MACRO-ECONOMIC IMPACTS OF COLOMBIA’S NDC

Paving the Way for NDC Implementation:
Analyzing Policy Options and Modeling Carbon Pricing
San Jose, Costa Rica – 6-8 December 2016
Real Intercontinental Hotel
7 December 2016
What was the commitment of Colombia at COP21?

Principal objective

Methodological issues
  • Sectoral GHG mitigation measures
  • Computable General Equilibrium Model for Colombia (MEG4C)
  • Microsimulations Model (MMS)

Results

Conclusions and recommendations
What is the commitment of Colombia?

Colombia commits to reduce its greenhouse gas emissions by 20% with respect to the projected Business-as-Usual Scenario (BAU) by 2030.

- GHG Mitigation measures will be:
  - Identified, prioritized and quantified
  - Abatement potential
  - Economic/financial variables
  - Institutional variables

- Mitigation scenario was built considering sectoral development priorities and needs.

Source: ECDBC, MADS, Uniandes, 2015
Assess the economic effects of implementation of mitigation measures that are part of National Commitment of Colombia.
Methodology

1. Adjust the information of mitigation measures to requirements of MEG4C.

2. Modeling baseline and mitigation scenario using MEG4C.

3. Assess macroeconomic results of MEG4C and the effects on households welfare obtained by microsimulation model (MMS).

2. Methodological Issues
Mitigation Measures

Example: MACC public transport

<table>
<thead>
<tr>
<th></th>
<th>Abatement MtCO2e</th>
<th>USD/tCO2e</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scrapping</td>
<td>$0.00</td>
</tr>
<tr>
<td>2</td>
<td>Better standards performance + Make Cars Green</td>
<td>$50.00</td>
</tr>
<tr>
<td>3</td>
<td>Better standards performance</td>
<td>$100.00</td>
</tr>
<tr>
<td>4</td>
<td>Better standards performance</td>
<td>$150.00</td>
</tr>
<tr>
<td>5</td>
<td>Better standards performance + Make Cars Green</td>
<td>$200.00</td>
</tr>
<tr>
<td>6</td>
<td>Replacement traditional vehicles with hybrid vehicles.</td>
<td>$250.00</td>
</tr>
<tr>
<td>7</td>
<td>Replacement traditional vehicles with electric vehicles.</td>
<td>$300.00</td>
</tr>
<tr>
<td>8</td>
<td>Replacement conventional buses with electric vehicles.</td>
<td>$350.00</td>
</tr>
<tr>
<td>9</td>
<td>Replacement road transport by river transportation.</td>
<td>$400.00</td>
</tr>
<tr>
<td>10</td>
<td>Renewal of cargo fleet.</td>
<td>$450.00</td>
</tr>
<tr>
<td>11</td>
<td>Increase of LNG share</td>
<td>$500.00</td>
</tr>
<tr>
<td>12</td>
<td>Replacement: road by rail</td>
<td>$550.00</td>
</tr>
<tr>
<td>13</td>
<td>Increase of NG share</td>
<td>$600.00</td>
</tr>
</tbody>
</table>

Source: ECDBC, Uniandes, 2015
Key dimensions of our tool

- Geographical scale: national
- Granularity: Sectoral with focus measures
- Time horizon: 2050
- Impact indicators: macroeconomic implications, distributional/social impacts
- Theoretical foundation and model solution: CGE model
- Ex-ante projection VS ex-post evaluation: Ex-ante

Economic impact of NDC implementation
Supply shock

- Promoting the economic activity (Demand of capital)

\[
\begin{align*}
\text{Production} & \\
\text{Value added + energy} & \\
\text{Intermediate Consumption} & \\
\text{Capital-Energy} & \\
\text{Capital} & \\
\text{Refined oil products} & \\
\text{Oil} & \\
\text{Energy} & \\
\text{Electricity} & \\
\text{Labor} & \\
\text{Coal} & \\
\text{Natural gas} & \\
\end{align*}
\]

\[
\begin{align*}
ak_i^{bau} &= \frac{k_i}{KE_i} \\
ak_i^{mm2} &= \frac{k_i + \Delta CK_i^{mm2}}{KE_i}
\end{align*}
\]

Source: SDAS - DNP
Supply shock

- Efficiency in the use of energetic inputs

\[
aep_{i,e}^{bau} = \frac{xap_{i,e}}{E_i}
\]

\[
aep_{i,e}^{mm2} = \frac{xap_{i,e} + \Delta O&M_{i,e}^{mm2}}{E_i}
\]

Source: SDAS - DNP
Example: Replacement of energetic inputs

2. Methodological Issues

- Capital
  - Refined oil products
  - Oil
- Energy
  - Gas Natural
  - Carbon
  - Electricity

Investment cost

Changes in production costs
• Total effect will depend on change of relative prices caused by mitigation measures.
MMS: Welfare of households

Share of goods in household consumption basket

Microsimulations

Price and income are outcome of MEG4C. Its calibration uses household consumption baskets, data taken from the Survey on Quality of Life 2014
There would be some adjustment costs in the short term, which would be more than compensated by a higher rate of economic growth in the medium-long term.
Mitigation measures focused on final energy consumption (households, industry and transport) have positive effect on the economy.
3. Results

- The unemployment rate is reduced by 2% to 2040.

- The investments are in labor-intensive (agriculture/transport) sectors encourage labor demand.
The implementation of mitigation measures generates a higher level of welfare for society. **There are not significant differences between income quintiles.**

![Change of welfare by quintile (average 2015-2040)](image)

- Quintile 1: 0.67
- Quintile 2: 0.71
- Quintile 3: 0.72
- Quintile 4: 0.76
- Quintile 5: 0.73

Average: 0.72
Conclusions and recommendations
Conclusions and recommendations

- NDC are the opportunity to generate an structural change in the economy with productive capital and social welfare

- Household welfare: The implementation of mitigation measures generate a higher level of welfare for society. There are not significant differences between income quintiles.
Conclusions and recommendations

- The economic benefits are *guarantee* if:
  
  - Increases operating profits (or reduction of O&M costs)
  - Transfer this increases/reductions to consumers
  - Strong institutional arrangements
  - Promote the absorption of employment in sectors such as industry, construction and transport.
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