committee for economic development of australia

A Taxing Debate

The forgotten issues of climate policy

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About this publication
A Taxing Debate: The Forgotten Issues of Climate Policy

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About CEDA
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Introduction

For over 50 years CEDA has played an important role in driving robust debate on important economic issues of the day. Over that time, few issues with such significant long term implications have been as divisive as climate change.

The wrong model could have serious consequences for Australia - right down the chain, impacting on industry, jobs and households. However, the right model at the right time could set Australia up as a global leader and maintain our standard of living now and in the future.

Climate change, and our response to it, has been a topic of considerable interest to our members and while we have heard intelligent and in-depth debate at CEDA events, this has largely failed to be matched in the public arena.

While there is bipartisan support for action from all sides of politics in one form or another, from a market based approach such as a carbon tax or ETS to direct action, the models being proposed have fundamental flaws that unnecessarily risk or penalise Australia's economy.

The following policy perspective does not seek to provide the answer but to highlight key flaws and issues that have failed to be properly debated and provide options to address these issues before a final model is adopted.

These policies were originally put on the table for discussion just prior to Copenhagen in 2009 and it is interesting to note that many of the key issues raised in 2009 have still failed to be addressed.

These chapters address issues such as a consumption versus production based climate policy, the flaws of transitioning to an ETS, and how Australia can implement policies that do not undermine the nation's international competitiveness.

There is no doubt that as the world responds to climate change Australia, as a significant industralised nation, needs to play a key role in this response and in fact has the opportunity to take a global leadership position – providing policy that other nations can use as a best practice model.

CEDA supports climate change policy action but it needs to be well thought out policy actions that achieve tangible benefits. Unfortunately, the current debate seems locked in headline grabbing extremes, while critical questions remain unanswered.

What is in the best interests of all Australians is a balanced and sensible debate on climate change. This will ultimately provide the best opportunity to deliver a course of action that balances the future economic prosperity of Australia with taking timely action to reduce our environmental footprint.

This policy perspective is part of ongoing work by CEDA on issues around climate change through our event series and a major energy research paper due to be complete in April next year.

CEDA hopes this policy perspective will be a valuable contribution to this debate.

Professor the Hon Stephen Martin
Chief Executive, CEDA

The Forgotten Issues of Climate Change Policy: A CEDA policy perspective

The government is considering implementing a carbon tax on production in Australia from 1 July, 2012. The intent of the current proposal is to reduce Australia's contribution to global greenhouse gas emissions, referred to collectively as 'carbon'.

While all policy details are yet to be determined, it is anticipated the carbon tax will last for a three to five year period with the price increasing annually at a pre determined rate. At the end of the fixed price period, the intent is for the system to convert to an emissions trading scheme (ETS). The ETS will operate in a manner similar to the previously proposed Carbon Pollution Reduction Scheme (CPRS).

The CEDA report *A Taxing Debate: Climate policy beyond Copenhagen* (2009) raised a series of questions about the CPRS that remain unaddressed. Three of the most critical questions are:

- What is the right base for carbon reduction policies?
- What is the best way to engage market forces in reducing carbon emissions? and
- Is a price or quota mechanism most appropriate for dealing with carbon emissions?

In the following three chapters, Geoff Carmody, Dr Michael Porter and Professor William Nordhaus address important aspects of the global climate change policy that are currently missing from the debate. The paper by Carmody offers new perspectives on the current debate while those by Porter and Nordhaus are reproductions of their original papers from 2009.

Among other issues, Carmody addresses the efficiencies of a carbon tax and how it could be applied in an Australian context, Nordhaus details the complications arising from the political nature of an ETS, while Porter discusses the issues associated with variability of the ETS as a financial derivative.

An overview of the key elements of their chapters is below.

National emissions consumption versus production focus

Greenhouse gas emissions caused by humans are associated with, and embedded in, economic activity. Attempts to reduce the carbon emissions intensity of economic activity can be focused on domestic production or domestic consumption. The first, measured by gross domestic product (GDP), includes exports and excludes imports. The second, measured by gross national expenditure (GNE), includes imports but excludes exports.

Policies designed to limit carbon emissions by focusing on domestic production (GDP) are only effective when undertaken in a harmonised global context. Unfortunately, the 1997 Kyoto Protocol (and Rio before it) envisaged non-harmonised national action, at least between developed and developing countries.

The inefficiency of production focused climate change policies has been highlighted in a number of studies. One, by Peters, Minx, Weber and Edenhofer (2010), found the European Union reduced annual domestic production of CO_2 emissions by 280 mega tonnes between 1990 and 2008. However, in 2008 the EU had an additional 181 mega tonnes of CO_2 embodied in its imports when compared with imports at 1990 levels. This meant that 65 per cent of the carbon removed from the EU economy was simply released elsewhere.

A similar pattern has emerged throughout the world. While many industrialised countries have stabilised domestic carbon emissions, those in developing nations have doubled since 1990. Meanwhile, the net emissions transfers via international trade from developing to developed countries increased from 0.4 gigatonnes of CO_2 in 1990 to 1.6 gigatonnes of CO_2 in 2008, exceeding the Kyoto Protocol emission reductions.

As a net energy exporter, Australia will be particularly penalised by a production focused carbon emissions abatement policy. Peters et al (2010) found Australia had 56 mega tonnes of carbon embodied in its exports, representing over 15 per cent of the nation's annual production of carbon. Much of the carbon embodied in Australian exports has the potential to displace higher carbon emissions sources elsewhere. For instance, Australia's LNG projects have the potential to abate approximately 40 to 50 million tonnes of carbon a year. A further 20 million tonnes can be abated from coal seam methane exports.

A carbon tax based on the domestic production of carbon would penalise Australia's energy exports and may make more carbon intensive energy sources more competitive, indirectly increasing global carbon emissions.

If policies to reduce carbon emissions are to be meaningful, in the absence of a harmonised global agreement, then they must address imports. Australia can be a world leader on climate change by showing how effective policy can be adopted to mitigate carbon emission regardless of international agreement. This can occur if the carbon tax is applied to domestic consumption of embodied carbon. Such a tax could be applied in a similar manner to the Goods and Services Tax (GST).

A political construct, not a market

A fundamental problem with an ETS is that it does not represent a real market but a political construct developed to create artificial scarcity over the right to emit carbon dioxide. The value of this right is entirely dependent on political decisions that control the level of supply to the market.

The inevitable uncertainty over the cost per tonne of carbon emissions will create considerable variability in prices for carbon emission permits. Professor Garnaut (2011) states that:

> "As soon as the parameters of the scheme are settled, business will focus on making money within the new rules, rather than on securing rules that make them money. That makes it essential that the rules really are settled."

This is accurate for exogenous risks. However, the political nature of the ETS market means businesses have the continuing ability to influence the rules of the market, and politicians have the capacity to adjust them over time. As the right to emit carbon is restricted it will become increasingly valuable, creating greater incentives for businesses to lobby government to achieve favourable market structures. This has the potential to embed a culture of lobbying whereby vested interests will attempt to extract favourable conditions from the political process.

The intention to allow the ETS to import 'carbon credits' will significantly expand political risk given the variability that exists between different governments around the world in terms of honesty, transparency and effective administration.

A direct carbon tax, with a clear escalation schedule, would provide the certainty business requires to continue investing in Australia. A carbon tax that is applied in

a similar manner to the GST, which has been successfully implemented in the past, would remove much of the justification for industry compensation and would reduce incentives for businesses to engage in political lobbying.

The significant advantage of a consumption based carbon tax is that it would enable the widest possible group of market participants to engage in minimising their carbon footprint. The clear price signal of a carbon tax, which could be stated on every invoice in a similar manner to the GST, would be explicit for market participants at all stages of the production process. This would enable them to take concerted actions to reduce their carbon footprint.

Quotas versus price

How to effectively deal with climate change depends on the nature of the costs and benefits of mitigation. When environment benefits are highly non-linear compared to costs, then quantity regulation is the most effective method of achieving a desirable outcome. However, when costs are non-linear compared with benefits, then a price mechanism is the optimal policy choice for achieving a desired outcome (Weitzman 1976).

The bipartisan climate change policy support that does exist is to reduce Australia's annual carbon emissions by 5 per cent by 2020 from 2000 levels. This represents a quota based approach to carbon emissions. Unfortunately, the environmental challenge of climate change has a very strong non linear relationship between costs and benefits. The benefits from mitigation relate to the stock of greenhouse gases, which have accumulated since industrialisation. In contrast, the costs of mitigation are related to todays flow of emissions.

This implies that the marginal costs of emissions reductions are highly sensitive to the level of reductions while the marginal benefits of emissions reductions are insensitive to the current level of emissions reductions.

The ETS may be attractive as it represents a 'tangible' contribution without a quantified financial cost. Unfortunately, if the costs of an ETS applied quota result in mitigation costs significantly disproportionate to benefits, then long term community willingness to support the program would be problematic. Australia's climate change policy should use price mechanisms to achieve an efficient outcome.

Australia's fair share

Professor Warwick McKibbin and David Pearce provided important context for climate change policy in the original *A Taxing Debate: Climate policy beyond Copenhagen* (2009):

> "When Australia's climate policy starts to bear fruit, today's political leaders will be distinguished elder statespeople, and the prime minister will be someone who hasn't been born yet… based on the typical life cycle of large firms, the current big players in the market won't exist."

Given the long term implications of climate policy, it is critical that it is done well regardless of how long it takes. Unless climate change policy addresses the issues raised in the three attached papers it will not be successful.

The proposed Australian carbon tax and ETS on production will undermine Australia's international competitiveness, act like a "GST from hell," fail to make an efficient contribution to the global climate change problem, and encourage other countries not to mitigate their own emissions.

A carbon tax, levied on consumption and implemented in the same manner as the GST, would incentivise the maximum number of market participants to reduce their carbon footprint. It would quantify Australia's contribution to global climate change mitigation and show a way forward for nations to take meaningful action independent of an international agreement.

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1. Consumption-based emissions policy: A vaccine for the CPRS 'trade flu'?

Geoff Carmody is Director, Geoff Carmody & Associates. He was the co-founder of Access Economics in 1988 and continues contracting work with that Company.

Before then, he worked in key policy areas in the Federal Treasury, including Budget, wages and foreign investment divisions. He represented Australia at the IMF and later at the OECD.

He has been an advisor to the Business Coalition for Tax Reform since the mid-1990s. He was a Panel Chair of COAG's Energy Reform Implementation Group (ERIG) that investigated practical reform options for Australia's electricity markets and reported to COAG on this matter in January 2007. Geoff was appointed as Chair, Sustainable Budget Commission, in South Australia, in June 2009. This engagement continued until just after the final report was delivered to the South Australian Government in early September 2010. From early 2008, Geoff has developed and refined an alternative, market-based approach to reducing greenhouse gas emissions should these be considered a threat to the global climate. This is a national emissions consumption model, using either a carbon tax or an emissions trading scheme.

Please note this chapter is a revised and updated version of Geoff Carmody's paper produced by CEDA in 2009. The chapter includes a new assessment of the current options. In addition this chapter identifies the best national emissions base for policy and how Australia could adopt policy action that does not undermine the nation's international competitiveness. It also discusses global emissions abatement targets and their allocation among countries. These issues have not been addressed in the current debate around climate policy in Australia.

Introduction

The debate about climate policy design isn't over. At least three issues are unresolved.

First, given the current proposal to start with a carbon tax and then transition to an emissions trading scheme, is an ETS better than a carbon tax? Here, a carbon tax is favoured. It delivers emissions reductions with less (or no) 'wastage' via 'emissions shuffling' (more politely called 'emissions trading'). It is better at delivering predictable carbon price increases, clearly and consistently signalling the need to shift investment towards lower emissions technologies. This signal is required for a switch to a low-emissions economy.

Second, the policy instrument question (ETS vs carbon tax, etc) is far less important than the emissions to which the instrument applies. That is, the most important debate by far is about the best national emissions base for policy.

The contenders are national emissions production and national emissions consumption. Either works under the very first policy idea leading up to the 1992 United Nations Framework Convention on Climate Change (UNFCCC): a globally applied carbon tax. Sadly, this idea didn't survive the 1992 UNFCCC. Worse, under the 1997 Kyoto Protocol, non-harmonised national action was formally approved. A national emissions production base will fail under this differentiated approach. 'First movers' suffer competitiveness losses compared with 'late movers'; effectively taxing their exports and subsidising their imports. This negative protection generates activity and job losses for little or no net reduction in global emissions. That's what the global hullabaloo about 'trade-exposed' industries is all about. That's why the Kyoto Protocol failed.

An emissions consumption policy base neutralises adverse trade competitiveness effects, and is World Trade Organization (WTO) compliant. The prisoner's dilemma – the 'I'll cut my emissions after you cut yours' syndrome – is no longer an impediment to a global deal.

Australia's main role should be to adopt a policy model that all countries can adopt as soon as possible. Anything else would be irresponsible. A national consumption-based model provides a solution to 'trade exposed' industry concerns and it would greatly improve odds for a global deal.

The third debate is about global emissions abatement targets and their allocation among countries. Carbon taxes and emissions trading schemes rely on the price of carbon as the instrument to deliver abatement outcomes. National carbon prices are the true measure of national emissions abatement efforts and deliver appropriate burden sharing. Under a uniform global carbon price, countries with large, high-emissions energy sources, and high-income countries with high per capita consumption (and carbon footprints to match) face the largest adjustment burdens. This seems fair. It's also reasonably easy to monitor.

A national emissions consumption-based carbon tax best delivers all these outcomes. This is a viable path to where the global community started: the original vision of a uniform global response.

