (1974): diminishing tolerance for the tunnel effect
- Kuznets: inverted U curve between inequality and growth. Dual economy hypothesis
- Kaldor: inequality helps development because rich save more
- Deaton and the Great Escape: some are left behind
- Dollar and Kray: growth is good for the poor
- Question: are trade and financial openness more effective for reducing inequality?
- Openness defines with respect to trade, foreign aid and FDI.
Globalization

- Jaumotte, Lall and Papageorgiou (2008): technology increases inequality
- Globalization has ambiguous effect.
- Trade reduces inequality while foreign investment increases inequality
- If openness does not matter, education and technology are the remaining options
- Which mechanisms ensure that growth (through trade or financial liberalization) reduce inequality?
Data Sets

- Poorest is Tanzania with 10% of world’s mean per-capital GDP.
- Brazil has highest Gini, Bulgaria has lowest
- Brazil has the lowest index of openness (20.5%), Honduras the highest (120.3%)
- Bangladesh has virtually no foreign investment
- Foreign aid for Mozambique is more than 33% of GDP
<table>
<thead>
<tr>
<th></th>
<th>Gini</th>
<th>dy</th>
<th>ry</th>
<th>gy</th>
<th>op</th>
<th>ay</th>
<th>fy</th>
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<tbody>
<tr>
<td><strong>Full sample (42)</strong></td>
<td></td>
<td></td>
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<tr>
<td>mean</td>
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<td>1.375</td>
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<td>17.237</td>
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<td>17.736</td>
<td>56.672</td>
<td>13.162</td>
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<td>42.930</td>
<td>0.957</td>
<td>22.378</td>
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<td>mean</td>
<td>41.431</td>
<td>1.033</td>
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<td>17.949</td>
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<td>2.763</td>
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<td>67.766</td>
<td>14.764</td>
<td>61.556</td>
<td>1.593</td>
<td>1.710</td>
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<td><strong>Upper-Middle Income Countries (10)</strong></td>
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<tr>
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<td>2.147</td>
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<td>15.216</td>
<td>70.960</td>
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<td>median</td>
<td>47.438</td>
<td>2.121</td>
<td>124.808</td>
<td>14.335</td>
<td>64.024</td>
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<td>2.645</td>
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### Correlation Coefficients with the Gini (Pooled Data Sets)

<table>
<thead>
<tr>
<th></th>
<th>dy</th>
<th>ry</th>
<th>gy</th>
<th>op</th>
<th>ay</th>
<th>fy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-set</td>
<td>-0.048</td>
<td>0.165*</td>
<td>-0.142*</td>
<td>-0.132*</td>
<td>0.048</td>
<td>-0.015</td>
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<tr>
<td>Low</td>
<td>-0.208*</td>
<td>0.043</td>
<td>0.189*</td>
<td>-0.102</td>
<td>0.259*</td>
<td>0.185*</td>
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<tr>
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<td>-0.244*</td>
<td>-0.325*</td>
<td>-0.002</td>
<td>0.208*</td>
<td>-0.057</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>-0.299*</td>
<td>0.243*</td>
<td>0.500*</td>
<td>-0.726*</td>
<td>-0.378*</td>
<td>-0.141**</td>
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</table>

Note: * Significant at the 5% level
Correlations with the Gini (summary of country-specific results)

<table>
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<th>Openness</th>
<th>FA</th>
<th>FDI</th>
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<td>Full set of 42 countries</td>
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<td>0.082</td>
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<td></td>
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<td>-0.911</td>
<td>-0.740</td>
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<tr>
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<td>maximum</td>
<td>0.958</td>
<td>0.868</td>
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<tr>
<td>Low Income</td>
<td>mean</td>
<td>0.049</td>
<td>0.034</td>
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<tr>
<td></td>
<td>minimum</td>
<td>-0.911</td>
<td>-0.530</td>
</tr>
<tr>
<td></td>
<td>maximum</td>
<td>0.958</td>
<td>0.677</td>
</tr>
<tr>
<td>Lower-Middle</td>
<td>mean</td>
<td>0.474</td>
<td>0.088</td>
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<tr>
<td></td>
<td>minimum</td>
<td>-0.887</td>
<td>-0.408</td>
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<tr>
<td></td>
<td>maximum</td>
<td>0.917</td>
<td>0.791</td>
</tr>
<tr>
<td>Upper-Middle</td>
<td>mean</td>
<td>-0.229</td>
<td>0.062</td>
</tr>
<tr>
<td></td>
<td>minimum</td>
<td>-0.885</td>
<td>-0.740</td>
</tr>
<tr>
<td></td>
<td>maximum</td>
<td>0.952</td>
<td>0.868</td>
</tr>
</tbody>
</table>
Panel estimation (with country and time specific fixed effects):

