

Lecture 5

Climate Change: A Complex Global **Externality**
Linked To A Fundamentally
Uncertain Economic Future

September 13th, 2019

LEARNING DEN

- Tailored small-group tutoring (2-6 students)
- Mondays and Thursdays 8.30pm-10pm | Gilman
- Walk in or reserve a seat at <https://academicsupport.jhu.edu/learning-den/schedule-a-tutor/>



Economic Policy Issues Colloquium (EPIC)

- Attend small lunch seminar featuring experts, student discussions and more!
- Join our mailing list to hear about events: <https://tinyurl.com/macro913epic>



“Supply and Demand” Fire Your Economist. Get yourself a Parrot

Scientists conclude that *Avocados prevent cancer*

Millions of people want to become new consumers of avocado

Does the government tell farmers to plant fewer cherries and more avocados?

No. The demand SHIFTS up, and the price jumps. At the new higher price, many more farmers switch to providing avocados

The *invisible hand* magic of the market?

Societies increased desire for avocados translates to what?

A HIGHER “willingness to pay” for avocados.

An avocado is a commodity.

It is bought and sold in a marketplace.

It is “exclusionary”. If I pay for—and eat—an avocado, no else can eat it.

What about a clean river?

- A company makes spoons.
- Its costs are: labor, tin, cyanide, electricity, water
- It sells the spoons for \$1/spoon
- Its manufacturing process requires it to cool spoons
- It diverts water from a nearby stream, cools spoons, then pours water back into the river.

- This process puts cyanide in the river
- **MANY FISH ARE DYING**

THE PROBLEM? THE RIVER IS A PUBLIC RESOURCE,
AND ITS USE IS OUTSIDE THE MARKET SYSTEM

Suppose fishermen calculate their losses.

They determine that they each lose \$1000/year.

They propose to pay the factory to stop using cyanide

What might many of the fishermen do?

(non-exclusionary goods and the free rider problem)

Climate Change: An **Existential** Market Failure?

Suppose we all agree on the science:

Earth heating, death certain, if we don't radically change.

Will the invisible hand come to the rescue?

A company cannot "sell" a stable future to individuals, like they can an avocado.

The environmental costs of burning fossil fuels, are EXTERNAL to the costs that companies and people directly pay, when they burn such fuels.

If we judge this EXTERNALITY to be an EXISTENTIAL threat, we need to take COLLECTIVE ACTION

If “the invisible hand” Won’t Help,
do we fire Economists and hire lawyers?

No! As Professor Papageorge emphasized, economics gives us tools to think about MARKETS and MARKET FAILURES, and the myriad of worldly challenges

Economists can help frame the problem.

Economists, working with scientists and lawyers, can help hammer out possible policy responses.

Economists, with scientists, can work to inform the public.

LET US START WITH SOME SCIENTIST THINKING:

