Inequality of Opportunities in Africa
(Preliminary findings from a study in progress)

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(Based on joint work with Alejandro Hoyos, Ana Luisa Abras and Jose Cuesta Leiva)

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Improvement in non-income dimensions of poverty in many African countries

Ghana and Namibia (but not Tanzania) increased immunization against measles over last two decades.
But inequalities among groups within countries have evolved differently......

E.g.: Rich-poor gap in immunization increased in Namibia and declined in Ghana

Source: DHS, STATcompiler
Malnutrition among children has fallen in most countries

Reduction in % of children underweight in all 3 countries, albeit at different rates

Source: DHS, STATcompiler
But large gaps persist among regions within countries

Source: DHS, STATcompiler

No urban-rural convergence in Namibia, but some convergence in Ghana and Tanzania
Why do we need to measure inequality in opportunities among children?

- Progress towards MDGs in many countries conceals lack of (or uneven) progress among groups within countries
  - Need for monitoring instruments that can add to evidence base and guide policy priorities
- Poverty and inequality in outcomes today is partially a reflection of inequality in opportunity in the past
- May be relatively easier to reach political consensus around equalizing opportunities at the beginning of life than equalizing outcomes among adults
  - Public policies and society can influence directly inequality in opportunity
Human opportunity index (HOI) as a measure

- Inequality-sensitive coverage rate that incorporates:
  
  A) The average coverage of a good or service, which society accepts should be universal

  B) If it is allocated according to an equality of opportunity principle
     → access to key goods and services should not be determined by “circumstances” outside one’s control (e.g. gender, parental education, wealth, geographic location)

- Allows for monitoring of coverage and equity in coverage of opportunities

- Definition of HOI: Coverage rate of a basic opportunity, discounted by the inequality in the allocation of opportunities

\[
HOI = \bar{C} (1 - D)
\]

Where,

→ Average access \( (\bar{C}) \)
→ Inequality of Opportunity Index \( (D) \)
Defining the Inequality of Opportunity Index ($D$)

An intuitive interpretation of $D$: Share of the total number of opportunities that needs to be reallocated to ensure equality of opportunity

$$D = \frac{1}{2C} \sum_{k=1}^{m} \alpha_k \left| \bar{C} - C_k \right|$$

- $\bar{C}$: mean coverage rate for population
- $C_k$: Coverage rate for group $k$
- $\alpha_k$: Share of group $k$ in total population
- $m$: disjoint groups defined by circumstances
Computing the HOI

1. Estimate a logit model, the dependent variable is the opportunity (access to water, sanitation, completing 6th grade on time, etc.) and independent variables are the circumstances (gender, ethnicity, parents income, location, etc.)

2. Obtain the predicted probabilities of the logit for each individual ($\hat{p}_i$)

3. Estimate the Inequality of Opportunity Index ($D$):

$$\hat{D} = \frac{1}{2n} \sum_{i=1}^{n} \left| \frac{\hat{C}}{n} - \hat{p}_i \right|$$

$$\hat{C} = \frac{1}{n} \sum_{i=1}^{n} \hat{p}_i$$

$n$: Total number of individuals in the sample

4. Estimate the Human Opportunity Index (HOI):

$$HOI = \hat{C} (1 - \hat{D})$$

Note that the estimated HOI then depends on the likelihood or chance that a child with a set of circumstances has access to a particular opportunity.
Data: DHS surveys of 9 African countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Late 1990's</th>
<th>Late 2000's</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana</td>
<td>1998</td>
<td>2008</td>
</tr>
<tr>
<td>Madagascar</td>
<td>1997</td>
<td>2008-09</td>
</tr>
<tr>
<td>Malawi</td>
<td>2000</td>
<td>2004</td>
</tr>
<tr>
<td>Mozambique</td>
<td>1997</td>
<td>2003</td>
</tr>
<tr>
<td>Namibia</td>
<td>2000</td>
<td>2006-07</td>
</tr>
<tr>
<td>Rwanda</td>
<td>2000</td>
<td>2005</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1996 and 1999</td>
<td>2004-05</td>
</tr>
<tr>
<td>Uganda</td>
<td>1995</td>
<td>2006</td>
</tr>
<tr>
<td>Zambia</td>
<td>1996</td>
<td>2007</td>
</tr>
</tbody>
</table>

