QCA

Kateřina Fridrichová

Sequence of the research

- Theory survey
- Conceptual work and study of the cases
- Data collection
- Data calibration
- Necessity analysis
- Truth table construction
- Boolean minimization

Standard analysis

1. Conceptual research – the research question, population of interest, outcome of interest, conditions to analyze
2. Data matrix – calibration of the measurements
3. Transformation of data matrix into truthtable
4. Testing for necessity
    1. Assessment of the outcome – consistency and coverage
5. Testing for sufficiency
    1. Assessment of the outcome – consistency and coverage
6. Repeating the process for non-outcome.

Truth table

- Truth table reflects data from the data matrix
- One row of truth table reresents combination of conditions that can appear
- 2^k (k = number of conditions)
- Not all of the conditions then appear in the reality = incomplete truth table – logical remainders
- If there is 1 in the outcome column that row expresses statement of sufficiency (under this combination of conditions the outcome of intererest happens)
- You take the truth table row and if it shows the outcome, than it is added to the logical minimization by Quine-McCluskey
- Fuzzy sets – fuzzy sets (as crisp ones) establish qualitative difference between membership and nonmembership in the set – property space – still belong into only one truth table row, because they will always have the value below 0.5 or above 0.5 for that condition

Data matrix into the truth table

Table 4.1 Data matrix with ten cases, three conditions, and outcome

		Conditions			Outcome
Row	Cases	A	B	C	Y
1	ARG	1	1	1	0
2	PER	1	0	0	0
3	BOL	1	1	0	0
4	CHI	0	1	0	1
5	ECU	1	0	0	0
6	BRZ	0	1	1	1
7	URU	1	0	1	1
8	PAR	0	0	1	1
9	COL	0	0	0	1
10	VEN	1	1	1	0

Y = set of countries with stable democracies
A = set of countries with violent upheavals in the past
B = set of countries with ethnically homogeneous population
C = set of countries with pluralistic party system

Table 4.2 Hypothetical truth table with three conditions

	Conditions			Outcome		
Row	A	B	C	Y	~Y	Cases
1	0	0	0	1	0	COL
2	0	0	1	1	0	PAR
3	0	1	0	1	0	CHI
4	0	1	1	1	0	BRZ
5	1	0	0	0	1	PER, EC
6	1	0	1	1	0	URU
7	1	1	0	0	1	BOL
8	1	1	1	0	1	AR, VEN

See Table 3.2
~Y = set of countries with non-stable democracies

Fuzzy set truth table

Cases	Conditions A	B	C	Truth Table Row A~BC	Outcome
HU	0.8	0.6	0.2		0.4
RO	0.9	0.3	0.2		0.3
CZ	0.6	0.3	0.6		0.7
BG	0.8	0.9	0.1		0.3
SK	0.2	0.3	0.9		0.6

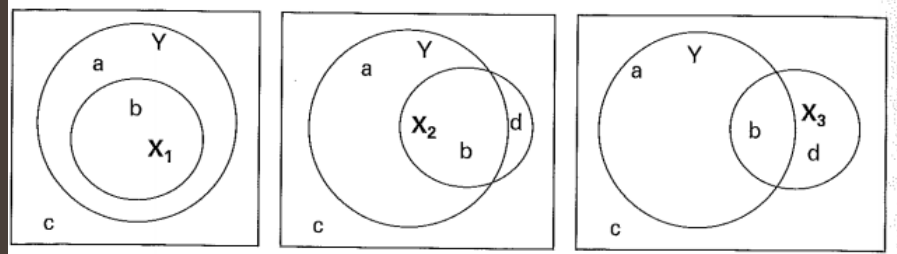
Dealing with contradictory rows and logical remainders

- Logical remainders – those combinations that do not realize in the data
  - Either use no assumpitons on logical remainders – bar them from logical minimization → conservative solution
  - Assign assumptions on logical remainders – the program itslef decides what to do with the remainders (uses those that lead to more effective logical minimization) → parsimonious solution
  - Directional expectations → intermediate solution
- Contradictory row - If the same combination of conditions shows both outcome and non-outcome
- Before logical minimization:
  - adding a condition
  - respecify the population of interest
  - respecify the definition, conceptualization, or measurement of the outcome or conditions

Sufficiency and its consistency

Table 5.1 Two-by-two tables – consistent and inconsistent sufficient conditions

Outcome Y	X_1 = 0	X_1 = 1	X_2 = 0	X_2 = 1	X_3 = 0	X_3 = 1
1	80 a	100 b	80 a	90 b	80 a	8 b
0	15 c	0 d	15 c	10 d	15 c	92 d