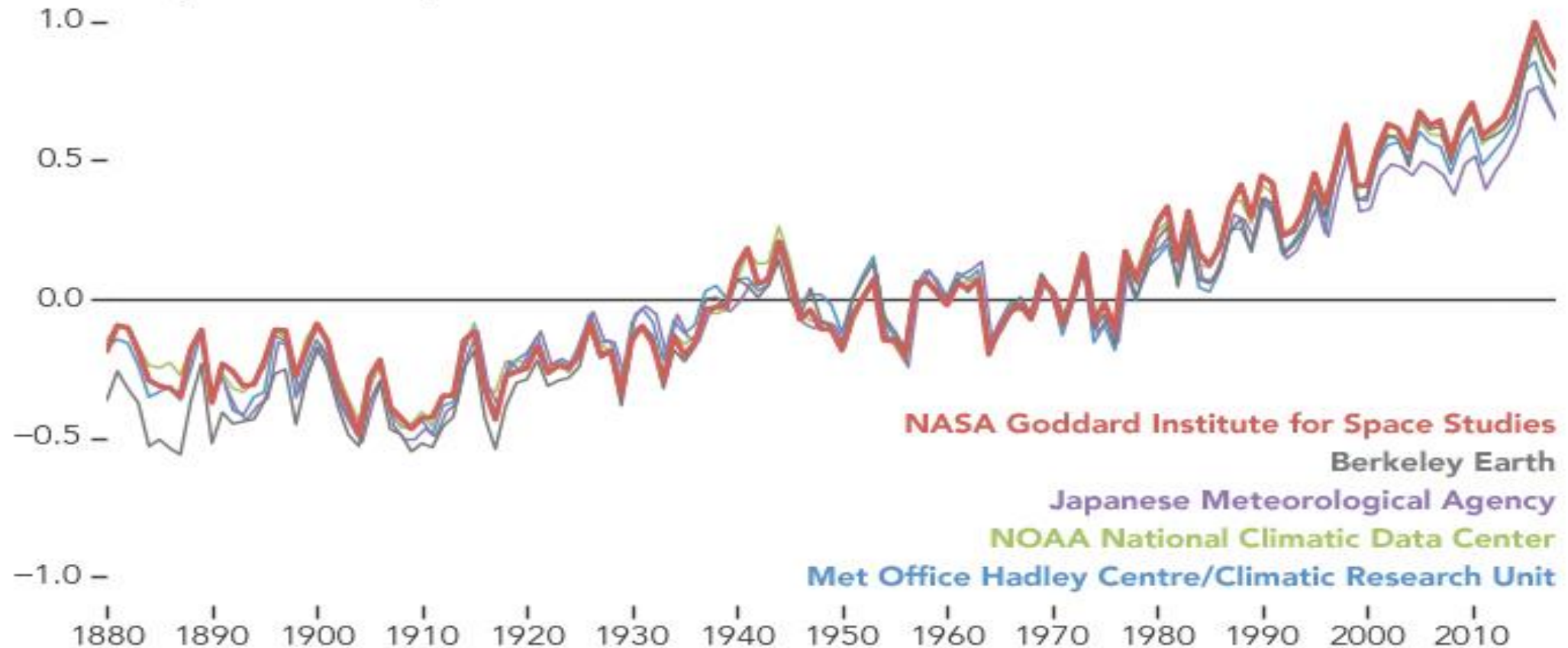
Multiple studies published in peer-reviewed scientific journals show that **97 percent** or more of actively publishing climate scientists agree:

Climate-warming trends over the past century are extremely likely due to human activities*.

*

A World of Agreement: Temperatures are Rising

Global Temperature Anomaly (°C)



