

APPENDIX TO
“PATTERNS OF DEMOCRACY OVER SPACE AND TIME”

A The cube of democracy patterns for 1950 and 1990

Color coding by Regimes of the World Index, Lührmann, Tannenber, and Lindberg, 2018

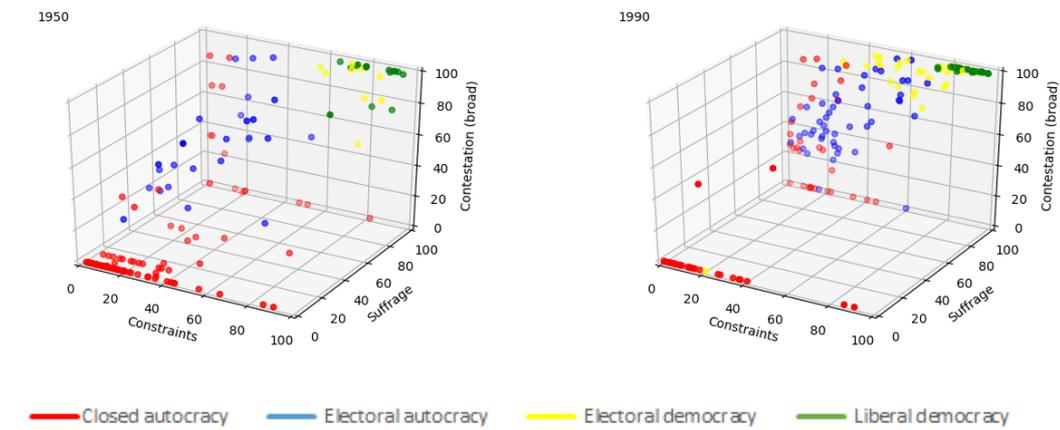


Figure 12: Narrow participation model

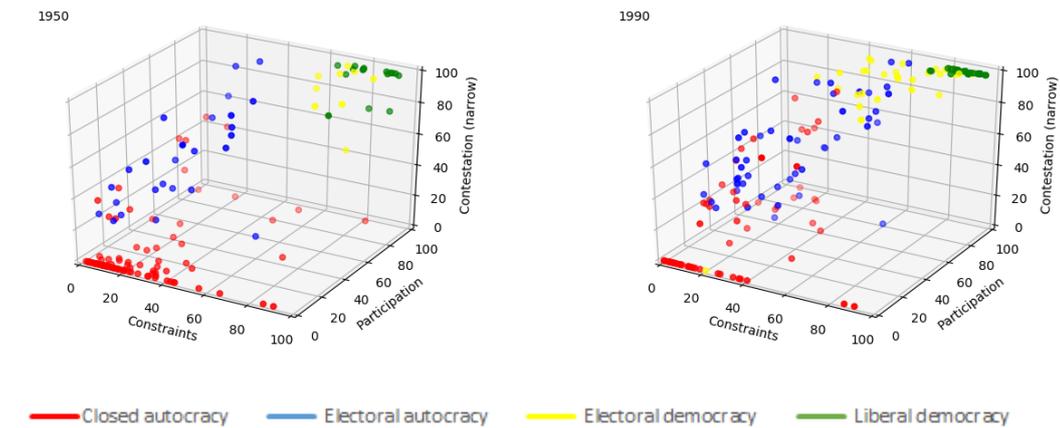


Figure 13: Broad participation model

B Results for the broad participation model

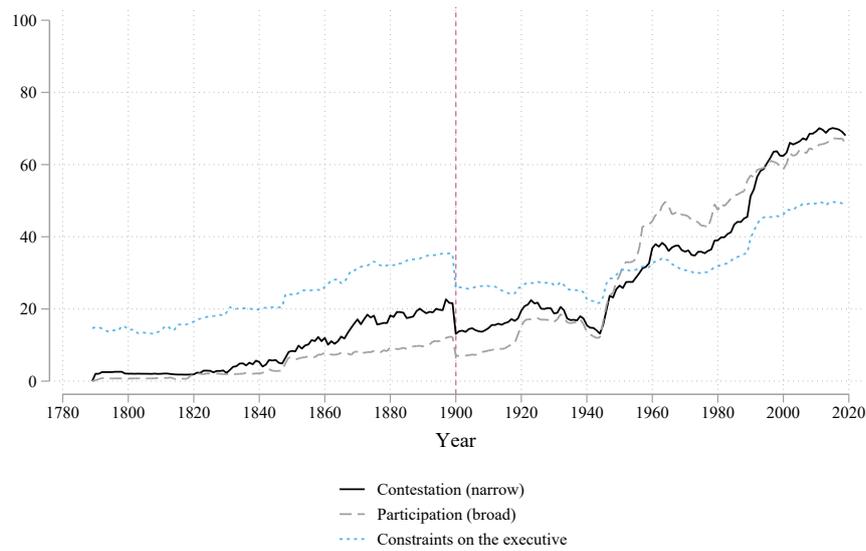


Figure 14: Global average participation (broad), contestation (candidates/parties), and constraints, 1789–2018. The vertical line marks the major expansion of the sample from year 1899 to year 1900, notably adding a number of African and Asian colonies.

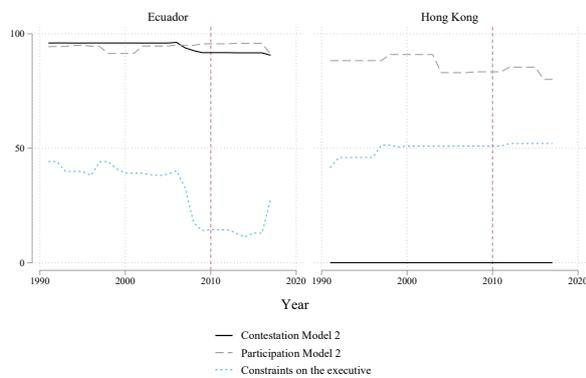


Figure 15: Broad participation model: contestation, participation and constraints for Ecuador and Hong Kong

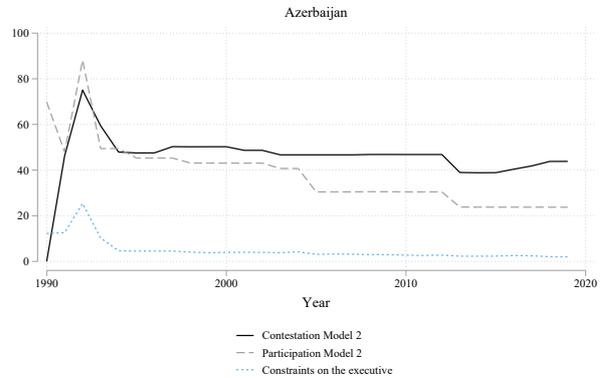


Figure 16: Broad participation model: contestation, participation and constraints for Azerbaijan

C Factor Analysis

The participation and contestation dimensions of the cube of democracy patterns were in part obtained using factor analysis. Below you find detailed information on each of these analyses.

Each of the indicators included in the factor analysis was re-scaled between 0-1 using a cdf-transformation and repeated over election periods (as detailed in Section 2.3). The predicted dimensions from the factor analysis are again re-scaled between 0-1 using a cdf-transformation.

