**34 minutes to record**

Hi everyone and welcome to this lecture on quantifying preferences and environmental valuation! My name is Kim Jacobsen and I’m at the university of Oxford, and I’m currently using these methods to study preferences in collaboration with the London School of Economics.

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Why would we want to quantify preferences? Imagine a situation where the government is committed to increase electric train transport as part of a shift towards using more renewable energy. A train service can be designed in different ways. A train may be faster or it may make more stops to service more towns, it might have more or less seats for people or it may have more or less luggage space. But there is usually a trade-off, it’s usually not possible to have everything. It’s not possible to have more luggage space and more seats at the same time. How does the imaginary government in question decide how to balance these things in its train service to make people as satisfied as possible? They need to know how much weight people place on this different attributes in a train service so that they can all be traded-off in an optimal way. But how do we determine the weight that people place on these different things?

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The answer is: Choice experiments!

Choice experiments work by asking participants to choose between two different experimentally designed scenarios that aimed to capture different aspects of the situation you are interested in. Each scenario is described by different attributes taking on different levels.

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Each respondent makes several choices and each choice implies a trade-off between the attributes of the chosen and non-chosen alternatives. We can use the information revealed by people’s choices to estimate their utility functions and infer their preferences.

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So that you get a sense of choice experiments work I’ll talk to through an example based on my work. I carried out a choice experiment in Zimbabwe in village communities on the border of a national park. In this area, lions live close to village communities. The communities depend on livestock production (mainly cows and goats) and crop production (mainly maize) for their livelihoods. Lions sometimes kill livestock, and sometimes, but very rarely, can kill a human. This is at the same time a conservation problem as lions are therefore often killed.

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My research organisation, WildCRU, is running some programs in the area to help people cope with the presence of lions. The first programme is “The mobile bomas”. They are protective fences to keep lions away from livestock.

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The second programme is the “lion guardians”. These are people who have been trained to chase the lions back into the national park, so that people will be safe and also the lions will be safe.

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This is a very relevant situation to Myanmar, as you have several endangered species of wildlife that can damage the livestock and crops of people and sometimes even pose a risk to human life. Elephants and tigers are good examples. They are incredibly important species for biodiversity conservation but can also be very difficult for local communities to live alongside. This is exactly the same dynamics that were taking place in my study site in Zimbabwe. This method also applicable to all sorts of environmental topics, such as industry. A factory may generate benefits for communities, but simultaneously have negative effects, such as through pollution. Choice experiments let us determine how people weigh the different costs and benefits.

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In Zimbabwe, to find out what kind of programmes people preferred, and how that affected their willingness to accept lions in the area, we designed a choice experiment, where participants chose between different scenarios with different attributes. The attributes included were:

Lion = number of lions

Mobile bomas = protective fence

Lion guardians = keep lions away from villages

Monthly payment = monetary compensation payment that villagers would receive to compensate of the difficulties of living alongside lions

Then we could see, for example, if people valued mobile bomas more than guardians, and if they would chose options with more lions if they compensation payment was higher.

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By repeating this choice experiment where all the attributes (numbers of lions, whether there are lion guardians or not, how large the compensation payment is) we get sophisticated understanding of people’s relative preferences towards the different attributes.

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I’ll introduce the mathematical foundation of how choice experiments are used. However, if you don’t like maths don’t worry! It is not important to understand this in detail, feel free to skip past all the maths if it doesn’t interest you. I just include it here for those who are interested in the mathematical details.

The multinomial logit model is one of the mathematical models that we can use to disentangle all the choices we have observed in our experiment.

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However, an important limitation of the multinomial logit model is that it doesn’t account for the fact that not everyone has the same preferences. It just estimates the weights put on the different options for the overall population.

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However, there are more complicated models that includes heterogeneity in preferences. The two most commonly used models are the latent class model and the mixed logit model. I won’t get into detail here, but these are more advanced models that you can use to describe the preferences in your population in a more nuanced way. But I always recommend starting with the MNL, and then moving to a latent class model or mixed logit model. I’ve put some optional readings on the slide in case you are interested in learning more about these advanced models.

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No matter which models you decide to go with, we always estimate them using some sort of statistical software to do the calculations for us. There are many options that you can use. Software such as STATA is easier to use for beginners, while software such as R, where you write the computer code yourself, lets you have more control and transparency in how you estimate the models. The picture on the slide here shows what the interface looks like when I’m doing choice models in R. R also has the advantage of being free software, with an big online community that help each other by making code and programming packages available and answering questions in online forums.