Venn diagrams – consistent and inconsistent sufficient conditions

Consistency of X as a sufficient condition for Y = number of cases where X=1 and Y= 1/ number of cases where X=1

( )

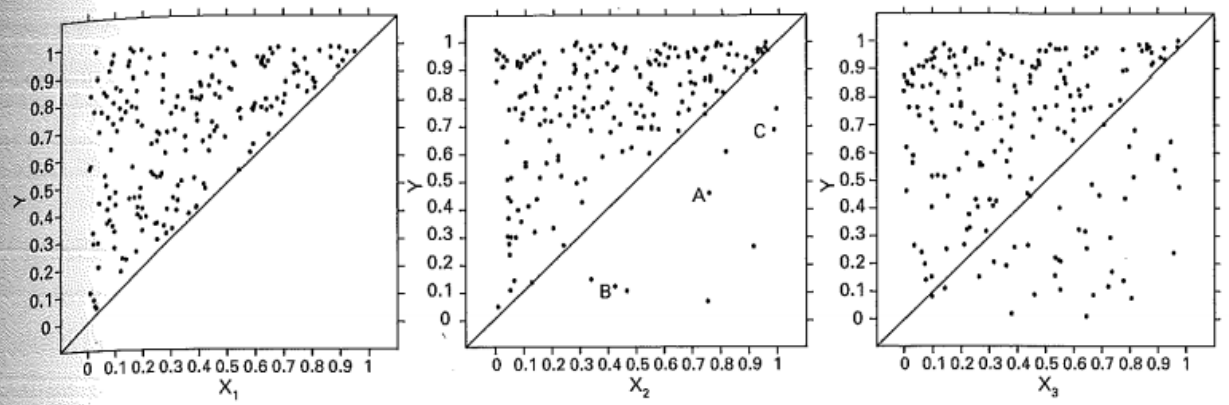
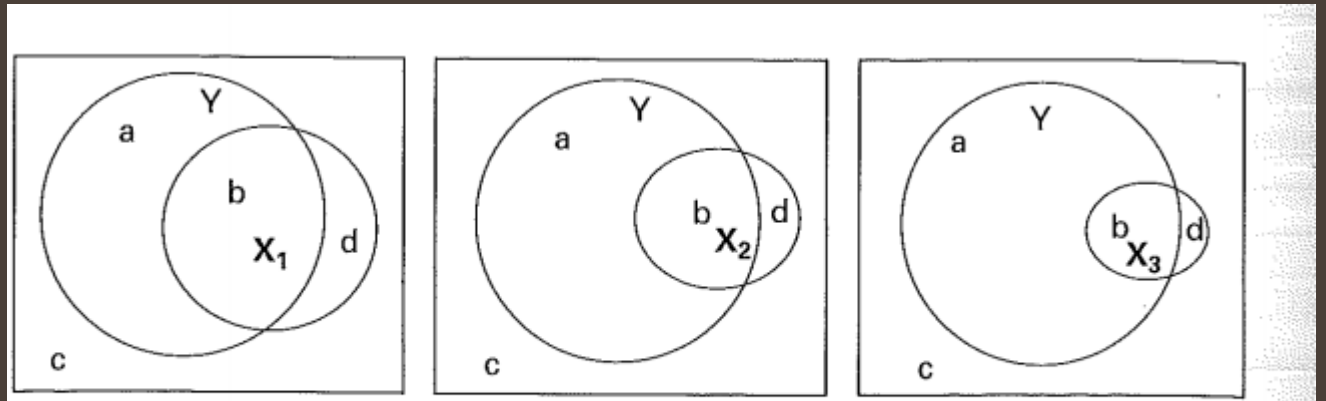


Figure 5.2 XY plot – consistent and inconsistent sufficient conditions

Sufficiency and its coverage



Venn diagrams – different levels of coverage sufficiency

Table 5.2 Two-by-two tables – different levels of coverage sufficiency

Outcome Y

			X_1
1	10 a	200 b	
0	20 c	8 d	
	0	1	

			X_2
	90 a	120 b	
	20 c	5 d	
	0	1	

			X_3
	186 a	24 b	
	20 c	1 d	
	0	1	

Sufficiency and its coverage

- However, it is common in crisp-set analyses to assess the proportion of cases following each path—that is, the number of cases following a specific path to the outcome divided by the total number of instances of the outcome. Ths simple proportion is a direct measure of set-theoretic coverage and is a straightforward indicator of the empirical importance of a causal combination.

