
# On Climate Change & Institutions

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# Outline

- 1. From & Beyond the Mainstream
- 2. Enclosing the 4 Essentials of Climate Policy
- 3. On the Green Paradox of Climate Policy
- 4. Climate Change & Growth
- 5. Main Conclusions

# 1. From & Beyond the Mainstream: A big problem!

- Large-scale *geophysical climate models* (ACIA, IPCC) agree that under BAU
  - $C0_2$ concentrations by 2100 will be 35% higher than during preindustrial levels, implying
  - Global temperature rises $\in$[1.5, 6] and an average $\uparrow 3.3^0$C by 2100
  - The consequences will be global and irreversible, although not homogenously distributed
- Climate change economics is a real challenge for economics. Key points:
  - Uncertainty (Knightian type)
  - Long time horizon (infinite?)
  - Global nature of the problem $\rightarrow$ collective action solutions
  - Related problems: Energy & Growth ($\rightarrow$ unemployment)
- Integration of Economics in the global warming debate
  - Takes off in 90s (Nordhaus, 1990; Hope, 1992; Anthoff and Tol; 1996)
  - High point with Stern review (2006) and its triggered debate
  - Relatively playing down attention with the spread of the financial crisis
  - Reheating: Green Paradox (Sims, 2008, 2012), new thinking around (de-)growth, etc.
- Still certain dominance of neoclassical economics & rising matter from *non-equilibrium* approaches (post-Stern).

# 1. From & Beyond the Mainstream: The Milestone (I)

- Stern review (2006) is an *essay in persuasion!* 3 valuable added points:
  - the framework of the *collective decision-making* process that it provides
  - giving a central role to the ignored *uncertainty* (unknown risk)
  - giving economic basis in favour of a *radical transformation of attitude* towards climate change
    - urgent call of *action* → targets ($2^0$C, 50%↓ by 2050)
- Modelling approach (PAGE2002, Hope(2006))
  - Integrated economic and geophysical assessment model (IAM)
    - Aggregated simulation model
    - Solow-type growth model (consumption and saving decisions, growth, exogenous)
  - Includes interdisciplinary risk analysis (though Monte Carlo analysis of 31 parameters)
- Concludes that (under BAU)
  - by 2035 concentration of GHG could reach 560 ppm of $CO_2$e → commit the world to ↑$2^0$C
  - by the end of the century high chance to ↑$5^0$C → disastrous changes in natural ecosystems and physical geography of the word, unknown territory!
  - global macroeconomic effects (GDP) (for now and forever)
    - 5% ↓ GDP /11% ↓ GDP (including health and environmental effects)/ 20% ↓ GDP (adjusting equity weighting)
- Demands urgent action & questions Nordhaus' *upward-sloping climate policy ramp*
  - Emissions stabilization at 550 of ppm of $CO_2$e, which implies 25% ↓ global emissions

# 1. From & Beyond the Mainstream: The Milestone (II)

- Generates a fruitful debate around 2 main disagreement points
  - The discount rate (r=1.4%)
    - Quantitative result and policy depend heavily on the value of some key parameters.
  - The treatment of the risk and uncertainty
- Stern's rate (r=1.4%) << than others adopted in IAMs.
  - Near zero rate of pure time preference ($\delta$=0.1) + logarithmic utility function (elasticity of consumption ($\eta$=1) is not supported by real macroeconomic data (Nordhaus, 2007), Weitzman (2007).
  - $\delta \approx 0.1$ implies a egalitarian attitude across time dimension, but $\eta$=1 implies insufficient concern for the problems of poverty today (Dasgupta, 2007). Proposes: $\eta$=[2,4]
- Uncertainty
  - The uncertainty highlights the need for a social insurance against low probability, catastrophic events that require a *precautionary principle*.
  - Dismal Theorem (Weitzman, 2009).
    - The marginal benefit of a reduction in GHG emissions is literally infinite.
    - So, Stern is right to require immediate action, but for the wrong reason!
  - Major emphasis on uncertainty linked to a framing of dangerous climate change rather than a focus on optimal warming policies based on optimization rationale (Baker, 2008; Weitzman, 2009; Barker and Scriecieu, 2010.

