

# The Economics of Climate Change

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# CONTENT OF PRESENTATION

INTRODUCTION: ECONOMIC CHARACTERISTICS OF CC

THE CHALLENGES

THE BEHAVIOUR

COST OF ACTION VS INACTION

THE POLICIES

THE GREEN PARADOX

FINAL COMMENTS

# INTRODUCTION: ECONOMIC CHARACTERISTICS OF CC

Earth's climate: Public good.

Consumption non-rival.

Non-exclusion.

P. Samuelson (Nobel Price)

# INTRODUCTION: ECONOMIC CHARACTERISTICS OF CC

- CHARACTERISTICS:
- PUBLIC GOOD GLOBAL AT TRANSNATIONAL LEVEL: inexistence of transnational powerful regulator.
- COMMON PROPERTY: free rider problem.
- Infraprovision of public goods.
- Climate Instability of Climate Change.

# INTRODUCTION: ECONOMIC CHARACTERISTICS OF CC

- Climate analysis multidisciplinary
- ECONOMISTS HAVE LEARNED:
  - \*Flow of emissions: GHG emissions are
    - persistent
    - perfect mixed (only the total sum of quantities matter).
  - \*Accumulated stock: Concentration of GHG increasing.

# INTRODUCTION: ECONOMIC CHARACTERISTICS OF CC

- CC urgent problem that requires global action.
- Economist look at the problem of CC as:
- MARKET FAILURE (N. Stern).

# INTRODUCTION: ECONOMIC CHARACTERISTICS OF CC

- Market failure    policy measures.
- New strategy for energy is needed.
- Change in the paradigm: development of energy technologies with low use of fossil fuels.
- How to achieve this?

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# THE CHALLENGES

- Simple relationship:
- $\text{CO}_2/\text{output} = \text{Energy}/\text{output} (\text{efficiency}) \times \text{CO}_2/\text{energy} (\text{carbon level})$

# THE CHALLENGES

- Any proposed solution has to include:
- The need for global action: sector, countries.
- Temporal dimension.
- Uncertainty and risk.

# THE CHALLENGES

- In Spain: Responsibility of emissions by sectors.
- Energy sector: 40% of global emissions
- Industrial sector: 18% of “ “
- Transport sector: 20% of “ “
- Residential and primary sector: 13%

# THE CHALLENGES

- In the world. Responsibility of emissions by countries very asymmetric.
- Investment needs to limit warming to 2°C (450ppm CO<sub>2</sub>) in 2013.

# INTRODUCTION

- REGION (constant 2005\$ billion)

- DC 563

- USA 175

- EU 129

- China 263

- India 75

- Source: MicKinsey & Cia (2009)

# THE CHALLENGES

- Global action implies need to take into account many countries.
- Good policy implies to define “intelligent” and “pragmatic solutions”.
- The selection of the policy instruments that guarantee “cost effectiveness”.

# THE CHALLENGES

- Not all the instruments equally efficient, not cost effective.
- Besides we need to consider static and dynamic properties.
- Objective is to achieve aims at minimum costs now and in the future. “Dynamic efficiency”.
- Not an easy task.

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# THE BEHAVIOUR

- Few incentives to act unilaterally to prevent CC.
- Individually rational not to participate in climate policies adopted by other countries.
- Individually rational to act as a “free rider”.

# THE BEHAVIOUR

- Type of behaviour very important.
- Cooperative behaviour needed to solve CC problem.
- Non-cooperation: inefficient solution.
- Cooperation implies difficult negotiations to distribute benefits and costs of adopted actions.

- Non-cooperation: inefficient solution.

# THE BEHAVIOUR

- Reasons cooperation difficult to achieve:
- Costs of emissions control unequally distributed among countries and sectors.
- Damage costs unequally distributed among countries.
- Costs of avoiding climate damages obvious and immediate. Benefits uncertain and in the future.

# THE BEHAVIOUR

- Difficult to insure international agreements because of uncertainty and wrong incentives.
- Difficult negotiation to distribute benefits and costs of the efforts in mitigation.

# THE BEHAVIOUR

- Behaviour differs depending in instruments used to achieve mitigation.
- Command and control, taxes on carbon, voluntary agreements, permit market, soft regulation.
- Analogies between permit market and carbon tax in theory.

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# COST OF ACTION VS INACTION

- Economics implications of policies.
- Many sectors affected- ¿Costs in terms of growth of GDP?
- Important to compare: cost of mitigation and adaption vs cost of inaction.