- ( )

Necessity and its coverage and parameters of fit

Conceptual work

- Research question: What factors motivate UN intervention.
  - causally complex phenomenon
  - outcome: the strength of international response (“STRONG”)
  - conditions:
    - Extent of the crisis
    - Spillover effects
    - Countervailing power
    - Institutional involvement
    - Media attention

Data matrix

Table I. Fuzzy-set membership scores for 31 humanitarian crises 1991–2004

		Explanatory conditions					*Outcome*
Cases	*Years*	*(1) Extent*	*(2) Spillover effects*	*(3) Countervailing power*	*(4) Institutional involvement*	*(5) Media attention*	*Strength of UN response*
Afghanistan	1991–2004	1	1	0.08	0.64	0.16	1
Angola 1	1991–1994	1	0.66	0.44	0.32	0.12	0.64
Angola 2	1998–2002	1	1	0.35	0.8	0.06	0.64
Azerbaijan (Karabakh)	1992–1994	0.68	0.59	1	0.16	0.09	0.16
Bosnia	1992–1995	1	1	0.38	0.8	1	1
Burundi	1993–2004	0.86	0.64	0.09	0.8	0.05	0.8
Colombia	1991–2004	1	1	1	0.16	0.11	0.16
Congo-Brazzaville	1997–1999	0.49	0	0	0.16	0	0.16
DR Congo	1996–2004	1	1	0.16	0.8	0.27	0.8
Georgia (Abkhazia)	1992–1994	0.13	0.13	1	1	0.06	0.32
Guinea-Bissau	1998–1999	0.1	0	0	1	0	0.16
India (Kashmir)	1991–2004	0.24	1	1	0.16	0.07	0
Iraq (Northern Iraq)	1991–1993	0.64	1	1	1	1	1
Liberia 1	1991–1995	1	1	0	1	0	0.64
Liberia 2	2000–2003	0.6	0.49	0	0.64	0.09	0.8
Mozambique	1991–1992	1	1	0.12	0.16	0	0.48
Myanmar	1991–2004	0.86	1	1	0.16	0	0.16
Nepal	1996–2004	0.06	0	1	0.16	0	0.16
Peru	1991–1997	0.64	1	1	0.16	0.07	0.16
Russia (Chechnya) 1	1994–1996	0.41	0	1	0.16	0.7	0.16
Russia (Chechnya) 2	1999–2004	0.86	0	1	0.16	0.37	0.16
Rwanda	1993–1994	1	1	0.06	0.8	0.22	1
Sierra Leone	1991–2002	0.82	1	0	1	0	1
Somalia	1991–1995	1	0.92	0	0.8	0.08	1
Sri Lanka	1991–2002	0.92	0.28	1	0.16	0.06	0.16
Sudan	1991–2004	1	0.72	1	0.32	0.07	0.32
Sudan (Darfur)	2003–2004	1	0.25	1	0.16	0.05	0.16
Tajikistan	1992–1997	0.32	0.3	1	1	0	0.32
Turkey	1991–2004	1	1	1	0.16	0	0
Uganda (Northern Uganda)	1994–2004	1	1	0.11	0.16	0	0.16
Yugoslavia (Kosovo)	1998–1999	0.1	1	1	1	0.87	0.64

Data matrix in RStudio

	EXTENT	SPILLOVER	COUNTPOWER	INVOLV	ATTENTION	STRONG
Afghanistan	1.00	1.00	0.08	0.64	0.16	1.00
Angola 1	1.00	0.66	0.44	0.32	0.12	0.64
Angola 2	1.00	1.00	0.35	0.80	0.06	0.64
Azerbaijan (Karabakh)	0.68	0.59	1.00	0.16	0.09	0.16
Bosnia	1.00	1.00	0.38	0.80	1.00	1.00
Burundi	0.86	0.64	0.09	0.80	0.05	0.80
Colombia	1.00	1.00	1.00	0.16	0.11	0.16
Congo-Brazzaville	0.49	0.00	0.00	0.16	0.00	0.16
DR Congo	1.00	1.00	0.16	0.80	0.27	0.80
Georgia (Abkhazia)	0.13	0.13	1.00	1.00	0.06	0.32
Guinea-Bissau	0.10	0.00	0.00	1.00	0.00	0.16
India (Kashmir)	0.24	1.00	1.00	0.16	0.07	0.00
Iraq (Northern Iraq)	0.64	1.00	1.00	1.00	1.00	1.00
Liberia	1.00	1.00	0.00	1.00	0.00	0.64
Liberia 2	0.60	0.49	0.00	0.64	0.09	0.80
Mozambique	1.00	1.00	0.12	0.16	0.00	0.48
Myanmar	0.86	1.00	1.00	0.16	0.00	0.16
Nepal	0.06	0.00	1.00	0.16	0.00	0.16
Peru	0.64	1.00	1.00	0.16	0.07	0.16
Russia (Chechnya) 1	0.41	0.00	1.00	0.16	0.70	0.16
Russia (Chechnya) 2	0.86	0.00	1.00	0.16	0.37	0.16
Rwanda	1.00	1.00	0.06	0.80	0.22	1.00
Sierra Leone	0.82	1.00	0.00	1.00	0.00	1.00
Somalia	1.00	0.92	0.00	0.80	0.08	1.00
Sri Lanka	0.92	0.28	1.00	0.16	0.06	0.16
Sudan	1.00	0.72	1.00	0.32	0.07	0.32
Sudan (Darfur)	1.00	0.25	1.00	0.16	0.05	0.16
Tajikistan	0.32	0.30	1.00	1.00	0.00	0.32
Turkey	1.00	1.00	1.00	0.16	0.00	0.00
Uganda (Northern Uganda)	1.00	1.00	0.11	0.16	0.00	0.16
Yugoslavia (Kosovo)	0.10	1.00	1.00	1.00	0.87	0.64