# 2. Enclosing the 4 Essentials of Climate Policy (I)

- We have simultaneously a climate change problem and an energy problem:
  - Carbon deposits are *natural capital,* fundamental to guaranty growth (and employment)
    - They may run out in 50 years!
  - But, emissions may take the climate unbearable in huge portion of the planet
- Thus, the task is to find:
  - The right exploitation pattern of fossil fuel deposits
  - Develop alternative (green) energy sources to fossil fuels
  - Since 2009, create employment! $\rightarrow$ growth
- Timing?: Related key issues: Growth implications & the cost of delay of actions
- 3 type of answers: a & b from IAM and c under endogenous technological change
  - a) Gradualist approach (Nordhaus, 1994, 2007)
  - b) Immediate, strong and permanent interventions (Stern, 2007)
  - c) Depends on substitution possibilities between clean (c) & dirty (d) sectors (Acemoglu, 2012).
    - Changes in relative prices of energy inputs highly influence technological change (endogenous)
    - If substitution possibilities are high, immediate (and temporal) action, because
      - productivity advantage of (d) $\rightarrow$ direct innovation and production to (d) $\rightarrow$ environmental disaster

# 2. Enclosing the 4 Essentials of Policy (II)

- Preventive actions to tackle the problems? The 4 Essentials

**1. Carbon pricing and regulations**

– Lessons from classrooms:
  - Market-based instruments (MBI)→ single price signal to all countries and sectors (Tirole, 2009)
  - Heterogeneous abatement costs help → abatement to the cheapest areas/sector (Sterner, 2003)
  - MBI may also send a price signal to stimulate research to develop new (green) technologies

– Carbon demand reduction policies: Taxes/subsidies/ trading $C0_2$ emission rights/regulations
  - Mixed measures. Not obvious which is which!

**2. Mixed Technological Policy** (research subsidies, Acemouglu et al. (2012) + Carbon pricing

**3. International Collective Action** (ICA) ← Climate change is a *global* problem

– Organisations (UNFCCC), Institutions (Kyoto Protocol) help to create the conditions for collaborative solutions

– Binding international agreement necessary → Institutional development

**4. Behavioural evolution**

– Changing people's preferences though information, discussion & education

# 3. On the Green Paradox of Climate Policy (I)

- Evaluating Climate Policy outcomes. Are we doing well?
  - Ad hoc implementation of climate policy
    - A wide array of *domestic* carbon taxes, subsidies on clean energy, tradable permit systems, regulation
    - *Changing* over time and *differing* from country to country
    - Many countries do not even have a GHG reduction policy at all
- Can this be effective to face global warming?
- Increasing evidences of warming (IPCC, 2014) & world GHG emissions accelerations
- Well-intended policies may have unintended and undesirable consequences!
  - GHG emissions may be increasing as a result of climate policy!
  - Green Paradox (GP) literature, although not new, expands with Sims (2008; 2012)
    - Special attention from:
      - Non-renewable natural resource modelling approach (Hoel, 2010; Gerlagh, 2011), etc.
      - Applied General Equilibrium Models (AGEM) (Paltsev, 2001; Burniaux and Oliveira, 2012)
    - Still no attention from non-equilibrium approaches, neither empirical assessments
  - *Theoretical* drivers of the Green Paradox?
    - Sub-global actions → AGEM & exogenous carbon supply
    - Gradual greening
    - Implementation lags → non-renewable resource models & supply reaction
    - Innovation feed-backs

# 3. On the Green Paradox of Climate Policy (II)

- **1. Sub-global Actions** (Paltsev, 2001; Babiker, 2005; Burniaux and Oliverira, 2012)
  - Green policies that fail to cover all the countries
    - Exampe: Kyoto Protocoll
  - Incentives emerge for non-abating (NA) countries to increase their emissions
    - $\Delta$ Emissions (NAC) > $\nabla$ Emissions abating-countries (AC)
    - Carbon leakage = 100% $\rightarrow$ $\Delta$ Emissions (NAC) = $\nabla$ Emissions (AC)
  - Carbon leakage has been mostly analysed by multi sector and multi country AGE models
    - Assumption: No supply reaction in the international carbon market
  - 4 Alternative channels for unilateral cutbacks to affect global GHG emissions have been pointed:
    - a) The international energy market channel
    - b) The channel of of international trade of non-energy goods
    - c) The channel of international trade in production factors
    - d) The channel of technological change and technological spillovers

