Supplemental Material

for

Mede, N. G., & Schäfer, M. S. (2021). Science-related populism declining during the COVID-19

pandemic: A panel survey of the Swiss population before and after the coronavirus outbreak.

Public Understanding of Science.

Contents

Introduction

In this document, we provide tables and figures supplementing the analyses presented in our research note "Science-related populism declining during the COVID-19 pandemic: A panel survey of the Swiss population before and after the Coronavirus outbreak", published in *Public Understanding of Science*.

Data and Code for Reproducing the Analyses

All analyses were conducted in R (version 4.0.3). They can be reproduced with the materials we share at https://osf.io/3hgpe/ (R syntax, survey data, additional data, original questionnaires in German, French, and Italian).

Comparison of Panel Sample, Cross-Sectional Samples, and Swiss Census Data

To get a better understanding of the characteristics of the panel sample, we did three tests: First, we compared the panel sample with the remainder of the 2019 cross-sectional sample (i.e., those 883 respondents not contained in the panel). We found that distributions of age ($t = 0.98$, $df = 225$, $p = .330$) and gender ($t = -1.05$, $df = 209$, $p = .296$) were similar, but panelists were significantly more likely to hold a university degree ($t = 3.30$, $df = 210$, $p < .01$) and reside in the German-speaking region of Switzerland ($t = 2.64$, $df = 219$, $p < .01$) than respondents from the 2019 cross-sectional sample.

Second, we compared the panel data with data from another cross-sectional *Wissenschaftsbarometer Schweiz* survey, which paralleled the second wave of the panel survey: It was also fielded in November 2020 in the three linguistic regions of Switzerland, was conducted by the same polling company, and also used an online questionnaire ($N = 1072$). This test mirrored the results of the first, and it indicated that the our panel sample contained significantly more people working as scientists ($t = 2.18$, $df = 179$, $p < .05$).

Third, we compared the panel data with Swiss census data, which indicated that the panel sample did not differ significantly from the Swiss population in terms of age ($t = 1.92$, $df = 1189$, $p = .055$) and gender ($t = -0.35$, $df = 1189$, $p = .727$), nor contained it more or less respondents living in the German-speaking region of Switzerland ($t = -0.05$, $df = 1189$, $p = .958$). In line with the first two tests, however, we found that the panel comprised more people with a university degree than the general population of Switzerland ($t = 5.90$, $df = 1186$, $p < .001$).

Overall, these comparisons suggest that the panel sample closely resembled other Swiss survey samples as well as the Swiss population in terms of age, gender, and place of residence. However, panelists had higher education and proximity to science. Descriptive statistics of the panel data and the three reference data sets are shown in Supplemental Table S1.

Supplemental Tables

Supplemental Table S1

Comparison of the panel data with reference data sets

Data	N	Age		Gender (%)	Education (%)			Residence place (%)			Proximity to science (%)
		M	SD	Female	Compulsory school	Secondary education	University degree	German-speaking part	French-speaking part	Italian-speaking part	Scientists
Panel sample (2019)	154	49.4	15.8	50.0	3.2	39.6	57.1	70.8	15.6	13.6	14.4
Cross-sectional *Wissenschaftsbarmeter Schweiz* survey (2019, w/o panelists)	883	48.0	17.6	54.6	6.8	50.3	42.8	60.1	24.2	15.6	10.2
Cross-sectional *Wissenschaftsbarmeter Schweiz* survey (2020)	1072	50.3	17.8	50.5	5.1	48.9	45.9	63.3	25.9	10.7	7.9
Swiss census (2019)	-	46.3	18.5	51.7	23.9	45.6	30.4	71.0	24.5	4.5	-

Supplemental Table S2

Overview of variables used in the analyses

Variable	Type	Question/Item	Range/Levels
Time of data collection	Single item (binary)	[Meta data]	0 = June/July 2019; 1 = November 2020
Science-related populist attitudes (SciPop Scale)[a]	composite score (continuous)	[Goertzian SciPop Score, see items below]	1.00 – 5.00, higher values indicate stronger endorsement of science-related populist attitudes
Conceptions of the ordinary people (PPL subscale)	mean score (continuous)	What unites the ordinary people is that they trust their common sense in everyday life.	1 = do not agree at all, 5 = agree completely
		Ordinary people are of good and honest character.	1 = do not agree at all, 5 = agree completely
Conceptions of the academic elite (ELI subscale)	mean score (continuous)	Scientists are only after their own advantage.	1 = do not agree at all, 5 = agree completely
		Scientists are in cahoots with politics and business.	1 = do not agree at all, 5 = agree completely
Demands for decision-making sovereignty (DEC subscale)	mean score (continuous)	The people should have influence on the work of scientists.	1 = do not agree at all, 5 = agree completely
		People like me should be involved in decisions about the topics scientists research.	1 = do not agree at all, 5 = agree completely
Demands for truth-speaking sovereignty (TRU subscale)	mean score (continuous)	In case of doubt, one should rather trust the life experience of ordinary people than the estimations of scientists.	1 = do not agree at all, 5 = agree completely
		We should rely more on common sense and less on scientific studies.	1 = do not agree at all, 5 = agree completely
Age	single item (continuous)	In which year were you born?	[Age in years]
Gender	single item (binary)	[Determined by interviewer]	0 = male, 1 = female
Swiss linguistic region	Single item (dummy-coded)	[Inferred from postal codes]	1 = German-speaking, 2 = French-speaking, 3 = Italian-speaking
Urbanity of residence place	Single item (continuous)[b]	[Inferred from postal codes]	6.19 – 12.92, higher values indicate higher urbanity
Proximity to science	composite score (categorical)[c]	[see items below]	0 – 4, higher values indicate higher proximity

