SCENARIOS ON CLIMATE CHANGE IMPACTS FOR DEVELOPING APEC ECONOMIES

Maximo Torero, IFPRI

APEC Climate Symposium 2016
CLIMATE VARIABILITY AND RISK

- Moderate consensus that temperate regions will have increased variability in temperature and rainfall
- No consensus on tropical regions (IPCC AR4)
- But increased mean temperature increases risk
Figure 1. Impacts of climate change on global yields, area, production and prices of the 5-crop aggregate relative to baseline values in 2050 for each Shared Socioeconomic Pathway (SSP) and Representative Concentration Pathway (RCP) compared across five models.

Note: ENV = ENVISAGE, FAR = FARM, IMP = IMPACT, MGN = MAGNET, MGP = MAgPIE.

Source: Work in progress by IFPRI, LEI-WUR, PIK, Purdue, USDA-ERS, IDS
Agricultural trade and Mitigation

Part of the problem...

• Trade increase emissions:
  – Trade creates markets, connecting a new demand to a new supply: it can cause severe environmental damage (direct e.g. timber and indirect effects e.g. tea plantation)
  – Trade requires to transport goods: more transportation emissions
  – Limiting trade is a second best tool: lack of enforcing capacity to protect environment or tax transport externalities

... Part of the solution

• Trade does not only lead to produce more, but also to produce differently, and potentially better:
  – Less energy intensive production
    • a Spanish tomato consumed in England has a carbon footprint of only ¼ of its British cousin
    • Agriculture: USA 553Kj/Kcal, Zambia 191Kj/Kcal
  – But markets need the truthiness of prices: danger of subsidies in agriculture on energy use
  – Role of technology transfer

• But trade can also promote “green” goods
  – Specific issues around Bioenergy
Agricultural trade policy: mitigation and adaptation

• Pattern of trade specialization matters for the terms of trade effects and country exposure to shocks (level and volatility)

• Degree of openness and size of the markets matter: market power and terms of trade

• Therefore: trade policies matter for managing climate change
  – Short term vs long term tools
Agricultural trade and Income: 
the bridge between mitigation and adaptation

• We promote trade because we want growth and inclusive growth.
• But growth has contrasted effects.
  – For the mitigation stage:
    • Without strong environmental policies: More growth = more emissions. The Environmental Kuznets Curve is not the rule!
    • Poverty alleviation is even a complex issue:
      – Poverty reduction: a powerful weapon to fight “charcoal” based economy
      – Poverty reduction: people will eat more, and more meat...
    • Political economy: More opportunity to implement new mitigation regulation with booming economies than high unemployment
  – For the adaptation stage:
    • Strong growth, combined with structural changes, the best adaptation strategy
      – Large investments in R&D and Infrastructure for coping with CC in agriculture
Climate change and Agriculture: what can we quantify in agriculture?

Changes in yields
- Water
- Temperature
- CO2 fertilization

Changes in Pest and Disease

Extreme events

Climate models:
Global Circulation Models → changes in weather patterns
(here 4 different models will be used)

Agronomic models:
Crop models → changes in yields at constant economic conditions
(here different models will be used based on AgMip)

Economic models:
Impact on the economic systems, feedback of investments, specialization...
(here we use the MIRAGRODEP CGE)
Heterogeneous projections
Illustration Maize – Rain fed

Rest of the World
AUS  BRN  CAN  CHL  CHN  IDN  JPN  MEX  NZL  PNG  PER  PHI  RUS  SGP  KOR  THA  US  VNM

-40%  -30%  -20%  -10%  0%  10%  20%  30%  40%  50%

GFDL  HadGEM  IPSL  MIROC  NorES
Heterogeneous projections
Illustration Rice- Irrigated

-30%
-20%
-10%
0%
10%
20%
30%
40%
50%

Rest of the World
AUS
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HadGEM
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MIROC
NorES
Average Yield impacts for APEC Economies by 2050

-50%
-40%
-30%
-20%
-10%
0%
10%
20%
30%
40%

AUS BRN CAN CHL CHN IND JAP MYS MEX NZL PNG PER PHL RUS SGP KOR THA USA VNM

Wheat Other Grains Rice Sugar
World Price increases due to climate change (average scenario)
Average Impact of climate change (yield effects) on real income per capita, %, by 2050

-0.2 0 0.2 0.4 0.6 0.8 1

APEC (Total)  North America  South America  Oceania  South East Asia  East Asia  High Income countries  Upper and Middle Income countries  Low and Middle Income countries

Geographical grouping

Income grouping
Average Impact of climate change (yield effects) on Agricultural Value Added, %, by 2050

Geographical grouping

- APEC (Total)
- North America
- South America
- Oceania
- South East Asia
- East Asia

Income grouping

- High income Countries
- Upper and Middle Income countries
- Low and Middle income countries
Average Impact of climate change (yield effects) on fruits and vegetables consumption per capita, %, by 2050
Effects over Fisheries

Schematic diagram indicating the biophysical and socio-economic impacts of climate change at different levels of organizations, from individual organisms to the society.