- Choice of countries partly depends on DHS availability for relevant period
- Use of similar survey for comparability across countries and time period
- Richness of DHS allows analysis of a number of key opportunities
Questions that arise in applying HOI to Africa

Some examples

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Circumstances</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Access to a service that society agrees is critical for individual development</td>
<td>➢ Set of exogenous characteristics for the individuals</td>
</tr>
<tr>
<td>➢ Essential for poverty eradication</td>
<td>➢ Society wants these to not influence a child’s access to basic opportunities</td>
</tr>
<tr>
<td>➢ Universality is a valid social objective</td>
<td></td>
</tr>
</tbody>
</table>

- Opportunities may need to be defined differently; but that may affect comparability across regions
  - Social objectives of universality need not necessarily be the same in SSA and LAC; also, what does universality imply in terms of the responsibility of the government?
  - Even the same “basic” opportunities may have to be defined differently for SSA, for HOI to be useful
- Circumstances need to be exogenous, but a strict interpretation of that may conflict with what the World Bank or policymakers find useful to monitor
  - Should household income/wealth be a circumstance? Distance to nearest school a circumstance for education opportunities?
  - Child’s orphan status (parent alive and in the household) is a relevant circumstance for many conflict-affected countries – exogenous, but may be temporary or change rapidly
Opportunities

- Attending School (6–11 yrs)
- Attending School (12–15 yrs)
- Finished 6th grade
- Started primary on time (6–7 yrs)
- Immunization against measles (2 years)
- No underweight (0-2 years)
- To be added: access to water, electricity
  - HOI for these should exclude household wealth as a “circumstance”, which would make them less comparable with other HOI

Circumstances

- Gender of the child
- Age of the child
- Number of children and presence of elderly in the household
- Location (urban/rural)
- Education and gender of household head
- Household Wealth index
- Family structure (presence of the parents and orphan status)
HOI for African countries: school attendance

- Coverage and HOI for attendance improve with age for most countries ➔ pattern of late entry into school
- HOI tends to improve more than coverage with age ➔ do circumstances matter more for attendance of younger children, i.e. entry into school?
HOI for starting and finishing primary school on time

- Low coverage for starting primary school and finishing 6th grade on time
  - Confirms pattern of late entry into school; not finishing 6th grade may also indicate dropouts
- HOI much lower than coverage for both opportunities
  - Exogenous circumstances appear to matter more for timely entry into school and finishing primary school on time than for attendance
• More variation across countries for immunization than malnutrition
• These opportunities more equitably distributed across children of different circumstances than school attendance
Improvement in HOI over time – school attendance

- Progress in all countries between late 1990s and late 2000s
- Improvement in HOI for most countries
  - Mozambique: increase in coverage but no statistically significant increase in HOI

Dots are the coverage of a specific country in each of the periods
Caps are the confidence intervals of the HOI
Uneven trends in HOI—starting primary school on time

- Only 5 out of 9 countries show significant progress in HOI
- No statistically significant increase in HOI for Mozambique, Rwanda, Tanzania; deterioration in Ghana
Some improvements– immunization and nutrition

- HOI in immunization against measles improved for 6 out of 9 countries, that for not being underweight improved for 6 out of 8

- In some cases, HOI is not significantly different from coverage
  - E.g. Namibia, Rwanda, Zambia (immunization); Tanzania, Uganda (underweight)
  - Underscores the importance of the standard error of the estimated D
Recall that $D$: Share of the total no. of available opportunities that needs to be reallocated to ensure equality.
Dissimilarity index falls in almost all cases
• Scale effect the most important for change in HOI in school attendance
• Equalization effect strongest in Rwanda and Tanzania
• Composition effect works in opposite direction to scale and equalization effects in 3 countries – suggests some “worsening” of circumstances
Decomposing the change in HOI: starting primary in time

Late 1990's - Late 2000's

Decomposition Started Primary On Time (6-7 years)

Negative scale effect for Ghana (very large) and Rwanda
Decomposing the Change in HOI: immunization and nutrition

Composition effects appear to play a larger role in changes in HOI for immunization and nutrition, compared to changes in HOI for educational opportunities.
Which circumstances matter the most for opportunities in education?

