Mitigating Climate Change – Emissions Trading or Carbon Taxes?

A Think Piece

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Background

Climate change and global warming driven by excessive green house gas (GHG) emissions are already upon us. The increasing appearance of unpredictable and extreme weather events such has affected the lives of people in areas as far and diverse as the Arctic, France, Spain, Kenya and several other developing countries.

Unless urgent and immediate steps are taken to address our emissions of GHGs, this is likely to get much worse. Melting glaciers will increase flood risk and deplete water reservoirs. Unpredictable and reduced rainfall will lead to a decline in crop yields and lead to an acute shortage of water particularly in Africa and the Mediterranean. Rising sea levels could leave 200 million people permanently displaced especially in heavily populated costal lands as diverse as Bangladesh on the one hand and counties such as the Netherlands on the other. Up to 40% of species could face extinction resulting in unprecedented biodiversity reduction and potentially upsetting the delicate balance in many ecosystems. Both the number and the intensity of extreme weather phenomenon, such as floods, droughts, hurricanes and storms which trigger natural disasters are likely to increase significantly in most parts of the world.

What is clear is that the effects of climate change on livelihoods, societies and economies are all likely to fall disproportionately on developing countries and the poorest citizens of the world. This is triply unfair because 1) the poor are much worse equipped to shoulder the impact of climate change than the rich 2) it is the rich countries and their citizens who have accounted for the vast majority of the 'stock' of GHGs resident in the atmosphere 3) the rich countries continue to emit vastly higher quantities of GHGs today even after the seriousness of the threat of climate change has been recognized.

It is clear to all countries, developing and developed that climate change needs to be tackled and tackled urgently. For example, David King the chief scientific advisor to the UK government has said that [climate change is] "more serious even than the threat of terrorism". Even though politicians in some major emitters such as the US seem to be happy to sit on their hands and twiddle their thumbs, they are being increasingly challenged both domestically (by a coalition of progressive state governments in this case) and internationally. Agreeing that climate change is a serious threat is still a long way from taking action to halt it but initiatives such as the EU Emissions Trading Scheme etc. show that some progress is underway.

The challenges that face us are enormous. The scientific consensus, as far as one can pin it down, urges something in the order of a 60% cut in global greenhouse gas emissions - it would like them today, but 2050 makes a more feasible target. However, once we bring in considerations of equity, it means that richer nations like Britain and the Netherlands need cuts in the order of 90%.

And while politicians such as Mr Blair warn of "catastrophic" consequences of climate change in one breath, in the next they can say, as he did at the Davos economic forum in 2005, that no climate action will be taken which damages business. There are three big problems here. One is that Mr Blair is mistaking "business" for "the economy"; the other is that he is neglecting the distributional impacts of climate change across various economic groups, countries and across generations.

Business is not the only driver of a healthy economy. It is affected by war, disease, storms, and global events: even (if you live in North Africa) by plagues of locusts. One would expect, given the rhetoric on development that someone like Mr. Blair would say that climate change will not be allowed to affect poor developing countries, but he mentions only the interests of businesses.

The Kyoto Protocol, the only agreement thus far to reduce global GHG emissions is widely seen as somewhere between troubled and terminal. Early troubles came with the failure to include the major developing countries along with lack of an agreed-upon mechanism to include new countries and extend the agreement to new periods. The major blow came when the United States withdrew from the Treaty in 2001. By 2002, the Protocol covered only 30% of global emissions, while the hard enforcement mechanism in the ETS accounts for about 8% of global emissions. Even if the current Protocol is extended, models indicate that it will have little impact on global temperature change. Unless there is a dramatic breakthrough or a new design, the Protocol threatens to be seen as a monument to institutional overreach.

One of the biggest dividing lines now is not on whether to do something about climate change but what exactly to do. This paper deals briefly with some options available to policy makers at both domestic and international levels and comments on their relative merits as judged by a set of criteria including assessing it against the three Es: equity (is it fair?), effectiveness (will it achieve its target?) and efficiency (will it be cost-effective?).

Based on this discussion, a reading of the political climate and our own key priorities and strengths, the paper concludes with some suggestions on what policy measures we should advocate.

What mechanisms can we use to reduce GHGs and tackle climate change?

We should start by immediately freezing CO2 emissions and then beginning sharp reductions. Merely engaging in high-minded debates about theoretical future reductions while continuing to steadily increase emissions represents a self-delusional and reckless approach. In some ways, that approach is worse than doing nothing at all, because it lulls the gullible into thinking that something is actually being done when in fact it is not. (Al Gore, 2006)

Al Gore's words serve to remind us that hard action is needed and that vague future promises are no longer enough.

For global public goods, there are three potential approaches: command-and-control regulation, quantity-oriented market approaches, and tax- or price-based regimes. Of these, only the tradable-quantity and the price-like regimes have any hope of being reasonably efficient. These instruments include subsidies, taxes, and tradable permits.

They differ primarily on their approach with quantitative instruments such as permits using a shrinking quota based system to wean society off carbon (the scarcity of permits makes the emission of carbon expensive and the quantitative limits mean that only a limited amount of carbon would be emitted) and price based instruments such as taxes focusing on making carbon usage more expensive which reduces the quantity of carbon usage.

These instruments are primarily domestic but have international equivalents - international tax agreements, tradable emission quotas, and joint implementation. Here it is important to recognize that countries differ in their institutional structures, economic structures, and existing policy structures and that the choice of policy instruments will be made in a political environment. As a result, the ability to enforce the different instruments is likely to vary across nations.

Adoption of any international instruments will have some impact on the distribution of wealth among countries, as will domestic instruments on the distribution of wealth within them. All instruments can, and probably will have to be connected with compensatory measures such as side-payments or specific permit/quota allocations; no differences arise among instruments in this regard.

It is important to remember at the outset that the scale of the challenge that faces us is so great that no one instrument alone would be enough. In that scenario, we need to be exploring a much richer set of approaches than just the pure quantity (trading) and price (taxes) approaches that we compare and contrast here.

Important combinations or hybrids including quantity controls with price caps and floors, or harmonized taxes with quantity caps will necessarily need to be used along with regulation, incentives to stimulate the development of green alternatives, information dissemination and education to induce behavioural change.

In a world without uncertainty and with perfect markets, the government could theoretically set a tax or set a quantity such that aggregate emissions and abatement costs would be the same in either case. In an uncertain world, however, an emissions tax and a quantitative target (implemented through a cap-and-trade program) are not necessarily interchangeable. The presence of imperfections in markets and considerations for other non-economic factors means that the asymmetry between the two approaches is even greater.

It is these real world imperfections and the asymmetry they bring about that help us make up our mind about which tool may be preferable.

Is tackling climate change just an economic issue or is there more to it?

Literature on the issue of tackling climate change is full of references to emissions should be reduced to a point where the economic cost of mitigation is equal to the economic benefits of mitigation and so forth. It also makes many references to the need for market based mechanisms and flexibility so that emissions can be cut where ever in the world it is most economical to do so.

These references seem to imply that climate change is still being treated as primarily an economic problem where the risks of lower future GDPs need to be balanced with the sacrifices in terms of economic costs that need to be made now to tackle climate change. While there are occasional references to social costs, they are seldom expanded on. This is a very disturbing approach with potentially disastrous consequences for the poorest and most vulnerable populations in the world.

Imagine one unit of carbon dioxide being emitted by the Goldman Sachs trading floor in London one the one hand and the same amount being emitted by a poor tribal in the Indian rural heartland burning firewood to cook his meal.

