Commitment to Equity (CEQ): Introduction, Recent Innovations, and the CEQ Stata Package

Sean Higgins
Co-Director of Data Center and Software Development, CEQ Institute
Post-Doctoral Fellow, UC Berkeley

Poverty Global Practice Summer School
World Bank
July 17, 2017
Agenda

• 9-9:20am Introduction to CEQ
• 9:20-10:45am What’s New: Recent Innovations in CEQ
• 10:45-11am Coffee Break
• 11-12:30pm CEQ Stata Package
Introduction to CEQ
CEQ Institute: Brief Description

Mission: The CEQ Institute works to reduce inequality and poverty through comprehensive and rigorous tax and benefit incidence analysis, and active engagement with the policy community.

Objective: To measure the impact of fiscal policy on inequality and poverty across the world using a comparable framework.

Workstreams:

• Research-based policy tools
• Data Center
• Advisory and training services
• Bridges to policy

➤ Grant from Bill & Melinda Gates Foundation US$4.9 million for 5 years (2016 – 2020)
CEQ Workstreams: Tools

- **CEQ Handbook**

1. Methodology
2. Implementation
3. Applications
4. Tools
   - **CEQ Master Workbook**: Excel spreadsheet to present background information, assumptions and results.
   - **CEQ Checking Protocol**
   - **CEQ Stata Package**
CEQ Workstreams: Data Center

- Data on poverty and inequality across income concepts in 30 countries can be downloaded from our Data Center

Future of Data Center

- Expand indicators included in Data Center
- Expand country coverage
- Interactive graphs programmed using Tableau
- For countries in which it is possible:
  - Harmonized microdata
    - Common variable names across countries for income concepts, categories of fiscal intervention
    - Would allow cross-country research using rich microdata
  - Code used to convert raw microdata to harmonized and produce CEQ Assessment
    - Allows others to test impact of changes to assumptions
    - Research Transparency: allows replication of results
CEQ Workstreams: Advisory and Training

- Events like this
  - This mini-training offered at no cost to World Bank as part of CEQ-World Bank agreement in process of being signed
- 2-3 day trainings at World Bank: Feb 2015, Feb 2016, Jul 2016
  - Attended by Bank staff and governments (Indonesia Ministry of Finance, South Africa Treasury)
- Trainings at:
  - Ghana, Paraguay, Timor Leste Ministries of Finance
  - Inter-American Development Bank
  - European Commission
  - World Bank country offices in Dominican Republic and Senegal
    - Participation of Ministry of Finance, Central Bank, Ministry of Development, National Statistics Office
CEQ Workstreams: Bridges to Policy

- Research collaborations with ADB, AfDB, CAF, IDB, IMF, ICEFI, OECD, Oxfam, UNDP, UNICEF, World Bank
- Agreements and partnerships with OAS, CGD
- Director Nora Lustig participation in:
  - G20 Group on Global Financial Governance
  - World Bank Commission on Global Poverty
- With IMF: Article IV and IMF program reviews
  - Completed for Costa Rica, Guatemala, Togo, Zambia
  - In progress for Nigeria and Swaziland
  - Soon to begin: Benin, Tajikistan
CEQ Assessments

• Working on over 40 countries
  • Covers around two thirds of the world population
  • Results available online for 30 countries in our Data Center
• Nonresident Research Associates and over 100 collaborators
• Utilized by governments
• Working Paper series
• Numerous scholarly publications
  • Journal of Development Economics
  • World Development
  • etc.
http://www.commitmenttoequity.org/
## CEQ-World Bank Partnership

<table>
<thead>
<tr>
<th>In partnership with CEQ Institute</th>
<th>World Bank on its own</th>
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<tbody>
<tr>
<td>Armenia</td>
<td>Albania</td>
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<td>Chile</td>
<td>Armenia (second round)</td>
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<td>Dominican Republic</td>
<td>Bangladesh</td>
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<td>Ethiopia</td>
<td>Belarus</td>
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<td>Georgia</td>
<td>Brazil (second round)</td>
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<td>Ghana</td>
<td>Cameroon</td>
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<td>Indonesia</td>
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<td>Croatia</td>
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<td>Russia</td>
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<td>South Africa</td>
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<td>Sri Lanka</td>
<td>Greece</td>
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<td>Tanzania</td>
<td>Indonesia* (second round)</td>
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<td>Zambia</td>
<td>Latvia</td>
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<td>Mali</td>
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<td>Mexico* (second round)</td>
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<td>Pakistan</td>
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<td>Poland</td>
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<td>Republic of Congo</td>
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<td>Russia (second round)</td>
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<td>Senegal*</td>
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<td>Serbia</td>
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<td>Sri Lanka (second round)</td>
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<td></td>
<td>Turkey</td>
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<td>Vietnam*</td>
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Note: *In collaboration with CEQ Institute or with a CEQ Institute team member as consultant
Data, Information, and Software Requirements

• Household survey (representative at the national level, most recent available)

• Input-output table or Social Accounting Matrix (preferably of year close to household survey)

• Detailed description of each tax and spending item to be included in the analysis

• Budget & administrative data for the year of the survey

• Stata 13 or higher
  • Make sure to update all
  • To export graphs directly to Excel, Stata 14 or higher
CEQ Assessment: Income Concepts

PRE-FISCAL INCOME (MARKET OR MARKET PLUS PENSIONS)

PLUS DIRECT TRANSFERS MINUS DIRECT TAXES

DISPOSABLE INCOME

PLUS INDIRECT SUBSIDIES MINUS INDIRECT TAXES

CONSUMABLE INCOME

PLUS MONETIZED VALUE OF PUBLIC SERVICES: EDUCATION & HEALTH

FINAL INCOME
CEQ Assessment: Fiscal Interventions

- Currently included:
  
  • Direct taxes
  • Direct cash transfers
  • Non-cash direct transfers such as school uniforms and school lunches
  • Contributions to pensions and social insurance systems
  • Indirect taxes on consumption
  • Indirect subsidies
  • In-kind transfers such as spending on education and health (valued at government cost)
Allocation Methods

- Direct Identification from survey
  - However, results must be checked: how realistic are they?

