A carbon price cap: Can it improve our future?

The current choice of policies facing both environmental advocates and the business community are too tightly drawn. What we propose is a more flexible policy with the potential to address the substantive concerns of both groups, i.e., uncertainties about both benefits and costs. The hybrid policy does just that. By implementing a tradable permit system where the pool of available permits remains fixed as long as the price remains below a reasonable threshold, the risk of catastrophic climate damages is greatly diminished. By capping the potential expenditure on GHG abatement and allowing additional permits to be purchased if costs turn out to be particularly high, the policy protects against runaway costs for business and consumers, enabling sound business planning.

Raymond Kopp, Richard Morgenstern and William Pizer, (1997)

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1 Introduction

1.1 The context

Over the last decade, both policy makers and business have become increasingly interested in using economic instruments to manage issues that have previously been managed by command and control regulation.

Two things have tended to coincide:

- a growing familiarity with and enthusiasm for allowing markets to operate;[1] and
- a range of new environmental problems and an increased policy seriousness in dealing with them. Many of these problems are particularly well suited to markets – from overfishing and the management of water flows to dealing with unwanted emissions. Providing that instruments can be developed to ensure that prices reflect true societal costs, not just the private costs markets would otherwise deal with, these environmental problems can be tackled with maximum flexibility and hence efficiency.

1.2 Economic instruments and carbon emissions

Economic instruments influence economic behaviour by influencing market prices. Firms are then free to react to the new prices in the most efficient possible way.

In this way, assuming firms are responsive to profit opportunities, the economic criterion for efficiency is met – namely that:

- all the lowest cost opportunities to correct unwanted outcomes – such as abating emissions – have been taken and that;
- they have been taken up to the point at which the marginal societal benefit equals the marginal cost.

There are two economically efficient ways of driving the cost of carbon emissions from their current zero or near zero level to a positive level which better reflects their probable cost to the global community. On option is to impose an emissions tax. Alternatively, the total level of emissions can be

[1] Despite occasional political reverses

capped, permits to emit can be distributed and holders of permits can be permitted to trade them.

Each of these two methods has its strengths and weaknesses.

Emissions trading is very flexible. It can help facilitate the development of markets that in turn generate efficient flows of information, investment and disinvestment. Thus for instance firms will have an incentive to abate emissions if they can sell the permits thus freed up to firms who will buy them for more than it costs the firms to abate. And permits with different tenures can be issued. This enables a market in carbon risk to develop – with firms able to express their appetite for carbon risk in their preferences for long or short-term permits. This is analogous to the money markets helping firms manage – and trade – their different appetites for interest and exchange rate risk.

Carbon taxation on the other hand is very simple. Within a given jurisdiction, emissions attract a tax wherever they are and whoever is responsible for them. It also raises revenue very efficiently. Most taxes gain revenue at the same time as suppressing valuable economic activity. Provided it is set at the right level, an environmental tax raises revenue at the same time as *improving* resource allocation by reducing undesired (polluting) activity.

In the greenhouse context it is likely that the greatest drawback of a trading system will be uncertainty about the carbon price and so economic effects of any given cap. We are remarkably ignorant about current opportunities for greenhouse gas abatement let alone the ways in which new technologies will change this. Indeed we are ignorant about the extent of economic growth to expect over the next ten years – yet plausible changes in these parameters could change the price of emissions very considerably. We would need accurate foreknowledge of all these variables to have even a reasonable chance of estimating the cost of achieving a given target.

If, as seems likely, the political preparedness to achieve any given level of emissions abatement is closely related to its economic cost, a firm emissions target would be a highly risky undertaking. If it were too easy to achieve, a target would be revealed – after the event – to have wasted an opportunity to do much better. If it were too difficult to achieve, the emissions cap would be abandoned at some stage severely impairing the credibility of subsequent emissions reduction efforts.

1.3 A hybrid system: Cap, trade and safety net?

These thoughts raise the prospect of a hybrid system. In such a system, emissions would be capped in the first instant with permits to emit being tradeable. However, in addition firms would be able to purchase from the government an unlimited number of permits to emit at some specific price – in effect a carbon tax *at the margin*. Clearly tradeable permits would not change hands above this price as firms could always pay the 'safety net' marginal carbon tax rather than buy permits.[2]

This hybrid 'cap, trade and safety net' system would harness some of the most important benefits of a trading system at the same time as ameliorating its most dangerous flaw.

