5 The cost and price of greenhouse gas – the economic debate

Introduction

It is very clear that, even if action is taken soon, the world is heading towards a doubling of GHG in the atmosphere. Scientists' current best guess is that we are several decades and maybe a century away from the most damaging impacts, but we are already experiencing discomfort. To address this, humanity is going to have to take a view of the world which goes beyond the needs of one generation. Fortunately, living beyond the immediate and doing something difficult now to ensure a better future is one of the defining human qualities.

In this context the aim is to bring human activities back into some sort of balance with the climate. The activity which is the focus of this report is transport, although most of the conclusions are of far wider significance. One of the keys to restoring the balance is for the climate impacts of individual actions to be reflected in people's choices. There are two basic approaches to doing this: the first is to create laws and regulations, the second is to use financial means to encourage climate friendly choices. They are not mutually exclusive and may differ between different activities.

An example of the first would be to set an annual GHG allowance for every person on the planet and once this has been used up, no more greenhouse causing activities can be undertaken that year. If you didn't use your allowance you could sell it or save it up for a big trip next year. People's allowances could start higher in places where carbon intensity is high (most of the developed world) and gradually be brought into line with the level at which the risk to the climate from humanity is reduced or virtually eliminated. Such a process is often referred as "contract and converge" [1].

However, financial policies could work towards the same result, for example using fuel tax, efficiency rebates, grants to insulate homes or provide solar heating, and a sales tax which is set according to how much GHG is emitted during the production and transport of everything we buy. The latter would certainly have to extend to all imports, addressing the issue of how much GHG has been "exported". The developing world is becoming less and less industrialised as it becomes richer, and so the emissions to make the things we buy occur in the new manufacturing countries such as China. This is one of the main reasons their emissions are growing so fast.

Both approaches can be combined and made mutually supportive. For example, issuing permits to pollute and then reducing the level permitted year by year is a regulatory approach, but the transition can be made easier, and less costly, using a financial mechanism. This works on the assumption that some people will find it so cheap to reduce their emissions that they don't need all their permits to pollute. Instead they can sell some of them to another polluter who finds it very difficult and costly to make an improvement.

This is the principle behind the European Trading Scheme (ETS)[2] which sets national permitted levels for some high emitting industries (such as power stations and cement). The first period of trading is just finishing, and while the electronic trading system worked, it produced an erratic and rather low carbon price [3]. This was almost certainly due to giving out too high a level of permits and illustrates one of the key problems with such a system. The second round is slightly tougher and the ETS scheme, which is the subject of international interest, is discussed in more detail later in the report.

This initial discussion on carbon price leads into one of the most hotly debated questions in the economics of climate change.

What is the cost of carbon and what is its price?

Underlying all the arguments about which policies should be applied to combating climate change is a profound split on the economics of charging for the emission of greenhouse gas. This is separate from the arguments over whether carbon "markets", which trade in permissions to pollute, are a suitable mechanism for achieving change.

Before any trading can take place there needs to be some assessment of what the charge should be for emitting too much greenhouse gas. In the ETS scheme it takes the form of a fixed fine (€40 per tonne CO2 up to 2008, €100 per tonne 2008-12). This in turn is related to how much we should pay now to avoid emitting carbon in the future.

There are essentially two different approaches. The first tries to create a value in present day prices for future damage caused by climate change. This is often referred to as the social cost of carbon. The second seeks to set the price in order to achieve the desired reduction. In this case the revenue can simply be returned to people through rebates and many argue that the only real costs are one off transition costs. These may, of course, be quite significant, such as building wind farms or tidal power for renewable power generation. On the other hand there may be long term benefits, in the case of renewable energy, stable and low long term costs and security of supply.

The social cost of carbon and the level of carbon tax

In the first approach it is possible to use established cost benefit techniques which could be attached to greenhouse gas. The Stern Report [4] uses such methods at least in part, trying to calculate the cost of future damage to the world economy. Even assuming that this damage figure is correct, the problem arises of how to translate the future costs into current prices. Economists usually do this by "discounting" the future, although this in itself can be very complex. A simple version is used to discount future benefits from road schemes over their life, taken as 60 years. In this case a pound 60 years from now is reduced in value by 3.5% every year until the present day. The same is done to pounds in year 59, 58, and so on. The results are how ever, easy to understand.

In the case of climate change, the key effect of discounting is that damage in future years is of low value in today's terms and tends not to influence our decisions.

This is quite plainly not appropriate where the desired benefits are focussed in the future and have major consequences which people have extremely strong reasons to avoid. Thus, in the case of climate change, discounting the future creates a moral dilemma. It is that people today will knowingly leave it to future generations to deal with a known and serious problem to which their actions now make a major contribution. This is often called the need for "intergenerational" or "intertemporal" equity. The use of discounting tends to give low social costs for greenhouse gas emissions in the present, insufficient to change behaviour significantly.

