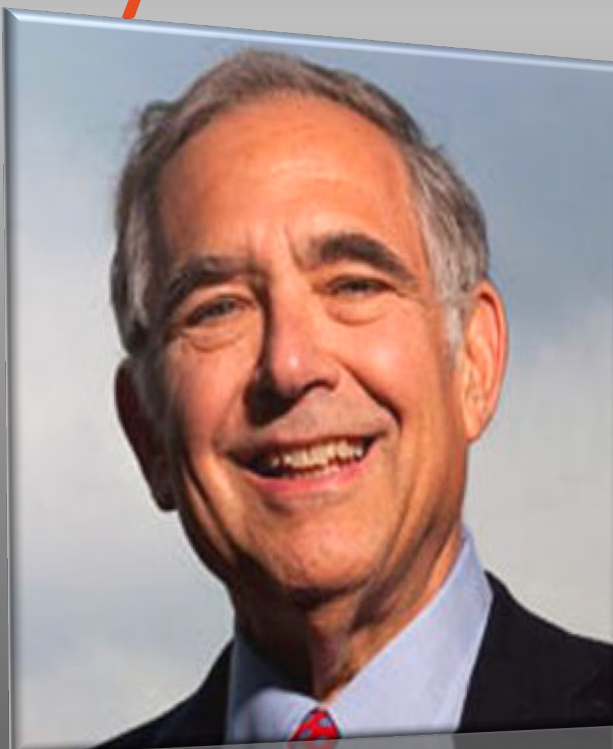


# Climate Policy: Moving beyond Ostriches and Pollyannas



Richard  
Zeckhauser  
(Harvard)

## Introductory Remarks

Markus  
Brunnermeier  
(Princeton)

# Past and Future Speakers

- Past



Arminio Fraga  
“Brazil’s Perfect Storm”

- Today



Richard Zeckhauser  
“Climate Policy”

- Future



Raghuram Rajan  
“EMDE”

- Related

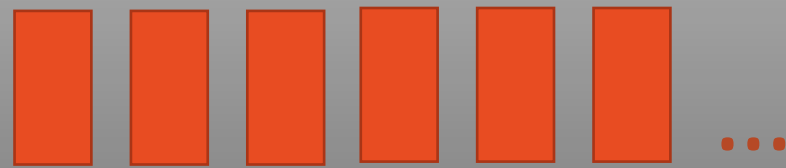


Larry Summers

# Dynamic Cost-Benefit Analysis

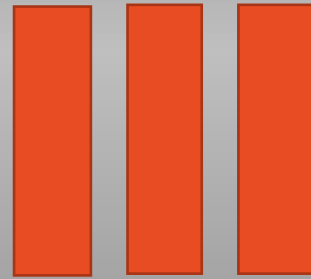
- Abatement Costs

*Now*

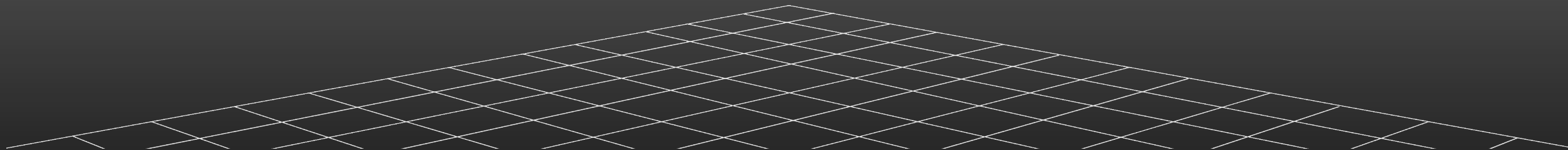


## Benefits

*Future*



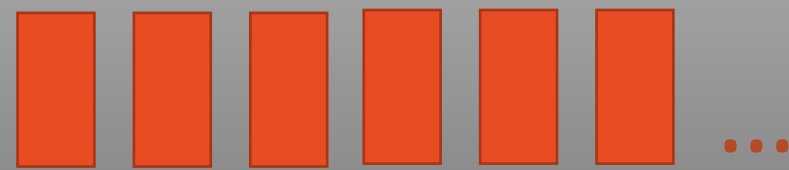
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# Dynamic Cost-Benefit Analysis

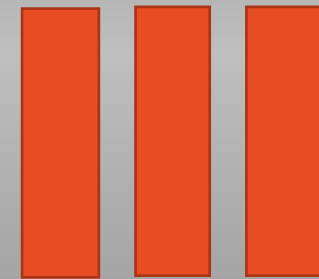
- Abatement Costs

*Now*

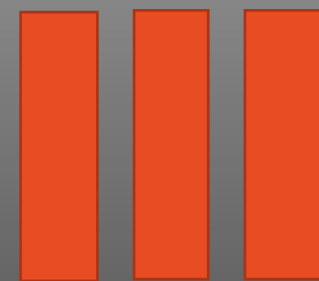


- Benefits

*Future*



- Ramp (Bill Nordhaus)



- Discount rate is key! (“Stern Review”)

# Discount rate & COVID

- Discount rate (log-utility,  $\gamma = \frac{1}{IES} = 1$ , growth rate  $\sim \mathcal{N}$ )

Time- Preference rate	Ramsey-term Intergenerational equality	Precautionary Motive	Lowers downside risk
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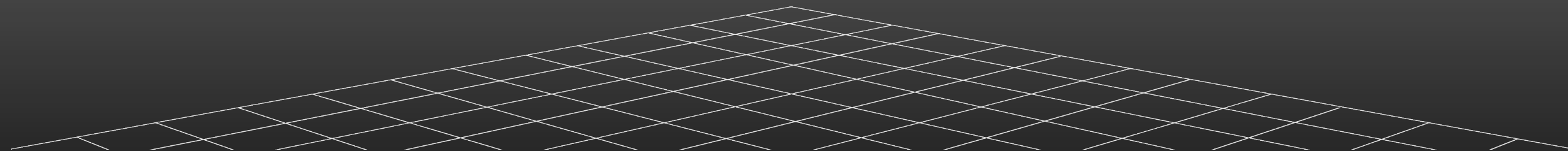
$$r = \underbrace{\rho + E[g_c] - Var[g_c]}_{\text{risk-free rate}} + \underbrace{Cov[g_c, g_{\text{benefit}}]}_{\text{risk premium} < 0}$$

- COVID



?