1. An ETS for Australia in 2015: what's the problem?

Suppose the Australian government actually told voters it would introduce a new GST, but with a really nasty twist. Unlike all other GST systems, this new GST:

- would apply to Australia's exports;
- would fully exempt Australia's imports; and
- would be introduced unilaterally, that is, regardless of what other countries do.

You might think this would be crazy. It would. The Howard Government introduced a GST, but it *exempted* exports and *taxed* imports. The 'nasty' GST outlined above amounts to *negative protection* – 'the GST from hell'.

The Australian government's carbon tax/ETS proposal will operate just like that. It will affect Australian exports and exempt its imports, rather than the other way around. Naturally, this reality is not highlighted in government information on the CPRS or ETS, but it is the reality. This is also the reason for all the deals for (an arbitrarily select group of) emissions-intensive trade exposed (and other) industries. An ETS entrenches a culture of business lobbying for distorting, efficiency sapping 'special deals'.

Smart countries won't adopt policies delivering *negative protection*. In the 14 years since the Kyoto Protocol policy model was 'agreed', the evidence supports this conclusion. Australia shouldn't, either.

Negative protection is the reason why the CPRS – and the European model on which it is loosely based – were not well received. This paper explores more globally acceptable policy alternatives.

2. Focus: a policy model where the economics actually *work*

This paper leaves the debate about the physics of climate change to professional scientists, but it does assume:

- global warming is happening and that man-made contributions are significant;
- emissions can be measured; and
- policy action can reduce the severity of this problem.

Given these assumptions, it is accepted that a global policy response is needed, something so far lacking. Indeed, securing a genuinely global, comprehensive policy deal should be the 'main game'.

This paper focuses on climate change policy design, having particular regard to the real-world context in which it must be applied, and paying particular attention to incentive effects associated with different policy models.

At the outset, it should be emphasised that the hand-wringing summarised in what Ross Garnaut labelled the 'prisoner's dilemma' is no longer accepted (Garnaut 2008, xviii). This notion – more accurately summarised as the 'I'll cut my emissions after you cut yours' syndrome – is largely if not wholly a product of poor government choices about the appropriate policy model under the 1997 Kyoto Protocol. It is not, as some would have you believe, some sort of global 'market failure'.[1]

The main themes are as follows:

- The policy model chosen must reflect the context in which it will be applied. In particular, a model suitable if all nations act together; it may well fail if they do not.
- Economic incentives associated with the policy model chosen, also determined by the context in which it is applied, can have powerful effects hampering the securing of a global deal. Indeed, these incentive effects are central to an understanding of the failure of the 1997 Kyoto Protocol to date (and, probably, in future).

3. The vision leading up to the 1992 UNFCCC: a consistent policy model

What are the lessons of history?

One of the very first climate change policy models envisaged in the lead-up to the 1992 UNFCCC made sense. That model:

- focused on national production;
- was applied by all countries at the same time; and
- was a globally harmonised carbon tax.[2]

In this context, a national production-based model was fine.

Because all nations applied the same carbon tax at the same time, there were no adverse national incentive effects, even using a national production model. By definition, the 'I'll cut my emissions after you cut yours' syndrome did not apply.

4. The 1997 Kyoto Protocol: a *really* dodgy detour or just the son of UNFCCC?

The 1997 Kyoto Protocol white-anted the internal consistency of the pre-UNFCCC vision in two ways:

- An ETS mechanism for putting a price on carbon emissions replaced the carbon tax (at the insistence of the United States (US) which, under George W Bush, then 'jumped ship'). The ETS, per se, was no great disaster. It was just messier and reliant on governments having the courage to limit emissions permits enough to impose a

significant carbon price. But combined with the other change (see below), it helped secure policy failure.

- More important by far was the formal agreement that different countries could implement climate change policies at different times (ie the rich developed countries were to act first and others, some time later).

In particular, this second change to the original vision set the Kyoto Protocol up for failure because the original national production-based policy focus was retained under Kyoto. The internal consistency of the original pre-UNFCCC policy model was shredded. The combination of a national production-based model and non-harmonised national action produced the 'I'll cut my emissions after you cut yours' syndrome. Ross Garnaut's prisoner's dilemma is really a government policy failure, not so much a market failure. The policy failure was choosing the wrong policy model.

The rest of the story is well known. Efforts to secure a global climate policy deal under the terms set out in the Kyoto Protocol in 1997 have since foundered. They have:

- degenerated into national posturing and moralising, including at international fora; plus
- fruitless and unresolved arguments about national burden-sharing (see below); plus
- *ad hominem* attacks, bordering on quasi-religious frenzy in some cases; plus
- non-transparent, tendentious policy analysis (including by governments and in Australia); and
- adoption by some of the targets set in the far distant future without credible measures to deliver them.

The Kyoto Protocol has been a cynical politician's dream. Promise the earth *beyond* your term of office and *never* be held accountable for delivery.[3] The now-rejected delayed CPRS is a good example.

5. Some basic emissions accounting relationships

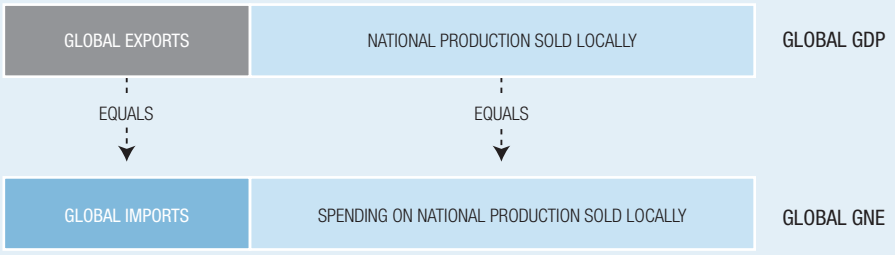
The sorry history just summarised is more easily understood if some basic emissions accounting relationships can be grasped.

First, anthropogenic greenhouse gas emissions are associated with, and embedded in, economic activity.

Second, economic activity can be measured in three ways under national accounting systems. It can be measured via national production (GDP), via national expenditure (GNE), or via national income. The first two of these, especially, provide industry and product-specific measures of economic activity. Combined with good carbon accounting frameworks (still a global work-in-progress), they can be used to measure national production of, or expenditure on (consumption of), greenhouse gas emissions.

Third, by definition, globally, national production and expenditure (and income) add up to the same thing. (If they don't, a 'statistical discrepancy' is added to make sure they do.) Figure 1 below illustrates this global equivalence between GDP and GNE.

FIGURE 1:
EMISSIONS EMBEDDED IN GLOBAL GDP = EMISSIONS EMBEDDED IN GLOBAL GNE



Note also that globally, exports must equal imports (absent interplanetary trade and helped by a 'statistical discrepancy' as needed). It follows, by definition, that there are at least two paths to reducing global emissions: by targeting national production of emissions via a GDP-based policy, or by targeting national consumption of emissions via a GNE-based policy. Globally applied policies targeting either path can produce the same global emissions abatement result.

The 1992 UNFCCC model chose national production as the target. It could have chosen national consumption (emissions embedded in GNE) as the target. Either would be equally effective if all countries acted at the same time using the same policy instrument (eg, a globally harmonised carbon tax.) Under the pre-UNFCCC global carbon tax model, choosing production or consumption as the policy target didn't matter.

But Kyoto (and before it, the UNFCCC) allowed for non-harmonised national action. From 1992, and especially from 1997, the choice was crucial. The wrong choice – national production – was made.

Figure 2 below illustrates the problem thrown up by the Kyoto Protocol (for example, for Australia).

FIGURE 2:
EMISSIONS EMBEDDED IN NATIONAL GDP ≠ EMISSIONS EMBEDDED IN NATIONAL GNE

Under a national production approach, a carbon tax (price) applies to a country's exports, not to its imports. Any country acting unilaterally effectively imposes a carbon export tax and offers a carbon import subsidy. This is a policy imposing *negative protection* on its national production. Its trade competiveness is undermined compared with countries not taking the same action.

Under a consumption approach, a carbon tax (price) does not apply to a country's exports and border tax adjustments apply to its imports. Any country acting unilaterally

effectively leaves its export pricing and competitiveness unchanged and, if properly designed, imposes a carbon tax on its imports that is the same percentage of value as that imposed on the competing locally-produced substitutes.[4] This is a policy imposing *zero protection* on its national production. Its trade competiveness is unaffected compared with countries not taking the same action.

This is at the heart of the problem with the Kyoto Protocol.

Non-harmonised national policy action based on a production model is the real-world *policy context*. It sets up 'first movers' for losses of trade competitiveness. It gives 'late movers' a trade competitiveness 'free kick' and in so doing, positively encourages them *not* to follow suit. Worse, the loss of competitiveness shifts activity and jobs – and embedded emissions – to countries not acting, at least at the margin. This 'carbon leakage' means that the net reduction in *global* emissions resulting from 'first mover' action might be very small, zero, or even negative.

These 'incentive effects', derived from the policy context, will likely kill prospects for a global deal.

Why should individual countries act under a Kyoto-type production model? There's no guarantee such action will reduce *global* emissions. It could do the opposite. The only certainty is a loss of trade competitiveness and a leakage of economic activity, jobs and emissions to those countries not acting.

This is the genesis of the 'I'll cut my emissions after you cut yours' syndrome. Applied globally, it means nothing gets done.

6. The policy design reason for the failure of Kyoto

Stripped to its core, the policy design reason for expecting the Kyoto Protocol model to fail is disturbingly simple and obvious:

- As soon as non-harmonised national action became the agreed policy context (eg Kyoto and action, if any, from now on – see postscript below), policy design should have been adjusted to neutralise the resulting adverse incentive effects associated with the initial national production-based focus.
- Specifically, international trade-neutrality should have been immediately restored by switching the policy design to target national consumption of emissions.[5]
- Governments failed to make this essential adjustment to policy design in 1992 and again in 1997. This failure, in Australia and elsewhere, continues.

7. Is a national emissions consumption approach practical?

Opponents of the proposed national emissions consumption-based policy have argued that such an approach is both unrealistic and inconsistent with WTO rules. The second objection is dealt with in the next section. The first is dealt with here.

The basis for the assertion of impracticality is that countries cannot know the emissions intensity of imports and therefore cannot know what border tax adjustment to make to them. If that objection were valid, it would be a heavy blow against a consumption approach.

However:

- This criticism is irrelevant.
- The only data needed to calculate the appropriate Australian border tax adjustment (BTA) for a specific import are (i) the Australian carbon price (or tax), expressed in AU$/tonne, and (ii) the Australian emissions intensity of the locally-produced version of the imported product concerned (measured in tonnes per unit of product).
- No overseas information is required. The same Australian information will be required or available (eg, for monitoring) under an Australian production-based approach anyway.
- These two pieces of information, multiplied together, deliver a carbon cost in Australian dollars per unit of the product concerned.
- Dividing that carbon cost by the carbon cost-exclusive price of the Australian-produced product delivers an ad valorem equivalent carbon cost adjustment (as a percentage rate based on the carbon cost-exclusive price).
- This same derived percentage rate is then applied to the imported substitute as an ad valorem equivalent border tax adjustment (BTA), just like a GST.
- Attempts to tax imports at *different* ad valorem equivalent rates than locally produced substitutes (especially if higher) would indeed run foul of current WTO rules.
- More generally, carbon costs are recorded as a one-item addition to Australian Tax Invoices. These entitle GST-registered businesses to input tax credits (ITCs) on such costs, as they pass them down the supply chain. At the export point, the carbon cost is also rebated, thereby 'zero-rating' exports. Imports attract an appropriate BTA as described above. In turn, this provides an ITC for business purchases and a rebate when imports feed into exports.
- Ultimately, therefore, the cost passes on to final consumption, just like the GST.[6]

8. Is an emissions consumption approach WTO-compliant?

Designed properly, a national emissions consumption-based climate policy is both trade competitiveness-neutral and WTO-compliant.

The simplest explanation is that the national emissions consumption model should operate in precisely the same way as a product-differentiated Value-Added Tax (VAT) or, as these are labelled in Australia and New Zealand, a GST. See the section above.

Here, the product differentiation solely reflects differing *Australian* emissions intensities in production.

Both VAT and GST systems are trade competitiveness-neutral and WTO-compliant.[7]

9. A qualitative evaluation of policy alternatives: broad policy design principles

In order to evaluate alternative policy options, it's useful to set out some principles to provide a framework for such an assessment. The 1992 UNFCCC goal: *Stabilising greenhouse gases at levels that would prevent dangerous anthropogenic interference with the climate system* should be the preamble for any analytical framework. We need to know where we are going.

Acceptance that countries probably won't act simultaneously should also appear in the preamble. We should recognise reality, not be mugged by it.

An agreed framework of principles to guide policy design comes next. The following seven principles might seem like obvious 'motherhood' statements. That's good. It means there's a good chance countries can agree to them.

National policies should:

1. Raise relative prices for carbon, but minimise effects on real national incomes.
2. Make the same contribution to lower emissions globally as they do nationally.
3. Minimise 'free rider' impediments to a global deal.
4. Be comprehensive to minimise avoidance and internal 'carbon leakage'.
5. Be trade competitiveness-neutral.
6. Allow countries freedom to choose between approaches, subject to principles 1 to 5.
7. Minimise national compliance and administration costs.

