Poverty and Social Impact Analysis: Taking Risk Into Account

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Objective

- Method to incorporate risk into the measurement of the impact of policy reforms on poverty
- Standard concepts of risk aversion and certainty equivalents are used to estimate *ex ante* risk-adjusted measures of income/consumption/poverty
- Poverty impacts *ex ante* may differ from traditional pre- and post-reform comparisons
Example #1

• Agricultural liberalization:
  – Many farmers may benefit from a higher share of world commodity price after liberalization
  – But variability in farm gate prices may also increase

• Despite higher expected revenues after reform, post-reform poverty taking into account risk aversion may be higher when taking into account risk aversion (while pre vs. post reform poverty comparison may suggest positive reform impact)

• Other risks may affect production itself (e.g., market failure for the provision of inputs)
Example #2

• Minimum wage increase:
  – Many workers should benefit from a wage increase
  – Some workers will probably lose their job

• Despite higher expected income after reform for most/all workers, post-reform poverty may be higher for low poverty lines if workers who lose their job are at zero or low subsistence wages

• Yet ex-ante poverty impact may suggest lower poverty if risk aversion is sufficiently low
  – Analogy: each individual/household computes expected wage/income & risk and votes for the reform depending on level of risk aversion
Example #3

• Trade liberalization:
  – Some workers may lose, others may gain, in each case with uncertainty as to exactly whom will be affected
  – Most consumers should enjoy lower prices
• Same setting as minimum wage reform for the income or wage component of the analysis
• Additional potential gain in equivalent income with the reduction in prices of goods – probability statements for likely price variations could be integrated in the analysis on the consumption side
Basic Method

• Assumptions for empirical illustration:
  – Constant Relative Risk Aversion
  – First order Taylor approximation

\[ y(\rho) = E(x) - \frac{1}{2} R_A(\rho)\sigma^2(x), \text{ with } R_A(\rho) = \frac{\rho}{E(x)} \]

• Notes:
  – Poverty increases with higher \( \rho, \sigma^2 \)
  – Assumptions can be relaxed/generalized
  – Method is extension of previous work on poverty, inequality, and social welfare measurement under risk aversion using panel data (Mexico, UK, Argentina)
Illustration #1: Minimum Wage

- Colombia - wages and employment elasticities to changes in minimum wage obtained from Maloney and Nuñez (2001)

<table>
<thead>
<tr>
<th>Wage/Minimum Wage Intervals</th>
<th>Hourly Wage Elasticity</th>
<th>Employment Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 0.5</td>
<td>1.3230</td>
<td>-0.2719</td>
</tr>
<tr>
<td>0.5 – 0.7</td>
<td>1.1612</td>
<td>-0.2499</td>
</tr>
<tr>
<td>0.7 – 0.9</td>
<td>1.0189</td>
<td>-0.1970</td>
</tr>
<tr>
<td>0.9 – 1.1</td>
<td>0.6869</td>
<td>-0.1680</td>
</tr>
<tr>
<td>1.1 – 1.3</td>
<td>0.5688</td>
<td>-0.1517</td>
</tr>
<tr>
<td>1.3 – 1.5</td>
<td>0.2635</td>
<td>-0.1661</td>
</tr>
<tr>
<td>1.5 – 2.0</td>
<td>0.4645</td>
<td>-0.0907</td>
</tr>
<tr>
<td>2.0 – 3.0</td>
<td>0.3874</td>
<td>-0.1114</td>
</tr>
<tr>
<td>3.0 – 4.0</td>
<td>0.1778</td>
<td>-0.1099</td>
</tr>
<tr>
<td>&gt; 4.0</td>
<td>0.1249</td>
<td>-0.1293</td>
</tr>
</tbody>
</table>
Pre- and Post-Reform Wages

• Wages before and after reform are $w_A$ and $w_B$. There are $J$ intervals with wage and employment elasticities $\varepsilon_{Wj}$ and $\varepsilon_{Ej}$. If subsistence wages are $w_S$, post-reform wage distribution is such that:

$$w_A = \begin{cases} 
  w_B(1 + \varepsilon_{Wj} \frac{\Delta MW}{MW}) & \text{w.p. } 1 - \left|\varepsilon_{Ej}\right| \frac{\Delta MW}{MW} \text{ if } w_A \in I_j ; j=1..J \\
  w_s & \text{w.p. } \left|\varepsilon_{Ej}\right| \frac{\Delta MW}{MW} \text{ if } w_A \in I_j ; j=1..J 
\end{cases}$$

• If household income is adjusted for change in individual wages, comparisons of distributions pre- and post-reform could generate higher poverty due to “bump” at bottom of distribution.
Risk-adjusted Ex Ante Impact

- For the ex ante analysis of the impact of the reform, expected household income may be computed assuming no behavioral response, using changes in individual wages for all individuals in the household.

\[
E(y) = \left[ y_B + w_B \left( 1 + \varepsilon_{w_j} \frac{\Delta MW}{MW} \right) - w_B \right] \left( 1 - p \right) + \left( y_B + w_s - w_B \right) \frac{\Delta MW}{MW} \right] \frac{\Delta MW}{MW}
\]

- The variance in household income is also computed using the two probabilities \( \sigma^2(y) = E(y^2) - E^2(y) \).
- The risk-adjusted household income can then be computed for various levels of risk aversion.
Poverty Comparisons

- For low poverty lines, pre- vs post-reform comparisons of poverty suggest negative impact of reform, but ex ante impact is positive even for high risk aversion

<table>
<thead>
<tr>
<th></th>
<th>Mean income</th>
<th>Headcount</th>
<th>Pov. Gap</th>
<th>Sq. Pov. Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-reform</td>
<td>787450.30</td>
<td>0.043</td>
<td>0.012</td>
<td>0.005</td>
</tr>
<tr>
<td>Post-reform</td>
<td>804355.40</td>
<td>0.046</td>
<td>0.021</td>
<td>0.015</td>
</tr>
<tr>
<td>Ex ante, $\rho=0$</td>
<td>802870.80</td>
<td>0.037</td>
<td>0.010</td>
<td>0.004</td>
</tr>
<tr>
<td>Ex ante, $\rho=2$</td>
<td>794923.50</td>
<td>0.039</td>
<td>0.010</td>
<td>0.004</td>
</tr>
<tr>
<td>Ex ante, $\rho=4$</td>
<td>786976.20</td>
<td>0.042</td>
<td>0.011</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Poverty Line = 1 US$/day, Min. Wage Increase = 10%, Subsistence Wage = 0
Illustration #2: Agriculture

- Basic setting for cotton liberalization:
  - Higher producer price as share of world price (possibly with ≠ increases in share for ≠ producers)
  - Move from a Government-set price to world price variance; issue of time frame for estimating $\sigma^2$
  - Yearly variance in world prices over 1994-2003 is 260
  - Monthly variance in world prices for one year is 41
  - Weekly variance over 4 months period in 2003 is 1.8
  - Possibility of introducing output response (price elasticity of producer supply; distinguishing short term vs long-term impacts, with crop substitution)
  - Possibility of introducing risk in input distribution
References

• **Risk-adjusted welfare measurement:**

• **PSIA – taking risk into account (in progress)**
  – Angel-Urdinola, D., and Q. Wodon, Ex Ante Measurement of the Poverty Impact of Increasing the Minimum Wage in Colombia
  – Siaens, C., and Q. Wodon, Cotton Sector Reform and Poverty