- If information not directly available in microdata, then:
  - Inference
  - Imputation
  - Simulation
  - Prediction
  - Alternate Survey
  - Secondary Sources (last resort)
CEQ Assessment: Questions

• How much income redistribution and poverty reduction is being accomplished through fiscal policy?
• How equalizing and pro-poor are specific taxes and government spending?
• How effective are taxes and government spending in reducing inequality and poverty?
• What is the impact of fiscal reforms that change the size and/or progressivity of a particular tax or benefit?
Composition of Social Spending as a Share of GDP (circa 2010)

(ranked by social spending plus contributory pensions / GDP; GNI right hand scale)

Source: Lustig (2017)
Fiscal Policy and Inequality
Contributory pensions as deferred income

Market income plus pensions  Disposable income  Consumable income  Final income


Source: Lustig (2017)
Fiscal Policy and Poverty Reduction
Change in Headcount Ratio from Market Income plus Pensions to Consumable Income (Poverty line $2.5 \ 2005 PPP/day); in %
Contributory pensions as deferred income

(rank by poverty reduction in %; poverty line $2.5 \ 2005PPP/day)

Source: Lustig (2017)
What’s New: Recent Innovations in CEQ
Outline of What’s New in CEQ

- Treatment of Contributory Social Insurance Pensions
- Fiscal Impoverishment Indicators
- Effectiveness Indicators
- Valuing Health Benefits
- Valuing Education Benefits
- Underreporting and undercoverage of top incomes
Treatment of Contributory Social Insurance Pensions:

• Pensions as Deferred Income? (PDI)

• Pensions as Government Transfer? (PGT)

Source: Lustig and Higgins (2017)
Treatment of Contributory Social Insurance Pensions:

Two extreme scenarios:

• Deferred income in actuarially fair systems: pensions included in *pre-fiscal income* and contributions treated as mandatory savings
  • Hence, pre-fiscal income should be net of contributions

• Government transfer: pensions included among direct transfers and contributions treated as a direct tax
  • Hence, pre-fiscal income should be gross of contributions which are subtracted out before arriving at disposable income

Source: Lustig and Higgins (2017)
Contributory Pensions: Double Counting

- Pensions as deferred income
  - Factor income during working years = \( Y \)
  - Factor income during retirement years = 0
  - Contributions to pensions at rate \( s \)
  - Actuarially fair system: receive pensions = \( sY \) in retirement (for simplicity zero interest)
- Total direct taxes = \( T \) and benefits = \( B \)
  - \( T', B' \) in retirement

<table>
<thead>
<tr>
<th></th>
<th>Factor income</th>
<th>Contributions</th>
<th>Pre-fiscal Income</th>
<th>Disposable Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working age</td>
<td>( Y )</td>
<td>( sY )</td>
<td>( Y ) or ((1-s)Y)?</td>
<td></td>
</tr>
<tr>
<td>Retirement age</td>
<td>0</td>
<td>0</td>
<td>( sY )</td>
<td></td>
</tr>
</tbody>
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Source: Lustig and Higgins (2017)
### Contributory Pensions: Double Counting

- **Pensions as deferred income**
  - Factor income during working years = $Y$
  - Factor income during retirement years = 0
  - Contributions to pensions at rate $s$
  - Actuarially fair system: receive pensions = $sY$ in retirement (for simplicity zero interest)
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  - $T'$, $B'$ in retirement

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<tr>
<td>Working age</td>
<td>$Y$</td>
<td>$sY$</td>
<td>$(1-s)Y$</td>
<td>$(1-s)Y - T + B$</td>
</tr>
<tr>
<td>Retirement age</td>
<td>0</td>
<td>0</td>
<td>$sY$</td>
<td>$sY - T' + B'$</td>
</tr>
</tbody>
</table>

Source: Lustig and Higgins (2017)
Contributory Pensions: Double Counting

- So in PDI scenario:
  - Pre-fiscal income is **market income PLUS pensions**
  - Market income PLUS pensions is **net of contributions**

- Pensions as government transfer
  - Contributions not subtracted out of pre-fiscal income
  - Subtracted when moving to disposable (like a tax)
  - Pre-fiscal income for retirement age is 0
  - For retired, pension added when moving to disposable income

- Note disposable income is the same in both scenarios

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<th>Disposable Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working age</td>
<td>Y</td>
<td>sY (treat as tax)</td>
<td>Y</td>
<td>(1-s)Y – T + B</td>
</tr>
<tr>
<td>Retirement age</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>sY – T’ + B’</td>
</tr>
</tbody>
</table>

