MEMO

To	Brian Anderton, New Zealand Fish and Game Council
From	Peter Wilson
Date	8 November 2019
Subject	Comments on three economic reports released by DairyNZ

DairyNZ have released three reports on the economic effects of proposed environmental policies. The reports are:

- 'Economic impacts of the *Essential Freshwater* proposals on New Zealand dairy farms', by Dr Graeme Doole of DairyNZ (Doole 2019)
- 'Regional and national impacts of proposed environmental policies on the New Zealand dairy sector' by Infometrics Limited (Stroombergen 2019)
- 'The economywide effects of proposed environmental policies' by Sense Partners (Ballingall 2019).

This memo provides NZIER's high-level comments on these reports. We have not discussed the reports with any of their authors.

1.1 Summary

In summary, Doole (2019) is an assessment of the impact of the *Essential Freshwaters* proposals and climate change policies on the New Zealand dairy sector at the farm level. Stroombergen (2019) takes the scenarios from Doole (2019) and incorporates them into a computable general equilibrium (CGE) model of the New Zealand economy and generates regional and national economic effects. Ballingall (2019) then takes the results from Doole (2019) and Stroombergen (2019) and estimates the regional economic impacts of the proposals, using a separate model. It also includes a discussion about the costs and benefits of the government's proposals.

None of the reports attempt to quantify all the benefits of the government's proposals. While this is explicitly acknowledged in all the reports, it does mean that the reports are just a partial analysis of the issue.

The reports do make valuable contributions to the debate around the government's policy proposals. However, they are not comprehensive enough in their treatment of all the costs and benefits of the proposals to allow conclusions to be drawn about the desirability of those proposals. What they do highlight is that the government should continue to focus on quantifying the benefits of its proposals so that costs and benefits can be compared on a like-for-like basis.

2 Doole (2019)

Doole (2019) uses an economic model to estimate the effects of several policy scenarios on elements of farm management and performance. The study covers the period 2019-20 to 2049-50.

Details of the model were not made transparent in the report. This makes it difficult to assess the robustness of the model and its results. The report does, however, provide some details of several key assumptions in the model, including:

- Dairy farms always stay as dairy farms. This means that if a farm becomes insolvent, ownership is transferred to a new dairy farmer, rather than any change in land use.
- Land that is taken out of dairy production is not offset through a land-use change.[1]
- There is limited innovation in farm management practices. The model allows for the adoption of mitigation strategies, which allow a farmer to adjust the level of nitrogen imported to the farm system. But there is no underlying increase in innovation in the model. That is, only currently available mitigation strategies are possible even though the model is representing a 30-year time frame.[2]

The report uses the *status quo* as a baseline, and then goes on to compare this baseline with four scenarios. These scenarios are outlined in Table 1.

Table 1 The modelled scenarios

Scenario	Scenario descriptions
Scenario 1	Farm environment plans (FEPS) are required, stock exclusion, consents for standoff pads and actions associated with FEPs.
Scenario 2	The features of Scenario 1 plus: – a catchment specific nitrogen cap – a national limit on nutrition fertiliser use – addressing nutrition nitrogen losses through FEPS.
Scenario 3	Features of Scenarios 1 and 2 plus: – bottom lines for dissolved inorganic nitrogen and dissolved reactive phosphorus where instream concentrations exceed the proposed national bottom lines.
Scenario 4	In addition to Scenarios 1, 2 and 3, Scenario 4 represents the cumulative impact of targeting greenhouse gas emissions alongside the *Essential Freshwater* package.

Source: Doole (2019)

[1] This is a critical part of the modelling. At p. 23, Doole (2019) says dairy area in 2050 falls by 20-30% in scenarios 3 and 4 yet there is no land use change, an assumed constraint that eliminates any offsetting production gains in trees, crops or other less nitrate intensive land uses: industry focus, not national output focus, which Infometrics and Sense modelling does not appear to correct as they do not include explicit land use components in their models.