The market based theory will then clearly indicate that the reduction in the emission must take place at the end of the Indian tribal as the economic productivity associated with the farmer cooking his meal – the economic value added – is nearly non-existent when compared to the value of keeping the lights on for one extra minute on the Goldman trading floor which could potentially generate as much as $5 million dollars of additional profit or economic value.

In 1992, an infamous leaked memo from Lawrence Summers, who was at the time Chief Economist of the World Bank, stated that "the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable, and we should face up to that".

The Stern report seems to argue that the cost-effectiveness of making emissions reductions is the most important factor, advocating market based mechanisms as the ways forward. While dumping toxic waste in the global South might look like a great idea from the perspective of the market, it ignores the glaringly obvious fact of it being hugely unfair on those getting dumped upon.

In a similar way, Stern's cost-benefit analysis reduces important debates about the complex issue of climate change down to a discussion about numbers and graphs that ignores unquantifiable yet key variables such as human lives lost, species extinction and widespread social upheaval.

It is imperative then, especially from our perspective as a development NGO that any measures designed to tackle and mitigate climate change minimise the full social costs of climate change - especially those falling on developing countries and not just focus on pure economic costs. It is of course always possible to design a mitigation policy that focuses exclusively on cost minimization and uses redistribution to tackle the asymmetric social costs of climate change. However, though such redistributive policies will have to form a key component of any final package, we know better than to think that they will tackle anything more than superficial social costs.

The safest root to guarding the interests of vulnerable communities will then be to insist that the minimisation of global social costs not the minimisation of economic costs be the main driver behind the design of mitigation policies. While it is extremely unlikely that developed economies would agree to

this, it would at the very least win more concessions such as increased redistribution towards the poorest countries and most vulnerable populations.

Emissions trading systems

A background discussion

Let us say that there is an agreement on 1) the final emissions levels target (consistent with a stable stock of GHGs in the atmosphere) and 2) the path (in terms of the annual emissions limits) that needs to be taken to get to a stable stock of GHGs.

The larger the number of years available to reach the target the more possible paths there are to it. Of these, some would be rejected as scientifically unsound – for example those that include the increase of interim stock levels beyond the final target and others, such as all reductions in the first year itself, will be rejected as economically more expensive.

Quantitative restrictions on how much GHGs an entity (defined at the level of an individual, a company, a country or perhaps the world) can emit within a certain period, usually a year can help the emissions outcome fit a path that satisfies both 1 and 2 above. These restrictions usually go under the name of caps.

It would be well nigh impossible and undesirable to specify exactly how much each entity (each company or individual for example) could emit each year. Even ignoring the ethical dimensions of such caps or indeed the implication for personal freedom and rights, such a provision would be well nigh impossible to monitor and very costly to implement.

While it may be impossible for an entity (especially an individual) to exactly predict and control their emissions, such an exercise becomes much more manageable as the number of entities grows to statistically significant numbers. This happens as the law of averages kicks in where some entities will use more than their allocation and others less in a way that the average would be stabilized.

However, a cap introduces an asymmetry where as the total amounts of emissions is less than what the group desires, most entities might end up exceeding their quotas. If one introduces the idea of tradable allowances here – so that those not emitting as much as they are allowed to are able to sell the right to emit to those who want to exceed their quota, it then becomes more likely that the group target will be met.

A market would develop in the permits and money will exchange hands and flow from those who want to use more than their quota to those who are frugal and save theirs. If the numbers wanting to buy the right to emit far exceeds the numbers of those wanting to sell the price tag attached to each emission would go up and the balance would shift till the market clears. So there is a self stabilizing mechanism within the market. It is imperative to note here that unless there is a heavy price for exceeding one's allocated quota, such a system of trading permits would not function well.

The lady in the Rolls-Royce car might still be driving around, but only after she has transferred a good deal of money to people who are poorer or more abstemious than she is. Economic justice is built into the system. . . What counts is that the country as a whole will not be exceeding its share of carbon dioxide. . . The market created by carbon rationing will automatically stimulate demand for low-carbon technologies, such as public transport and renewable energy (George Monbiot, Heat, 2006).

"instead of banning particular products, services or activities, or taxing them heavily, a personal carbon allowance enables citizens to make trade-offs . . . "unlike taxes or attempts to ban products, personal carbon allowances regulate the outcome to be achieved, not the means of achieving it. Carbon trading fixes the outcome to be achieved, and leaves the price of carbon to adjust to the necessary level to change behaviour". (Rt. Hon David Miliband, UK Minister for the Environment, 19/7/06).

A well functioning emissions trading system allows emissions reductions to take place wherever abatement costs are lowest, regardless of international borders. Since costs associated with climate change (e.g. coastal flooding, increasing incidence of violent storms, crop loss, etc.) have no correlation with the origin

of carbon emissions, the rationale for this policy approach is clear. If emissions reductions are cheaper to make in Poland than in France, emissions should be reduced first in the former where costs are lower.

As well as flexibility across space (entities), such a system can also have a built in inter-temporal flexibility where targets need to be met not over each and every single period but over some aggregate period. This increases the flexibility in the system making it easier to meet targets and allows for emissions reductions to be even more cost effective.

It is imperative to point to the problems that can arise with unlimited spatial and temporal flexibility. For example, given that the economic value associated with emissions in developing countries is usually much lower than that in developed countries, it is likely that most emission cuts would take place in developing countries with rich countries being able to buy their way into emitting almost as much as under the business as usual scenario. This may be economically efficient for the world as a whole but can have potentially serious social-economic consequences for the poorest and most vulnerable (see Goldman Sachs example in previous section). Similarly, having unlimited inter-temporal flexibility would mean that most entities would post-pone cuts in their consumption for as long as possible thus increasing (at least at an interim stage) the stock of GHGs in the atmosphere. Even if the economic costs may not be great, this has serious social costs which fall disproportionately on poor developing countries.

This discussion shows that while using tradable permits (under a cap and trade scenario) may be a good way to minimise economic cost and ensure that targets are met, the system needs to be very carefully designed so as to minimise social (not just economic) costs. At a minimum, there need to be limits to both spatial and temporal flexibility in the trading of permits.

One way of achieving this would be to put limits on how much of an entity's emission quota can be bought from others – such a step is easier to undertake for a country than an individual. Inter-temporal flexibility can be had by limiting the bankability of the permits by limiting both the carry over (from the previous period) and the borrowing (form the next period) of permits.

Such a system is more equitable ensuring that each and every entity no matter how powerful makes a contribution towards tackling climate change and cannot just buy their way out of making sacrifices. This system also ensures that the real costs of cutting back on emissions are more equitably borne across all entities and generations and that the economically powerful actors are not able to get away with no behavioural change. Combining this with very strict fines and punishments for exceeding one's allocation of quotas ensures that the system is even fairer since fewer people will have an incentive to game it".

Tradable Permits

A country committed to limiting its GHG emissions could implement such a policy using tradable permits for energy-related CO_2 emissions, non-energy sources of CO_2, emissions of other GHGs, and carbon sequestration. Energy-related CO_2 emissions could be controlled by a system of tradable permits for the carbon content of fossil fuels consumed. Under such a scheme, regulated sources are given (or must buy) permits for the carbon content of the fossil fuel. Tradable permits could also be applied to actual energy-related CO_2 emissions.[29] Participants are free to sell surplus permits or to buy permits to achieve regulatory compliance. Downstream of the permit system, the effect is comparable to that of a carbon tax.