\[ GN_{it} = \alpha_i + \alpha_t + \beta_1 dy_{it} + \beta_2 ry_{it} + \beta_3 gy_{it} + \beta_4 op_{it} + \beta_5 ay_{it} + \beta_6 fy_{it} + \epsilon_{it}; \]
\[ \epsilon_{it} \sim N(0, \sigma^2_{\epsilon}) \]

<table>
<thead>
<tr>
<th></th>
<th>dy_{it}</th>
<th>ry_{it}</th>
<th>gy_{it}</th>
<th>op_{it}</th>
<th>ay_{it}</th>
<th>fy_{it}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-dataset</td>
<td>-0.197*</td>
<td>-0.033**</td>
<td>0.209*</td>
<td>0.051*</td>
<td>0.037</td>
<td>0.075</td>
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<tr>
<td>Low-Income</td>
<td>-0.429*</td>
<td>0.354*</td>
<td>-0.063</td>
<td>0.090*</td>
<td>0.023</td>
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<tr>
<td>Lower-Middle</td>
<td>-0.155*</td>
<td>-0.002</td>
<td>0.230*</td>
<td>0.099*</td>
<td>-0.189*</td>
<td>-0.049</td>
</tr>
<tr>
<td>Upper-Middle</td>
<td>0.039</td>
<td>-0.095*</td>
<td>-0.158</td>
<td>-0.068*</td>
<td>-1.176*</td>
<td>0.174**</td>
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</tbody>
</table>

Note: * Significant at 5% level, ** Significant at 10% level
Key result of panel: growth and relative income have significant effects on inequality

For relatively more prosperous, relative income more important

For low-income countries, growth of income reduces inequality

In these countries, widespread increase in income needed to reduce poverty and inequality.

Higher government spending as a share of GDP, increases inequality (Rudra 2004)

She argued that spending programs in the lower income countries have much greater political lobbying

There are thus little redistributive effects of public spending
Positive effect of FDI on Gini
Corroborates positive results of Feenstra and Hanson (1997) on wage inequality in Mexico
Basu and Guariglia (2007): FDI reduces agricultural share of GDP
Little evidence that aid reduces inequality, similar to Calderón and Chong (2006)

Deaton: aid which reduces mortality rates increases the population of poor people.

Perverse effects: access to foreign aid flows makes governments less accountable to domestic constituents,
Trade openness has negligible effects for low income countries, but has significant negative effects for the middle income countries.

Gourdon, Maystre, and de Melo (2008): initial endowments with respect to skilled labour, matter most.


Munschi (2012) on Bangladesh: greater openness led to increase in labour intensive industries.

Turnovsky (2013): many stories to tell based on empirical results.

Ehrlich and Kim (1997), these empirical results provide evidence of empirical associations,
DSGE Model: Key Features

- Stylised low-income economy
- Households
  - heterogeneous agents with different labour endowments
  - Gorman polar form utility function
- Production of Two Types of Goods
  - tradeables with prices determined globally
  - non-tradeables with market-clearing prices
- Financial sector
  - accepts deposits from households, borrows from foreigners
  - lends to public sector and firms
- Public sector
  - manages government expenditures
  - taxes labour income and consumption
  - sets exchange rate
Heterogeneous agents with one unit of time, for work and leisure