[2] We note that assuming no technological change is common and pragmatic modeling practice, as the alternative is to assume an as-yet unproven new technology, which is equally as unrealistic as the no change scenario. That said, it is often useful to perform sensitivity analysis around that assumption and show effects of an assumed improvement in technology – but this does not appear to have been done in Doole (2019).

In Scenario 1, the stock exclusion scenario depends on how much water-course in dairy country needs additional fencing etc for exclusion and how much is already compliant with what will be required under the Government's proposals. At page 19, Doole (2019) does not give a clear statement of the total watercourse, how much is compliant, what length of existing fencing needs altering to comply or the length of new fencing. The assumed amount of new fencing is a basic assumption around which all modelling revolves, and the validity of the approach used is questionable.

In Scenario 2, Doole (2019) applies a nitrogen cap to selective catchments with the worst water quality, but again (at page 21) does not explain how many farms within its selected catchments are required to do how much to comply.

The report does not present any details of the effect of these scenarios on the environment. That is, there is no discussion of the reductions in nitrogen leaching or greenhouse gas emissions that result from the government's proposals.

2.1 Results

Doole (2019) presents results for the effects of the scenarios on land area utilised for dairy production, the number of cows in the New Zealand dairy sector, total levels of milk production in the New Zealand dairy sector and on the regional distribution of annual operating profits in the New Zealand dairy sector.

Because of how the model is set up, the results in Doole (2019) show an increase in costs, a reduction in production and a reduction in farm profitability. His model, as a matter of design, does not include any benefits that might accrue either to farmers, regions or the economy as a result of reductions in nutrient leaching.

3 Stroombergen (2019)

Stroombergen (2019) presents the results of assessing the impact of the scenarios developed in Doole (2019), using Infometrics' ESSAM CGE model of the New Zealand economy.

CGE modelling is a well understood technique for assessing how changes in one part of the economy flow through into the rest of the economy. This is the strength of CGE models. Unlike the model used in Doole (2019), CGE models explicitly allow resources to move from sector to sector in response to changes in the economy. There are no 'free lunches' in CGE modelling. Likewise, any sources that cease to be profitable in their existing use will be transferred to their next best alternative.

Using actual economic data, CGE models estimate how an economy reacts to major projects or changes in policy, technology or other external factors. CGE models are useful whenever we wish to estimate the effect of changes in one part of the economy upon the rest of New Zealand.

In summary, to estimate the effect of a change (referred to as a 'shock'), the modeller specifies a starting position for the economy based on data in which supply is equal to demand in all markets (known as being 'in equilibrium'), then changes parts of the data to reflect the shock and then, using a highly detailed model of the economy and specialised

software, determines what needs to happen to return the economy to a new equilibrium. The difference between the old and the new equilibrium can then be analysed to determine the effect of the shock on a range of economic indicators, like Gross domestic product (GDP), employment, wages and living standards.

In the case of Stroombergen (2019), the shock used was to alter the capital output ratio of dairy farms. This seems to be an appropriate technique. It reflects the findings of Doole (2019) that complying with the various policies proposed by the *Essential Freshwater* package will require dairy farms to increase capital spending.

To allow the model to achieve a new equilibrium, some aspects of the economy must remain fixed. These are known as closures. Common closures, for example, are population and the labour force, exchange rates, interest rates or export prices. Determining what should be included in the closure and what should be allowed to vary is a key part of any modelling exercise and it is very important that the modeller be very transparent about what is a result of the modelling and what has been imposed via the closure.

In the case of Stroombergen (2019) the closure features are:

- The current account balance is fixed as a percentage of GDP
- The post-tax rates for term investment are unchanged
- Any change in demand for labour is reflected in changes in wage rates not changes in employment
- The government's fiscal balance is fixed across scenarios.

This seems to be an appropriate set of closure conditions for this type of modelling, although it does have several implications, which we set out in Table 2.