Table 6 displays the three latent variables (printed in bold letters) we coded using factor analysis: a joint voter & candidate contestation variables for the contestation dimension of the narrow participation model as well as voter contestation and a candidate contestation variable for the broad participation model. In the broad participation model any indicators affecting contestation on the voter’s level is included in the participation dimension. Therefore, voter contestation is included in the participation dimension of said model. Table 6 also displays the low-level indicators used to derive the latent variables. In the following we provide the factor analysis results for each of the three latent variables.

model	dimension	components	origin
narrow participation	participation	suffrage	v2x_suffr
	contestation	voter & candidate contestation	factor analysis of <i>v2elembaut, v2elembcap, v2elintim, v2elrgstry, v2elvotbuy, v2elirreg</i>
broad participation	participation	Elected Officials Index	v2x_elecoff
		suffrage	v2x_suffr
		voter contestation	factor analysis of <i>v2elrgstry, v2elvotbuy, v2elirreg</i>
	contestation	candidate contestation	factor analysis of <i>v2elembaut, v2elembcap, v2elintim</i>
		Elected Officials Index	v2x_elecoff

Table 6: Overview of latent variables (in bold), their corresponding input and the dimensions as well as models they are used in

Tables 7 to 12 display the factor analysis results as well as the factor loadings and unique variances for each of the three latent contestation measures.