Some brief comments on these principles follow:

- The first principle addresses the *instrument* through which broad-based climate change policies must operate: a price on carbon. Emissions must be made costly. The target is an increase in the *relative* price of carbon emissions, not a reduction in real living standards. The intent, as far as possible, is to deliver similar living standards at less longer-term environmental cost.
- The second principle seems obvious, but is worth stating explicitly. Every country must make a *net* contribution to lower emissions relative to business-as-usual (BAU). There is no point in adopting policies that simply shift the same level of emissions from one country to another. Such 'churning' does nothing to deal with the problem to which climate change policy is directed.
- The third principle goes to the heart of the design defects reflected in the failure of climate change policy efforts to date. If 'first mover' countries are condemned to suffer competitive disadvantage relative to 'late mover' ('free rider') countries because of the policy model chosen, a truly comprehensive, global, climate change policy deal will not be consummated. We know this from the evidence of the last decade or so. Global recession won't improve the odds in the future. Policy design must root out 'free rider' or 'late mover' trade advantages as far as possible.
- The fourth principle underlines the need to minimise 'escape clauses' that weaken intra-national policy effectiveness, undermine a principled approach, and invite interminable 'rent seeking' for special 'carve outs' (eg as in Australia and Europe at present).

- The fifth principle is another way of expressing the third and fourth principles combined, but added for clarity. Climate change policy should not be protectionist, either between or within countries. But it should be trade competitiveness-neutral. 'First movers' should not suffer job losses and 'carbon leakage' because they are 'first movers'. Policy must be WTO-compliant, but 'first movers' should not be asked to give a trade 'free kick' to 'late movers'.
- The sixth principle seeks to give individual countries the maximum discretion, subject to these broad principles, in choosing the precise modalities that best suit them in dealing with climate change.
- The seventh principle is self-explanatory. Effective climate change policy, almost by definition, will be one of the most interventionist and detailed engagements undertaken by governments in the operation of their economies ever seen. Policies that secure the largest benefit at the lowest administrative and compliance costs are needed. These costs, at best, will be significant anyway.

This framework allows evaluation of alternative policies.

A production-based model would not comply with principles 1 to 5; whereas a consumption model would comply with these principles.

10. A quantitative evaluation of policy alternatives: a proper, transparent review

Qualitative evaluations are fine as far as they go.

However, for practical policy-making, the best possible *quantitative* assessment of alternative policy options is essential for evidence-based decisions delivering the best benefit-cost outcomes.

In Australia, and elsewhere, the official quantitative assessments that have been published seem to some extent, to be tendentious and incomplete:

- Treasury modelling (at least that which has been published) seems to have focused on long-term 'equilibrium' outcomes, and had little if anything to say about transition or adjustment paths.
- Treasury modelling seems mainly (only?) to have looked at the effects of a loose approximation to the CPRS and not at alternative policy options. This precludes the required ranking of benefit-cost outcomes across different policy options.
- Certainly, such an official benefit-cost ranking has not been published.

That said, Treasury made the following observation in its modelling report (Commonwealth of Australia 2008):

> "[Emission] Allocations based on production are likely to result in higher welfare costs for Australia than allocations based on consumption."

If this is correct – even in long-term equilibrium – what are its full implications? Could it imply likely modelling support for a national consumption base? Is it consistent with Minister Wong's repeated assertions that the production-based CPRS is the lowest-cost policy option for Australia?

We do not need to labour under uncertainty in this area. Rather, we should follow the Centre for International Economics (CIE) Managing Director, David Pearce's recommendation for a comprehensive quantitative review of all feasible policy options (CIE 2009).

11. Conclusion

At present, there are at least three unresolved public debates about the design and objectives of broad-based, price-oriented climate change policies – the debate is *not* over.[8] These debates are as follows:

1. A debate about the best policy instrument, with a carbon tax and an ETS (or some hybrid of the two) as the focus.
2. Much more importantly, a debate about the most appropriate policy base, with national emissions production or national emissions consumption as the likely cost-effective contenders.
3. A debate about appropriate global greenhouse gas concentration targets and national burden sharing of abatement to achieve those targets.

On the first of these debates, on balance, a (relatively) simple global carbon tax is favoured as the most cost-effective instrument for putting a highly visible price on carbon emissions along the entire supply chain to final demand. One of its major advantages is that when imposed as a predictable, increasing cost on emissions over time, it delivers the closest thing to achieving certainty in this area of climate change policy, plus a clear signal to reduce emissions. This is crucial, especially for longer-term investment decisions.[9] An ETS could be made to work but probably at higher cost. The history of the European ETS is not at all encouraging.

On the second of these debates (far more important than that about policy instruments), and as this paper makes clear, a national emissions consumption base is favoured. This base improves chances of securing a comprehensive global agreement. Surely, this must be the 'main game', not least for a relatively exposed, relatively small total emitter like Australia. It also has equity advantages (for those wishing to pursue such matters) relevant to the *burden sharing* debate

The attempts to 'band-aid' over the problems with production models, rather than deal with them in a principled, objective and systematic way, have introduced additional problems for the countries involved. For example:

- The CPRS (Mks I and II, and the current carbon tax/ETS proposal) has generated a frenzy of business lobbying for 'special deals' to insulate them from concerns about the costs of the policy on their operations. Not all these concerns relate to international trade competitiveness. The government has encouraged this frenzy because it announced its intention to do such deals.
- Some of the 'behind the border' industry assistance might, if not actually, be close to being protectionist in nature. (However, if so, Australia certainly will not be alone in this regard.)
- The 'carve outs' proposed under the current model reduce the national production target base at both ends. Some exports are 'carved out'. Some import-competing products are carved out. These 'carve outs' substantially shrink the total production

base actually exposed to the CPRS. Further 'carve outs' – for example, the effective insulation of petrol used in Australia – shrink the target base even further. As a result, any given emissions reduction target is imposed upon a much smaller production base, therefore requiring a much higher carbon price to deliver the same emissions reduction outcome (and increasing the chances that some of this will shift offshore as 'carbon leakage' and job losses). In this context, note that the effective coverage of the European ETS is about 50 per cent of CO_2 emissions and about 40 per cent of total greenhouse gas emissions.

These problems do not arise under a properly designed national emissions consumption-based policy:

- Lobbying for export 'carve outs' is not required as automatically, exports are 'zero-rated'. Lobbying by import-competing businesses is not required either. Border tax adjustments on competing imports match (in percentage terms) the emissions abatement costs faced by the domestic producers of those products. (Note, incidentally, that this does not mean Australia's emissions intensive exports, such as coal, are exempt from the coverage of the climate policy. They are covered under the policies of the consumers (importers) of those products via border tax adjustments in the importing countries.)
- As noted earlier, the consumption model is trade-neutral and WTO-compliant, just like the GST.
- A national consumption (GNE) policy base will be roughly as large as a fully inclusive production (GDP) base. Indeed, especially for large developed economies running large current account deficits, the GNE base can be even larger than the GDP base.

On the third of these debates, accepting the science pointing to specific maximum global atmospheric concentrations as the target (eg 550ppm, 450ppm, 350ppm, or less), it is worth making some brief observations about national burden sharing.

Any translation of global emissions abatement tasks, relative to BAU, into slices which are then allocated to specific countries has not been helpful. Also unhelpful is the alternative proposal (eg by Garnaut) for convergence to equal per capita emissions.[11] These attempts at national distribution of the adjustment burden are zero-sum games about which agreement is almost certain to be impossible, and impractical. There is a better way.

Broad-based climate change policies – carbon taxes, cap and trade measures like the ETS, or hybrids – are all specifically designed to put a price on carbon emissions. *Price* is the policy weapon intended actually to deliver the targeted emissions abatement outcome.

It is therefore sensible to focus on price measures (eg the carbon price or tax in each country) when assessing 'comparability of effort' (and burden sharing).[12] In this sense, separate apportionment of emissions shares is not required. Moving to a uniform global carbon price does this job reasonably fairly (see below).

A focus on national emissions abatement relative to BAU is a difficult practical exercise at best. Measuring and agreeing on the national BAU 'counterfactual' will be problematic, for a start. Current debates about arbitrary historical 'baselines' or starting points from which emissions abatement will be measured are sterile, often self-serving and probably unproductive. Carbon prices and taxes, in contrast, should be relatively easy to discover as policies are implemented.

Even if such national abatement shares could be decided and measured, there is virtually no chance whatsoever that they would lead to similar carbon price levels across countries if they were pursued. Countries differ substantially in their resource endowments, including endowments of high- and low-emissions energy sources. Large carbon price differences between countries will lead markets to shift resources in an effort to eliminate such price differences (carbon cost arbitrage). This incentive-based market response will tend to undermine national absolute or per capita abatement shares, even if these can be agreed, which seems highly unlikely.

For Australia, a global deal on climate change, signified by a substantial and rising global price for carbon, will in any case change global comparative advantage currently enjoyed by some relatively low-cost (as measured) high-emissions energy sources. Selective application of similar carbon prices – as proposed under Australia's CPRS – will not have this effect. Rather, it will simply shift competitive advantage in relation to such resources to other countries not acting on climate change.

For those worried about equity, a *global* carbon price, applied to a national emissions consumption base by each country, delivers the following results:

- First, countries with relatively high endowments of high emissions energy sources (eg coal) will incur above-average adjustment burdens, because their competitive trade advantages based on the (hitherto) low cost of such energy sources will be reduced or eliminated, even when there is no 'carbon leakage'. Australia will probably incur an above-average adjustment burden in this context.
- Second, under an emissions consumption base, relatively wealthy, high income countries with high per capita expenditures on goods and services (and a high per capita consumption of embedded emissions to match), will pay much more in per capita terms than poorer countries. Australia will probably incur an above-average adjustment burden in this respect as well.
- A uniform global carbon price is the practical option for effective policy, for practical measurement and assessment of national emissions abatement effort, and for delivery of a tolerable distribution of burden sharing.
- Finally, a global deal based on a common global carbon price applied to a national consumption base achieves a very important end-result.

Through the consumption path, this deal would take the global community back to where it started: the original policy vision – a globally harmonised carbon tax to reduce emissions.[13]

12. Postscript and update following Copenhagen's failure

The analysis above preceded the Copenhagen climate conference at the end of 2009. That conference was a failure that no amount of *ex post* sophistry can conceal. Developments since then, including in Australia, have tended to confirm that policy in this field remains mired in the morass of government-inflicted poor policy design and the lack of cost-effective action this implies. Some key issues remain outstanding, including those reviewed below.

12.1 The justification for Australian action

Australia contributes less than 1.5 per cent of global emissions. So why should it act much, if at all?

The *only* hard-nosed reason is that Australian action will materially improve chances of securing a global agreement that sees the major emitters, including North America, China, India, etc., also taking action. Without a global deal, cessation of *all* economic activity in Australia will make no significant difference to any anthropogenic emissions-induced global warming.

What empirical evidence do we have that action by Australia will induce others to follow suit? To date this consequence is, at best, assumed and/or asserted, or, worse, ignored. (In the latter case some leave uncorrected the false implication that Australian action alone will save the Great Barrier Reef, the Sydney Opera House, etc.). Reviewing the events in this area since 1992, history is not encouraging. The Kyoto Protocol was ambiguous in principle about when a global deal could be expected, and substantially ignored in practice anyway. A global deal remains uncertain at best and possibly out of reach at worst.

For those advocating Australian action to curb its greenhouse gas emissions (whether based on national emissions production or consumption) this is a key hypothesis in need of proof. To date, there is no such proof, and as a result this key issue, at best, is glossed over.

12.2 Independent cost-effectiveness ranking of alternative policy options

Despite calls from various parties (including myself) there has been resolute multi-party refusal to allow a qualified independent organisation (such as the Productivity Commission) to make an economy-wide cost-effectiveness assessment of all possible policy options for reducing anthropogenic greenhouse gas emissions. The latest Productivity Commission report on action in selected other countries does not address this matter comprehensively.

As a result, different political parties and others have been allowed to assert that their preferred policy option is best. The Labor Party advocates a national production-based carbon tax/ETS. The Coalition argues for 'direct action' (whatever that means in practice) although the Productivity Commission finds this an expensive option. The Greens support anything going (and ignore the PC), arguing for the full smorgasbord, regardless of the cost-effectiveness of specific measures. Some independents support other options. This is a fruitless, unresolved, debate that only continues to have life because nobody is prepared to allow the required examination by an impartial umpire of all possible options, (including, of course, a national consumption-based price on emissions).

12.3 The costs of doing nothing versus doing nothing effective

In Australia we've heard many assertions about the cost of not taking action – even unilateral action – to reduce our greenhouse gas emissions. The cost of 'doing nothing' is claimed to be high (and higher than taking action).

That said, the current political effort seems to be focussed on pricing emissions at a low level – a 'soft start' strategy – and focussing the modelling on that. The problem is that a low emissions price will be ineffective in reducing emissions while adding all the 'deadweight' economic costs inherent in a new tax. This suggests a new question: aren't the costs of doing nothing at all less than the costs of doing nothing effective? Could the Productivity Commission look at this issue?

12.4 Selling the carbon tax/ETS policy: what is needed?

The process of 'selling' CPRS Mks I and II and the current carbon tax/ETS proposal to the electorate has not been handled very well. To be fair, it is a difficult policy to sell. The costs come soon, and the (asserted) benefits accrue only to generations in the distant future.

But suppose we are trying to tell the truth, and encapsulate the message in relatively simple relationships. What is required?

At a minimum, we need quantitative data on at least four relationships, as follows:

- First, the relationship between the cost of emissions mitigation and emissions abated (economists would focus especially on the most efficient cost/abatement trade-off).
- Second, the relationship between emissions reductions and global warming avoided.
- Third, the relationship between global warming avoided and social/economic damage avoided in future.
- Fourth, the translation of future benefits in terms of damage avoided to some present value equivalent that can be compared with present costs of emissions abatement (using some sort of discount rate).

What information do we have on these relationships?

The fact is that we have no robust quantitative information about any of the four relationships listed above. We have much debate about some of them, but no hard data on any. 'Selling' the policy therefore is a task long on assertion and fear mongering (on all sides), and short on detail. We're left with vague appeals to 'the precautionary principle' and 'taking out insurance' against global warming (without any real scrutiny of the fine detail of the proposed insurance policy).

