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The economics of climate change: An examination of the McKibbin-Wilcoxen hybrid proposal for a carbon price for Australia

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Abstract

Many countries are contemplating the design of institutions to address 'the greatest market failure the world has ever seen'.[1] In Australia, a carbon trading scheme is being considered, and prominent amongst the proposals being discussed is the 'McKibbin-Wilcoxen hybrid scheme' (2007, 2006, 2002).[2] We critically examine the literature on this proposal. As a national trading scheme there is much to admire in the institutional arrangements suggested, and this is our most important conclusion. Nevertheless, we do seriously question the theoretical framework advanced to justify the hybrid structure – a framework that is also used in some sections of Stern (2007) and elsewhere. We argue that by justifying their proposals in terms of theories conceived in the 1970s when it was believed that pollution could be contained and its damages quickly 'cleaned up', the authors run the risk of confusing or misleading a lay audience by stretching the credibility of benefit-cost analysis, potentially undermining broader support in the process. Rather than having to posit unknowable short and long-run marginal benefits curves, we believe it is more sensible and credible to argue in terms of 'cost effectiveness analysis'; that is, achieving a long-run national target in the most cost-effective (and painless) way possible. By analogy, we favour taking the 'Hungarian' path to economic transition rather than the 'Russian' route.

Putting aside theoretical differences, we believe the McKibbin-Wilcoxen scheme has many good features, not least of which is the potential for business to

[1] Stern, N. (2007) *The Economics of Climate Change*, Cambridge UK: Cambridge University Press, p. xviii.

[2] McKibbin, W. and Wilcoxen, P. (2007) Two issues in carbon pricing: timing and competitiveness, *Working Papers in International Economics*, April, No. 1.07, McKibbin, W. and Wilcoxen, P. (2006), 'A credible foundation for long term international co-operation on climate change', *Working Papers in International Economics*, June, No. 1.06, Lowy Institute for International Policy, Sydney; and also McKibbin, W. (2006), 'Why Australia should take early action on climate change', Lowy Lunch Lecture, December 13. Available at www.lowyinstitute.org, accessed 22 May 2007.

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manage policy risk through the purchase or gift of long term permits to emit carbon, thus lowering the cost of capital and encouraging investment in low carbon alternatives. The long term permits also offer a capacity to compensate the most politically obstructive opponents and build up a constituency with a financial stake in policy stability. At the same time, annual permits provide an avenue for limiting economic disruption that might occur along the way towards the achievement of the country's long term emission targets. The annual permits can therefore address the much-publicised political concerns about economic impacts of a carbon price. The scheme also handles the difficult question of international competitiveness in a way that retains the incentive to invest in low carbon technologies. It also incorporates some sound policy design principles such as gradualism, adaptability and micro-flexibility (among other features) as recommended by ecological economists. The strong proviso is that the annual permits used to manage the costs of transition to a low carbon economy should not be allowed to jeopardise achievement of the long-run goal, a matter emphasised by Stern (2007), but less so by McKibbin and Wilcoxen. A carbon bank, with functions analogous to the Reserve Bank, is suggested as one way to address the problem of managing the short term costs, whilst ensuring that a long term goal is met.

Another area of discussion relates to the issue of carbon offsets. The McKibbin-Wilcoxen system does allow for offsets to be added according to national priorities, and the final section of our paper presents the case for carbon sinks created in the agricultural sector to play a major part in any system. For many farmers there is a low opportunity cost to creating carbon sinks and a high willingness to participate. There are also strong equity reasons for including them. Indeed, we argue that the many positive externalities in farm management to increase soil and timber carbon are

sufficient grounds for research into broad guidelines that would permit their inclusion.

1. Introduction

The economics of climate change breaks new ground for economists, irrespective of their preferred theoretical lens. For ecological economists aiming to combine the insights and methodologies from numerous disciplines into a transdisciplinary approach,[3] the 'field of vision' is broad. Nevertheless, the three goals of ecological economics clearly indicate where the analysis of an appropriate institutional policy response to climate change would start. In section 2 of the paper, we review this approach briefly and how it compares with that favoured by those economists who associate with the neoclassical tradition. We do this because the central argument of the first half of this paper is that for the economics of climate change, a 'cost effectiveness' analysis is to be preferred to the 'abatement optimality' approach favoured by the neoclassicists. In section 3 of the paper we then critique the theoretical justification for the McKibbin-Wilcoxen hybrid scheme,[4] as the proposal that arguably attracts the most attention within the Australasian context at present. This takes us to some US literature and also to sections of Stern (2007), since a similar analytical framework is utilised in one of three approaches adopted in this report. The main focus in the third section of the paper is the veracity of the analytical construct of a short-run marginal benefits curve, and the implications of conflicting short-run and long-run recommendations in this theory. Section 4 of the paper questions the wisdom of using a long-run marginal benefits curve, also known as the Social Cost of Carbon (SCC). Section 5 then examines the nature of the institutional arrangements in the McKibben-Wilcoxen scheme, where we find much to support, albeit with one important caveat (reflecting the ambivalence in the theory). The sixth

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[3] Daly and Farley, *Ecological Economics*, Washington DC: Island Press, p. xxi.

[4] We do not examine the State and Territory Governments' National Emissions Trading Taskforce proposals as consultations are still underway on key elements of the scheme.

section of the paper argues that there are strong equity and environmental grounds for including the agricultural sector when considering the nature of offsets to be included a scheme such as the McKibben-Wilcoxen hybrid proposal. Section 7 draws the conclusions to the paper.

2. Comparing the approaches of ecological economists and neoclassical economists to climate change

A useful way of representing the ideological differences between ecological economists and neoclassical economists on the question of climate change is to use Robert Costanza's simple classification of F, E and S values.[5] That is, in considering an appropriate policy response to climate change, one might ask the following questions: What is fair (F)? What is efficient (E)? What is sustainable (S)?

Considering the F value (*homo communicus*), the ecological economist will have a long list of ethical propositions that need to be addressed at the outset, accounting for them in a way that is transparent in analysis. In the case of global warming policy one might, as a start, take a position on which countries should take primary responsibility for the concentrations of greenhouse gases currently in the atmosphere, which countries benefited most from these, and which countries are in a better position to bear the costs. A further consideration would be the obligation of the current generation towards the quality of the later life of their children and subsequent generations.