		Are you a scientist yourself?	0 = no, 1 = yes
		Do you know a scientist personally?	0 = no, 1 = yes
		Are you professionally involved with science?	0 = no, 1 = yes
		Do you have family members who have studied or are studying?	0 = no, 1 = yes
Education	Single item (dummy-coded)	What is your educational background?	1 = compulsory school, 2 = secondary education, 3 = university degree
Political orientation	Single item (continuous)	How would you classify your own political orientation?	1 = very left, 7 = very right
Religiosity	Single item (continuous)	How religious would you consider yourself?	1 = not at all religious, 5 = very religious
Interest in science	Single item (continuous)	How interested are you in science and research?	1 = not interested at all, 5 = very strongly interested
Trust in science	Single item (continuous)	How high is your trust in science in general?	1 = very low, 5 = very high
Trust in scientists	Single item (continuous)	How high is your trust university scientists?	1 = very low, 5 = very high
Being affected by COVID-19	composite score (categorical)[d]	[see items below]	0 – 2, higher values indicate being more affected
		Do you have conditions that could make infection with the novel coronavirus dangerous for you?	0 = no, 1 = yes
		Have you been tested for the novel coronavirus?	0 = no, 1 = yes

Note. Original items were in German, French, and Italian, but we translated them into English for this article.

[a] Using the original R code from Mede et al. (2021), we find that the SciPop Scale performs very well in our sample: Multi-group confirmatory factor analysis with the 8 items (specified as indicators loading on 4 latent factors) and time of data collection defined as grouping factor suggested that the scale reliably captures support for science-related populism among our panel respondents ($Chi^2 = 36.038$, $df = 36$, $p = 0.467$; RMSEA = 0.003; SRMR = 0.046; CFI > 0.999; TLI > 0.999; all factor loadings $p < .001$).

[b] Inferred from log-transformed inhabitant counts of respondents' residence municipalities, which were obtained by merging their postal codes with Swiss census data. Log-transformation was advisable as inhabitant counts were approximately log-normally distributed in the survey data. This pattern corresponds with previous analyses of Swiss census data showing that inhabitant counts of Swiss municipalities follow Zipf's Law (Decker et al., 2007).

[c] Respondents working as scientists were assigned a 4. Respondents were assigned a 3 if they answered "yes" to all three remaining questions; a 2 if they answered "yes" to two questions; a 1 if they answered "yes" to one of these questions; a 0 if they answered "yes" to none of these questions. The resulting score thus ranged from 0 (least proximity to science) to 4 (highest proximity to science).

[d] Responses to the two questions were summed, i.e. respondents were assigned a 2 if they answered "yes" to both; a 1 if they answered "yes" to one; a 0 if they answered "no" to both.

Supplemental Table S3

Overview of SciPop Scores used in the main analyses and robustness tests

Score	Purpose	Computation	Type (range/levels)	Reference
Goertz	Main analysis	Smallest mean value of the four subscales	Continuous (1.00 – 5.00)	e.g., Stier et al. (2020)
Bollen A (mean)	Robustness test	Mean value of all eight items	Continuous (1.00 – 5.00)	e.g., Rico and Anduiza (2019)
Bollen B (CFA score)	Robustness test	Factor score extracted from polychoric confirmatory factor analysis (CFA) with all 8 items permitted to load on one latent factor	Continuous (-1.07 – 1.35)	e.g., van Hauwaert et al. (2019)
Sartori A (75% percentile)	Robustness test	Classify as populist if all subscale means equal or exceed 75% percentile thresholds	Binary (0 = not populist, 1 = populist)	e.g., Wuttke et al. (2020)
Sartori B (agree 6+ items)	Robustness test	Classify as populist if agreeing with at least 6 SciPop Scale items	Binary (0 = not populist, 1 = populist)	e.g., Vehrkamp and Merkel (2020)

Supplemental Table S4

Repeated-measures ANOVA (2019 vs 2020) with time-varying covariates[a]

Dependent variable	df	F	p	η^2
Science-related populist attitudes				
Goertz score	1, 122	6.79	.010 **	0.046
Bollen score A: mean	1, 126	11.05	.001 **	0.068
Bollen score B: CFA scores	1, 108	8.90	.004 **	0.064
Sartori score A: 75% percentile	1, 126	2.93	.090	0.020
Sartori score B: agree 6+ items	1, 108	0.16	.691	0.001
Conceptions of the ordinary people	1, 124	4.98	.027 *	0.032
Conceptions of the academic elite	1, 124	8.50	.004 **	0.055
Demands for decision-making sovereignty	1, 126	1.39	.241	0.010
Demands for truth-speaking sovereignty	1, 126	9.32	.003 **	0.058

Note: ***$p < .001$, **$p < .01$, *$p < .05$.

