Integrated Assessment Models

I'm the king of the world! — Jack Dawson.

Ivo Welch

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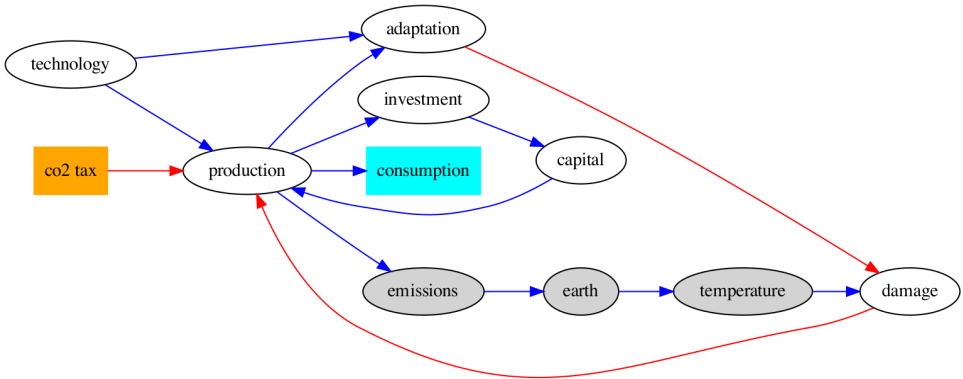
IAMS

- Basis of all international negotiations.
- Key Question: Good Tax on tCO_2.
  - Higher tax → lower emissions.
  - What is the optimal path over time?
    - too fast → economy RIP;
    - too slow → too much warming.

Nobel Prize (appropriately so) for Nordhaus (DICE). However, I will later explain why these models are practically not very useful.

Simplified Dice Sketch



Basics

- DICE is simpler than many other models.
- DICE is *one* big world model.
  - there are also regional versions.
- *One* benevolent policy maker optimizes tax, for all of us, both now and in the future.
  - over about 200 years; by then,
  - most fossil fuels will be exhausted.

Key Inputs And Outputs

- Policy Inputs:
  - Tax rates on CO_2 for each of 200 years;
  - no other taxes (e.g., on children).
- Model Outputs:
  - Sum consumption (incl. environmental!?);
  - Incidental: Temp, CO_2, etc.
- Modeler's Goal:
  - Set policy inputs to max model outputs.

Trustworthy?

- Of course not!
- But better than all alternatives,
  - which are also models — just terrible thoughtless ones.

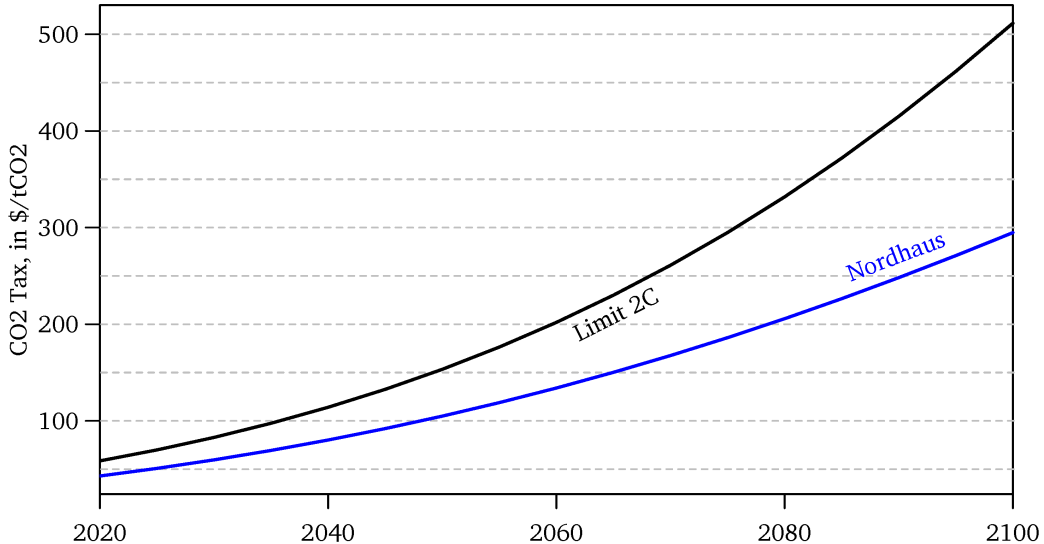
Iam Problems

- Unreliable (and difficult):
  - more speculative even than macro models;
  - way longer out in time (100-200 years);
  - with improving sciences and uncertainties;