- Future counts more  $\Rightarrow$  steeper ramp!



# Discount rate & COVID

- Discount rate (log-utility,  $\gamma = \frac{1}{IES} = 1$ , growth rate  $\sim \mathcal{N}$ )

$$r = \underbrace{\rho + E[g_c]}_{\text{risk-free rate}} - \underbrace{Var[g_c]}_{\text{Precautionary Motive}} + \underbrace{Cov[g_c, g_{\text{benefit}}]}_{\text{Lowers downside risk}}$$

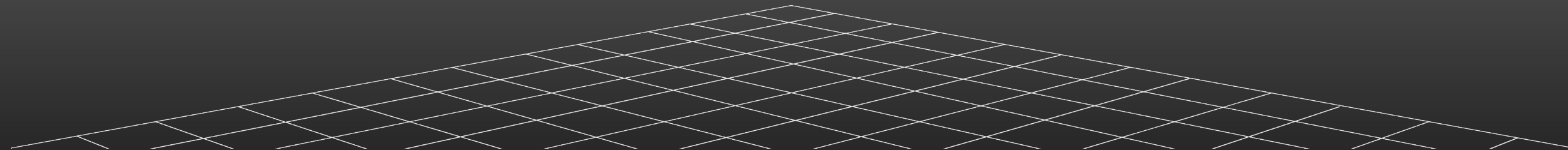
Time-Preference rate      Ramsey-term Intergenerational equality      Precautionary Motive      Lowers downside risk

- COVID
- Future counts more  $\Rightarrow$  steeper ramp!
- Tail risk makes risk premia more pronounced
- Tipping points and non-linearities (golf stream)
  - Known tipping point
  - Unknown tipping point (take worst case)

# COVID and Climate Policy

- Depreciation rate of equipment  $\Rightarrow$  **flatter ramp**
  - Varies across industries
- New technology/inventions
- COVID leads to rethinking/restructuring across industries
  - Synchronized coordination (chicken and egg problem)
- Clear planning certainty!!!

Brunnermeier  
Landau



# How to incentivize?

- Malthusian approach vs. Innovation approach (Ralf Fücks)

- Path: Planning certainty

1. Carbon tax path

C02 price certainty

2. Pollution permits

pollution certainty

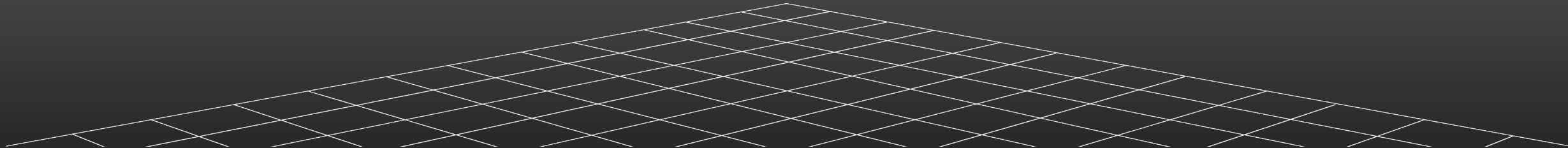
- For free vs. auction off

- Short-term permits vs. central bank approach (Depla)

- To keep C02 price within range


*Report:  
German council of  
economic experts*

- 3 ways to achieve C02 reductions (Richard)

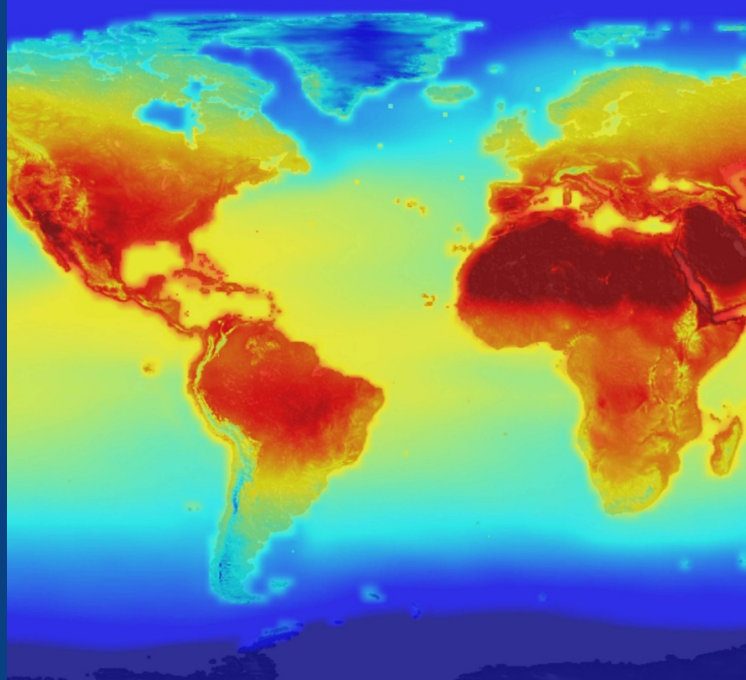




# Poll

1. Are COVID and climate policy linked?
    - a. Climate change makes pandemics more likely
    - b. COVID changes policy trade-offs
    - c. Should be treated separately
  
  2. Climate policy should primarily work through
    - a. Restriction on consumption (including the poor in EMDE)
    - b. Innovation and “smart growth”
  
  3. Should central banks get into climate policy
    - a. No
    - b. Only to the extent that it affects risk management and collateral policy
    - c. Yes
  
  4. Climate policy
    - a. Should require clear mandates via parliamentary vote
    - b. Can be done “through the backdoor” since it is so important and shouldn’t be undermined by opposition groups like, yellow vests etc.
- 

# Climate Policy: Moving Beyond Ostriches and Pollyannas



Joseph E. Aldy and Richard J. Zeckhauser

Princeton – BCF Webinar

July 17, 2020

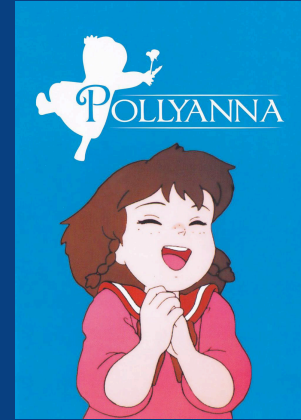
# Climate Skeptics – Ostriches



## Ostrich Behavior

- Recent warming is natural climate variation.
- Human behavior not responsible.