Source: Lustig and Higgins (2017)
Constructing Income Concepts

Pre-fiscal income in PGT scenario

- Contributory Pensions
  - Contributions to Pensions

Market Income

Market Income plus Pensions

- Direct Transfers
- Non-Taxable Income

Taxable Income

Gross Income

Net Market Income

- Direct Taxes
- Direct Transfers

Disposable Income

- Indirect Subsidies
- Indirect Taxes

Consumable Income

- In-Kind Transfers (Education, Health)
- Copayments, User Fees

Final Income

Source: Higgins and Lustig (2017)
Outline of What’s New in CEQ

• Treatment of Contributory Social Insurance Pensions
• Fiscal Impoverishment Indicators
• Effectiveness Indicators
• Valuing Health Benefits
• Valuing Education Benefits
• Underreporting and undercoverage of top incomes
Fiscal Impoverishment

• **The issue:** Analyzing the impact on poverty and inequality indicators can be misleading

  • Fiscal systems can show an *unambiguous* reduction in poverty and inequality, and yet a substantial share of the poor could have been impoverished by the combined effect of taxes and transfers

Source: Higgins and Lustig (2016)
Income

- Pre-fisc
- Post-fisc
- Poverty line
- Fiscal impoverishment
- Fiscal gains of the poor

Population ordered by pre-fisc income

Source: Higgins and Lustig (2016)
Fiscal Impoverishment
(Market Income plus Pensions to Consumable Income)

<table>
<thead>
<tr>
<th>Country (survey year)</th>
<th>Market income plus pensions (Poverty headcount (%))</th>
<th>Change in poverty headcount (p.p.)</th>
<th>Market income plus pensions (Gini)</th>
<th>Reynolds-Smolensky</th>
<th>Change in inequality (ΔGini)</th>
<th>Fiscally impoverished as % of population (Fiscally Impoverished as % of consumable income poor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil (2009)</td>
<td>16.8</td>
<td>-0.8</td>
<td>57.5</td>
<td>4.6</td>
<td>-3.5</td>
<td>5.6 (34.9)</td>
</tr>
<tr>
<td>Chile (2013)</td>
<td>2.8</td>
<td>-1.4</td>
<td>49.4</td>
<td>3.2</td>
<td>-3.0</td>
<td>0.3 (19.2)</td>
</tr>
<tr>
<td>Ecuador (2011)</td>
<td>10.8</td>
<td>-3.8</td>
<td>47.8</td>
<td>3.5</td>
<td>-3.3</td>
<td>0.2 (3.2)</td>
</tr>
<tr>
<td>Mexico (2012)</td>
<td>13.3</td>
<td>-1.2</td>
<td>54.4</td>
<td>3.8</td>
<td>-2.5</td>
<td>4.0 (32.7)</td>
</tr>
<tr>
<td>Peru (2011)</td>
<td>13.8</td>
<td>-0.2</td>
<td>45.9</td>
<td>0.9</td>
<td>-0.8</td>
<td>3.2 (23.8)</td>
</tr>
<tr>
<td>Russia (2010)</td>
<td>4.3</td>
<td>-1.3</td>
<td>39.7</td>
<td>3.9</td>
<td>-2.6</td>
<td>1.1 (34.4)</td>
</tr>
<tr>
<td>South Africa (2010)</td>
<td>49.3</td>
<td>-5.2</td>
<td>77.1</td>
<td>8.3</td>
<td>-7.7</td>
<td>5.9 (13.3)</td>
</tr>
<tr>
<td>Tunisia (2010)</td>
<td>7.8</td>
<td>-0.1</td>
<td>44.7</td>
<td>8.0</td>
<td>-6.9</td>
<td>3.0 (38.5)</td>
</tr>
</tbody>
</table>

Panel A: Upper-middle income countries, using a poverty line of $2.5 2005 PPP per day

Source: Higgins and Lustig (2016)
Fiscal Impoverishment  
(Market Income plus Pensions to Consumable Income)

<table>
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<tr>
<th>Country (survey year)</th>
<th>Market income plus pensions Poverty headcount (%)</th>
<th>Change in poverty headcount (p.p.)</th>
<th>Market income plus pensions inequality (Gini)</th>
<th>Reynolds-Smolensky Change in inequality (▲Gini)</th>
<th>Fiscally impoverished as % of population</th>
<th>Fiscally Impoverished as % of consumable income poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armenia (2011)</td>
<td>21.4</td>
<td>-9.6</td>
<td>47.4</td>
<td>12.9</td>
<td>-9.3</td>
<td>6.2</td>
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<tr>
<td>Bolivia (2009)</td>
<td>10.9</td>
<td>-0.5</td>
<td>50.3</td>
<td>0.6</td>
<td>-0.3</td>
<td>6.6</td>
</tr>
<tr>
<td>Dominican Republic (2013)</td>
<td>6.8</td>
<td>-0.9</td>
<td>50.2</td>
<td>2.2</td>
<td>-2.2</td>
<td>1.0</td>
</tr>
<tr>
<td>El Salvador (2011)</td>
<td>4.3</td>
<td>-0.7</td>
<td>44.0</td>
<td>2.2</td>
<td>-2.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Guatemala (2010)</td>
<td>12.0</td>
<td>-0.8</td>
<td>49.0</td>
<td>1.4</td>
<td>-1.2</td>
<td>7.0</td>
</tr>
<tr>
<td>Indonesia (2012)</td>
<td>12.0</td>
<td>-1.5</td>
<td>39.8</td>
<td>1.1</td>
<td>-0.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Sri Lanka (2010)</td>
<td>5.0</td>
<td>-0.7</td>
<td>37.1</td>
<td>1.3</td>
<td>-1.1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

