

Supplementary File to the paper:

'BUSINESS POWER IN NOISY POLITICS: AN EXPLORATION BASED ON DISCOURSE NETWORK ANALYSIS AND SURVEY DATA'

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I. Discourse Network Analysis: Coding procedure, code book, newspaper sample

A first version of the codebook was developed by a close reading of 50 newspaper articles appearing in 10 newspapers that were published at the beginning, in the middle, and at the end of the referendum campaign. The resulting preliminary coding scheme was the basis for the first coding iterations of the entire newspaper dataset. Previously unmentioned arguments emerged repeatedly, necessitating the initial coding scheme to be modified several times during the coding process. To ensure a coherent way of coding, a multipass coding strategy was employed by performing multiple coding iterations and navigating «back and forth between the statements» [1, p. 177]. The final codebook (see below) contains 20 arguments.

The unit of analysis in DNA is the statement. Using the software *Discourse Network Analyzer* (DNA) [2], each statement containing an argument in relation to nuclear phase-out within the period of observation was coded manually according to six variables:

1. the date when the statement appeared,
2. the newspaper in which it appeared,
3. the name of the actor making the statement,
4. the organizational affiliation of the actor,
5. the specific argument revealed in the statement,
6. whether the actor approved or rejected the argument.

The following table briefly sketches the categories relevant for the last two variables (specific argument / approval or rejection). It also indicates the regular expressions that were used within the coding software. These are a means to render the coding procedure semi-automatic, but they do not compensate for in-depth reading of all articles.

Argument (short)	Argument (extended)	Regular Expression (German / French)
Cost of Phase-Out	= yes: nuclear phase-out leads to unnecessary costs (e.g., decommissioning costs; rising electricity prices; investments in new electricity generation capacity and the grid)	- Kosten, teuer - coût, coûteu[...], cher
Coal Power Import	= yes: nuclear phase-out leads to imports of coal-based electricity	- Kohle, dreck - Charbon, sale
Climate Friendliness	= yes: nuclear power does not emit carbon dioxide and helps Switzerland maintain a small carbon footprint	- Klima, Klimaschutz, Erwärmung - Climat, climatique, réchauffement
Timing too hasty	= yes: implementing the nuclear phase-out initiative will lead to chaos because it provides for a hasty phase-out	- Schnell, voreilig, überstürzt, verfrüht - Rapide, vite, précipité, précipitamment, prématuré
Endangered Security of Supply	= yes: implementing the nuclear phase-out initiative will put security of electricity supply at risk	- Versorgungssicherheit, Versorgung, Lücke, Flatter, Band, Netz - alimentation, sécurité, approvisionnement, pénurie, fluctuant, ruban, réseau
No Technology Ban	= yes: the nuclear phase-out initiative means prohibiting nuclear power as a technology. There should be no bans on technologies	- Technologie, verbot - technologie, interdiction
Energy Dependence	= yes: implementing the nuclear phase-out initiative will increase Switzerland's energy dependence from other countries	- abhängig, Ausland, Deutschland, deutsch, Frankreich, französ[...] - dépendan[...], étranger, Allemagne, allemand, France, français
Indemnity Claims	= yes: implementing the nuclear phase-out initiative will lead to claims for damages by the nuclear utilities, which will be costly	- erpress[...], Schadenersatz - extorque[...], chantage, pression, dommage, indemnisation
Job Losses	= yes: nuclear phase-out destroys jobs	- Arbeitspl[...], Job - travail, emploi
Energy Strategy 2050	= yes: nuclear power will be phased out anyway according to the Energy Strategy 2050	- Energiestrategie 2050 - Stratégie énergétique 2050
Nuclear Risk	= yes: nuclear power is hazardous, which is why the power plants should be phased out	- Risiko, abschalt[...], Gefahr, Unfall, sicher - risque, arrête[...], danger, accident, incident, sécur[...]
Nuclear = Uneconomic	= yes: nuclear power is a losing game, so the power plants need to be retired as quickly as possible	- wirtschaftlich, Verlust, rentabel - perte, rentable
Intergenerational Justice	= yes: nuclear power is a problem in terms of intergenerational justice	- Generation, gerecht, kommend, künftig - Équité, justice, intergénération[...], génération, future, prochain, suivant
Feasibility	= yes: phasing out nuclear power plants according to the popular initiative is technically feasible	- machbar, verzicht[...], möglich - faisab[...], renonce[...], possible, réalisable
Drives Alternative Technology	= yes: a nuclear phase-out would be a driver of alternative technologies	- intelligent, smart, grid, Entwicklung - intelligent, smart, grid, développement
Waste Problem	= yes: nuclear waste is a big societal problem, which will be aggravated by not phasing out nuclear	- Abfall, Müll - déchet
Nuclear = Unpopular	= yes: nuclear power is unpopular. As the people do not like the technology, the plants should be phased out	- Akzeptanz, unbeliebt - acceptabilité, impopulaire
Reliability for Utilities	= yes: phasing out nuclear would lead to reliability for the electricity sector	- Verlässlichkeit, verlässlich - fiabilité, fiable
Benefit Hydropower	= yes: phasing out nuclear would be beneficial for Swiss hydropower	- Wasserkraft - hydraulique, hydroélectricité
Renewables are Ready	= yes: nuclear power plants can be retired because renewable energies can already now fill the gap	- erneuerbar - renouvelables