Considering the E value (*homo economicus*), the ecological economist asks the question as to whether the proposed solution is efficient. If the assumptions of a

[5] Costanza, R. (2004), 'Changing visions of human's place in the world and the need for ecological economics', in Fullbrook, E., *A Guide to What's Wrong with Economics*, London: Anthem Press, pp. 237-46.

neoclassical benefit-cost analysis were to hold (e.g. the current distribution of income and the scale of economic activity are acceptable, the proposed changes are marginal, consumer sovereignty is an appropriate guiding principle, the preferences of consumers are unlikely to change over the time period concerned, and there are no significant externalities), then a conventional neoclassical analysis would provide useful insights.[6] Unfortunately, these assumptions have limited validity when considering the benefits and costs of global warming mitigation policies so a different approach is necessary. Whatever approach is taken, the E value requires that scarce resources are not wasted.

Considering the S value (*homo naturalus*), the ecological economist will want to be satisfied that the proposed policy results in an ecologically sustainable scale of economic activity. S values are determined with input from scientists assessing the state of the ecosystem(s) affected. In the case of climate change, the S (and F) values set the stabilisation targets for CO_2 (or CO_2 equivalent (CO_2e)[7] concentrations in the atmosphere), and the date by which this level should be achieved.

Following the Precautionary Principle,[8] the S value is set as a 'cap', and the challenge becomes one of finding the most cost-effective set of policy instruments to implement during the adjustment period until the cap (or chosen stabilisation path) is reached. In choosing policies, ecological economists recommend specific policy design principles – notably, gradualism, adaptability, and micro-flexibility – and

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[6] We accept the analysis of John Gowdy (See Gowdy, J., 2004) *Land Economics*, vol. 80, no. 2, pp. 239-257) and others, including neoclassical economists, that the Pareto test is conceptually flawed.

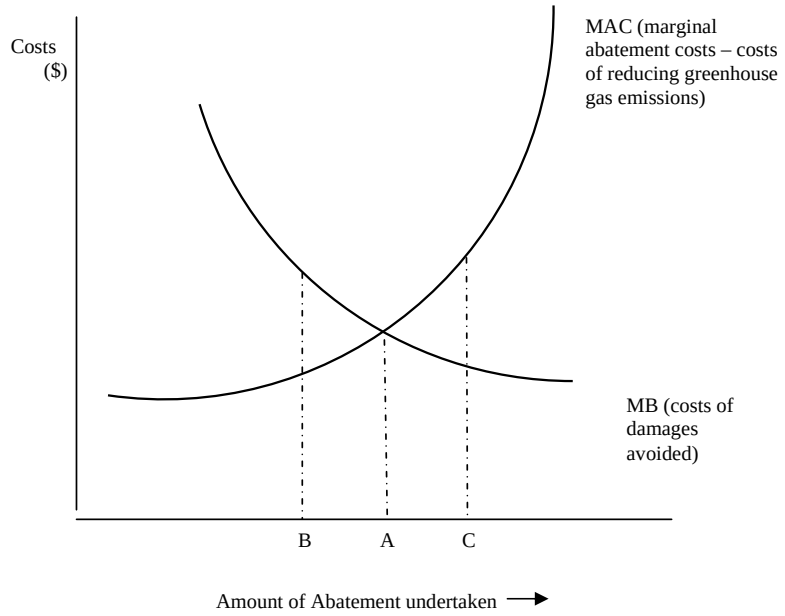
[7] CO_2 equivalent (CO_2e) is a more correct measure of greenhouse gases because it includes the impact of gases other than carbon dioxide that contribute to global warming. It is a calculation that converts the global warming effects of the other gases (methane, nitrous oxide, etc.) into an amount of CO_2 that would have the same effect.

[8] 'When an activity raises threats of harm to human health or to the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically'. Wingspread Conference (1998) interpretation of the Precautionary Principle – see Common, M. and Stagl, S. (2005), *Ecological Economics*, Cambridge, UK: Cambridge University Press, p. 389.

tradable permits issued under a cap are encouraged. (These design principles are discussed in more detail in section 5.)

By contrast, the customary approach of mainstream economists is to focus exclusively on the E value, examining economic efficiency in terms of the estimated benefits of reducing carbon emissions (interpreted as the cost of damages avoided), and the estimated costs to industries and other agencies of 'abating' their greenhouse gas emissions, leading to an optimal abatement point (or pathway). Optimal abatement is where the difference between total benefits and costs is greatest or – saying the same thing in marginal analysis – where marginal benefits and marginal abatement costs intersect (at point A in **Figure 1**).

Figure 1: Simple optimal abatement model



At any point to the left of A (e.g. at point B), the cost to industry to reduce their greenhouse gas emissions is less than the cost of the damages that would occur

through global warming. Since, by assumption, the marginal damages decrease as more abatement is undertaken, it follows that increasing abatement measures and moving toward point A is recommended. At point C, the economic cost to industry is higher than the costs imposed by climate change, so a move back towards point A is desirable. The optimal abatement at point A is the target abatement; the analogue of the S value to ecological economists, albeit of a different complexion and reached by another route. Significantly, costs are denoted in dollars on the vertical axis, which means that to undertake this analysis, monetary values are calculated for all the environmental and human impacts of climate change when determining the target abatement.

3 Problems with the short-run marginal benefits curve

The Intergovernmental Panel on Climate Change (IPCC) reports present an increasingly grim picture of the effects of rising global temperatures (the consequence of the increasing concentration of greenhouse gases (GHG) in the atmosphere since the industrial revolution).[9] Nicholas Stern's conclusion in his report (Stern 2007) was thus unequivocal that there is a 'case for strong and urgent action' on climate change.[10] Preston and Jones (2006) examining the situation for Australia, have concluded that '… even with early action to reduce GHG emissions, there is likely to be an increased risk of extreme weather events, such as potentially more intense

[9] See, for example, IPCC (2007) *Working Group II Contribution to the Intergovernmental Panel on Climate Change* (2007), Fourth Assessment Report, Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability, Summary for Policymakers.

