



MAX-DIFF ANALYSIS (SAWTOOTH VS. R)

2015/2016



METHODS USED FOR MAX-DIFF ANALYSIS

1. Counts analysis
2. Tricked logit Models
3. Rank – ordered logit models with ties

NOTE: no matter which method is used the results should be the same

The method used is a preference of the analyst

We use several methods to confirm accuracy of results.

WHAT IS DIFFERENT?

At first glance the results are practically same common. The problems that arise for Max-Diff lies in the design and assumptions that may seem reasonable but it quite is easy to make logical errors. Design flaws can lead to results at the personal level that are significantly different than the aggregated sample.

What influence results the most?

- Sample size
- How many times each choice/attribute appears to each person as well across the entire sample
- Randomness of attribute combinations
- **Are goal is NO PREDESIGNED SETS** - aim is to preserve randomness and possible combinations

EXAMPLE 1.

25 variables / 4 per question / 20 questions (Sawtooth design for study compared)

In this case the design generates a misbalance at the personal level

$$20 \times 4 = 80$$

$$80 / 25 = 3 (5)$$

That means that per case (person) at least one and most 5 variables will appear more than 3 times. Worse case one variable could have up to 8 appearances instead of 3 as other 24, as there is no guarantee that difference of five are five different variables.

In our design we suggest that in case of 25 variables one follow next schematic:

25 variables / 5 per question / 15 questions

Or

25 variables / 4 per question / 25 questions

The reason that the number of questions rise is to preserve balance and ensure an equal number of appearance of each variable

Some numbers of attributes allow for a deep analysis (25, 16, 9) with relatively small number of required questions (15, 12, 9).

Suggested optimal design structures:

Number of items	Number of questions	Number of appearance	Number of variables per question	Number of items	Number of questions	Number of appearance	Number of variables per question
4	6	3	2	13	13	min 3	min 3
5	10	4	2	14	14	min 3	min 3
6	15	5	2	15	9	3	5
7	7	3	3	15	15	min 3	min 3
8	8	4	4	16	12	3	4
8	16	4	2	17	17	min 3	min 3
8	8	3	3	18	18	min 3	min 3
9	9	3	3	19	19	min 3	min 3
9	9	4	4	20	20	3	3
9	9	5	5	20	12	3	5
10	20	4	2	20	15	3	4
10	10	4	4	21	28	4	3
10	8	4	5	21	21	4	4
10	10	3	3	22	22	4	4
11	11	min 3	min 3	23	23	min 3	min 3
12	12	min 3	min 3	24	18	3	4
13	13	min 3	min 3	25	15	3	5

ASSUMPTIONS WE AVOID:

- 1. Position of item in given alternatives does not influence quality of sampled data** - even that this assumption should be applicable, there is high influence of personality that we have to take into account, we have to assume that in large sample there will be those who will be influence by position of item in battery and simply chose first as best and last as worst, thus in design we consider that each item appears on all positions during survey
- 2. Item will be chosen at least once as best or worst** – this common assumption is making a logical error in the programming part of analyses, when recognized can be avoided
- 3. Normal distribution is representative for sample** – in this case we could make logical mistake, but mathematically we would not notice a problem. Structure of the sample is binomial. There is mathematically reasoning that those two distributions are pretty close in same cases, but not all.
- 4. On personal level we do not need even distribution of alternatives** – this assumption highly corrupts logic and as well as the mathematics underlying Max-Diff, even if at the aggregated level everything looks fine, throughout the sample we can have bad cases, thus balance in the aggregate will be disturbed if we discard some of these cases. As well due to differences in the number of appearances, Max-Diff will not show same results on personal level and aggregated one. Simply a case of garbage in - garbage out. Balance on personal level is equally important as one on aggregated level. Achieving balance on personal level allows dynamic approach to evolve and to use Max-Diff logic within a survey and allows a deeper analyses with additional questions. It also allows you to discard cases without destroying the integrity of the design. Balance at the individual level always gives aggregate balance.

COUNTS (METHOD_1)

Results of computing the overall counts for the whole sample with a 1 for the highest brand.

This aggregate counts analysis (METHOD_1) suggests which one is the most preferred of the brands. Counts can be computed on individual level (METHOD_1A) as well.

However to interpret the counts we need to compute the rankings.