Table 1. Code book used for the Discourse Network Analysis.

Newspaper	language	type
20 Minuten	German	tabloid newspaper (free)
20 minutes	French	tabloid newspaper (free)
24 heures	French	subscription newspaper
Aargauer Zeitung	German	subscription newspaper
Basler Zeitung	German	subscription newspaper
Berner Zeitung	German	subscription newspaper
Blick	German	tabloid newspaper
Blick am Abend	German	tabloid newspaper (free)
Die Weltwoche	German	news magazine (weekly)
Le Matin	French	tabloid newspaper
Le Matin Dimanche	French	Sunday tabloid newspaper
Le Temps	French	subscription newspaper
L'Hebdo	French	news magazine (weekly)
(Neue) Luzerner Zeitung	German	subscription newspaper
Neue Zürcher Zeitung	German	subscription newspaper
NZZ am Sonntag	German	Sunday newspaper
Schweiz am Sonntag	German	Sunday newspaper
Sonntags-Blick	German	Sunday tabloid newspaper
SonntagsZeitung	German	Sunday newspaper
Südostschweiz	German	subscription newspaper
Tages-Anzeiger	German	subscription newspaper
Tribune de Genève	French	subscription newspaper

Table 2. Newspaper sample for the Discourse Network Analysis.

II. Information about the post-vote survey

The data used to analyse voting behaviour stem from the third (and hence final) wave of a panel survey conducted in the context of the Swiss nuclear phase-out initiative. The survey was fielded between November 27 (voting day) and December 1, 2016. Survey participants were drawn from a Swiss online access panel operated by the market research agency Intervista. The statistical target population consists of ca. 70,000 individuals registered in the company’s online panel. This panel is entirely actively recruited and closely resembles a probability sample of the Swiss voting population.¹

Hence, similarly to samples taken by companies such as YouGov, the data are from a non-probability-based sample. To approximate a representative sample of the Swiss voting population, stratified random sampling with proportionate allocation was applied (for a discussion of the advantages of this technique, see [3]). The target population *of the first survey wave* was stratified with respect to region, gender, education, age and party preference. As a benchmark for stratification, the distribution of socio-demographic characteristics in the Swiss voting population as provided by the Swiss Federal Statistical Office was used. Stratification of partisan orientations corresponds to the results of the 2015 parliamentary election to the lower chamber. As only 6.1 percent of Swiss voters live in the Italian-speaking region of Switzerland, this area was not covered by the survey. The sample distribution of socio-demographic variables and partisan orientations of the sample used for the analysis of voting behaviour (i.e., the last survey wave) is shown in [4].