Voter & candidate contestation

Factor	Eigenvalue	Proportion	Cumulative
1	4.84	0.99	0.99
2	0.16	0.03	1.02
3	0.09	0.02	1.04
4	-0.04	-0.01	1.03
5	-0.07	-0.01	1.02
6	-0.08	-0.02	1.00

Table 7: Factor analysis results for voter & candidate contestation

Kaiser-Meyer-Olkin measure (overall)= 0.89

Voter contestation

Factor	Eigenvalue	Proportion	Cumulative
1	2.39	1.06	1.06
2	-0.04	-0.02	1.04
3	-0.09	-0.04	1.00

Table 9: Factor analysis results for voter contestation

Kaiser-Meyer-Olkin measure (overall)= 0.74

Candidate contestation

Factor	Eigenvalue	Proportion	Cumulative
1	2.40	1.06	1.06
2	-0.04	-0.02	1.04
3	-0.09	-0.04	1.00

Table 11: Factor analysis results for candidate contestation

Kaiser-Meyer-Olkin measure (overall)= 0.75

Variable	Factor 1	Uniqueness
v2elembaut	0.90	0.19
v2elembcap	0.91	0.17
v2elintim	0.89	0.21
v2elrgstry	0.91	0.17
v2elvotbuy	0.85	0.28
v2elirreg	0.93	0.14

Table 8: Factor loadings and unique variances, voter & candidate contestation

Variable	Factor 1	Uniqueness
v2elrgstry	0.86	0.27
v2elvotbuy	0.88	0.22
v2elirreg	0.93	0.13

Table 10: Factor loadings and unique variances, voter contestation

Variable	Factor 1	Uniqueness
v2elembaut	0.93	0.13
v2elembcap	0.87	0.24
v2elintim	0.88	0.23

Table 12: Factor loadings and unique variances, candidate contestation

D Components of the dimensions

NARROW PARTICIPATION MODEL			BROAD PARTICIPATION MODEL:		
constraints	participation	contestation	constraints	participation	contestation
- v2x_jucon	- v2x_suffr	- v2elembaut	- v2x_jucon	- v2x_suffr	- v2elembaut
- v2xlg_legcon		- v2elembcap	- v2xlg_legcon	- v2elrgstry	- v2elembcap
		- v2elintim		- v2elvotbuy	- v2elintim
		- v2x_elecoff		- v2elirreg.	- v2x_elecoff
		- v2elrgstry			
		- v2elvotbuy			
		- v2elirreg.			

Table 13: Overview of V-Dem Indicators that contributed to the dimensions in both models

E Number of countries in sample over time

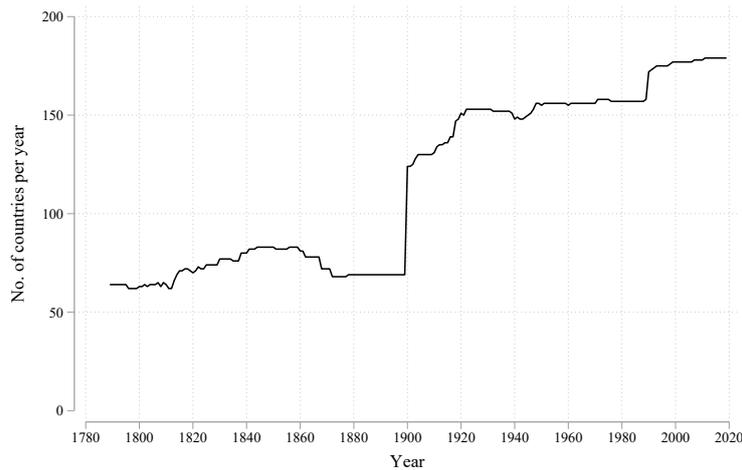


Figure 17: Number of countries in our sample over time

The sample of countries used in this paper and its analyses is highly unbalanced. Figure 17 displays the number of countries in the sample over time. Figure 18 displays the coding start and end-years for each country unit (distinguished by CoW country codes). Both figures show that at 1900 and 1990 our sample amplifies significantly in scope.