12.5 Ross Garnaut on the national consumption policy model

The current Government's climate change adviser, Ross Garnaut, in principle, seems attracted to a national consumption climate policy – as a policy base, if nothing else. In his *Garnaut Climate Change Review Update 2011, Update Paper 6, 'Carbon Pricing and reducing Australia's emissions'*, he observes:

> "There have been constructive suggestions for seeking special rules that suit our circumstances. Certainly a "consumption basis" rather than a "production basis" for comparing contributions to global mitigation would have suited (Australia) better…"
>
> "…overall a consumption basis for comparing international effort would have been somewhat less problematic for us."

However, Garnaut rejects this policy option on the following single ground:

> "Be that as it may, the days when it might have been possible to persuade the international community to a different approach have long passed. We can think it a pity that we were not more active in international diplomacy when these matters were settled, but that does not allow the history to be re-wound."[14]

In short, Garnaut seems to be asserting that:

- a national consumption-based model is fine in principle, but
- whatever its intrinsic merits, it's too late to have it adopted.

This dismissal is extraordinary. It comes from somebody who, in 'launching' his update reports at a Press Club lunch at the end of May 2011, seemed almost to welcome the demise of the Kyoto Protocol framework, and stressed that 'differentiated national action' was the basis on which future policy would be developed.

In that context, and viewing the wreckage of policy efforts in this area over recent decades, in what possible sense can it be argued that different policy approaches cannot be applied because 'it is too late'? We are considering policy design applicable for decades – even centuries – in the future. We are considering this matter when a global deal still remains to be agreed.

Especially when a production-based policy actually sets up incentives for others not to act, thereby undermining prospects of securing a global deal, the Garnaut dismissal seems quite wrong. It seems to reflect more weight being given to Australian political constraints as perceived by the reviewer, and bureaucratic inertia supporting the past (failed) policy course, than anything else.

Garnaut's argument *supporting* a consumption based approach is also misconstrued. It's not a question of the model being 'more convenient' for Australia. This is a model that all countries could and should consider. And it's a model that reduces current impediments to a global deal by eliminating trade competitiveness as a reason - indeed an incentive - not to take action. Garnaut himself has acknowledged this as the greatest single problem hampering a global deal.

12.6 Should Australia do nothing for now?

The development of the most cost-effective policy for reducing anthropogenic greenhouse gas emissions must rest on foundations that include solid scientific evidence defining the policy problem, plus the best quantitative evidence we can obtain on the relevant relationships between policy levers and the desired emissions outcomes. These must be framed in a global context, given the agreement that this is a global policy problem. We don't have the required information at present. If we accept that 'the science is settled' – and there are some who do not – the required information on cost-effective policy responses in a world where different countries will act at different times (if at all) and in different ways is still a major gap in the diligent policy-maker's armoury.

For Australia, it seems likely that the current Government will seek to introduce a low carbon tax, based on a national emissions production base (with various 'carve outs') transitioning to an ETS at some future time. This policy is likely to be ineffective and costly, both because the price signal will be low (in some cases – eg, petrol – zero) and also because of 'carbon leakage' and associated job losses at the margin.

If the only choice is between a costly, globally-ineffective, emissions reduction policy and doing nothing, what's the better option? The former is just a more inefficient and costly substitute for the latter.

As a result, I'm coming to the view that we need more information before acting.

If we face the choice between a re-run of the flawed production-based CPRS model or doing nothing, for now, maybe Australia should do nothing – except push for the collection of more data on the science, on what the major emitters will do, and on what policy measures are most cost-effective.

'Don't just stand there! Panic!' was a poor strategy for selling the CPRS before Copenhagen. In my opinion, while it is still being used, it remains a poor strategy today.

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Latest Garnaut report update, 2011

Endnotes

1 That said, dealing with climate change *is* a diabolical problem, as Garnaut and others have said. The costs of policy responses come early, and the benefits accrue only over a long period of time, and are at best uncertain.

2 Unfortunately, in the end, the 1992 UNFCCC itself (see Article 4 – Commitments) already envisaged national timing and policy instrument differences, and referred to developing economies acting only after developed economies. So the 1992 UNFCCC itself got off on the wrong foot by sticking with a national production-based policy model under a non-harmonised response. The UNFCCC vision was for a globally harmonised response to climate change, ultimately, but it set up broad provisions that led to the failed Kyoto Protocol in 1997. By concentrating on the global end-point, but not thinking enough about feasible paths to it, arguably both the 1992 UNFCCC and the 1997 Kyoto Protocol have actually delayed national policy responses.

3 The ACT government announced its 'support' for a zero emissions target for the ACT. No timetable is indicated. No listing of measures to achieve this result is available. The government concedes it will be hard to achieve. The announcement was easily made, but the government's credibility will be exposed after it is long gone.

4 A detailed analysis of the consumption-based approach is presented in three policy notes by Geoff Carmody & Associates. Copies of these papers, and related opinion pieces, can be downloaded from http://www.onlineopinion.com.au/author.asp?id=5613.

5 Some will continue to argue that, ' … if we can only close a global deal, the problems of the production-based model will disappear because this achievement will deliver the harmonised global policy response we are seeking'. This is true. The practical problem is in the word 'if'. Moreover, the world is now well aware of the trade competitiveness problems with the production model. After all, most of the debate is about the trade exposed sector and seeking to insulate it from such adverse effects. Incentives to cheat in the light of this knowledge cannot be ignored. If this delusion about a global deal based on targeting national production of emissions continues as the basis for negotiations especially after the debacle at Copenhagen in December 2009, it is surely a triumph of hope over 12 years of very clear contrary policy experience.

6 For more details on this reasoning, see *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, especially section 4 and attachments A and B.

7 For more details on this reasoning, see *Effective climate change policy – the seven Cs: Implementing effective climate change policy – ETS or carbon tax?* Policy note no. 3, Geoff Carmody & Associates, October 2008, especially section 2 and attachment A.

8 A critical fourth issue is how to objectively measure greenhouse gas emissions associated with anthropogenic activity. 'Carbon accounting' is still a global work-in-progress. Without good carbon accounting, measuring emissions, and compliance with emissions abatement policies, are impossible. This issue must be resolved regardless of how governments choose to deal with climate change. In that sense, it is a given, and a matter for scientific research, development and debate.

9 For more information about my reasoning see *Effective climate change policy – the seven Cs: Implementing effective climate change policy – ETS or carbon tax?* Policy note no. 3, Geoff Carmody & Associates, October 2008, especially section 6.

10 For more information about my reasoning *Effective climate change policy – the seven Cs: Some design principles for evaluating greenhouse gas abatement policies*. Policy note no. 1, Geoff Carmody & Associates, July 2008, especially section 5.3. See also *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, especially section 4 and attachments A and B. On WTO compliance issues see *Effective climate change policy – the seven Cs: Implementing effective climate change policy – ETS or carbon tax?* Policy note no. 3, Geoff Carmody & Associates, October 2008, especially section 2 and attachment A.

11 See *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, attachment D.

12 See *Effective climate change policy – the seven Cs: Some design principles for evaluating greenhouse gas abatement policies*. Policy note no. 1, Geoff Carmody & Associates, July 2008, especially section 5.4. See also *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, especially section 5 and attachment C.

13 This is where William Nordhaus concludes we should be, too. See, for example, *Economic Issues in Designing a Global Agreement on Global Warming*, William D Nordhaus, Keynote address prepared for the Climate Change: Global Risks, Challenges, and Decisions conference in Copenhagen, March 10-12, 2009.

14 Garnaut, Update paper 6, page 6, paragraph 5.

2. Reforms in the greenhouse era: Who pays, and how?

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Please note this chapter is a reprint in full of a piece by Dr Michael Porter first printed by CEDA in 2009. It has been included here because it addresses key issues about the operation of an ETS, the proposed market structure for exchanging carbon credits and implications of quotas and price mechanisms. These issues have not been addressed in the current debate around climate policy in Australia.

Summary

The accumulation of greenhouse gases (GHGs), and notably CO_2, is seen increasingly as a cause of global warming, volatile weather, changed rainfall patterns and much more. Although this paper makes no comment on the science and causes of global warming, it acknowledges there is broad-based community pressure to reduce carbon-emitting activities in Australia and to favour renewable energy sources (preferably those with a low GHG footprint).

The Australian government has responded to these pressures with the Carbon Pollution Reduction Scheme (CPRS), a variant of the 'cap-and-trade' emissions trading scheme (ETS) used, for example, in Europe. This has occurred despite the CPRS delivering negative protection when adopted unilaterally: it penalises the energy-intensive goods that dominate Australian exports and exempts imports that will compete with locally-produced output covered by the scheme. This has created understandable Australian pressure for 'compensation and carve-out' measures so those firms do not feel victimised. While the government, and even some members of the opposition, favour the CPRS, the problems of implementation are so substantial that there needs to be a far more efficient alternative 'in the wings'.

Along with other proponents of a consumer-based carbon tax (notably Carmody in this volume), this paper advances a system where a tax per tonne of emissions is imposed but that, as with other input costs under the GST, this cost is passed down the chain of production. Price quotes and invoicing enable consumers to see the carbon element of price – a relatively minor modification of the GST invoicing system. Goods and services that avoid using carbon at all stages of production will pay the pure 10 per cent GST; other goods and services will pay a premium in proportion to emissions intensity, weighted over all stages leading to the final sale. Exports from Australia would be 'zero-rated' (and taxed by the importing nation's carbon reduction policies). Imports to Australia would be subject to Border Tax Adjustments so they are treated the same way as substitute locally-produced items.

A further problem with the ETS is that the trade is in financial instruments, or GHG derivatives, not GHGs. The current global financial crisis – brought on by toxic financial derivatives and their misuse, trade and 'securitisation' of what should be secure housing finance – should warn us off similar trade in GHG derivatives on a massive scale. Yet that is precisely what is entailed as the ETS ramps up to a worldwide scheme across many countries with poor financial governance and major emissions. The ASX is in print with no doubt disinterested but enthusiastic documents regarding carbon derivatives trading.[1] However, in the context of the current financial crisis, the prospect of promoting billions of dollars of trades in carbon derivatives (credits and debits by jurisdiction) is frightening and a potential source of yet another financial bubble ready to burst.

Introduction

No guarantee on emissions quantities via a CPRS

It is commonly asserted that an advantage of an ETS (or CPRS) over a carbon tax is that the former guarantees a *quantitative* emissions reduction outcome (by capping emissions) with no certain price outcome, while the latter guarantees a price outcome (by setting a price on carbon emissions) at the expense of emissions reduction uncertainty.

This 'quantity of emissions' argument for a CPRS is false because of the ability to import (cheaper) emissions permits that undermine the Australian cap. There is absolutely *no* certainty about whether or how much *Australian* emissions will be reduced, let alone what will happen to global emissions under an ETS. Additionally, setting quantity limits is particularly difficult when targets must adapt to differential economic growth, uncertain technological change and evolving science. Accordingly, the guarantee of quantitative emissions reductions may really be an illusory benefit. As Nordhaus notes (2008, p. 25):

> "We do not know what emission levels would actually lead to dangerous interferences, or even if there are dangerous interferences. We might make a huge mistake – either on the low side or the high side – and impose much too rigid and too expensive or much too lax, quantitative limits."[1]

While the ETS and CPRS currently have a political head of steam in the EU and Australasia, and possibly the US, there are many creaky bridges to cross. A particular source of vulnerability of an ETS arises from its reliance on the creation of another financial derivatives market, and the emissions debits and credits and packaged derivative instruments, this market will spawn.

The difference between the current financial crisis and a likely future 'carbon derivatives bubble' is the necessary involvement, in order to obtain a global ETS solution, of many more jurisdictions including the developing countries of Asia, Eastern Europe and South America. As new jurisdictions with high carbon emissions join the market, this raises a new layer of complexity around questions of financial governance, quality of carbon accounting, who should pay for adjustment and so forth. In contrast, a local carbon tax (based on national consumption of emissions) is something the world community can help developing countries to phase in, in tandem with reduced emissions schemes, and with no penalty to first movers in contrast to the ETS and CPRS. A carbon tax can replace more distorting taxes, fund R&D schemes, and provide aid for phasing in lower emissions technology for energy generation.

In summary, quite apart from the EU evidence of the past 12 years, there are many in-principle reasons to doubt the efficacy and durability of an ETS, given the continuing and necessary involvement of assessors, auditors and regulatory parties. There is scope for corruption and the real capacity for a financial bubble. As with the financial crisis, many question whether counterparties to the contracts – outside the OECD for example – will seek to exploit a major weakness of an ETS: whether there will be emissions reductions as per the issuance of credit instruments. The additional point of asymmetry raised here is that an ETS fails to engage the financial support of consumers, but attracts the financial community.

A tax in sync with consumers

A carbon-adjusted GST is a broad-based approach in sync with community pressures for clear incentives to reduce our carbon footprint. While politicians favour the ETS, there is widespread agreement among economists that there are threats to both its integrity and durability. In addition, sound economics suggests a strong case for a carbon consumption tax to be placed on the interchange bench and enter the field when the damage to and from the ETS calls for a better solution. Ross Garnaut's Final Report also agrees with the thrust of this paper when he says in his summary on policy:

> "A well-designed emissions trading scheme has important advantages over other forms of policy intervention. *However, a carbon tax would be better than a heavily compromised emissions trading scheme"* (emphasis added; Garnaut 2008, p. xxiv).

