

The Design of Policy Instruments for a Climate Policy in a Changing and Diversified World

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Ladies and Gentlemen, Thankyou.

I will speak by briefly describing WHAT sort of a problem we face, what the COSTs are and use this to discuss the DESIGN of policies: **and some consequences for EU budgets**. Let me start with 3 facts:

I do not know exactly how you all got here this morning. I hope you took the train but either way we all emitted some CO₂ and share responsibility for a contribution to future climate change including drowning some parts of Bangladesh and Holland.

Obviously this should not stop all travel particularly not for climate meetings! But let me dwell on this characteristic: Our travel damages others. It is an externality. **Let us compare with running out of fossil fuels**. I sort of wish that were the problem because it is conceptually so much simpler. Not *nicer* but simpler. The climate problem is like running out of fuel except that we are not running out. We just are unable to use them. This requires much more complex policy. Much more work for people like yourselves!

If we ran out of fossil fuels the price would rise and we would use less. Substitutes and efficiency would develop through higher prices but the market would take care of this – not very much policy would be needed². We may want to use policies to help those affected but **the scarcity will speak for itself**. In the case of climate change **the scarcity will NOT speak for itself**.

Oil and coal will continue to be cheap but the Worlds politicians must find a way to stop us from using very much of these attractive resources!

The most efficient instruments are taxes or auctioned Carbon rights. These may not be the most popular.

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² In reality, we may be faced with shortages of oil in the future while there will still be plenty of coal. Since fuels can easily be synthesized from coal, the scarcity of oil will not have any consequences that are at all commensurate with climate change. We are abstracting from issues of energy security and many other concerns here in order to focus on the broad picture. Water scarcity provides another example: it can push people to enormous hardship but again the scarcity takes care of itself. Water is expensive and people will economize or even move. Policy may be needed on humanitarian grounds but not necessarily for efficiency – as long as the water is priced.

2. The next fact I want to dwell on is that the externalities are mutual³. We hurt the poor Bangladesh by driving our cars but they hurt themselves and us by methane from paddy or forest fires. The climate system is a **public good of global scale**⁴. **Policy making must inevitably and unconditionally be GLOBAL.**

3 The Third fact that must be properly understood is that this is to a large extent a **STOCK** problem. I want to take a moment to remind you what that implies.

Please would you all make a mental image of the word: **Disaster.**

What sort of images do you see: cars or buildings in flames, explosions but hardly this peaceful tanker.



The largest tankers can be 500 m long. Most of the time these are safe and efficient means of transport but if on a collision course this ship has such momentum it will crash ½ hour later. The emergency breaking distance, to stop in “crash astern” is at least 10 km. (from Stepney Green to Kensington)... And yet it will crash. It is a disaster waiting to happen. So what do you do? Precautionary principles like max speeds in some waters... Some technologies are avoided altogether like Zeppelins.

I find this image catches my imagination: An unstoppable yet impending disaster that will happen in half an hour. But the inertia of the climate is measured in decades and even centuries rather than hours. Even if we could keep the carbon content of the atmosphere constant at 387 ppm, warming would continue for another century by another half a degree - roughly the same increase as we have had so far. We have only seen half the effect of what we have caused so far (in fact much less taking into account the cooling from sulfur etc particles).

Let me illustrate this another way: This diagram shows the long run! We economists think 5 or 10 years is long run but here we have half a million. The history of china is just a thin line.



The Carbon content of the atmosphere has varied between 180 and 280 ppm throughout all of this period. Now we have brought it to 387 and

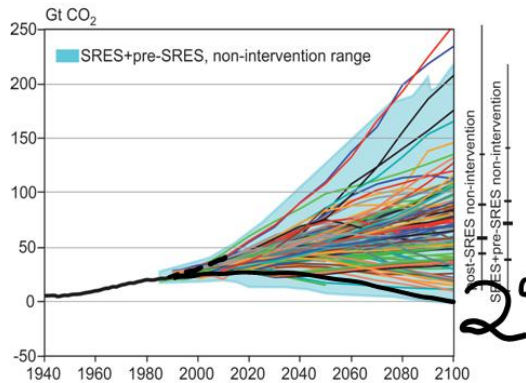
³ The main direction of causation is from our cars, our industry and our heating that will affect the poor through changes in climate, rain patterns, glacial melting and sea level rise. But those who are poor and use extremely inefficient technologies, burning considerable amounts of coal to get some still very unsatisfactory heating or burning entire forests to clear land, they also affect the climate to their own detriment and to ours.