# COST OF ACTION

- Mitigation.
- Short run:
  - Small reductions, ~6% annual reduction in emissions imply reductions in GDP lower than 0.5% per year.
  - Larger reductions, ~16% imply GDP losses around 1,6% per year.

# COST OF ACTION

- Long-run:
- Bottom up and top down models: Produce different results that are converging, 2-2.5% of GDP (2050)
- Important to consider range of changes in climate (2-4°C) and periods.
- Remember that climate change will not stop at 2100 nor it is confined to such a narrow range.

# COST OF ACTION

- (IPCC 2007)
- Temperatures  $\leq 2-2,8^{\circ}\text{C}$
- World GDP: Reduction lower than 3% in 2030.
- World GDP: Reduction lower than 5.5% in 2050.

# COST OF ACTION VS INACTION

- Figures suggest we can manage to reduce emissions.
- But the question is not only whether we can do it or not. It is also a question of whether we **should do** it.
- Is the cost of action against CC greater or lower than the cost of inaction?

# COST OF INACTION

- DICE´s model, Nordhaus: a global temperature rise of 4.5 degrees Fahrenheit –the consensus projection for 2100- would reduce GDP of the world by almost 2%.
- If temperature grows 9 degrees, the model estimates losses at about 5% of GDP at the world level.

# COST OF INACTION

- (IPCC) Increase of 4°C at world level imply losses in the interval 1-5% GDP. Include: costs in agriculture, tourism, natural disasters, infraestructure for adaptation.
- Stern: includes other intangible values. Costs around 5-20% GDP. He uses discount rates near to zero and weights more damages in poor countries.

# ACTION VS INACTION

- M. Weitzman (2007).
- If there is a positive probability (although it may be low) of a catastrophe, climate policy should be implemented. “There is little doubt that the worst-case scenarios of global-warming catastrophes are genuinely frightening”.
- Climate policy: risk management.

# THE POLICIES

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# THE POLICIES

- To increase efficiency: reduce energy consumption per unit of output.
- To reduce carbon use: change use of fossil fuel in, everyday life; in particular electricity and transport sector...

# THE POLICIES

- To avoid deforestation, better management of land uses.
- To modify consumption habits.
- Use of renewable sources of energy.
- Technological improvements in energy mix.

# THE POLICIES

- More efficient transport modes: public transport.
- Improvement in building (isolation, material selection).
- Geoengeering solutions.
- To reduce production and limit economic growth?

# THE POLICIES

- Economics of climate change have to take into account factors that are very difficult to tackle although very important.
- Lot of uncertainty in a large part of the scientific chain that explains the consequences of global warming.
- **Risk, uncertainty, ethics and the need of a global solution.**

# THE POLICIES

- Global solution because CC can be characterized as a “pure public bad”.
- Ethics because CC is a long run phenomena that does not only affect current generations but also future ones.

# THE POLICIES

- And we have to take risk and uncertainty into account because:
- Climate science cannot tell, without any margin of error, **what** the consequences of global warming would be and
- **When** they would take place.

# THE TIMING OF POLICIES

- Nordhaus suggests, designing a policy that builds gradually over a long period of time, what is known as the “**the climate policy ramp**” or
- With a “**big-bang climate policy**” that consists on the implementation of aggressive action to limit emissions in a short period of time. N. Stern.

# IMPLICATIONS OF POLICIES

- The differences between both policies have implications, among other things, in the way in which carbon prices will react.
- These in turn will have implications on incentives about abatement, on technological improvements and so on.
- The criteria underlying the selection of one or the other alternative is closely related to the issue of what **the discount rate** should be when planning climate policy.

# SOME GOOD NEWS

- Economic Implications will not always be negative.
- New opportunities for investment
- Processes of technological innovation
- Positive impacts on service sector: insurance cias, financial analysts, investment firms.

# THE DISCOUNT RATE

- It concerns ethics as it has to do with the way in which present generations are valued with respect to future ones.
- The answer to this ethical question is very important as the decision of what discount rate to use determines the results of cost benefits analysis applied to many issues and in particular to climate policy.

# THE DISCOUNT RATE

- Arrow (2007): differences in discount rates used in the analysis of different alternatives overwhelms the possible differences that appear in the estimation of future losses generated by green house gases.
- Also differences between economic discount rates and environmental discount rates.

# THE DISCOUNT RATE

- Hoel and Sterner (2007) include changes in relative prices into a model that distinguishes between environmental goods and consumption goods.
- C.Gollier (2009) ¿which rates should be used to discount costs and benefits of different natures at different time horizons? In a model with two goods.
- Use of an ecological discount rate of a smaller size that the economic discount rate may be justified.