[10] Stern, N. (2007) *The Economics of Climate Change*, Cambridge UK: Cambridge University Press, p. 320.

cyclones, and extremes of temperature and precipitation'.[11] The response of the Australian Business Leaders Roundtable has been to argue the case for early action,[12] a position endorsed by McKibbin in a presentation entitled: 'Why Australia should take early action on climate policy'.[13]

Against this backdrop, the following statement from McKibbin and Wilcoxen (2002) seems counter intuitive: 'The array of uncertainties associated with climate change makes it impossible to tell whether the benefits of the treaty are worth its costs',[14] a sentiment also reflected in the paragraph written by the same authors below:

> In the absence of a clear threshold, basing a climate policy on a rigid emissions target makes little sense: achieving the target does not eliminate the risk and exceeding the target does not cause consequences markedly different from achieving it. Put bluntly, when every ton of emissions contributes equally to the problem, it is impossible to justify any particular emissions target, other than possibly no emissions at all. As a result, a rigid system of targets and timetables for emissions reductions is not economically efficient.[15]

How can the benefits of so serious a problem be less than the costs, or how can targets not be justified? The explanation is that these statements are referring to the short run, not the long run. The short-run marginal benefits curve is defined by those using this approach as the cost of damages avoided by ceasing greenhouse gases emissions over one year. Importantly, as it is the *stock* of emissions in the atmosphere that is causing the climate problem – rather than the flow of emissions in any one year – the short-

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[11] Preston, B. and Jones, R. (2006), 'Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions', Consultancy report to the Australian Business Roundtable on Climate Change, CSIRO, www.csiro.au.

[12] Australian Business Leaders Roundtable reports, see www.businessroundtable.com.au.

[13] McKibben, W. and Wilcoxen P. (2006), 'Why Australia should take early action on climate policy', Lowy Institute for International Policy, Lunch Lecture, December 13, 2006.

[14] McKibbin, W. and Wilcoxen (2002), 'Climate change after Kyoto: a blueprint for a realistic approach', *The Brookings Review*, Sprint, vol. 20, no. 2, pp. 7-8.

[15] McKibbin, W. and Wilcoxen, P. (2006), 'A credible foundation for long term international co-operation on climate change', *Working Papers in International Economics*, June, No. 1.06, Lowy Institute for International Policy, Sydney; p. 6.

run marginal benefits curve is thought to be flat; the annual emissions being quite small in relation to the total stock of gases in the atmosphere. This is made clearer in the following extract from a United States Congressional Budget Office (CBO) Paper published in January 2005 which uses the same analytical framework:

> Expected benefits are thought to be constant over the range of potential emissions reductions in a single year because those reductions will have only a small effect on the total stock of greenhouse gases in the atmosphere, and damages are a function of the size of that total stock. (Total emissions in a single year represent less than 1 per cent of atmospheric emissions so the *reduction* in emissions in a given year is likely to be a small fraction of 1 per cent of atmospheric emissions).[16]

With this is mind, the authors go on to conclude that:

> … the expected benefits created by each additional reduction in emissions in a given year would probably be fairly constant; … the costs [for abatement] would probably rise – perhaps steeply – with more abatement. Thus setting an emissions price equal to the expected benefits would result in the least-costly balancing of expected costs and benefits.[17]

For a non-economist reading these papers – and the CBO papers are intended for a lay audience – one might easily be left with the impression that climate change costs are not significant. This is not the intended message, but is the outcome of presenting an analysis which defines a short-run marginal benefits curve of climate change policy in a particular way, and concludes from this that for a 'stock' pollutant like greenhouse gases, a price instrument (such as a tax) is economically more efficient than a quota system. The message is not that no instrument is justified at all. Nevertheless, it is easy to see how statements such as that in the CBO paper cited above, might be misconstrued as such, supporting the US position on Kyoto Protocol and implying

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[16] CBO Paper (2005), *Uncertainty in Analyzing Climate Change: Policy Implications*, January, United States Congressional Budget Office, p. xii.

[17] Ibid.

that urgent climate policy is not warranted. The technical wizardry of economics seems to be proving the point.

The discourse as to whether policy should use quotas or prices goes back to the 1970s. The theoretical origins for the ideas that appeared to settle the debate are attributed to Weitzman (1974) and Roberts and Spence (1978).[18] Weitzman (1974) asked, in situations where there is uncertainty about costs and benefits, whether prices or quotas were the more efficient regulatory instrument. He observed that, in a world of perfect knowledge, there would be no difference between prices or quotas. An omniscient regulator would set an optimal price, and markets would determine the optimal quantity or, alternatively, the regulator could set the optimal quota and markets would arrive at the optimal price. In short, either instrument would have the same result. In an imperfect world, on the other hand, where costs are not known with certainty, Weitzman demonstrated that the selection of the more efficient instrument would depend upon the relative slopes of the expected marginal benefit and cost curves. Simply put, he said that the chances of making a costly mistake are less if prices are used when the expected marginal benefits curve is flatter, relative to expected marginal costs. On the other hand, quotas are preferred when the curves have the opposite relative position, and marginal benefits are steeper than marginal costs. In lay terms, one might interpret all this as prices 'biting more quickly' when abatement costs rise more steeply than the benefits of avoided environmental damage. Conversely, when the benefits (of reducing pollution) are increasing more quickly than the costs associated with doing so, cleaning up is more attractive, so setting a

[18] Weitzman, M. (1974), 'Prices vs Quantities', *Review of Economic Studies*, vol. 41, p. 477-91; Roberts, M. and Spence, M. (1976), 'Effluent charges and licenses under uncertainty', *Journal of Public Economics*, vol. 5, pp. 193-208.

quota on how much pollution should be cleaned up will be better than a price because it will minimise the chances of industries not cleaning up.

Writing at almost exactly the same time,[19] Roberts and Spence (1976) also examined the issue of whether regulatory authorities should focus on price or quantity instruments. Evaluating the efficacy of effluent fees (prices) or licenses (quotas) when there is uncertainty about the actual damage costs of pollution and the costs of pollution control, Roberts and Spence concluded that expected total costs would be minimised if the regulator used not one or the other, but *both* instruments simultaneously. This article gives the original justification for a 'hybrid' system, Roberts and Spence (1976) argued that prices were likely to be preferable when the expected damage is linear in nature, but that quotas would be more attractive when marginal damages are expected to increase. By deploying both instruments at the same time, Roberts and Spence (1976) suggested that 'each could protect the failings of the other', and effect a compromise.[20]

To summarise the preceding discussion, it is easy to see how those following this literature might slip into a discourse, when applying it to climate change, which states that the costs of quotas can exceed the benefits. This is a product of their focus on the short term costs of climate change and the use of the analytical construct of a short-run marginal benefits curve. A number of comments might be made of this, not least of which concerns the way the literature of the 1970s has been employed to address the climate change problem of the present.