**Average Ranking Late 1990s**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Children's characteristics (gender and age)</th>
<th>Household's composition (number of children and elderly)</th>
<th>Household's location (Urban/Rural)</th>
<th>Household head's characteristics (education, gender and age)</th>
<th>Wealth Quintil</th>
<th>Presence of parents (missing or orphans)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Attendance (ages 12-15)</td>
<td>4.1</td>
<td>5.2</td>
<td>4.0</td>
<td>1.3</td>
<td>2.2</td>
<td>4.1</td>
</tr>
<tr>
<td>School Attendance (ages 6-11)</td>
<td>1.8</td>
<td>5.6</td>
<td>3.9</td>
<td>2.1</td>
<td>2.2</td>
<td>5.4</td>
</tr>
<tr>
<td>Finish primary (6th) (ages 13-15)</td>
<td>4.3</td>
<td>5.1</td>
<td>2.8</td>
<td>2.0</td>
<td>1.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Begin primary school on time</td>
<td>3.3</td>
<td>5.7</td>
<td>3.0</td>
<td>2.3</td>
<td>1.4</td>
<td>5.2</td>
</tr>
</tbody>
</table>

- Household head’s characteristics (education, gender, age) and household economic status (wealth quintile) are the most important circumstances on the *average*.
- But high *variation* in how each circumstance influences education opportunities—across countries and opportunities.
Which circumstances matter the most for opportunities in education?

Average Ranking Late 2000s

<table>
<thead>
<tr>
<th>Variable</th>
<th>Children's characteristics (gender and age)</th>
<th>Household's composition (number of children and elderly)</th>
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<th>Wealth Quintil</th>
<th>Presence of parents (missing or orphans)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Attendance (ages 12-15)</td>
<td>2.9</td>
<td>4.9</td>
<td>4.9</td>
<td>1.6</td>
<td>2.2</td>
<td>4.6</td>
</tr>
<tr>
<td>School Attendance (ages 6-11)</td>
<td>1.7</td>
<td>5.6</td>
<td>3.9</td>
<td>2.4</td>
<td>2.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Finish primary (6th) (ages 13-15)</td>
<td>3.8</td>
<td>5.1</td>
<td>2.9</td>
<td>2.3</td>
<td>1.1</td>
<td>5.8</td>
</tr>
<tr>
<td>Begin primary school on time</td>
<td>2.4</td>
<td>5.1</td>
<td>3.7</td>
<td>2.8</td>
<td>1.6</td>
<td>5.4</td>
</tr>
</tbody>
</table>

- Over time, children’s characteristics and household composition have become less important on the average; wealth quintile remained as important; and location, head’s characteristics and presence of parents in households have become more important.
- Have the last group of circumstances changed over time?
Urbanization in most countries – except Madagascar, Uganda and Zambia

Household heads have become more educated in all countries.
Change in circumstances -II

High proportion of children without parents in the household or orphans

Proportion of children with missing or dead parents has increased in 6 out of 9 countries
In terms of school attendance, African countries are comparable with many countries in LAC region – in coverage and HOI.

*Note:* All HOI used for these comparisons use the same definition of opportunities and comparable list of circumstances.
But African countries compare poorly with most LAC countries on completion of 6th grade on time

- More indication that late entry into school is a major problem in Africa
Encouraging trends for Africa on school attendance (late 1990s – late 2000s)

- Large improvements in school attendance for most African countries
- In almost all African countries change in HOI > change in coverage → reduction in inequality in attendance
But mixed picture on trends for primary school completion in Africa

- Little or no improvement in HOI for 4 out of 9 African countries
- Increase in HOI much smaller than increase in coverage for the 6 African countries showing an improvement → rise in inequality in primary school completion
Thank you

http://www.worldbank.org/poverty
Human Opportunity Index

\[ HOI = \bar{C} (1 - D) \]

\[ HO \bar{C} - \sum_{k: C_k < \bar{C}} \alpha_k \left( \bar{C} - C_k \right) \]
Human Opportunity Index