Gorman Polar Form Utility:

$$\max_{C,L,K^h,M} E_0 \sum_{t=0}^{\infty} \beta^t \left( \frac{1}{\eta} (C_t)^{\eta} (V_t)^{\omega \eta} G_t^{\chi \eta} \right)$$

Consumption is a basket of traded and non-traded goods

Households accumulate capital and rent to firms:

$$K_t^h = (1 - \delta)K_{t-1}^h + I_t^h$$

Investment is imported

Parameter $\delta$ determines the replacement rate of imported capital goods
Budget Constraint and Euler Equations

- **Household budget constraint:**
  \[
  (1 - \tau^w) W_t (H - V_t) + (1 + R_{t-1}^m) M_{t-1} + R_t^k K_t^h + \Pi_t = (1 + \tau^c) P_c^t C_t + M_t + P_t^k I_t
  \]  
  \[3\]  

- **Euler Equations:**
  \[
  \omega C_t = \frac{(1 - \tau^w) W_t V_t}{(1 + \tau^c) P_t^c} \tag{5}
  \]
  \[
  \frac{(C_t)^{\eta-1} (V_t)^{\omega \eta} G_t^{\chi \eta}}{(1 + \tau^c) P_t} = E_t \left[ \beta (1 + R_t^m) \frac{(C_{t+1})^{\eta-1} (V_{t+1})^{\omega \eta} G_{t+1}^{\chi \eta}}{(1 + \tau^c) P_{t+1}^c} \right] \tag{6}
  \]
  \[
  (1 + R_t^m) \left( P_t^k - R_t^k \right) = E_t \left[ P_{t+1}^k (1 - \delta) \right] \tag{7}
  \]
Exports: natural resource products

\[ Y_t^x = C_t^x + X_t \]  \hspace{1cm} (8)

\[ \ln(X_t) = \rho^x \ln(X_{t-1}) + (1 - \rho^x) \ln(X) + \epsilon_t^x, \quad \epsilon_t^x \sim N(0, \sigma^x) \]  \hspace{1cm} (9)

Production function:

\[ Y_t^x = \overline{Z}_t^x \left( K_t^x \right)^{\alpha^x} \left( L_t^x \right)^{1-\alpha^x} \]  \hspace{1cm} (10)

Price of export goods:

\[ \ln(P_t^{x*}) = \rho^p \ln(P_{t-1}^{x*}) + (1 - \rho^p) \ln(\overline{P}^{x*}) + \epsilon_t^p, \quad \epsilon_t^p \sim N(0, \sigma^p) \]  \hspace{1cm} (11)

Wage bill (financed by borrowing from banks):

\[ N_t = W_t L_t^x \]  \hspace{1cm} (12)
\[ Y_t^h = G^k Z^h (K_t^h)^{\alpha^h} (L_t^h)^{1-\alpha^h} \] (13)

\[ Y_t^h = C_t^h + G_t \] (14)

\[ G_t = G_t^c + G_t^k \] (15)

\[ G_t^k = \zeta G \] (16)

- Government spending is for consumption and for infrastructure
Pricing, labour Mobility

- Flexible prices for home goods

\[ \Pi_t^h = P^h Y^h - W_t L_t^h - R_t^k K_t \]

- First order conditions:

\[ \frac{(\alpha^h) W_t}{(1 - \alpha^h) R_t^k} = \frac{K_t^h}{L_t^h} \]

- Labour is mobile across the two sectors

- Marginal costs:

\[ P_t^h = \frac{(W_t)^{1-\alpha^h} (R_t^k)^{\alpha^h}}{Z_t^h G_t^k} \cdot \left( \frac{1}{(\alpha^h)^{\alpha^h} (1 - \alpha^h)^{1-\alpha^h}} \right) \]  

(17)
Banks and Financial Sector

- Reserves and Lending Costs:
  \[ \Phi_m^t = \Phi_m^m + \phi_m^m(M_{t-1} - \bar{M}) \]  
  \[ \Phi_n^t = \Phi_n^n + \phi_n^n(N_{t-1} - \bar{N}) \]  