Weitzman (1974) and Roberts and Spence (1976) had a different conception of pollution compared to the way we conceive of it today. It was local (e.g. effluent into a river), reversible, and it could be cleaned up quickly. Climate change is a clearly

[19] Although Roberts and Spence's article was not published until 1976.

[20] Roberts and Spence, *op. cit*., p. 194.

quite different proposition. In transposing the principles to climate change policy, theorists have added a time dimension and optimisation now takes place in both the short run *and* the long run. A price instrument (tax) is now recommended in the short run, because the short run marginal benefits curve (as defined earlier) is flatter than the marginal abatement costs curve, whilst quotas are deemed optimal in the longer run, when the marginal benefits curve is likely to be steeper than the marginal abatement costs curve. The ramifications of this arrangement are that, in the long run, an emission quota must be met, but in the short run, one need not be so concerned about meeting this quota, because setting a price (and letting quantity adjust) is economically optimal.

Whilst having the appearance of being logically coherent, one problem in this schema is the construct of the short-run marginal benefits curve. A relatively flat short run marginal benefits curve makes it sound innocuous and masks the fact that this is somewhat of a breathtaking leap into the unknown. One year's emissions of greenhouse gases, no matter how small in relation to the total concentrations, remain in the atmosphere for hundreds of years, adding to radiative forcing. Even if we ever reached a point of sufficient scientific understanding to realise that a certain year's emissions caused a threshold to be passed, this is not something we would find out until some considerable time had passed.

This is not a case of our misunderstanding the short run marginal benefits curve; we do accept that nothing will happen tomorrow from today's emissions, but today's emissions are not harmless. As Stern (2007) notes: 'While action is delayed, greenhouse gases in the atmosphere continue to accumulate, committing the world to greater impacts in the future or to the higher costs of bringing down flows of emissions more sharply to attain any stabilisation level. … The longer the stocks of

greenhouse gases are allowed to accumulate in the atmosphere, the greater the impacts to which we are committing the world. [21]

Surely we do not need to construe such a theoretical construct, and even if one did, how do we reconcile these conflicting recommendations of first the short, then the long run? Is it not the case that we are always in the short run? If not, how does one know when to behave with the long run in mind? Is there some theory missing that would be instructive in this regard?

Some writers, such as Hepburn (2006) have pointed out that a relatively flat short run marginal benefits curve does not mean that damages from climate change are inconsequential, and they could indeed be 'extremely high'.[22] If they are extremely high, though, this means that the *level* of the curve is very high (as distinct from the *slope*). This raises the question as to whether the curve would still be 'on the same graph' as the marginal abatement cost curve (in order to have an intersection point to indicate optimum abatement)! Further, assuming it is still on the same graph, what is being assumed about the abatement costs? Are they extremely high too at the assumed point of intersection?

On the issue of whether the short run or the long run optimisation analysis should take precedent, Stern (2007) makes the point several times that short term policies must conform to long term goals. He notes, for example, that 'the challenge is how to ensure that the short term policy framework remains on track to deliver the long-term stabilisation goal', and that 'short term tax or trading policies will need to be consistent with this long-term quantity constraint'. Again, he repeats that 'clear revision rules are therefore necessary to ensure that short-term policies remain on

[21]Stern, N. (2007) *The Economics of Climate Change*, Cambridge UK: Cambridge University Press, pp. 652 and 653,

[22] Hepburn, C. (2006) Regulation by prices, quantities or both: A review of instrument choice, *Oxford Review of Economic Policy*, Vol. 22, No. 2. p. 232.

track to meet the long-term stabilisation goal'.[23] Stern's (2007) emphasis on the importance of the long run goal clearly derives from the report's analysis of the science, as well as the economics of climate change. Of the stabilisation (of greenhouse gas emissions) scenarios depicted, Stern picks a middle course (of 550 ppm CO2e) where the scientific predictions are of potentially serious but not dire effects. Mid-term targets will then depend on the timetable a country chooses to meet that stabilisation level.

In the CBO papers for the United States audience, on the other hand, there appears to be an argument that the short run optimisation goal will be the one to prevail, not the long run. These papers emphasise that when there is uncertainty about industry costs, the short-run preference for prices over targets is best, and that this is likely to change to a preference for targets 'only under restrictive conditions that do not currently exist'[24] or under 'very restrictive conditions'.[25]

In response to the criticism in this paper that the optimal abatement analyses gives no indication of which of the two conflicting recommendations is to prevail (managing the price or managing the target), one might make the point that differing short and long run targets are not uncommon within macroeconomic policy sphere. In the case of monetary policy, for example, these conflicting objectives are not a concern. Short run interest rates are determined according to short run economic conditions whilst longer term targets are set for the rate of inflation. Paradoxically,

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[23] Stern (2007) *op. cit*. pp. 359 and 360.

[24] CBO Paper (2005), *Uncertainty in Analyzing Climate Change: Policy Implications*, January, United States Congressional Budget Office, p. xii. The restrictive conditions appear to derive from a study by Newell, R. and Pizer, W. (1998) 'Regulating stock externalities under uncertainty', Discussion Paper 99-10, Resources for the Future, Washington. The modelling in this study shows that emissions reductions have to be quite stringent before a preference for quotas would replace the preference for prices, and that 'the 5 percent aggregate reductions mandated by the Kyoto Protocol are inconsistent with quantity regulation regardless of parameterization' (p. 4). Their model also concludes that 'flatter [marginal] benefits not only favour price policies, but also lead to lower abatement levels' (p. 4).