To understand the implications of such a policy we must know what kinds of hybrid systems have received attention in the past, and what their strengths and weaknesses have been. We must also know which of those strengths and weaknesses are logically implied by a hybrid system itself, and which are particular to specific variants of such a system.

This paper seeks to explore these issues. It explores the architecture of the most elaborated of the proposals for a hybrid system – the McKibbin/Wilcoxen system – in the authors' original and more recent elaborations.

The next section sets out the basic structure of the current arrangements as enshrined in the Kyoto Protocol. Having outlined that system the paper moves on to explore some of its key strengths and weaknesses. This sets the stage for an examination of the McKibbin/Wilcoxen system as an alternative 'hybrid' system. The subsequent section goes on to explore which of those strengths and weaknesses are logically implied in a hybrid 'cap, trade and safety net' system. By doing so we are able to see what might be improved in the McKibbin/Wilcoxen proposal (and the costs we might have to trade for those improvements) and what cannot be changed without abandoning a hybrid system.

[2] Moving from a pure volumetric based trading system to one capped by a marginal carbon tax is analogous to moving from a strict volumetric limitation on imports (a quota system) to a tariff quota where importers have the choice of bringing in imports over their quota entitlements upon payment of a 'penalty tariff'. Australia ran such tariff arrangements in a range of industries such as cars in the 1980s.

2 The Kyoto Protocol

2.1 Introduction

Generally speaking, there are two ways to set up an emissions trading system. One – a 'baseline and credit system' allows traders to buy and sell entitlements to emit above a given baseline. Even at the outset, setting baselines is a technically difficult process. There are political and administrative complications as well. Should one facility which is already less emissions efficient than a competitor facility get less or more emissions permits per unit of output?

These problems tend to mount over time. What 'baseline' should a new firm be given? And what if old firms seek to 'game' the system by changing their structure?

The alternative system simply imposes a global 'cap' on emission entitlements, distributes them, and then allows those who hold them to trade with each other. The Kyoto Protocol establishes a partial global cap and trade emissions trading system for the world. Thus each Annex 1 country is given a cap – their assigned amount – and the protocol allows them to trade this amount, subject to a range of qualifications.

The major weaknesses of the trading system foreshadowed in the Kyoto Protocol include the following:

1. There are (ambiguous) qualifications on the extent to which trading is permissible. Article 6 allows countries to trade entitlements however paragraph (d) constrains this to action which is "supplemental" to domestic actions. The kind of volumetric interpretation sought by the Europeans – whereby an arbitrarily set proportion of any emissions reductions must be generated domestically – would seriously diminish the efficiency of international trade in emission entitlements.[3]
2. Developing countries do not yet have a cap under the Protocol and so have no direct economic incentive to constrain their emissions. This has been one of the critical weaknesses cited by the Bush administration in its disengagement with the Protocol. The problems

[3] The Europeans largely exclude themselves from this stricture as it does not constrain trade within 'bubbles' such as the proposed European bubble.

are disproportionately large for Australia because our exports are emissions intensive (and thus the most exposed to 'carbon leakage') and because we are in the same region as the most populous, and many of the most prosperous non-Annex 1 countries.

3. Even without these 'imperfections', the global trading system envisaged in the Protocol would entail the following risks:
    - The international capital flows generated by international trading would have substantial and potentially disruptive economic effects;
    - There would be powerful incentives for countries to 'cheat' – to under report their emissions and over-report carbon sequestration.
    - Even without these incentives to cheat, new institutions would be required to ensure compliance and cope with the added complexities involved by trading. They may be beyond the capability of some countries, particularly less economically developed ones.
4. The policy target of a given volume of carbon emissions is a major drawback in the context of the great uncertainty involved in climate change.

2.1.1 Scientific uncertainties

There is a scientific consensus that greenhouse gasses are capable of making important changes to the earth's climate and that the process of warming has begun. Nevertheless great uncertainties remain. The extent to which the earth will produce equilibrating climatic changes without further human intervention is unclear. Further, while the consensus has steadily grown and is now strong that 'anthropogenic' emissions are influencing and will influence further the earth's climate, there remains considerable disagreement about the likely *extent* of warming and the likely effects of any given warming.