⁴ The Stern Review referred to this as the biggest environmental issue externality) ever faced by mankind.

we must stop at something like 450 or 500 to avoid more than 2K warming. That might not sound very dramatic - but it **is** dramatic because this is a **stock** pollutant:

If we keep emissions constant from year to year the stock rises but for the last century we have been increasing emissions each year and letting the stock rise at an accelerating rate. **If we want to stabilize a stock we need to cut emissions by about 75%.**

At the same time the World population is rising and emissions are very unequally distributed so we in the rich World must reasonably cut our emissions even more.



This diagram shows the UNFCCC Special Report on Emission Scenarios. Note that to avoid overshooting 2° C we actually need to stick to the very lowest scenario. But in the last decade in spite of all the talk about climate we have actually been following the top trajectory! It is clearly a gigantic challenge for policy making to keep economic growth high but still bring down the emission curve to one that is sustainable.

The context of Other World problems

Climate Change **is** unique in its geographical and temporal scope. But it is not our only problem. It is not even the only environmental problem we face. Just think of the disappearance of species and entire ecosystems, the spread of toxic elements or chemicals all through the biosphere. Climate Change is not even the only problem in the energy sector. Even the alternatives to fossil fuel like nuclear power pose formidable problems and the competition for space between biofuels and food could, if poorly managed, cause serious conflicts.

Most importantly CC is not the only severe problem facing humanity. We have disease⁵, malnutrition, starvation, conflicts, war and the bad governance and institutions that cause these. About ½ the World population lives in destitution. How credible is it that we worry about the effects of climate change in 2100 if we don't do more to help those in need today?

Lets be very blunt: We need the whole World to collaborate otherwise climate policy is meaningless. The poor of this World are however not going to collaborate very much unless we also take poverty alleviation seriously. Conferences like Stockholm, and Rio have been saying this for a quarter century but now we **actually need the collaboration of the poor.** For once this will give them influence. And I think we can already notice a new tone...

A year ago I heard a lot of people at conference saying things like: "*The question is how we get China and India on board*". Now this always sounded pretty presumptuous but it is also

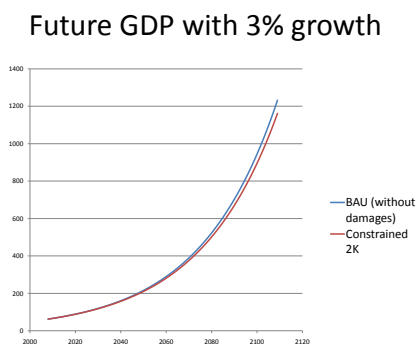
⁵ Diarrhea kills an estimated 1.6 to 2.5 million children every year, according to researchers quoted in the Bulletin of the World Health Organization. Quoted in <http://www.sciencedaily.com/releases/2008/06/080616170801.htm>

stupid. We must realize that this treaty hinges on our willingness to pay. The relevant question is how do we get rich countries on board? The fact is that it is we in the rich world who must stand for a large share of the necessary change. Now we can see the positions of countries for Copenhagen: China demands that the rich countries should reduce emissions by 40%. This can be compared to 20/30 that the EU has decided and the roughly 0% that the new more radical regime in the US proposes (the old one wanted a sizeable increase)⁶.

Costs

So a very natural question is what this is going to cost. One way to think of this is to say that the energy sector today accounts for some 5% of global GDP. Sustainable sources of energy will be more expensive, on the other hand energy efficiency and saving is often a cheaper alternative. All in all it will be up to a few % of GDP. The Stern Review says 1% but uncertainties are large. It could be 2% as well it is still low compared to the costs of damage (estimated to 5-20%).

Furthermore: in the context of a growing economy over 100 years 1 or 2 % - although big, will be dwarfed by the general effect of growth. (I have chosen an example with 4%). The cost will be the discounted difference between two growth paths. In this case that is a lot of trillions of dollars (560 10^{12} \$) and of course a very serious undertaking. We should remember how difficult many countries find it to actually live up to promises of 1% development assistance. So I don't want to play down the cost – I think it will be sizeable.



But this is not the end of civilization as we know it... nor even of Western comfort. We should remember that with 3% growth per year we would be 20 times richer in 2109. If we have to pay more for a sustainable energy system we still become 20 times as rich but in 2111: it will take us 102 years instead of a hundred. In this perspective the cost is less catastrophic⁷. Now you might wonder if we can have growth without fossil fuels. The answer is yes – growth in the economy as a whole but we must also understand that the World has to change. We will not have growth in coral reefs and we must not have growth in fossil fuels. We can probably not have

⁶ (Waxman Markey has -17% 2005-2020 Obama has -14%). (Emissions increased by about 20% 1990-2005, <http://www.eia.doe.gov/oiaf/1605/ggrpt/carbon.html>) thus both proposals imply roughly 0% 1990-2020.