[25]CBO (2005) 'Limiting carbon dioxide emissions: Price versus caps', *Economic and Budget Issue Brief*, March 15, p. 4.

however, the analogy is useful precisely because it demonstrates that the monetary authorities are, in fact, given a clear charter favouring the medium term goal of currency stability, whilst short run interest rates stabilise the economy and encourage economic growth within boundaries compatible with achieving the medium term target. As we shall argue below, a similar rationale in favour of the long run goal for the microeconomics of climate change needs to be just as clearly stated. This point is important because the ambivalence within the McKibbin-Wilcoxen literature, and the economics as it has been presented in the CBO papers, have given serious cause for concern. In short, if policies derived from these analytical foundations are to be adopted, then the impression is formed that the environment will become the 'safety valve' and targets will not met.[26]

4. Problems with the long-run marginal cost of climate change

The long-run marginal cost of climate change is also called the social cost of carbon (SCC). The definition and use of the concept by Stern (2007) is explained as follows:

> Consider, for example, the social cost of carbon – that is, the impact of emitting an extra unit of carbon at any particular time on the present value (at that time) of expected wellbeing or utility. The extra emission adds to the stock of carbon in the atmosphere for the lifetime of the relevant gas, and hence increases radiative forcing for a long time. The size of the impact depends not only on the lifetime of the gas, but also on the size of the stock of greenhouse gases while it is in the atmosphere, and how uncertain climate-change impacts in the future are valued and discounted. The social cost of carbon has to be expressed in terms of a numeraire, such as current consumption, and is a relative price. If this price is higher than the cost, at that time, of stopping the emission of the extra unit of carbon – the marginal

[26] Hamilton, C. and Muller, F. (2007) Critique of the McKibbin-Wilcoxen Emissions Trading Scheme, The Australia Institute Research Paper No. 42, Canberra, The Australia Institute, p. 5.

> abatement cost – then it is worth undertaking the extra abatement, as it will generate a net benefit. In other words, if the marginal cost of abatement is lower than the long-lasting damage caused by climate change, it is profitable to invest in the abatement.[27]

From this long-run optimal abatement analysis so described, comes the case for 'early', 'strong' and 'urgent' action. Not content to settle for the clearly prohibitive economic and environmental costs indicated qualitatively by certain emission pathways identified in his discussion of the science, however, Stern (2007) still sees a necessity to present the analysis in terms of optimal abatement frameworks. In our view, this stretches the credibility of the economics. To put this into context, let us consider what is involved in the calculation of the SCC.

The expected climate change impacts rise with increasing concentrations of greenhouse gases because average global surface temperatures also rise. The exact relationship between concentrations of greenhouse gases and temperature is not understood precisely (and whether, for example, there are feedback loops to hasten temperature change, or 'global dimming' effects), but temperatures are expected to rise and it is this that will cause the physical impacts. Among these are:

- falling crop yields in many developing regions; smallholder subsistence farmers and those reliant on fishing, particularly at risk
- large numbers of people at risk from hunger
- hundreds of millions of people exposed to acute water shortages, particularly in Africa
- at temperature rises of 4°C, sea level rise threatening major world cities

[27] Stern, N. (2007), *The Economics of Climate Change*, Cambridge, UK: Cambridge University Press, p. 322.

- many ecosystems having insufficient time to adapt, many species facing extinction
- coral reef ecosystems extensively and irreversibly damaged
- rising intensity of storms, hurricanes, forest fires, droughts, flooding and heat waves
- coastal regions experiencing increased damage from floods and storm surge; coastal wetlands disturbed
- increasing health costs from malnutrition, diarrhoeal, cardio-respiratory and infectious diseases; disease vectors changing;
- increasing morbidity and mortality from the heat waves, floods and droughts.[28]

Impacts of this magnitude not only pose problems of risk (possible outcomes known, probabilities known) and uncertainty (possible outcomes known, probabilities not known) but also of ignorance (the full range of possible outcomes are not known, neither are probabilities) and indeterminacy, which adds to ignorance; the fact that we do not know how *societies* would react to some of the extreme outcomes possible.[29]

Even if we *did* know quite precisely the physical impacts and social outcomes, we still have the problem of assigning monetary valuations to the market and non-market effects. The impacts under consideration here are not marginal. Climate change impacts are potentially so large relative to the size of the global economy, it cannot be assumed that everything apart from this change will be undisturbed – a

[28] List taken from Stern (2007), *op. cit*., p. 330 and *Working Group II Contribution to the Intergovernmental Panel on Climate Change* (2007), Fourth Assessment Report, Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability, Summary for Policymakers, 6 April, p. 15.

[29] Ekins, P. (2005), *A note on the impossibility of deriving a scientifically valid, ethically sound or policy-useful estimate of the social cost of carbon.* Obtainable from: www.defra.gov.uk/environment/climatechange/research/index.htm.

necessary feature for sensibly valuing a marginal change. It cannot be assumed, for example, that economies will continue to grow after the change, at the rate they were growing before the change. Prices, income distribution and the scale of economic activity are all likely to be profoundly affected, so there would appear to be no valid way to value the effects described.

Even if valuation was possible, there is the question of plotting dollar values of climate change impacts against emissions. We simply do not have the scientific knowledge to do this sufficiently well to draw curves. We know that emissions create concentrations, that these concentrations create temperature rises, and temperature rises create the physical effects that, validly or otherwise have been monetised, but we do not have the knowledge to trace these values back to annual emissions, which is the relationship needed for the SCC curve in the optimal abatement analysis.

In summary, therefore, the reality of the situation is that as we do not know the nature of the physical impacts with any certainty, we can barely hazard a guess at societies' reactions to these, we have no scientifically valid way of valuing the impacts and no way of relating these to emissions. In short, it is stretching the credibility and integrity of economic techniques to the limit to suggest that such models can come up with meaningful magnitudes.