2.1.2 Technological uncertainties

We have some idea of what technical changes are on the horizon and some could make very large contributions. The following technologies offer the possibility of making very substantial improvements in our carbon efficiency.

- 'Hybrid' cars
- Fuel cells

- Low cost voltaic coatings may be able to turn commercial buildings (and subsequently house roofing into net exporters of energy to the electricity grid
- Intelligent (ie networked) energy systems (chips with everything).

But how much contribution can they make, and how fast will the cost of solar and wind power fall with increased research and development and scale of production? We do not know.

2.1.3 Political and economic uncertainties

We are profoundly uncertain about the political capacity of humanity to produce a globally co-ordinated political response to the challenges thrown up by greenhouse. Further, if a major political commitment can be made by a substantial proportion of the world's population, how long will they continue their effort in the presence of others free riding – and in so doing sabotaging the progress otherwise being made.

In short we are profoundly ignorant of the economic costs and benefits of any given degree of climate change effort. Despite this the Protocol commits its developed participants to reduce greenhouse gases by approximately five per cent with little knowledge of the technologies that will be available to achieve this, the benefits it will achieve or the costs of doing so.

Indeed, the costs of achieving such a target could change dramatically depending on the degree of economic growth we achieve before and during the first commitment period. Adopting a volumetric target before we have that knowledge means that one of two outcomes is highly likely. If for instance, technological advance is rapid and economic growth slows, the target may be relatively easily reached. In such a case, we have wasted an opportunity to commit to a more ambitious target. Today the alternative outcome looks more likely. Technical progress has been moderate since the Protocol was signed, and economic growth relatively strong. At least in hindsight, and given what we know now, the target may well be too ambitious and so lead to the political collapse of the agreement. It is hard to see how such an outcome can do anything but harm to the global climate change effort.

3 The McKibbin/Wilcoxen Proposal

The McKibbin/Wilcoxen proposal seeks to address all of the shortcomings of the Kyoto Protocol mentioned above. It is an extremely clever proposal which is founded on the following insights.

Insight One: In an environment of uncertainty, it makes much better sense to target the price of carbon over the medium term rather than a rigid volumetric emissions target.

Insight Two: The essential economic function of carbon trade is to equalise the marginal cost of abatement between regions which trade – the criterion of economic efficiency of the global carbon effort. It is not to exchange any physical substance.

The essence of the McKibbin/Wilcoxen proposal is as follows:

All countries establish domestic 'cap and trade' carbon emissions trading systems with a cap at some level which is expected to 'bite' and so impose disciplines to abate carbon. In addition, a price cap would be imposed on the trading system with a 'marginal carbon tax'. Thus any firm not holding a permit would be required to pay tax at a given rate per ton of carbon emitted. This effectively imposes a price cap on the trading system. The criterion for global economic efficiency would then be met by an international agreement which bound countries to impose their marginal carbon taxes at the same levels.

As the proposal has been developed, greater detail has been added to it. McKibbin and Wilcoxen have proposed a starting price of US$10 per ton of carbon to be renegotiated once a decade under the auspices of the UNFCCC.

They have specified that the 'cap and trade' system should be built around 'emission endowments' which entitle their holders to perpetual rights to emit. They leave the proportion of national emissions accounted for by emission endowments and the proportion accounted for by annual permits to individual governments. They also suggest that emissions endowments be distributed to fossil fuel industries as compensation for the loss in shareholder value entailed by abatement and that part should be distributed to every person in the economy generating a political constituency for the plan.

Perpetual endowments do not prevent the international community from negotiating domestic caps down below the level of emission endowments currently in circulation. However they do mandate the means by which it would be done. The government would have to purchase the endowments back from their holders.

3.1 Strengths

The McKibbin/Wilcoxen proposal has the strengths of a powerful understanding of the economic textbook, whilst also being practical. In the course of outlining the strengths of the proposal we also explore some of its weaknesses and limitations.

3.1.1 Targeting price not volume

Its greatest strength is the proposal that a cap be placed upon the price of permits. Of course there are some who would argue that this 'waters down' the more unequivocal commitment to meet volumetric targets. But in a world in which agreements will have to be continually negotiated, this argument plays more to the emotions than to logic.

