

Climate Change and Risk

Joseph E. Stiglitz (Columbia Univ.)

UZH Sustainable Finance Conference

Univ. of Zurich, 16th January, 2020

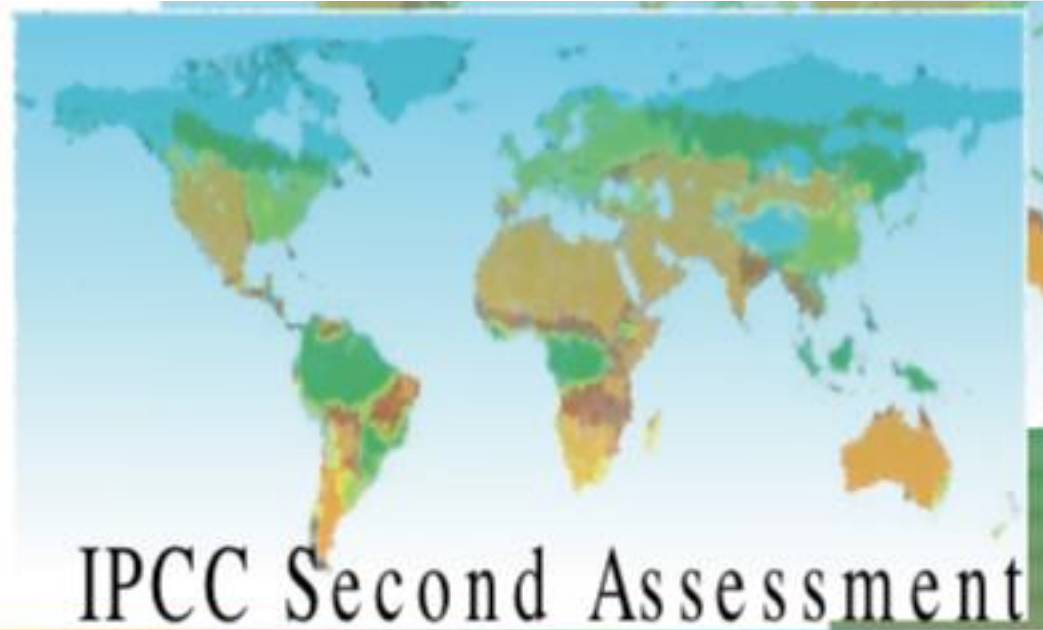
Outline

- I. Motivations/background
- II. Why markets cannot handle climate change well
- III. Why recent work in economics underestimates urgency and scope of what has to be done
- IV. Closer look at Stern Stiglitz Report
- V. Green New Deal

Insights from 1995 IPCC Report



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



IPCC Second Assessment

Climate Change 1995

Insights from 1995 IPCC Report


- Unique characteristics of the “problem”:
 - large uncertainties (scientific and economic),
 - possible non-linearities and irreversibilities (climate tipping points)
 - asymmetric distribution of impacts geographically and temporally,
 - the very long time horizon,
 - the global nature
- Application of the precautionary principle provides rationale for «action beyond no regrets»

Juliana v. United States



Juliana v. United States

- *Juliana, et al. v. United States of America, et al.* is a [climate justice](#)-based [lawsuit](#) filed in 2015 that is being brought by 21 youth plaintiffs against the [United States](#) and several of its [executive branch](#) positions and officers
- The plaintiffs, represented by the non-profit organization [Our Children's Trust](#)
 - The lawsuit asserts that the government violated the youths' rights by encouraging and allowing activities that significantly harmed their right to life and liberty, and sought the government to adopt methods for reducing greenhouse gas emissions
 - Brought under provisions of Constitution and Comon Doctrines
 - The **public trust doctrine** is the principle that the sovereign holds natural resources in **trust** for **public**
 - Key issue is intergenerational equity
- The trial is currently on hold



Report of the High-Level Commission on Carbon Prices

2017 Report of the High-Level Commission on Carbon Prices supported by staff of the International Bank for Reconstruction and Development/ International Development Association (The World Bank). Chaired by Lord Stern and Joseph Stiglitz (referred to as the Stiglitz-Stern Report)

Global Carbon Pricing Commission (Stiglitz-Stern Commission)

The purpose of Commission: to explore ways of achieving Paris goals, including explicit carbon pricing options and levels that would induce the change in behaviors, including investment in infrastructure, technology, plant and equipment, needed to deliver on the temperature objective of the Paris Agreement of “well-below 2C,” in a way that fosters economic growth and development as expressed in the Sustainable Development Goals.