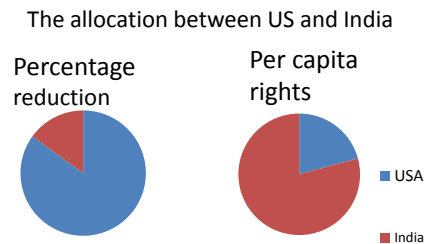
⁷ Assumptions are conventional for climate modeling: 3% growth of the economy in BAU (with no damages accounted for). When the economy has to bear the cost of staying below 2K, growth has been set 2% lower ie at 2,94% instead of 3%. In 100 years GDP will then be 6% lower than today. The discounted (1,4%) sum of the first century will be 3,7% lower so this is a much bigger cost than the 1% estimate of Stern. Still the discounted difference is 560 Trillion \$ (T\$).

growth in air or road transport until we achieve new technological breakthroughs. Other sectors such as communications or computer games can probably grow without bounds⁸.



Also you know as politicians that total cost is not what matters. Some periods of rebuilding and gigantic costs are actually remembered as relatively good periods with full employment and a sense of purpose and optimism.

A much more important issue than these aggregate losses is the issue of who should pay.. This is a big issue that can topple negotiations and even lead to conflicts. I have a picture to drive this point home. One principle that seems harmless enough is that all countries should do the same amount of percentage abatement. For example all abate by 50%. We call this grandfathering. Another principle is that each person on Earth should have the same rights to emit – so countries emission rights are proportional to population. If the World just consisted of India and the USA then the two allocations



would give these two different distributions:
 Naturally Americans argue in favor of GF while India argues in favour of equal accumulated allocation (taking into account the last hundred years – which would mean that the USA has basically used up all its rights and would get nothing.

The trouble is that these are so far apart there seems to be little common ground to meet and compromise.

The Design of Policies

The perfect instrument is a carbon tax but which is the second best. First let me do a scientific quiz: You are all law makers: Which instrument most effective of those on in this list? My vote goes for Gasoline (and diesel) taxes.

The most **effective** pol Instrument?

- Kyoto
- ETS
- Agricultural policy
- Subsidies
- R&D – fusion, solar, wind...energy saving
- Chinese "One Child" policy
- **Gasoline Taxes!**

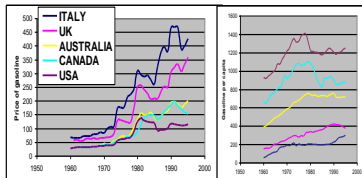
Let me tell you why: transport fuel demand is my favorite topic.

⁸ This has many interesting consequences for economic analysis, see for instance “An Even Sterner Review” in the reference list.

People think there is a fixed need for transport fuel. Nothing could be more wrong: It is only fixed in the very short run: Given a certain car, a certain house, a certain job then, yes you might say you *need* x litres of fuel/month.

But econometric studies show that if income grows 10% - people use 10% more fuel. The demand is given by $Q=Y * P^{-0.8}$ and the only thing that can stop demand from rising is if the price of fuel goes up by 12% as can be deduced from the demand follows the formula I have here. These elasticities are estimated on data like these:

Petrol
prices
Consumption/cap



You see that the US has consistently had petrol prices only a fraction of ours in Europe (because they have virtually no taxes). As a long-run result, their use per capita is several times higher than the typical European. We should thank the politicians of Europe for this. (Particularly those in Italy, the UK and others that have led the way when it come to higher fuel taxes). As I have calculated in the following table, these European taxes have avoided emissions of about 0.3 GtC/yr – that is about 5% of World Emissions⁹. Gasoline taxes are the only policy that has so far had a real effect on the carbon content of the atmosphere. It might have been 390 instead of 387 had we not had these taxes!

Transport Fuel Use in OECD
Gtons fuel (and ~C*(12/14))

	Real	UK prices	US prices
Fuel use	1,13	0,72	1,47
		-36%	+30%

I have talked many times about this before but never had such a good opportunity to thank the policy makers as I have today. THANK YOU!

What about the future: First of all the rest of the World – particularly the US is going to have to start taxing motor fuel seriously. Eventually we are going to raise taxes to keep demand from growing and to encourage alternatives and efficiency. 3% growth in GDP means at least 4% real growth in gasoline prices just to avoid increase!