Targeting climate change action by explicitly pricing carbon simply allows us to be more accurate in our targeting of the problem. Opinions will differ about how ambitious we should be based on a wide range of considerations. 'Altruists' will want to abate as much carbon as is practicable and politically possible. Others may want to move more slowly.

The critical question which confronts humanity in the climate change debate is this "how much are we prepared to pay – how much of our current comforts are we prepared to sacrifice" to tackle climate change. No-one knows the answer to this question. What we do know is that a price target allows us to hit any given target (of community economic sacrifice to achieve an environmental objective) more accurately than if it were expressed as a volumetric target of emissions.

3.1.2 Domestic enforcement incentives

In an international trading system, those who 'cheat' – understating emissions or overstating sequestration – will often be cheating other countries. By contrast under the McKibbin/Wilcoxen proposal, those cheating will be cheating their own government of revenue. This creates the same incentives that governments always have to enforce compliance to

defend their own revenue base. Like any enforcement system this will not be perfect, but it will be animated by a more equal balance of domestic interests than might be the case under international trading. On the other hand external pressure might improve the demands which the domestic business community make for integrity of the domestic emissions trading system – where for instance the permits of a country are losing their credibility in markets and commanding poor international prices.

3.1.3 Capital flows

International trading will unleash substantial capital flows. McKibbin/Wilcoxen argue that they will be destabilising. In fact while the carbon market could be large, it will not dwarf other markets. Thus for instance, the AGO have mooted the figure of $12 billion as the annual value of Australia's assigned amount (1999, p. 5). If that were the case, then 10% of this figure amounts to $1.2b or less than half a percent of Australia's annual imports and exports, hardly an amount that would be a destabilising quantity of trade. Provided it occurred gradually, this extent of trade could rise substantially without undue economic disruption.

There are some costs in doing away with carbon trading. It is true that one does not need physical international trade (only international agreement on price) to equalise marginal abatement costs across economies. Nevertheless investment must be funded. And removing carbon emissions permits from the international trading system can conceivably constrain funding options for carbon abatement.

A firm may wish to invest in country A to sequester carbon which its new project in country B will emit. The two projects considered together are globally emissions neutral. A trading system would provide the most direct way in which the firm could guarantee that its balancing physical emissions expansion and abatement cancelled each other out financially as they do physically. Perfect markets would obviate the need for any direct financial link between the two physical projects. But markets are not perfect. There will be circumstances in which this financial equivalence is an inadequate

substitute for direct trade.[4] Without such links some of the lowest cost carbon abatement projects may go unfunded.[5]

There are some other problems. At some stage after allocation of emissions endowments, some countries may have a cost of abatement that is sufficiently low that the supply of endowments is not exhausted at the international price. In this case no-one in such countries is paying the marginal carbon tax and the value of the domestic emission endowments of these countries falls below the international price of emission endowments and the economic efficiency of the global carbon abatement effort suffers.

Yet if this degree of change was going on in such a country it is likely to be going through relatively more structural change than other countries on behalf of the global climate effort. In such circumstances it may be more equitable for other countries to make some contribution to that greater level of adjustment. This is exactly what they would do if they were purchasing that country's permits in the international carbon market in the same way that they might purchase any other exports.

Whether this equity argument holds or not, this is one of the few areas in which the McKibbin/Wilcoxen model generates clear inefficiencies over international trading if the latter is practicable. The international carbon market is likely to have much greater depth to fund the purchase of emission endowments in the host country than the government of that country. Yet if the abatement is to take place – and the marginal cost of abatement is to remain equal across countries –someone will have to buy back emission endowments to preserve the global parity of carbon prices.

3.1.4 Engaging the developing countries

As Warwick McKibbin comments, the engagement of the developing countries is "absolutely essential for a successful policy" (2000, p. 5). According to some estimates, the developing countries will have larger

[4] One possibility is that firms will consider that the MW proposal increases their country risk, whereas a direct trading system in which a bilateral 'emissions for abatement' swap has been done would quarantine firms from countries' individual emissions risk.

[5] On the other hand we suspect that McKibbin and Wilcoxen would argue that their own arrangements would reduce country carbon risk. They may be right. What can be said is that different arrangements have different degrees of risk.

emissions than the developed countries by the end of the first commitment period.