Respondents were surveyed using computer-assisted web interviews (CAWI). Compared to traditional computer-assisted telephone interviews (CATI) and mail-based surveys, online surveys based on large panels have the advantage of being cost-efficient. Moreover, the declining rate of landline telephones leads to the problem of coverage with studies that use CATI, whereas the population of internet users has steadily grown

¹See https://www.intervista.ch/uploads/2017/03/intervista_ESOMAR28e.pdf (accessed 17.05.2018).

in past years.² Surveys based on CATI and random sampling in Switzerland underrepresent voters of right-wing parties while overrepresenting voters of left-wing and green parties [7], and citizens without a landline connection systematically differ from those with a landline across a range of variables relevant to political behaviour [8, p. 100]. Moreover, several controlled comparisons have shown that internet-based surveys can be at least as reliable and accurate at estimating parameters of voting behaviour as surveys that use more traditional modes of accessing potential respondents [9, 10].

Argument (no. of mentions)	Line of reasoning put forward by the coalition using the argument more often
Nuclear Risk (229)	Globally, CH has the oldest fleet of commercial nuclear power plants. In recent years, there were several unplanned reactor outages due to security concerns. The likely consequences of a nuclear disaster are exacerbated by the fact that CH is a small, but very densely populated country.
Endangered Security of Supply (183)	Nuclear energy is the only low-carbon energy source that reliably supplies electricity at any time and independent of weather conditions. If CH phased out its reactors, more than 30 % of its electricity production would be lost.
Coal Power Import (129)	If CH phased out NP, dependence on imported coal power would rise massively. Importing dirty coal power would seriously deteriorate the carbon footprint.
Timing too hasty (124)	The proposal demands a chaotic shutdown of nuclear reactors. The time frame is unrealistic, because the transformation of the energy system takes longer than foreseen by the exit plan. NPO must be planned carefully. More time is needed to prepare for phase-out, decommissioning and dismantling.
Nuclear = Uneconomic (114)	The market signals are clear: given low electricity prices, power generation based on nuclear reactors will be a losing game for years to come. The operators of nuclear power plants are already bankrupt on the balance sheet, and the financial risks of a nuclear power plant are tremendous. Economic risks will further accumulate with increasing age of nuclear power plants.
Cost of Phase-Out (107)	NPO will cost billions of Swiss francs. It necessitates investments in new power plants and the grid. Additional electricity imports will raise transmission costs. It also means new costs for decommissioning and disposal. Ultimately, higher electricity prices burden businesses and households.

Table 3. The six most frequently mentioned arguments in the nuclear phase-out discourse.

Notes: CH = Switzerland; NPO = Nuclear Phase-Out; NP = Nuclear Power.

²Between 1995 and 2015, the number of landline connections decreased from 62.1 to 30.8 connections per 100 inhabitants [5]. In 2016, 91% of Swiss households had an internet connection [6].

Short label	Questionnaire item (German)	Questionnaire item (French)	English translation
Nuclear Risk	«Die Schweizer AKW müssen abgeschaltet werden, bevor es ein tragisches Ende nimmt.»	«Les centrales nucléaires suisses doivent être arrêtées avant qu'une catastrophe ne se produise.»	«The Swiss nuclear power plants must be shut down before it comes to a tragic end.»
Endangered Security of Supply (*)	«Auch nach dem Ausstieg aus der Atomenergie ist die Stromversorgung in der Schweiz jederzeit sichergestellt.»	«Même après la sortie de l'énergie nucléaire, l'approvisionnement en électricité sera assurée en permanence en Suisse.»	«Even after phasing out nuclear power, electricity supply in Switzerland will be ensured at all times.»
Coal Power Import	«Bei einem verfrühten Atomausstieg droht der Import von dreckigem Kohlestrom aus dem Ausland.»	«En cas de sortie précoce du nucléaire, il existe le risque d'une importation d'électricité sale produite à partir du charbon.»	«Prematurely phasing out nuclear power makes imports of dirty coal power from foreign countries imminent.»
Timing too hasty	«Wir sollten nicht mit einem überstürzten Atomausstieg die Fehler Deutschlands wiederholen.»	«Nous ne devrions pas répéter les erreurs de l'Allemagne avec une sortie précipitée du nucléaire.»	«We should not make a rash phase-out decision, which would mean replicating Germany's mistakes.»
Nuclear = Uneconomic	«Das Festhalten an einer alten Technologie bringt den Innovationsstandort Schweiz nicht voran.»	«Rester fixé sur l'ancienne technologie ne fera pas avancer la Suisse en tant que site d'innovation.»	«Adhering to an old technology does not advance Switzerland as an innovation location.»
Cost of Phase-Out	«Der Atomausstieg würde unnötige Kosten durch den verfrühten Rückbau unserer sicheren AKW verursachen.»	«La sortie du nucléaire générerait des coûts inutiles dû au démantèlement précoce de nos centrales nucléaires sûres.»	«Phasing out nuclear power would produce unnecessary costs due to the premature dismantling of our safe nuclear power plants.»