# 3. On the Green Paradox of Climate Policy (III)

*a) The energy market channel*

- Unilateral reduction policies → ∇ Demand AC→ ∇ internacional price → Δ Demand NAC
- The size of the respond depends on supply and demand elasticities
  - » If supply is inelastic → carbon leakage =100%
- Demand responses depend on the degree of market integration

*b) The channel of international trade of non-energy goods*

- Unilateral carbon prices ΔCost and ΔP of carbon intensive goods in AC
- Incentives to substitute towards goods produced in NAC→ ΔGHG emissions of NAC
- The leakage degree depends on the elasticity of substitution among goods of different regions
  - » The larger the Armington elasticity the easier to switch to goods from cheaper NAC

*c) The channel of international trade in production factors*

- Δ Cost AC→ ∇ the rate of return of capital in AC → capital might flight to NAC →
- Δ Marginal Productivity of polluting inputs in NAC → Δ GHG emissions

*d) The channel of technological change and technological spillovers*

- Leakage <0 (abatement in one country → abatement on another country)

- The GP is not a general conclusion from the AGM literature of carbon leakage
  - Its occurrence depends on specific assumptions
  - Even some papers have shown the possibility of leakage < 0

# 3. On the Green Paradox of Climate Policy (IV)

- Carbon owners may also react as a result of climate policy
  - The might $\Delta$ carbon supply $\rightarrow \nabla$ carbon prices
    - Increasing credibility of tightening climate policy & Insecurity of property rights
  - Sub-global actions (leakage) + supply reaction
    - $\nabla$ carbon prices $\rightarrow \Delta\Delta$ GHG emissions
  - 3 additional drivers analysed by non-renewable resources model approach
    - Gradual greening
    - Implementation lags
    - Innovation feedbacks
- **2. Gradual Greening** (Hoel, 2010)
  - Steeply rising carbon tax paths
  - The occurrence of GP depends on the model
  - GP is less likely to occur under Heal model (HE) than under Hotelling (HO)
    - Under HE only if the carbon tax (g) grows at a sufficiently higher rate than g>>> induces a GP
    - Under HO increasing carbon tax expectations increases extraction and hence emissions
    - When including a backstop (HE) the answer depends on marginal extraction costs and the share of the returns to investment in the clean technology

# 3. On the Green Paradox of Climate Policy (V)

- **3. Implementation Lags** (Di Maria el al. 2008; Eichner and Pething, 2010)
  - There is a lag between policy announcement and implementation
  - In the interim policy agents are still free to emit and to do it for free
  - The expectation about the green policy may induce the agents to increase extractions
    - 1. Increasing extractions imply $\rightarrow$ lower prices & increases the energy use in the interim phase and
    - 2. Low – high carbon reaction: with a cap the scarcity of *low* carbon fossil fuels increase $\rightarrow$
      - Low carbon price $\Delta$, it would be optimal to preserve the low carbon for the constrained phase $\rightarrow \Delta$ high carbon use in the interim phase.

- **4. Innovation Feedbacks** (Ploeg and Withagen, 2010; Gerlagh, 2011; Hoel, 2011)
  - Green policies aiming $\nabla$ fossil fuel demand via subsidies to green energy/support R&I
  - Two effects:
    - 1. $\nabla$ the value of the resource in situ $\rightarrow \nabla$ price $\rightarrow \Delta$ carbon demand

# 3. On the Green Paradox of Climate Policy (VI)

- The evidence for the existence of the Green Paradox is not overwhelming, neither from AGE, nor from exhaustible models.
  - GP is not a general conclusion from the AGE, it depends on specific assumptions.
  - The simplest theoretical models of non-renewable resources support GP, but more realistic ones (including increasing extraction costs, upward-sloping supply curves for backstop technology) show less likely the emergence of GP.
- By no means implies that the Green Paradox of climate policy should be banished.
  - Recent data in AGE models might conditioned the results, mainly because of the increasing presence of emerging and non-abating countries in the international channels.
  - The AGE approach lacks the dimension of non-renewable condition of carbon supply
  - Combining the mechanism from different non-renewable natural resource theoretical models may very well lead to new or mutually reinforced unintended policy outcomes.
  - Lack of empirical assessments (econometrics!) to test for its empirical support
- Attention to:
  - Macroeconomic (uninttended) effects of climate policy via international markets of energy, goods and capital.
  - Attention to the carbon extraction paths, carbon supply, carbon price and GHGs