Without developing country engagement, a substantial proportion of greenhouse gas abatement by developed countries – and a much greater proportion of Australian greenhouse gas abatement – will simply reflect 'carbon leakage'. Carbon leakage occurs when emissions intensive activity is simply relocated from a country with commitments to a country without commitments. This is not only economically inefficient, and probably actively damaging to the environment – as developing countries often have higher greenhouse gas intensities per unit of energy and output than developed countries. It is also potentially politically disastrous as voters in developed countries see much of their effort being squandered in relocation rather than reduction of emissions.

Yet from the beginning of the UNFCCC process, it has proven to be enormously difficult to get developing countries to take on commitments. Their attitude is that the developing countries have had the benefit of freely polluting the planet for the last 150 years, that they have reaped the economic benefit of doing so, and that it is accordingly appropriate for developed countries to take the lead in addressing the matter. So far it has been a broadly accepted proposition that taking on 'commitments' to binding targets must involve some sacrifice *vis a vis* staying outside the system.

McKibbin's and Wilcoxen's proposal is in this spirit, but moderated by the proposal that the developing countries sacrifice be postponed in the next few years. They propose that developing countries be allowed to issue emission endowments "far in excess of current requirements (2000, p. 5)". This would see the short term price of carbon remain at zero – removing short-term costs in their goods markets. But with economic growth sometime in the future, emission endowments would ultimately have a positive value.

This would limit the amount of 'carbon leakage' taking place – at least in the longer run as investors will factor in the positive future price of carbon in the country in question. It will be seen that while this will shield their domestic goods markets from immediate rises in costs, its whole purpose is to forestall 'carbon leakage' investment for developing countries. Yet this is something that some of those countries see as a benefit for them now and into the next few years.

Further, it is not clear what emission endowments "far in excess of requirements" really means. If the excess were small enough to have a major effect on expectations of future domestic carbon costs for investors, the endowments might be expected to become scarce within – say – ten years. Given their past participation, it seems unlikely that developing countries would accept such a package.

If they were permitted to issue emissions endowments which would not bite for a much longer period, little would be done to prevent carbon leakage in the next ten years. If technology change was more rapid or economic growth more slow than anticipated, a given stock of endowments might miss their intended mark. Being intended to become scarce in – say – 15 years they might not become scarce for 20 or 30 years.

This would mean substantial carbon leakage in investment decisions today, and substantial economic inefficiencies in the global carbon abatement effort well into the next decade. The developing world where so many of the most promising low cost abatement opportunities are located would continue be lost to those wishing to invest in carbon abatement. Further, can international agreements usefully contemplate lying essentially dormant for such lengths of time and retaining their potency for the day the agreed conditions come about?

These considerations lead us to consider the extent to which pressure should be brought to bear on developing countries to make commitments. If some threat of coercion is not used, then at least judging from their participation in the Convention so far, it seems unlikely that developing countries would be tempted by the McKibbin/Wilcoxen proposal even in a fairly generous form. It simply offers to delay imposing costs on them and to impose fewer costs on them than a more niggardly regime.

We believe that given their conduct to date, it may well be necessary to force developing countries to commit to targets. If so the McKibbin/Wilcoxen scheme could be considered as one of the possible schemes which we might seek to foist upon them.

Nevertheless there is one alternative which offers an opportunity to engage the developing countries by making it worth their while to participate without coercion. The architecture for doing so – indeed a specific precedent – is provided within the Kyoto Protocol. For if the developing countries were provided with excess permits, *and allowed to trade them with other*

countries, then they would be acquiring an asset with an immediate value which could offset or indeed outweigh the long term cost of commitments.

This is how Russia was brought into the Protocol. The entitlement of 100% of 1990 emissions it received in the Protocol was known at the time to be well in excess of its own domestic needs. This generated a dilemma. On the one hand Russia's surfeit of emissions entitlements meant that if it could not trade them, its firms would face inadequate incentives to abate carbon. This would be particularly unfortunate – ie inefficient – given Russia's abundance of low cost abatement opportunities. On the other hand if Russia did trade its surplus entilements, the constraints which the Protocol imposed on other countries to reduce their emissions would be relaxed.