Table 4. Questionnaire items to gauge citizens' opinions on important arguments used during the political campaign. Note: (*) This item was adopted from [11].

Note: A potential limitation concerns the wording of the item used to measure agreement to the assertion that the phase-out proposal was «too hasty», as it simultaneously mentioned that a quick phase-out would mean «replicating Germany's mistakes». Some respondents might have indicated agreement with the item while actually agreeing more with avoiding Germany's mistakes than with seeing the timeframe as overly ambitious. This is particularly relevant given that the aspect of timing turned out to be the argument with the strongest impact on voting behaviour. Encouragingly, however, there is further evidence that the timing was indeed *the* central reason for many to reject the phase-out proposal. In the questionnaire, before answering to the provided arguments analysed earlier, participants were asked to freely indicate the reasons why they had supported or rejected the popular initiative. Consistent with the analysis above, the most frequently mentioned reason to reject the proposal (by 34 percent of No-voters) was the 'overly ambitious' timeframe, while only one participant mentioned Germany as a bad example for energy policymaking. This suggests that agreement to the survey item was in fact driven mainly by the timing component of the argument.

	MIN	MAX	MEAN	STANDARD DEVIATION	N
Voting behaviour	0 (Rejection of ballot proposition)	1 (Acceptance of ballot proposition)	0.46	0.50	886
ARGUMENTS					
Nuclear Risk	1 (fully disagree)	5 (fully agree)	3.50	1.38	873
Endangered Security of Supply	1 (fully disagree)	5 (fully agree)	2.80	1.37	855
Coal Power Import	1 (fully disagree)	5 (fully agree)	3.55	1.34	859
Cost of Phase-Out	1 (fully disagree)	5 (fully agree)	3.11	1.48	854
Nuclear = Uneconomic	1 (fully disagree)	5 (fully agree)	3.69	1.22	864
Timing too hasty	1 (fully disagree)	5 (fully agree)	3.28	1.47	843
PARTISAN ORIENTATIONS					
Right Party Supporter	0 (No)	1 (Yes)	0.62	0.48	896
Left Party Supporter	0 (No)	1 (Yes)	0.36	0.48	896
SOCIO-DEMOGRAPHICS					
Cars	0	7	1.21	0.89	888
Young	0 (older than 34)	1 (younger than 35)	0.15	0.36	896
Elderly	0 (younger than 60)	1 (older than 59)	0.34	0.47	896
Female	0 (male)	1 (female)	0.49	0.50	896
Residence within Danger Zone	0 (No)	1 (Yes)	0.16	0.37	896
French-speaking	0 (German)	1 (French)	0.23	0.42	896
Higher Education	0 (less than high school)	1 (high school or higher)	0.37	0.48	896

Table 5. Descriptive statistics of variables used in the analyses.

III. Robustness checks for the analysis of voting behaviour

A. Extended Heckman-selection probit model

The core aim of the statistical analysis presented in the paper is explaining citizens' preference for nuclear phase-out. To address the selection problem that arises if two outcomes are jointly determined, a Heckman-selection strategy is used. This procedure involves two steps, both based on regression analysis: first, the selection model models the process by which survey participants decide to participate in the ballot, and second, the outcome model models support for nuclear phase-out as a function of both independent variables and the estimates of step one. In other words, the procedure jointly estimates the probability to participate in the vote (step one) and to cast a «yes»-vote (step two; see [12, 13]).

Participation

In Table 6, the columns labeled «Selection Model» present the estimates for participation in the popular vote. While Selection Model 1 corresponds to the selection model shown in the paper (Table 1), Selection Model 2 also includes partisan orientation. According to both selection models, the number of cars in a household and being younger than 35 are significantly associated with lower turnout. Neither partisan orientations nor agreement with specific arguments about nuclear phase-out are systematically related to turnout rates. Given that the models cover only 82 non-voters, respectively, precautions should be taken when interpreting these findings.