In principle, tradable permit systems could also be used to regulate non-energy CO_2 emissions, emissions of other GHGs, and carbon sequestration. Permits earned for carbon sequestration could be sold to sources that need permits for their emissions. The difficulties of monitoring emissions (sequestration) may make the use of tradable permits impractical in some or all of these situations. Considerations such as the number of participants, the share of total emissions covered, industry structure, and enforcement will influence the choice among alternative trading system designs.

Regardless of the specific design, a number of factors can adversely affect the performance of emissions trading systems, including situations where a few participants can influence the permit market or where a few firms can influence the output market, transaction costs, non-profit maximizing behaviour, the pre-existing regulatory environment, and the degree of monitoring and enforcement required. Some of these factors also affect the performance of other policies and measures.

A government may choose one of two main ways to distribute permits to participating sources. Sources could be allocated permits *gratis* based on an agreed allocation rule, such as emissions during some historical period, or the government could sell the permits at auction, although the latter approach has never yet been adopted. Combinations of these two approaches also may be feasible.

These approaches differ primarily in two respects. First, allocating permits *gratis* transfers wealth to the regulated sources, while selling permits at auction transfers this wealth to the government. Second, allocating permits *gratis* may increase the wealth of existing sources, thus reducing the rate of entry of new firms and slowing technological change, although mechanisms can be designed to reduce such potential impacts.

Allowing permits to be banked for use at a later date is important for both the efficiency and the political acceptability of a tradable permit scheme. Without a banking option, permit-liable sources would be confronted with greater end-of-period permit price uncertainty. Banking also facilitates adjustments to lower emission caps.

Both taxes and tradable permits tend to equate the marginal cost of emissions abatement for all affected sources. The difference is that the tax is set by the government, and the level of emissions is determined by the responses of the affected sources; whereas in a tradable permit system, the government determines the overall level of emissions, and permit prices are determined by the market.

The problems of too many permits and the problem of free permits

If everyone got as many permits as they wanted, then obviously they would have no or little monetary value. It is the scarcity of permits that creates value. There are many way of allocating these permits amongst various entities but they can be classified into one of two categories – 1) permits are allocated (free of charge) according to some specified criteria (such as a proportion of the previous years emissions – such an approach is called grandfathering or 2) permits are auctioned to the highest bidder. It is possible to have an intermediate regime where permits are assigned a price and then sold to the entities based on some allocation criteria.

Under the last round of the European Emissions Trading Scheme (ETS) strong corporate lobbying and a lack of national leadership ensured that, governments massively over-allocated emissions permits to the heaviest polluting industries in the initial round. What is more, these permits were not auctioned but grandfathered – allocated without charge.

Where on the one hand, the idea of the scheme was to generate financial costs for polluting so that industries had incentives not to pollute – the generous allocations handed out ensured that in the scheme's first year, the UK's most polluting industries earned collectively £940m ($1,792m) in windfall profits from these allocations. Industries that were supposed to be made to pay for polluting were now being paid to pollute. The generous allocation of permits also caused the price of carbon to drop by more than 60%, creating even more disincentive for industries to lower their emissions at source.

Large companies with large allocations therefore found themselves sitting on a gold mine. At the same time, the cost of the permits drove up energy prices. A study by UBS Investment Bank, for instance, found that most of the energy price increase in Europe last winter was due to the cost of emissions permits. This prompted calls from environmental groups for windfall profit taxes and other measures to remove the "unearned" value of the permits from the hated industries.

Free permits constitute a massive subsidy to the industries concerned. John Fitz Gerald of the ESRI, in a strong attack on the arrangement, estimated that 'free permits' would be worth €1, 350 million if the price being put on the right to emit a tonne of CO2 rises to €20. This is money lost to Irish residents. Moreover, the fact that it has been announced that the permits will be given away next time encourages the owners of polluting plants to keep them open so that they can benefit from the subsidy again. If the plants had had to buy the permits, however, the dirtiest ones would have had to close.

The permits will also encourage the construction of more fossil-fuel power plants rather than the development of renewable energy sources. This is because, although wind farms will benefit from the higher electricity prices that will result from the permit scheme, so will the promoters of, say, new gas-fired power stations, because they will be given the permits they require to buy their fuel. This will,

effectively, reduce the costs of constructing their new power station. "For a new combined cycle gas turbine electricity generator, the subsidy in the period 2005-2012 could amount to at least 50% of the capital cost of the new plant" Fitz Gerald says.

For the emissions trading scheme to work, it is thus important to have allocations that are significantly lower than the business as usual (bau) emissions scenario. Auctioning the permits to the highest bidders rather than just handing them out as is done under a grandfathering approach is also a preferable option for a number for a number of reasons some of which are listed below.

Auctioning the permits means that no one benefits from polluting more (which they may if next year allocations were based on current year emissions), that there are no entry barriers to new entrants (which there will be if they had to buy there permits from existing entities who got them for free), that there are no perverse incentives (of the kind seen in the European ETS) and that substantial sums of money can be raised for the public purse.

This money can then be used in a number of ways which can help in the mitigation of climate change or help minimise social costs. An example of the first would be when the money is allocated to research in clean energy or used to provide subsidies for clean energy. Alternatively the money could be used as public support to both the poorest citizens within a state and poorer countries both of whom will have to pay a high social cost (even if the economic cost is low) as a result of increased energy prices and the effects of incipient climate change.

US estimated effects of grandfathered permits

Another drawback of grandfathered permits is their adverse effect on the distribution of household income. The rents or profits created by grandfathered permits ultimately accrue to shareholders, either directly through dividends and capital gains, or indirectly through their holdings in retirement accounts. Stock ownership is highly skewed toward the better-off; the top income quintile in the United States owns approximately 60% of stocks, while the bottom income quintile owns less than 2%. Indeed, this windfall to the wealthy can more than compensate them for higher energy prices: Dinan and Rogers (2002) estimate that using grandfathered permits to reduce U.S. carbon emissions by 15% would reduce annual real income for the lowest income quintile by around $500 per household but increase that for the top income quintile by more than $1,500 per household.16 Emissions taxes (and auctioned permits) do not create windfall gains for shareholders. Instead, the government obtains revenues that can be recycled to households in distributionally neutral tax reductions, or reductions that favour the poor.

Addressing the distributional impacts

Countries could negotiate national limits on emissions of GHGs - either voluntary or legally binding targets/quotas - to be achieved by specific dates. These could be negotiated for a single gas, for a group of gases, or as an aggregate CO_2 equivalent. A more comprehensive approach allows more flexibility and larger cost savings.

Given differences in marginal emission control costs among countries, allowing international trade of emission quota would reduce the cost of achieving compliance with national emission limits regardless of the initial allocation. Each country would be expected either to reduce its emissions, or to purchase quota from other countries so that the sum of these two was not more than its national emission limit.

The national quota allocations can be used to address distributional issues and to draw countries into the agreement. Most proposals for allocating emission quota among countries envisage proportionately higher reductions in national emissions by industrialized countries, and slower rates of emission growth by developing countries. Thus, international negotiations will seek quota allocations that do not harm Annex I countries with economies in transition and non-Annex I countries, and that distribute the burden equitably among Annex I countries.

An international tradable quota system presupposes the existence of one or more markets where quota can be traded. For a trading scheme to be effective in controlling emissions, it is clear that there must be

a reasonable probability of detecting and penalizing those responsible for unauthorized emissions. This, however, does not distinguish a tradable quota system from any other international agreement on emissions reductions.