The Russian model offers the template for a proposal that might be capable of drawing developing countries into commitments of their own volition. Provided the 'commitments' they undertook were sufficiently in excess of their current requirements, and provided trade was allowed, it would be in their own interests to take on constraints into the future in return for the benefits of selling their excess permits to other countries in the short and medium term.

It needs to be understood that providing more emission entitlements to developing countries requires *ipso facto* that the developed countries give themselves that much *fewer* entitlements if any given global emissions target is to be achieved. Over time, this is the case with or without international trading – although, the logic of scarcity emerges more immediately with international trade.

If developing countries were to be encouraged into the system a la Russia, the international sale of entitlements "far in excess of their current requirements", could generate destabilising capital flows. Accordingly phasing options should be considered.

3.2 Weaknesses

There are some aspects of the McKibbin/Wilcoxen plan that we regard as clear liabilities.

3.2.1 One gas not three

The plan attaches to carbon dioxide from fossil fuel burning only, not carbon dioxide from other sources and the other two gases putatively covered by

the Kyoto Protocol. McKibbin and Wilcoxen's justification for this is a technical one. They believe that current science is inadequate to allow other gases to be included in the regime. They may be right, but it is a strange call for them to make for the following reasons:

1. The decision is best left to others whose expertise lies in this area;

2. From the perspective of economically efficient design, whatever can be practicably included in the regime without fundamentally impairing its integrity should be included – as the broader the base over which the carbon abatement effort is waged, the more efficient it will be. While carbon dioxide emissions from fossil fuel burning represents some of the easiest emissions to capture within a trading system, there are plenty of other emissions including emissions of other gases which do not present insuperable practical difficulties. Indeed this reasoning suggests that the Kyoto Protocol should not arbitrarily be restricted to three gases, but rather to whatever it is practicable to measure with integrity. For instance a wide range of emissions of the three Kyoto gases and indeed others such as perflourocarbons can be monitored with a reasonable degree of accuracy – this is particularly so of industrial emissions. (See the appendix for more on this point).

3.2.2 Perpetual rights to emit, freely allocated

There is an elegance about setting up a carbon market with a clean mix of fixed price (floating volume) and floating price (fixed volume) permits.

However it involves some large costs.

Firstly the distribution of emission endowments will generate inevitable inequities. Persons and firms in existence at the time of the one off allocation will benefit at the expense of persons and firms who are not yet in existence. Thus a baby born on one day will acquire a windfall of several thousands of dollars – possibly above $10,000 dollars, and a baby born the next day will receive nothing. This should be recognised as politically untenable.[6] It will also be easy to attack. Environmentalist opponents of the

[6] A number of possible variations could be considered to alleviate this problem but they are all likely to require watering down the principle of privatising emission endowments in perpetuity (particularly those given to the populace).

plan can attack it as compounding the way in which past and existing generations have been 'mortgaging the future' for unborn generations.

Perpetual endowments would not only be perceived by many as inequitable – at least in the way they are allocated. There is a strong argument that they are also inefficient. Even with the level of uncertainty about the science and policy of greenhouse, discount rates applied to these rights in the private capital market would be well below the right discount rates. What amount would a private buyer today pay for that part of the endowments providing rights to emit from 2025? Very little indeed, and yet they are a valuable social resource.[7]

Put another way, the existence of negative externalities from emitting carbon provides the state with a super-efficient means of raising revenue. Most revenue raising depresses desirable economic activity. Thus stamp duty on houses depresses house building activity, income tax reduces the incentive to work and so on. Revenue raising from pure rents – such as occurs when electromagnetic spectrum is auctioned – arguably does not have any adverse economic effects at the same time as raising revenue. When properly designed, environmental taxes go one better. Most taxes change the pattern of economic activity. Generally the activity which is taxed is suppressed in favour of other activities. By contrast a tax on pure rent – such as the rent attaching to the right to broadcast over electromagnetic spectrum – has a minimal effect on economic behaviour and so has a minimal effect on economic efficiency. By contrast a tax on a negative externality is super-efficient because as well as raising revenue, it suppresses activity that is harmful.