Effects over Fisheries

Sea surface temperature changes, global fish catch and the number of publications on the relationship between climate change and fisheries.

Effects over Fisheries
Summary of the approach and key results of a modelling study that assesses the impacts of climate change on potential catches from global fisheries

Effects over Fisheries

Summary of the approach and key results of a modelling study that assesses the impacts of climate change on potential catches from global fisheries.

### Effects over Fisheries

Summary of potential impacts of climate change on the economics of fisheries based on information from the published literature

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Region</th>
<th>Catch Potential</th>
<th>Prices</th>
<th>Cost</th>
<th>Earnings to Companies</th>
<th>Resource Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift in distribution of species</td>
<td>Arctic</td>
<td>Increase (^{12}) Invasion of warmer water species (^{47})</td>
<td>Decrease *</td>
<td>Fishing: decrease (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Increase (^{69,\dagger})</td>
</tr>
<tr>
<td></td>
<td>Temperate</td>
<td>No change (^{12}) Changes in species composition resulting from both species gains and losses (^{47})</td>
<td>Not yet known</td>
<td>Fishing: not yet known (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Increase (^{13,\dagger})</td>
</tr>
<tr>
<td></td>
<td>Tropics</td>
<td>Decrease (^{12}) Species losses (^{47})</td>
<td>Not yet known</td>
<td>Fishing: increase (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>No change</td>
</tr>
<tr>
<td>Ocean acidification</td>
<td>Global</td>
<td>Decrease (^{32})</td>
<td>Increase *</td>
<td>Fishing: increase (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Increase</td>
</tr>
<tr>
<td>Expansion of oxygen minimum zones</td>
<td>Global</td>
<td>Decrease (^{32})</td>
<td>Increase</td>
<td>Fishing: increase (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Increase</td>
</tr>
<tr>
<td>Reduction in body size</td>
<td>Global</td>
<td>No change</td>
<td>Increase (^{72})</td>
<td>Fishing: no change (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Not yet known/ increase</td>
</tr>
<tr>
<td>Increased variability</td>
<td>Global</td>
<td>No change</td>
<td>Variable</td>
<td>Fishing: increase (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Not yet known/ increase</td>
</tr>
<tr>
<td>Increased extreme weather</td>
<td>Global</td>
<td>Actual catch: decrease</td>
<td>Increase *</td>
<td>Fishing: increase (\text{Adaptation: increase})</td>
<td>Not yet known (^{1})</td>
<td>Not yet known/ increase</td>
</tr>
</tbody>
</table>


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* Details of each topic, and the supporting references, are summarized in this review. *Everything being equal, an increase in catch means a decrease in price, but recall discussion in main text. *Depends on the interplay between changes in price and the cost of fishing and adaptation. *In general, whether rent will increase or decrease depends on the state of the resources before climate change, and the institutional and management regimes in place. *Everything being equal, if catch decreases then price increases, but recall discussion in main text.
Climate Smart Policies: We Know the Big Picture
1. Accelerate investments in agricultural R&D for productivity growth and climate resilience

2. Increase investment in rural infrastructure; regulatory reform in seed and input markets; improve extension services (big data, IT)

3. Reform economic policies: open trade; land and water rights; reduction of energy, water, and fertilizer subsidies; value carbon
Climate Smart Policies:
But the Details Need More Evidence
CLIMATE SMART POLICIES: BUT THE DETAILS NEED MORE EVIDENCE

1. Analysis is needed to close knowledge or information gaps regarding the degree of “climate smartness” of policies, investments and technologies.

2. Market signals cannot provide the necessary guidance because impacts are not easily observable and prices are missing on resilience and GHG emissions. So these need to be discovered through analysis.

3. In addition, climate smartness is highly location specific, so evidence needs to be spatially disaggregated.
CSA forces us to shift the emphasis from policies that aim at a single target to policies that have multiple objectives.

CSA changes the planning time horizon: policies and analyses necessarily span long time periods of 20-30 years.
Therefore, CSA requires the use of integrated modeling frameworks that work at multiple geographical scales to:

1) Prioritize investments and provide an accurate understanding of tradeoffs

2) Increase velocity of technological innovation and adoption taking into account demand side

3) Design long-term economically and politically sustainable policies
More importantly, given its complexity, CSA requires an even closer collaboration between policy makers and research community.