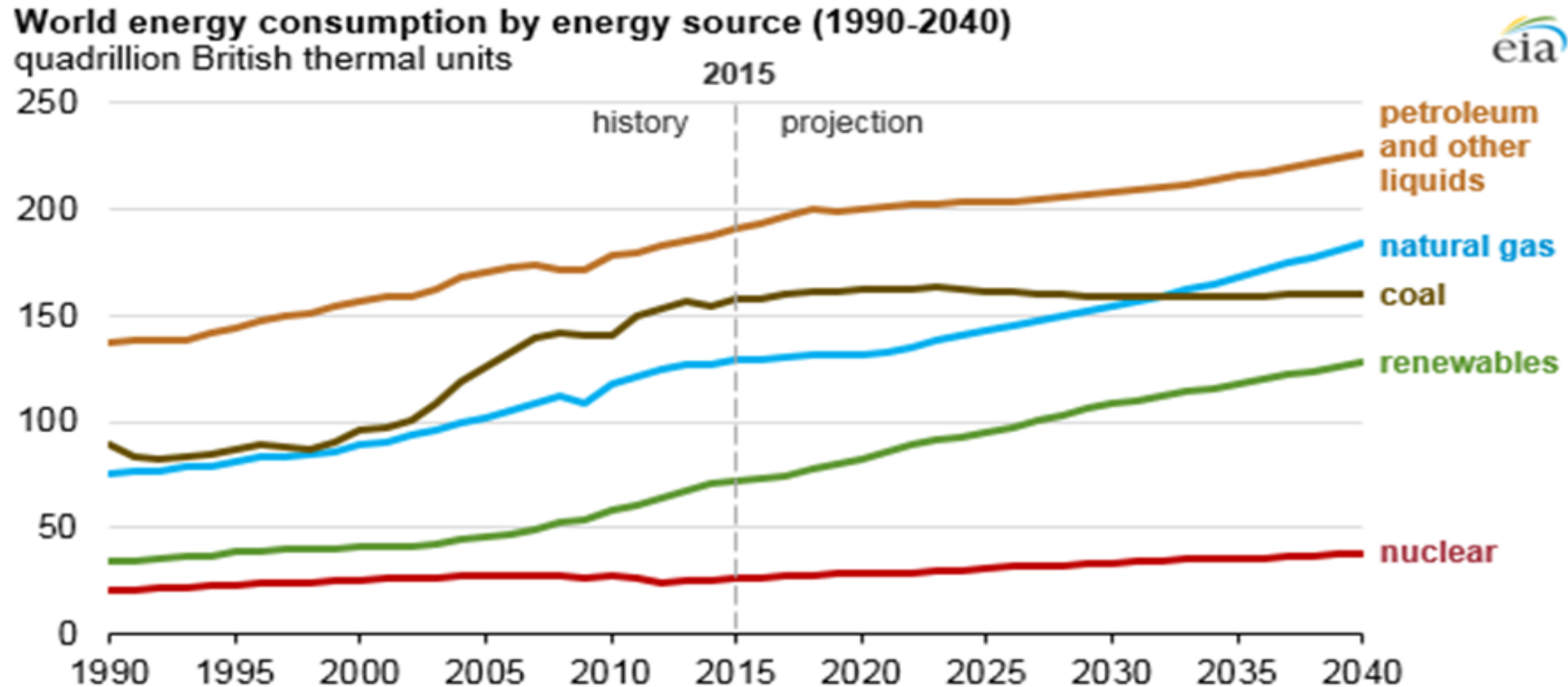
[What do chemists/physicists/biologists/earth scientists combine to tell us about a 3 Degree average rise for global Celsius temperatures? A gruesome description is provided in a recent New Yorker article:](https://www.newyorker.com/culture/cultural-comment/what-if-we-stopped-pretending)

source: <https://www.newyorker.com/culture/cultural-comment/what-if-we-stopped-pretending>

Our atmosphere and oceans can absorb only so much heat before climate change, intensified by various feedback loops, spins completely out of control. The consensus among scientists and policy-makers is that we'll pass this point of no return if the global mean temperature rises by more than two degrees Celsius (maybe a little more, but also maybe a little less). The I.P.C.C.—the Intergovernmental Panel on Climate Change—tells us that, to limit the rise to less than two degrees, we not only need to reverse the trend of the past three decades. We need to approach zero net emissions, globally, in the next three decades.

Now let us look at fossil fuel company inspired visions of the future of energy use in the USA:

source: U.S. Energy Information Agency



The disconnect between Fossil Fuel Industry Notions, and Climate Change Focused Experts

is Captured by a *Resources for the Future* quote:

- Under all scenarios other than the IEA SDS, liquids demand in the East drives global consumption due to growth in commercial transportation, aviation, and petrochemicals. Demand for passenger vehicles is moderated by energy efficiency, but still increases substantially in the East. Liquids consumption in 2040 is 29% to 46% higher than 2015, with the exception of the IEA SDS, where consumption is 11% lower in the region.
- The RFF study:

- <file:///Z:/Documents/AA%20Intro%20Macro%20Class/2019/Lecture%205%20Climate%20Change/Resouerces%20for%20the%20Future%20energy%20demand%20analysis.pdf>

The RFF study goes on:

- Under most scenarios, carbon dioxide (CO₂) emissions from the global energy system are on a path to far exceed international targets of the Paris Agreement. CO₂ emissions grow from 32 billion metric tons (bmt) in 2015 to as high as 43 bmt, while Ambitious Climate scenarios show emissions falling below 20 bmt by 2040 (Fig. 6)

Both mainstream environmental economists and thoughtful conservative economists Now Agree that Something Must Be Done:

The Mainstream Environmental Economist View:

<file:///Z:/Documents/AA%20Intro%20Macro%20Class/2019/Lecture%205%20Climate%20Change/Resources%20for%20the%20Future%20energy%20demand%20analysis.pdf>

The Enlightened Small Government View:

<https://e360.yale.edu/features/climate-converts-the-conservatives-who-are-switching-sides-on-climate-change>

LET US DRILL DOWN TO ONE EASY TO MEASURE QUESTION:

Will FUTURE U.S. electric car sales dramatically LOWER the use of petroleum fuels?