# Concerned Environmentalists – Pollyannas



## Pollyanna Beliefs

- Massive mitigation is politically feasible.
- Mitigation alone will be sufficient.

# Our Central Arguments

## Climate Skeptics

1. Natural swings in temperature tend to be regional, and very long term. (Medieval Warm Period, roughly 1,000 years ago, was warm in North Atlantic, but cool elsewhere on the planet.)
2. Overwhelming scientific evidence that dramatically increased GHGs due to human behavior is the prime cause of global warming.

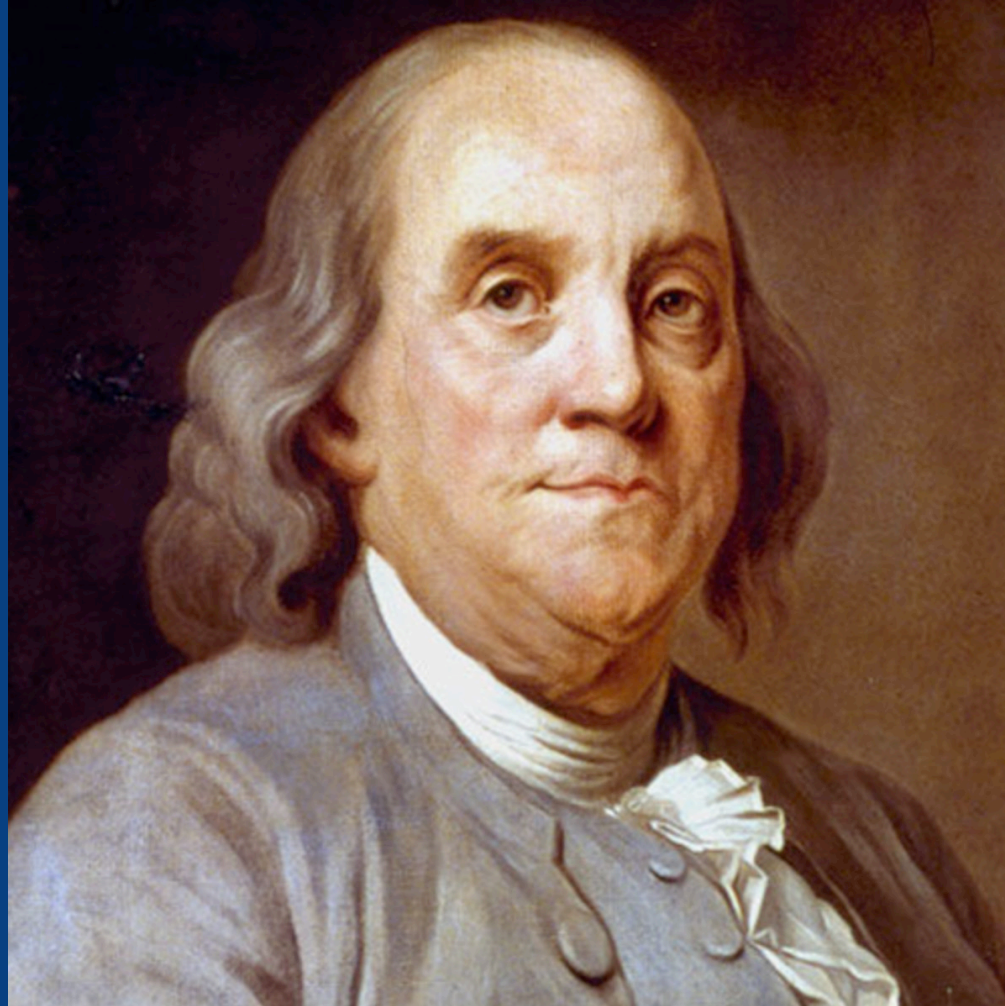
# Our Central Arguments

## Concerned Environmentalists

3. Little evidence that the nations of the world are likely or able to cut GHG emissions massively.
4. Mitigation alone, even if aggressive, will not prevent extreme damages due to climate change.

GIVEN THAT CONCERNED ENVIRONMENTALISTS SURELY VASTLY OUTWEIGH CLIMATE SKEPTICS AT THIS PRESENTATION, WE WILL FOCUS ON ARGUMENTS 3 and 4, THE POLLYANNA CONCERN.

# WHAT BENJAMIN FRANKLIN WOULD SAY:



# About Climate Skeptics

Ostrich Outlook Promotes Pollyanna Perspective

“Just go along, climate change is not a big deal.”



# About Concerned Environmentalists

A Pound of Pollyanna Requires Ounces of Ostrich

“If we don’t change our ways soon, disaster will hit. But with appropriate political will and moderate sacrifice, we could curb emissions sufficiently to keep damages manageable.”

# Prominent Concerned Environmentalists

Ostriches about drawing inferences from:

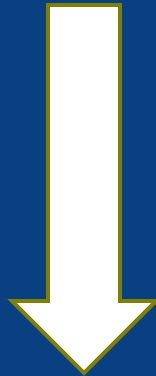
- The bleak record of the past.
- Their own failed predictions.

Pollyannas about assessing prospects for **mitigation alone** or **virtually alone** in the future.

# Prudent Climate Policy



Mitigation



Adaptation



Amelioration

“To state the facts frankly is not to despair the future nor indict the past.”

John F. Kennedy

# Three Prongs for Climate Policy

- MITIGATION –
  - Significantly reducing greenhouse gas emissions for the future.
  - Ultimately achieving negative emissions (pulling CO<sub>2</sub> out of the atmosphere).
- ADAPTATION –
  - Taking measures to reduce damages given specific levels of climate change.
    - Examples: Restoration of marshes, building seawalls, moving activities.
- AMELIORATION –
  - Taking measures to reduce climate change given specific levels of atmospheric concentrations.
    - Example: Solar radiation management.
- Most concerned environmentalists are one-prong players.
- We will identify one-, two- and three-prong players.

# Three Prongs for Prudent Climate Policy

## Next 10 Years Are the Last Chance

Al Gore



“Unless drastic measures to reduce greenhouse gases are taken within the next 10 years, the world will reach a point of no return.”

“Time is running out, so we must capitalize and build upon solutions available today.”

---

2006

2018

# Three Prongs for Prudent Climate Policy Next 10 Years Are the Last Chance

Jim Hansen



“We have at most 10 years—  
not 10 years to decide upon  
action, but 10 years to alter  
fundamentally the trajectory of  
global greenhouse emissions.”

