Climate Change Policy and Forestry

Review of an NZIER report entitled:

Effects of New Zealand's Climate Change Policies on the Forestry Sector - Stage I: Preliminary Assessment

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Executive Summary

- This paper reviews the first results from a three-stage research programme being undertaken by the New Zealand Institute of Economic Research (NZIER) into the impacts of climate change policies on the forestry sector.

- The terms of reference for Stage 1 of the NZIER study were extensive and, given the time and resources available, arguably reflected over-ambitious expectations of what could be accomplished. While this qualification limits the extent of analysis that could reasonably be expected, the Stage I report still falls short of reasonable expectations, primarily as a result of a lack of rigor in its analytical framework. It also does not appropriately qualify its conclusions to indicate the limitations of the analysis undertaken.

- Given the very tentative and preliminary nature of the analysis in the Stage I report it is unfortunate that the Executive Summary presents as definite conclusions a number of hypotheses which are not substantiated by that analysis.

- A serious omission is the lack of any baseline evaluation of the likely gains and losses for the New Zealand economy as a whole from implementation of the Kyoto Protocol. Recent work by other analysts suggests that New Zealand may well have a carbon-trading surplus due to the crediting of forest sinks during the first commitment period, with sinks more than compensating for the penalties on excess emissions over New Zealand's assigned amount. If verified, this potential "Pareto gain" for the economy as a whole ought to set the scene for detailed debate over the design of domestic climate change policy and its effect on the forestry sector. The Stage I report lacks, however, a set of estimated national carbon-trading accounts for New Zealand in the first Kyoto commitment period (2008-2012), and hence provides no estimate of the likely balance of sources and sinks across the economy as a whole.

- The pattern of allocation of a national carbon-trading surplus, if indeed one were to emerge, would then be a key policy issue in determining whether individual sectors or subsectors gain or lose. Detailed comparison of alternative policy packages has, however, been left to the last stage of the NZIER research programme. This leaves a gap in the Stage I discussion, which assumes climate change policy to consist simply of an unmodified pass-through of international price signals by the New Zealand Government. The provisional conclusions drawn in Stage I are heavily dependent on this policy specification, and can be expected to change as the NZIER modeling work progresses towards more sophisticated and fully developed policy scenarios.

- A major shortcoming of the Stage I work is the absence of reference to any previous or current economy-wide analysis, to ensure that the sectoral projections are located within a consistent macroeconomic context. Although such a starting point was specified in the terms of reference, the analytical framework of the Stage I study remains confined to partial equilibrium analysis, with macroeconomic variables such as the exchange rate, the wage rate, and the cost of capital held fixed by assumption. Partial analysis is often appropriate for the analysis of policies which are targeted at specific sectors and have little impact on the national economy as a whole. When dealing with the sectoral effects of policies which impact on the economy as a whole, general equilibrium analysis is to be preferred.

- In discussing the international competitiveness of forestry-based industries, the Stage I report does not appear to have taken account of the principle of comparative advantage, which provides the essential basis in economic theory for explaining the success or failure of individual export sectors in a small open economy. The principle states that with the aggregate balance of payments in equilibrium, the economy will export those goods which it is able to produce at the lowest relative opportunity cost, and import those which can be produced only at high opportunity cost.

- The Stage I report frames the issue of the international competitiveness of forestry in terms of absolute, not comparative, advantage. There is no discussion of the extent to which climate change policies would change the relative ranking of forestry as against other export sectors in terms of comparative advantage. Failure to address this issue means that the Stage I report almost certainly reaches conclusions about the impact of climate change policies on forestry export prospects which are too pessimistic.

- A number of key distinctions specified in the terms of reference are not well carried through in the Stage I discussion. International and domestic policies are treated as an undivided whole, when it would have been more informative to have evaluated domestic policy options for New Zealand on the assumption that prior overseas implementation of the Kyoto Protocol is taken as given. "Non-Kyoto" forests are not clearly separated from "Kyoto" forests when setting up the relevant sectoral balance sheet. Economic responses in Annex I and non-Annex-I competitors are similarly bundled into a single narrative, when separate treatment would have clarified the mechanisms assumed to be at work behind the predicted global log glut.

- The perception of perverse incentives to deforest non-Kyoto forests prior to 2008 appears to be the central mechanism driving the report's log price projections, but is not adequately explored. Evidence is not assembled to show what proportion of New Zealand's non-Kyoto forests are on land which could be expected to switch to other uses at the next harvest. (There is no policy-derived motive for premature harvesting of land

which is to remain under forestry.) Nor are any calculations presented to reconcile the predicted premature harvesting with rational forward-looking behaviour in a market where arbitrage is possible both between countries and over time. The conclusion that owners of non-Kyoto forests must lose from climate change policies is not convincingly argued.

- The processing sector balance sheets, and the accompanying prediction of negative impacts, rely heavily upon three hypotheses which are not well substantiated: that large-scale displacement of fossil fuels by wood-waste in the processing and pulp and paper industries is not feasible; that climate change policies will slow the domestic economy down sufficiently to cause a recession in the domestic construction industry; and that imported cement will become increasingly competitive against domestic timber products in a post-Kyoto economy.

- The ongoing NZIER work on the second and third stages of the analysis provides ample opportunity for the shortcomings identified in this review to be addressed.

1. Introduction

The New Zealand Institute of Economic Research (NZIER) has prepared, for the Wood Processing Strategy Climate Change Group, two reports addressing the likely impacts, on forest-based industries, of policy measures expected to be implemented following ratification by New Zealand of the Kyoto Protocol.

The first of the two reports sets out the conceptual framework adopted by the NZIER analysts in approaching their task. The second report (still to be completed at the time of writing) quantifies various effects, using a spreadsheet model developed in-house by NZIER.

The Ministry of Agriculture and Forestry (MAF) has asked Simon Terry Associates Ltd (STA) to review both reports. This paper contains our comments on the Stage I report. A review of the Stage II modeling work will be undertaken once a final version of the Stage II report becomes available.