Table 2 The closures condition the results

Closure condition	Implications
Current account fixed	The exchange rate and terms of trade are free to adjust. If NZ needs to purchase international emissions units to meet its climate change targets (which would count as an import) then there must be a corresponding reduction in another class of imports or an offsetting increase in exports.
Fixed post-tax rate of return	Any impacts of the policy scenarios on agricultural profitability will be short-term, as the closure requirement will force the model to eventually return the sector to its pre-scenario level of profitability.
Changes in labour demand reflected in wage rates	The long run level of total employment in the economy will be driven by the forces of labour supply and labour demand, not by environmental policies.
Government fiscal balance	Any increases in expenditure need to be matched by changes in tax rates, this means, for example, if the government needs to purchase overseas emissions units it must finance these from either offsetting reductions in expenditure or increasing taxes.

Source: Stroombergen (2019)

3.1 Results

The results of Dr Stroombergen's modelling are outlined in Table 3.

Table 3 Stroombergen's results

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Macroeconomy					
Private consumption		0.1%	0.0%	0.1%	0.3%
Exports		-0.7%	-0.7%	-5.2%	-6.5%
Imports		-0.1%	-0.1%	-0.7%	-0.7%
GDP		-0.1%	-0.2%	-1.1%	-1.3%
RGNDI		0.1%	0.0%	0.2%	0.3%
Real wage rate		-0.2%	-0.3%	-2.2%	-2.7%
Industry Gross Output		-0.2%	-0.3%	-2.0%	-2.6%
Dairy farming					
Output		-3.1%	-3.2%	-24.0%	-27.7%
Employment		-1.2%	0.4%	-17.2%	-10.4%
Dairy processing					
Output		-3.0%	-3.1%	-23.5%	-27.3%
Employment		-1.2%	-1.2%	-10.2%	-12.3%
Emissions CO_2e (Mt)					
Gross emissions	77.0	76.2	76.1	70.4	65.0
Agricultural CH_4 & N_2O	37.8	37.0	37.0	31.6	26.3

Source: Stroombergen (2019)

While in general the results show a reduction in many economic variables, they are more muted than the results presented in Doole (2019). This is one consequence of using a CGE approach rather than the partial equilibrium approach used in Doole (2019). The CGE model allows the economy to adjust to the shock and, in particular, any resources that are freed up as a result of a good practice in dairy farming are transferred to other parts of the economy.

One very interesting result relates to the macroeconomic indicator Real Gross National Disposable Income (RGNDI). RGNDI is the real purchasing power of national disposable income, considering changes in the terms of trade, and real gains from net investment and transfer income with the rest of the world. Effectively, it is a measure of the volume of goods and services New Zealand residents have command over. A nation with a rising RGNDI per person will have a greater capacity to deliver a better quality of life and standard of living to its population.

In the various scenarios modelled, Stroombergen (2019) shows that the effect of reductions in greenhouse gas emissions is that New Zealand needs to import fewer international carbon units, and this influences the exchange rate, due to the closure conditions specified

in the model. In other words, when all of the economic effects of the government's proposals are taken into account, including ones that might not naturally occur to the general public, like the adjustment in the exchange rate, the effect of the proposals on New Zealand's economic well-being at the national level is in fact slightly positive. This is the case in all the scenarios.

4 Ballingall (2019)

Ballingall (2019) is largely a summary of the results in Doole (2019) and Stroombergen (2019), although it does provide results of some additional modelling of the regional effects of the scenarios, plus some commentary about the desirability of the proposed reforms.

While including a useful discussion on the benefits of the government's proposals, Ballingall (2019) does not come to a conclusion as to where the balance of costs and benefits lie.