This raises concerns in terms of comparability of average results over time (see section 3.2). To ensure that our finding from sections 3.2 and 4.3 are in fact not driven by expansions of the sample we replicated their respective analysis for a limited sample of 72 countries. Each of these 72 countries was chosen because it is in our sample for at least 140 years (Figure 19 displays the number of years in the sample for each country). The average time series for this sample includes 186 years. We chose 140 to achieve the longest possible time span for a group of countries from all World regions.

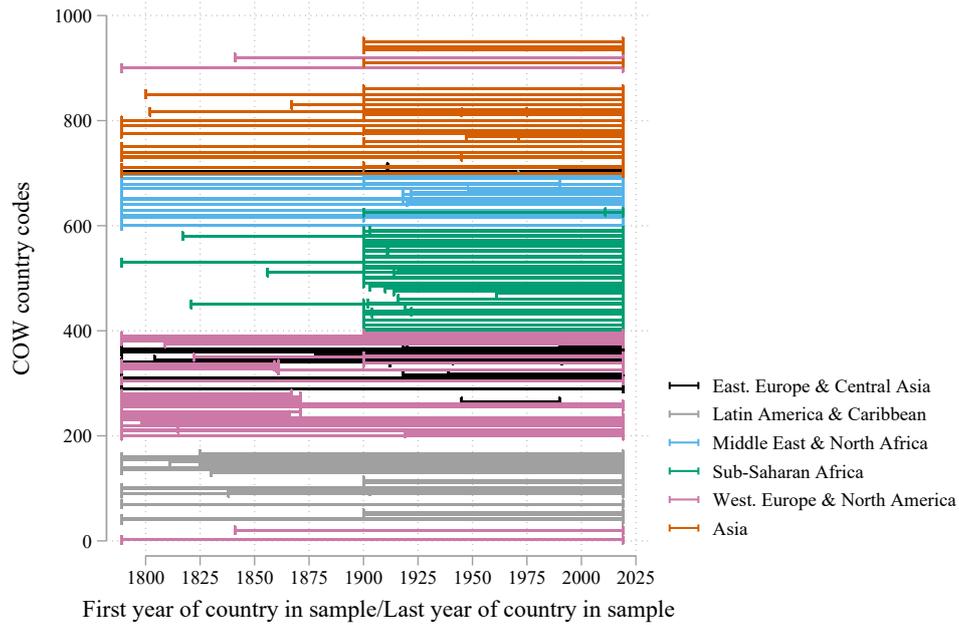


Figure 18: Start to End year of V-Dem coding for each country unit in the sample. Country units are distinguished by COW country code.

