

Integrated Assessment Models

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

Ivo Welch

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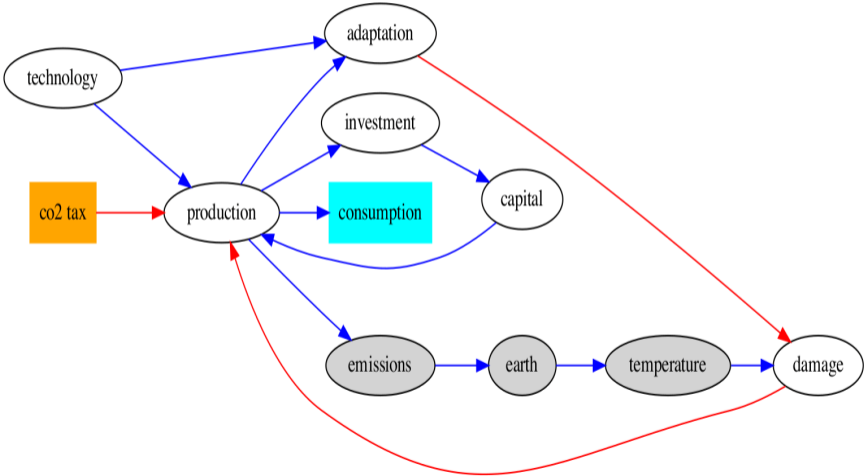
Figure 1: survive-today-tomorrow

IAMS

- ▶ Basis of all international negotiations.
- ▶ Key Question: Good Tax on tCO₂.
 - ▶ 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 CO₂ for each of 200 years;
 - ▶ no other taxes (e.g., on children).
- ▶ Model Outputs:
 - ▶ Sum consumption (incl. environmental!?)
 - ▶ Incidental: Temp, CO₂, 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.

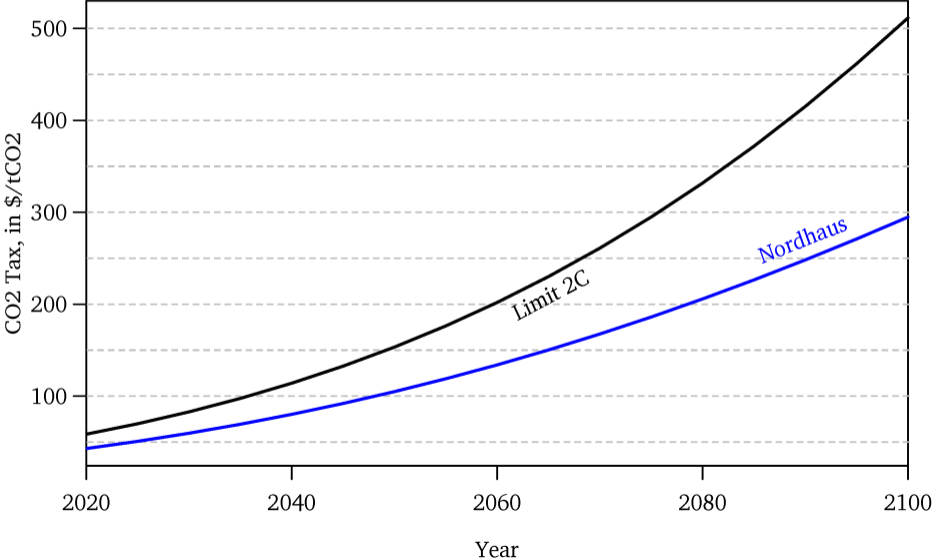
Iam Problems

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

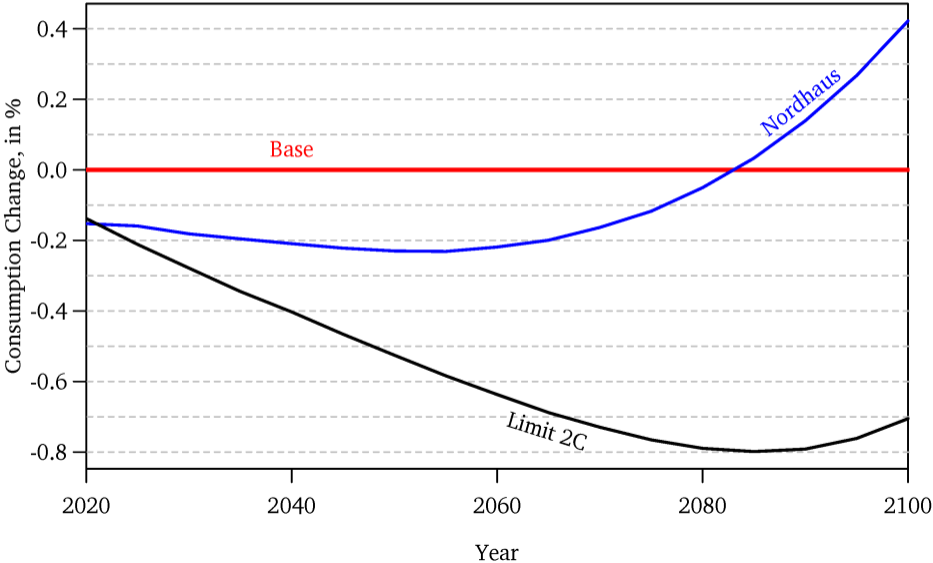
even Nordhaus himself has only mild intuition.