*Panel B: Lower-middle income countries, using a poverty line of $1.25 2005 PPP per day*

Source: Higgins and Lustig (2016)
Fiscal Impoverishment: Axiomatic Measure

• The % fiscally impoverished showed earlier violates certain axioms

• Axioms:
  • FI Monotonicity
  • Focus
  • Normalization
  • Continuity
  • Permutability
  • Translation invariance
  • Linear homogeneity
  • Subgroup consistency
Fiscal Impoverishment: Axiomatic Measure

- A measure satisfying these axioms is uniquely determined up to a proportional transformation

\[ f(y^0, y^1; z) = k \sum_{i=1}^{n} \left( \min\{y^0_i, z\} - \min\{y^0_i, y^1_i, z\} \right) \]

- Pre-fisc poor and impoverished \((y^1_i < y^0_i < z)\) contributes fall in income, \(y^0_i - y^1_i\)

- Pre-fisc non-poor and impoverished \((y^1_i < z \leq y^0_i)\) contributes amount to transfer her back to poverty line, \(z - y^1_i\)

- Non-impoverished pre-fisc non-poor \((y^0_i \geq z \text{ and } y^1_i \geq z)\) contributes \(z - z = 0\)

- Non-impoverished pre-fisc poor \((y^0_i < z \text{ and } y^1_i \geq y^0_i)\) contributes \(y^0_i - y^0_i = 0\)
Fiscal Impoverishment: Axiomatic Measure

- With analogous axioms for gains of the poor:

\[ g(y^0, y^1; z) = k \sum_{i=1}^{n} (\min\{y_i^1, z\} - \min\{y_i^0, y_i^1, z\}) \]

- Poverty gap can be decomposed into fiscal impoverishment minus gains
  - Poverty gap \( p(y; z) = v(n, z) \sum_{i=1}^{n} (z - y_i) \mathbb{I}(y_i < z) \)
    - \( v(n, z) = 1 \) gives total poverty gap
    - \( v(n, z) = \frac{1}{zn} \) gives poverty gap ratio

\[ p(y^1; z) - p(y^0; z) = \frac{V}{k} [f(y^1, y^0; z) - g(y^1, y^0; z)] \]
Poverty Gap Decomposition: Brazil

(a) Total FI and FGP (Billions of dollars per year)

(b) Total poverty gaps (Billions of dollars per year)
Fiscal Impoverishment: Policy Lessons

• In 10 of 15 countries, between one-quarter and two-thirds of the post-fisc poor lost income to the fiscal system.

• In five countries, between 25 and 50% are still fiscally impoverished even when the monetized value of education and health services are included as transfers.

• Extreme care must be taken with emphasizing domestic resource mobilization to achieve SDGs.

• Must assess the impact on fiscal impoverishment of tax and subsidy reforms.
  • Otherwise one may not realize hurting a substantial number of poor.

• Impact on the poor of increasing taxes requires the use of adequate indicators.
  • Conventional measures of inequality and poverty can be awfully misleading.

Source: Higgins and Lustig (2016)
Outline of What’s New in CEQ

- Treatment of Contributory Social Insurance Pensions
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Effectiveness

- An indicator that you typically would think of:
  \[ \Delta \text{Gini}/\text{Spending} \]

Problem:
- Fiscal interventions of larger size could be ranked worse just because higher spending may result in incrementally lower declines in Gini
  - Decreasing marginal returns to spending for non-linear measures like Gini, squared poverty gap
  - Leads to improper ranking of fiscal interventions

Source: Enami (2017)
Effectiveness

Additional problems with

\[ \Delta \frac{\text{Gini}}{\text{Spending}} \]

- Not “unit-free” which is usually desirable for indices
  - Measured in Gini points per $ spent
  - Our old CEQ Effectiveness Indicator \( \Delta \frac{\text{Gini}}{\text{Spending}} / \text{GDP} \) is unit free but still has same other issues and can be below or above 1; hard to interpret

- Not normalized
  - Normalization axiom: should = 1 when a program reaches its maximum efficiency

Source: Enami (2017)
Effectiveness

Desirable properties:

• Ranks interventions properly

• Normalization
  • Be within a certain range (i.e., between 0 and 1, or between -1 and 1)
  • Equals 1 when program reaches maximum efficiency

• Intuitively appealing interpretation

Source: Enami (2017)
Reminder: How to Calculate the Marginal Contribution

- Let’s use an example: *Marginal Contribution of Direct Taxes to the inequality of Disposable Income*

**Market Income – Direct Taxes + Direct Transfers = Disposable Income**

- Two important Income concepts:
  - “Before”: Disposable Income without (before subtracting out) Direct Taxes
    - Market Income + Direct Transfers, or
    - Disposable Income + Direct Taxes.
  - “After”: Disposable Income

- Marginal Contribution of the Direct Taxes:

\[
\text{MC}_{\text{Direct Taxes}} = \frac{\text{Gini}_{\text{Disposable Income}} - \text{Gini}_{\text{Disposable Income}}}{\text{Direct Taxes}}
\]

- Direct Taxes are equalizing if \( \text{MC}_{\text{Direct Taxes}} > 0 \)

Source: Enami (2017)
CEQ Effectiveness Indicators

- **General Indicators:**
  1. Impact Effectiveness
  2. Spending Effectiveness

- **Poverty-Specific Indicators:**
  3. Fiscal Impoverishment and Gains Effectiveness
1. Impact Effectiveness

- For Inequality Indices (e.g. Gini):

\[
\text{Impact Effectiveness} = \frac{MC(T) \uparrow \text{End income}}{MC(T) \uparrow \text{End income}^{\star}},
\]

where \( MC(T) \uparrow \text{End income}^{\star} \) is the maximum possible \( MC(T) \uparrow \text{End income} \).