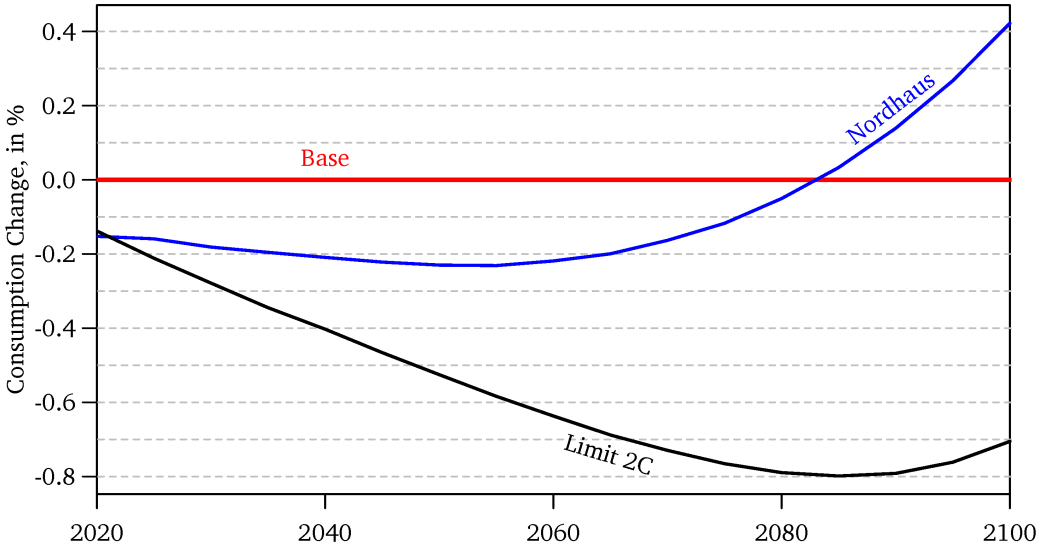
  even Nordhaus himself has only mild intuition.

- Models need some subjective inputs, too.
- Don't take the models *too* seriously!
  - They are *order-of-magnitude* sketch models.