2. Objectives of the NZIER Study

The terms of reference are not appended to the Stage I report but were made available for this review in the form of a "third draft" version which dates from mid-2001 and envisions a report being completed by June 30 2001. (The first version of the Stage I report from NZIER was completed in July.) The draft terms of reference state that:

> The purpose of this study is to complement the existing macroeconomic and broad microeconomic modeling underway by providing the Government with a clear picture of the impacts of climate change policies on the forest sector as a whole. The study would attempt to quantify the gross costs and benefits of the policies as well as estimates of net effects. In particular, it should give a clear sense of how the Kyoto regime will affect marginal management and investment decisions in the forest sector, such as decisions to replace felled trees or pay for 'emissions'….[T]he study should attempt to indicate the likely order of magnitude of particular effects so that important effects can be identified for more intensive quantitative analysis leading up to the N[ational] I[nterest] A[nalysis] in November 2001.

The terms of reference emphasise the link between the forest-sector study and three other studies commissioned for the National Interest Analysis:

> The ABARE and Infometrics macroeconomic studies apply general equilibrium methodologies to ascertain likely GDP consequences of various policy scenarios. The PA Consulting study seeks to identify the nature of price transmission within various sectors of the economy. All of these studies touch upon the forest sector but do not provide the depth of analysis necessary to satisfy the information requirements of [the] Cabinet programme.

The terms of reference would seem, therefore, to require the analyst to at least refer to, if not start from, the results of recent general-equilibrium work, including sectorally-disaggregated scenario projections of output and value added under various policy assumptions, and to see how an in-depth investigation of sector-specific information relating to forestry might modify or amplify the results from those studies.

The terms of reference furthermore direct the analyst to "draw upon existing global wood sector studies to the greatest extent possible".

The project is to be phased in three steps. In Stage I (the subject of this review) the aim is to "identify key sectoral effects that would arise from New Zealand policies to implement the Kyoto Protocol, the key drivers of those effects and their orders of magnitude. The initial objective is to develop an analytical framework that will establish the connection between certain components of the Kyoto Protocol and any associated domestic policies with particular sectoral effects that will manifest themselves in the forest sector. Stage I would therefore comprise the development of a qualitative framework and the delivery of some partially quantified results."

In particular the terms of reference directed the analyst to "consider, as an input, the findings of a Forest Research Institute (FRI) report contracted by MAF ('The Effect of Different Carbon Credit Values on Rates of New Land Planting')" and noted that in that report the prediction had been made of a "wall of wood" flooding the world market, due to South American afforestation in response to carbon trading. The Stage I study

> would be expected to develop three areas that were not addressed in detail by FR[I]. These are the international context, price and supply assumptions appropriate under the Kyoto regime, the mechanics by which Kyoto effects are passed through the New Zealand forest sector value chain and the impacts on the forest processing sub-sector as well as forest owners.

The terms of reference include two and a half pages of detailed issues and effects to be analysed. Clear distinctions were to be drawn between:

- the international and the New Zealand domestic policy responses to Kyoto;
- the forest-sector economic response patterns in Annex I and non-Annex I competitors of the New Zealand forest sector;
- Kyoto and non-Kyoto forests; and
- narrow (CO2 only) and broad (methane included) policy regimes.

Stage I of the study was to produce projections for:

- forested land area,
- planting patterns,
- annual volumes of plantation timber,

- the pattern of new processing investments, and
- "the timing of these effects relative to the timing of the exercise of the climate change instrument that drives the effect".

Scenarios to be investigated were to include:

- a base case without the Kyoto Protocol;
- a carbon-charge-only case, a narrow New Zealand regime with and without sinks under the CDM, and
- a broad New Zealand regime with and without sinks under the CDM.

When measured against these extremely ambitious, demanding and wide-ranging terms of reference, it is probably inevitable that the work under review falls short of the required outputs. A substantial research team, with modeling capability already in place, would require several months to do justice to the issues set out. It was unrealistic to expect NZIER on its own to fulfil the specified brief with a small team working within what appears to have been a very short time frame. The Stage I report indeed does not fulfil the brief in more than a very limited sense.

Even granted that the terms of reference embodied over-optimistic expectations of what could be achieved within the time and resources available, the Stage I report fails to carry forward significantly the previous state of knowledge on the areas covered by the terms of reference. In some respects it is less clear than the terms of reference in its framing of the problem and design of a conceptual framework. Key distinctions set out in the terms of reference become blurred in the report itself; the prescribed scenarios are given only the most cursory and limited discussion; and many of the economic response mechanisms which underlie key predictions of the study are poorly articulated and not substantiated by reference to relevant evidence or theory.

The report fails to begin from a literature review covering the specific starting points to which, according to the terms of reference, the research was to be anchored. We understand that the ABARE modeling work referred to in the terms of reference was not completed in time to be available to the NZIER team, which would obviously have handicapped significantly NZIER's ability to relate its forestry sector work to the economy-wide context as projected by ABARE. However there does exist quite an extensive range of general-equilibrium economy-wide model results exploring the impact of climate change policies on New Zealand, and given the preliminary status of the Stage I report as the scene-setter for later sector-specific modeling, it would have been appropriate both to refer to that existing literature and to include in the Stage I conceptual framework a basis for the eventual incorporation of the ABARE results into the Forestry sector study.

It is true that existing general-equilibrium models lack satisfactory routines for the incorporation of carbon sinks. Nevertheless, the substantial existing modeling literature on economic adjustment to carbon charges ought to have provided the starting point for the work reviewed here.

The Stage I report contains no reference to any general-equilibrium modeling of climate change policy; no review of existing global wood market studies or of wood-sector results from general global trade models; and no direct reference to the FRI report's predictions regarding a possible wall of wood, although a substantial part of the Stage I report's discussion of forestry and logging is premised on the idea of a global forestry "hog cycle" driven by a hypothetical - but poorly-articulated - expectational mechanism relating to carbon charges and credits.