AGGREGATE LOGIT MODEL (METHOD_2)

Is based on TRICKED LOGIT MODEL method used by Sawtooth

The 'trick' is to transform the data before using logistic regression - this method violates some assumptions especially the independent and identically distributed random variables assumption (IID) - The assumption is important in the classical form of the central limit theorem, which states that the probability distribution of the sum (or average) of IID variables with finite variance approaches a normal distribution. Note that IID refers to sequences of **random** variables, as a result the parameter estimates may be biased

Approach can be corrected if we assure in design that IID is satisfied on personal level.

The mathematics behind the analysis is the estimation of the multinomial logit models with individual and/or alternative specific cases.

The logit model is useful when one tries to explain discrete choices, i.e. choices of one among several mutually exclusive alternatives.

AND OTHERS

RESPONDENT LEVEL LOGIT MODEL (METHOD_2A)

RANK- ORDERED LOGIT MODEL WITH TIES (METHOD_3)

RESPONDENT – LEVEL RANK ORDERED LOGIT MODEL WITH TIES
(METHOD_3A)

MIXTURE LOGIT MODEL

No matter which method for Max-Diff we used we obtained much the same results as with original Sawtooth research.

Slight observed differences are due to change in sample

Sawtooth sample had 2573 x 20 entries and we found 2572 x 20 correct entries.

Because of a misbalance on personal level not same number of appearances of all variables appeared

As well there is slight difference in data when ties are taken into account (between R and Sawtooth)

DUFFERIN RESEARCH APPROACH

Balanced design

A balanced design ensures the logic of method is not violated

Randomness consistency

Personal level balance makes useful individual level analysis and clustering of groups

SUGGESTED DESIGNS. 21 ATTRIBUTES IS PERFECTION.

25	Q	15	R	3		24	Q	18	R	3		21	Q	28	R	4			
1	6	11	16	21		1	5	9	13	17	21		1	4	7	10	13	16	19
2	7	12	17	22		2	6	10	14	18	22		2	5	8	11	14	17	20
3	8	13	18	23		3	7	11	15	19	23		3	6	9	12	15	18	21
4	9	14	19	24		4	8	12	16	20	24								
5	10	15	20	25															
1	5	2	3	4		1	18	10	4	20	12		3	3	3	4	4	9	9
7	9	6	8	10		6	21	13	7	23	15		4	10	16	10	14	10	14
11	13	12	14	15		10	1	18	12	4	20		9	14	20	16	20	20	16
18	19	16	17	20		13	6	21	15	7	23								
21	23	22	24	25									1	1	1	5	5	7	7
													5	12	17	12	17	12	17
													7	13	19	13	19	19	19
22	23	24	25	1		2	9	17	5	4	19		2	2	2	6	6	8	8
2	3	4	5	6		3	11	19	9	22	8		6	11	18	11	15	11	15
7	8	9	10	11		5	14	22	17	3	16		8	15	21	18	21	21	18
12	13	14	15	16		8	16	24	2	11	24								
17	18	19	20	21															
18	Q	18	R	3		16	Q	12	R	3									
1	4	7	10	13	16	1	5	9	13										
2	5	8	11	14	17	2	6	10	14										
3	6	9	12	15	18	3	7	11	15										
						4	8	12	16										
1	12	3	10	2	11														
5	13	4	14	6	15	1	3	2	15										
7	17	9	16	8	18	8	5	6	4										
						9	11	10	12										
1	2	3	4	5	6	14	13	7	16										
7	8	9	10	11	12														
13	14	15	16	17	18	1	2	3	4										
						5	6	7	8										
						9	10	11	12										
						13	14	15	16										

Yellow best

Green worst

White is neutral

First presentation is random, then patterned from the random start. For 21 do 3 per page, 28 pages, and you rate EVERY best against all bests of the 1st set, all worst against all, same for middle points.

Fine tuned ratings.

Data checks

Efficient data checks during the process of sampling and afterwards before data encounter the model

Dufferin Research method of generating the design ensures balance through out sample even in case of wrong entries

Every step qualitative and quantitative checking of data entries

Multi method
data analysis

The eligibility of any of particular approach to Max-Diff is disputable

Comparing results of multiple approaches assures correctness and validates the findings

FOR MORE INFORMATION ON MAXDIFF &
OTHER SIMPLE OR ADVANCED METHODS...



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