Voting behaviour

In Table 6, the columns labeled «Outcome Model» present the estimates for supporting the nuclear phase-out initiative at the ballot. Outcome Model 1 corresponds to the outcome model shown in the paper (Table 1), and Outcome Model 2 also includes partisan orientation.

Variable	Outcome Model 1 (1 = support for phase-out)		Selection Model 1 (1 = participation in the vote)		Outcome Model 2 (1 = support for phase-out)		Selection Model 2 (1 = participation in the vote)	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
ARGUMENTS AGAINST PHASE-OUT								
Endangered Security of Supply	-.477**	.099	.078	.067	-.471**	.099	.077	.068
Coal Power Import	-.313**	.105	.069	.073	-.302**	.106	.079	.073
Timing too hasty	-.524**	.095	.009	.068	-.505**	.097	.013	.068
Cost of Phase-Out	-.437**	.088	-.067	.069	-.431**	.088	-.063	.069
ARGUMENTS IN FAVOR OF PHASE-OUT								
Nuclear Risk	.237**	.085	.031	.062	.231**	.085	.029	.062
Nuclear = Uneconomic	.370**	.104	.065	.064	.351**	.106	.056	.064
PARTISAN ORIENTATIONS								
Right Party Supporter					-.106	.850	.387	.389
Left Party Supporter					.130	.855	.540	.392
CONTROLS								
Car ownership	-.137	.113	-.134*	.066	-.151	.113	-.135*	.066
Young	.707**	.264	-.316*	.154	.697**	.263	-.325*	.155
Elderly	.149	.228	.282	.158	.142	.228	.259	.159
Female	.156	.191	-.158	.125	.125	.194	-.170	.127
Residence within Danger Zone	-.615*	.294	-.163	.159	-.614*	.294	-.173	.160
French-Speaking	-.358	.221	.085	.166	-.322	.224	.106	.168
Higher Education	-.436*	.219	.271	.142	-.455*	.219	.261	.143
Intercept	3.490**	.866	.918	.521	3.496**	1.235	.476	.641
<i>N (censored / uncensored)</i>								
			825 (82/743)				825 (82/743)	

Table 6. Heckman-selection probit models explaining support for nuclear phase-out.

Note: Entries are Heckman probit coefficients and standard errors (SE). Significance levels: *.05, and **.01.

B. Ordered probit regressions explaining agreement with arguments

Table 7 entails ordered-probit models to explain voters' endorsement of arguments related to nuclear phase-out.

Variable	ARGUMENTS AGAINST PHASE-OUT				ARGUMENTS IN FAVOR OF PHASE-OUT			
	Endangered Security of Supply	Coal Power Imports	Timing too hasty	Cost of Phase-Out	Nuclear Risk	Nuclear = Uneconomic		
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	SE	SE	SE	SE	SE	SE	SE	SE
Right Party	.750**	.588*	.788**	.618**	-.146	-.405	.291	
Supporter								
Left Party	-.128	-.443	-.302	-.423	.637*	.572	.294	
Supporter								
Cars	.018	.045	.013	.059	-.061	.027	.042	
Young	-.118	-.017	.030	.073	.089	.063	.102	
Elderly	.110	.240**	.226**	.365**	-.199*	-.074	.085	
Female	-.040	-.116	-.036	-.158*	.160*	.050	.076	
Residence within Danger Zone	.101	.226*	.083	.013	-.125	.055	.103	
French-Speaking	-.145	.004	.019	-.179	.175	.455**	.094	
Higher Education	-.025	.056	-.098	-.051	-.005	.079	.082	
Cut 1	-.642	-1.201	-.568	-.920	-.857	-1.080	.356	
Cut 2	.218	-.498	-.091	-.365	-.179	-.350	.356	
Cut 3	.564	-.099	.336	.024	.234	.285	.356	
Cut 4	1.451	.816	1.162	.886	.971	1.154	.356	
Pseudo R ²	.053	.073	.076	.079	.049			.070
N	847	851	836	846	865	856		

Table 7. Ordered probit regressions explaining agreement with arguments.
Notes: Entries are coefficients and standard errors (SE).
Significance levels: *.05, and **.01.

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