3. Does the New Zealand Economy Gain or Lose from Kyoto?

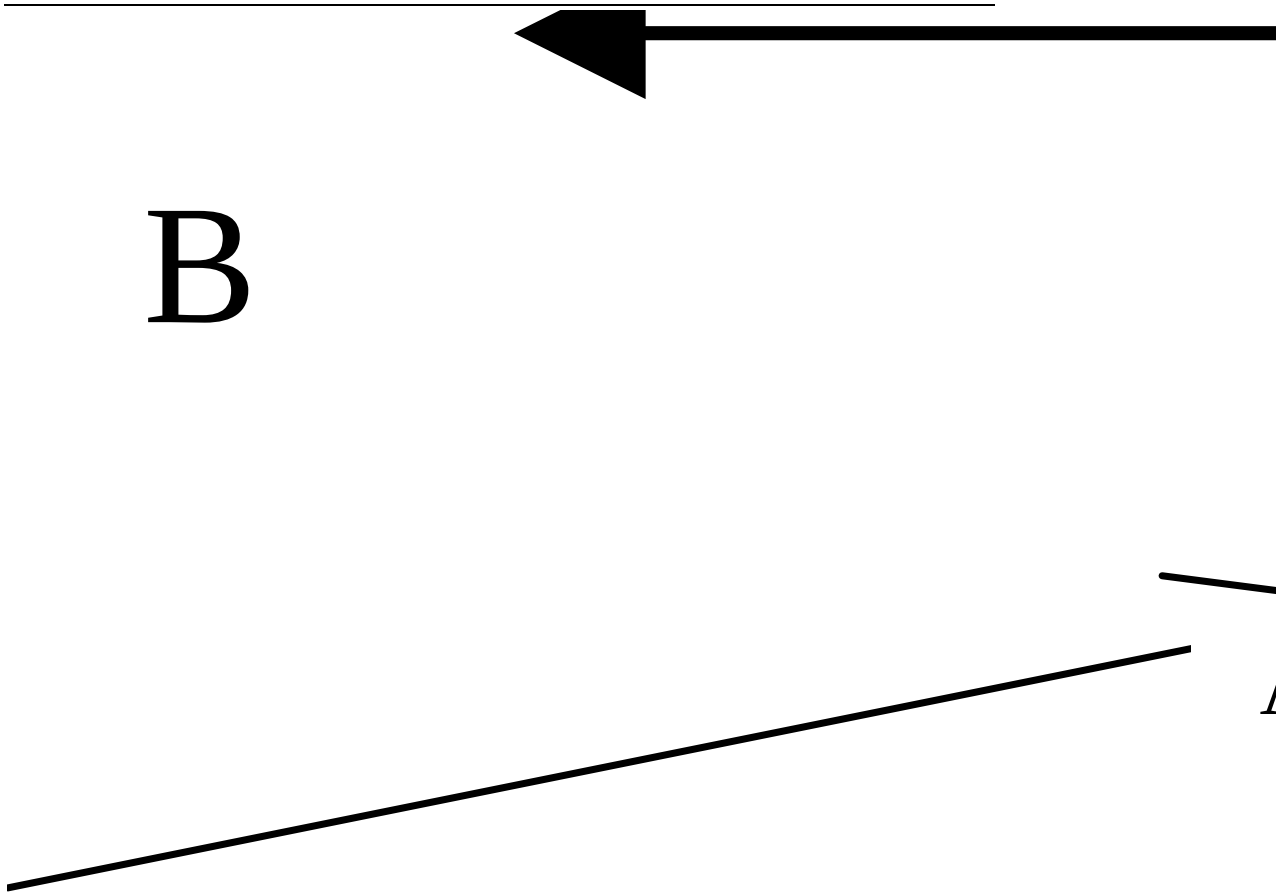
The terms of reference required an assessment of gross and net costs and benefits of climate change policies, and much of the discussion in the Stage I report is ostensibly directed to this issue, although no well-specified cost-benefit accounting framework is presented or utilized. NZIER claims to have refuted the following assumption:

> "At a high level, there has been a tendency to assume that climate change policies will be beneficial for the sector, because forests sequester carbon". (Stage I report p.3).

There are, obviously, many instances on the record of both official and independent analyses which have concluded that positive impacts from the Kyoto crediting of carbon sinks would occur for the economy as a whole under specified conditions, and it must be presumed that the NZIER critique is directed at those analyses and their extension to the forestry sector.

The argument for allowing Annex I countries to offset carbon sinks against their gross emissions for the purposes of meeting obligations under the Rio Treaty was strongly advanced by New Zealand negotiators during the 1990s, on the basis of the judgement that New Zealand would be in a stronger position under a net regime than under a gross regime because of its extensive new forestry plantings.

Emissions, mt CO2 equivalent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Source: Diagram 1 from New Zealand Climate Change Programme, *Forest Sinks and the Kyoto Protocol: An Information Document* June 2001 p.6, as modified by FRI October 2001.

While detailed research was not undertaken for this review, data put forward by the Forest Research Institute at a recent seminar[1] suggest that in the first commitment period, 2008-2012, roughly 110mtCO2 are likely to accrue to New Zealand as absorption credits on its Kyoto forests, during a period when New Zealand's gross CO2 emissions are projected to exceed its Assigned Amount by an estimated 40-50 mtCO2.

There do not appear to be any issues raised by NZIER which upset the proposition that New Zealand as a national economy is likely to be strengthened by the implementation of a climate change policy regime which includes carbon sinks. Certainly, relative to the position in which New Zealand would have found itself if the Kyoto negotiations had led to a simple international carbon charge on emissions over and above each country's Assigned Amount (including the tradeable-permits modification that enables high-abatement countries to sell surplus Assigned Amount), the carbon-sinks mechanism appears to represent a significant gain to the New Zealand economy as a whole.

As specified at Kyoto, "climate change policies" to be applied internationally by the Annex I parties can in principle leave New Zealand economically better off because it is in an unusually favourable position within Annex I in terms of its ability to use forest sinks to more than offset its excess gross emissions. This would seem to be the most obvious sense in which it has been "widely assumed" (as NZIER put it) by both policymakers and analysts that "climate change policies [as they emerged from Kyoto] will be positive" for the New Zealand economy, if not the forestry sector specifically.

In this context of positive economy-wide implications of forestry sinks, the impact of Kyoto on New Zealand's forest-based industries is basically an issue of domestic policy design in the allocation, across sectors and groups, of the aggregate "gains from trade" benefits to New Zealand in a carbon-trading world, in which New Zealand's forest sinks confer a degree of comparative advantage.

A useful starting point for the NZIER work would therefore have been a review of the projected aggregate numbers regarding emissions and sinks relative to New Zealand's Assigned Amount for the first commitment period. In the absence of an estimated set of national carbon accounts to provide the big-picture numbers, it is difficult to see how a credible analysis of the potential net gains or losses for the forest sector from Kyoto can be undertaken.