“Earth is not lost today,  
but time for action is  
short.”

---

2006

2019

# Three Prongs for Prudent Climate Policy Next 10 Years Are the Last Chance

## European Leaders



“But the agreement... represents the last chance to bring climate change under control before it is too late.”

2008

Stavros Dimas, DG Environment

“That is our goal, to ensure that one-fourth of the budget goes toward climate change mitigation, and this is going to be a paradigm shift.”

2019

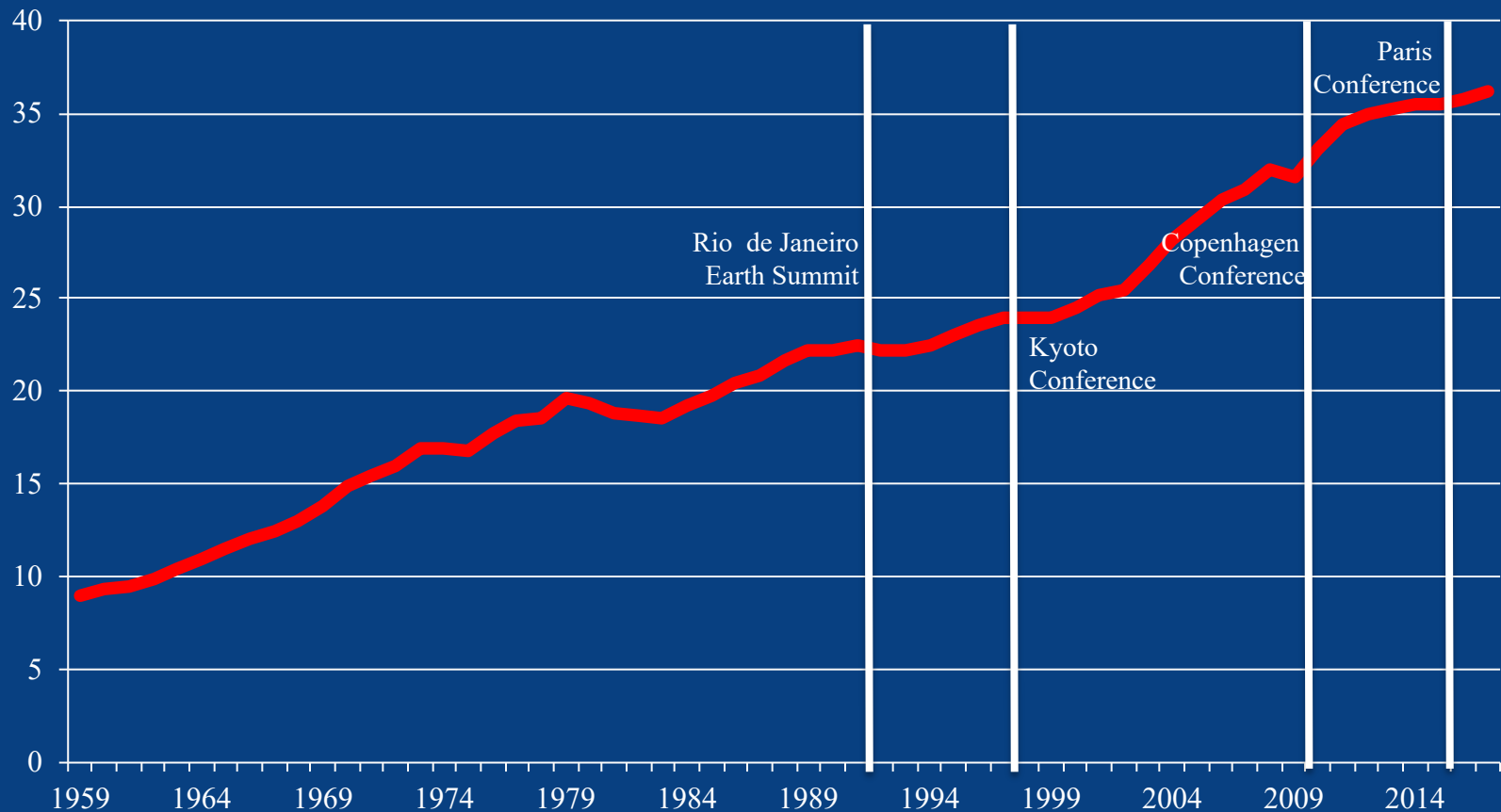
Jean-Claude Juncker, EC President