The counter argument to this is that future generations will be so much richer that the cost of sorting out climate change impacts in the future will be cheaper relative to their income. This also leads to discounting (though in a slightly different way).

The Stern Review comes up with a simple, and understandable, solution. There is very little pure discounting (strictly speaking the discount rate is close to zero). He also applies a fairly low rate to allow for future wealth. Thus the future costs of climate change are represented today at levels much closer to their full value. This leads to social costs for carbon in Stern's report which are significantly greater than previous studies, particularly in the present day.

The Review uses a cut off point because it is assumed that climate change stops happening by about 2200. In addition, Stern has attempted to introduce the value of avoiding risk, another difficult issue because this has to be quantified and costed. He explains and explores this further in the section on ethics and economics (Stern, Chapter 2).

His description of the different economic models which try to value climate change, and why they differ, is summarised in Chapter 6, especially Figure 6.3. He argues that modelling to date has only dealt in a limited way with elements such as:

- the risk of major step change in the climate;
- non-market effects such as human health and the natural environment;
- effects such as mass migration and any resulting conflicts
- equity implications – damage to the poor countries counts for less in the model because their GDP is low.

Understandably, the introduction of an ethical dimension, the inclusion of distant but severe risk, and the full present day value placed on future damage, has caused a great deal of discussion amongst economists [5, 6]. The cut off point is also important in determining costs. If there is low discounting, any amount of future damage can be added to give a higher present day value. Calculating costs to 2200 is quite speculative enough, but some critics have pointed out that much of the high cost occurs after 2100.

One of the best known commentators, whose modelling Stern quotes, is Professor William Nordhaus from Yale. He has issued a response [7] and is critical of Stern's modelling assumptions, although he welcomes the report's contribution to the debate as a whole. His current modelling suggests a social cost of $17 per tonne of carbon (tC), whereas Stern suggests $311 (in the report expressed as $85 per tonne of CO2). This huge difference is largely explained by the way in which future costs are reduced by different approaches to discounting.

Nordhaus draws attention to why this is important for policymakers. The previous social cost models imply that action should start slowly and then rise in future years as the damage gets closer. The same modelling that produced $17 tC today, produces rising values for carbon of $84/tC by 2050 and $270/tC by 2100. He describes this as the "climate policy ramp" and the logic behind it as follows,

"As societies become richer in the coming decades, it becomes efficient to shift investments toward policies that intensify the pace of emissions reductions and otherwise slow GHG emissions."

However, he immediately qualifies this by saying,

"The exact mix and timing of emissions reductions depends upon details of costs, damages, and the extent to which climate change and damages are irreversible."

These comments come to the heart of the matter. Stern is attempting to represent some very real factors within a social cost benefit framework which is not really designed to handle them. He is in fact led by a higher level objective than defining the right social cost for carbon which is the need to "prevent dangerous anthropogenic interference with the climate system" (Article 2 of the UN Framework Convention on Climate Change [8]). Nordhaus fully recognises this, quotes Article 2, and goes on to say,

"If that is the reason, why not impose the limit directly? Instead of using the near zero social discount rate as an analytic subterfuge to slow climate change, why not simply adopt policies that will directly keep climate change below the dangerous threshold? Limiting climate change directly is more efficient as well as more transparent."

This quote leads into a discussion of the second avenue to achieving carbon targets through fiscal means – restructuring tax and charges to influence behaviour.

Putting a price on carbon to influence behaviour

A different price based approach to applying a general carbon tax based on social cost asks the question "how much does it cost to influence behaviour?". There are many examples where the effect of price on use is regularly calculated and used in policy formulation. In economic terms, there are

established price elasticities for such items such as fuel cost and traffic (distance travelled)[9]. These can be used to design policies which are likely to influence behaviour.

For example, the short term impact of fuel duty between 1994 and 1999 was for every 10% increase in cost, a 3% decrease in fuel used. This in turn was split approximately equally between more efficient driving and less distance travelled. In the longer term the impact (elasticity) tends to be significantly higher. There tends to be a lower effect on the number of journeys – in other words distance is reduced by making journeys shorter. This is particularly the case for heavy goods vehicles.

Such so called "environmental taxes" are often combined with the idea of redistributing revenues, broadly to the people from whom they are collected. Thus an additional fuel duty which had the purpose of changing travel patterns (for example encouraging walking and cycling), and encouraging more efficient cars, could be recycled broadly as follows. The amount raised from personal travel would go back to the population as and the amount raised from business (who would pay the duty on fuel used by lorries) would go back to individual businesses.

The way in which this is distributed will have different effects. For example, a lump sum paid annually to every UK resident would probably have a slight negative impact on GDP, but be of positive help to the least well off and child welfare. If the fuel duty (or any other environmental tax or levy) came back in the form of a reduction in income tax or national insurance it would probably be positive in GDP terms but favour people who are better off.