Under an international tradable quota system, participating countries could use whatever domestic policies they preferred to achieve compliance. For example, a country might employ tradable permits, a domestic tax, or regulations. Where a domestic tradable permit system exists, the government could allow permit holders to trade directly on the international market. If a domestic carbon tax is used, the efficient tax rate for the coming period would be the (unknown) quota price for that period.

There is some experience with the use of tradable permit schemes within countries, whereas international tradable quota systems so far have been applied only on a small scale (e.g., the international CFC production quota trade and the CFC consumption quota trade within the European Union).

Problems with Emissions Trading

Dislocation of reductions is inequitable

As compared to taxation where even if different tax rates operated in different countries (with developing countries having lower rates of taxation) many of the most GHG intensive sectors such as transportation and the power sector cannot be 'outsourced' to those lower tax developing countries – permit trading potentially allows the outsourcing of all carbon reductions so that life can carry on as normal in the developed countries and developing countries are forced to make all the reductions because it is 'economically efficient'.

If a country chooses to purchase permits rather than reduce domestic emissions it loses whatever "ancillary benefits" might emerge from co-control of other harmful air pollutants. For example, if a country puts in place GHG control policies that reduce coal combustion, the policy also can reduce emissions of SO2, nitrogen oxides and fine particulates – pollutants that cause health problems and ecological damage. If instead GHG emitters bought permits internationally, they would not reduce their coal combustion and local pollutants so much.

A related concern is that if the richer industrialized countries can "get by" through international permits, they will act too slowly to make the long-term changes in their energy and economic systems necessary for sharper future GHG reductions, such as greater energy conservation and more rapid development and spread of new technologies.

The seriousness of this problem is a function of two variables – 1) the tightness of the cap and 2) the extent to which permits can be bought from outside – especially developing countries.

The extent of cynicism prevalent in the developing world is clear from reports that the Clinton administration used cost estimates implying that the United States intended to buy abroad as much as 85 per cent of the permits it would need to comply with the Kyoto reductions, instead of making those reductions in the American domestic economy.

This despite the fact that in the section (Article 17) in which the Kyoto text authorizes trading, it adds that this trading "shall be supplemental to domestic actions." Some negotiators from other regions, particularly Europe, did question whether the American intentions meet the "supplementary" test of the Kyoto language, and they proposed limits on the use of international trading that would drive up compliance costs for the US and other countries.

Emissions trading may prevent meaningful *domestic* reductions from taking place. If the global climate system is to be stabilized, emissions reductions should take place sooner, rather than later, in the countries most responsible for the problem. This concern relates to profound equity issues among developed, developing and transitional economies.

Complications

Emissions trading proposals are highly complicated and technical, unlike taxes which are an extremely familiar instrument to policymakers. Many technical issues would need to be resolved before trading

could begin, including treatment of sinks, different GHGs, monitoring, enforcement, etc. Ongoing costs are also low for tax systems because of the lack of monitoring and enforcement requirements.

Problems with volatility in carbon markets

"If they needed more, they would have to buy them; if they were able to cut emissions below their allocation, they would be able to sell them."

The idea seemed wonderful in theory—a 'market-based' way to reduce emissions. In practice, the market has been a roller-coaster, reaching record highs of over €30 per ton before collapsing to just €11 recently. To understand what happened we need to think about what the market price of an emissions permit actually represents.

A price is essentially information. At its simplest, the price paid for a permit represents merely the cost of undertaking the activity for which the permit is granted. Permits have been auctioned in the past at least partly to establish the true level of such costs. However, when permits are traded, extra information is added that changes the price from a mere reflection of the cost. Scarcity value is the most obvious example: when the market believes permits will be scarce, their value increases. If there will be enough for everyone who wants one to get one, no scarcity value will be added. Thus a rise or drop in price will reflect the market's greater emerging knowledge about the actual level of scarcity involved.

Prices can rise or drop quicker when speculation is involved and traders are essentially gambling that scarcity will be greater or less than the market as a whole believes. Wide price fluctuations, therefore, inevitably represent a lack of complete information about the nature of the market. Political uncertainty or lack of transparency related to the market merely lessens information available and therefore contributes to market uncertainty (this should be borne in mind when considering demands to keep emissions information secret).

This is important. When traders do not have the information to act rationally they have a tendency to act irrationally, on hunches or gut feeling. In a politically charged market such as the carbon permit market, traders will also react to statements by major political players. Environmental groups demanding tighter allocations or auctions, for instance, will cause traders to take this political risk into account, the implied increase in scarcity almost certainly driving the price up.

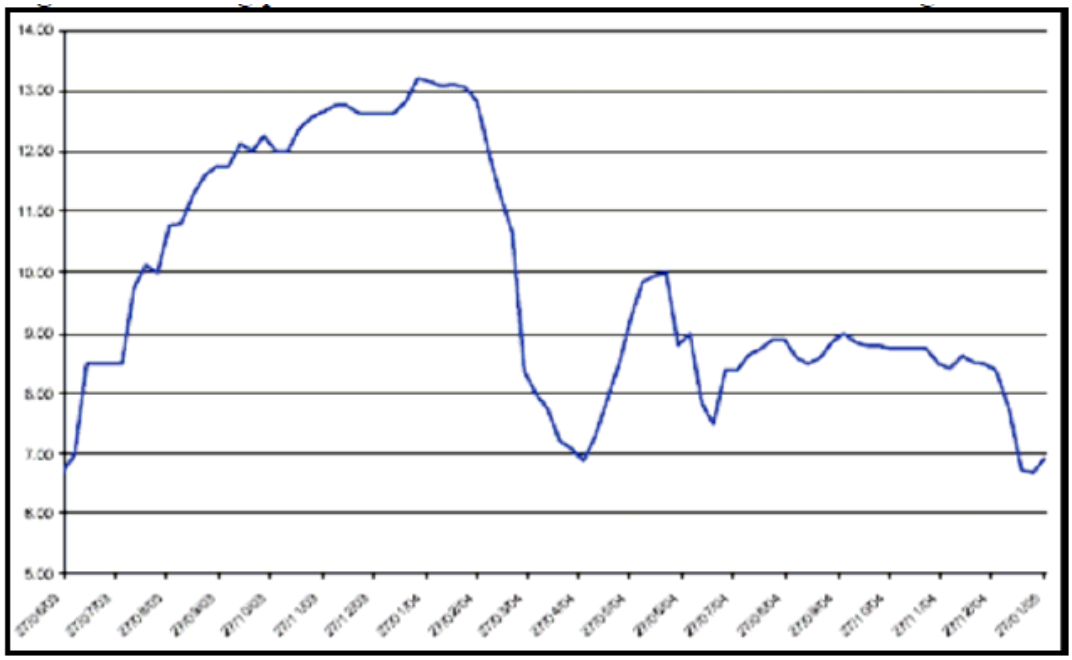
Politicians and greens cannot claim vindication as the cost of emissions reduction in the event of (perceived or actual) scarcity has been revealed to be much higher than they thought, while companies are experiencing the volatility of an uncertain market and consumers have paid the price.