Stern (2007) is certainly aware of many of these problems and pitfalls, but it is a mystery to us why he deemed it necessary to plough on regardless, unless it was thought necessary to take this particular approach to get more attention to the issue of climate change. In this, of course, he was remarkably successful, and one must applaud the end, if not the means. One is reminded of Herman Daly's comment on the 1997 attempt to value the world's ecosystem services (a valuation that, ironically,

was roundly condemned by many neoclassical economists for its non-marginal nature):

> There are evident physical consequences of excessive human expansion that scream the same message without the need of explicit valuation. But for those who only hear dollars, let us scream now and then in dollars! It is a crude and inaccurate measure, but I think it is more than a 'bad underestimate of infinity'.[30]

In his defence, Stern (2007) did persist with the optimal abatement framework as one of three ways of approaching the economics of climate change, and whilst ecological economists might wince at a calculation of the SCC, it is certainly worth noting in passing that there are a number of methodological differences in Stern's work that are welcome departures from earlier climate change studies. These include:

- an expected utility approach that allows for risk aversion in a way that gives some weight to the Precautionary Principle;
- greater weight (than earlier studies) given to loss of life in poor countries;
- a low discount rate;
- equity weighting (a higher valuation for the loss of one dollar in poor countries, compared to the loss of one collar in rich countries);
- weight given to uncertainty, amplifying-feedback risks and risks of extreme events;
- effort devoted to identifying and discussing the implicit ethical assumptions of economic techniques.[31]

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[30] Daly, H. (1998), 'The return of Lauderdale's paradox', *Ecological Economics*, vol. 25, pp. 22-3. The valuation of the world's ecosystem services was undertaken by Costanza, R. *et al*. (1997), 'The value of the world's ecosystem services and natural capital', *Nature*, vol. 387, pp. 253-60.

[31] See Stern (2007), *op. cit*., p. 314 and Chapter 2 for more details on the economic methodology of the study.

5. The proposals of the McKibbin-Wilcoxen hybrid scheme

The hybrid policy envisages that the government will sell two kinds of emission permits;[32] long term permits entitling the owner to the permit to emit one metric ton of carbon every year forever, and short term (annual) permits allowing one ton of carbon to be emitted in a single specified year at a stipulated price. The long term permits may be sold for a lesser period if the government chooses to issue permits of varying length (e.g. 20, 30 or 50 years) to maturity.

The long term permits are limited in quantity to the emission target Australia chooses to meet. For example, some agreed fraction of 1990 (or current) levels. They are issued only once, when the policy commences, and they can be bought, sold or leased only within Australia. The market will determine their price.

A scheme such as this has several appealing features. To begin with, the scheme provides a price signal, which raises the price of conventional energy sources and assists renewable sources to compete as alternatives. In addition to this, the long term nature of the tradable permits provides firms with the capacity to manage their climate change risk. Thus, firms making large investments in plant lasting for many decades can do so assured of the price of their carbon emissions. McKibbin and Wilcoxen (2006) argue that companies pay significant amounts to reduce risk when making very large investments in infrastructure, and the long term permits offer a

[32] This description of the scheme is based on McKibbin, W. and Wilcoxen, P. (2006), 'A credible foundation for long term international co-operation on climate change', *Working Papers in International Economics*, June, No. 1.06, Lowy Institute for International Policy, Sydney; and also McKibbin, W. (2006), 'Why Australia should take early action on climate change', Lowy Lunch Lecture, December 13. Available at www.lowyinstitute.org, accessed 22 May 2007.

straightforward way to manage climate policy risk. They further argue that this lowers the cost of capital, providing a significant economic benefit.[33] Recent research from the OECD (2007) supports this contention, noting that 'climate policy risks may be brought down to modest levels compared to other risks if policy is set over a sufficiently long time scale into the future'.[34] According to the OECD, this encourages earlier adoption of lower emission technology and avoids significant inefficiencies that policy uncertainty tends to encourage; for example, extending use of existing infrastructure beyond optimal levels, and the creation of investment cycles that exacerbate short term peaks and troughs in generation capacity.[35] When new capital investments are undertaken that reduce the need for permits, then holdings of permits can be sold at that time.

Maintaining the credibility of policy is also important to risk assessment, according to the OECD,[36] and to do this, governments must enforce and monitor the policy assiduously to ensure the permits retain value. With policy certainty and credibility, the added advantage of long term permits is that they will build up a constituency of support for the continuation of the policy when governments change. In other words, the existence of valuable long term permits held by companies and financial institutions in the private sector give these parties a strong financial stake in lobbying for unchanged policy arrangements at the end of a government's term in office. Such an incentive is not likely to exist if the policy instrument was, for example, a carbon tax.

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[33] McKibbin, W. (2006), 'Why Australia should take early action on climate change', Lowy Lunch Lecture, December 13. Available at www.lowyinstitute.org, accessed 22 May 2007.

[34] Organisation for Economic Co-operation and Development (OECD) and International Energy Agency (IEA) (2007), *Climate Policy Uncertainty and Investment Risk*, Paris: OECD, p. 14.

[35] *Ibid*., pp. 13-16.

[36] *Ibid*. p.14.

In addition to these features, the initial allocation of the long term permits affords an opportunity to 'bribe' parties most capable of blocking the implementation of the policy (by free allocation of permits); a price that may not be too high to pay, given the urgency and importance of getting the policy in place. In this regard, climate policy is not unlike other structural adjustment policies where opposition is much reduced when financial inducements are substantial.

The initial allocation of the permits also offers an opportunity to address international competitiveness concerns. Free allocation of long term permits can provide compensation for loss of competitiveness, and unlike other measures of addressing competitiveness concerns (such as excluding a company from the scheme), it provides an ongoing incentive to look for ways of abating greenhouse gas emissions. This is because the permits can always be sold for profit. In this way, compensation will not be 'entrenching old ways', as it is sometimes said to do, because there will always be an incentive to sell the permits.

The annual permits, on the other hand, build into the scheme a capacity to manage short run adjustment costs. This is important because carbon policy is 'new territory' for policy-makers and we do not know yet how high (or low) industry abatement costs will be. The annual permits, because they are being issued at a fixed price, can effectively cap the costs of abatement. This is because firms will always undertake abatement activity up to the point where the costs of going any further exceed the price of the permit. When it becomes cheaper to buy an annual permit, then the price of the permit effectively caps the abatement costs. We could say, metaphorically, that the annual permits facilitate a 'Hungarian' route to a fundamental economic transition rather than a 'Russian', 'scorched earth' route. Also, factors such as extremely hot weather, for example, could precipitate a surge in energy demand

and push long term permit prices very high, as efforts are made to cover extra emissions. The annual permits would provide an 'escape valve' to limit price volatility of this sort. The main disadvantage with the annual permits is that they threaten the achievement of the long term target, unless reviewed periodically. This a point to which we shall return shortly.