Carbon pricing is necessary but insufficient

European Economic Review 119 (2019) 594–612



Contents lists available at [ScienceDirect](#)

European Economic Review

journal homepage: www.elsevier.com/locate/euroecorev

Addressing climate change through price and non-price interventions

Joseph E. Stiglitz¹

Columbia University, United States

Carbon pricing is necessary but insufficient

- Need for large public and private investments
- Need for regulations to guide the economy and stimulate innovation
- The larger the investment, and the better the regulations, the lower the carbon price required to achieve the Paris goals.

II. Why markets cannot handle climate change well

- Quintessential example of an externality
- Obvious “market failure”, but less obvious: interactions with other market failures
 - Climate change exacerbates consequences of other market failures
 - Externalities are pervasive in networks
 - Consequences become severe in the presence of large risks
- High level of uncertainty and risk
 - And risk markets are very imperfect
 - Risk is endogenous—at least in part of the actions the economy takes
- Adapting to climate change marks a large structural change in economy
 - And markets do not handle well large structural changes
 - Key part of climate risk is transition risk, risk that the transition will not go smoothly, markets will be short-sighted
- A key part of responding to climate change is innovation
 - But there are pervasive market failures associated with innovation (both the levels of expenditures and direction)

New understandings of the limits of markets

- Prices can help address externalities
 - But in the absence of a full-state dependent set of prices (which *never* exists) regulations can be superior, or at least an important complement (Weitzman)
- Economies with imperfect risk markets and imperfect information are essentially never (constrained Pareto) efficient (Greenwald-Stiglitz)
 - Important role for government interventions
 - Interventions should *not* be limited to simple price interventions
- Capital market imperfections are pervasive
 - And can lead to underinvestment in certain key areas
 - Likely to be especially important in investments in areas where price signals are not working (climate change)
 - Capital markets and firms are short sighted
 - Partly as a result of problems of corporate governance

New understandings of the limits of markets

- Networks matter
 - And markets pay too little attention to systemic risk
- Distribution matters
 - And needs to be taken into account in the design of interventions

The rules of the economic game matter

- Markets don't exist in a vacuum
 - The rules affect both efficiency and distribution
- Key rules affecting climate change include: corporate governance, disclosure rules, bankruptcy rules, rules governing fiduciaries
 - Many of the rules were designed to address market failures—but some were imperfectly designed
 - Some of these rules create a bias *against* doing anything about climate change
 - Market does not have appropriate incentives for disclosure
 - Need disclosure rules concerning climate risk
 - But rules have to reflect *systemic risk and transitional risk*
 - Conflicts of interest are pervasive
 - But fiduciary standards were often set in wrong way, focusing on short term financial returns—now need to get reversed to look at long run consequences

(See J. E. Stiglitz and FEPS (Foundation for European Progressive Studies), *Rewriting the Rules of the European Economy*, 2019)

III. Some recent work in economics underestimates urgency and scope of what has to be done

- Reflects excessive confidence in markets—ignoring pervasive market failures
 - Evident in financial crisis, when markets couldn't see systemic consequences of their actions just a few years away
- Poorly designed models
 - Not incorporating advances in climate science, economics, and finance
 - Showing importance of non-linearities, non-convexities
 - Which can give rise to systemic fragility
 - Damage functions which increase disproportionately with climate change
 - Importance of climate variability (over space and time)
 - Climate change which can increase disproportionately with greenhouse gas concentrations

Inadequacy of standard integrated assessment models (continued)

- Inadequate treatment of risk
 - Often focusing on “central case”
 - Seldom incorporating full analysis of implications of fat-tailed distribution
- Inadequate treatment of endogeneity of technology and non-convexities associated with innovation
- Inadequate normative framework (next slide)

Result:

- **Failure to recognize the urgency and scope of what has to be done**
 - Some have even suggested that we shouldn't be worried so long as temperature increase is less than 3.5 degrees C.
- **Reliance of simplistic instruments—just price intervention**

Normative framework needs to change

- Standard model sets policy to maximize intertemporal utility, uses that model to assess the social cost of carbon, and uses that to set appropriate price intervention
 - Defining “social cost of carbon”
- Standard approach ignores consequences of fat-tailed distributions (Weitzman)
 - Expected utility isn’t even defined (equals minus infinity)
 - Implies high (infinite) social cost of carbon
- Standard approach confuses risk discounting with time discounting
 - Greater uncertainty may mean that we should take greater precautionary actions
 - Increasing discounting because of risk says we should pay *less* attention to future
 - Using a 7% discount rate says we should pay essentially no attention to future generations