Relation between the probability of completing sixth grade on time and circumstances

\[ \hat{C} \hat{D} = \frac{1}{2n} \sum_{i=1}^{n} |\hat{C} - \hat{p}_i| \]
Interpretations of the Inequality of Opportunity Index (D)

1. The weighted average of the distance between group’s access and population access

2. Distance between the distributions of the population and opportunities

3. Share of the total number of opportunities that needs to be reallocated to ensure equality of opportunity
Decomposing the change in HOI

- Two periods (1 & 2).
- Change in the HOI:

\[
\Delta = HÔI_2 - HÔI_1 \\
\Delta = \bar{C}_2 (1 - \hat{D}_2) - \bar{C}_1 (1 - \hat{D}_1) \\
\Delta = \bar{C}_2 (1 - \hat{D}_2) - \bar{C}_1 (1 - \hat{D}_1) \\
\Delta = \left[\bar{C}_2 (1 - \hat{D}_2) - \bar{C}_2 (1 - \hat{D}_{mix}) \right] + \left[\bar{C}_2 (1 - \hat{D}_{mix}) - \bar{C}_{mix} (1 - \hat{D}_{mix}) \right] + \left[\bar{C}_{mix} (1 - \hat{D}_{mix}) - \bar{C}_1 (1 - \hat{D}_1) \right] \\
\Delta = \triangle_{Equalization} + \triangle_{Scale} + \triangle_{Composition}
\]
Decomposing the change in HOI

$\bar{D}_{mix}$ and $\bar{C}_{mix}$ are obtained following the next steps:

- **First**, estimate a logit model, the dependent variable is the opportunity (*access to water, sanitation, completing 6th grade on time, etc.*) and independents the circumstances (*gender, ethnicity, parents income, area, etc.*) using as sample the data of period 1.

- **Second**, using the coefficients of the step 1, calculate the predicted probabilities in the sample of period 2. ($\hat{p}_{i}^{mix}$)

- **Third**, calculate:

\[
\hat{D}_{mix} = \frac{1}{2\bar{C}_{mix}n_2} \sum_{i=1}^{n_2} \left| \bar{C}_{mix} - \hat{p}_{i}^{mix} \right|
\]

