

Taking climate change seriously.

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Yes ! We are listening !

Let us take for granted the COP21 position:

- mean warming by the year 2100 has to be contained within 1.5 to 2°C
- for this to be achieved, the total amount of CO₂ which humans add to the atmosphere from now on is limited to 800 Gt (carbon budget)
- reserves lie way above that threshold, and at current rates the budget will be spent by 2050

The question is **implementation** : how to we achieve this goal ?

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- **Bouncing back (effet rebond)** . Suppose fuel efficiency of cars is doubled. Will it lead to a 50% decrease in overall CO² emissions ?
- Evidently no. I now have a clear conscience and I will use my shiny new car much more than I used its gas-guzzling predecessor

Human behaviour and climate change.

Climate change is a global problem: the **physical** world (radiation, absorption) interacts with the **biological** world (carbon cycle), which feedback on each other, and this is important. It interacts also with the **human** world (emissions), which may be the most important of all, but this has been neglected. IPCC models do not include feedbacks from/on human society.

The ratchet effect . Every generation considers as "normal" the situation it knew when it was young. As the global situation deteriorates, the baseline ratchets up regularly (dolphins in the Mediterranean)

The economist's way of identifying the global warming problem

- air and weather quality are **public goods**: everyone benefits or suffer from them in the same way, regardless of the efforts they make. The sun shines for the good, the bad and the ugly.
- the atmosphere is a **common good** everyone can access it and help oneself to the extent of one wishes
- the carbon cycle has a **large inertia** : global warming depends on the stock, not on the flow. So any policy designe to fight global warming must be pursued over long periods of time (50 to 200 years)

The economist's toolbox

"We" = "Humanity" is **NOT NOT NOT**, repeat NOT, an individual. The problem is to **coordinate** the actions of very different people in very different situations spread across the planet. The economist knows of three ways to do that:

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- **Institutions** : if the market does not work, we are left with trying to draft agreements between groups of people (the state, for instance, which is in charge of defining and implementing the common good). The question then is whether people will abide by these agreements, otherwise these conventions are not worth the paper they are written on

First solution: the planner

This is neo-classical growth theory, which goes back to Ramsey (1928). Society has to decide how to allocate investment and consumption over time:

$$\text{production} = \text{investment} + \text{consumption}$$

$$\text{investment} = \text{future welfare}$$

$$\text{consumption} = \text{present welfare}$$

Welfare is **mediated** through material goods (money, or GDP): you transmit welfare to your descendants by transmitting goods. Of course there is uncertainty in the process as well. Suppose you take an extremely ethical position, that is, what happens to humanity in 100 years is as important as what happens today. Then, the interest rate you should be using is:

$$r = \theta g$$

meaning that one unit of material good in t years is worth to you e^{-rt} units today.

The ecological interest rate

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- $\theta > 0$ is the planner's **risk aversion** (experimentally $2 < \rho < 4$)
- g is the **growth rate** of the economy
- if you believe that the growth rate will be around 3% in the future, then you should charge future generations $r = 6$ or 8%, even though you are an ethical person, and what happens to humanity in 100 years is as important as what happens today

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- if on the other hand you believe that the growth rate will be negative (as is probably the case for environmental goods), then you should use a **negative** interest rate

Second solution: the competitive market

Producers and consumers come together, none of them is in a position to influence prices, and yet prices emerge from an endogeneous process.

Prices carry all the relevant information about availability and usefulness, and determine the behaviour of firms and individuals.

This works if we can **restrict access** : if I have paid for something, I have the exclusive use of it. It is the definition of private property. But atmosphere is a commons !