Optimal Co_2 Tax



Consumption Outcome

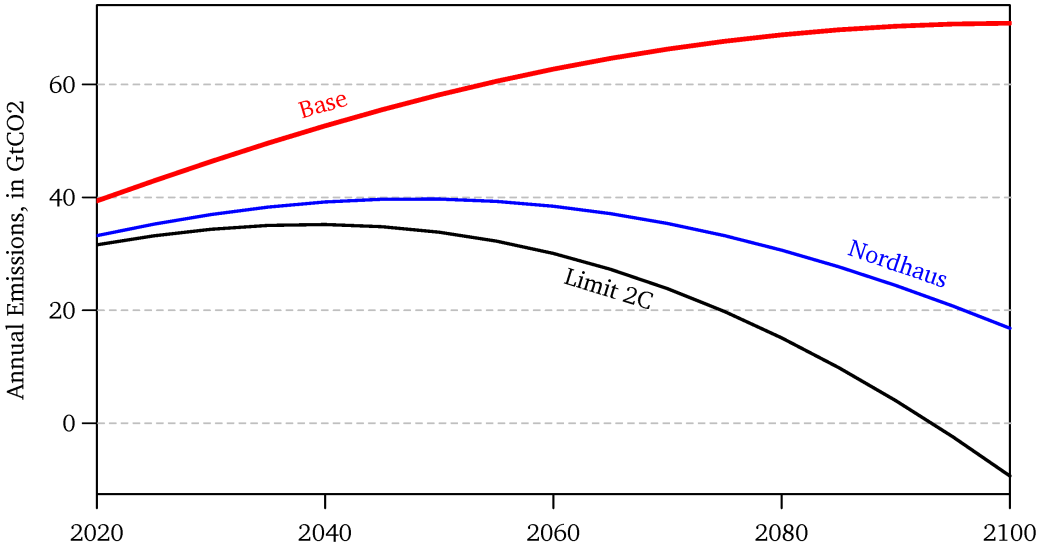


Look Careful

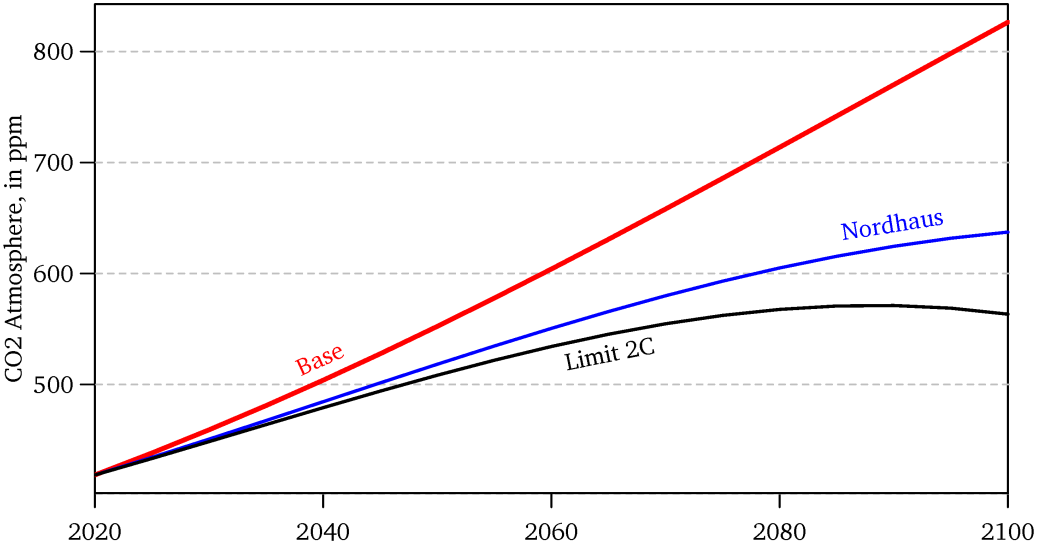
- This graph is largely based on the *expected* scenario.
  - How much will CO2 raise *unknown* risks?
- Optimal means optimal,
  - even if the change is modest.
  - But understand the relative effects!
- Even the best curbing will gain only *a little* consumption / benefit:
  - Limit to 2°C may be too aggressive — $$.
  - Limit to 1.5°C would be crazy — $$$$.

- Yes, it's optimal to curb CO_2 via a tax:
  - Bad for us/kids, good for the grandkids.
  - The world will not end w/o intervention.
- Good intervention should not attempt to stop global warming:
  - Curbing 2°C ≠ curbing 0.5°C .
  - Optimal choices are about 0.5°C more or less.
  - Going for stopping warming would be crazy.
- Fact: **The world will warm greatly!**
  - No matter what we can reasonably do.
  - Prescriptive: Don't bother with > 0.5°C.