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

Optimal Co₂ Tax



Consumption Outcome

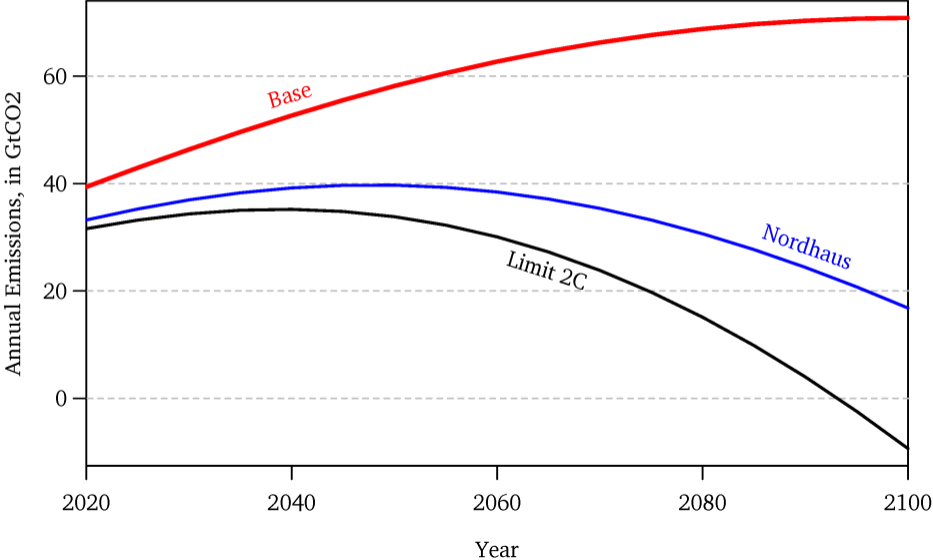


Look Careful

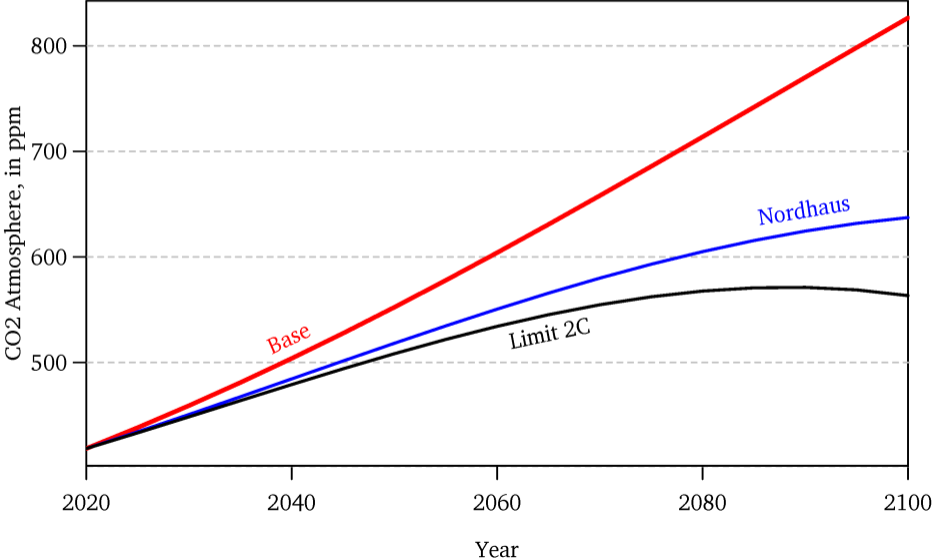
- ▶ This graph is largely based on the *expected* scenario.
 - ▶ How much will CO2 raise *unknown* risks?
- ▶ Optimal means optimal,
 - ▶ even if the change is modest.
 - ▶ But understand the relative effects!
- ▶ Even the best curbing will gain only *a little* consumption / benefit:
 - ▶ Limit to 2°C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

- ▶ Yes, it's optimal to curb CO₂ 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.