This points to a more general problem in the report under review, namely the absence of an economy-wide or general-equilibrium analysis to locate the sectoral projections in a wider context. Throughout the study the analytical framework remains confined to partial-equilibrium comparative statics. The high-level macro variables that will ultimately determine the shape of the economy under climate change policies are all frozen into their 2001 configuration by the sweeping assumption that "all other things are held equal".

With respect to the forestry processing industries (wood processing, and pulp and paper) the report's partial-equilibrium approach, especially with regard to the determinants of long-run international competitiveness, would be appropriate for modeling purposes only when the policy shocks to be considered are sector-specific (for example, a change in stumpage levies or a targeted subsidy to processing industries, within the context of an unchanged macro policy environment). When considering the sectoral impact of policies which have major economy-wide implications, it is essential at least to consider the likely feedback effects from policy-induced changes in aggregate economic activity, rate of growth, the exchange rate, the wage rate, the cost of capital, and the composition of aggregate output and employment.

The terms of reference clearly anticipated that such consideration of the macroeconomic impacts of climate change policies would form the backdrop for the forestry sector study. In the absence of such consideration, the Stage I report is unable to make robust claims regarding matters such as the international competitiveness of forestry processing, because of its assumption that key determinants of competitiveness such as exchange rates and real wage rates are simply held fixed while foreign-currency log prices and local-currency fuel costs are varied.

4. Conceptual Framework

The Stage I report suffers from poorly specified objectives and a weakly-developed analytical framework. (It is noticeable that in the Stage II analysis the intellectual discipline of modeling appears to be leading NZIER to an increasingly realistic and sophisticated appraisal regarding which of the Stage I conclusions are sustainable even within the narrow partial-equilibrium setting adopted.)

A major shortcoming in Stage I has been inadequate specification of the basic building blocks for the analysis. NZIER failed to break the problem down into

appropriately-sized pieces before attempting to push through to sweeping conclusions.

The following conceptual distinctions, which were clearly signaled in the terms of reference, should have structured and disciplined the analysis:

- **The distinction between gains or losses (a) for New Zealand as a sovereign Annex I state and economy, and (b) for the forest-based industries within the New Zealand economy.**

  From the standpoint of familiar welfare-economic theory, the situation for New Zealand is a potential Pareto gain (the nation as a whole is potentially made better off by carbon sinks crediting) and this makes it possible in principle to compensate any parties which turn out to be losers in the implementation of climate change policy. Suppose that, for purposes of argument, we accept NZIER's Stage I hypothesis that three of their four forestry sub-sectors – non-Kyoto forests, wood processing, and pulp and paper – are net losers from implementation of the Kyoto package, while all the gains accrue to owners of Kyoto forests, on the basis that it is these sinks that deliver to the national economy its fortunate emission-trading position under the institutional arrangements that were internationally agreed at Kyoto. In principle, a lump-sum tax on Kyoto forests to fund lump-sum transfers to the other three sectors, sufficient to compensate them for their losses, would leave all forestry players better off.

  The issue to be addressed would then be whether such compensatory transfers to losing sectors are the optimal way to utilise a carbon-trade surplus. Hence one might have expected the NZIER analysis to weigh up the extent to which there is a normative case for compensatory transfers from Kyoto forests to the old-established forestry companies. Implicitly, the objectives of the Wood Processing Strategy Steering Group, which commit the Government to promotion of the international competitiveness of processing industries, constitute the core of the case for protecting the processing sector against any adverse impacts from climate change policy. An important question, which the Stage I report could usefully have addressed, would still be whether the Wood Processing Strategy is in conflict or in harmony with climate change policy. The NZIER analysis offers no insights on this score.

- **The distinction between climate change policies implemented internationally, and those implemented nationally.** The Stage I report refers simply to "climate change policies" in general, and its negative conclusions are aimed at the entire policy package without drawing clear distinctions between those policy elements which are at the discretion of the New Zealand Government once it has ratified the Protocol, and those which are not. This analytic failing means that there is no clearly-defined counterfactual for the NZIER analysis, and hence no ability to draw policy conclusions of relevance to a post-ratification New Zealand Government. (This gap is apparently to be addressed in Stage III of the project.)

- **The distinction between Kyoto and non-Kyoto forests.** Treating "forestry and logging" as a single entity is unhelpful, given the great importance of the division between Kyoto and non-Kyoto forests. In the Stage I report, NZIER's discussion of forestry and logging tries to cover both forest classes within a single qualitative narrative running through pp.4-11, and in the process creates a confused picture with no clear conclusion. The summary attempt to encapsulate the whole discussion within a single aggregated "Forestry and Logging Balance Sheet" (p.5 Table 1) is correspondingly uninformative. A far more accessible and conceptually stronger approach would have been to consider separately the positions of Kyoto and non-Kyoto forests, reaching clear (if possible quantitative) conclusions for each and setting up a transparent set of accounts.

5. The Counterfactual Benchmark

In any climate-change modeling exercise it is necessary to specify a "business as usual" path against which various scenarios can be compared. The business-as-usual path adopted by NZIER is a world economy without any climate change policies at all. This corresponds to the usual practice in the general-equilibrium modeling community, which over the past decade has put enormous effort into the attempt to estimate the shadow price of carbon at which the world economy, and particular national economies within that international system, might be able to meet pre-specified abatement targets. For that modeling work the no-climate-change-policy counterfactual is both relevant and informative.

The NZIER study's focus is, however, much narrower and the questions it asks are far more limited. When using partial rather than general equilibrium methods, as NZIER does, the relevant counterfactual benchmarks (encapsulated in the expression "other things equal") should be set at (at least) two separate levels. First one could ask how the international economy might be predicted to change, relative to a no-policy business as usual, by implementation of the Kyoto Protocol by any group of Annex I countries. In this stage of analysis projections would be made of world market impacts (for example international-policy impacts on log prices and carbon permit prices in international markets), and the implications for the New Zealand economy and individual sectors could be drawn out on the assumption (specified in the terms of reference) that New Zealand is small enough to be considered a price-taker in the relevant world markets.

