

CHOICE MODELING IN R

CLASS 9

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CHOICE MODELING

RANDOM REGRET

NON-RUM BASED MODEL

Random utility model has been very useful for applied choice analysis

- Easy to estimate
- Rooted in microeconomic theory
- Allows for straightforward inference: calculating WTP, predicting market shares or price elasticities
- In use for almost 50 years now
- Several extensions of standard MNL allowed for better representation of individuals' choice behavior

On the other hand, extensive research from psychology and behavioral economics suggests that utility maximization is not a good description of individuals' behavior

NON-RUM BASED MODEL

In choice modelling literature it has been recognized for a while now that there is a room for improvement in behavioral realism of the modelling

- Nonetheless applications are somewhat limited by the practical consideration

Some examples of more “behavioral” models (some of them are RUM based):

- Random regret minimization
- Attribute non-attendance
- Elimination by aspect
- Choice set formation
- Satisficing
- Decision field theory
- Hybrid choice models

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Today we cover
this one

(based):

RANDOM REGRET MINIMIZATION

Regret minimization is relatively popular decision process in the choice modelling, especially in the transportation literature

- Chorus, C. G., Arentze, T. A., & Timmermans, H. J. (2008). A random regret-minimization model of travel choice. *Transportation Research Part B: Methodological*, 42(1), 1-18.

Employs regret theory developed in the 80's for the lottery choices

It assumes that decision-makers are afraid of the regret associated with non-chosen alternative occurring better than the chosen one

Decision is driven by the decision-maker trying to avoid this feeling of regret

- In the travel context: trying to avoid regret associated with being late, stuck in traffic etc.

RANDOM REGRET MINIMIZATION

For multinomial choice with multiple attributes, regret for alternative j is given by:

$$R_j = \max \{ R_{j1}, \dots, R_{jJ} \}$$

and

$$R_{ji} = \sum_{k=1}^K \max \{ 0, \beta_k (X_{ki} - X_{kj}) \}$$

Only comparison with the best alternative matters

Regret is summed over all attributes

Not compensatory – there is no rejoice if given attribute is the best for the current alternative

Alternatives are evaluated in the context of the choice task

RANDOM REGRET MINIMIZATION

This specification of RRM is not differentiable, and therefore it is not straightforward to optimize a choice model like that

In 2010 a new RRM was proposed utilizing a different definition of regret

$$R_{ji} = \sum_{k=1}^K \ln \left(1 + \exp \left(\beta_k \left(X_{ki} - X_{kj} \right) \right) \right)$$

And then simply summing it over alternatives

$$R_j = \sum_{i \neq k} R_{ji}$$

Comparison is now made with all outcomes, not only the best one

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Comparison is now made

Let's go to



RANDOM REGRET MINIMIZATION

The model is operationalized by adding error component to the regret function

$$RR_{ji} = R_{ji} + \varepsilon_{ij}$$

Assuming that individuals are trying to minimize regret probability of choosing given alternative is given by MNL-like formula

$$P(y_i = j | \mathbf{X}_i) = \frac{\exp(-R_{ij})}{\sum_l \exp(-R_{il})}$$

RANDOM REGRET MINIMIZATION

For this model IIA property does not hold

Alternatives with an “*in-between*” performance on all attributes, relative to the other alternatives in the choice set, receive a “*market share bonus*”

All the extensions of standard MNL can be also applied to RRM model

- Latent classes
- Random parameters
- Etc.

WTP cannot be really estimated, there is no economic theory which would allow for interpretation of the derived welfare measures

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DECISION PROCESS HETEROGENEITY

If we acknowledge that individual can use some heuristics and/or different strategies to make decisions, there is no reason to assume that everyone will make decisions in the same fashion

- In SP this can be probably induced to some extent

Analogously as we modelled preference heterogeneity, we can try to account for decision process heterogeneity in which different individuals make choices differently

- It is likely that we cannot fully differentiate between the two with the limited data

LCM model is useful in this regard, as we can specify the model in which different classes represent different decision strategies

DECISION PROCESS HETEROGENEITY

Alternatively, one can try to define more general model which will contain different decision processes as its special cases

For example, generalized RRM was proposed, with regret defined as

$$R_{ji} = \sum_{k=1}^K \ln \left(\mu + \exp \left(\beta_k (X_{ki} - X_{kj}) \right) \right)$$

For $\mu = 1$ this is standard RRM, whereas for $\mu = 0$ it becomes RUM

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Let's go to  