The tragedy of the commons : the case of fisheries

- Fish is a **renewable** resource, and there is an optimal stock size: if the fish population falls below this threshold, it should be left to reproduce and grow back. However, what is a fisherman to do when he finds more fish in the sea ? If he leaves it there, there is a good chance that it will be fished by a competitor, instead of being left to reproduce. So I had as well fish it myself. The result is **overfishing**
- Classical remedy: **restrict access** . This was the aim of the cod wars between Iceland and Great Britain, with the creation (and subsequent generalization) of the 200 miles coastal zone. States restrict access to nationals. However, this has not stopped overfishing: the Newfoundland fisheries have collapsed in 1990 and never recovered.
- More radical remedy: **privatize the fish** . The case of whales (Colin Clark, 1973).

Creating a market where there is none

An imaginative solution is to create a market not for the good itself, but for **the right to access it** : instead of privatizing the fish, one can create fishing rights, and let fishermen trade the rights.

- traditionally done for water in regions where it is scarce (irrigation)
- fishing quotas, or fishing licenses
- emission rights for carbon. This is the so-called "carbon market"

This is not a perfect solution either, because:

- such markets can function only if there is an authority able to create and operate the market, verify the rights (control all the emissions) and to enforce them (no one can emit if he has no permit) - which is a heavy investment
- the market works on a global quota, which as to be decided by some regulatory authority. Deciding the quota is a problem by itself .
- in fact, the EU carbon market collapsed

Contrary to accepted wisdom in classical economic theory, the work of Elinor Ostrom has shown that the commons did not function that badly. Their breakdown in 19th century England by the enclosure acts may have had more to do with chasing the poor out of the countryside to provide manpower to burgeoning industry than with economic efficiency. Gneezy and Rustichini (2000) : "A fine is a price "

Third solution: collective action

If markets do not work, we are left with devising an appropriate way of implementing COP 21. The stumbling block here is the **free rider problem** (Mancur Olson, 1966).

- Suppose there are 200 countries, all identical, and there is an agreement between them to lower the mean temperature by 2°C . This means 0.02°C for each of them. This is so small as to be inobservable, and certainly if country A does not make the effort, it will not derail the final objective. So country A will not make the effort, and neither will country B

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- The free rider can also be played between generations. Country A is pledged to emit less than 40 Gt of carbon between now and 2100. However, it is inconvenient to begin right now, when we have so many problems on our hands: let us start the effort 5 years from now. This does not compromise the global objective. 5 years down the road, we will discover that tomorrow has become today, and we will postpone again. So it is business as usual all the way

Conclusion from theory

- There is every reason not to act. We are on the road to 4°C in 2100.
- There may be an unanticipated factor, like technological progress, or progress in economic theory (why not?) which will make things different (better or worse), but the risk runs both ways
- There may be unanticipated events, like a major catastrophe, or worse, which will bring the future so close that governments will have to act drastically

Practical conclusion

Economic theory captures only part of human behaviour. For individuals (not for governments or corporations) fairness considerations and social norms are at least as important as enlightened self-interest. Such things are not taken into account in the expert debate (for instance, in the IPCC reports, or in this conference)

IF NOT US, WHO ? AND IF NOT NOW, WHEN ?

(Rabbi Hillel, quoted by JFK in his inaugural address)

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- For the normal person, this is a call for acting right now
- This is precisely the situation we are in. Global warming is an ethical problem, and if we treat it exclusively as an ethical one, we will not solve it. **Social norms will be more efficient than prices.**

Some personal conclusions

- The importance of social norms should be recognized, and religious and moral authorities have a crucial role to play (see the pontifical encyclical on climate change, *Laudato Si*)
- Global agreements (like COP 21) are negotiated by governments. These are the wrong actors, because they are ruled by self-interest and do not have a stake beyond their own constituency. The true actors are a (non-existent) world government or the individuals
- One should act on the demand side (consumption) as well as the supply side (production). This has already been pointed out repeatedly in this conference, and this is precisely where individuals can act.

Further references

For those who read French, this is basically the content of my book:

"Le syndrome de la grenouille: l'économie et le climat "

For more about the economic models, you can check my website

www.ceremade.dauphine.fr/~ekeland