I do not know if I have time to go into more details of subsidies to fuels and cars, air transport domestic sector, industry etc... Each sector has its special issues. Naturally taxes or prices again play a major role but there are other factors:

For domestic appliances and electricity there are issues of information quality and assymetry: bills are so complicated, electricity demand caused by any given appliance so hard to calculate that more information is needed. I suggest more transparency. I suggest less fixed fees and more transparent bills. Meters are usually placed 8 feet up in stairways where you

⁹ Sterner, T, (2007) "Gasoline Taxes a useful instrument for climate policy" *Energy Policy*, Vol. 35, Issue 6, pp 3194-3202, June 2007

need a ladder and a torch to see anything and you need to be an electrical engineer to understand what you see.

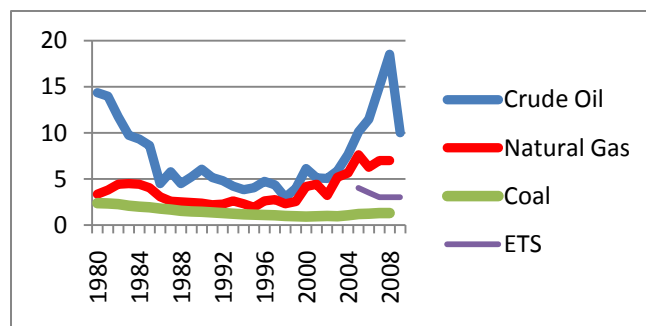
Why don't they look like this instead: Get rid of fixed charges and give us a big display that says how many €/month our current consumption corresponds to. Make it a sport to turn off



the lights....

Industry is particularly difficult because of competitiveness. Employment is of special importance and strong alliances will be formed between owners and workers at threatened industries– particularly if they feel the industry will be moved to countries with a more lax policy.

Let me come back to one issue of instrument choice: Market Based Instruments are often superior from the viewpoint of efficiency but this does not mean there is no role for regulations. Both the EU and USA are forbidding incandescent lamps (“ordinary bulbs”). Normally we don't want that kind of policy – maybe we should see this as a wake-up call. Sometimes technology policy can be a good complement because it will always be difficult to set a sufficiently high tax rate and because people do not easily see the connection between appliances and CO₂. But sectoral fixes are only a complement they can never SUBSTITUTE for a price signal. If the only policy you did was to forbid certain lamps and motors and make insulation mandatory then this would drive down the price and lead to new sources of demand.. Energy is usefull! and people will just start to warm their pools in the winter or blow garden leaves with diesel powered blowers. ...



How much have we done so far?

One way to judge this would be to ask if environmental policy measures dominate the cost of emitting CO₂. Clearly they do not – particularly not for oil. Still the vagaries of the oil market dominate prices to the final consumer and ETS prices mean fairly little– for industrial oil products. In a world where climate change is a top priority – most of the cost of using a barrel of oil would be environmental taxes or permit prices.... Yet ETS prices (20€/ton) correspond to only 10% of variation in oil prices (if we convert oil prices to a corresponding measure they have varied between 100 and 300 €/ton). The picture is quite different for coal however. This poses a problem: We would like a single unique price for carbon emissions in all sectors and countries for efficiency but we will discover time and again that a price that is too low to have any effect in one country or sector may be too high to be politically acceptable in another.

The only countries to have sizeable carbon taxes (120 €/ton CO₂) are in Scandinavia and they do have a large effect, Carbon taxes have led to large scale Carbon storage in Norwegian

aquifers and to massive use of biofuels in Sweden's district heating. (And as already mentioned the only policy that is really sizeable is EU fuel taxes for auto use – these are in the same order of magnitude as the peak of the oil prices or 300 €/ton CO₂).

Technology policies

None of this is enough: Sufficiently high carbon prices are politically very hard to implement. We also need Technology Policy:

There are so many research ideas that might possibly provide ways to help solve the climate issue: finding ways to reduce methane from rice cultivation or cattle, carbon capture and storage, fusion and even far flung ideas like fertilizing the seas so they will use up more CO₂.

Ideally any inventor who contributes should become very rich because the lure of profit is the only way that big companies can motivate large research costs. **The limited protection of intellectual property at this level is a second source of market failure:** If anyone does come up with a good solution we might just copy his invention and use it for free. We face the same problem with drugs for the big diseases like Tuberculosis or HIV. **Therefore we need to subsidise R&D.** But the R&D must really be new and good research- we also need to avoid perverse and expensive subsidies. We do not want to find excuses to recycle industrial restructuring, infrastructure or farm subsidies. I used some positive Swedish examples earlier. When it comes to subsidies for environmental cars it seems we might well have overdone it in Sweden¹⁰.