- If the same amount of \( T \) is taxed optimally to reduce inequality
  - To achieve maximum: tax richest until income equal to second-richest, tax both until income equal to third-richest, etc.

- Or same amount of \( B \) is taxed optimally to reduce inequality
  - To achieve maximum: give to poorest until income equal to second-poorest, give to both until income equal to third-poorest, etc.

Source: Enami (2017)
1. Impact Effectiveness

For Poverty Indices (e.g. Poverty headcount ratio):

- **Transfers**: Same formula as for inequality.
- **Taxes** can only increase poverty. New definition:

\[
Pov\text{er}\text{ty Impact Effectiveness]\downarrow T\uparrow End income = -\frac{MC\downarrow T\uparrow End income}{MC\downarrow T\uparrow End income \uparrow H}\]

where \( MC\downarrow T\uparrow End income \uparrow H \) is the Marginal Contribution of a tax if it is redistributed in the worst possible way.

- Worst possible way means tax the poorest until income = 0, then tax second poorest until income = 0, etc.
- So it captures how badly the poverty-increasing tax does relative to the amount of harm it could potentially do

Source: Enami (2017)
1. Impact Effectiveness

- This Indicator is always between -1 and +1 and the higher its value, the better it is.

- Interpretation: Given the amount we spent (or taxed), we achieved X% of the inequality (or poverty) reduction that was possible
  - “Relative realized inequality or poverty reduction of a tax, a transfer or a combination of taxes and transfers”
  - Example: inequality impact effectiveness of a transfer = 0.7 → the transfer has realized 70% of its potential to reduce inequality

- In the context of poverty and only for the taxes: how much of the tax’s potential to harm the poor was realized? (More negative → more potential for harm realized)

Source: Enami (2017)
1. Impact Effectiveness (Application: Iran)

<table>
<thead>
<tr>
<th>Fiscal Incident</th>
<th>Impact Effectiveness with respect to:</th>
<th>Disposable Income</th>
<th>Consumable Income</th>
<th>Final Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Income Tax</td>
<td>Employee contributions to the health insurance</td>
<td>Employer contributions to the health insurance</td>
</tr>
<tr>
<td>Direct Taxes and Contributions</td>
<td></td>
<td>0.3287</td>
<td>0.0838</td>
<td>0.2214</td>
</tr>
<tr>
<td>Direct Transfers</td>
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<td>0.0838</td>
<td>0.2214</td>
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<tr>
<td>Indirect Taxes (Sales Taxes)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>In-kind Transfers</td>
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<td>-</td>
<td>-</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: The Gini coefficient is the index used to calculate the effectiveness indicator here.

Source: Enami (2017)
2. Spending Effectiveness

- It is only applicable to the taxes and transfers with positive Marginal Contribution (inequality or poverty reducing)

\[
\text{Spending Effectiveness} = \frac{T^* (\text{and/or } B^*)}{T (\text{and/or } B)}
\]

where \( T^* (\text{and/or } B^*) \) is the minimum amount of Tax (or Benefit) that is needed to create the same \( MC^* (\text{and/or } B) \).

- This Indicator is always between 0 and +1 and the higher its value, the better it is.

Source: Enami (2017)
# 2. Spending Effectiveness (Application: Iran)

<table>
<thead>
<tr>
<th>Fiscal Incident</th>
<th>Spending Effectiveness with respect to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disposable Income</td>
</tr>
<tr>
<td>Direct Taxes and Contributions</td>
<td></td>
</tr>
<tr>
<td>Income Tax</td>
<td>0.3693</td>
</tr>
<tr>
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<tr>
<td>Employer contributions to the health insurance</td>
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<tr>
<td>Employee contributions to the Social Security</td>
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<tr>
<td>Employer contributions to the Social Security</td>
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<td><strong>Total Direct Taxes and Contributions</strong></td>
<td><strong>0.2475</strong></td>
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<td>Direct Transfers</td>
<td></td>
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<tr>
<td>Targeted Subsidy Program</td>
<td>0.2863</td>
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<tr>
<td>Social Assistance</td>
<td>0.4147</td>
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<tr>
<td>Semi-cash Transfers (Food)</td>
<td>N/A</td>
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<tr>
<td><strong>Total Direct Transfers</strong></td>
<td><strong>0.2966</strong></td>
</tr>
<tr>
<td>Indirect Taxes (Sales Taxes)</td>
<td></td>
</tr>
<tr>
<td>Education Transfers</td>
<td>-</td>
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<tr>
<td>Education User-fees</td>
<td>-</td>
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<tr>
<td>Health Transfers</td>
<td>-</td>
</tr>
<tr>
<td>Health User-fees</td>
<td>-</td>
</tr>
<tr>
<td>Source: Enami (2017)</td>
<td></td>
</tr>
</tbody>
</table>
3. Fiscal Impoverishment and Gains Effectiveness

- It is only applicable to the poverty indicators.