Both the proposal that emission endowments be in perpetuity and the proposal that they be allocated for free as compensation to industry, forgo

[7] This kind of argument – resting as it does on the deviation between private and public discount rates – can be applied to many other markets where we routinely disregard it. Thus in the 1980s and 90s we have privatised many assets which were previously in government hands. However there are countervailing arguments. When an asset has been privatised, whether it is land or a business enterprise, the owner has an incentive to develop it and this may outweigh any loss in value associated with the higher discount rate of the new private owner. However carbon permits cannot be 'developed' in this way and they are entirely fungible against all other carbon permits. This still leaves an argument about ensuring the certainty of investment incentives for users of the permits which is discussed below. But providing they can be given that certainty, emitters have no interest in holding any *particular* permits.

an opportunity for efficient revenue raising, and so an opportunity to reduce or remove more inefficient means of raising revenue.

It may be that such compromises are necessary to win political approval for a course of action. If that is the case however the policy advising bureaucracy is one of the critical players. It would vehemently oppose the issuing of emission endowments in perpetuity. It would do so principally because of the risk it exposes government to buy back emission endowments sometime in the future in response to a change in Australia's negotiated assigned amount. It would also argue that permanent endowments, particularly when given away, squander a precious means by which the tax system might be made more efficient.

It is for analogous reasons that governments typically auction spectrum rights for finite periods – often 15 years – rather than in perpetuity.

3.2.3 What's necessary, what's optional

Fortunately a substantial number of the weaknesses of the McKibbin/Wilcoxen proposal come from policy preferences or political judgements of the authors that are not central to their essential proposal.

CO_2 from fossil fuels only

Thus there is nothing about the McKibbin/Wilcoxen proposal which requires that it be applied to carbon dioxide from fossil fuel emissions only. If they are right about the technicalities they can win that argument on its merits rather than build it into their own hybrid model.

However we would add our own opinion here that it is critical for the ongoing dynamic efficiency of the global carbon abatement architecture that it actively accommodates new abatement, verification and auditing technologies as rapidly as practicable. This is a critical point that economists should be stressing about institutional design. Without it we run the very real risk of narrowing the comprehensiveness of our abatement effort quite unnecessarily. In principle we should not really be specifying what is 'in or out' at this stage, so much as establishing a system whereby more and more things can come into the system as soon as it becomes practicable to admit them.

Creating perpetual emissions endowments and giving them away

McKibbin and Wilcoxen have proposed that domestic governments decide what proportion of their domestic carbon market should be accounted for by marginal carbon taxation (annual emission permits in their terminology) and what proportion by emissions endowments.

Their proposal for perpetual emission endowments appears in part to be an appeal to elegance. Their proposal as to how to distribute the endowments appears to reflect a particular political strategy. But neither are essential to their proposals.

4 Other hybrid options

Because their proposals are so valuable, McKibbin's and Wilcoxen's embellishments should be dropped from the package and seen for what they are – one possible way to implement a scheme which embodies the essential insights embodied in their proposal. Their embellishments are one possible response to the vicissitudes of the political economy of climate change.

Any number of alternatives would be as efficient. Indeed we have argued that some variants would be both more efficient and more equitable. Options which would be as efficient as the McKibbin/Wilcoxen proposals (or more so) include a set of full domestic carbon tax regimes all set at an internationally agreed level. Such options extend to a wide range of emissions permit regimes to facilitate domestic trading with 'marginal' carbon taxation above some internationally agreed price. Apart from guaranteeing the price of carbon at the margin, each country could come to its own arrangements as to how carbon emissions were to be domestically rationed, and how the rents from such rationing were to be shared.

Put another way, providing the carbon tax continued to be paid at the margin and so set the marginal price of carbon within the domestic economy, each country could set up whatever (infra-marginal) domestic trading, taxation or regulatory structure it wished.

In our view the most economically efficient companion to the marginal carbon tax would be a set of longer lived carbon permits. The bulk of them should range in tenure from 5 years to 20 years with a few longer-lived permits issued to satisfy the needs of highly carbon risk averse investors and generate a more fully informed market. The government is unlikely to

be prepared to shoulder all the 'renegotiation risk' and markets will not be good at pricing 'renegotiation risk'. Accordingly, some (probably most) of the permits should be devalued (in terms of the tonnage of emissions they permit) in the event of Australia's assigned amount being reduced. Nevertheless if some permits were issued designated in tons this would provide valuable information about the markets' perception of 'renegotiation risk'.