Secondly, one requires a baseline for analysis of the sectoral impacts of national climate change policies implemented by New Zealand, within a world economy in which the Kyoto Protocol has actually been implemented. (There is no realistic prospect at present of New Zealand acting unilaterally on climate change in the absence of international action.) The issue then is how alternative domestic policy packages under the Kyoto Protocol would affect (a) New Zealand's aggregate economic performance as a carbon-trading economy within a new international economic order which includes Kyoto carbon markets; and

(b) the sectoral impacts of the economic adjustments set in train by domestic policy measures to implement Kyoto.

This means that for each of the sub-sector scenario exercises there would be two sets of impacts on profitability: those flowing from the international implementation of the Kyoto Protocol regardless of what New Zealand does, and those flowing from the domestic policy package adopted by New Zealand if it ratifies Kyoto. The second set of impact estimates would then amount to a cost-benefit analysis of ratification in a world where Kyoto has actually been implemented by other countries. The results would be helpful to policymakers in the forthcoming debate over ratification, given that the only setting in which ratification is seriously interesting is one in which other countries act also. By bundling together the effects of international implementation with the impacts of New Zealand ratification, the NZIER Stage I study misses the opportunity to illuminate the real issues facing the New Zealand Government.

6. Forest Planting and Harvesting

It may be helpful to summarise the present state of thinking on rotation forestry under the Kyoto Protocol, into which the NZIER work has been inserted, and to consider the extent to which the Stage I report contributes new insights.

(1) Internationally, the Kyoto arrangements will divide the world into two separate carbon-trading blocs, Annex I and the rest. Annex I countries will adopt policy measures designed to result in substantial abatement of their net carbon emissions, while the future policies of non-Annex I countries remain uncertain. To assume that non-Annex I countries remain passive, in the face of potentially large opportunities for opportunistic behaviour to take advantage of Annex I nations' abatement efforts, would obviously be simplistic, and NZIER devotes some discussion to the possibility that countries such as Chile might undertake large-scale afforestation under subsidy from the Clean Development Mechanism (CDM). The report contains, however, no focused analysis of these strategic factors in the geopolitical scene, nor any discussion of the considerable literature under the heading of "carbon leakage" which has addressed the issue of industrial relocation from Annex I to non-Annex I countries stimulated by climate-change policy.[2]

(2) Annex I countries will account for their carbon emission and absorption during the first Commitment Period, 2008-2012, under a methodology which is still not fully defined, but which will definitely place penalties on carbon emissions from industry, transport, and deforestation relative to 1990, and will allocate offsetting absorption credits for those forests meeting the criteria to be classified "Kyoto forests".

    There is a difficult issue of interpretation regarding how the Protocol will deal with deforestation of pre-1990 plantings undertaken between 1990 and the beginning of the first commitment period in 2008. It appears that the wording of Articles 3.3 and 3.4 leaves a loophole for countries to

avoid penalties on post-1990 deforestation, if the resulting landuse changes are completed before the first commitment period begins in 2008. There has been some speculation that this might constitute a perverse incentive for the premature harvesting of existing forests in any country where (a) it is intended to change the relevant landuse away from forestry at some time anyway, and (b) the price of carbon permits is expected to be sufficiently high at the time when harvesting would normally be done, to offset the loss of timber volume (and hence sales revenue) due to early harvesting.

The possibility of such perverse incentives creating a log supply "spike" prior to 2008, as a means of avoiding harvesting charges, is canvassed on pp.11-12 of the New Zealand Climate Change Programme's recent working paper *Land Use and Forests (Sinks) Sector*, released in October 2001. This scenario is given considerable prominence in NZIER's Stage I report (pp.2, 6, 9). In turn, it heavily influences the results of the discussion. The "decline in profitability of non-Kyoto forests" entered into NZIER's Stage I balance sheet (p.5) appears to rest almost entirely on the proposition that an international oversupply of logs, and consequent price slump in the lead-up to 2008, will be driven by the alleged incentive to deforest early. The same applies to the unequivocal claims (Stage I report p.10) that "profitability of the existing non-Kyoto forests will fall", and (p.19) "owners of pre-Kyoto forests would aim to advance logging in order to position themselves for the post-2008 regime". Page 6 of the Stage I report sets out the suggested mechanism in the following, barely qualified, terms: "In the absence of replanting, harvesting is treated as carbon emission that attracts a tax. Consequently, once climate policies are confirmed, forest owners will have an incentive to harvest non-Kyoto forests prior to the introduction of any emission charges. This may result in a short-term glut in timber supply, and lower prices ahead of the introduction of climate change policies." [Emphasis added.]

While the NZIER study uses this mechanism of pre-emptive tax-avoidance deforestation as the central pillar of its projected fall in the world log price prior to 2008, it provides no systematic exploration of the apparent loophole in the letter of the Protocol (which, if genuine, is unlikely to remain unaltered by the parties until 2008 in the face of widespread subversion of the clear spirit of the Protocol). Nor does the NZIER study consider the likelihood of the New Zealand Government avoiding the adoption of a domestic climate change policy package which would incentivise forest owners to deforest early.

NZIER fails also to provide estimates of what proportion of pre-Kyoto forests it would be profitable to switch to alternative land-uses on present information, or of the threshold carbon price at which tax-avoidance deforestation would be cost effective. In general the Stage I report does not add to the state of the debate on the issue of perverse incentives, and probably gives undue credence to the view that a wall of wood will hit the world market due to such incentives. The hypothesized behaviour is

hard to reconcile with rational forward-looking decision-making by the world forest sector as a whole, spanning both Annex I and non-Annex I countries – and hence able to arbitrage both across countries and over time.

A systematic analysis of this issue would have to deal separately with the projected world price of logs (which will depend on the aggregate world supply, not just Annex I) and with the probability and likely scale of perverse premature harvesting in Annex I countries. The NZIER study does not go deep enough to get fully to grips with this issue.

There would appear to be three issues in particular raised by the perverse incentive/premature harvest hypothesis:

- Is it actually correct that carrying out deforestation of non-Kyoto forests prior to 2008 will avoid any penalty for New Zealand during the first commitment period? The wording of the relevant Protocol provisions seems unclear, but the intent (to deter deforestation) is abundantly clear;

- Is there any *a priori* reason to suppose that large areas of non-Kyoto forestry land would optimally switch to other uses once the current standing crop is harvested, under business-as-usual? Unless such large-scale switching is anticipated, there is no prospective penalty at harvest, hence no contingent liability and no incentive to harvest early;

- Why should it be anticipated that the New Zealand Government's policy package to implement the Kyoto Protocol will incorporate (or result in) perverse incentives for premature logging, given the ease with which the issue can be addressed in policy design?