Qantas Chairman Leigh Clifford has also noted the impracticality of a CPRS relative to a carbon tax.[2]

A carbon tax integrated with the GST system also fits with the capacity of new technology and smart devices to inform us of costs in ways that have a low transactions cost. Increasingly techno-savvy consumers, using smart handheld devices or phones for example, will be able to price and buy products knowing just what the carbon element is (if they wish). The carbon-affected goods of greatest interest include electricity and water by time of day, season and carbon content, as well as all other products to which those environmentally sensitive products are inputs.

Phasing in a carbon tax

A carbon tax can be set at values per tonne that escalate to the desired value over a period, making the phase-in element more politically manageable and economically sensible. A ramp-up of the tax fits with technical arguments; and notably that there is no case for precipitous action despite the current hype.

In support of the ramping model suggested by Nordhaus and others, three key points emerge from the scientific discussions:

- Whatever action we take, the global emissions stock will barely be affected over the next three-to-four decades.
- The contribution of Australian greenhouse gas emissions to this flow is about 1.4 per cent and falling. This measure – a flow – is in tonnes. The relevant stock measure is a concentration concept – measured in parts per million (ppm) by volume, with targets specified in the range of 450 to 550 ppm by 2050 for example.
- A tonne of emissions from any point on the globe at any given time has the same effect on the atmospheric concentration of CO_2.

The most cost-effective way to reach a specific atmospheric concentration is to undertake the lowest-cost emissions reductions regardless of where they are located. Closing down major power stations and aluminium smelters in Australia will increase, rather than reduce, emissions if this simply leads to expansion in more polluting environments.

While Australia does not wish to be a free rider in reforms aimed at creating a safer and better planet, we should not be forced into unsound agreements or well-meaning but ineffective measures that will undermine the economy in the short run for no certain long-run benefit. At a minimum, we should design a robust scheme for shifting to a low-carbon economy without large costs in transition. We need to get the incentives right and phase them in to adjust without trashing existing production and assets. We

should also foster R&D, aid newly developing countries in their emissions and pollution reduction strategies, and generally keep a high standard of science, fairness and policy awareness in the debate.

The rhetoric on emissions trading schemes such as the CPRS in Australia includes references to the need to 'price carbon' but lacks the substance, simplicity, transparency and sense of an explicit price incentive. The government favours a heavily bureaucratic scheme that inevitably raises uncertainty regarding investment in Australia. Once the cost of somewhat arbitrarily assigned obligations to purchase credits starts to be felt, producers such as electricity generators, energy-intensive exporters and major manufacturers feel they will lose comparative advantage and cease to invest. Others, including investors in renewables, will also hold off, waiting to see whether the CPRS will be legislated, whether other countries will support such schemes at Copenhagen, or whether a different scheme might emerge.[3]

Efficiency and corruption

While tax systems are far from perfect, they have the advantage of involving two parties in a zero-sum game – and thus there are natural disincentives to abuse. On the other hand, a valuable quota (as in a cap-and-trade) can be issued by a bureaucracy without a clear sense of cost to other parties and with a chance for the issuer to be paid for the privilege – without the knowledge of others.

While there is a quoted European price for carbon via derivative 'securities' such as carbon credits, in reality the political marketing of the ETS is conducted as if it is creating new opportunities for rents and privileges. And of course it is *not* a trading of carbon, or even GHG emissions, but of financial instruments or commitments.

Treatment of imports

In the case of imports and a carbon tax, as covered by Sampson in this volume, WTO rules allow Australia to apply a Border Tax Adjustment (BTA) to compensate for the effect of a carbon tax on domestically produced products. [4] To quote Sampson (2009):

> "In the case of a domestic carbon tax, a BTA would charge imported goods the equivalent of what would have been paid had they been produced domestically and rebate the tax paid by exporters. With a cap and trade scheme, a border adjustment would be doubly bureaucratic in that it would oblige domestic importers or foreign exporters to secure emission permits analogous to that faced by domestic producers. Exporters would need to apply for and receive emission permit rebates."

The sound economics of a carbon-adjusted GST

This paper, and others written for CEDA (Shapiro 2007; Nordhaus 2009; Carmody 2009), argue:

Why not target the same (ramped) emissions reduction goals through a properly assigned, broadly based and foreseeable tax on GHG emissions content?

A carbon tax follows sound and tested economic principles, using a price mechanism to change the relative prices of energy inputs and, consequently, the prices of goods and services. Emissions-intensive goods become more expensive relative to those that

are less emissions intensive. This provides an incentive for consumers and businesses to adjust their purchasing decisions in favour of lower-priced, less emissions-intensive goods and services. As well as driving emissions reductions by changing relative prices, the introduction of a carbon tax would provide a financial incentive for investment in low emissions technology research, development and commercialisation.

Just as importantly, it creates a sense that we are all paying for what is 'our' problem, and roughly in proportion to the GHG emissions intensity and level of national consumption.

Carbon leakage

The reason the climate policy problem is seen as so "diabolical" (to quote Ross Garnaut) is that global warming is a 'public good' – a public commons related to the existing *stock* of GHG in the atmosphere, where the flow in any year is modest in proportion to the stock, and where the annual Australian contribution to the flow is around 1.4 per cent. A policy problem is that reduced production or consumption by one country or consumer has no discernible effect on the total, and thus little can be achieved without international cooperation.

To complicate matters profoundly, the costs of acting come early and the benefits come very late, are uncertain, and can only be measured in the distant future – long after the policy initiators have left office. The good news is that the 'public good' aspects (ie no point in a country going first) can at least be minimised by eliminating trade competitiveness as a driver that encourages inaction. For this reason a consumption-based carbon tax is more helpful than an ETS, since a carbon tax does not penalise the exporters in early mover countries, whereas an ETS hurts exporters and creates a need to compensate or exclude from scheme coverage, as exemplified in the government and opposition contributions to the debate in Australia.

In terms of reducing the supply of such a public good (or 'bad' in this case) there is a need for concerted action. Many of the current 'solutions', such as reducing electricity or aluminium production in Australia, will make the matter worse as countries that produce more emissions per unit of output expand as Australia reduces its own emissions. This is called 'carbon leakage' in climate jargon. A related issue is that competitively priced electricity has been a source of competitive advantage for many Australian industries. The Australian power generation industry is characterised by a very high proportion (approximately 84 per cent) of coal-fired power generation capacity which is strongly affected by the introduction of a price on carbon emissions. Alternative low-emissions power generation technologies need technological development, cost reduction and time to transform the energy mix towards a lower emissions profile.

The problem is that concerted action to date is based on targeting national emissions production, not consumption, and cap-and-trade, with incentives at the end – and not the start – of the policy queue. If you delay charging your producers for generating GHG, you benefit, since they gain at the expense of the first movers. A carbon tax model targeted on consumption is attractive because it targets those pressuring for reform, who thereby pay, and does not penalise exporters or import-competing industries (see Carmody 2009).

An ETS is effectively a burden on the production of energy emissions. It penalises exporters and creates rent-seeking pressures, as an emissions quota may be negotiated along with a price exemption since the permits have value and are tradable. Worse, an ETS may actually increase emissions when more polluting countries take up the slack, since there is no easy mechanism by which other countries can be made to follow suite.[5] If a community (especially a relatively rich community like Australia) rejects an explicit tax on its own emissions consumption, then that community is not favouring a genuine and transparent response to carbon reduction.

On the other hand, 'favouring' the CPRS is playing the game of 'don't tax him, don't tax me, tax the fellow behind the tree'.

Consumer footprints – where should they lead?

Many environmental groups and other strong supporters of strategies to reduce carbon emissions in Australia are critical of the CPRS and favour an explicit tax. In large part this is because many in the community who want to reduce their 'carbon footprint' find they are not part of the scheme as it only focuses on the major wholesale emitters and that even some of these, including agriculture, have been exempted or 'carved out'. The ETS has no incentives that touch the community directly – in sharp distinction to a consumption tax model. There is no capacity under the quota model for customers to 'carbon-cost' their actions, or better, lower costs by varying their consumption of GHG embedded in commodities. On the other hand a carbon tax creates the incentive for individual reductions. People can monitor with new smart devices that report taxes and charges of commodities such as electricity, water, gas, as well as variations by time of day. Environmental groups in Australia have been highlighting this flaw.

Why we need a 'new tax'

Taxes are relatively simple to administer. Even the Garnaut Review (2008, pp. 308–309) conceded this much:

> "Carbon taxes are straightforward to apply and avoid the need for governments to take discretionary decisions about who ought to be allowed to emit. Carbon taxes also provide certainty about the marginal costs of mitigation."

The principle of sound (Pigovian) taxation generally suggests in the case of 'bads', such as carbon emissions, that the user or consumer should pay to offset the negative external effect of emissions. A virtue of a carbon consumption tax in a country such as Australia is that it automatically exempts goods that are exported, which then get taxed in the country that imports them, and ensures imports are treated the same way as local products. In contrast the CPRS obliges firms to buy permits and then penalises the 'first mover'.

For some reason this obvious application of targeted consumer taxes remains barely discussed. Instead, we have seen the uneven and hastily attempted introduction of emissions caps and trading arrangements, followed by attempts to carve out compensation

arrangements or provide temporary assistance to energy intensive industries. The ground rules for these exemptions are neither consistent nor clear. Australia's largest export industry, the coal industry, is excluded from emissions-intensive trade-exposed (EITE) assistance despite the industry arguing that it meets the criteria for moderately intensive activities (1000 tonnes of carbon dioxide equivalent per million dollars of revenue) with an average emissions intensity of more than 1300 tonnes of carbon dioxide equivalent per million dollars of revenue. It also argues it will lose international competitiveness if it is not eligible for EITE assistance. In support of its argument it commissioned a report from ACIL-Tasman which backed its claim that most coal production is from mines above the threshold for moderately intensive activities and that higher costs, mine closures, job losses and reduced coal production would follow. Nonetheless, the government has excluded the coal industry arguing that coal is below the required threshold and unique in that the level of greenhouse gas emissions can vary so much from mine to mine. Its exclusion may equally reflect the standing of an industry politically out of favour on the climate change issue.

One reason the community appears to have endorsed ETS proposals around the world and in Kyoto is that it is easy to endorse a system that has no direct or immediate voter cost.

While there are clear concerns with implementation costs of an ETS, it is also true that implementing a carbon tax via the GST has its complications. If the tax is set by an average industry classification it may offer inadequate incentive for firms to individually reduce emissions, although they will benefit by using low emissions inputs with less tax to pass on. There will be a case for review and change of the carbon tax supplement within the GST schedule, and so the scheme is not free from bureaucratic dimensions and costs. It is just that these costs, rent-seeking and scope for corruption are far less than for an ETS – a system of credits and debits and tradeable instruments that require constant audit against actual emissions. One option to manage the costs of a carbon tax in the early stages is to zero-rate most very low emissions commodities, and to apply more frequent adjustment on emissions-intensive products.

There are some pluses to the CPRS in terms of incentives to cut emissions and sell the permits, and for rent seekers to search out benefits from emissions reduction possibilities. Finally, McKibbin and Wilcoxen's hybrid proposals address rent seeking and related issues in ways that can improve the likely outcomes of a carbon tax relative to an ETS (1997).

Facilitating business certainty

Benjamin Franklin (1706–90) remarked "In this world nothing can be said to be certain, except death and taxes". Had he lived today he might have added that nothing is more certain to kill investment than uncertainty itself. And a sure way of creating economic uncertainty is to intervene across the economy according to committee and bureaucracy-administered judgements on emissions of CO_2, company by company.

The industries affected most by taxes or obligations related to emissions of carbon are typically capital intensive, with long-term investments driven by a discounting calculus that extends over many decades. Energy-related industries seek taxing and regulatory regimes that create the least possible degree of uncertainty, since anything that raises

the risk premium raises the discount rate that applies. Moving a discount rate from 9 per cent to 15 per cent, for example, demolishes the capacity of long-term income streams to drive investment.

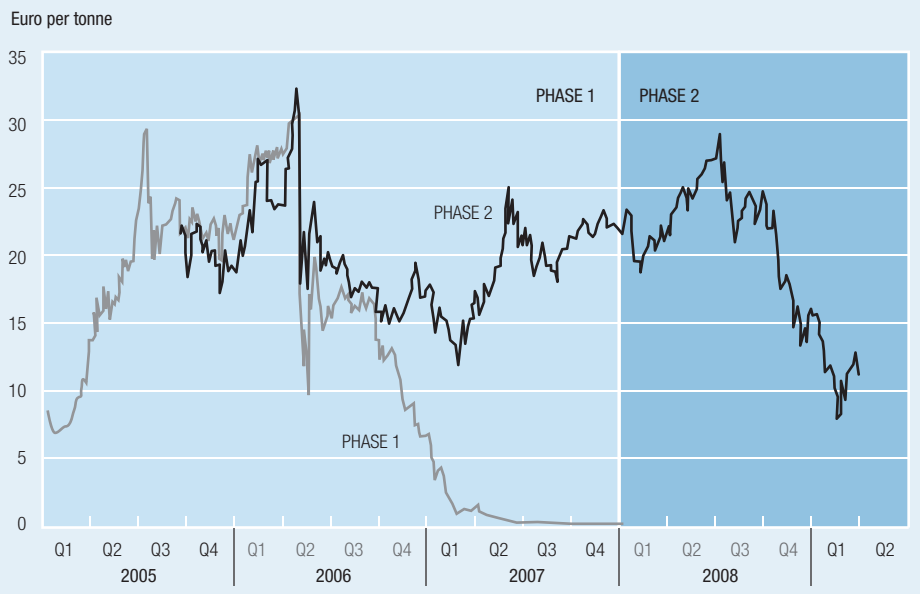
Even more remarkable is the time chosen to try to implement a highly uncertain ETS. In 2009, the world is battling the greatest shock to the international economy since the Great Depression – one that resulted directly from misuse and poor understanding of financial derivatives. Yet the ETS has, at its heart, the creation of a new and far more questionable financial instrument than the credit default swaps and other synthetic derivatives behind the global financial crisis. The tradable emissions credits are to be issued by all countries – with the bulk of them eventually to come from a range of countries with relatively unsophisticated financial governance and trading regulation. If Wall Street's financial manipulations of debt and derivative instruments gave us the global financial crisis, the ETS seems certain to give us something far worse.