# Basic Argument

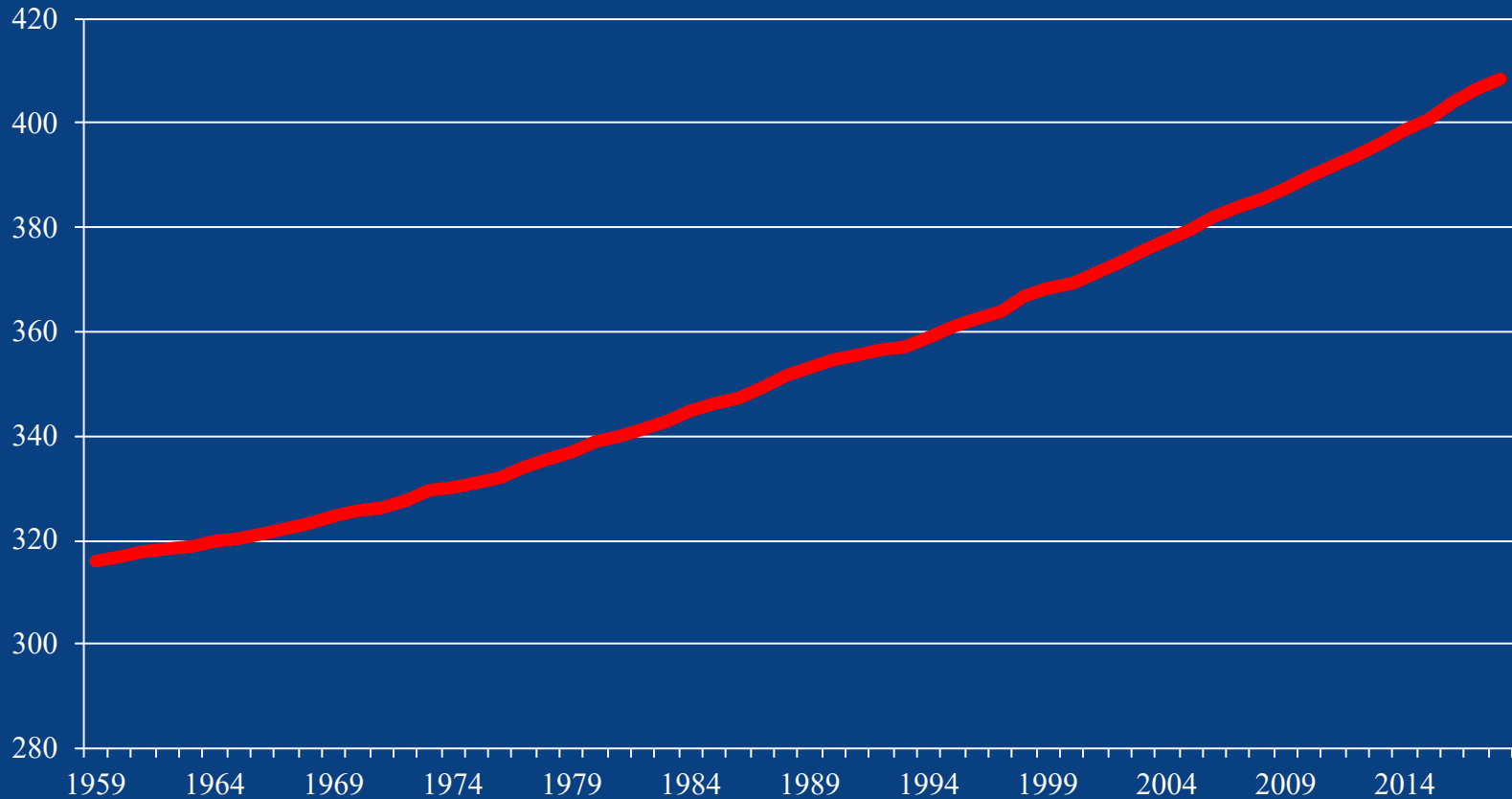
- Emission mitigation has served as principal instrument of climate policy since 1990.
- The last clear chance has already been passed.
- Three unhappy facts:
  - CO<sub>2</sub> emissions have climbed rapidly for 60+ years.
  - CO<sub>2</sub> concentrations have climbed rapidly for 60+ years.
  - Global temperatures have increased since 1890.



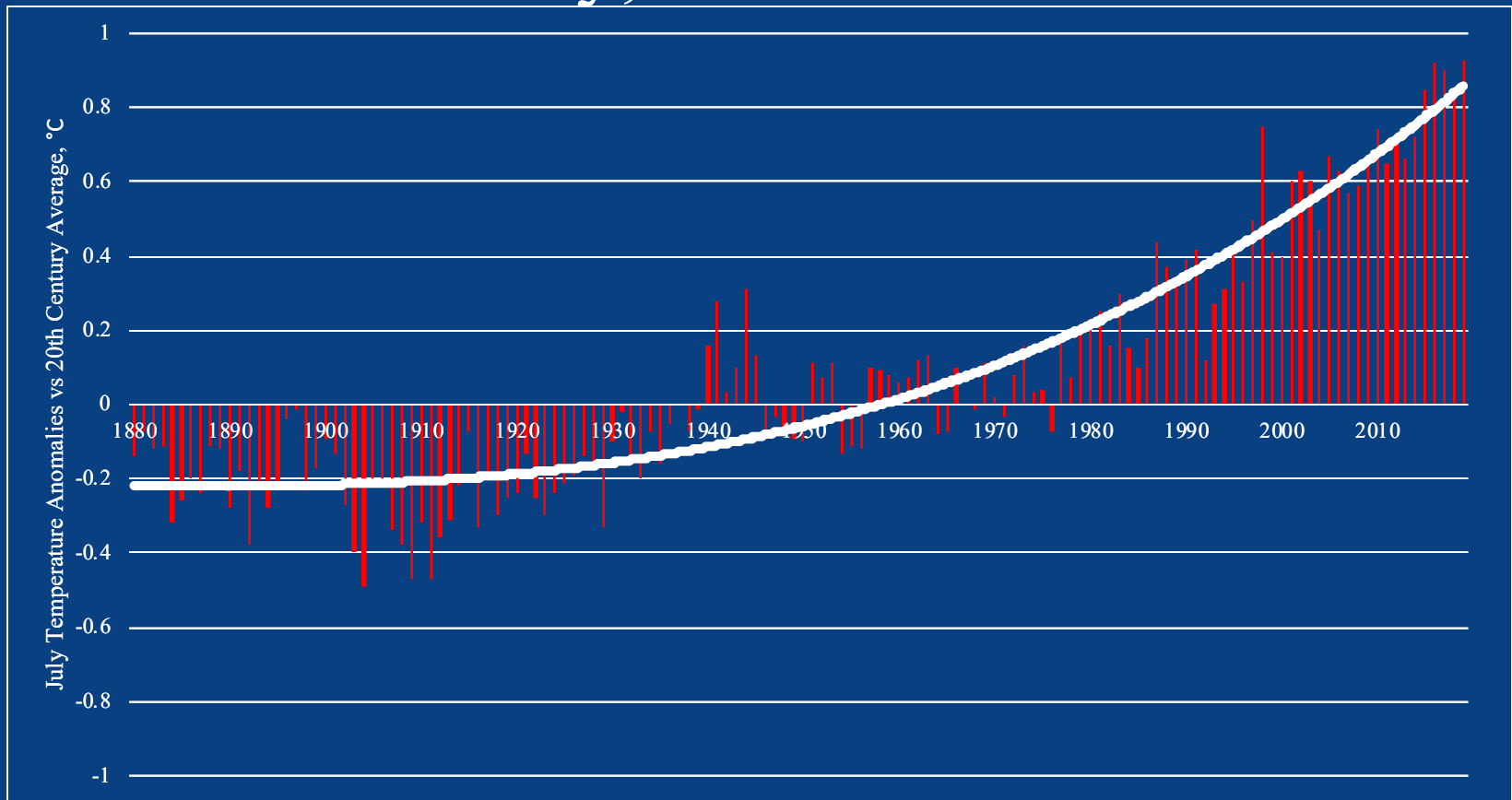
# Major UN Climate Conferences and Global CO<sub>2</sub> Emissions (gigatons)