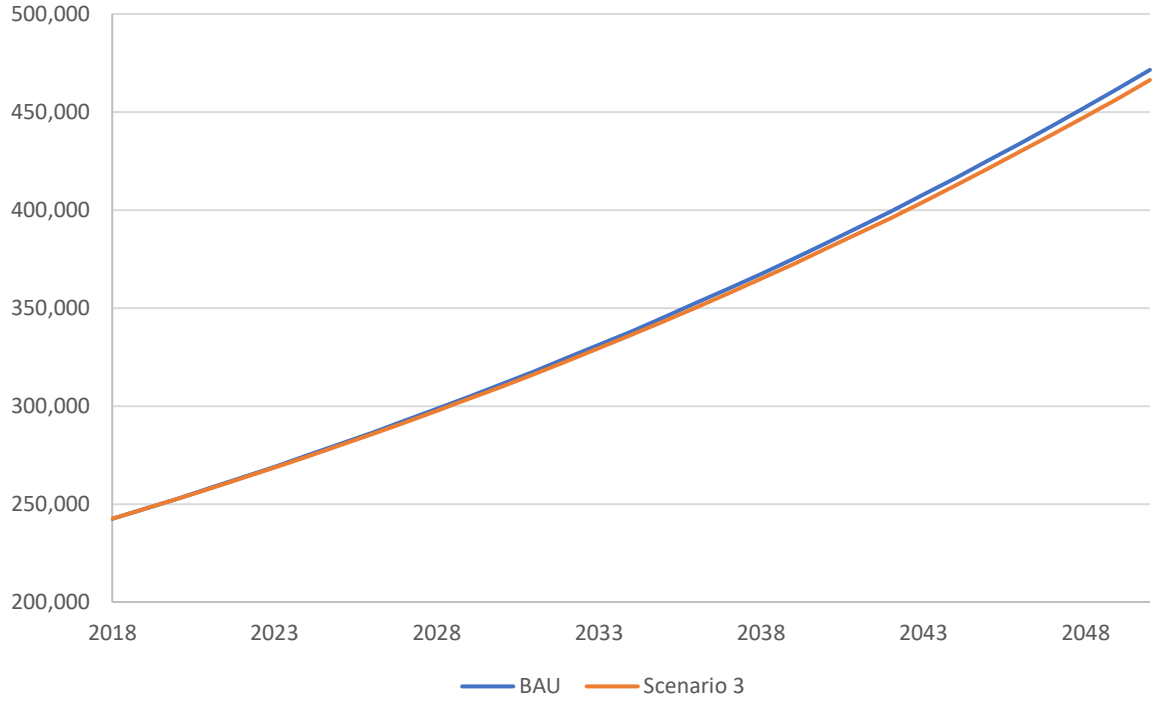
In the case of the Sense Partners (Ballingall 2019) and Infometrics (Stroombergen 2019) work, the main point of interest is that they don't report the business-as-usual (BAU) results, just the percentage differences from BAU under each scenario. This allows them to describe the effects of the scenarios in terms like "the fall in production" and "GDP is lower by 1.1 %".

Presenting the results in this way is misleading. With assumed economic growth averaging 2.1% out to 2050, the economy will be much larger than today. A more accurate description of the results would, for example, be "GDP is lower by 1.1 % than it would have been in the BAU, but still 192% higher than today". Put another way, "under Scenario 3, the economy grows at 2.06% each year on average compared with 2.10% under the BAU scenario".

The figure below shows the path of GDP under the BAU and Scenario 3. That you can't really see much difference is the whole point.

Figure 1 We will be much richer in the future

Nominal GDP, $ millions



Source: NZIER calculations

5 Conclusion

Doole (2019) is exclusively focussed on the dairy industry and constrains its modelling to excluding external effects, both environmental and offsetting land uses. Stroombergen (2019) and Ballingall (2019) take these results and settings, including their constraints/limitations, for their modelling.

Stroombergen (2019) shows there are offsetting benefits through the reduction in carbon sequestration, causing some improvement in income measures.

Omitting to show the effect of the strong economic growth in the business-as usual case paints the results in a wholly negative light.

More analysis is needed, but this suite of reports does tend towards a worst-case depiction that may exaggerate the impact of at least two of the scenarios. All the results hinge on the scenarios representing the most likely implementation of the new proposals, which is by no means proven in the existing reports.