Volatile carbon derivative prices

The track record and nature of an ETS indicates no likelihood of predictable emissions reductions or carbon 'prices'. In contrast to a predictable consumer tax, data from the European ETS indicates the price of emissions credits is ultra volatile. Both supply and demand are ultimately political, and thus highly inelastic to the carbon price. Small changes in the supply of credits or debits can cause very large 'carbon credit' price variations. The largest producers of CO_2 emissions are likely to be power generation utilities, particularly coal-fired power stations. Under a strict cap-and-trade system, a cold winter or hot summer will cause CO_2 emissions to rise rapidly with electricity consumption. Since the quantity of emissions will be capped, their price will also rise sharply and be passed onto consumers as higher electricity prices.

Because the supply of carbon credits and debits is set politically, the resulting 'market' in emissions credits is destined to make a roller coaster look relatively flat. Figure 1 shows the volatility of the price of carbon credits with the slump in price reflecting, far

FIGURE 1: EUROPEAN ETS CARBON PRICE MOVEMENTS: EUAs



Source: www.pointcarbon.com

more than liquidity factors, notably the changing willingness of European governments to issue new credits.

The price of EU emission allowances (EUAs) (the light grey line) climbed to 30 Euros per tonne in December 2005 and remained in the 20–30 Euro band for almost an entire year. However, in April 2006 the price of EUAs crashed by almost 20 Euros. By the end of 2007, it had fallen to an average of just 3 Euro cents as it became clear that actual emissions in the first commitment period (2005–07) would be lower than the proposed cap.

Less than a year ago, phase 2 permits were trading at almost 30 Euros per tonne before falling steeply to below 10 Euros per tonne. More recently, the price has risen again towards 15 Euros per tonne.

The volatility in price for EUAs has led influential market particpants to express concern that it is undermining incentives to channel long-term investment towards large-scale (often very capital-intensive), carbon-saving projects and technologies. The Institutional Investors Group on Climate Change (IIGCC), for example, is worried that carbon markets have not provided investors with the strong, long-term price signals necessary to support large investments in low-carbon solutions (IIGCC 2009, p. 4):

> "The EU Emissions Trading Scheme (EU ETS), for example, has not provided companies or investors with the robust price signal needed for them to make long-term capital commitments towards low carbon technologies. So far, the EU ETS has encouraged short-term emission reductions when prices are high (e.g. switching from coal to gas) but has not had an impact on investment decisions in new technologies. The EU ETS has suffered from price volatility, with higher-than-expected prices followed by sharp declines both in Phase I and Phase II."

Spikes, not gradual adjustment, are already a feature of the very limited trading across a few advanced countries.[6] Enter the supply of permits from less sound sources of governance and the graph of carbon prices will be reminiscent of the Himalayan skyline, not the dunes of Oman.

While emissions may not be priced explicitly under an ETS, the cash and opportunity costs of permits, or lack of permits, are large. Given that energy resources are distributed unevenly across countries, the allocation of carbon credits and debits is sure to be an endless source of international political jockeying and industrial rent-seeking.

While the incidence of an ETS is uncertain, it is very real. When a market disappears, or when a competing party is exempt from a permit requirement and gains market share regardless of its carbon emissions (carbon leakage), the world moves back to the jungle of trade based on politics, horse-trading, industry protection by fiat, and even corruption and cheating – not comparative advantage.

By contrast, carbon taxes raise the price of carbon-based energy directly, predictably and in a constant manner, imposing the greatest costs on those forms that produce the most emissions. In doing so, carbon taxes create direct incentives to reduce carbon-based energy use or substitute low-emissions sources of energy until the cost of doing so is greater than the tax.

The smoother price path offered by a carbon tax will enable firms to plan better for investments in capital equipment that reduces CO_2 emissions (eg by increasing efficiency or using low-carbon fuels). It will also provide a more certain price signal for firms considering investing in the development of new emissions-reduction technologies.

Efficiency and corruption, taxes and quotas

Quotas allocated by government – such as the rights to emit carbon in an ETS – are valuable. However, if they are largely given away in the first instance they create wealth for the beneficiary and a waste of rent-seeking effort on the part of parties seeking such benefits. By not raising revenue, there is no capacity to fund other reductions in tax, or R&D, carbon sequestration projects and the like. On the other hand, if taxes on emissions are used to fund reductions in other more distorting taxes, then a carbon tax is a win-win; it delivers environmental benefits and improved efficiency (reduced dead-weight losses elsewhere). On this score a carbon tax at the consumption level is advantageous relative to a quota system, which also brings the prospect of corruption.[7]

Along with public funding for technological development and adaptation, the Garnaut Climate Change Review saw the international trading of emissions entitlements emerging as the most important mechanism for the international collaboration needed to support national action (2008, p. 191):

> "The only realistic chance of achieving the depth, speed and breadth of action now required from all major emitters is allocation of internationally tradable emissions rights across countries."

And (2008, p. 228):

> "International trading in emission entitlements allows financial flows between countries. Such financial flows could offset abatement costs in developing countries, drawing them into an international policy framework."

The federal government appears to be of a similar view (Australian Government 2008):

> "Growth in international carbon markets presents opportunities for Australia by broadening the abatement opportunities for liable parties and by extending the market for Australia's own abatement."

Others view this as, at best, naïve in the extreme and, at worst, an attitude that would undermine the integrity of the ETS.

In the early but rapid stages of national economic development, the standards of financial governance are generally less than ideal. Acceptance of the rule of law, property rights, a sound judiciary, a sound administration of competitive tendering, independent regulation and the capacity to prevent cronyism are all hard to achieve in this phase. Yet they are required for an ETS to work well. Many countries contributing substantially to the growth of GHGs are in the early stages of development with improving but less than ideal standards of financial governance. Although it must be said that Wall Street's recent performance suggests no country is immune from abuse of financial instruments and institutions.

When it comes to international trading of permits, or what are in fact carbon derivatives, the resulting impact on the entire system is clear. As the US Congressional Budget Office noted in a 2008 study (p. 20):

> Lax monitoring or enforcement in one country would undermine the effectiveness of the policy not only in that country but in other participating countries as well. The country with lax enforcement could become a supplier of fraudulent allowances (ones that did not correspond to actual reductions), diminishing the environmental integrity of the entire trading system.

Linking cap-and-trade programs also means that countries give up sovereignty over the price of allowances traded in their programs, as arbitrage transmits prices. This means the effectiveness of the national caps they set is reduced:

> Linking cap-and-trade programs…would change the price of allowances in each participating country, which would alter gains and losses and could create incentives for strategic behavior. A country with a relatively high allowance price (because of a more stringent cap, for example, or a greater dependence on high-carbon fuels) would experience a price decrease as a result of linking. In contrast, a country with a relatively low price before linking would see an increase. (Congressional Budget Office 2008, p. 20)

As Garnaut recognised, linking would also create net flows of allowances (and resulting revenues) into or out of countries. This creates the incentive for countries to choose their caps strategically to take advantage of these potential flows. A less stringent cap could result in a country becoming a net supplier of allowances and the recipient of a significant capital inflow – as happened with Russia under the EU scheme. As a result, an ETS is much more susceptible to corruption than a carbon tax. Limiting emissions creates scarcity where none previously existed and a valuable international asset. It invites corruption, evasion, false declarations and an audit framework that needs to apply in countries with poor records on economic governance.

To integrate the tax on emissions with the GST, or the VAT in Europe for example, is a process that we know can and will work. To quote Nordhaus (2007, pp. 30–31)[8]:

> "The tax approach also provides less opportunity for corruption and financial finagling than quantitative limits, because it creates no artificial scarcities to encourage rent-seeking behaviour."

While there is a quoted European price for carbon via derivative 'securities' such as carbon credits, in reality the political marketing of the ETS is conducted as if it is creating new opportunities for rents and privileges. And of course it is *not* a trading of carbon or even GHG emissions, but of financial instruments or commitments. We are already witnessing the capacity for shonky carbon credits to be issued by jurisdictions with poor governance. For example, the Papua New Guinean government has suspended the head of its Office of Climate Change and Carbon Trade pending a full-scale investigation into possible illegal carbon credit sales.

The Obama administration has forecast revenues of $650 billion over 10 years from the sale of carbon credits. The global carbon trading market is expected to grow to $700 billion annually by 2013 and $3 trillion by 2020. The global financial crisis has shown us that brilliant, highly-paid financial executives gearing trades around mortgages (as safe as houses!) are capable of creating toxic assets in the hundreds of billions of dollars. Yet the backing behind these transactions is far more credible than commitments by polluting countries to reduce emissions.

The lesson from the global financial crisis is that derivatives and other complex financial instruments issued in bulk can bring economies down. So too could an ETS.

Intergenerational effects of the ETS

An uncontroversial assumption about the objective of all current economic policies is that they leave future generations with a sound, healthy and productive environment, achieved by appropriate incentives. This should be delivered by a competitive economy that sustains an innovative technological and educational system through a growing capital stock.

The assumption by Stern and Garnaut of very low discount rates has been criticised by experts in that area (such as Nordhaus, Arrow, Varian, das Gupta – see Box 1). Assuming artificially low discount rates biases choices in favour of closing carbon-intensive activities now by failing to properly to discount future incomes. More reasonable assumptions of the intertemporal and intergenerational tradeoffs argue for a steady ramping up of policies to reduce carbon emissions, especially under conditions of uncertainty.

In many economists' views (notably Nordhaus in this volume), applying very low discount rates grossly distorts the trade-off between future and present generations. Given future generations will experience higher incomes based on improved technologies, fewer regulatory constraints than their predecessors, and the expansion of knowledge, it is hard to argue the case for acting early in terms of the needs and wellbeing of future generations.

Choosing policies that differentially affect current and future generations raises major ethical questions that go well beyond economics. Is it sufficient to leave future generations with a per capita capital stock no smaller than at present? Or growing at one per cent a year? If so, the criteria applied to policy choices by Stern and Garnaut are far too harsh. What is clear is that Stern, for example, assumes sustained growth over the next 200 years so that sacrifices now (when per capita world income is about US$6,000) will be to the benefit of future generations projected to be earning a large multiple of current per capita income ($87,000, projected by Stern's assumed growth rate of 1.3 per cent). Why should the financing of investments in future low-emissions technology be largely financed by current generations?

Most commentators, including this one, are in favour of assisting the development of low-emissions technologies and their extension into the polluting countries most likely to be dominant future sources of emissions. However, forcing major cuts in energy-intensive production in developed countries, and Australia in particular, seems unnecessary and likely to increase emissions as more polluting countries take up the slack.

The current debate on this issue is not one we can resolve in this volume. However, it is false to assume there is a strong ethical obligation to burden current versus future generations for investments in low emissions technology. More seriously, there are already clear signs that investment – including in renewable and carbon-free activities – will be killed by the uncertainties of the ETS. The best legacy we can leave future generations is a sound and growing capital stock, strong economic institutions, durable and fair models of governance, systems of taxation based on sound incentives, and other examples of best or better practice economic policy.

BOX 1: The impact of artificially low discount rates

Recalculating the Costs of Global Climate Change
Hal R Varian, December 2006

The [Stern] report not only chooses to weigh all generations' welfare almost equally, it also makes an extreme choice when specifying the relationship between consumption and welfare. These choices together imply that a 1 per cent reduction in consumption today is desirable if it leads to slightly more than 1 per cent increase in the consumption of some future generation, even though, in the model, future generations will be much wealthier than the current generation.

Global Climate Change: A Challenge to Policy
Kenneth Arrow, Economists' Voice, June 2007

Critics of the Stern Report don't think serious action to limit carbon dioxide (CO_2) emissions is justified because there remains substantial uncertainty about the extent of the costs of global climate change and because these costs will be incurred far in the future. They think that Stern improperly fails to discount for either uncertainty or futurity.

I agree that both futurity and uncertainty require significant discounting. However, even with that, I believe the fundamental conclusion of Stern is justified: we are much better off to act to reduce CO_2 emissions substantially than to suffer and risk the consequences of failing to meet this challenge. As I explain here, this conclusion holds true even if, unlike Stern, one heavily discounts the future.

Graduated responses: a ramping up of carbon tax

It would be far better to have a well-targeted and explicit consumer-based tax that reflects emissions content (as set out by Carmody), than a rent-seeking, politically-convenient CPRS (that only seems 'free' to voters). An extension of the GST would be paid by everyone who benefits from the consumption of goods and services and from a low carbon environment. The carbon element in the tax formula will skew consumption patterns away from carbon-intensive products, enable other taxes to be lowered, and finance other ways of improving the environment.

The level of the tax can be phased to appropriate levels, adjusting gradually for a problem that has emerged over the 250 years since the start of the Industrial Revolution, and where the stock of emissions can only be reduced by a little over 1 per cent a year at best. Emissions in any given year are only a small portion of that total. Limiting the risk of climate change requires substantial reductions in emissions over many years. As the Congressional Budget Office noted (2008, p. ix):

> "…ensuring that any particular limit was met in any particular year would result in little, if any, additional benefit. In contrast, the cost of cutting emissions by a particular amount in a given year could vary significantly depending on a host of factors."