Aspects of the structure of the McKibbin-Wilcoxen hybrid scheme do appear to satisfy desirable policy design principles as defined by those in the ecological economics community:[37]

- *Macro-control with the minimum level of micro-level freedom and variability*

Trading long term permits in the market is efficient compared to direct regulation to deal with emissions because firms are in the best position to know their own costs and abatement options. Trading tends to equalise marginal abatement costs across the economy (in theory, assuming 'smooth' abatement curves, those firms that can afford to abate cheaply will do so up to the point where the abatement costs equal the permit costs) ensuring a least-cost abatement path for the economy as a whole. The annual permits, too, allow some desirable micro-variability and freedom to deal with the unexpected, within overall macro-control. (Again, this is provided, of course, that the annual permits are utilised in such a fashion that the macro goal is not compromised.)

- *Leaving a margin of error to adapt to changed conditions*

The level of uncertainty when dealing with climate change is, as we have already noted, very high. Policy must be able to adapt without destroying credibility. Should it be necessary to step up national abatement to meet a tighter long term target, the hybrid scheme does provide an option for governments to step in and buy (remove) long term permits in a manner similar to the current government purchase of

[37] Daly, H. and Farley, J. (2004), *Ecological Economics*, Washington: Island Press, pp. 360-363.

oversupplied water rights. That the federal government would have to do this, at a cost to taxpayers is a cause for concern, but it would appear to be the most equitable and politically acceptable solution. We would argue, in fact, that it is a potential liability that the government should be preparing for during a period of budget surpluses. Indeed, the staging of a formal inquiry by Australian federal and state governments into the possible economic and financial impacts of climate change, the timing of these events, adaptation options, and the best way to fund future liabilities is probably well overdue. Development of a policy framework on a similar scale to that of Australia's National Competition Policy of the 1990s would seem highly desirable in order to prepare for structural adjustment towards a low carbon economy.[38]

Apart from purchasing long term permits as a way to hasten abatement towards a revised emission pathway, if it turns out to be necessary to meet the given target more quickly as a result of overshoot, then the option available to the federal government under a hybrid scheme is to raise the price of the annual permits. This would lift abatement activities up to the higher level of the annual permit price. Abatement would be further stimulated by the fact that the price of the long term permits (the present value of the annual permits over the relevant time period) would also rise, together with the opportunity costs of holding on to these permits.

- *Gradualism and use of current institutions rather than radically re-designing new institutions*

The hybrid scheme will create new financial instruments, new regulations and new regulatory authorities and, whilst there is nothing easy about successfully implementing such a program, it can largely be done using the existing socio-legal

[38] This suggestion is made by Hamilton, C. and Dennis, R. 'The transition to a post-growth society' in J. Goldie, B. Douglas, B. and B. Furnass, (eds) *In Search of Sustainability*, Collingwood, Victoria: CSIRO Publishing, p.50.

infrastructure and other basic institutions (e.g. markets and bureaucracy) already in place.

- *Congruency of the domain of the policy-making unit with that of the causes and effects of the problem policy deals with*

Climate change is a global problem and ideally it needs to be dealt with at a global level. It is true, however, as negotiations over complex international trading rules amply demonstrate, that waiting until the institutional detail of international negotiations is settled will delay implementation of carbon trading schemes. As McKibbin (2006) argues, a national scheme can be put into place much more readily, and then 'harmonised' with other national schemes to form an internationally co-ordinated policy. Institutional arrangements under Kyoto are currently being renegotiated, and a hybrid scheme adopted within Australia can (and should) co-ordinate with these as far as possible. The direct question of whether Australia negotiates to be part of international carbon trading should be left open, perhaps, until developments elsewhere become clearer. McKibbin's (2006) view on this is quite unequivocal: permit trading and any offset arrangements under a hybrid scheme should apply solely within Australia because the added administrative burdens, delays and loss of sovereignty entailed in international agreements will offset any efficiencies gained by expanding trading opportunities.

One problem with the exposition of the McKibbin-Wilcoxen proposals is the ambivalence concerning the point at (or pathway along) which the annual concern about smooth adjustment costs gives way to the goal of ensuring the long term quotas are met. The lack of clarity on this in the description of proposals in the McKibbin-Wilcoxen literature seems to parallel the same ambivalence in the theory. It is important to stress, therefore – as Stern (2007) does – that any scheme Australia

adopts must be designed to ensure that the long-term emission targets are met. One way to do this would be to adopt the suggestion of Helm, Hepburn and Mash (2003),[39] and create an institution with the charter to ensure that the emissions goal is achieved. In an Australian context this might mean establishing a 'Carbon Bank' that would function rather like the Reserve Bank. Just as the Reserve Bank has a charter to meet an inflation rate target, using interest rate policy to ensure that this target is reached as smoothly as possible, a Carbon Bank could be given the charter of meeting the long term emission target, using 'permit policy' to ensure that the route towards this target is not too economically disruptive. With such an agency, the credibility and certainty of policy is further assured and, because this will lower the cost of capital, investment in low carbon technologies is encouraged.

To sum up this discussion of the proposals of the hybrid scheme, the institutional framework advocated, especially if a Carbon Bank is added, has the potential to manage the important requirement for business certainty and policy credibility, whilst also containing economic adjustment costs on the way to achieving long term goals. The latter feature addresses the much publicised political concerns about economic impacts of a carbon price. The scheme also offers a facility to compensate the most politically difficult opponents and build up a constituency of longer term support, and it can manage the difficult question of international competitiveness in a way that retains the incentive to invest in low carbon technologies. Finally, it has ways of handling any need to revise long term goals. Although there are many specific details yet to be decided – upon which the policy could stand or fall – it is a politically adroit and innovative approach to instituting a clear carbon price.

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[39] Helm, D., Hepburn, C. and Mash, R. (2003), 'Credible Carbon Policy', *Oxford Review of Economic Policy*, November, Vol. 19, Iss. 3, pp. 438-447.