Failures of standard normative approach

- Standard approach (using a dynastic intertemporal utility function, as if there is a single infinity lived individual, rather than explicitly taking account the effects on later generations) assumes that we can (and will) costlessly compensate future generations for environmental damages
 - And ignores the fact that in those states of nature where damages are high, we will be worse off, have less resources to adapt to climate change
 - This alone implies a low (possibly negative) discount rate (Arrow, Stiglitz, *et al.*)
- Standard approach doesn't put any (reasonable) assessment of the value of life
 - If a fraction v of the population loses their lives every year because of climate change, if the value of a life is m times per capita income, expected loss on this account alone is mv . Reasonable estimates of this imply high values for the social cost of carbon
 - Just one example of many of important costs that have been ignored
 - Loss of biodiversity

IV. Closer look at Stern Stiglitz Report

- Motivated by concerns over the immense potential scale of **economic, social and ecological damages** that could result from the failure to manage climate change.
- Current climate action is **insufficient to induce a cost-effective transition** at the **pace and on the scale** required for the Paris Agreement.



INTRODUCTION

- The required changes imply **structural change, learning, experimentation, and technological changes, and involve large uncertainties.**
- Climate policies, if done well, are **consistent with growth, development and poverty reduction.**
- Potentially a **powerful, attractive and sustainable growth story** with more friendly cities, robust agriculture and stronger ecosystems.

Climate policy packages

- **Achieving the Paris objectives will require all countries to implement climate policy packages.**
 - Packages include pricing, regulations, and investments
 - Policies should be designed to **induce learning** and **respond to new information**
 - should take into account non-climate benefits, particularly reduced pollution, local context, and political economy
- The **design of country policies will vary** and take into account national and local circumstances. **Lower-income countries may choose lower carbon prices** as complementary resources may be cheaper and distributional issues less easy to handle (contrary to principle of single price: necessary part of political compromise, and required to address distributive consequences)
- **International cooperation to promote and provide support for consistency of action** across countries can help to lower costs, prevent distortions in trade and capital flows, and facilitate the efficient reduction of emissions



CARBON PRICING

- A **well-designed carbon price** is an indispensable part of a strategy for reducing emissions in an efficient way.
- GHG emissions can be priced explicitly with a **carbon tax** or **cap-and-trade systems**.
- **Reducing fossil fuel subsidies** is another essential step toward carbon pricing.
- Explicit carbon pricing can be usefully complemented by **shadow pricing in public-sector activity** and **internal pricing in firms**.

Carbon pricing

- Requisite prices need to be much higher than current prices but are eminently affordable

The explicit carbon-price levels consistent with the Paris temperature target are at least **US\$40–80/tCO₂ by 2020 and **US\$50–100/tCO₂** by 2030.**

- These price ranges assume that the pricing policy is complemented with well-designed policies and actions, such as efficiency standards, research and development, city design, networks..., and a supportive investment climate. In the absence of these elements, the carbon-price range required is likely to be higher.
- These carbon prices are eminently affordable, will induce changes in energy prices smaller than those that have been experienced in the past



Carbon pricing alone likely will not be sufficient to induce change at the **pace and scale** required for the Paris temperature target—or be the most **efficient/equitable** way to do so.

Adopting other cost-effective policies – with strong emphasis on other, related, market failures and the dynamics of change – can mean that a given emissions reduction could be **induced with lower carbon prices**.

Such policies include:

- investment in low-carbon infrastructure,
- Regulations, efficiency standards, urban planning,
- groundwork for renewable-based power generation,
- land and forest management,
- fostering R&D investment,
- financial instruments

Examples of regulatory interventions

- No coal electric generating plants without carbon storage
- Emission standards for cars
- Cement standards
- Embraces large fraction of emissions
 - But still leaves much out
- Many of these standards/regulations are easy to enforce

Deviations from Efficiency

- Economists criticize regulations because they result in deviations from efficiency (single “price” for carbon in all uses, in all places)
- But most countries have deviated from relying on a single price by subsidizing (e.g. renewables) or regulations

How do we explain this?

- Reducing distributive burden—can be large changes in prices for small allocative effects
- Correcting other market failures
 - (i) coordination failures
 - (ii) induced innovation
 - (iii) changing preferences (consumption externalities)
 - (iv) High levels of uncertainty, imperfect risk markets

Adaptability

- Carbon prices and other aspects of climate packages (e.g. regulations) will need to be adjusted over time, particularly upward if existing prices fail to bring about the required changes, but based on criteria that are transparent and sound.