Showing 1 to 31 of 31 entries

Truth table

```
 OUT: outcome value
   n: number of cases in configuration
incl: sufficiency inclusion score
```

	EXTENT	SPILLOVER	COUNTPOWER	INVOLV	ATTENTION	OUT	n	incl	PRI
19	1	0	0	1	0	1	1	1.000	1.000
28	1	1	0	1	1	1	1	1.000	1.000
2	0	0	0	0	1	?	0	1.000	-
4	0	0	0	1	1	?	0	1.000	-
8	0	0	1	1	1	?	0	1.000	-
9	0	1	0	0	0	?	0	1.000	1.000
10	0	1	0	0	1	?	0	1.000	-
11	0	1	0	1	0	?	0	1.000	1.000
12	0	1	0	1	1	?	0	1.000	-
18	1	0	0	0	1	?	0	1.000	1.000
20	1	0	0	1	1	?	0	1.000	1.000
23	1	0	1	1	0	?	0	1.000	-
24	1	0	1	1	1	?	0	1.000	-
26	1	1	0	0	1	?	0	1.000	1.000
32	1	1	1	1	1	1	1	0.969	0.943
27	1	1	0	1	0	1	8	0.949	0.929
30	1	1	1	0	1	?	0	0.944	0.829
31	1	1	1	1	0	?	0	0.906	0.304
15	0	1	1	1	0	?	0	0.881	0.000
16	0	1	1	1	1	0	1	0.816	0.681
14	0	1	1	0	1	?	0	0.794	0.000
17	1	0	0	0	0	?	0	0.776	0.421
25	1	1	0	0	0	0	3	0.737	0.519
1	0	0	0	0	0	0	1	0.653	0.314
22	1	0	1	0	1	?	0	0.623	0.000
7	0	0	1	1	0	0	2	0.611	0.000
6	0	0	1	0	1	0	1	0.538	0.000
3	0	0	0	1	0	0	1	0.537	0.213
5	0	0	1	0	0	0	1	0.446	0.000
21	1	0	1	0	0	0	3	0.439	0.000
29	1	1	1	0	0	0	6	0.393	0.053
13	0	1	1	0	0	0	1	0.360	0.000

	cases
19	Liberia 2
28	Bosnia
2	
4	
8	
9	
10	
11	
12	
18	
20	
23	
24	
26	
32	Iraq (Northern Iraq)
27	Afghanistan,Angola 2,Burundi,DR Congo ,Liberia,Rwanda,Sierra Leone,Somalia
30	
31	
15	
16	Yugoslavia (Kosovo)
14	
17	
25	Angola 1,Mozambique,Uganda (Northern Uganda)
1	Congo-Brazzaville
22	
7	Georgia (Abkhazia),Tajikistan
6	Russia (Chechnya) 1
3	Guinea-Bissau
5	Nepal
21	Russia (Chechnya) 2,Sri Lanka,Sudan (Darfur)
29	Azerbaijan (Karabakh),Colombia,Myanmar,Peru,Sudan,Turkey
13	India (Kashmir)

Bibliography

- Binder, Martin. 2015. "Paths to Intervention What Explains the UN's Selective Response to Humanitarian Crises?" *Journal of Peace Research*, July, 0022343315585847. doi:10.1177/0022343315585847.
- Ragin, Charles C. 2008. *Redesigning Social Inquiry: Fuzzy Sets and Beyond*. Chicago: University Of Chicago Press.
- Schneider, Carsten Q., and Claudius Wagemann. 2012. *Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis*. Cambridge: Cambridge University Press.