International Collaboration

One of the prime demands of the developing countries is also for technology transfer. If they are going to collaborate and help us solve this problem they are demanding access to the suitable technologies essentially for free. To many western economists this is bizarre: patents and technology are like any other good: you have to buy them. I think we should see both sides: It is a problem if companies think their patents will not be respected because they will not invest in new knowledge. On the other hand: If we want to persuade low income countries to put solar panels on the roofs instead of burning coal when this is not a priority for them – then we cannot expect them to pay our western companies a lot for the new products. The result of this line of thought is that we need support to new technologies directly and separately support the acquisition by developing countries of such technology.

Look again at the Chinese position¹¹:

40% reduction is just the first item on their list.

The rest are essentially about us creating funds with public money to help pay for the transfer of new technology, the costs of adaptation and damages etc... The Chinese proposal is very significant and implies that the rich countries must find “new, additional, adequate and predictable resources” to the tune of 1% of GDP. The purpose was to set up UNFCCC funds for :

¹⁰ Enormous subsidies have created a situation where the vast majority of new cars registered in 2008 were “environmental” but the term is used very generously since the cars are still heavy and far from fuel efficient. Most of them get the label just because they can be driven on alternative fuels (usually ethanol). Often they are not even driven with ethanol in practice. In spite of this they received massive and inefficient subsidies: Rebates on the annual tax (Renew.cars paid 360; gasoline 2046; Diesel 4011 SEK) The difference was worth several hundred €/yr. Free parking worth 100 – 600 €/yr. A cash “Env car” subsidy of 1000€. Additional tax benefits worth about 80 €/yr. The total benefits may have been up to 2000 €/yr or 0,05 to 0,1 €/km. It is hard to believe these are reasonable figures. See for instance Kågeson (2009).

¹¹ http://en.ndrc.gov.cn/newsrelease/t20090521_280382.htm

- * Adaptation
- * Mitigation
- * Technology Acquisition
- * Capacity Building

I am convinced we should listen.

What to do:

- a) A global agreement, where we move first but must include all¹².
- b) Mitigation is top priority: A high and rising price of carbon. (maybe not fully uniform)
- c) A high (but falling) subsidy to new technology
- d) Complementary standards and other policies
- e) Serious development and climate adaptation cooperation: we must pay

Implications for a parliamentary budget or finance committee.

There will be large costs for technology subsidies and for funds for developing countries. We also have a large potential source of tax revenue through taxes and auctioned permits.

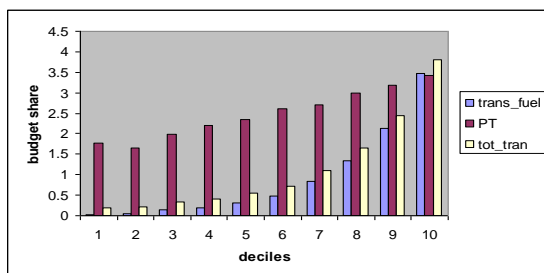
Environmental taxes and carbon allowances if auctioned can be substantial (for instance 50 €/ton * 1,6 B tons = 80 B €). Economists and budget experts like yourselves can agree they are best kept in treasury. (If you lean to the left you might be happy to increase the state budget, if you lean to the right you would prefer to cut more damaging taxes). Efficiency speaks in favor of keeping taxes that have to be collected anyway. Political economy however speaks in favour of free allocation, dividends, earmarking and perverse subsidies instead of taxes. These temptations will reduce efficiency considerably and it would be very useful if the budget committees can continue to fight for increased taxes on all carbon fuels and for auctioning of permits (with revenue going to the budget). The current plans are:

In the US the Waxman-Markey bill implies 85% Free grandfathered to emitters. 15% auctioned. But then 39% of the 85 are actually dividend to utility companies.

EU: Current plans auction 50 → 70% by 2020. At the same time number of permits -1,74%/yr

.....

In response to a question for the floor concerning the political economy of fuel taxation, I presented the following slide and mentioned ongoing research on the distributional effects of fuel taxation. My research shows that in most countries (in particular the low income ones), fuel taxes are actually progressive not regressive!



¹² It is important to look into the individual positions of distinct country groups. The island states, the oil producers, the coal dependent countries, the countries with large coastal populations and the island states etc all have very distinct interests. OPEC countries for instance want to be compensated for climate policy.

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