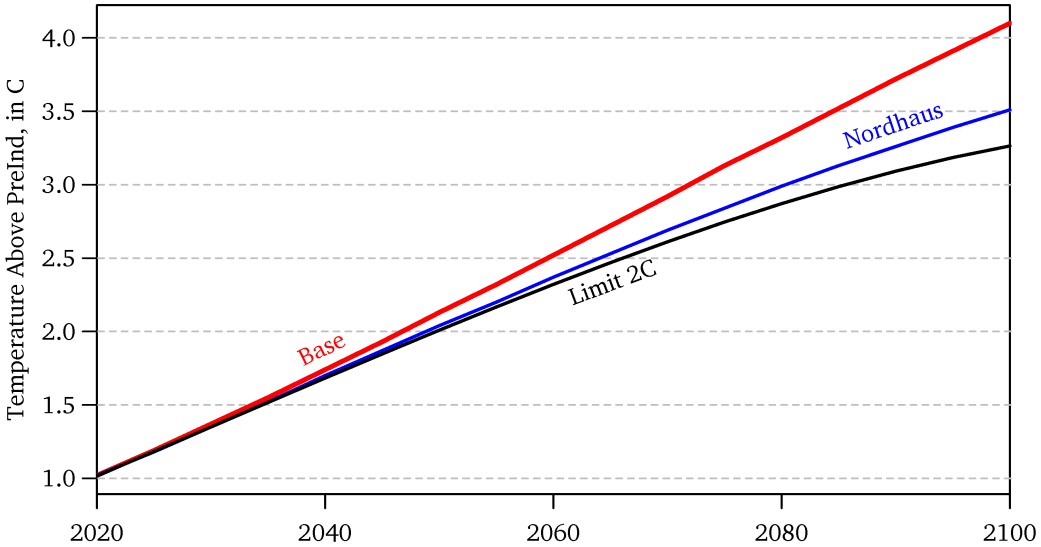
Incidental: Co_2 Emissions



Incidental: Co_2 In Atmosphere



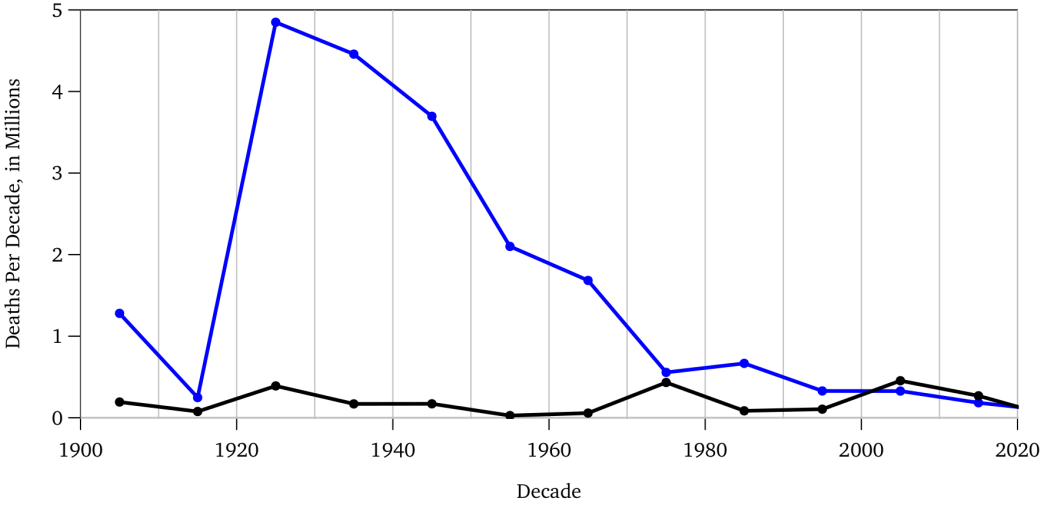
Incidental: Global Temperature



Adaptation Helps

- Deaths and misery will not be as bad as you think.
  - Except in very unlikely but not entirely impossible scenarios.
  - Life did not evolve on a risk-free planet.
- Innovation will solve many problems.
- See next graph:
  - Blue = Climate
  - Black = Earthquakes etc.

Lomborg Example: Disaster Deaths



Optimal Co_2 Tax Next Year

- Trump: \$5 /tCO_2 .
- Biden: \$50 /tCO_2 .
- IAWG (US): \$50 /tCO_2 .
- Nordhaus: \$50 /tCO_2 .
- Stern: \$80 /tCO_2 .
- Range: −\$15 to \$2,500 /tCO_2 .

All increasing over time. All effectively phase out CO_2 completely in $\approx$ 50 years.

Meaning Of Co_2 Tax

$50/tCO$_2$ means about:

- 50% increase in gasoline price (like Europe);
  - soon less important anyway.
- 2-5 times increase in coal;
  - RIP economically in most places.
- 2 times increase in gas;
  - deceptive, wrong— pipeline leakage!
- Trees: subsidize by $5-10 each!

Most Important Disagreement

- Nordhaus \$50/tCO_2 .
- Stern \$80/tCO_2 .