We need to do some stock flow analysis on the fleet of vehicles.

Imagine electric vehicle sales climb 25% per year, vs. 2% total growth:

	2016	2026	2036
stock of electric vehicles, %	0.4%	4.5%	10.4%
stock of vehicles	270	329	401
new vehicles bought	17	21	25
old vehicles junked	-12	-15	-18
electric vehicles	1	15	42
gasoline vehicles	269	314	360
new electric bought	0.2	1.6	14.7
new gasoline bought	16.8	19.1	10.5

Great Innovations elicit faster changes. Imagine electric vehicle sales climb 50%/year for 10 years, then 10%/year for the next 10 years.

(FYI: "Are the Saudis Thinking Clearly and Should We?", Robert Barbera, CFE blog)

	2016	2026	2036
stock of electric vehicles, %	0%	16%	29%
stock of vehicles	270	329	401
new vehicles bought	17	21	25
old vehicles junked	-12	-15	-18
electric vehicles	1	52	115
gasoline vehicles	269	278	286
new electric bought	0.2	9.8	25.4
new gasoline bought	16.8	10.9	-0.2

Samuel Jackson, now at McKinsey & Co.

provides this as his senior thesis:

Jackson imagines MAJOR flow shifts, and it still takes along time...

<u>millions of light vehicle units: global</u>					
	2017	2018	2028	2038	2048
Worldwide Auto Sales Flow	84	86	110	140	180
Worldwide Electric Vehicle Sales Flow	1.2	2	110	140	180
Implied Worldwide Auto Stock	1340	1,380	1844	2412	3123
Implied Worldwide Electric Vehicle Stock	2.4	4	363	1622	3123
Proportion of Auto Sales which are Electric	1.40%	2.3%	100.0%	100.0%	100.0%
Implied Proportion of All Autos which are Electric	0.18%	0.3%	19.7%	67.3%	100%
total implied oil quantity demanded	98	98.4	93.1	62.9	47.0

William Nordhaus, Noble Prize for modeling climate change.

- We imagine a simple system, with the following inputs:

Labor

Capital

Energy (fossil Fuels)*

Energy (green)**

*fossil fuels \equiv wood, coal, oil, natural gas

** green \equiv wind, solar, nuclear

Nordhaus creates the DICE model

- DYNAMIC
- INTEGRATED
- CLIMATE
- ECONOMY

NORDHAUS NO DOUBT CHOSE HIS ACRONYM WITH CARE

- ALEA IACTAS EST
- THE DIE IS CAST
- WE HAVE CROSSED THE RUBICON
- GLOBAL WARMING EFFECTS IN 25 YEARS
WILL VERY MUCH REFLECT WHAT WE DO OVER THE NEXT 10
YEARS

What about the USA politics of Global Warming?

- Over 90% of scientists believe humans are warming the earth
- Bloomberg Poll Conducted 9/10/2012 (97% of climate scientists)