It should also be mentioned that volatile markets are particularly prone to manipulation by the unscrupulous. Enron recognized the potential volatility of carbon markets when it lobbied hard for their introduction in the United States. "*Badly structured markets where transparency is lacking are to the rogue traders like pheromones in the insect world.*"

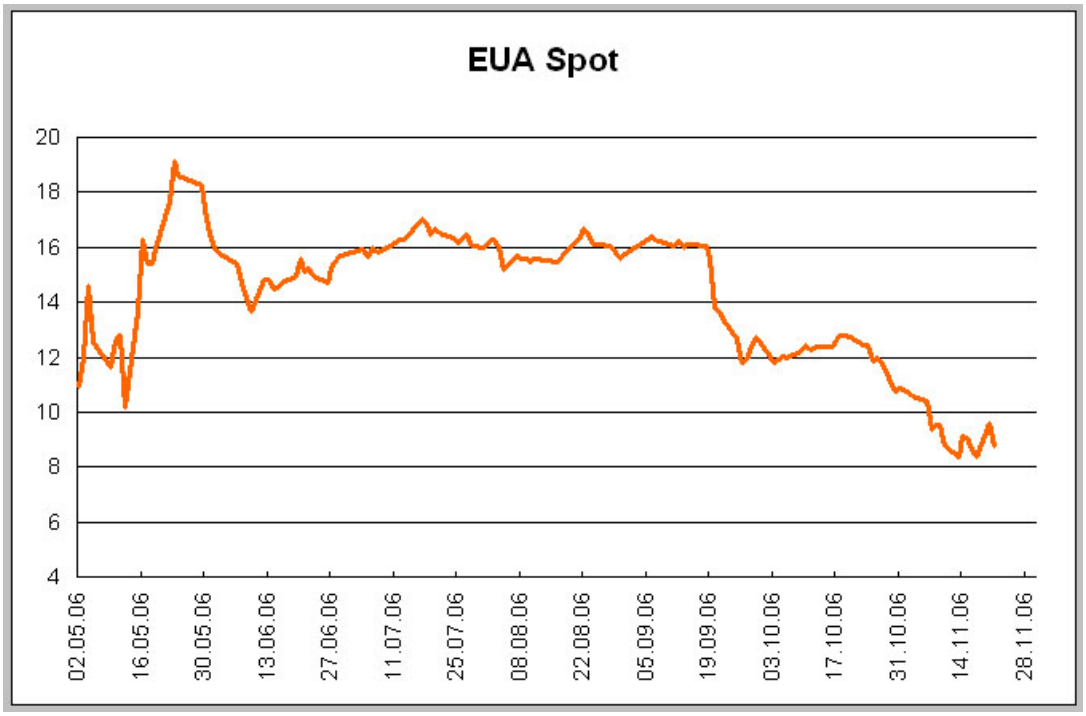
Another very important point is that under the environment of uncertainty of the kind tha prevails in the costs of abatement in the climate change quantity-type regulations are likely to show extremely volatile prices for the trading prices of carbon emissions. Carbon prices are likely to be extremely volatile because of the complete inelasticity of supply of permits in the quantity case along with the presumption of quite inelastic demand for permits in the short run.

All indications are that European trading prices for CO2 are highly volatile, fluctuating in a band at plus or minus 50% (see graphs below). More extensive evidence comes from the history of the U.S. sulfur-emissions trading program. SO2 trading prices have varied from a low of $70 per ton in 1996 to $1,550 per ton in late 2005. This is analogous to a carbon-trading program because the supply is virtually fixed and the demand is inelastic because of the low substitutability of other inputs for sulfur in the short run. Both programs build in some banking features, which can in principle moderate price volatility.

Such rapid fluctuations would be extremely undesirable, particularly for an input (carbon) whose aggregate costs might be as great as petroleum in the coming decades. An analogous situation occurred in the U.S. during the "monetarist" period of 1979-82, when the Federal Reserve targeted quantities (monetary aggregates) rather than prices (interest rates). During that period, interest rates were extremely volatile. In part due to the increased volatility, the Fed changed back to a price-type approach after a short period of experimentation. This experience suggests that a regime of strict quantity limits might become extremely unpopular with market participants and economic policymakers as price variability caused significant changes in price levels and import and export values.



(Source: Point Carbon, 2004-05)



Problems of calculating baselines

A related issue concerns the baseline policy against which countries set their policies. Quantity limits are particularly troublesome in a world of growing economies, differential economic growth, and uncertain technological change. These problems have become evident under the Kyoto Protocol, which set its targets thirteen years before the control period and used baseline emissions from twenty years before the control period. Base year emissions have become increasingly obsolete as the economic and political fortunes of different countries have changed. The 1990 base year penalizes efficient countries (like Sweden) or rapidly growing countries (such as Korea and the United States). It also gives a premium to countries with slow growth or with historically high carbon-energy use (such as Britain, Russia, and Ukraine).

The baselines for future budget periods and for new participants are deep problems for the Kyoto Protocol. The natural baseline, were it feasible to calculate, is the zero-restraint level of emissions. That level is in practice impossible to calculate or predict with accuracy. Problems would arise in the future as to how to adjust baselines for changing conditions and to take into account the extent of past emissions reductions.

The possibility of market manipulation

Trading systems that use government-issued permits (such as the sulphur dioxide allowance trading system in the U.S.) have lower transactions costs than do systems that use self-defined credits. Permits appear to have a distinct advantage in creating the basis for a futures market that could enable more efficient spreading of the risks associated with changing emissions targets. For a tradable permit system to work effectively, relatively competitive conditions must exist in the permit (and product) market. Should a firm control a significant share of the total number of permits, it might attempt to manipulate permit prices to improve its position in the permit or product market (e.g., by withholding permits, thus forcing others to cut production or keeping new entrants out). These risks can be reduced by government auctioning of permits and other mechanisms. Little information is available on the administrative costs for monitoring, enforcement, and management of an international tax system, internationally harmonized taxes, or a tradable quota system.

Upstream vs. Downstream proposals

From the perspective of distribution, auctioned upstream emissions trading is the same as an upstream carbon tax (will all the caveats that have already been discussed). The difference between the two is whether the price is set and total emissions vary or total emissions are set and the price varies. Overall, the distributional consequences are equivalent and you can use the same compensation mechanisms.

But we also need to look at the upstream/downstream distributional issue from a different perspective. An ecobonus is a payment of equal size given to each individual to redistribute the revenues from an ecotax (say, a carbon tax) and has the same distributional effect as a personal quota assigned equally, it's just that the individual is given money, rather than a personal quota they can trade. In the same way, the Sky Trust proposal to equally distribute the revenue from an upstream emissions auction that Richard Starkey has proposed to is distributionally equivalent to a personal quota.

However, there's a huge difference administratively. Now we have a largely integrated tax and benefits system, an ecobonus or the equivalent from an upstream emissions auction can be delivered just by increasing the personal tax allowance, benefits and tax credits by a certain amount. It could be made more explicit and popular by making it an additional item shown in everyone's benefits or a credit in the calculation of their tax. Either way, the marginal administrative costs are virtually zero because one uses systems that already exist. And because it's collected upstream, the administrative costs of tax collection or an upstream auction are very low, actually much less than those, for example, of the Climate Change Levy.

Distributionally, all four options are similar. Administratively and practically, carbon taxes and upstream emissions trading are simpler and easier than downstream personal quotas.

The positive aspects of an Emissions Trading System

They have appeal across the political spectrum

Tradable quotas can claim support from different political ideologies. Right-wing free-marketers like them because they are market-based and allow people the full panoply of personal choice.

Left-wing social thinkers like them because they are equitable, and because they will have a net effect of redistributing income; overall, poor people produce lower greenhouse gas emissions, and so would be more likely to be sellers than buyers of carbon.