# Atmospheric CO<sub>2</sub> Concentrations, 1959-2018 (parts per million)



# Global Land and Ocean Surface Temperature Departure from Average, July, 1880-2019

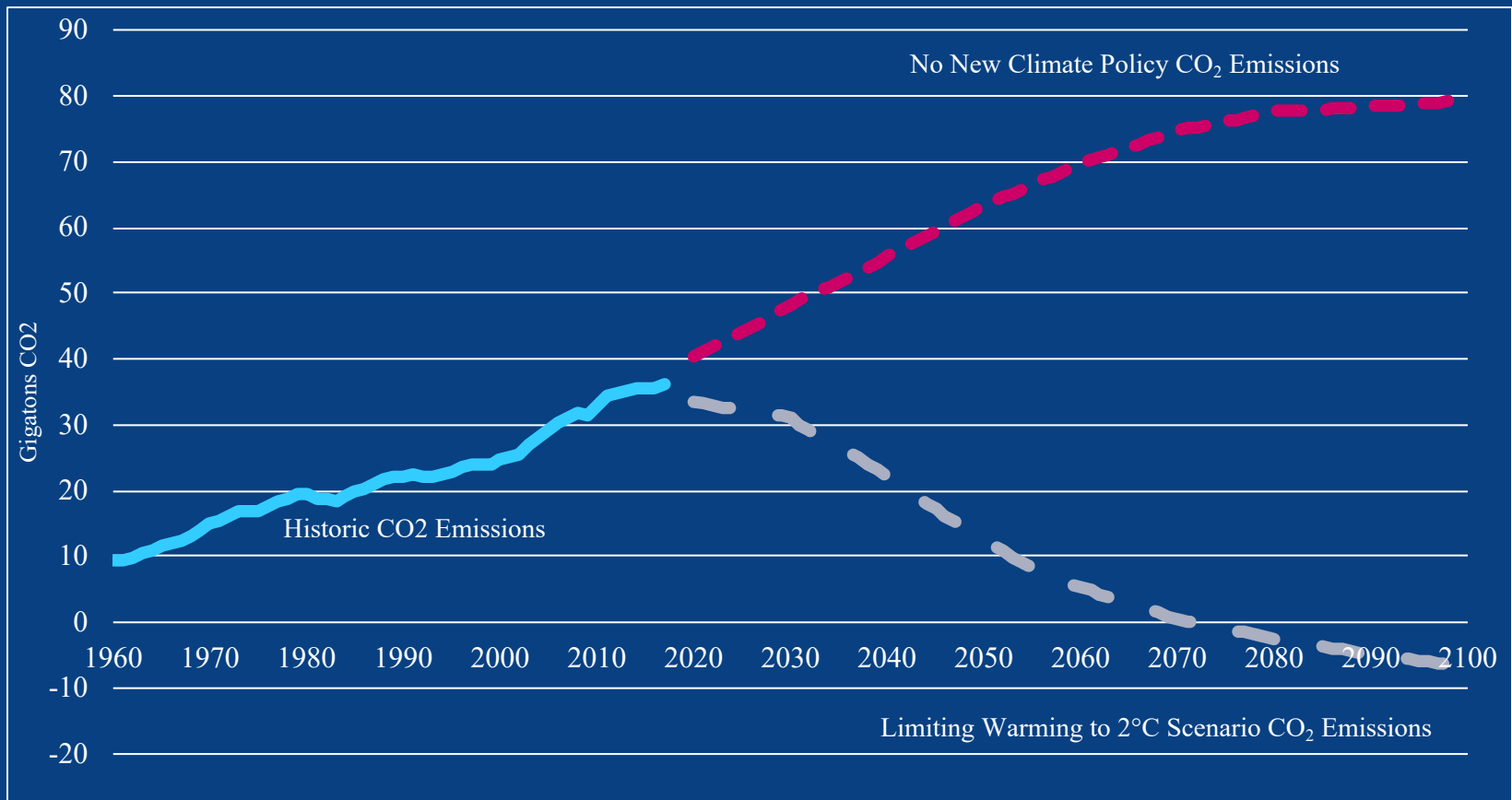


# Prospects for Reversing these Trends

- Paris Agreement: “well below 2°C” & 1.5°C goals
  - Note that countries’ pledges are inconsistent with goals.
- Global CO<sub>2</sub> emissions increased in 2018
  - 85% of increase from U.S. and China.
- Climate Action Tracker:

“[M]ost governments are nowhere near taking the radical steps required, especially given that global emissions need to halve by 2030 in order to keep the goal of 1.5°C alive.”

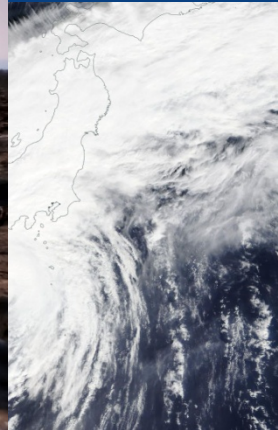
# Permissible Emissions for 50% Chance of Less than 2°C Warming by 2100