- It uses two concepts introduced in Higgins and Lustig (2016):
  - **Fiscal Impoverishment (FI):** How much poor individuals are made worse off by a fiscal system.
  - **Fiscal Gains to the Poor (FGP):** How much poor individuals are made better off by a fiscal system.

3. Fiscal Impoverishment and Gains Effectiveness

- For a fiscal system (composed of taxes and transfers):

\[
\text{Effectiveness}_{\downarrow \text{FI}}/\text{FGP} = \left[\frac{B}{T+B}(\text{FGP}_M C_{\downarrow T} \text{ and } B\uparrow \text{End income } /B)\right] + \left[\frac{T}{T+B}\left(1 - \text{FI}_M C_{\downarrow T} \text{ and } B\uparrow \text{End income } /T\right)\right]
\]

where:
- \(B > 0\) is total transfers, \(T > 0\) is total taxes
- \(\text{FGP}_M C_{\downarrow T} \text{ and } B\uparrow \text{End income } \geq 0\) is the marginal contribution of \(T\) and \(B\) to \(\text{FGP}\)
- \(\text{FI}_M C_{\downarrow T} \text{ and } B\uparrow \text{End income } \geq 0\) is the marginal contribution of \(T\) and \(B\) to \(\text{FI}\)

- This is a weighted average of:

\[
\text{Tax Effectiveness}_{\downarrow \text{FI}} = 1 - \text{FI}_M C_{\downarrow T\uparrow \text{End income }} /T,
\]

\[
\text{Transfer Effectiveness}_{\downarrow \text{FGP}} = \text{FGP}_M C_{\downarrow B\uparrow \text{End income }} /B
\]

Source: Enami, Higgins, and Younger (2017)
Outline of What’s New in CEQ

- Treatment of Contributory Social Insurance Pensions
- Fiscal Impoverishment Indicators
- Effectiveness Indicators
- Valuing Health Benefits
- Valuing Education Benefits
- Underreporting and undercoverage of top incomes
Valuing Health Benefits

- We follow so-called “expenditure incidence” or the “government cost-of-provision” approach.
- Per beneficiary input costs obtained from administrative data as the measure of average benefits.
  - As disaggregated as possible.
  - E.g. by type of care and by state.
- This approach amounts to asking the following question:

  How much would the income of a household have to be increased if it had to pay for the free or subsidized public service at its full cost to the government?
Valuing Health Benefits

- **Issue:** welfare impact could be very different than amount spent
  - For example: low-cost preventative care (e.g. oral rehydration therapy, vaccination) can have large health impacts

- **Alternative:** Behavioral-outcome approach
  - Accounts for behavioral change and relies on outcomes to measure welfare

- **Ongoing work by Jeremy Barofsky**

- **Strategy:** use natural experiments where public health insurance coverage was expanded to estimate effect of different health interventions on mortality
  - Then convert to $ using value of statistical life
Valuing Health Benefits

- Limitations of the behavioral-outcome approach
  - Necessary data and natural experiments to evaluate welfare impact not available in most countries
  - Relies on value of statistical life estimates

- Unlikely that these methods will replace government cost-of-provision approach in CEQ methodology
  - In ongoing work Jeremy Barofsky is comparing the results from this method to cost-of-provision
  - Can be added as robustness checks when possible
Outline of What’s New in CEQ

- Treatment of Contributory Social Insurance Pensions
- Fiscal Impoverishment Indicators
- Effectiveness Indicators
- Valuing Health Benefits
- Valuing Education Benefits
- Underreporting and undercoverage of top incomes
Valuing Education Benefits

- Same as health: “government cost-of-provision” approach
  - As disaggregated as possible
  - E.g. by level of schooling and by state

- **Issue:** welfare impact could be very different than amount spent
  - Net present value of education benefits over lifetime

- Other possibilities to determine benefit of public education
  - Mincer regressions – but many reasons this might not estimate private rate of return (Heckman et al 2006)
Valuing Education Benefits

- Ongoing work by Sergio Urzua
- Estimate internal rates of return by modeling decision of whether to pursue next level of education
- Drawbacks to this approach:
  - Leads to estimates of differences in return across levels, not an absolute level of the return
- Like new health methods, unlikely to replace government cost-of-provision approach in CEQ methodology
  - Amounts can be compared to current methodology
  - Can be added as robustness checks when possible
Outline of What’s New in CEQ

• Treatment of Contributory Social Insurance Pensions
• Fiscal Impoverishment Indicators
• Effectiveness Indicators
• Valuing Health Benefits
• Valuing Education Benefits
• Underreporting and undercoverage of top incomes
Underreporting and Undercoverage at Top

- **Issue**: multiple issues lead to bias in inequality estimates
  1. Underreporting of incomes
     - Can happen anywhere in the distribution
     - Don’t know direction of bias on inequality estimate
  2. Unit non-response
     - Rich are less likely to respond to survey
     - Counter-intuitive: not necessarily true that this → inequality is underestimated (Deaton, 2005)
       - A “missing rich” person, once added back into survey, affects both relative distribution and mean income
       - Gini is function of both
     - In practice, this problem has led to underestimation of inequality (e.g. Hlasny and Verme, forthcoming)
Underreporting and Undercoverage at Top

