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22 April 2020

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High-level Review of Essential Freshwater Economic Impact Reports: Cost Model

Dear Nigel

This note relates to the first of the models you have asked me to review, namely the Cost Model developed by Resource Economics. The Cost Model is a Partial Equilibrium model, in contrast to a General Equilibrium model which has been used by NZIER to study the wider economic effects of the Essential Freshwater package. A review of that modelling will follow in due course.

I understand that the scope of my review should address the following questions:

- Is there a clear and logical approach to the modelling?
- Are the approaches credible and reasonable given the available information and timeframe constraints?
- Are the conclusions reasonable and consistent with the analysis undertaken?

Out of scope are:

- Modelling inputs such as the modelled load assumptions, or cost and effectiveness of mitigations.
- The assumptions made by consultants or MfE such as discounts rates, multifactor productivity etc.

The Cost Model analysis estimates the effects of the NPS (2017) and the effects of the EFW package, such that the difference is the incremental cost of the EFW package. This is a logical approach.

The model takes biophysical outputs from modelling by NIWA to determine what reductions in nitrogen and phosphorus are required to meet the NPS and EFW standards, relative to current discharges, covering 11,186 catchments over 16 regions. Bundles of mitigation options (their costs and effectiveness) are estimated from reports by Landcare Research, AgResearch, Perrin Ag Consultants and others. The options are estimated for each catchment, which are then incorporated into a large spreadsheet model (the Cost Model) to estimate the cost of complying with (or not) the proposed standards – for dairy and sheep & beef farms, by region.

The approach is sensible and clearly explained, but I have one question. It is stated in Section 2.2.2 that *"we assume the same profit levels per hectare for every hectare within a region."* Is that also across all farm types?

The model essentially works along marginal cost of abatement curves, implementing cheaper mitigation options such as riparian setbacks first, through changes in fertiliser use, stocking rates etc, and finally to changes in land use. In practice, however, land use change totally dominates the adjustments as the other actions are simply insufficient to produce the desired results. As expected, most of the land use change is from dairy to forestry, so the results seem very plausible.

To deal with simultaneity in nitrogen and phosphorus reductions, the modelling assumes that abatement actions are first targeted specifically at nitrogen with their consequential effect on phosphorus then forming the basis for other actions directed specifically at phosphorus. These actions in turn have consequential effects on nitrogen.

If changes in dairy and sheep & beef farming (on-farm and land use change) do not deliver the required reductions in nitrogen and phosphorus, other types of land use change are assumed to meet the deficit, but these other types are unknown. The associated remaining cost is essentially a residual between what can be done according to the model and what is required to meet the standards.

It seems to be the case that in the model no land can change to non-use (reverting to scrub), so perhaps that is one interpretation of the residual cost.

Because the mitigation strategies are essentially profit-maximising and ignore non-economic factors such as path dependency of farm types, there may be a tendency for the model to understate mitigation costs, but this is clearly acknowledged by the authors.

The sensitivity testing is good. Ideally variations in the adoption path of mitigation strategies over time could have been explored. I suspect, however, that not only would the differences be minor, but they are likely to be small in relation to the implicit margin of error in the assumption about constant discharges under the counterfactual 'business as usual' scenario over the next 30 years.

Summary

With regard to the stated scope of this review I would say that:

- There is a clear and logical approach to the modelling.
- Given the information (and timeframe) constraints and the vast amount of heterogeneity in discharges and mitigation options costs across farm types and locations, the approach is both credible and reasonable.
- The conclusions follow logically from the analysis that was undertaken and are caveated appropriately.

As a final point is useful to note that polices to improve water quality can take many years or even decades to deliver the desired results. Thus there will be on going opportunities to update the model – and the policies – over time, opportunities that should be exploited. In this connection I would prioritise research into to the residual 'unknown' land use changes that are required to meet the clean water targets.

I am happy to discuss any aspect of the above especially if I've misunderstood something.

Yours faithfully

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