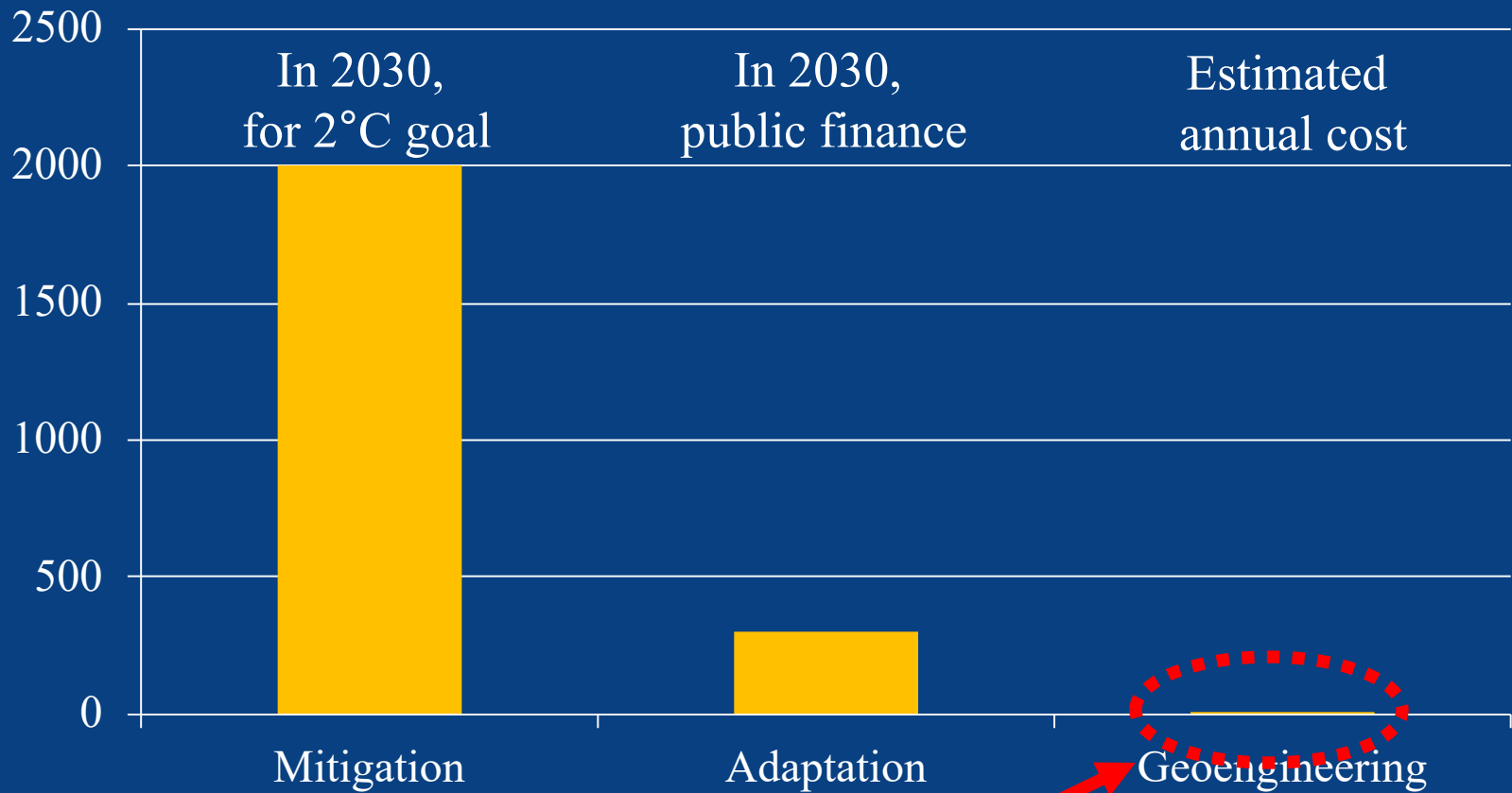
# Likely Dates of Reaching 2°C of Warming

- Average Decarbonization Rate
  - 2000-2017: 0.4%/year
  - 2008-2017: 0.7%/year
- No new policies: 2052
- 2015 Paris + continued ambition: 2061
  - Minimum decarbonization rate of 2%/year
- 2015 Paris + increased ambition: 2067
  - Minimum decarbonization rate of 5%/year

# Likelihood of a Climate Catastrophe is Extremely High



# Resources Required by Policy Prong (billions USD)



**Need exacting vision to see geoengineering cost of \$4bn/year**



# Outline of Analysis

- Fable to Introduce Three Prongs of Policy
- The Moral Hazard Concern
- 0-, 1-, 2-, and 3-Prong Players
- The Infeasibility of the Feasibility Argument for 1.5°C and 2°C Targets
- Dynamic Three-Prong Strategy for Climate Policy

# The Boy Who Cried for Three Prongs





Mitigation



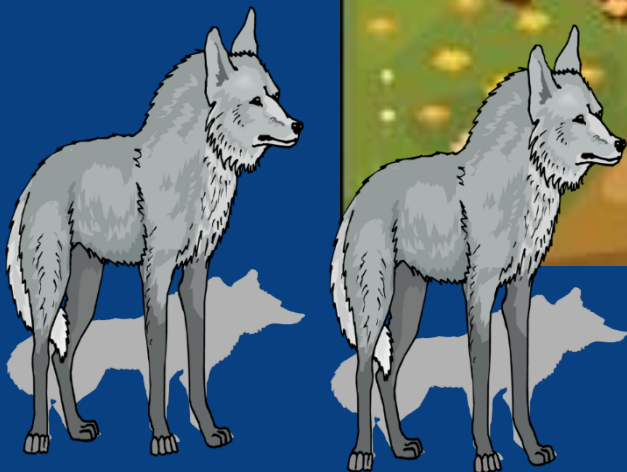
“Fewer hybrid sheep, more  
crops.”





“Fewer hybrid sheep,  
more crops. Put up  
protective fences.”





“Fewer hybrid sheep, more crops. Put up protective fences.”



Fewer hybrid sheep, more  
crops. Put up more fences.  
Raise a posse.



*Posse*

# Raise a Posse

- Villagers have no experiences:
  - As Riders
  - With Guns
- Villagers had not read: “The Economic Implications of Learning by Doing,” Kenneth Arrow (1962)
- No Posse!





# Equilibrium

- Analyst observes:
  - Too many hybrid sheep
  - Not enough crops
  - Too few fences
  - No posse, though desirable
- Falling short on:
  - **Mitigation** – reducing hybrid sheep
  - **Adaptation** – putting up fences
  - **Amelioration** – raising a posse
- Too many wolves
- Too many sheep lost



# Moral Hazard Concerns

# Moral Hazard Concerns

- Mitigation, Adaptation, and Amelioration (Geoengineering) are substitutes for one another.
- Investing in one diminishes value of another:
  - Explains modest discussion of adaptation among enviros.
  - Explains hostility to amelioration/geoengineering.
  - Some might **mistakenly** think geoengineering is a “cure”.
  - Adaptation merely reduces damages from emissions and can advertise the cost of climate damages.

# Possible Approaches to Substitute Instruments

- Benefits = damages avoided – costs of instruments
  - Given uncertainties, all outputs should be assessed using von Neumann-Morgenstern utilities.

(1) Simply optimize: select mix of instruments to maximize expected benefits.

(2) Support favored instrument and constrain other instruments.

# Actual Approach to Substitute Instruments

- Since 1990, global approach has been (2) (support and constrain):
  - Push for mitigation.
  - Gently acknowledge adaptation.
  - Shun solar geoengineering.
- The world spends  $< \$10$  million/yr on geoengineering research (Keith *et al*).
- Finger on the scale approach risks locking in extreme expected damages.