Emissions trading can guarantee an emissions outcome

Emissions trading has the advantage of fixing a certain environmental outcome - the aggregate emissions levels are *fixed*, and companies/countries pay the market rate for the rights to pollute. This also makes emissions trading more conducive to international environmental agreements, such as the Kyoto Protocol, because specific emissions reduction levels can be agreed upon more easily than tax rates or policy instruments, which may vary in appropriateness and applicability between states.

Emissions trading can be more easily expanded to look at all GHGs and sinks

Emissions trading is better equipped than taxes to deal with all *six* GHGs included in the Kyoto Protocol and sinks (e.g. trees which absorb and store carbon) in one comprehensive strategy. Each gas has a "greenhouse gas potential" (GWP, based on carbon dioxide). Thus firms emitting more than one GHG have more flexibility in making reductions.

Emissions trading adjusts more readily to macroeconomic changes

Permits adjust automatically for inflation and external price shocks, while taxes do not. For example, the US has already experienced an extended period of stable greenhouse gas emissions levels from 1972 to 1985 because of high oil prices. Taxes would need to be designed to adjust for such external shocks.

There have been successful outcomes

"The story of US acid rain control offers a case study in the successful regulation of a wide-ranging pollutant. Economists agree that at least partial credit must go to the unusually flexible US regulations and their use of the free market."

Taxation of Emissions

Background

Carbon taxes are simply direct payments to government (collection body), based on some measure of the carbon content (or emissions potential) of the fuel being consumed. Given that the primary objective of the abatement policy is to lower carbon dioxide emissions, carbon taxes make sense economically and environmentally because they tax the externality (carbon) directly.

"For the last fourteen years, I have advocated the elimination of all payroll taxes — including those for social security and unemployment compensation — and the replacement of that revenue in the form of pollution taxes — principally on CO2. The overall level of taxation would remain exactly the same. It would be, in other words, a revenue neutral tax swap. But, instead of discouraging businesses from hiring more employees, it would discourage business from producing more pollution." (Al Gore, 2006).

Peter Prior of the renewable energy and waste disposal company Summerleaze, for example, believes a carbon tax - a concept which has won its spurs in Norway as an emissions reduction tool - would be a better bet than emissions trading.

"We've looked at it, and to us, a carbon tax would be more efficient,". "It would benefit suppliers of alternative energy and people who wanted to be energy efficient, and it wouldn't have to be regressive - it really wouldn't."

Comparing a carbon tax with a CO_2 tax and an energy tax

Under an emission tax system, sources that produce GHG emissions must pay a tax per unit of emissions. To ensure that the cost of a given emission abatement is minimized, all emissions should be taxed at the same rate per unit of contribution to climate change. The tax rate needed to achieve a particular emission target must be found by trial and error over a number of years.

A tax on the carbon content of fossil fuels - a carbon tax - is generally proposed in lieu of a tax on the CO_2 emissions from fossil fuel use, since it has a similar impact and is much simpler to administer. A CO_2 emissions tax would require every source that uses fossil fuels to monitor its emissions and to pay the corresponding taxes. A carbon tax would affect the same emissions, but would involve only the fuel producers or distributors, most of which already are involved in the collection of other energy-related taxes. In practice, existing excises on energy products complicate the design of a carbon tax that changes prices in proportion to CO_2 emissions.

A carbon tax is a more efficient instrument for reducing energy-related CO_2 emissions than are taxes levied on some other bases, such as the energy content of fuels or the value of energy products (*ad valorem* energy tax). Model simulations for the United States indicate that for an equivalent reduction in emissions, an energy tax would cost 20 - 40% more than a carbon tax, and an *ad valorem* tax would be 2 to 3 times more costly. This is because an energy tax raises the price of all forms of energy, whether or not they contribute to CO_2 emissions, whereas a carbon tax changes relative costs, and so provides incentives for fuel switching.

However, taxing carbon instead of emissions will mean that any technological advancements that help entrap carbon dioxide (and other GHGs) between the production in fuel consumption and final emission would be at a severe disadvantage as would some carbon sequestration techniques. It is of course possible to build in exemptions for sequestration but that would make the system more complicated. In the end, a decision will need to be made about the trade-offs between using a carbon based tax (which would be administratively simpler) or an emissions based tax (which would provide better incentives for emission reduction) and the importance of carbon entrapment and sequestration in overall emissions control would be a key decision variable.

Analysts agree that actions to respond to climate change should include all GHGs (taking into consideration their heat-trapping potentials and atmospheric lifetimes) and carbon sinks. Methane for example, is four times as potent as carbon dioxide in its heat trapping effect. A carbon tax on fossil fuels (or a tax on fossil fuel CO_2 emissions) could therefore be complemented by emissions taxes on non-energy sources of CO_2, emissions taxes on other GHGs, and tax rebates or subsidies for carbon sequestration. The administrative challenges and difficulties of monitoring emissions (sequestration) by these diverse sources may make the use of taxes (rebates/subsidies) impractical in some of these situations.

Internationalizing the proposal

At the international level, a GHG emissions tax could be implemented in one of two ways. Countries could agree to create an international agency that would impose a GHG emissions tax on participating countries. Alternatively, countries could agree that each would levy comparable GHG emissions taxes domestically. The agreement to create an international GHG emissions tax agency would need to specify both the tax rate(s) and a formula for distributing the revenues from the tax.

The use of harmonized prices, fees, or taxes as a method of coordinating policies among countries has has no international experience in the environmental area, although it has modest experience nationally in such areas as the U.S. tax on ozone-depleting chemicals. On the other hand, the use of harmonized price-type measures has extensive international experience in fiscal and trade policies, such as with the harmonization of taxes in the EU and harmonized tariffs in international trade.

Under such a proposal, countries would agree to penalize carbon emissions domestically at an agreed-upon and harmonized "carbon tax." This is essentially a dynamic Pigovian pollution tax for a global public good. The carbon tax is negotiated, but conceptually it is determined by weighing environmental and economic objectives. This must involve aiming to limit changes in GHG concentrations or global mean temperature below what are thought to be critical levels and it might also use some kind of cost-benefit approach (ideally including social costs) to make micro level decisions within the framework of overall GHG stock control. Unlike the quantitative approach under the Kyoto Protocol, country emissions quota will not be central and there will be no emissions trading, and no base period emissions levels. The

efficient tax should ideally be equalized across space and growing over time at approximately the "real carbon interest rate.

However, due to differences in resource endowments, consumption patterns, climate change impacts, and other factors, the single harmonized tax rate may not be the most appropriate from a national perspective, thus side-payments are likely to be required to secure broad participation. Under the harmonized tax system, the reallocation of tax revenues could involve lump-sum payments; whereas under the international tax system, the agreement could specify what shares of the international tax revenues would go to each participating country. In principle, international transfers could be negotiated to yield the same international distribution of the tax in either case. A GHG emissions tax imposed by an international agency would impinge on national sovereignty and would therefore be difficult to negotiate.

A uniform tax rate for all countries would be best for reasons of cost- effectiveness but, given different existing energy tax regimes in participating countries, the system could potentially become very complex.

It would be critical to have a fair burden of the cost of emissions reductions among nations. It would be reasonable to allow participation to depend upon the level of economic development. For example, countries might be expected to participate fully when their incomes reach a given threshold (perhaps $5,000 - $10,000 per capita), and poor countries would receive transfers to encourage early participation. The issues of sanctions, the location of taxation, international-trade treatment, and transfers to developing countries under this regime are important details that are subject to discussion and refinement. If carbon prices are equalized across participating countries, there will be no need for tariffs or border tax adjustments among participants. While much work on the details would be required, this is familiar terrain because countries have been dealing with problems of tariffs, subsidies, and differential tax treatment for many years. The issues are elementary compared to those of a quantity-based regime.