Parallel to this, business costs would be increased by higher road fuel costs and this could come back as employer national insurance reductions, or rate rebates, either as a lump sum or graduated according to size or turnover. Again, lump sums would favour smaller, more marginal businesses and this may well be the preferred option to support small business creation and the role of local shops [10].

The idea of stimulating markets to work in a particular direction is not new. In relation to climate change in general, and transport in particular, there are several examples.

Examples of influencing behaviour through price – a mixed picture

The new car market

In the car market, recent changes to company car tax and annual vehicle excise duty (VED), which penalise the least efficient cars, have been introduced. Unfortunately this has led to a major switch away from traditional company car purchase to other ways of subsidising car use by employees rather than ownership. In this case they are free to buy a car privately. Thus, in recent years, company cars have become more efficient, but often this has been because those who want larger models have taken the private purchase

route instead. HM Treasury has lost more revenue than expected because of this effect [11]. Meanwhile, private purchases have not been much affected and are now, on average, less efficient than company cars – the opposite of ten years ago.

This illustrates the importance of having an integrated approach to applying such policies. In fact, there are clear and more direct pathways to improved vehicle efficiency using sales tax and fuel duty. Voluntary agreements with manufacturers aimed for specific improvements by 2008 which will not be met by some considerable way. The position could be recovered through a fiscal approach and a proposal is set out in detail later in Section 8 of this report.

Aviation

In aviation the per capita Air Passenger Tax (recently increased) is said to be an environmental tax. How far it influences behaviour is not clear, nor is it well related to the carbon emitted by the actual flights. It is not at all apparent why, at least for domestic flights, a fuel duty is not applied instead. This is specifically permitted by the EU and a consultation document including such an option has been produced by the Conservative Party [12]. For EU flights, a Europe-wide agreement on some form of carbon tax or trading scheme is being actively discussed. A proposal for a carbon tax for domestic flights is being prepared as a supplement to this report.

Assessment

In infrastructure assessment, the example of the price of a road death is well known. This is set at a deliberately high level at which it will always be worth saving. It is a policy based value.

Guidance for infrastructure assessment now includes a spreadsheet which costs carbon emissions and should be included as part of the appraisal process. These are based on earlier DEFRA research [13] which chose £70 per tonne from a range of studies. This report raised many of the relevant social cost issues which were later to be considered in Stern.

Avoiding cost through adaptation

While most predictions of the impacts of climate change are negative, there are some who argue that there will be mitigation, at least in part, by the benefits of a temperature rise in colder parts of the world. These arguments include both technological change (such as building design or materials) and some short term increases in agricultural production. There is not, however, a comprehensive vision of an “adapted” future which can be compared to the results from the international climate models. Such results reflect the difficulties caused by such rapid change in the climate and the severe damage caused to equatorial regions should temperatures rise. More locally, EU predictions of winners and losers, have recently been published [14], showing severe droughts in the Mediterranean region, with extreme temperature events more common. Crop gains in Northern Europe are

balanced by serious losses in the South, raising issues of equity and large scale migration.

Undoubtedly there will be some adaptation, but to suggest it has any significant impact in terms of reducing costs, particularly at the global scale, appears speculative. It remains important to distinguish between the relatively small scale beneficial adaptations and the larger expenditure undertaken to avoid the consequences of climate change (defensive adaptation). An example of this would be flood defence programmes (both for rivers and as a result of sea level rise). Already costs are being incurred to adapt to future warming.

Conclusions

The arguments over how to calculate social costs, and how to derive a carbon tax value from them, make this a very difficult path for policymakers to follow. It is clear that the usual formats and models work for only part of the real world objectives and there is no agreed methodology for dealing with key areas such as health, forced migration, or the balance between rich and poor. Nevertheless, climate change is an area where the application of agreed goals for reduction can be illuminated by such models – indeed they have provided an important way in which these issues can be teased out and addressed.

For this reason, while continuing to use the resources offered by the economic models, the basic approach for this report is for the financial framework to be led by the objective of stabilising GHG at a safe level. It is not entirely clear what this is - but we have a reasonable approximation and thus it is possible to make progress of the right sort of scale while it is being finalised. Even the social cost models suggest that the social cost of carbon is rising quite significantly all the time. For most people this makes waiting for the final answers a very poor policy choice.

As set out in the previous Sections, this will require a series of interim targets which lead to rapid progress. This contrasts strongly with the “climate ramp” approach and some of the risks were illustrated in Section 2. This leads to the recommendation of a rapid, rather than a slow start to reducing GHG.

This could be achieved by an integrated approach using enforceable targets and new financial measures. These will have to operate as efficiently as possible in a manner which is clearly related to the objective and transparent to those affected.

References

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