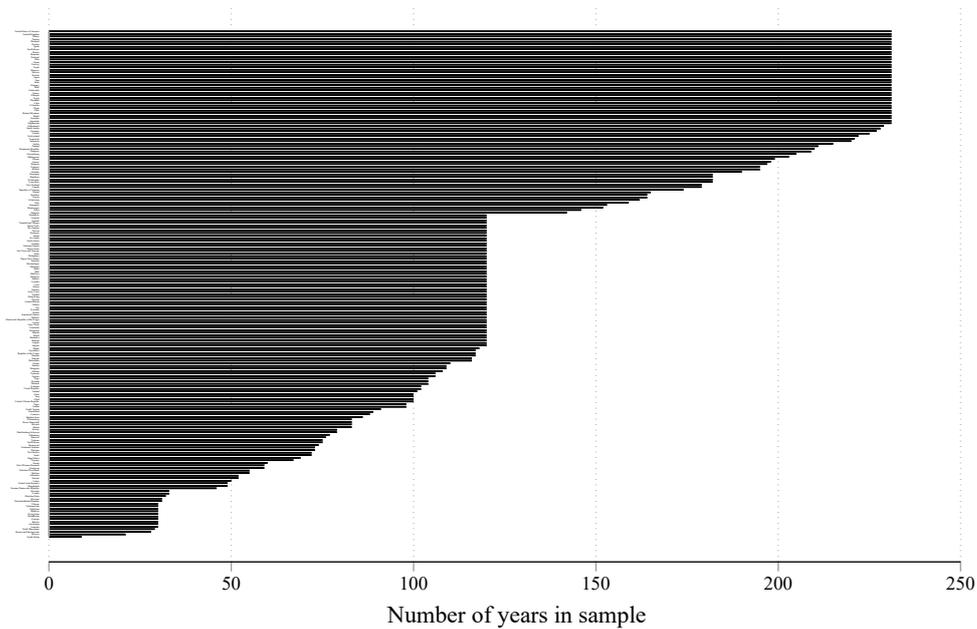


Figure 19: Number of years in sample by country

For this limited sample, Figure 20 replicates Figure 4. The drop in averages in Figure 4 due to the expansion of the sample in 1900 is no longer visible. Table 14 replicate Table 4 for the restricted sample. The results are very similar and suggest that the results presented in the main manuscript are not due to variations in sample composition over time. Due to the long time series for each

Variable	Overall				Between	Within	
	Mean	Std.Dev.	Min	Max	Std.Dev.	Std.Dev.	
EDI	29.47	27.85	0.80	92.40	17.80	21.61	
LDI	24.06	25.16	0.70	89.10	17.15	18.52	
Narrow Part. Model:	Constraints	35.53	31.23	0.88	96.65	23.97	19.56
	Contestation 1	34.02	40.18	0.00	98.11	23.42	32.93
Broad Part. Model:	Participation 1	41.49	43.97	0.00	100.00	18.53	40.37
	Contestation 2	34.62	40.60	0.00	97.56	23.55	33.27
	Participation 2	30.74	37.49	0.00	98.17	18.76	32.75

Table 14: Summary statistics for a restricted sample of 72 countries. The Table reports statistics for the dimensions of the cube of democracy patterns, as well as V-Dem’s Electoral Democracy Index (EDI) and Liberal Democracy Index (LDI). Between and Within Std. Dev. refers to the variation between and within panels.

country in this restricted sample, none of these countries display a time series average of full suffrage (participation model 2= 100).

Replications of additional Figures or Tables are available upon request.

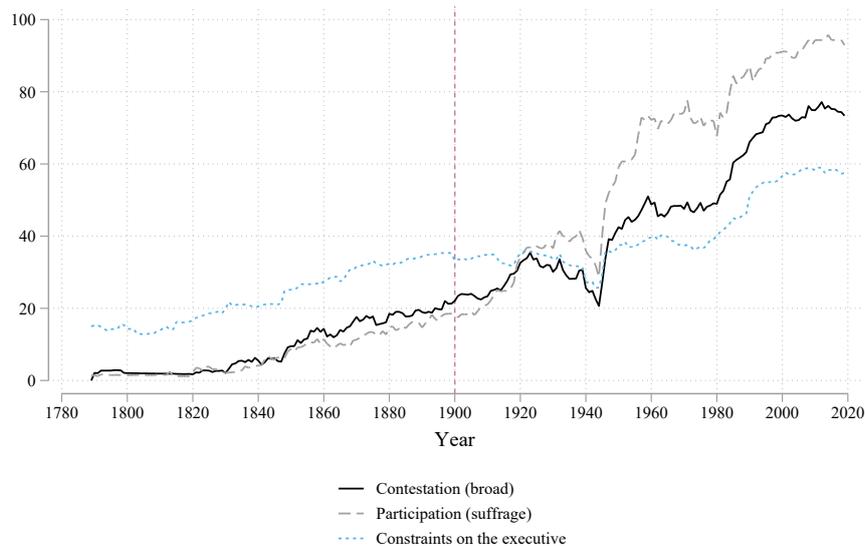


Figure 20: Global averages for a restricted sample of 72 countries. Narrow participation model.