However, if software and programming isn’t something you are very comfortable, don’t worry! By finding the right collaborators (from Myanmar or abroad), it is possible to develop choice experiment research where one person knows the local context and carries out the field work, while the other person takes care of the experimental design and analysis. So you don’t have to know statistics or programming to lead a choice experiment project.

Here is an example of what the output from one of these models looks like. The most important thing to look at is the coeffcients (that tells us about the effect of the attribute) and whether the variable is significant or not. From this output we can see that people’s preference towards increases in lion numbers is negative and also that its quite a strong preference (0.2 is quite high). In contrast, people have positive preferences for the mobile bomas and lion guardians, so seems like they really like the services that the conservation organisation is providing. And of course, the preference for compensation payments is also positive!

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If one of the attributes in the choice experiment refers to monetary payment, then we can also use choice experiments for economic valuation. In a simplified way, to illustrate: if we see that participants chose the options with more lions only when the compensation payment is $300 or more, then we know that those lions are worth negative $300. In other words, lions cause them harm to such an extent that they are willing to give up any compensation payment that is less than $250.

Of course, the other attributes (mobile bomas and lion guardians) vary too, so it’s a little bit more complicated because we have to account for that too. But don’t worry, there are statistical calculations that can do that for us.

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This is really useful because it allows us to assign a monetary value to things that do not have a market value. In the case of many things, like mobile phones, clothes, or houses, we know how much people value them because we know how much they are willing to pay in the market. However, many things don’t have a market, and moreover these are some of the most important things of all. There is no market for clean air, there is no market for soil protection or a clean ocean. So what often happens is that, when governments and other major policy actors make cost-benefit analyses to decide what to prioritise, often these really important things get assigned a value of zero and therefore always lose when compared to the benefit of making a factory, or making a hydroelectric dam. However, this completely ignores the value that people assign to having access to these valuable things. However, non-market techniques such as choice experiments get around this problem by constructing a experimental choice situation to see how much money people are willing to pay or to give up in order to have more of a non-market good (such as lower air pollution). This is really useful because that helps ensure that policymakers don’t under-invest in these valuable services. It does not mean that we are going to ask people to pay for these things (of course, no one should have to pay for clean air). But it shows us how important clean air is compared to increased wealth from the construction of a factory, for example. There are also other techniques that can be used to derive an economic valuation estimate, such as wellbeing regressions. Today we’ll focus on choice experiments.

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We can calculate the economic value very simply by dividing the coefficient of the attribute that we are valuing by the coefficient for the monetary term. Note that how we interpret this depends on exactly how we presented the monetary attribute in our choice experiment. If we, like I did in my experiment in Zimbabwe, use a compensation payment, then the results will be “willingness-to-accept”. However, if we instead used a payment that the participant has to make (for example, paying to improve air quality) then we get “willingness-to-pay”.

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So, using the output from my analysis as an example: to calculate the value of increases in the lion population we need take the coefficient of the attribute for increase in lions and divide it by the coefficients for the compensation attribute.

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This gives us the economic value of $-12.4 per month. This means that lions have negative value for the people in this area of Zimbabwe. So we can see that in this area, lions are causing quite a lot of costs for the local people. These costs are things like losing livestock to lions, and the cost of making fences and herding cattle, but it also contains all the unobservable costs of lion presence, such as stress and fear. So this gives us the a *total value* estimate for costs caused by lions, which is much more accurate than just using the market value of the cattle that lions kill, because that would miss out on all the intangible costs that people experience, such as fear. Though such intangible costs cannot be observed, they are nonetheless very influential on people.

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Like all methods, choice experiments also have limitations.

* Hypothetical bias: choice experiments are artificial, hypothetical situations. Participants might have chosen differently in a real situation where they actually would receive compensation payments, or themselves have to pay for a good or service. One reason that hypothetical situations can give inaccurate value estimates is that people might have a desire to say the socially acceptable thing as long as there is no real cost to them. Or they might want to say high WTP for public goods such as clean air because it feels good. This can bias WTP and WTA estimates.
* Utility mis-prediction: choice experiments require the participants to predict how they will feel about a good or service (predict how much utility they will get from it). Experiments have shown that people are not always able to predict how much they will enjoy something in advance.
* Anchoring: People‘s stated values can be influenced by irrelevant cues. For example, if participants are presented with a larger range of values in the payment or compensation attribute, they tend to show higher WTP or WTA (while this value should really be constant, as the economic theory behind choice experiments is based on the assumption that people have reasonably constant preferences).
* Insensitivity to scope: a common problem is that participants do not differentiate between high levels of the good that is being valued and low levels. For example people might be willing to pay the same for an increase in the population of an endangered bird of 10 000 individuals as they would be for 20 000. So deriving an economic value per bird is not meaningful, as people just value a general increase.

