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An Economic Approach to Climate Change

Matt Bogard
Western Kentucky University, matt.bogard@wku.edu

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An Economic Approach to Climate Change

Matt Bogard, M.S.
Why is economics important

• Economics provides mathematically precise theories and empirically sound methods
• Evaluation of costs and benefits associated with policy proposals
• Modeling behavioral responses to changing costs and benefits
Benefit / Cost Analysis

- Information organizing tool
- Translation of all stocks and flows into a common unit of measurement
- Dollar prices reveal how people value scarce resources (use value)
- Non-use value is considered
Global Warming Science

• IPCC 2007 4th Assessment Report (SPM)
• 9/10 experts agree humans have net warming effect p.4
• 66% certain human influence has been enough to affect storm patterns p.6
• 50% certain humans have affected heatwaves and droughts p.6
• 66% certain we will see drastic climatic events (cyclones, storms, droughts) p.8
• 90% chance we will see increases in temperature extremes p.8

*Probabilities defined on p. 3 of introduction of actual report.
An Economic Approach

- CO2 emissions are a negative externality
- External to market transactions, not considered in the prices we pay for goods and services
- Taking science into account, economists try to estimate the value of the negative externality
- Ex: price of CO2 / ton
Theoretical Background

• 1960 JLE The Problem of Social Cost
• 1967 AER Toward a Theory of Property Rights
• Externalities result from poorly defined PR’s
• With PR’s & low transaction costs, externalities can be internalized via markets (bargaining)
Organized Exchanges

- CCX - carbon offsets
- Kyoto Protocol - EU
- $100/ton Summer ‘07
Nordhaus vs. Stern

- Stern Review on the Economics of Climate Change, Sir Nicholas Stern, Head of the Government Economic Service, UK
- DICE-2007 model: Dynamic Integrated Model of Climate and the Economy
- Consists of mathematical equations that represent the laws of motion of output, emissions, climate change, and economic impacts
- Each component is a submodel that draws upon research from the natural sciences.
Baseline Case

- No action taken
- 2100: CO2 = 685 ppm
- Temperature increases 2.4 C
- PV(damages) = $22.6 trillion
- damages consider agriculture, sea level effects, health, and other ‘non-market’ values.
- *IPCC indicates temperature ranges could increase 1.8-4C
Stern Review

- Taking no action, damage from climate change will equal 5% of global GDP/year
- Could be as much as 20% GDP/year
- Abatement costs ~1% GDP/year
## Stern Proposal (in DICE-2007)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TAX/TON CO2</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>$300</td>
<td>Would increase gas prices by $1.20</td>
</tr>
<tr>
<td>2050</td>
<td>$600-$800</td>
<td>$700/ton ~increasing the cost of coal fired electricity by 150%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COST</th>
<th>BENEFITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>$27 trillion</td>
<td>$13 trillion</td>
<td>Negative net benefits</td>
</tr>
</tbody>
</table>
## Nordhaus’ ‘Optimal Policy’

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TAX/TON CO2</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>$34</td>
<td>gas price increase $0.15/gallon</td>
</tr>
<tr>
<td>2015</td>
<td>$42</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>$90</td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td>$207</td>
<td></td>
</tr>
<tr>
<td>COST</td>
<td></td>
<td>BENEFITS</td>
</tr>
<tr>
<td>$2.2 trillion</td>
<td>$5.2 trillion</td>
<td>Positive net benefits</td>
</tr>
</tbody>
</table>
Different Conclusions, Different Discount rates

- Nordhaus: should approximate the market return on capital.
- Investments in reducing climate change should be given equal weight to investments in other technology and capital.
- Stern: $r = 0.1\%$
- Inflates future damages from climate change, or the benefits of immediate action.
Agreement Among Economists?

- For effective policy, we must raise the price of carbon
- Signals to consumers about their ‘carbon footprint’
- Provide incentives for technological change
- Markets economize on the information—partial bits of decentralized information that are possessed by multitudes are coordinated to produce results.
Market vs. Regulatory Approaches

- “proposals resulting in increased fuel efficiency for cars, requiring high efficiency light bulbs, subsidizing solar and wind power ..are largely fluff”- Nordhaus
- Regulatory approaches shrink the pool of knowledge for solving resource related problems
- Motivate ‘rent seeking’ by big business and special interests.
References

- The Challenge of Global Warming: Economic Models and Environmental Policy, William Nordhaus, Sterling Professor of Economics, Yale University 2007