- Why?
  - Different assessments of science?
  - Different assessments of inputs?
  - Different assessment of objective?

Discount Rate

Biggest Disagreement:

- Quasi-Philosophical:
  - How do we value future generations' welfare?
- What is $1 today worth in the future?
  - How much should we eat less today to give more to our great-great-grand-kids in the future?

Sensitivity Wrt D.R.

- 5% $\rightarrow \approx$ \$30/tCO_2 optimal tax now.
- 1% $\rightarrow \approx$ \$500/tCO_2 optimal tax now.

- Stern's d.r. was lower than Nordhaus' d.r.:
  - More acrimonious in the past,
  - but converged over time.
  - Useful to have both views.
  - Good scientific disagreement.

Who Is Right On D.R.?

- Economists' efficiency consensus:
  - 3-5% is more reasonable than 1-2%.
  - Nordhaus higher d.r. was more reasonable on economic grounds,
  - but Stern's higher tax estimate wins back points when CC uncertainty is added.

What Is More Ethical?

- But what is ethical?
  - Are we not stewards of Earth for the future?
  - Do ethicists pick Stern's higher estimate?

What Is More Ethical?

- Do we owe the future a better economy or a healthier ecology?
- Would you prefer having been born
  - into the middle ages with a "healthy planet,"
  - or into today's "unhealthy planet," based on industrial growth and pollution?

What Is More Ethical?

- Steward for whom?
  - Not for kids. Think great-great-grand-kids.
- Six generations into the future, people will be $\approx$ 30 times wealthier than us.
- How many $$$ should today's humanity forego so that future humanity is full 30 (not only 20) times wealthier than us?

Stewarding Decision?

Don't overthink it.

- Humanity is not that logical and deliberate to contemplate such questions.
- How much to great-great-grand-children?
  - Interesting but largely irrelevant.
  - Our generation today makes decisions.
  - Future generations don't vote!
  - … whether you like it or not

Climate Suffering Of The Poor

- Won't the poor suffer the brunt of CC?
  - ***Yes***, they will.
  - Draughts, flooding, hurricanes, etc.
  - We rich should/could help them by making them richer and adapt,
  - but probably won't…it is what it is:  .
- We wish poor people mattered more,
  - but they don't, whether you like it or not  .

*Is it the **ethical** choice to fight CC?*

Where To Send $$$s To?

If you care for ‘others’:

- Why send to future generations?
- Instead why not send to the poor *today*?

Are not both ‘*other people*’ on whose behalf we rich people today should be stewards?

Help Today's Poor People?!

- They don't get to vote much, either.
- If humanity were more humane, what should it spend $$$s on?
  - 0.1°C less warming in 60 years?
  - Or poverty and misery today:
    - e.g., wipe out Malaria instead?
    - e.g., feed all poor children instead?

Read Lomborg's Copenhagen consensus. You need not agree, but you need to contemplate the tradeoffs.

Cynical View

Just because a view is cynical does not make it wrong.

- Is each an excuse not to spend on other?
  - Though not *that* deliberate, anyway.
  - I wish less fortunate mattered more 
  - You are so blessed. Recognize it!
  - Help *poorer* others when you can.
  - All of us in Western universities are hugely privileged.

Read Peter Singer.

But, But, But

Don't trust models too much!

- $50/tCO$_2$ is based on *expected* path.
- What if Earth will suffer worse?
  - What if Permafrost melts catastrophically?
  - What if the Indian monsoon stops?
- Humanity should be *very* worried about uncertainty, not just expectation.
  - perhaps even if we cannot fix it.

Reasonable Assessment

- The Economist: World GDP: $250 vs. $258 trillion w/o climate impact. then subtract off cost.
- More interesting information: The Economic Costs of Climate Change

Conclusion

- IAMs are sketch models.
  - They are *not* reliable, and
  - useful for orders of magnitudes only.
- Newer IAMs better about uncertainty.
- \$50/tCO_2 tax immediately would be *great*,
  - but I would take \$30/tCO_2 or \$80/tCO_2.
- *Expected* net benefits are 'modest'.

Instead, the world has a crazy negative CO_2 tax today!