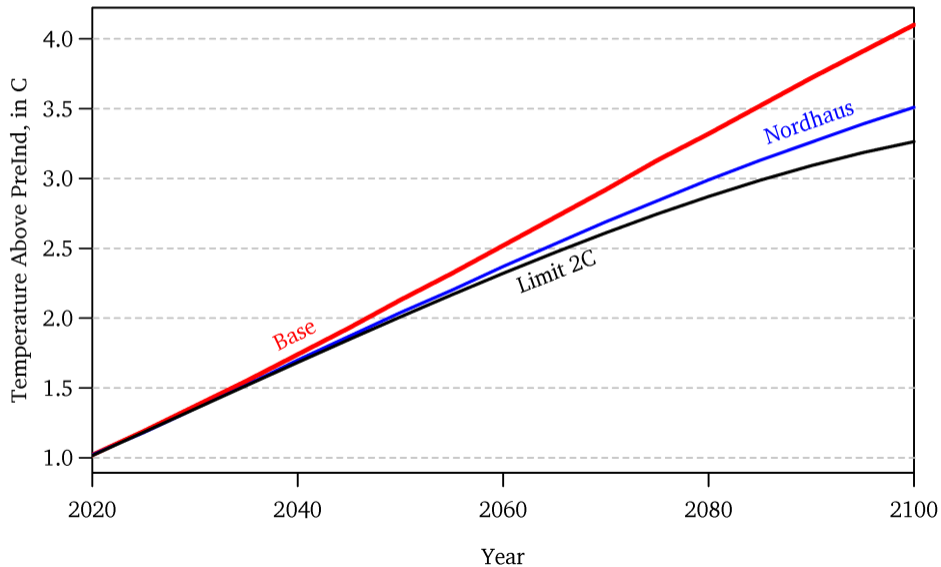
Incidental: CO₂ Emissions



Incidental: CO₂ In Atmosphere



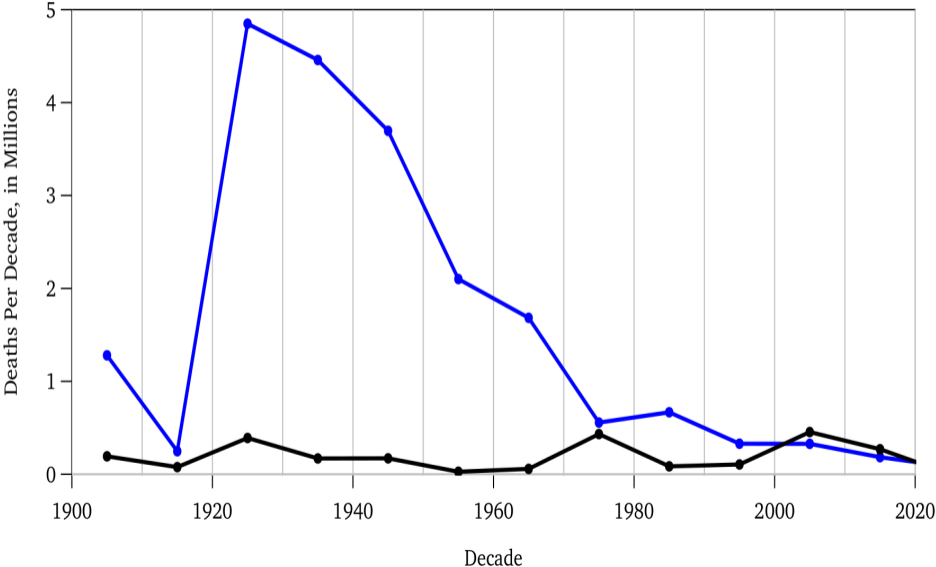
Incidental: Global Temperature



Adaptation Helps

- ▶ Deaths and misery will *very probably* 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 CO₂ Tax Next Year

- ▶ Trump: \$5 /tCO₂ .
- ▶ Biden: \$50 /tCO₂ .
- ▶ IAWG (US): \$50 /tCO₂ .
- ▶ Nordhaus: \$50 /tCO₂ .
- ▶ Stern: \$80 /tCO₂ .
- ▶ Range: -\$15 to \$2,500 /tCO₂ .

All increasing over time. All effectively phase out CO₂ completely in ≈ 50 years.

Meaning Of Co₂ Tax

\$50/tCO₂ 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/tCO₂ .
- ▶ Stern \$80/tCO₂ .

- ▶ 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/tCO₂ optimal tax now.
- ▶ 1% $\rightarrow \approx$ \$500/tCO₂ 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 ≈ 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/tCO₂ 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/tCO₂ tax immediately would be *great*,
 - ▶ but I would take \$30/tCO₂ or \$80/tCO₂.
- ▶ *Expected* net benefits are 'modest'.

Instead, the world has a crazy negative CO₂ tax today!