- **Issue:** multiple issues lead to bias in inequality estimates
  3. Extreme observations
    - Even in absence of underreporting or higher probability of unit non-response from rich
    - Incomes of the rich are sparse (long tail of distribution)
    - Suppose our survey samples 1% of population, evenly distributed throughout distribution
    - We will sample 1 of richest 100 people
    - Assuming Pen parade is convex at upper tail of distribution:
      - In expectation, we get the right income for richest 100
      - More likely to underestimate than overestimate
      - But if we overestimate, expected to do so by more than if we underestimate
Underreporting and Undercoverage at Top

- **Issue:** multiple issues lead to bias in inequality estimates
  3. Extreme observations

![Graph showing income distribution by percentile](image)
Underreporting and Undercoverage at Top

- Potential solutions
  - Reweight or adjust incomes
  - Parametric correction to top incomes (e.g. fit a Pareto to upper tail of distribution)
  - Use tax record tabulation; cell-based imputations

- Drawbacks of these:
  - Based on assumptions we haven’t had the data to test
  - We don’t know which of the three issues described before is more prevalent

- Ongoing work by Facundo Alvaredo, Mauricio De Rosa, Sean Higgins, Nora Lustig, Andrea Vigorito

- Merge individual-level survey and tax return data to quantify extent of each issue, test assumptions and solutions
CEQ Stata Package
Outline of CEQ Stata Package

- **Getting started and resources**
- Treatment of Contributory Social Insurance Pensions with CEQ Stata commands
- Newest commands
- Commands to run first; check basic results
- Commands for more advanced tasks
- Ongoing work: standalone commands for CEQ indicators (fiscal impoverishment, effectiveness)
CEQ Stata Package: Getting started

- Make sure have Stata 13 or newer
  - To export *graphs* (*ceqgraph* commands) directly to MWB, need Stata 14 or newer

- To install or update the CEQ Stata Package:
  - `update all`
  - `ssc install ceq, replace`

- Include the above in your do files that use CEQ Stata commands
  - This ensures always using most recent version of commands

- Read the resources (next slide)
CEQ Stata Package: Resources

- CEQ Handbook Chapter 7 (Higgins, 2017)
  - All the indicators used in the results in MWB Sections D and E
  - Commands and their syntax
- If analysis separated by group: Chapter 8 (Aranda and Ratzlaff, 2017)
- `help ceq` and help files for other commands
- If you get an error or have suggestions to improve the package email me at sean.higgins@ceqinstitute.org
- Always working on improving package
  - For example, thanks to Mata code for Ginis and concentration coefficients from Paul Corral, improved efficiency and runtimes of commands
Outline of CEQ Stata Package

• Getting started and resources
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• More commands
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Constructing Income Concepts

Pre-fiscal income in PGT scenario →

Market Income

- Contributions to Pensions

Contributory Pensions

Market Income plus Pensions

Net Market Income

Gross Income

Direct Taxes

Disposable Income

Indirect Taxes

Consumable Income

Copayments, User Fees

Final Income

Direct Transfers

Indirect Subsidies

Non-Taxable Income

Taxable Income

Pre-fiscal income in PDI scenario →

Market (market())

Contributions to Pensions (contribs())

Contributory Pensions (mpluspensions())

Direct Transfers (dtransfers())

Direct Taxes (dtaxes())

Disposable Income (disposable())

Indirect Taxes (indtaxes())

Consumable Income (consumable())

Copayments, User Fees (userfeeseduc(), userfeeshealth(), userfeesother())

In-Kind Transfers (Education, Health) (educ(), health(), otherpublic())

Source: Higgins (2017)
Outline of CEQ Stata Package

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Newest Commands

• `ceqmarg` calculates the marginal contribution of each fiscal intervention to inequality, poverty, reranking

• `ceqef` calculates effectiveness indicators for broad categories (going from one core income concept to another)

• `ceqefext` calculates effectiveness indicators for each fiscal intervention

• `ceqcoverage` calculates coverage and leakages among each income group for each fiscal intervention

• `ceqtarget`: same but among target population
Outline of CEQ Stata Package

• Getting started and resources
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• Commands to run first; check basic results
• More commands
• Ongoing work: standalone commands for CEQ indicators (fiscal impoverishment, effectiveness)
Commands to run first; check basic results

- **ceqppp** as input to other commands
  - Automates PPP conversions

- **ceqassump** gives inequality, poverty, distribution by decile
  - Unlike other commands, no specific options for each income concept
  - Instead list any set of income variables in `varlist`

- Many uses
  - First glance at results
  - Test effect of different assumptions when constructing income concepts
  - Policy simulations
Commands to run first; check basic results

- `ceqdes` gives non-distributional summary statistics
  - For both income concepts and fiscal interventions
  - % with non-0; mean; median; etc.

- Tip: rather than construct all income concepts first, often teams will start using `ceqassump` and `ceqdes` as they go
  - E.g. construct market income plus pensions and disposable income, use `ceqassump` and `ceqdes`, check these results to see if reasonable
  - Often even produce more results (`ceqlorenz`, `ceqfiscal`, `ceqextend`) and send through CEQ Checking Protocol before constructing consumable, final income
Outline of CEQ Stata Package

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• More commands
• Ongoing work: standalone commands for CEQ indicators (fiscal impoverishment, effectiveness)
More commands

- \texttt{ceqlorenz}, \texttt{ceqfiscal}, \texttt{ceqextend} jointly produce a lot of the “main” incidence and concentration results for Section D
- \texttt{ceqfi} produces the fiscal impoverishment indicators
- \texttt{ceqstatsig} assesses statistical significance of differences in inequality and poverty across core income concepts
  - \texttt{ceqextsig} does the same for impact of particular fiscal interventions on inequality and poverty
- \texttt{ceqgraph} (with various subcommands) produces graphs of Lorenz curves, concentration curves, CDFs, fiscal impoverishment curves
Outline of CEQ Stata Package