- Risk premium on foreign borrowing:
  \[ \Phi_s^t = \Phi_s^s + \phi_s^s(F_{t-1} - \bar{F}) \]
Interest Rates and Macroeconomic Identities

- FOC's of banks:

\[(1 + \Phi_t^n) (1 + R_t) = (1 + R_t^n) \] \hspace{1cm} (21)
\[(1 - \Phi_t^m) (1 + R_t) = (1 + R_t^m) \] \hspace{1cm} (22)

\[(1 + R_t) S_t = (1 + R_t^* + \Phi_t^s) S_{t+1} \] \hspace{1cm} (23)

- Foreign Debt

\[\bar{S}F_t = (1 + R_{t-1}^* + \Phi_{t-1}^s) \bar{S}F_{t-1} + \bar{S} P_{t}^{m*} I_t - \bar{S} P_{t}^{x*} X_t \] \hspace{1cm} (24)

- Domestic Debt:

\[B_t = (1 + R_{t-1}) B_{t-1} + P_t^h G_t - \tau_t^w W_t L_t - \tau_t^c P_t C_t - Q_t - P_t^z K_t^x \] \hspace{1cm} (25)

\[Q_t = \Phi_t^m M_t + \Phi_t^n N_t + (1 + R_t^n) N_t - (1 + R_{t-1}^n) N_{t-1} \] \hspace{1cm} (26)
Openness, FDI, and Aid

- Openness and GDP

\[ \Phi_t = \frac{S_t P^m_t I_t + S_t P^x_t X_t}{Y_t} \]

\[ Y_t = P^h_t Y^h_t + P^x_t Y^x_t \]  \hspace{1cm} (27)

- FDI Modification
  - foreigners own capital
  - capital disappears from household budget constraint
  - investment decision is discounted by return to portfolio investment

- AID Modification:
  - foreigners pay for investment goods
  - funds go to the government

  - funds going to government sector
Initial Endowments

- Each agent receives a share of initial deposits (money endowments) and share of profits:

\[
\Pi_t^i = h^i \Pi_t
\]  
(28)

\[
M_t^i = (1 + R_{t-1}^m) M_{t-1}^i + (1 - \tau_w^t) W_t \left[ 1 - \frac{(1 + \omega)^i V_t}{\omega} \right] 
+ h^i \Pi_t + h^i \left[ R^k_t K^h_t - P^k_t l_t \right]
\]  
(29)

\[
y_t^i = (1 - \tau^w) W_t (1 - \rho^i V_t) + (1 + R_{t-1}^m) M_{t-1}^i + h^i R^k_t K^h_t + h^i \Pi_t 
\]  
(30)

- Money endowments and leisure relation:

\[
\rho^i = \frac{1}{V} \frac{\omega}{1 + \omega} \frac{R^m M^i + (1 - \tau^w) W + h^i \Pi + h^i \left[ R^k - P^k \delta \right] K^h}{(1 - \tau^w) W}
\]  
(32)
Implication: richer members of the economy work less.

Income of about 90 per cent of workers is through the provision of labour services.
Inequality and Steady States

- Sums of Labour, Income and Money equal Aggregate Steady States:

\[
\sum_{i=1}^{H} M_t^i = \bar{M} \tag{33}
\]

\[
\sum_{i=1}^{H} V_t^i = H - \bar{L} \tag{34}
\]

- Deaton modified Gini index:

\[
DG = \frac{H + 1}{H - 1} - \frac{2}{(H - 1)} \frac{\sum_{i=1}^{H} p^i y_i}{\sum_{i=1}^{H} y_i}
\]
## Parameter Specification