\[
\bar{C}_{mix} = \frac{1}{n_2} \sum_{i=1}^{n_2} \hat{p}_{i}^{mix}
\]
## Logit estimation - School Attendance 6-11 years (Period 1)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0.0539</td>
<td>-0.162**</td>
<td>-0.183***</td>
<td>0.364***</td>
<td>-0.0374</td>
<td>-0.0454</td>
<td>-0.256**</td>
<td>0.199***</td>
<td>-0.0274</td>
</tr>
<tr>
<td></td>
<td>(0.0839)</td>
<td>(0.0678)</td>
<td>(0.0573)</td>
<td>(0.104)</td>
<td>(0.104)</td>
<td>(0.0569)</td>
<td>(0.114)</td>
<td>(0.0667)</td>
<td>(0.0609)</td>
</tr>
<tr>
<td>Age</td>
<td>0.267***</td>
<td>0.246***</td>
<td>0.481***</td>
<td>0.404***</td>
<td>0.530***</td>
<td>0.699***</td>
<td>0.667***</td>
<td>0.428***</td>
<td>0.734***</td>
</tr>
<tr>
<td></td>
<td>(0.0275)</td>
<td>(0.0209)</td>
<td>(0.0200)</td>
<td>(0.0348)</td>
<td>(0.0396)</td>
<td>(0.0206)</td>
<td>(0.0382)</td>
<td>(0.0217)</td>
<td>(0.0212)</td>
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<tr>
<td>Children in HH (0-15 years)</td>
<td>-0.105***</td>
<td>-0.0398**</td>
<td>0.00702</td>
<td>-0.0691**</td>
<td>0.0328</td>
<td>-0.0138</td>
<td>-0.0444*</td>
<td>0.00109</td>
<td>0.0339**</td>
</tr>
<tr>
<td></td>
<td>(0.0223)</td>
<td>(0.0188)</td>
<td>(0.0141)</td>
<td>(0.0295)</td>
<td>(0.0234)</td>
<td>(0.0189)</td>
<td>(0.0248)</td>
<td>(0.0155)</td>
<td>(0.0143)</td>
</tr>
<tr>
<td>Presence of Elderly (+65 years)</td>
<td>-0.422***</td>
<td>0.0392</td>
<td>0.000424</td>
<td>-0.291</td>
<td>-0.675***</td>
<td>0.0166</td>
<td>0.0523</td>
<td>0.284**</td>
<td>0.0285</td>
</tr>
<tr>
<td></td>
<td>(0.142)</td>
<td>(0.127)</td>
<td>(0.112)</td>
<td>(0.219)</td>
<td>(0.162)</td>
<td>(0.129)</td>
<td>(0.171)</td>
<td>(0.131)</td>
<td>(0.126)</td>
</tr>
<tr>
<td>Urban</td>
<td>-0.151</td>
<td>0.152</td>
<td>0.283**</td>
<td>0.346**</td>
<td>0.145</td>
<td>0.415***</td>
<td>0.264</td>
<td>-0.168</td>
<td>-0.142</td>
</tr>
<tr>
<td></td>
<td>(0.152)</td>
<td>(0.113)</td>
<td>(0.141)</td>
<td>(0.172)</td>
<td>(0.188)</td>
<td>(0.107)</td>
<td>(0.183)</td>
<td>(0.108)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>Education (head)</td>
<td>0.134***</td>
<td>0.212***</td>
<td>0.156***</td>
<td>0.183***</td>
<td>0.0974***</td>
<td>0.0750***</td>
<td>0.105***</td>
<td>0.120***</td>
<td>0.135***</td>
</tr>
<tr>
<td></td>
<td>(0.0106)</td>
<td>(0.0153)</td>
<td>(0.00949)</td>
<td>(0.0234)</td>
<td>(0.0159)</td>
<td>(0.00996)</td>
<td>(0.0198)</td>
<td>(0.0110)</td>
<td>(0.00978)</td>
</tr>
<tr>
<td>Age (head)</td>
<td>0.0124***</td>
<td>0.00632*</td>
<td>0.00603***</td>
<td>0.0126**</td>
<td>0.0379***</td>
<td>0.00105</td>
<td>0.00768</td>
<td>0.00865***</td>
<td>0.0147***</td>
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<tr>
<td></td>
<td>(0.00406)</td>
<td>(0.00334)</td>
<td>(0.00282)</td>
<td>(0.00544)</td>
<td>(0.00505)</td>
<td>(0.00317)</td>
<td>(0.00535)</td>
<td>(0.00323)</td>
<td>(0.00322)</td>
</tr>
<tr>
<td>Male (head)</td>
<td>-0.353***</td>
<td>-0.123</td>
<td>-0.387***</td>
<td>-0.665***</td>
<td>-0.749***</td>
<td>-0.352***</td>
<td>0.0309</td>
<td>-0.574***</td>
<td>-0.142</td>
</tr>
<tr>
<td></td>
<td>(0.131)</td>
<td>(0.104)</td>
<td>(0.0828)</td>
<td>(0.136)</td>
<td>(0.122)</td>