Just as the buildup has been slow and uncertain, the response should favour a gradual 'ramp up' of disincentives to emit carbon. While Stern and Garnaut have grossly distorted the discounting arguments for the alleged tradeoffs between current and future generations, that does not mean they are wrong in seeking policy reforms now, as Arrow stresses in Box 1. But there is a need to avoid change for the sake of change, to maintain competitive producers of goods and services, and to phase out high-emitters over time with a new and gradual escalation of carbon-penalising taxes.

Less developed economies that rationally seek their own industrial revolutions should phase in their carbon taxes more slowly, helped by the 'carrot' of aid-funded technology, R&D and other low emissions technologies.

If AusAID, for example, was funded through such a carbon tax and devoted largely to assisting developing countries to implement state-of-the-art technologies, this might be far more effective than a plethora of conferences attempting to implement a system with fundamental flaws – an ETS.

Conclusion

The point of this paper is consistent with the views of most leading economists – that tax and price-based solutions can most effectively encourage countries to shift production away from carbon usage. A carbon tax – a means of genuinely pricing carbon to encourage substitution to lower carbon technologies – is the obvious and tried model. It raises revenue which can be used in part to foster solutions to other underlying problems. Taxes are the tried and tested system in which governments and the private sector can interact for community and environmental benefit.

The ‘carbon price’ emerging from trading in emissions debits and credits (eg in Europe) is a derivative price, or financial instrument price, based on a set of allocation principles, transactions and securities trade that is potentially far worse than the worst financial arrangements of Wall Street. If we have learned anything in the last two years it is the need for transparency in financial instruments and their regulation. We need tight governance on the very issuance process and packaging of securities. Yet when the issuance processes for carbon credits are examined, and the national markets analysed, it is hard to seriously believe the world understands what is being sold to them by their respective governments.

The majority of political and business leaders, as well as ordinary people, do not understand the complexities of an emissions trading scheme. But a carbon tax – like the GST, or an alcohol or tobacco tax – is readily understood. The policy dilemma faced by the world’s leaders is that they have ‘sold’ a solution to their constituents on the basis of no tax or price changes. Rather, they have invented a system whereby the largest carbon-emitting firms in each country are allowed to continue to emit up to an aggregate cap on emissions, relative to a benchmark year (1990 – a convenient year for most Europeans coming out of polluting structures). Firms have a right to buy and sell these permits to achieve their desired level of production, *inter alia* creating a ‘price’ for those emissions credits and debits.

Yet there is increasing access to smart devices for engaging consumers in arrangements for pricing and taxing environmentally sensitive products, such as emissions, electricity consumption and water. Products such as the Google Power Meter, for example, can present information in user-friendly ways so that consumers can see immediately what they are being charged for any commodity in terms of access, amount, time of day and tax – including carbon tax.

If governments are serious about urgent action on carbon emissions, they would impose taxes on the use of carbon now, and use the funds to transform our countries into low-carbon economies. But of course to date no country is applying such across-the-board carbon taxes. Instead, an international game of charades is taking place where there is talk, but not taxing of emissions. The good news is that low-emissions technologies are emerging with the potential to reduce carbon usage over time – solar, other renewables and indeed nuclear. A more honest complementary policy is to do the things which encourage substitution *away* from carbon – and use aid and R&D budgets to help those countries that are late to economic development to also make the transition.

A carbon tax comes from a sound economic standpoint and delivers relative simplicity, investment certainty, retention of competitive advantage, consumer engagement, as well as avoiding large measures of rent-seeking and corruption. Finally and potentially quite critically, a carbon tax avoids the prospect of a major financial carbon bubble that will inevitably burst. This near certainty arises because of the mass of carbon credits and derivatives that will need to be traded across jurisdictions for a meaningful optimisation of emissions generation and production worldwide. These jurisdictions attracted to the issuance of tradeable credits and debits are far more financially vulnerable and open to corruption than those who gave us the current financial crisis.

Endnotes

1 See, for example, http://carbonfinance.ws/2007/12/12/asx-carbon-emissions-futures-trading/.

2 In a speech to a CEDA Forum in Perth on 8 July 2009, Qantas Chairman Leigh Clifford said "…it would be better to have the certainty provided by a carbon tax -- easier to implement, simpler for everyone to manage, and much more flexible. The tax can be targeted quite specifically and raised or lowered as its impact is assessed." (The Australian, 9/7/2009).

3 As an example of the intrinsic uncertainty and shifting debate regarding emissions trading schemes, and the need for a tax driven approach, consider this quote from Point Carbon (20 July 2009), which illustrates how there is no real consensus on what emissions trading systems will cover, and how a wide range of derivatives is in prospect:

> Carbon trading could cut the cost of emission reductions by 70 per cent, a report today said. Markets themselves, however, are not sufficient and additional domestic action is required, according to a new report commissioned by UK Prime Minister Gordon Brown. "Cap-and-trade should be combined with targeted regulation, taxation and public finance for comprehensive action," said Mark Lazarowicz MP, the prime minister's special representative on carbon trading and author of the report. Lazarowicz reckons this combination would make it easier to keep global temperatures from rising above 2C, the level UN scientists believe is necessary to prevent runaway climate change. It would also enable an extra 40-50 per cent of emission cuts to be made at the same cost as could be achieved by using only domestic policies, he said.

4 See Chapter 1.3 in this volume by Sampson: "What is clear is that Australia is free to impose: "on the importation of any product…a charge equivalent to an internal tax…in respect of the like domestic product".

5 The Garnaut Review's Final Report (2008) confirmed just how problematic a CPRS would be for the energy intensive exporters: "Until sectoral or global agreements are reached, the Government should assist trade-exposed, emissions-intensive industries (TEEIIs), to account for material distortions arising from major trading competitors not adopting commensurate emissions constraints".

6 See data on www.pointcarbon.com

7 To quote Nordhaus (2007): "An additional question concerns administration of programs in a world where governments vary in terms of honesty, transparency, and effective administration. These issues arise with particular force in international environmental agreements, where countries have little domestic incentive to comply, and weak governments may extend corrupt practices to international trading. Quantity-type systems are such more susceptible to corruption than price-type regimes. An emissions-trading system creates valuable international assets in the form of tradable emissions permits and allocates these to countries. Limiting emissions creates a scarcity where none previously existed. It is a rent creating program. The dangers of quantity as compared to price approaches have been demonstrated frequently when quotas are compared with tariffs in international trade interventions. Rents lead to rent-seeking behaviour. Additionally, resource rents may increase unproductive activity, civil and international".

8 Nordhaus, WD 2007, *The Challenge of Global Warming: Economic Models and Environmental Policy*, Yale University Press, New Haven, CT.

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3. The many advantages of carbon taxes

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Please note this chapter is a reprint in full of a paper by Professor William Nordhaus first printed by CEDA in 2009. It has been included here because it raises key issues around how to calculate the costs of climate change, whether prices or quotas are most appropriate for dealing with greenhouse gas emissions and the consequences of the politically constructed market for carbon emission permits. These issues have not been addressed in the current debate around climate policy in Australia.

1. Prices versus quantities for global public goods

When dealing with economic public goods like global warming, it is necessary to reach through governments to the multitude of firms and consumers who make the vast number of decisions that affect the ultimate outcomes. There are only two mechanisms that can realistically be employed: quantitative limits through government fiat and regulation; and price-based approaches through fees, subsidies or taxes.[1] This paper addresses the major differences and explains why prices, and in particular carbon taxes, have major advantages over quantitative approaches.

In the global warming context, 'quantitative limits' set global targets on the time path of greenhouse gas emissions of different countries. Countries then can administer these limits in their own fashion, and the mechanism may allow transfer and trading of emissions allowances among countries, as is the case under the Kyoto Protocol and the European Trading Scheme. This approach has limited international experience under existing protocols, such as the chlorofluorocarbon (CFC) mechanisms, and broader experience under national trading regimes, such as the United States (US) sulfur dioxide ($S0_2$) allowance-trading program.

The second approach is to use harmonized prices, fees or taxes as a method of coordinating policies among countries. There is no international experience in the environmental area of this model, although it has considerable national experience for environmental markets in such areas as the US 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 the harmonization of taxes in the European Union (EU) and harmonized tariffs in international trade.

Attempts to address climate change through prices rather than quantities have been discussed in a handful of papers in the economics literature but much careful analysis remains to be done (Cooper 1998, Pizer 1998, Victor 1998, and Aldy *et al* 2003). A few of the details are highlighted here.

For concreteness, a mechanism called harmonized carbon taxes is discussed. This mechanism is a substitute for binding international or national emissions limits. Under this approach, countries agree to penalise carbon emissions at an internationally harmonized 'carbon price' or 'carbon tax'. Conceptually, the carbon tax is a dynamically efficient Pigovian tax that balances the discounted social marginal costs and marginal social benefits of additional emissions.

The carbon price might be determined by estimates of the price necessary to limit greenhouse gas concentrations or temperature changes below some level thought to be 'dangerous interference', or it might be the price that would induce the efficient level of control. For example, if an international agreement were reached that global temperature increase should be limited to 2°C, then, according to earlier results,[2] the harmonized tax would be set at US$72 per ton carbon (US$20 per ton of CO_2) for 2015, rising at about 3 per cent per year during the next decade, assuming full participation.

This number could be estimated in several integrated assessment models and should be updated as new information arrives. Because carbon prices would be equalised, the approach would be spatially efficient among those countries that have a harmonized set of taxes. If the carbon tax trajectory follows the rules for 'when efficiency', it would also satisfy intertemporal efficiency.

Many important details would need to be negotiated on burden sharing. It might be reasonable to allow full 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 US$10,000 per capita), and poor countries might receive transfers to encourage early and complete participation. If carbon prices are equalised across participating countries, there is no need for tariffs or border tax adjustments among participants. The issues of sanctions, the location of taxation, international-trade treatment, and transfers to developing countries under a harmonized carbon tax are important details that require discussion and refinement.

The literature on regulatory mechanisms entertains a much richer set of approaches than the polar quantity and price types that are examined here. An important variant is a hybrid system which puts ceilings on the price of emissions-trading permits by combining a tradable permit system with a government promise to sell additional permits at a specified price. Price caps were considered and rejected by the Clinton administration in its preparation for the negotiations on the Kyoto Protocol. Such an approach should include floors as well as caps, although most hybrid proposals do not include floors. Hybrids, as a possible useful middle ground, are discussed in the final section of this paper.

2. Comparison of price and quantity approaches

This section compares the performance of quantity and price systems for regulating stock global public goods like global warming. The basic message is that because of its conceptual simplicity, a harmonized carbon tax might prove simpler to design and maintain than a quantity mechanism like the Kyoto Protocol.

Setting baselines for prices and quantities

Quantity limits are particularly troublesome where targets must adapt to differential economic growth, uncertain technological change and evolving science. These problems have been well illustrated by the Kyoto Protocol, which set its targets 13 years before the date on which the controls become effective (2008–12), and used baseline emissions from 20 years before the control period. Base-year emissions have become increasingly obsolete as the economic and energy structures, and even political boundaries, of countries have changed.

The baselines for future budget periods and for new participants will present deep problems for extensions of a quantity regime like the Kyoto Protocol. A natural baseline for the post-2012 period would be a no-controls level of emissions. That level is in practice impossible to calculate or predict with accuracy for countries with abatement policies in place. 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.

Under a price approach, the natural baseline is a zero carbon tax or penalty. Countries' efforts are then judged relative to that baseline. It is not necessary to choose a historical base year of emissions. Moreover, there is no asymmetry between early joiners and late joiners, and early participants are not disadvantaged by having their baseline adjusted downward. The question of existing energy taxes does raise complications and these are addressed below.

Treatment of uncertainty

Uncertainty pervades climate change science, economics and policy. One key difference between price and quantity instruments is how well each adapts to deep uncertainty. A major result from environmental economics is that the relative efficiency of price and quantity regulation depends upon the nature, and more precisely, the degree of non-linearity of costs and benefits (Weitzman 1976). If costs are highly non-linear compared to benefits, then price-type regulation is more efficient; conversely, if the benefits are highly non-linear compared to costs, then quantity-type regulation is more efficient.

While this issue has received scant attention in the design of climate change policies, the structure of the costs and damages in global warming gives a strong presumption to price-type approaches. The reason is that the benefits of emissions reductions are related to the stock of greenhouse gases, while the costs of emissions reductions are related to the flow of emissions. This implies that the marginal costs of emissions reductions are highly sensitive to the level of reductions, while the marginal benefits of emissions reductions are insensitive to the current level of emissions reductions (Pizer 1999 and Hoel *et al* 2001). In the DICE model,[3] the benefit function for emissions of a single decade is essentially linear, while the cost function is highly convex with an elasticity of close to 3. This combination means that emissions fees or taxes are likely to be much more efficient than quantitative standards or tradeable quotas when there is considerable uncertainty.

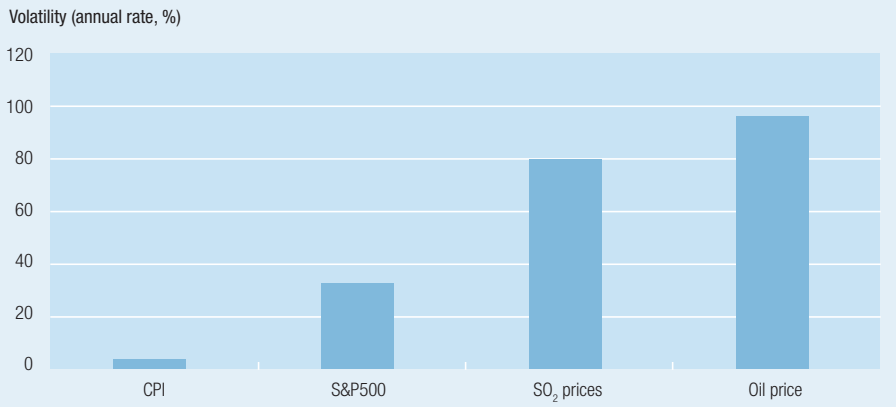
Volatility of the market prices of tradable allowances

Uncertainties affect prices. Because supply, demand and regulatory conditions evolve unpredictably over time, quantity-type regulations are likely to cause volatile trading prices of carbon emissions. Price volatility for allowances is likely to be particularly high because of the complete inelasticity of the supply of permits along with highly inelastic demand for permits in the short run.