• Getting started and resources
• Treatment of Contributory Social Insurance Pensions with CEQ Stata commands
• Newest commands
• Commands to run first; check basic results
• More commands
• Ongoing work: standalone commands for CEQ indicators (fiscal impoverishment, effectiveness)
Thank you!
Credits
CEQ Institute: Team

TEAM

• Nora Lustig, Director
• Ludovico Feoli, Director of Policy Area

• Core Team (in alphabetical order):
  • Maynor Cabrera, Director of Projects and Advisory Services and Associate Director for Latin America & the Caribbean
  • Samantha Greenspun, Director of Grants and Project Management
  • Sean Higgins, Co-Director of CEQ Data Center and Software Development
  • Jon Jellema, Associate Director for Africa, Asia and Europe
  • Carlos Martin-del-Campo, Director of Communications
  • Israel Martinez, Coordinator of CEQ Masterdata
  • Itzel Martinez, Administrative Coordinator
  • Sandra Martinez, Co-Director of CEQ Data Center and Software Development
  • Estuardo Moran, Associate Director for Latin America & the Caribbean
  • Lisa Paterson, Assistant Director
  • Stephen Younger, Associate Director for Africa, Asia and Europe

• Research Associates (resident): Jim Alm, Rodrigo Aranda, Stefano Barbieri, Koray Caglayan, Enrique de la Rosa, Ali Enami, Siyu Quan

• Research Assistants: Marc Brooks, Cristina Carrera, Ruoxi Li, Michael Ossorguine, Xavi Recchi
References:


Teams and References by Country (the year for which the analysis was conducted in parentheses); C=consumption & I=income)


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(the year for which the analysis was conducted in parentheses); C=consumption & I=income)


Cabrera, Maynor and Hilcias E. Moran. 2015a. “CEQ Master Workbook: Guatemala. Version: May 6, 2015,” CEQ Data Center (CEQ Institute, Tulane University, Instituto Centroamericano de Estudios Fiscales (ICEFI) and International Fund for Agricultural Development (IFAD)).


Teams and References by Country
(the year for which the analysis was conducted in parentheses); C=consumption & I=income)


Cabrera, Maynor and Hilcias E. Moran. 2015b. “CEQ Master Workbook: Nicaragua. Version: October 14, 2015” CEQ Data Center on Fiscal Redistribution (CEQ Institute, Tulane University, Instituto Centroamericano de Estudios Fiscales (Icefi) and International Fund for Agricultural Development (IFAD)).


Jaramillo, M. 2015. CEQ Master Workbook: Peru, August 7. CEQ Institute, Tulane University.
Teams and References by Country
(the year for which the analysis was conducted in parentheses); C=consumption & I=income)


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(the year for which the analysis was conducted in parentheses);
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Appendix
Classification

A = Pro-poor and equalizing, per capita spending declines with income

B = Neutral in absolute terms and equalizing, same per capita for all

C = Equalizing but not pro-poor, per capita spending as a share of market income declines with income

D = Unequalizing, per capita spending as a share of market income increases with income
<table>
<thead>
<tr>
<th>Country</th>
<th>Total Education</th>
<th>Pre-school</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
<th>Health</th>
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<tbody>
<tr>
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<td>A</td>
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<td>--</td>
<td>C</td>
<td>A</td>
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<tr>
<td>Armenia (2011)</td>
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<td>A</td>
<td>A</td>
<td>--</td>
<td>C</td>
<td>B</td>
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<tr>
<td>Bolivia (2009)</td>
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<td>A</td>
<td>A</td>
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<td>C</td>
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<tr>
<td>Brazil (2009)</td>
<td>A</td>
<td>A</td>
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<td>A</td>
<td>C</td>
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<td>Chile (2013)</td>
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<td>A</td>
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<td>Colombia (2010)</td>
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<tr>
<td>Costa Rica (2010)</td>
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<td>A</td>
<td>C</td>
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<tr>
<td>Dominican Republic (2013)</td>
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<td>C</td>
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<td>Ecuador (2011)</td>
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<td>El Salvador (2011)</td>
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<td>Ethiopia (2011)</td>
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<td>D</td>
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<td>C</td>
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<td>Peru (2009)</td>
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<tr>
<td>Russia (2010)</td>
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<td>--</td>
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<td>--</td>
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<tr>
<td>Tanzania (2011)</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>C</td>
<td>D</td>
<td>C</td>
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<td>Tunisia (2010)</td>
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<tr>
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<td>C</td>
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<td>A</td>
<td>A</td>
<td>B</td>
<td>A</td>
</tr>
</tbody>
</table>

Source: Lustig (2017)
Main Results

- Education spending on primary schooling per person tends to decline with income (“pro-poor”)...
  - ... with the exception of Ethiopia where it is the same across the income distribution (neutral in absolute terms)

- Education spending on secondary schooling per person tends to decline with income (“pro-poor”) or be the same across the income distribution...
  - Are middle-classes opting out in middle and high income countries?

- Tertiary education spending is not pro-poor but it is equalizing except for Ethiopia, Ghana, Guatemala, Indonesia, Tanzania, and Uganda, where it is unequalizing

Source: Lustig (2017)