On economic grounds there appears to be an almost overwhelming case for an internationally harmonized carbon tax, at least if taxes could be introduced in a revenue-neutral fashion in individual nations. The efficiency costs of moderate carbon taxes can be dramatically lower than those of equivalently scaled grandfathered permits, and for the United States, costs might actually be negative. These economic arguments, in addition to the transparency of the carbon tax compared with the endless bargaining over inter-country permit allocations endemic in the Kyoto Protocol, suggest that a regime of harmonized taxes is more likely to achieve what is ultimately the most important objective the establishment of a credible international emissions control regime that will stand the test of time.

Advantages of Taxation

No baseline problems

One of the most contentious issues in the Kyoto negotiations and all subsequent discussions of using quantitative (cap and trade) measures has been the level to fix base emission at and whether that should be uniform across countries or not. Under a tax (price) approach, the natural baseline is a zero-carbon-tax level, which is a straightforward calculation for old and new countries. Countries' efforts are then judged relative to that baseline. It is not necessary to construct a historical base year of emissions. Countries are not advantaged or disadvantaged by their past policies or the choice of arbitrary dates for the baseline. Moreover, there is no asymmetry between early joiners and late joiners.

Taxes more under efficient under high uncertainty

One key difference between price and quantity instruments concerns the structure of the uncertainties — and uncertainty is clearly a central feature of climate-change policy. There remains substantial uncertainty over the (primary) costs of reducing carbon emissions. A familiar result from one-period models with uncertain abatement costs (e.g., Weitzman 1974) is that emissions taxes yield higher expected welfare gains than permits when the marginal environmental benefit curve is flat relative to the marginal abatement cost curve, and the converse applies when marginal benefits are relatively steep.

Taxes allow emissions to vary but place a cap on abatement costs. That is, if abatement costs turn out to be high, firms can avoid abatement and pay more in taxes, but if abatement costs are low, firms can lower tax payments by doing more abatement. In contrast, under permits, emissions must be reduced by a fixed amount; the emissions cap is not automatically relaxed if control costs turn out to be high, or tightened if control costs are low.

Carbon dioxide is a stock pollutant where atmospheric accumulations of carbon dioxide decay at a rate of only about 1% per year. Global carbon emissions in one year add less than 4% to the atmospheric stock; therefore the marginal damage from global emissions in one year is essentially linear, even though climate change damages are nonlinear in the stock.

Using a carefully calibrated dynamic model with abatement cost uncertainty, Newell and Pizer (2002) estimate that the expected welfare gains from carbon taxes amount to several times those under emissions permits, under a wide range of scenarios.

Abatement costs, by contrast, are likely to be highly nonlinear as a function of emissions. This combination of relative nonlinearities means that emissions fees or taxes are likely to be much more efficient than quantitative standards or auctionable quotas when there is considerable uncertainty, as is clearly the case for climate change.

Though this issue has received little attention in the design of climate-change policies, the structure of the costs and damages in climate change gives a strong presumption to price-type approaches.

More generally, where the damages are caused by stock externalities (as is the case for climate change because damages are a complicated function of the stock of greenhouse gases), then the damage function is likely to be close to linear with respect to current emissions.

This analysis holds true more strongly in the short to medium term though in the long term quota based systems are theoretically more efficient. However, given that there is an urgent need to frontload the emission reductions much more than would happen under a long-term scenario (to minimise social costs and not just economic ones) and also taking into account that the political cycle usually operates over the short to medium term only – the advantages of a price based (tax) reduction mechanism are further amplified.

Taxes are preferable from a fiscal perspective

An important advantage of tax mechanisms is the strong fiscal-policy preference for using revenue-raising measures rather than quantitative or regulatory measures. When prices are raised and real incomes are reduced by regulations, this increases the inefficiency losses from the overall tax system. This effect is the “double burden” of taxation (misnamed as the “double dividend” from green taxes). If the carbon constraints are imposed through taxes that are then rebated in taxes that have approximately the same marginal deadweight loss as the carbon taxes, then the overall efficiency loss from taxation will be unchanged. If the constraints under a quantity-based system are imposed by allocations that do not raise revenues, then the conventionally calculated abatement costs will underestimate the economic costs and the efficiency losses from the price-raising elements should be added to the abatement costs. Rough estimates indicate that the losses here are likely to be large.

Carbon taxes earn revenue, which can be "recycled" back into the economy by reducing taxes on income, labor and/or capital investment. This is often referred to as a "revenue neutral" tax and may be part of a broader program of "environmental tax reform" (ETR) which attempts to shift the tax burden from "goods" like labor, to "bads" like pollution. Evidence indicates that there can be profound employment, distributional and political benefits to such an approach.

While it is possible that emissions permits will be auctioned (thereby retaining the revenues, removing the double burden of taxation and creating similar redistribution patterns to taxes), history and current proposals suggest that most or all of the permits are likely to be allocated at zero cost to “deserving” parties, or will be distributed to reduce political frictions. In the cases of SO2 allowances and CFC production allowances and the first round of ETS allowances, all the permits were allocated to producers. The point here is that using tax approaches rather than quantity approaches will help promote a more efficient collection and recycling of the revenues from the carbon constraints

The taxation route is also potentially better from an international redistributive perspective provided at least part of the revenue is directed towards developing countries. In fact, emissions related taxes can generate long term predictable sources of financing that can then be allocated towards climate change mitigation efforts, green technology transfer and development related expenditure and investment. It would be much more difficult to have this reallocation of resources even if significant resources were raised from a (highly unlikely) auction of emissions permits.

The taxation approach creates fewer incentives for corruption

A final question applies particularly to international environmental agreements and concerns the administration of programs in a world of where governments vary in terms of self-interest, honesty, transparency, and effective administration. One of the subtle problems with quantity-type systems is that they are much more susceptible to corruption than are price-type regimes. An emissions-trading system creates valuable tradable assets in the form of tradable emissions permits and allocates these to different countries. Limiting emissions creates a scarcity where none previously existed and in essence prints money for those in control of the permits. Such wealth creation is potentially dangerous because the value of the permits can be used by the country's leaders for non-environmental purposes rather than to reduce emissions. If the elite in some corrupt countries pocket oil export revenues, why would they not pocket emissions permits as well (perhaps after suitable "privatizations").

A price approach gives less room for corruption because it does not create artificial scarcities and monopolies. There are no permits handed over to countries or leaders of countries, so they cannot be sold abroad for wine or guns. Any revenues would need to be raised by taxation on domestic consumption of fuels. In fact, a carbon tax would add absolutely nothing to the instruments that countries have today. The only difference would be the international approval of carbon taxes, which probably adds little to their acceptability in corrupt countries. The dangers of quantity as compared to price approaches have been shown frequently when quotas are compared to tariffs in international trade interventions.

Carbon taxes potentially offer more coverage for emissions reduction

A carbon tax would offer a broader scope for emissions reductions than emissions trading because it is likely to have broader coverage. Trading systems have been primarily implemented among private firms or countries - not individual consumers (since transaction costs could be prohibitively high at the level of an individual). Carbon taxes extend to all carbon-based fuel consumption, including gasoline, home heating oil and aviation fuels. Trading systems may not be able to reach parts of the transportation and service sectors which could account for a significant part of the emissions.