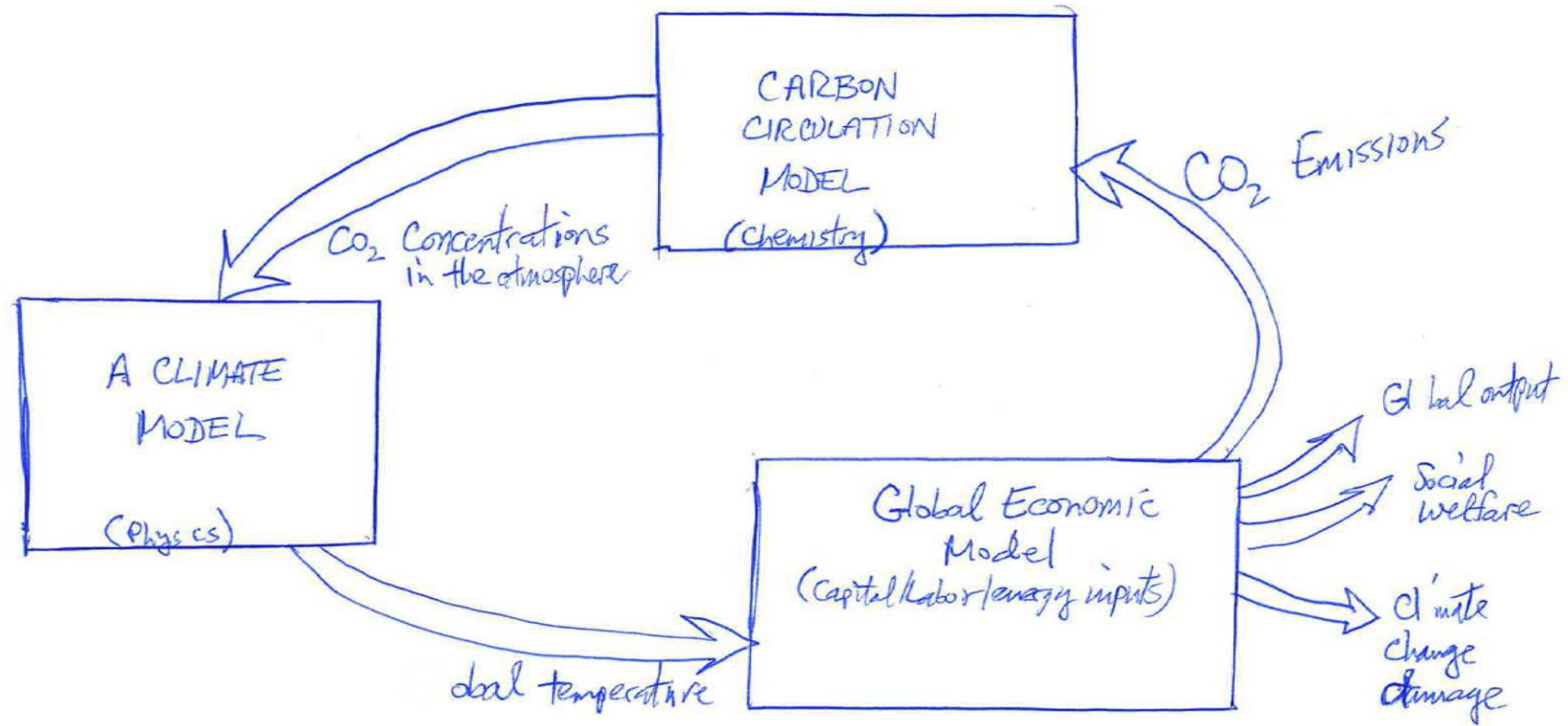
- Are Humans warming the earth?

	Dems	Independents	GOP
• Percent who said YES	89%	62%	35%

HOW DO PEOPLE AROUND THE GLOBE PERCEIVE THE GLOBAL WARMING THREAT? (PERCENT WHO THINK HUMANS ARE WARMING THE EARTH)

- BRAZIL 80%
- CHINA 58%

A View of the Nordhaus Model:



What about criticism of the Nordhaus approach from greens?

- Think Russian roulette
- Probability we destroy the earth is 10%
- Cost if we do? 100% of everything
- How should we process this TAIL RISK

Some argue we cannot base policy on our sense of the most likely future.

- <https://www.nytimes.com/2019/09/04/business/energy-environment/martin-weitzman-dead.html>
-
- Martin Weitzman: Harvard Economist

WE MUST DESIGN POLICY EXPLORING A RANGE OF OUTCOMES

Asbestos usage: how about ZERO!