# 4. On Climate Change and Growth (I)

- Global warning is one of the results coming from an unidirectional view of economic activity. Climate change is a concern about humans, animals, plants, etc. ...
  - Natural resources are not considered holistically in growth models
  - But economic activity is embedded in the context of an overall ecosystem and it composes a subsystem (Boulding 1978)
  - The imbalances created by economic and human activity over the ecosystem frequently develop different kinds of collapses
- *Conventional macroeconomics* searches for full employment of production factors. Natural resources are considered given!
  - The challenge is to reconcile macroeconomic *equilibrium* with the *equilibrium* of natural ecosystems
  - The approaches that support self-regulatory capacity of the economic system to coping economy and natural systems by means of *market prices* carry out many problems to ecosystems
- *Keynesian macroeconomics* can offer new advances to understand and give some answers to global warming and other ecological concerns.

# 4. On Climate Change and Growth (II)

- Although Keynesian macroeconomics historically has been just focused on cycles, full employment and growth, it gives a frame to understand different kinds of *disequilibrium* and to analyze them in combination with other complement approaches
  - Ecological Economics and Institutional Economics dictates can be very useful!
- The Keynesian aggregated demand (AD = C + I + G + XN) offers an adequate framework to understand some of these concerns. However, notice that:
  - Consumption is a key element of AD
  - Modern societies has taken the adjective of *consumer societies*
    - The access to welfare is to get greater quantity of material goods and services!
  - At the same time this behaviour solves the problem of growth
- But: the support of this kind of growth is the consumption of *dirty* energy → global warming
- However there are some niches that do not need increased *material consumption* and they can be produced without *fossil fuels*
  - Keynesian AD with a selective consumption (environmentally friendly) based on green energy (renewable energy) (Harris, 2010)
  - Private and public *investments* have a central role to develop investments and

# 4. On Climate Change and Growth (III)

## Some Lessons from the Financial Crisis

- Different scenarios:
  - EU (specially the PIGS): reduction of expenditures + unemployment
    - Decline of GDP (PIGS) with reductions in *each* component of aggregate expenditures
    - Sharp increase in unemployment and a long stagnation process
      - Impoverishment of the weakest in society (youngest)
    - Emissions' reduction
  - USA and NICs: increasing of expenditures + economic growth
    - Increase in private and public consumption
    - reductions in the interest rates to incentive C & I
    - increasing carbon consumption and emissions
  - Amid, underdeveloped countries collect all the negative of each side
- Neither EU reduction of expenditures + unemployment nor increasing the expenditures + (this kind) of economic growth is desirable or sustainable

# 4. On Climate Change and Growth (IV)

## The Key Role of the Institutional Side

- The installed rationality of the the prisoner's dilemma trap and the tragedy of the commons (Hardin, 1968).
  - EU has addressed unilateral emission reduction by means of rules, mandated technical standards and qualities of the goods and services exchanged in Europe. Imports need respect this standards
  - Competitors have understood that the former are in fact unilateral trade barriers playing the role of protection for the European market, a subterfuge to gain competitive advantage
    - Regulatory Imperialism ( Zaki Laidi 2007; Zielonka 2006)
  - Other players have understood that EU will cooperate with the reductions of emissions in all cases because it is the consistent way to demand the standards. So they can free ride freely!
  - Developing countries defend that they have the historical legitimacy to develop themselves
- Given these current scenario it is compulsory to design robust institutions to get effective cooperation
  - Institutional Economics is well adapted to advance research in this domain

# 5. Concluding Remarks

- Agreement: Humanity has a big nested and global dilemma!
  - Climate Change ⇔ Energy ⇔ Growth (Employment)
- Mixed Climate Policy
  - Carbon pricing
  - Technological policy (transition)
  - International collective action
  - Education & information (behaviour)
- Climate Policy & Green Paradox
  - Sub-global action and international markets (energy, goods, capital)
  - Carbon supply reaction (insecure property rights + greening expectations)
- Macroeconomics matter!
  - Effective AD model reoriented: changes in the C & I components!
  - Selective C and I
    - Incentives to green investment
    - Green estimulus
- Institutions (the rules of the game) at the centre of de debate
  - Precautionary Approach
  - International Collective Action. Binding Agreements.
  - Behavioural change!


Thank You !