# THE DISCOUNT RATE and ASYMMETRIES

- Asymmetries exists in the real world. Asymmetries: in preferences, in income, in welfare.
- Rich countries and developing countries tend to defend different positions with respect mitigation.

# THE POLICIES

- Policies are designed by Public Authorities
- They are implemented by countries, firms, private agents.....
- Enforcement is not easy unless is individually rational to follow the imposed rules.
- Good to know opinions of agents that take real decisions.

# THE POLICIES

## World Business Summit on CC

- Technological innovation will take place only “if aims and policies are long term and clear”.
- The transition to a low carbon economy requires that investors, pension funds, big companies obtain “positive returns” on their investments.
- The mechanisms and the regulation should insure clear, robust and long term signals for investors.

# THE POLICIES

- Trade programs and instruments such as standards, taxes, carbon markets, (market instruments) allow better possibilities for prediction, transparency and security.
- A new and appropriate context to promote new financing mechanisms: private-public societies, green funds for infrastructures...

# THE INSTRUMENTS

- Instruments should help the development of low carbon technologies that may not be economically profitable.
- Promote technologies and methods that insure cost effectiveness.

# THE GREEN PARADOX

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# THE GREEN PARADOX

- In the absence of a tax on CO2 emissions, subsidizing a renewable backstop energy (solar or wind) may bring forward the date at which fossil fuels become exhausted. Global warming is aggravated
- If path of prices for fossil fuels decreasing, incentives to extract resource quicker.

# THE GREEN PARADOX

- Is this paradox always true? ( F.van der Ploeg and C. Withagen)
- It occurs for relatively expensive (eolic, solar) but clean backstops.
- Does not occur if backstop sufficiently cheap relative to marginal global warming damages (nuclear)

# THE GREEN PARADOX

- Does not occur when it is attractive to leave fossil fuels unexploited .
- This imply the need to analyze the dynamics of CO2 tax carefully. We may need a gradually declining CO2 tax.

# THE GREEN PARADOX

- From a global social welfare perspective a decrease in the cost of supplying the backstop may be beneficial but it may not be beneficial for green welfare.
- Welfare dynamic analysis important.

# FINAL COMMENTS

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# FINAL COMMENTS

- The decision about the need for a climate policy, is only the beginning of a sequence of actions. Many other questions remain to be solved.
- Which instruments to use to obtain the planned objectives?
- What the timing of the policy should be?

# FINAL COMMENTS

- The economic perspective that maintains that a safe climate policy has to imply lower net costs than the absence of such a policy is sound but can add some new perspectives.
- Cost of climate policy as “delayed GDP growth”.

# FINAL COMMENTS

- Real welfare instead of GDP.
- Comparison with large public investment.
- Behaviour, learning and substitution.

# FINAL COMMENTS

- Climate policy insurance against climate change
- In terms of of real welfare, climate policy less expensive than in terms of lost GDP.
- Conversely, climate change causing catastrophes more expensive in terms of welfare than in terms of GDP.

# FINAL COMMENTS

- Effective safe climate policy will rise energy prices considerably.
- Generate a motion process of creative destruction that is an inevitable component in the transition to a low-carbon economy.
- Postponing the transition will make the transition more expensive and safe levels of GHG concentrations out of reach.

# FINAL COMMENTS

- i) Liquidity for the economy is like the flow of blood for the body. The economic system can not work without the environment goods provided by the Earth.

# FINAL COMMENTS

- ii) Financial agents have behaved without taking into account negative external effects and provoking a market failure. The same happens with Climate Change.

# FINAL COMMENTS

iii) In the financial sector, with the subprimes, almost everybody have talked about “toxic assets”

In the environmental world we also have assets that are “toxic”; carbon that produce CO<sub>2</sub> and GHG.

# FINAL COMMENTS

- iv) The financial crisis and the Climate Change crisis both constitute global phenomena. They both need coordination among countries.
- v) The actual economic crisis has a short run and long run component as Climate Change. The strategy needed to fight the crisis needs a dynamic approach that allows flexibility and different options.

# FINAL COMMENTS

- It seems that a “portfolio of initiatives is needed. The same happens in the CC problem.
- vi) The new financial architecture for the world is not yet constructed. Lack of agreement.  
Similar situation with CC

# FINAL COMMENTS

vii) Different policies are used to solve the financial and real economy crisis.

We should do the same with CC. And we should do it

**AS SOON AS POSSIBLE**