# Instruments that Substitute for Each Other: Moral Hazard

- Doing more of one instrument reduces the value of each of the others.
- Don't pursue geoengineering.
  - It will reduce emission control efforts.

# Instruments that Substitute for Each Other: Awful Action Alert

- Extreme danger of situation not widely recognized.
- Pursuing an *awful action* indicates the extreme danger.
- Public becomes more supportive of other instruments.
- Would this apply to geoengineering and emission reduction?

# Awful Action Alert in Different Context: COVID-19

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Date	S&P500 Close vs. Previous Day	Key Policy Announcements
March 12, 2020	-9.51%	President Trump announced a travel “ban” for travelers from Europe
March 16, 2020	-11.98%	Federal Reserve cut interest rates 100 basis points Federal Reserve announced new \$700 billion in lending facilities

---



# Instruments that Substitute for Each Other: Deleterious Deterrence

- Experts wish to promote instrument X.
- Given moral hazard concern, they discourage use of instrument Y.
- Significant delay in pursuit of Y.
- Extreme danger not effectively confronted.

# Zero-, One-, Two-, and Three-Prong Players

# Types of Climate Policy Observers

- Denier of human-cause climate change
  - Zero-prong policy strategy
- Climate control assurer
  - One-prong policy strategy:  
emission mitigation
- Climate policy realist
  - Three-prong policy strategy:  
emission mitigation + adaptation + geoengineering

# 0, 1, 2, and 3-Prong Players

Zero-Prong



One-Prong



Two-Prong



Three-Prong



# The Infeasibility of the Feasibility Argument for 1.5°C and 2°C Targets

# Infeasibility of 1.5°C / 2°C Targets

- Today's capital stock – if used through the end of its economic lifetime – will result in  $\geq 1.5^\circ\text{C}$ .
- “Overshoot” Scenarios: limiting warming to 2°C requires negative GHGs over 2050-2100:
  - Electrify transportation, buildings, industry globally.
  - Generate electricity from biomass + carbon capture and storage; wind and solar power insufficient.
  - Alternative: major deployment of direct air capture.

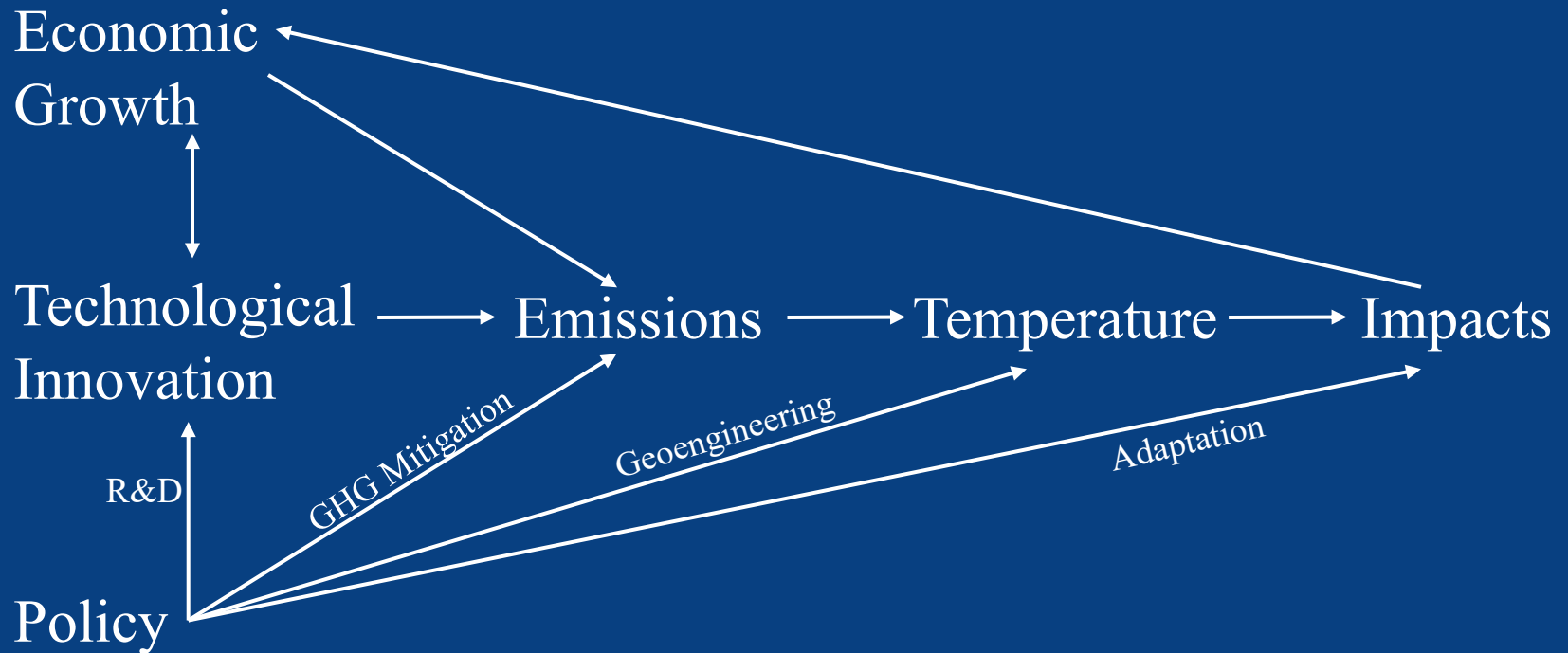
# Political Economy of 1.5°C / 2°C Targets

- Last 30 years illustrates strong free-riding / cheap-riding incentives
- Domestic energy and climate policies reveal strong opposition to raising energy prices
  - Continuing fossil fuel subsidies
  - Carbon pricing that exempts energy-intensive sources
  - Preventing carbon price pass-through to energy prices

# Dynamic Three-Prong Strategy for Climate Policy



# Three Prongs for Prudent Climate Policy



Uncertainties → act-learn-act approach to three-prong climate strategy  
Time is a critical ingredient

# Three Prongs for Prudent Climate Policy

Aldy, J. E. and R. J. Zeckhauser, Three Prongs for Prudent Climate Policy, NBER Working Paper No. 26991, April 2020

And RFF Discussion Paper version available at:

<https://tinyurl.com/3climateprongs>

THANK YOU