<td>(0.0904)</td>
<td>(0.174)</td>
<td>(0.0990)</td>
<td>(0.0947)</td>
</tr>
<tr>
<td>Wealth Quintil 2</td>
<td>0.607***</td>
<td>0.211**</td>
<td>0.614***</td>
<td>-0.00206</td>
<td>0.727***</td>
<td>0.147</td>
<td>0.0380</td>
<td>0.115</td>
<td>0.346***</td>
</tr>
<tr>
<td></td>
<td>(0.106)</td>
<td>(0.0939)</td>
<td>(0.0819)</td>
<td>(0.154)</td>
<td>(0.151)</td>
<td>(0.0955)</td>
<td>(0.185)</td>
<td>(0.102)</td>
<td>(0.0915)</td>
</tr>
<tr>
<td>Wealth Quintil 3</td>
<td>0.644***</td>
<td>0.735***</td>
<td>0.922***</td>
<td>0.161</td>
<td>0.630***</td>
<td>0.118</td>
<td>-0.108</td>
<td>0.411***</td>
<td>0.586***</td>
</tr>
<tr>
<td></td>
<td>(0.126)</td>
<td>(0.0956)</td>
<td>(0.0852)</td>
<td>(0.160)</td>
<td>(0.151)</td>
<td>(0.0992)</td>
<td>(0.181)</td>
<td>(0.103)</td>
<td>(0.0926)</td>
</tr>
<tr>
<td>Wealth Quintil 4</td>
<td>1.164***</td>
<td>1.187***</td>
<td>0.480***</td>
<td>0.920***</td>
<td>0.793***</td>
<td>0.122</td>
<td>0.865***</td>
<td>0.713***</td>
<td>1.041***</td>
</tr>
<tr>
<td></td>
<td>(0.168)</td>
<td>(0.106)</td>
<td>(0.0859)</td>
<td>(0.168)</td>
<td>(0.170)</td>
<td>(0.0971)</td>
<td>(0.179)</td>
<td>(0.106)</td>
<td>(0.128)</td>
</tr>
<tr>
<td>Wealth Quintil 5</td>
<td>1.496***</td>
<td>2.450***</td>
<td>1.073***</td>
<td>1.501***</td>
<td>1.265***</td>
<td>0.559***</td>
<td>1.870***</td>
<td>1.188***</td>
<td>1.878***</td>
</tr>
<tr>
<td></td>
<td>(0.215)</td>
<td>(0.184)</td>
<td>(0.111)</td>
<td>(0.267)</td>
<td>(0.254)</td>
<td>(0.122)</td>
<td>(0.219)</td>
<td>(0.133)</td>
<td>(0.156)</td>
</tr>
<tr>
<td>Missing any parent (both alive)</td>
<td>0.0972</td>
<td>-0.260***</td>
<td>-0.0677</td>
<td>-0.444***</td>
<td>0.0551</td>
<td>-0.425***</td>
<td>-0.446***</td>
<td>-0.181*</td>
<td>-0.129</td>
</tr>
<tr>
<td></td>
<td>(0.124)</td>
<td>(0.0927)</td>
<td>(0.0849)</td>
<td>(0.131)</td>
<td>(0.134)</td>
<td>(0.104)</td>
<td>(0.146)</td>
<td>(0.0926)</td>
<td>(0.0806)</td>
</tr>
<tr>
<td>Orphan (Any parent)</td>
<td>-0.298*</td>
<td>-0.478***</td>
<td>-0.176*</td>
<td>-0.173</td>
<td>0.0770</td>
<td>-0.444***</td>
<td>-0.472***</td>
<td>-0.287***</td>
<td>-0.328***</td>
</tr>
<tr>
<td></td>
<td>(0.168)</td>
<td>(0.124)</td>
<td>(0.0996)</td>
<td>(0.165)</td>
<td>(0.195)</td>
<td>(0.0932)</td>
<td>(0.202)</td>
<td>(0.109)</td>
<td>(0.101)</td>
</tr>
<tr>
<td></td>
<td>(0.322)</td>
<td>(0.256)</td>
<td>(0.219)</td>
<td>(0.380)</td>
<td>(0.445)</td>
<td>(0.248)</td>
<td>(0.489)</td>
<td>(0.252)</td>
<td>(0.260)</td>
</tr>
<tr>
<td>Observations</td>
<td>3970</td>
<td>5352</td>
<td>11236</td>
<td>6943</td>
<td>5079</td>
<td>7829</td>
<td>3351</td>
<td>6204</td>
<td>6956</td>
</tr>
<tr>
<td>Pseudo R-squared</td>
<td>0.164</td>
<td>0.206</td>
<td>0.159</td>
<td>0.180</td>
<td>0.169</td>
<td>0.207</td>
<td>0.249</td>
<td>0.136</td>
<td>0.273</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
• Lower D associated with higher coverage
• Tanzania and Zambia appears to have higher D compared to the predicted average for its coverage rate
Dissimilarity index and coverage – immunization

- Association between D and coverage much weaker here
  - E.g. Namibia has higher coverage and D than Malawi, Zambia and Rwanda