(3) *Non-Kyoto forests which are maintained as forests,* whether for rotation production forestry or as permanent cover, are to remain outside the Kyoto carbon accounts in perpetuity, neither earning absorption credits nor paying carbon charges at harvest. The long-run contribution to the national economy of these forests, therefore (whether in terms of value added at current prices, or in terms of net economic surplus relative to the economy-wide cost of capital), will not be impacted directly by any tax or subsidy imposed by the international community, but will depend on world price trends for inputs and outputs. To the extent that the world log price falls relative to the (non-Kyoto) business-as-usual benchmark, and/or the world price of imported inputs is driven up, these forests would make a reduced economic contribution. To the extent that world log prices rise and imported input costs fall, their profitability will rise. Evaluating the impact of climate change policies on non-Kyoto retained forests therefore requires a fully-specified model of the relevant world markets to project international price trends.

The NZIER study neither constructs such a model, nor makes use of outputs from existing global economic models. Instead the Stage I report relies upon poorly documented assumptions regarding international trends in log prices and harvest volumes. The NZIER study therefore fails to carry the state of knowledge forward in regard to these forests, and leaves indeterminate the issue of whether their long-run private profitability and contribution to New Zealand GDP should be expected to rise or fall relative to the non-Kyoto-world benchmark. In terms of the impact of national climate change policies implemented by New Zealand within a Kyoto world, NZIER's Stage I report offers virtually no insights in its scenario analysis; the exploration of domestic policy options is deferred until the foreshadowed Stage III report, yet to be published.

(4) *Non-Kyoto forests which are harvested and not replanted* are classed under the heading of "deforestation" in the Kyoto Protocol, and carbon charges are payable in relation to the terminal harvest. This means that relative to a no-Kyoto-Protocol world benchmark, New Zealand will suffer an economic penalty (due to the utilisation of an additional tranche of its Assigned Amount to cover the harvesting) to the extent that deforestation actually proceeds during the first commitment period. It is important to note that the penalty incurred by New Zealand will be attributable not to the harvest itself but to the decision not to replant – the penalty attaches to the landuse change decision rather than the standing crop.

The intent of this penalty is clearly to restrict landuse changes from forestry to non-forestry activities. Such reallocation of land should occur only when the alternative land use is more profitable than forestry by a margin which includes the internalised deforestation cost to the world community. NZIER's Stage I executive summary (p.2) states that this reduction of flexibility reduces "the option value of changing to a non forest land use" and that this "devalues pre 1990 forests". There is no attempt in the remainder of the report, however, to evaluate more precisely the change in option value, nor to estimate what proportion of non-Kyoto forest land has an opportunity cost (value in alternative use) sufficiently close to its value under forest to make the option value relevant as a determinant of the market value of the land in its highest and best use.

Overall I could see nothing novel in the Stage I report's discussion of the profitability of non-Kyoto forests, and certainly no demonstration that the profitability of those forests must necessarily fall as a result of climate change policy. The report simply does not present an adequate conceptual framework to make the issue analytically tractable. NZIER's claimed conclusion that the likely impact on forestry and logging of climate change policy will be "negative due to the scale of existing investment in pre-1990 non-Kyoto forests" (Stage I report p.2) is not substantiated by any analysis in the report, nor by the four "factors" listed immediately after the quoted sentence on p.2.

(5) *Kyoto forests* (planted after 1989) will earn carbon absorption credits for New Zealand on the basis of the carbon tonnages sunk by them during the 2008-2012 commitment period. Since no harvesting of Kyoto forests is likely until after the end of the period (when even the oldest Kyoto plantings will be only 22 years old) this represents a substantial early economic gain for New Zealand, much of which the Government evidently intends to pass through to the forest owners[3]. This will, NZIER acknowledges (p.3) "increas[e] the financial value of post 1990 Kyoto forests". Nothing in the Stage I report gives any reason to doubt this outcome. On the contrary, insofar as any market dynamics are considered, they point generally towards positive feedbacks between carbon prices and log prices, due to the possible medium-term incentive to retain planted forest as permanent or semi-permanent cover rather than harvesting, if the emission permit price rises sufficiently fast through time. (Stage I report p.8). The only cloud on the horizon for Kyoto forest owners might be low log prices due to a future worldwide glut caused by CDM forest planting in non-Annex-I countries, but this is purely a speculative possibility mentioned, but not seriously developed, in NZIER's Stage I report p.9.

(6) The Clean Development Mechanism (CDM) provides a vehicle for some investment by Annex I countries in forestry sinks outside Annex I. The intent is to take some pressure off Assigned Amount targets, and hence lower the marginal abatement costs faced by Annex I countries. The main effect will be to reduce (probably only very slightly) the international price of emission permits and hence the gains to New Zealand from its surplus of sink credits over excess emissions in the 2008-2012 period. Given the uncertainty surrounding the likely carbon permit price a decade in the future, it is difficult to see the CDM as more than a second-order influence on the expected carbon price. NZIER however puts forward two claims regarding CDM (Stage I report p.10), namely that "sinks under the CDM represents [sic] a competitive threat to New Zealand forestry" and "assuming [planting] costs are much lower in developing countries, and assuming also that the caps agreed do not imposed significant limits … to the land that can be subject to afforestation, permit prices may become very low". The first of these points is not developed or substantiated in the Stage I report (in fact, it is acknowledged that the scope of the CDM is limited by country-specific caps and the "threat" is therefore not great). The CDM, furthermore (a point not raised by NZIER) can affect potential worldwide timber harvest volumes only two to three decades in the future once the plantings mature.

The second point – that the CDM will reduce permit prices if anything – is well understood and was a key part of the rationale for introducing the Mechanism in the first place.