F Date-to-year aggregation

V-Dem, similar to many other data sets on democratic regimes, serves many purposes. A number of compromises and middle-ground solutions seek to produce data that maximizes validity. One such compromise is the temporal aggregation procedure. According to V-Dem, “C-variables, ratio/percentage variables, and High-Level/Mid-Level Democracy indices are aggregated from the countrydate level to the countryyear level by the day-weighted mean. Ordinal Avariables and A*-variables

are aggregated by taking the last observation in the year with one exception: event-specific dichotomies or event-specific ordinal variables, which mostly concerns elections or election related data, are aggregated by max (meaning the highest observed value for a given year is retained) to reflect that an ‘event’ of the coded type occurred within the year” (p. 37, Coppedge et al., 2020a).

For our specific purpose, this procedure is not optimal. We are interested in the variation among institutional arrangements, but only those that actually exists at a given moment. Consider a July coup d’etat in an orderly, democratic society. At some specific date, a number of V-Dem variables will shift abruptly, but given the aggregation rules, the annualized representation of that year will be a mix of the values from 31 December, the weighted average of a year and the max values for that year. The end of year values will reflect the autocratic nature of a coup regime, the maximum values will reflect the democracy that was, and the average values will reflect an anocracy that never was. The combination of these values do not reflect a regime that existed at any given point in time. It an institutional crochphant.

To obtain a comparable list of regimes, we started out from the Country-Date version of V-Dem. This version dates specific changes and provides accumulated changes as an aggregate value on 31 December. Each update only relates to the specific variables that are relevant to the event in question, and missing is hence understood as the continuation of previous values. At times, the participation and competition variables that we rely on are not updated. We have replaced these to an appropriate value using the following coding rule:

- We standardize all variables on a [0,1] scale using the cumulative normal distribution, after which 0 will be the minimum value.
- We recode *v2xlg-legcon* to 0 whenever *v2xlg-legcon* is missing and *v2lgbicam* is 0. If there is no legislative chamber, there can’t be any legislative oversight.
- We recode the relevant participation and competition variables to 0 when *v2x_elecereg* is 0. If the current executive is not elected, then all these variables should be set to the minimum value.
- We copy forward the most current values to replace missing values.
- We keep only observations for 31 December. Hence, some very short-lived regimes will escape our attention, but the lack of a standardized code book for the dating of significant events means that a large number of these short regimes are coding artefacts rather than real existing institutional arrangements ³¹.

The code and the final dataset can be found in the replication material.

G Missing values in election specific indicators

Several V-Dem indicators, such as election vote buying and election monitoring board autonomy, are election-specific. These are coded by country-experts only in years when there are elections. In order to include such election-specific in the construction of our democracy dimensions, we thus follow V-Dem’s practice, as described by Teorell et al. (2019), and “interpolate between elections until there is

³¹An example can be whether the date for a democratic transition should be the day when an election was announced, the first round election date, the second round election date or the inauguration of the electoral winner.

Cube-piece	Observations in each piece for			
	Narrow Participation Model		Broad Participation Model	
	Number	%	Number	%
Dicatorship	12,684	47.34	14,251	53.19
Only Participation	2,756	10.29	968	3.61
Only Contestation	137	0.51	196	0.73
Contestation and Participation	1,668	6.23	498	1.86
Only Constraints	534	1.99	595	2.22
Constraints and Participation	139	0.52	74	0.28
Constraints and Contestation	231	0.86	544	2.03
Mid-point	4,249	15.86	5,939	22.16
Democracy	4,397	16.41	3,730	13.92

Table 15: Location of observations within the cube, divided into nine pieces (8 corners and 1 center-piece), CDF transformation. Same as Table 5.

an electoral interruption, defined as either (i) the dissolution, shutdown, replacement, or in any sense termination of the elected body (such as after coups or violent takeovers of the government) or (ii) an elected body which, while still intact or in place, is no longer appointed through (direct) elections (as after an autogolpe)” (p. 80). Whenever there is an electoral interruption, or, more generally, elections are not on course (including in non-electoral regimes such as current Saudi Arabia), the election-specific indicators are given the minimum value (0 for normalized variables) .

H Normal CDF versus minmax standardization

Our choice of the normal CDF as the basis of our score normalization is important. As argued in the paper, we firmly believe that the CDF approach is better than the alternatives, of which the most common is a min-max standardization. This approach consists of subtracting the minimum value from all observations and then dividing this figure with the difference between max and min in the sample.

