Climate change policy lessons from an agricultural focused agent based model

The following questions were asked during our live webinar with Fraser Morgan but due to time restrictions, we were unable to answer these in the session.

How would you assess the climate change commission's assumptions on uptake of mitigation and adaptation technologies given your comments how people behave and their ability / desire to change? Have they recognised the realities of adoption?

I initially gave this presentation at the Government Economics Network 2021 conference, almost directly after the leads on 2 of the 3 CCC models used in their draft report highlighted their results. On the whole (and from the outside as I haven't seen their models in detail) I think that the trends they highlight are correct, but the speed on how quickly the 'public/farmers' will respond to the policy that are being modelled are lacking. I think the other aspect which is forgotten in the CCC assumption, is the push back on making voluntary change primarily because of all of the other voluntary changes that local, regional, central govt, or industry groups are asking for, make them less likely to do anything for any of these voluntary changes. To answer your last question, no I don't think that the CCC has recognised the realities of adoption at the individual level, but on the flipside they were not really tasked with that either. However, I also think that it is now when these realities do need to be accounted for and the vast arrangement of policy required to achieve the goals of the draft advice will need to start thinking about the individuals.

All of your farmer symbols seemed to be male, and gender wasn't one of the characteristics that was modelled. Would you expect farmers of other genders to make different decisions?

A bit of unconcious bias in there, and a good thing to highlight (I have changed it as there are ~20-30% of rural decision-makers who are female. In the initial study and the initial survey, I am unsure if we asked about gender but you are right we didn't use it in our analysis at the time. All of the SRDM surveys do ask about gender, and a colleague in our Wellington office, Pike Brown, did look into this aspect in more detail (see Brown, Philip. 2019. "Gender, Educational Attainment, and Farm Outcomes in New Zealand" Land 8, no. 1: 18. https://doi.org/10.3390/land8010018)

Questions & Answers

Would incentivising "change" help move the middle, and what might that look like?

Through our discussions with farmers across NZ, yes! The middle cohort of farmers realise the changes that they face but when asked to make voluntary change they are concerned (rightly, from my perspective) about a number of issues which means that they might regret their decision in the future. Supporting both the farmers (to understand the agency that they have to make these decisions) but also highlighting to other groups (such as councils) that they have a lot of control over the agency of farmers to respond to these issues (most of the time without even knowing about it). These aspects are what we aim to analyse within the Moving the Middle MBIE bid which is in the current MBIE Endeavour funding round.

With an agricultural community focus in mind for the decision-making process, why was an agent-based modelling approach chosen over a systems dynamics modelling approach?

System models are great tools at understanding the feedback loops and other aspects around how one part of a system can affect another. However, the ABM approach supports this type of an approach for all of the individual decision makers within the system while also supporting the notion that there is a lot of heterogeneity within how individuals respond. Again, no problems with either approach, more just understanding the pro's and con's of each and also what question you are trying to understand.

The rural decision maker survey seems to be a great resource, which I was unaware of. Did you use additional resources to explore agent-based values?

For empirical data around how NZ rural decision makers operate, no the SRDM is a great resource and within NZ is one-of-a-kind. They types of social networks used by farmers, the decision approaches used, etc, all result from the wider literature.

Do you have any examples of what might 'unlock' the constraints in an individual?

Great question, sort-of is the best answer. ABM models enable us to explore the constraints that farmers face and their effects. They enable us to explore options that could unlock the constraints that they face, but don't tell you what those solutions are. Rather you would identify a series of solutions and then model those solutions to identify the ones which do better at unlocking the constraints. An example might be, cashflow constraints. We can model the effects of a cashflow constraint, the affects of no constraint. But the ABM could also model the effects of a type of policy that would remove cashflow constraints (or actively improve cashflow), or improve it just at certain points/timeframes/weather conditions/etc. What this looks like as a policy is outside what we can do with a model, but if someone came and asked about a policy they had in mind, we could explore how well it might work using the model. Happy to discuss this more if you wish.

Why did you use an ABM instead of microsimulation model?

ABMs and Microsimulations are both simulation models but differ widely in how we model individuals. Microsimulation takes a set of data about a population – of people, households or firms – and applies rules to reflect changes, enabling the modeller to look at the overall impact. Such an approach is particularly useful for modelling policy changes, for example, to see who is made better or worse off by tax changes. There are two key differences between Microsimulations and ABMs. The first is that microsimulation does not model the interaction between agents which miss the direct interactions (such as information networks) but also the secondary interactions of their decisions on both agents and the policy being modelled (i.e. Land prices when selling). ABM's allow this type of modelling interaction between agents. Another way to look at it, is to view Microsimulations as modelling one-direction interactions: specifically, the impact of the policy on the individuals. ABM's allow for a two-way interactions looking at the he impact of the policy on the individuals, but also the impact of individuals on the policy, and interactions between individuals about the policy. Furthermore, microsimulation models do not have the behavioural modelling capability of ABM. The second key difference is the explicit inclusion of behavioural approaches (both the variation of these, but also simulating the decision-making process itself) rather than a more rule-based approach used in Microsimulation models. ABMs are designed to create 'agents' with some slight degree of cognitive ability (i.e. have a memory; can interact with other agents; capable of learning). Of course, this makes the simulations more complex to work with but arguably more powerful. Again, nothing wrong with microsimulation models I see that you get the same info, plus more insights with an ABM. With most things there are cons with ABMs so if you are wanting to model 10's of thousands of farmers, then microsimulation models would probably be a better option because simulating this number of agents will need significant high-performance computing requirements. Happy to discuss it more if you want, so please get in touch if you want more information.

When developing policy is it really a case of taking into account indiviual agency? It seems to be a way to completely stop policy development. Isn't it a case of identifying what needs to be done and then perhaps aligning the communication of that to an individual's "agency"?

I see them as both the same thing, but viewing from different perspectives (i.e. top down or bottom up), so in my view it's a bit of both. We need policy which is developed that takes into account that not everyone is the same and there are numerous reasons as to why one person won't respond the same as the other. You might view it as this happens already, but farmers on the ground (or homeowners, or builders, or business owners) don't see it that way, because of the way in which the policy is applied, but also in how it might be changed in the future (locking them into an incorrect decision). One other aspect, as you mention in your question "aligning the communication of that to an individual's agency", in my view this is critical and something which some might say is part of creating good policy. It's also something that we will hopefully look at in a lot more detail within the Moving the Middle MBIE proposal that we have in the current MBIE Endeavour round.

Questions & Answers

To what extent are you able to control for or explore the constraints of governance, especially with collectively-owned Māori freehold land?

Yes, we can and do account for changes in governance, such as collectively-owned Māori freehold land, within the model when we have data. We see a range of approaches in how farms on Māori freehold land are operated. Within an ABM we can utilise it as a what-if scenario tool to explore how changes in governance would change farms. One example of this is the potential rise of large-scale corporate type farms which also have a different governance structure than family or Māori owned farms.