6. Carbon Offsets

A national carbon trading scheme such as the hybrid system can be extended to include carbon offsets. Those in a position to provide carbon sinks can contract to do so and receive credits for the (estimated) amount of carbon that is offset by the type of sink provided. Offsets thus provide another option for purchasing carbon credits in addition to long term and annual permits. The NSW Greenhouse Gas Reduction Scheme (NGAS) set up in 2005 is an example of an offset scheme. NGAS establishes targets for electricity retailers in NSW, and is monitored by the Independent Pricing and Regulatory Tribunal (IPART) of NSW. IPART also administers the scheme, accrediting parties to undertake eligible offset projects which then provide certificates that electricity retailers (and other parties) may buy in order to emit carbon. Forests NSW, for example, is fully accredited as an abatement certificate provider.

One of the advantages of setting up a national trading scheme as soon as possible (as distinct from waiting until international rules are agreed) is that offset schemes can then be devised to suit local (i.e. national) priorities. Few would likely disagree that a local priority for Australia would be providing tree and soil carbon offsets to restore soil fertility and provide greater drought resilience to degraded lands. Research into the willingness of farmers to participate in such schemes indicates that interest in doing so is high.[40] The measurement of (net) carbon

[40] See Patrick, I., Barclay, E. and Reeve, I. (2007), 'Determining landowners' willingness to participate in offset markets', *Report to the Environmental Trust*, Project No. 2005/RD/0081, University of New England, Armidale: Institute for Rural Futures. See also, for example,

'Soil Carbon 'needs check', *Queensland Country Life*, 22 February 2007, p. 4;

'Harness the power of grass', *Armidale Express Extra*, 28 February 2007, p. 25;

sequestered in soils in less precise than that for trees, but vegetation cover such as grasslands, managed with regenerative grazing practices, can provide more effective soil carbon storage than trees because the roots can put carbon back into the soil quickly.[41] Jones (2006) estimates that around 50-80 per cent of organic carbon that was once in Australian topsoil has been lost to the atmosphere and hence, by inference, degraded soils have the potential to store up to five times more organic carbon in their surface layers than they currently hold.[42] Regenerative cropping and grazing patterns – allowing sufficient rest from grazing to build up pasture and root biomass – increase biological activity in the soil and increase soil water storage, nutrient cycling and disease suppression. Increasing the root biomass and biological activity in the topsoil can also reduce soil acidity and the incidence of dryland salinity as well as providing crops (foods) that are higher in vitamin and mineral content and lower in herbicide and pesticide residues.

Whilst the accurate measurement of net soil carbon retention requires more research, it is known with greater certainty that particular land management practices improve soil carbon capture and retention among other environmental and economic benefits. It is possible, therefore, to identify management guidelines that are sufficiently robust to warrant inclusion in a carbon offset scheme. This, in fact, is precisely what the Chicago Climate Exchange does, offering carbon credits under its 'No-Till program', the 'Seeded Grass and Forage program' and the 'Native Rangeland' program, in addition to running a forestry credit program.[43] The Chicago

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'Australia to trial carbon soil scheme', *Australian Broadcasting Commission*, Radio National, ABC Rural News, 28 February 2007.

[41] Brunckhorst, D. and Whalley, W. (2006), 'Carbon credits need work: UNE', as reported in *Rural Weekly*, Toowoomba: 9 March 2007, p. 9.

[42] Jones, C. (2006), 'Soil carbon and carbon credits', paper presented to YLAD Living Soils Seminar, Eurongilly, Young, NSW, 14-15 February, p. 2. Available at www.amazingcarbon.com.

[43] See www.chicagoclimatex.com for further details.

Climate Exchange (CCX) offers a fixed amount of carbon credit per ton per acre; for example, for grasses planted after 1999, eligible United States counties are credited with 0.75 metric tons of $C0_2$ capture per acre per year. Local farmers associations are accredited with the CCX as 'Offsets Aggregators' which means that they can bundle together the farmers contracts, buy carbon credits and on-pass these funds to the farmers. The price obtained will depend on the price prevailing at the time the offset credits are on offer. The Offset Aggregators hold back a percentage of the credits until the final year of the contract period (usually around five years) in order to provide an incentive for farmers to complete their undertakings. Amongst the companies listed as members of the CCX are companies such as Cargill and AGL Energy. Such companies could be buying credits from an Australian Climate Exchange, were one to be set up, thus directing their funds to Australian rather than United States farmers.

Aside from the significant environmental and economic benefits of including farmers in an offset scheme under an Australian carbon trading system, it must be said that there are strong equity reasons for including them as well. Should Australia achieve its 2008-2012 Kyoto targets it will be largely because of the bans imposed on land clearing. Between 1990 and 2004 Australia's net emissions increased by 2.3 per cent. Within this respectable figure, however, is an increase of 43 per cent from stationary energy suppliers over the same period, a 23.4 per cent increase in transport, and an 18 per cent increase from industrial processes. These increases were offset by a 72.5 per cent decrease in emissions from Land Use, Land Use Change and Forestry.[44] This is a cost borne by farmers in terms of lost production opportunities. It is unfair to deny farmers the opportunity to obtain some benefits under a national

[44] Robinson, M. (2006), 'Future climates and Australia's greenhouse profile', former CEO, CRC for Greenhouse Accounting, web site now supported by ANU. See www.greenhouse.crc.org/briefings/

scheme, particularly since building a political constituency to support a proposed scheme is so important to ensuring successful implementation.

7. Summary and Conclusions

The goal of this paper was to critique the McKibbin-Wilcoxen hybrid scheme as a means to address the climate change problem in Australia. The task has taken us to Stern (2007) and related literature on the economics of climate change. Our argument has been that there is much to admire in the institutional arrangements suggested for a national carbon trading scheme. Where ambivalence exists in the scheme, it can be traced back to the theory on which the analysis is based. This theory – optimal abatement analysis – cannot be applied in any credible way to the problem of climate change policy. It is not necessary to do so in any case, because the McKibbin-Wilcoxen hybrid scheme can be justified by arguing for a cost-effectiveness approach to reaching a scientifically determined target.

Having given our qualified support for the McKibbin-Wilcoxen scheme, we then made the case for utilising this system to satisfy broader ecological economic goals through the more extensive use of carbon offsets. While we accept there are uncertainties regarding the reliability of some carbon offset schemes, we argue that there are positive externalities in farm management to increase soil and timber carbon which could outweigh these uncertainties. Furthermore, in addition to a high willingness to participate on the part of the farm sector, there are strong equity reasons for including it given its contribution to the reduction in emissions from enforced land use change.