7. The Principle of Comparative Advantage

Achievement of abatement targets in Annex I countries will involve significant changes in relative prices within those economies. Generally speaking, in terms

of the price signals facing individual economic agents, goods and services which are emission-intensive will rise in price relative to others. At the partial-equilibrium level of the individual firm, this will involve a change in its mix of costs. If the firm holds its physical mix of inputs unchanged, then an increased proportion of its total costs will be allocated to the purchase of emission-intensive inputs such as energy derived from fossil fuels. At the same time, in the markets where the firm sells its outputs, it will see the relative prices increase for all goods which cannot be produced with less emission-intensive production processes. If there are competitors in the output market using lower-emission production techniques, or if there are close substitutes produced with low-emission technologies, then the firm will lose market share and may be driven out of existence by the usual logic of the competitive process. This is the means by which the economic system identifies the new "winners" following a change in policy regime to internalise the externalities associated with carbon emissions.

The market mechanism will not present a threat to the existence or profitability of any firm which is using best-practice technology for the new set of relative prices, which produces a good or service for which there is adequate demand, and which is in a market not overhung by substantial excess capacity in the hands of equally-efficient firms.

In order to predict the effect of climate change policies on the profitability of a sector, or of the firms in that sector, it is therefore necessary to specify an economic model which at a minimum takes account of the following factors:

- The sector's production function and the associated menu of feasible choices of technique, which determines the extent to which the sector can change its input mix away from emission-intensive inputs and thereby reduce its incidence of carbon charges by contributing to the economy's overall abatement response

- At the level of the individual firm, the extent to which the firm is locked into a technology which is obsolete in the sense of being uncompetitive at the new set of relative prices; such firms must either adopt new techniques, or exit in the face of competitors with techniques which are more efficient at the new set of relative prices

- The relationship between input and output prices for a firm which is fully efficient in its input mix and selling into markets with competitively-determined prices reflecting the new economy-wide configuration of consumer purchases (including exports).

The standard economic theory of comparative advantage establishes that an open economy will be held in external balance by market feedback which maintains that economy's relative competitiveness as a whole in the world market. That is to say, what determines the survival or extinction of particular export sectors is their relative opportunity costs of production when ranked against alternative possible export-oriented uses of the economy's scarce resources. Raising some input cost (wages, fuel, cost of capital or whatever) across the entire national economy will push an individual export sector out of profitability only if that

sector loses comparative advantage and is replaced by other export sectors which are able successfully to bid resources away under the new set of relative prices.

In analysing climate change policies, therefore, the relevant question to ask for forestry (or any other existing export sector) is whether the expected economy-wide changes in exchange rate, wage rate, cost of capital, and relative prices within the domestic economy, will have the overall effect of weakening or strengthening the comparative advantage of forestry relative to other export opportunities that are open to New Zealand. Following implementation of climate change policies, New Zealand will continue to earn foreign exchange by exporting, and the market mechanism will select as exporters those industries which enjoy comparative advantage at the new set of relative prices. The market mechanism, if allowed to work unchecked, will weed out those sectors which are not efficient exporters at the new set of relative prices. Sectors with comparative advantage will then have "international competitiveness" in the sense that they succeed in selling to export markets; sectors which have lost comparative advantage will disappear unless sustained by policy intervention, presumably motivated by the belief that the market has failed in some way.

NZIER's approach to the competitiveness of wood processing and pulp and paper implicitly relies upon the theory of absolute advantage. This predicts that if we take an economy all of whose exports are emission-intensive relative to those of competitor countries then that economy will be driven out of all its export markets, and will end up with zero exports, following implementation of a carbon charge. Such an outcome would be not only economically absurd but clearly unsustainable: an open economy must pay for its imports in some way, and that external budget constraint will force adjustment of exchange rates, domestic monetary conditions, wage rates, and other variables, until the required macroeconomic balance between aggregate export earnings and aggregate import payments is restored.

Once the economy-wide adjustment to macro balance is completed, the ranking of the country's export sectors in terms of comparative advantage may have changed, and this may mean that in the new situation it is not economically efficient for the economy to continue to export certain products which are unable to earn foreign exchange without incurring excessive costs (in terms of the resources which must be diverted from alternative uses to maintain those sectors). Whether forestry processing industries would fall off the list of efficient export sectors for New Zealand under climate change policies will depend not simply on the sector's own production function and cost structure but also on the relative performance of all other potential exporting (and import-competing) sectors across the economy.

Robust conclusions cannot be drawn about the effects of economy-wide price shocks on the "international competitiveness" of a single sector without explicit consideration of the issue of comparative advantage and the macroeconomic process of adjustment to external balance. NZIER's methodological approach to the two processing sub-sectors (wood processing and pulp and paper) falls into elementary fallacies because of its failure to start from a properly-specified general-equilibrium framework. It must again be emphasised that there are

scenario results available for these sectors from properly-specified CGE modeling exercises, and it would be standard practice for a new study on the issue of sector-specific impacts to review that relevant literature.

8. **The Processing Sector Balance Sheets**

The analysis of pulp and paper on p.17 of the Stage I report is too brief and shallow to add anything to serious debate on climate change policies. Accordingly one should discount the report's unduly sweeping conclusion that the sector "appears to be a loser from the introduction of climate change policies since there will be no incentive to locate pulp and paper processing in New Zealand" (p.17). There is only the most cursory mention of the issue of choice of technique (NZIER notes that mechanical pulping is electricity-intensive, but does not conduct any comparative analysis of alternative technologies which might be competitively superior at a different set of relative prices). There is no discussion of fuel substitution to utilise greater volumes of wood waste for cogeneration, although the "balance sheet" on p.17 does include "biomass cogeneration" as the sole line item on the positive side.

The issue of fuel technology receives slightly more attention in the discussion of wood processing (p.14-15). However, this section of the Stage I report is merely a summary of EECA work on increased use of biomass fuels across the economy in general, rather than an analysis of the potential for the wood processing and pulp/paper industries to avoid carbon charges by moving towards 100% energy self-sufficiency on the basis of wood wastes. A number of previous studies have drawn attention to the low degree of energy self-sufficiency in New Zealand forestry processing relative to Sweden, where price incentives to reduce use of oil and externally-purchased electricity have been in place for some time now, and where several pulpmills appear to have achieved over 100% self sufficiency in response to those incentives. An important issue which ought to have been brought to the fore would seem to be, therefore, the extent to which carbon charges in New Zealand might induce significant substitution of biomass for purchased energy in forestry processing. Technological substitution options are not, however, brought qualitatively into focus nor quantitatively assessed in the Stage I report.