V. Green New Deal

- Language meant to evoke urgency of taking actions and the scale and scope of what is required
 - War-time mobilization might be a better metaphor
 - Costs to US from weather related extreme events in one recent year—2% of GDP
 - Will have to pay costs one way or another
- Also meant to emphasize *positive* aspects of response—that it could help stimulate economy and a transformation of society
- Also meant to emphasize that markets on their own won't be able to accomplish green transition

Irony about resource costs

- Some say we cannot afford it
- At the same time, we worry about AI, robotization leading to high levels of unemployment
- And many economists talking about “savings glut,” inadequate aggregate demand to fully employ capital or labor

We have underutilized resources and unmet needs

- Including retrofitting the global economy for global warming
- There is no real savings glut
- The challenge is how to redeploy resources to address these needs

Key issue: short term financial markets intermediating between long term savers (pension funds, sovereign wealth funds) and long term investment needs

- Role for “green” (development) banks
 - Already part of mandate of European Investment Bank and World Bank
 - New global lending facilities—South led, including AIIB and BRICS Bank
 - Facilitating risk mitigation
 - Banks being created in US

Exacerbated by wrong rules

- Failure to require disclosure of climate risks, especially systemic risk, and to incorporate these into risk analysis, e.g. by central banks and other financial institution
 - Will need to incorporate into regulatory structure
 - Will need to incorporate advances in network risk analysis
- Wrong fiduciary standards

Green transition could stimulate the economy

- Help bring about a new era of energy and other innovations
- Basis of social transformation
- Required investments likely only partially through expanding production
 - Disagreements about how much expanded production is possible in short run
 - But societal transformation—reducing discrimination, integrating partially excluded groups into the economy—could support larger in production
 - Impact analogous to World War II

European Green Deal

- Making Europe climate-neutral and protecting our natural habitat will be good for people, planet and economy.
- The EU will:
 - Become climate-neutral by 2050
 - Protect human life, animals and plants, by cutting pollution
 - Help companies become world leaders in clean products and technologies
 - Help ensure a just and inclusive transition
- 93% of Europeans see climate change as a serious problem
- 93% of Europeans have taken at least one action to tackle climate change
- 79% agree that taking action on climate change will lead to innovation

climate-neutral by 2050

- ENERGY
 - Decarbonise the energy sector
- BUILDINGS
 - Renovate buildings, to help people cut their energy bills and energy use
- INDUSTRY
 - Support industry to innovate and to become global leaders in the green economy
- MOBILITY
 - Roll out cleaner, cheaper and healthier forms of private and public transport

VI. Concluding Remarks

- World is engaged in a risky experiment
 - Science has provided us with an increasingly clear and bleak view of what will happen if we don't change "business as usual."
 - Imperative that there be reductions in emission levels
 - But imperative that it be done in ways where the burden of adjustment is equitably shared
- Will require new economic model—changed patterns of consumption and innovation
 - **We have treated two scarce goods (air and water) as if they were free**
 - Charging for them will lead to large changes in prices
 - With possibly large distributive consequences
 - With large changes in our economic and social systems

Concluding Remarks

- Global warming is a long-run problem
- But it is a problem which needs to be attacked now
 - Delay will increase the costs—less expensive to not add greenhouse gases to atmosphere than to remove them, once there
 - Delay in agreeing on equitable burden sharing will increase the likely inequities which will arise
 - Inequities within countries, across countries, and across generations
 - Current approach unduly discounts value of future generations

- Cost of responding to climate change—if we do it efficiently—is relatively small, and much smaller than the cost of not responding
 - But certain sectors and firms will be hurt
 - Coal
 - Large car manufacturers
 - But new industries will also be created
 - Firms that respond to new opportunities creatively will do well

Need for global cooperation—and enforcement

- Global climate change is a global issue, that has to be addressed globally
 - Would be good if necessary cooperation could easily be achieved
 - Right now, one country is standing out as a “rogue” country refusing to cooperate
 - Even though that country has already suffered largest amounts of property damage
 - And its climate scientists have done as much as anyone to establish the nature of the threat
- Will need to impose cross-border taxes
 - Such taxes are WTO consistent (shrimp-turtle case)
- All countries need to cooperate in imposing sanctions against any country failing to cooperate
- Risks of climate change are simply too large to let any single individual or country put the entire planet in danger

Climate change poses a rich and essential research agenda

- Economics and finance disciplines have given short shrift to climate science—in spite of its importance
- Requires a multiple disciplinary approach
- Climate change challenges conventional thinking in economics and finance, which has assumed rational expectations, well functioning markets, and ignored important non-linearities and non-convexities
- Climate change is marked by a high level of risk and uncertainty
- Advances in our ability to analyze climate change will have important collateral benefits, e.g. in other areas marked by high levels of uncertainty and risk, such as macroeconomics