Other things being equal, it would be most economically efficient to auction these permits (probably over a period of time to avoid making too great a call on the capital markets at any one time). However other things may not be equal and McKibbin/Wilcoxen's proposal to give them away to various parties (we would add selling them at concessional rates as a possibility) may help facilitate the political compromises necessary to establish an efficient scheme.

This leaves the question of what role some kind of 'safety valve' played by a marginal carbon tax might play in an international system which did involve international carbon trading. Little thought has been given to this issue, but it does not appear particularly difficult. A 'safety valve' of a domestic marginal carbon tax would not create any intractable administrative complexities and would add some economic rationality if overlaid on the mechanisms of the Kyoto Protocol. The Protocol itself permits the use of taxes and/or permits to achieve its aims.

Accordingly, particularly given how few countries appear to be on course to meet the spirit and letter of the Kyoto Protocol, simply adopting a carbon tax 'safety valve' could be considered as a strategy by Annex 1 countries as part of the suite of measures to meet its commitments. Certainly no Annex 1 country of which we are aware has in place domestic arrangements which guarantee it will meet its volumetric commitment as specified in the Protocol. It would be a worthwhile objective for business and responsible environmentalists to seek to ensure that any renegotiation of the Protocol explicitly allows for some safety valve in a hybrid system.

In the context of an international trading system, a series of marginal domestic carbon taxes would have complex effects on the flow of income arising from payments for emissions. Without such a 'safety valve', firms in a country might have to purchase permits on the international markets to fund emissions expansion. Under the safety net proposal they would have the option of simply paying a domestic tax. It is possible that this option curtails some beneficial international investment (in particular the abatement

activity in the other country which the purchase of the permit would bring about), and it would change international income flows. It would generally be in the interests of a country to capture any payments of emission rents to its own economy rather than pay another country for the privilege. This motive – along with the simpler one of seeking to permit greater emissions – could encourage a 'race to the bottom' in the rate of marginal carbon taxes, illustrating the need for some international co-ordination.

5 Conclusion

Where does all this lead? Ultimately to the kind of vision sketched out by Kopp, Morgenstern and Pizer in their paper for the think tank 'Resources for the Future'. International negotiation on global climate change would focus on two variables. A long term target and a 'safety valve' which provided a pre-set point at which some flexibility was introduced into the system as a result of costs rising higher than expected or agreed.

Of course this can always be painted as a kind of 'watering down' of potentially purer environmental objectives. But this is quite misleading. Though the quote which appears at the head of this paper seeks to promote a hybrid system, it gives away much too much to its opponents. The aim of any negotiation towards a hybrid approach should be to share the dividend of greater policy efficiency between those seeking to avoid costs and those seeking to maximise action. Because an 'hybrid' system enables us to target the costs of action more precisely it enables us to be more ambitious with our targets.

Appendix: A comment on certainty and the trading system

Sub-section 3.2.1 argued that the trading system should not arbitrarily exclude sources or sinks of carbon unless it is clearly impracticable to include them. Many people have argued – or rather they have simply assumed – that there needs to be a high degree of certainty before a sink or source should be included in a trading system.

But it is not clear that there needs to be all that much certainty in measurement of outcomes. What is necessary is that if an estimation procedure is used it does not produce a biased estimation and that the procedure has integrity – it does not increase the scope to cheat. Thus for instance, if we could only be certain within a tolerance of 20% of how much carbon (measured in GWPs) a particular project would abate, it would increase the comprehensiveness of the abatement effort to include it in the trading system secure in the knowledge that:

1. It was making a beneficial contribution to abatement;

2. Given the unbiased nature of any estimation, any error could just as easily produce better rather than worse environmental outcomes and that;

3. Over time and over a large number of projects such errors would tend to cancel each other out.

If such reasoning were not accepted it would be far better to discount the project by the extent of any uncertainty rather than see its abatement potential go unfunded because it fell out of the carbon abatement market.

However widely or narrowly we draw the trading net at the outset, an in principle commitment to extend it at the earliest practicable opportunity and institutions capable of so doing should be an important design element of the system.

There is a sound case for such an in principle commitment to 'pragmatic comprehensiveness' in any circumstances. But the issue takes on much greater relevance when one considers the importance of technological change in meeting our objectives.

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