Instead, NZIER's Stage I section on wood processing devotes an entire page (p.12) to a lengthy discussion of the possibility that cement might displace wood in domestic construction. As elsewhere in its discussion of competitiveness issues, the report adopts a simplistic analysis of the cement industry, with the entire supply of cement being predicted to switch from local production to imported supplies, and the result predicted to be a fall in the local price of cement driving out timber construction.

The information on which this prediction is based points, if anything, in the other direction. According to NZIER the domestic industry is a duopoly pricing its product just below the import price. The production costs of the duopolists are claimed to be "just below the cost of imported cement" but there is room for scepticism about the validity of "cost" information for a limit-pricing duopoly,

given the level of sunk cost embodied in the industry's capital equipment. It is not clear whether NZIER is arguing that the industry is barely covering its variable costs (i.e. is actually close to the shut-down threshold) or that it is covering its total costs (in which case it will be well above the shut-down price). Nor is any discussion provided of the ability of domestic producers to adjust costs to hold their market under climate change policies.

Domestic cement production does not appear to be protected at present, yet NZIER argues that closing down the domestic industry would result in lower prices because the local market would then be "more competitive". This argument is not coherent, especially in a report which elsewhere emphasizes the competitive discipline exercised by international (e.g. import) prices on local industry. Why the removal of two local competitors from a market in which the price is already capped by the import price should result in a fall in the local price of cement is quite unclear.

The space devoted to this poorly-constructed argument revolving around the cement price is at the expense of analysis of other, arguably more important, elements affecting the competitive survival of wood processing. In the sector "balance sheet" (p.13) the most coherent mechanism put forward for a contraction of the local construction market is that climate change policy might induce an "economic slowdown" and hence a drop in construction activity. This, however, has not been modelled as part of the NZIER work

9. Scenario Analysis

The final section of the Stage I report devotes three pages to a very cursory and preliminary consideration of some effects that might differ among three of the scenarios specified in the terms of reference: business as usual, carbon charge only, and a broad emissions target. Of those canvassed, the only two factors that might add anything to the debate are (i) the proposition (p.19) that rising sink values might lead to conversion from rotation forest into permanent cover, with the option to harvest retained; and (ii) the strong prediction that widening the scope of emissions targeted would reduce agricultural land prices, which is presented as "positive" for the forestry sector (p.20). Both of these deserve further analysis as part of the wider quantitative modeling exercise being undertaken by NZIER for Stage II of this project.

10 Conclusion

This review has been confined to an evaluation of the first stage of a three-stage project being undertaken by NZIER. The focus has therefore been on the way in which NZIER has sought to formulate the conceptual framework within which the subsequent quantitative modeling is to be undertaken, and we have not devoted much attention to the quantitative estimates in the Stage I work, given their very preliminary status.

Our main conclusion is that the Stage I report does not provide a sound basis for the subsequent stages of research, for three central reasons:

- First, the analysis has been confined to a partial-equilibrium treatment of the forestry sector, without adequate links to economy-wide modeling of climate change policies undertaken both in the past and currently for the National Interest Analysis. Partial analysis is appropriate when analysing the effects of sectorally-targeted policy shocks whose impact is confined to the sector concerned, with the wider economy remaining essentially unaffected. Under those conditions, "other things equal" can serve as a useful working assumption. However, when analysing policy shocks which are implemented economy-wide, it is the policy-induced changes in the wider economy that come prior to, and largely determine, the impacts on any particular sector. Other things will not be equal if climate change policies are effective, and it is the changes in those other things that will flow through to the fortunes of the forestry sector.

- Second, the Stage I report does not appear to have taken account of the principle of comparative advantage, which provides the essential basis in economic theory for projections of success or failure for individual export sectors in a small open economy. This principle states that the total export earnings of the economy as a whole will be endogenously determined as part of the process of establishing and maintaining external balance in a macroeconomic sense, and that once that balance is established, the economy will export those tradeable goods which it is able to produce at the lowest relative opportunity cost, and import those which can be produced only at high opportunity cost.

  The NZIER Stage I report frames the issue of the international competitiveness of forestry in terms of absolute, not comparative advantage. In doing so it both departs from fundamental economic theory and reaches unjustifiably pessimistic conclusions about the impact of policy changes on forestry's export prospects. NZIER's competitiveness analysis applies two unfavourable shocks (higher local fuel prices and lower world log prices) to a sector which is assumed to secure no benefit whatever from the economy-wide processes of market adjustment. This assumption is an extreme one for this analytical problem and requires substantial further exploration before it could serve even as a provisional starting point for any policy proposal.

- Third, the Stage I report fails to establish and maintain a rigorous set of classifications and distinctions to guide and confine the analysis of particular issues. Climate change policy throws up a complex set of issues and discussion easily becomes either too general, or too narrowly focused on non-essential details, to give helpful guidance for policy. Striking the right balance is not easy and requires the discipline of a tightly-specified analytical agenda. The Stage I report does not achieve the required degree of rigour either in its selection of the crucial issues to be analysed in depth, or in its classification of sub-sectors to be analysed.

None of the criticisms outlined above necessarily carry through to the forthcoming stages of the NZIER research programme. We hope that the comments in this first review will provide constructive assistance with the further development of the programme's inputs to the NIA.

[1] Justin Ford-Robertson, *Domestic Policy Response to the Kyoto Protocol*, FRI October 2001, p.3.

[2] For a recent survey and bibliography see Hoel, M., "International Trade and the Environment: How to Handle Carbon Leakage", Chapter 7 in Folmer, H. et al (eds) *Frontiers of Environmental Economics*, Edward Elgar, 2001, pp.176-191.

[3] Domestic policy design is still in flux, but the Government in January 2001 stated that at least some of the gains from emission trading are to be passed down by means of economic instruments to the sectors which are responsible for generating a carbon-trade surplus for the national economy. (New Zealand Climate Change Programme, *Climate Change Working Paper: Land Use and Forest (Sinks) Sector*, October 2001, p.7.) This principle, on the face of it, provides a fair amount of comfort for forestry as a whole given that there is nothing in the NZIER (or other available) analysis to suggest that forest sinks will fail to carry New Zealand into an emission-trading surplus position during the first commitment period.