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Let’s have a look at some examples of how this is used in the literature.

Willingness-to-pay for cold water corals: The authors assessed the trade-offs between protection of cold-water coral reefs and economic activities, such as fisheries and oil extraction, through a survey of a representative sample of the populations of Norway and Ireland. On average, people were willing to pay USD38 and USD47 for a small and large increase in protected areas respectively, and USD99 if the area is important habitat for fish, all else held equal. However, there was large variation across individuals and countries. Norwegian respondents valued pure existence of cold-water corals more than the Irish respondents, and the latter were less willing to trade off industrial activities than the former.

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The Korean government has set a target that 11% of the total primary energy supply should be obtained through renewable energy sources until 2030. In order to develop proper policies for renewable energy investment, these researchers analysed the benefits of renewable energy investment based on households’ willingness to pay.

They presented the participants with different scenarios where the price of electricity varied, and the effect of the production of that electricity also varied in terms of its impact on air pollution, wildlife and employment. This was to see what price increases people would be willing to accept to have the benefits of greener energy production and increased employment.

Wilingness-to-pay for reduced air pollution: $0.10 (annually)

Wilingness-to-pay for increased employment: $0.13 (annually)

Wilingness-to-pay for improvement for wildlife: $0.084 (annually)

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Economic valuation estimates are widely used in policy-making.

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* It is used in cost-benefit analysis to measure all costs and benefits in monetary terms, for example to compare the benefits of environmental policies with the costs of carrying them out.
* It is also used for pricing and resource management purposes. For example, to determine the right entrance fees to national parks, and how to optimise the characteristics of natural area according to the preferences of the users of that space
* Value estimates can be used for taxation, for example taxes that penalises pollution in industries according to how much damage the pollution does to the people who experience that pollution.
* It is also used for legal procedures and damage litigation. By determining the true value of a an environmental resource, the appropriate level of compensation to that resource can be determined. A good example of this is the Exxon Valdez oil spill that took place on the coast of Alaska in the United States. It caused a lot of damage to the coastline and wildlife. The oil company claimed it should only have to compensate for the value lost due to people being unable to use the area for recreation or fishing and other activities. This value came to $4 million. However, economic valuation showed that people attached a much higher value to the coastline than just the value from the activity that takes place there. People gained value from knowing that there was a pristine environment, so the when that was damaged that impacted the people of Alaska more than just the loss of the activities that took place on that coast. These non-use values were estimated to $3 billion. (in this precise example they used a method called contingent valuation rather than choice experiment, but this could just as easily be done using choice experiments).
* There has been a global movement towards Green national accounting. Advocates for this approach argue that the GDP is misleading if economic growth is achieved by short-term, unsustainable use of natural resources, and that the value of the environmental resources that are lost should form part of national accounting. Economic valuation lets us assign to total value to environmental goods.
* Economic valuation can also be used to create markets for public goods, such as through Payment-for-ecosystem services programmes. For example, this has been used to estimate the value of protecting cloud forest in Ecuador for the services of water quality and biodiversity protection.

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There have also been choice experiment studies in Myanmar.

The dramatic increase in vehicle ownership in Myanmar over the past few years has resulted in an alarming increase in traffic accidents. This study aimed to quantify the costs of increased mortality from traffic accidents, using choice experiments and willingness-to-pay for reduction in risk from traffic accidents.

The value of avoiding one death was found to be MMK 118.062 million

By multiplying this by the total number of traffic deaths in Myanmar in 2015, the authors estimated total cost of death was estimated to range from MMK 594.681 billion to MMK 820.296 billion in 2015.

WTP was associated with age, family status, education, occupation, individual income, household income, the vehicle used, exposure to traffic, drunk driving, personal experiences, and the perceived risk of traffic accidents.

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A study on Water Quality Improvement and the Floating Settlements on Inlay Lake, Myanmar found that the average surplus gain from the lake water quality improvement is at least as large as 5.9% of the average annual per capita income of those on the lake. So that’s clearly a very worthwhile investment of funds.

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So we see that choice experiments are really useful to understand people’s preferences and how they trade-off different characteristics of goods and services as well as harms and negative consequences. The method can be used to derive a monetary estimate of the value of non-market goods, and though the method does of course have biases and weaknesses, it is very useful to inform policymaking, and help prevent inadvertent reductions in people’s welfare.

Thank you so much for listening, and please don’t hesitate to get in touch!