The history of European trading prices for CO_2 illustrates the extreme volatility of quantity systems. Over 2006, the range of trading prices was from US$44.47 to US$143.06 per ton carbon (Point Carbon 2006). The prices of allowances fell by more than 70 per cent in one month because of new regulatory information.

More extensive evidence on the trading prices of quantitative environmental allowances comes from the history of the US sulphur dioxide ($S0_2$) emissions trading program. This program includes an annual auction conducted by the Environmental Protection Agency (EPA) as well as private markets in which firms and individuals can buy and sell allowances. The comparison between the prices for $S0_2$ and carbon trading is useful because the economic characteristics of the two markets are similar. Both markets are ones in which the supply is fixed or near-fixed in the short run. Moreover, for each market, the demand is highly inelastic because it involves the substitution between a fuel (such as coal) and other inputs, where the technology is relatively inflexible in the short run. To some extent, the volatility can be moderated if an agreement allows

FIGURE 1:
PRICES OF SULPHUR EMISSIONS ALLOWANCES SHOW HIGH VOLATILITY



Note: This figure shows the estimated volatility of four prices over the 1995–2006 period. From left to right: the consumer price index (CPI), the stock price index for the S&P500, the price of US SO_2 allowances (SO_2 prices), and the price of crude oil (Oil price). Volatility is calculated as the annualized absolute logarithmic month-to-month change.

Source: Oil prices, CPI, and stock prices from DRI database available at Yale University. Price of SO_2 permits are spot prices provided by Denny Ellerman and reflect the trading prices.

banking and borrowing, meaning that firms can draw from future emissions allowances, or save allowances for the future. But programs are unlikely to allow borrowing, and banking provides only limited relief from price volatility.

Some insight is gained into the likely functioning of CO_2 allowances by examining the historical volatility of the price of $S0_2$ allowances. Spot $S0_2$ prices at the annual EPA auction have varied from a low of US$66 per ton in 1996 to a high of US$860 per ton in 2005. Futures prices have varied by a factor of 4.7 (EPA 2006). When looking at the private market, allowances prices varied by a factor of 69 in the period 1995–2006, and by a factor of 12 in the period 2001–06. Some changes have been induced by alterations in regulatory policies, but that feature would be relevant for the carbon market as well.

A more precise measure of variability is obtained by calculating the statistical 'volatility' of the prices of $S0_2$ emissions allowances and comparing them with other volatile prices. Volatility measures the average absolute month-to-month change, and is a common approach to indicating the variability and unpredictability of asset prices. Figure 1 shows the estimated volatility of four prices for the period 1995–2005: the consumer price index, stock prices, $S0_2$ allowances prices and oil prices. $S0_2$ prices are much more volatile than stock prices (or than the prices of other assets such as houses, not shown); they are vastly more volatile than most consumer prices; and their volatility is close to that of oil prices.

Such rapid fluctuations are costly and undesirable, particularly for an input (carbon) whose aggregate costs might be as great as petroleum in the coming decades. An interesting analogue occurred in the US during the monetarist experiment 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 Federal Reserve reverted to a price-type approach after a short period of experimentation. This experience suggests that a regime of strict quantity limits might have major disruptive effects on energy markets and on investment planning, as well as on the distribution of income across countries, inflation rates, energy prices, and import and export values. It might consequently become extremely unpopular with market participants and economic policymakers.

Public finance questions

Another consideration is the fiscal-policy advantage of using revenue raising measures in restricting emissions. Emissions limits lead to valuable rights to emit, and the question is whether the government or private parties get the revenue. When tax or regulatory restrictions raise the goods prices, this increases inefficiency losses from the existing tax system. The reasoning is that the existing tax and regulatory system raises prices above efficient levels. Adding further taxes or regulations to existing ones increases the inefficiency or 'deadweight loss' of the existing system and should be counted as part of the additional costs of a global warming policy. This effect is the 'double burden' of taxation, analysed in the theory of the 'double dividend' from green taxes (Goulder *et al* 1997 and Goulder *et al* 1996).

If the carbon constraints are imposed through taxes, and the revenues are recycled by reducing taxes on other goods or inputs, then the increased efficiency loss from taxation can be mitigated so that there is no necessary increase in deadweight loss. If the constraints under a quantity-based system are imposed by allocations that do not raise revenue, however, then there is no government revenue to recycle to mitigate the increased deadweight loss. This is an important issue as the inefficiency losses can be as large as abatement costs.

While it is possible that emissions permits will be auctioned (thereby generating revenue with which the tax inefficiency can be mitigated), historical practice indicates that permits would be allocated at zero cost to 'deserving' parties, or distributed to reduce political resistance. In the cases of $S0_2$ allowances and CFC production allowances, virtually all permits were allocated at no cost to producers and with no revenue for governments to recycle. While pure tax systems are the most reliable device for raising revenue, a useful alternative in a hybrid system would buttress quantity approaches with taxes to capture at least part of the permit revenue.

Rents, corruption and the resource curse

An additional question concerns the administration of programs in a world where governments vary in terms of honesty, transparency and effective administration. These issues arise with particular force in international environmental agreements, where countries have little domestic incentive to comply and weak governments may extend corrupt practices to international trading. Quantity-type systems are much more susceptible to corruption than price-type regimes. An emissions-trading system creates valuable international assets in the form of tradable emissions permits and allocates these to countries. Limiting emissions creates a scarcity where none previously existed. It is a rent creating program. The dangers of quantity as compared to price approaches have been demonstrated frequently when quotas are compared with tariffs in international trade interventions.

Rents lead to rent-seeking behaviour. Additionally, resource rents may increase unproductive activity, civil and international wars, and slow economic growth – this being the theory of the 'resource curse' (Sachs *et al* 1995 and Torvik 2002). The scarce permits can be used by a country's leader for non-environmental purposes rather than to reduce emissions. Dictators and corrupt administrators can sell part of their permits and pocket the proceeds.

Calculations suggest that tens of billions of dollars of permits may be available for foreign sale from Russia under a tightened Kyoto Protocol. Given the history of privatizing valuable public assets at artificially low prices, it would not be surprising if the carbon

market became tangled in corrupt practices, undermining the legitimacy of the process. Imagine a revised Kyoto Protocol extended to developing countries. Consider the case of Nigeria, which had carbon emissions of around 25 million tons in recent years. If Nigeria was allocated tradeable allowances equal to recent emissions and could sell them for US$40 per ton of carbon, this would raise around US$1 billion of hard currency annually – in a country with non-oil exports worth only US$600 million in 2000.

Problems of financial finagling are not limited to poor, weak or autocratic states. Concerns arise in the wake of the recent accounting scandals in the US. A cap-and-trade system relies upon accurate measurement of emissions or fossil fuel use by sources in participating countries. If firm A (or country A) sells emissions permits to firm B (or country B), where both A and B are operating under caps, then it is essential to monitor the emissions of A and B to make sure that their emissions are within their specified limits.

Indeed, if monitoring is ineffective in country A but effective in country B, a trading program could actually end up raising the level of global emissions because A's emissions would be unchanged while B's would rise. Incentives to evade emissions limitations in an international system are even stronger than the incentives for tax evasion. Tax cheating is a zero-sum game for the company and the government, while emissions evasion is a positive sum game for the two parties involved in the transaction for a global public good.

A price approach gives less room for corruption because it does not create artificial scarcities, monopolies or rents. There are no permits transferred to countries or leaders of countries, so they cannot be sold abroad for wine or guns. There is no new rent-seeking opportunity. Any revenue needs to be raised by taxation on domestic consumption of fuels, and a carbon tax will add absolutely nothing to the rent-producing instruments that countries have today. It is a zero-sum game between the government and the taxpayer, so the incentives are stronger to ensure enforcement.

Here again, a hybrid system that combines both tax and quantitative systems dilutes the incentives for corruption in the quantity system. If the carbon tax is a substantial fraction of the carbon price, then the net value of the permits and the rents to seek, are reduced accordingly.

Administrative and measurement issues

There are many measurement and administrative issues that arise in implementing a harmonized carbon tax, and these have not yet been fully addressed. Perhaps the most important conceptual issue is the treatment of existing energy taxes and subsidies. Should we calculate carbon taxes including or excluding existing taxes and subsidies? For example, suppose a country imposes a US$50 carbon tax while maintaining an equivalent subsidy on coal production. Would this be counted as a zero or a US$50 carbon tax? Additionally, how would subsidies to zero-carbon fuels, such as wind power, be counted in the analysis?

One approach would be to calculate the net taxation of carbon fuels, including all taxes and subsidies on energy products, but not go beyond this to indirect, embodied impacts outside of exceptional cases. Such a calculation would require two steps. First, each country would provide a full set of taxes and subsidies relating to the energy sector; and second, there would need to be an accepted methodology for combining the different numbers into an overall carbon tax rate. There would of course be many technical issues, such as how to convert energy taxes into their carbon equivalent. Some of the calculations involve conversion ratios (from coal or oil to carbon equivalent) that underpin any control system. Others would require input-output coefficients,

which might not be universally available on a timely basis. On the whole, calculations of effective carbon tax rates are straightforward as long as they do not involve indirect or embodied emissions.

To go beyond first-round calculations to indirect effects would require assumptions about supply and demand elasticities and cross-elasticities, which might engender disputes among countries and should be avoided if possible. The procedures would probably require mechanisms similar to those used in World Trade Organization deliberations, where technical experts would need to calculate effective taxes under a set of guidelines that evolve under quasi-legal procedures. Many of these issues are discussed in the literature on ecological taxes.[4]

3. A hybrid approach?

Many considerations enter the balance in weighing the relative advantages of prices and quantities in controlling stock public goods. However, we must be realistic about the shortcomings of the price-based approach. It is unfamiliar ground in international environmental agreements. Tax is almost a four-letter word. Many people distrust price approaches for environmental policy. Taxes are of special concern to environmentalists for global warming because they do not impose explicit limitations on the growth in emissions or on the concentrations of greenhouse gases. What would guarantee that the carbon tax would be set at a level that would prevent 'dangerous interferences'? Might the international community fiddle with tax rates and definitions, and measurement issues and coverage while the planet burns? These are real concerns and will require time and patience to address.

By contrast, quantitative approaches such as cap-and-trade regimes are widely accepted as the most realistic approach to slowing global warming.

Cap-and-trade is firmly embedded in the Kyoto Protocol and most proposals for countries' policies, such as the US and elsewhere, as well as those for deepening the Kyoto Protocol, follow this prototype. A realistic worry about policies today is not whether they will be cap-and-trade instead of carbon taxes, but whether they will be just 'plain' cap-without-trade. For example, in implementing the Kyoto Protocol, some approaches favour countries doing a substantial fraction of their mitigation through 'domestic implementation' rather than 'buying their way out' by purchasing emissions permits from other countries. Even worse, countries might continue to argue and end up doing nothing, as has been the case for the US up to now.

Given the strong support for cap-and-trade among analysts and policy makers, is there a compromise where the strengths of the carbon-tax regime can be crossed with cap-and-trade to get a hardy hybrid? Perhaps the most promising approach would be to supplement a quantitative system with a carbon tax that underpins it. For example, countries could buttress their participation in a cap-and-trade system by imposing a tax of US$30 per ton carbon along with the quantitative restriction. Countries should also put a 'safety value' along with the tax, wherein nations sell carbon emissions permits at a multiple of the tax, perhaps at a 50 per cent premium, or US$45 per ton in this example.

The hybrid approach would share a little of the strengths and weaknesses of each of the two polar cases. It would not have firm quantitative limits like a pure cap-and-trade

system, but the quantitative limits would guide firms and countries, and would give some confidence that the climatic targets were being achieved. The hybrid would have some but not all the advantages of a carbon tax system. It would have more favourable public-finance characteristics; it would reduce price volatility; it would mitigate the incentives for corruption; and it would help deal with uncertainties. The narrower the band between the tax and the safety-value price, the more it has the advantages of the carbon tax; the wider the band, the more it has the advantages of the cap-and-trade system.

The coming years will undoubtedly witness intensive negotiations on global warming as the planet warms, the oceans rise, and new ecological and economic impacts are discovered. A dilemma will arise particularly if, as has been suggested above, the quantitative approach under the Kyoto Protocol proves ineffective and inefficient. As policy makers search for more effective and efficient ways to slow dangerous climatic change, they should consider the possibility that price-type approaches like harmonized taxes on carbon, or perhaps hybrid approaches, are powerful tools for coordinating policies and slowing global warming.

Endnotes

1 This distinction is drastically simplified. For a nuanced discussion including variants and hybrids, see Aldy, Barrett and Stavins, (2003) and the many references and proposals therein.

2 These are set forth in Nordhaus, 2007b.

3 See "Accompanying notes and documentation on development of DICE-2007 model: Notes on DICE-2007.delta.v8 as of June 7, 2007", Yale University, June 2007, available at http://www.econ.yale.edu/~nordhaus/homepage/DICE2007.htm

4 See the pioneering study on ecological taxes in von Weizsaecker and Jesinghaus (1992).

5 From a technical point of view, the hybrid plan sketched here is a special case of a non-linear environmental tax, in which the tax is a function of economic or environmental variables, which are superior to either linear taxes or quantitative regulations.

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