There are suggestions for emissions permits at an individual level and measures have now been announced to say that the aviation industry (which has till this point been left out of the ETS) would also be covered in the next round. Both these developments may blunt some of the criticisms of trading to do with coverage, but the main point – that coverage comes easier with taxation, is still very valid.

Taxation is likely to have lower transaction costs

Taxes are a part of everyday life and have been hardwired into the modern economy especially in developing countries. All OECD countries, for example, already impose some form of a tax on the sale of gasoline which could easily be extended and modified to be a emissions reducing carbon tax. Such systems are simple and have very low transaction and collection costs.

A system of tradable permits, on the other hand, entails significant transaction costs, which include: *search costs*, such as fees paid to brokers or exchange institutions to find trading partners; *negotiating costs*; *approval costs*, such as delays or fees incurred during the approval process; and *insurance costs*. Especially when we get into the discussion of trading permits and rights issued at the level of individuals (as referred to in the previous section), transaction costs are likely to rise exponentially.

Taxation has the potential to provide longer term incentives for emissions reduction

Carbon taxes have *dynamic efficiency* advantages that trading lacks because taxes offer a *permanent* incentive to reduce emissions. Technological and procedural changes, and subsequent technology

diffusion, will lead to reductions in permit price (i.e. since emissions goals will be easier to meet, there will be a decrease in permit demand, and hence, a decrease in permit price). Trading systems may not be able self-adjust in response to rapid change, and thus provide the permanent incentive of a tax system to reduce emissions. In short, emissions trading must have some method of removing permits (in addition to the foreseen predictable annual reduction in the caps) from the system or other method of ratcheting-up permit prices to match the dynamic efficiency of the tax system.

Developing countries (and some others) in general seem to favour taxation over trading

Developing countries (known as G77/China in UNFCCC negotiations) are extremely cautious of emissions trading, and view it primarily as a "loophole" that the US and Japan can use to avoid their domestic responsibility. They are in favor of rules and guidelines that ensure equitable allocation of allowances and monitoring provisions. Between the two options, developing countries seem to favour the principle of carbon taxes – (as long as they are levied on rich countries and not poor ones of course).

Countries that refuse to join international efforts to cut greenhouse emissions – such as the US and China – should face a European carbon tax on their imports, Dominique de Villepin, the French prime minister, proposed last week. Of course, such a (punitive) tax is not incompatible with an emissions trading regime in a group of countries (such as the EU), but would be much easier to impose (and justify politically) if there were exiting carbon taxes schemes instead.

Relative to other industrialized countries, the US is energy *inefficient* and has high per capita carbon dioxide emissions levels. Thus carbon taxes would penalize the US more relative to other, less fossil fuel dependent nations. That is why US industry has been strongly against any taxation measures to achieve GHG reductions. However, In Kyoto, the EU was against emissions trading, but was unable to overcome US support for trading.

Taxation would be a much fairer way to ensure that the "polluter pays" especially in the case of energy inefficient countries such as the United States who have a vested interest in promoting trading which allows them a much easier route of buying their way out without imposing too many domestic reductions. EU efforts have now been channeled into developing effective rules and guidelines for their trading system to also serve as a model when other countries (hopefully) join. For example, the EU requires that at least 50% of countries' reduction targets should be achieved *domestically* which though a good start is too easy a target.

Even differentiated Taxes are good

Though a harmonized taz system is ideal, in reality such a system will be well nigh impossible to get political agreement on. Instead, what we can expect to see would be a scaling up and some rationalization of the current system of many differentiated tax rates and exemptions. For example, a common feature of many European systems of environmental and energy taxes, is indeed that of extensive exemptions and differentiation of tax rates (see Ekins and Speck, 1999 for example). In this case it would be worthwhile to compare the merits of such a 'messy' tax system with an emissions trading regime.

In the Norwegian system for CO_2 taxes, for example, the CO_2 tax on gasoline is more than twice as high as for other fuel oils (measured per ton emission of CO_2). Several industries have substantially reduced tax rates or no carbon tax at all. For North Sea oil and gas production, on the other hand, tax rates per ton CO_2 are almost as high as for gasoline, and thus much higher than the implicit emission taxes paid by mainland industries. Such differentiated taxes will not equalize marginal abatement costs between polluters, which was, after all, one main reason for advocating market-based instruments in the first place.

Nevertheless, it is important to remember that it may only be such a 'messy' regime that may be politically feasible in practice. The conclusions from simulations and analysis by the Norwegian Statistics service are that although free issued quotas yield lower welfare than uniform carbon taxes, as expected, differentiated taxes produce almost the same level of welfare as uniform taxes. One reason for the latter is that differentiated taxes produce more public revenue than the uniform tax, given the level of CO_2 emissions. This implies that other distortionary taxes - that is, the payroll tax - can be kept lower in the differentiated tax regime and this also introduces the possibility of higher redistributive transfers - more emphasis on minimising social costs and more resources to do just that.

Problems with Taxation

Possibility of falling revenues

Green taxes have a lot of support within environmental circles, but from the policymaker's perspective there is a major flaw; if they are successful, revenue goes down. Expand that situation to a national treasury which has to allocate taxation money to schools, hospitals and pensions, and the problem becomes clear.

Taxing income and sales, on the other hand, should produce rising revenue so long as the economy is expanding. This is perhaps the reason why no country in the world bases its taxation system on resource use and polluter payments (yet) ; many tinker at the fringes, but green taxes are not the major player which environmental groups would like them to be.

Taxation (price controls) cannot guarantee quantitative outcomes

Moreover, a carbon tax, however structured, cannot guarantee that any particular level of emissions will be achieved at any given date in the future whereas a quota can. A carbon tax rate which would bring about the required emissions reduction in a booming economy could be too high and thus also have a depressing effect on a depressed one. As a result, for a carbon tax to work well, its rate would need to be adjusted regularly to conform to the stages of the business cycle. It will also need to be adjusted keeping in mind the emissions outcome desired and thus there will need to be a trial and error adjustment of the tax rate.

This could make setting the rate a perennial source of conflict between the government, the consumer and business interests. With a quota, however, the market automatically sets the price to be paid for permits giving the right to burn extra fossil fuel and leaves no scope for argument – subject of course to an overall decision on yearly (or multi-year) quotas which may also be very hard. Despite this potential difficulty over the level of emissions quotas and caps, emissions trading should still have less uncertainty than taxation.

Possible negative distributional impacts

There is an extensive literature on the distributional impacts of carbon taxes, emission taxes, gasoline taxes, and energy taxes that already exist in many developed countries. These taxes are usually portrayed as regressive, because expenditures on fossil fuel consumption as a proportion of current annual personal income tend to fall as incomes rise. However, recent studies using U.S. and European data show that carbon taxes are considerably less regressive relative to lifetime income or annual consumption expenditures than to annual income.

The formula needed to drive the redistributive mechanism may be more difficult to agree to

Unlike under an emissions trading regime involving poor low emission countries, having a tax would not create an automatic mechanism for transfers of resources and technology from richer to poorer countries. Such transfers are of course critical to getting developing countries engaged in GHG emissions reductions, and thus to getting competitiveness-conscious industrialized countries to act as well and will need to form part of the agreement. A compromise formula for sharing and revenue transfer may be agreed and in fact may transfer more revenue than a emissions trading regime especially when the permits have been 'grandfathered', but because the allocation mechanism is not market driven it may be more liable to be hijacked towards political ends and may also be more contentious.