In our sample, the output from both the V-Dem measurement model and our factor analysis can be at times quite large numbers, well within the definition of outliers. The rank- based CDF standardization is robust against outliers, but the minmax approach is not. In the presence of outliers, values on our measures will be artificially clustered towards the middle of the scale. If we reproduce Table 5 with the minmax standardization, we should see a lot more observations in the middle. If outliers are more likely in either end of the scale, we should also see more autocracies or more democracies as well. The other corners should be found correspondingly less often.

Comparing Table 15 and Table 16 shows that the middle category increases dramatically, as does the autocracy category. At the same time, many of the corners become almost empty. The contestation dimension in particular seems to be much less relevant.

Azerbaijan is a good illustration of the effect within the narrow participation model. Suffrage is universal and hence at the maximum value, which will be handled equally well in both models. Constraints on the executive is simply the average of two indicators and is not subject to a standardization. How-

Cube-piece	Observations in each piece for			
	Narrow Participation Model		Broad Participation Model	
	Number	%	Number	%
Autocracy	14,279	52.86	16,335	60.47
Participation Only	3,254	12.05	571	2.11
Contestation only	8	0.03	1	0
Participation & Contestation	791	2.93	5	0.02
Constraints Only	708	2.62	800	2.96
Participation and Constraints	178	0.66	16	0.06
Contestation and Constraints	89	0.33	329	1.22
Mid-point	4,031	14.92	6,508	24.09
Democracy	3,675	13.6	2,448	9.06

Table 16: Location of observations within the cube, divided into nine pieces (8 corners and 1 center-piece), minmax transformation

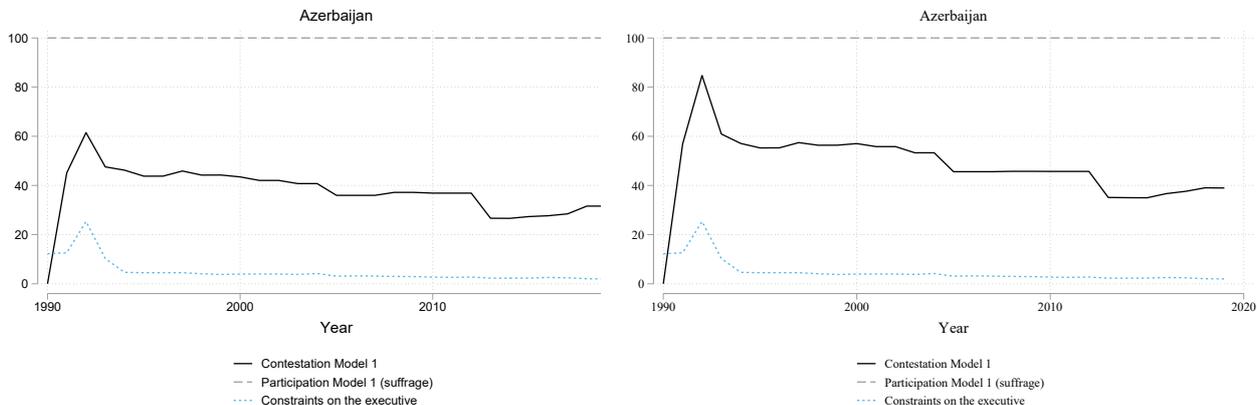


Figure 21: Narrow participation model: minmax transformation

Figure 22: Narrow participation model: CDF transformation

ever, contestation differs very much. The shape of the graph is more or less the same, but contestation drops from a value of 80 to around 60 in the early 90s. Looking at the time trend, the minmax standardization flattens out the decline in Azerbaijani democracy compared to the CDF standardization. With regard to the cube, Azerbaijan is briefly in the “Contestation and Participation” corner in the CDF series, before moving into the middle category with high suffrage, low constraints and medium score on contestation. On the left hand, there is no variation.

All of the indicators that constitute our two contestation measures are outputs from the V-Dem Measurement model, and all of them have a unimodal distributions with significant tails. These tails are not unexpected from the empirical bayes factor analysis employed here, and V-Dem use a normal CDF to counter these extreme values. We follow V-Dem in this decision.