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Definitions</th>
<th>Calibrated Values</th>
</tr>
</thead>
<tbody>
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<td>$\beta$</td>
<td>discount factor</td>
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<td>relative risk aversion</td>
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<td>$\omega$</td>
<td>labour supply elasticity</td>
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<td>$\chi$</td>
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<td>$\gamma$</td>
<td>share of tradeables in consumption bundle</td>
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<td>$\theta$</td>
<td>intratemporal substitution elasticity</td>
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<td>$\varphi^m, \varphi^n, \varphi^s$</td>
<td>risk premium parameters</td>
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<td>$\rho^x, \rho^p$</td>
<td>autoregressive terms for shock processes</td>
<td>0.5, 0.5</td>
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<tr>
<td>$\sigma^x, \sigma^p$</td>
<td>standard deviation for shocks to $X, P^{x*}$</td>
<td>$0.1 \bar{X}, 0.1 \bar{P}^{x*}$</td>
</tr>
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<td>$\tau^w, \tau^c$</td>
<td>tax rates</td>
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<td>$\zeta$</td>
<td>share of public capital expenditure in $G$</td>
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<tr>
<td>$\delta$</td>
<td>share of import replacement in capital</td>
<td></td>
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<tr>
<td>$\alpha^h, \alpha^x$</td>
<td>parameters in production function</td>
<td>0.5, 0.5</td>
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</table>
Calibration is set so that the index of openness is .513, close to observed mean in the data.

Ratio of government spending to GDP is .31.

Deaton-adjusted Gini is .49, within the range of the reported sample.

Share of labour in non-traded sector is 65%, share of labour income is 50%.

Consumption spent on traded goods is 10%, proportion of non-traded G is 39%.

Most traded goods sold overseas: 87%.

Arellano (2009) parameterizes the non-traded sector as more capital intensive.

Kuralbayeva and Vines (2008) assume the reverse.
Impulse Response: Export Demand Shock

Graphs showing the impulse responses of various economic variables following a shock to export demand. The variables include:
- Export Volume Shock
- Consumption Price Index
- Consumption
- Wage Income
- Money Balances
- Profits
- Output
- Openness Index
- Gini

The graphs display the changes over time, with the x-axis representing time (0 to 20 periods) and the y-axis showing the magnitude of the variable changes.
Impulse Responses following a shock to Export Price: 

- Export Price Shock
- Consumption Price Index
- Consumption
- Wage Income
- Money Balances
- Profits
- Output
- Openness Index
- Gini

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• Impulse Response with and without FDI and Foreign Aid

Export Demand Shock

Export Price Shock

Base
With FDI

Export Demand Shock

Export Price Shock

Base
With FA

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We are interested in the relations between the Gini and openness. Model re-parameterized for varying degrees of productive activity. Shocks processes remained the same. Deep parameters fixed, as well as tax policy and risk premia parameters. Generate a number of stylised economies with varying degrees of openness. We varied the factor share of capital in the production functions $\alpha^h, \alpha^x$, as well as $\delta$. These parameters affected the import content and degree of openness.
## Sensitivity Analysis

<table>
<thead>
<tr>
<th>Case</th>
<th>Gini</th>
<th>$\Phi_t^o$</th>
<th>${\text{Gini}, \Phi_t^o}$</th>
<th>$\delta$</th>
<th>$\alpha^h$</th>
<th>$\alpha^x$</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0.277</td>
<td>0.255</td>
<td>0.398</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
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<tr>
<td>2</td>
<td>0.215</td>
<td>0.257</td>
<td>0.599</td>
<td>0.1</td>
<td>0.2</td>
<td>0.8</td>
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<td>0.779</td>
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<td>0.8</td>
</tr>
<tr>
<td>6</td>
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<td>0.626</td>
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<td>8</td>
<td>0.295</td>
<td>0.310</td>
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For economies with a high degree of openness, there is a negative correlation between the Gini and the index of openness, for high depreciation and high capital intensity in production.

For high openness and low capital intensity, and depreciation, there is a positive but small correlation between openness and the Gini.

Despite high capital intensity in both sectors, the economy with the higher import content in the non-traded sector, opens the economy to more international shocks and the gains from trade are distributed more broadly.
Concluding Remarks

- Empirical results
  - growth reduces inequality
  - trade openness can increase or decrease the Gini
  - FDI and AID have negligible effects for low-income countries but reduce inequality in middle-income countries

- Simulation results
  - Key channel from open to Gini: distribution to labour income, with high capital intensities and high capital-replacement rates
  - Under high openness and low capital intensity, and import-replacement rates, there is a positive but small correlation between openness and the Gini.