[a] Covariates: Age, gender (1 = female), linguistic region (1 = German-speaking), linguistic region (1 = Italian-speaking), urbanity (log-transformed), education (1 = university degree), education (1 = compulsory school), proximity to science, political orientation (7 = right), religiosity, interest in science, trust in science, trust in scientists, affected by COVID-19.

Supplemental Table S5

Means and standard deviations of science-related populist attitudes and its dimensions, and results of paired-sample t-tests of mean differences between 2019 and 2020

	M_{2019} (*SD*)	M_{2020} (*SD*)	*M* diff.	*t*	*df*	Confidence interval		*p*
						2.5%	97.5%	
Science-related populist attitudes								
Goertz score	2.03 (0.71)	1.79 (0.67)	0.22	3.51	142	0.09	0.34	< .001 ***
Bollen score A: means	2.79 (0.64)	2.57 (0.63)	0.22	4.41	152	0.12	0.32	< .001 ***
Bollen score B: CFA scores	0.07 (0.41)	-0.08 (0.41)	0.13	3.83	125	0.06	0.19	< .001 ***
Sartori score A: 75% percentile	0.10 (0.30)	0.04 (0.19)	0.06	2.21	153	0.01	0.11	.029 *
Sartori score B: agree 6+ items	0.05 (0.22)	0.02 (0.15)	0.03	1.42	125	-0.01	0.08	.158

Note: ***$p < .001$, **$p < .01$, *$p < .05$.

Supplemental Table S6

Results of linear and logistic regressions with varying intercepts for respondents and within-subjects covariates to predict alternative SciPop Scores

	Science-related populist attitudes									
	Linear models						Logistic models[a]			
	Goertz score		Bollen score A: means		Bollen score B: CFA scores		Sartori score A: 75% percentile		Sartori score B: agree 6+ items	
Predictors	*b*	*p*	*b*	*p*	*b*	*p*	*log-odds*	*p*	*log-odds*	*p*
(Intercept)	3.04	< .001 ***	3.96	<. 001 ***	1.02	< .001 ***	-1.75	.576	0.18	.974
Year (2020)	-0.25	.003 **	-0.21	.002 **	-0.15	.001 **	-1.54	.031 *	-3.67	.025 *
Age	0.00	.388	0.00	.355	0.00	.232	0.04	.066	0.05	.176
Gender (female)	-0.04	.666	-0.02	.778	0.01	.819	0.71	.253	-0.92	.410
Linguistic region (ref. French-speaking)										
German-speaking	0.18	.165	0.05	.671	0.04	.634	0.63	.482	1.19	.449
Italian-speaking	0.07	.701	-0.14	.393	-0.09	.342	-0.79	.558	1.24	.511
Urbanity	-0.00	.892	-0.03	.336	-0.02	.227	0.03	.875	0.32	.373
Education (ref. secondary education)										
University degree	-0.01	.895	-0.05	.592	-0.03	.592	-0.53	.362	0.30	.751
Compulsory school	-0.23	.329	-0.27	.171	-0.14	.242	-23.89	.981	-25.06	.986
Proximity to science	-0.13	.001 **	-0.09	.010 *	-0.06	.007 **	-0.47	.107	-2.24	.003 **
Political orientation (right)	0.00	.885	0.04	.170	0.03	.085	0.35	.131	0.56	.189
Religiosity	-0.00	.929	0.02	.482	0.02	.324	-0.13	.582	0.20	.637
Interest in science	-0.03	.515	-0.01	.744	-0.01	.565	-0.18	.521	-0.98	.057
Trust in science	-0.08	.269	-0.06	.369	-0.08	.059	-0.39	.410	-0.14	.838
Trust in scientists	-0.15	.044 *	-0.21	.001 **	-0.15	< .001 ***	-0.41	.398	-1.63	.118
Affected by COVID-19	-0.10	.392	-0.15	.097	-0.05	.435	0.29	.755	3.09	.015 *
Random Effects										
σ^2	0.31		0.19		0.07		3.29		3.29	
τ_{00}	0.11 respondent		0.14 respondent		0.05 respondent		0.00 respondent		0.00 respondent	
ICC	0.25		0.43		0.39		0.00		0.00	
N	149 respondent		149 respondent		148 respondent		149 respondent		148 respondent	
Observations	272		276		257		276		257	
Marginal R^2	0.164		0.213		0.285		-		-	
Conditional R^2	0.376		0.550		0.566		-		-	

Note: ***p < .001, **p < .01, *p < .05. P-values estimated using Kenward-Roger's degrees of freedom approximation. Marginal/conditional R^2 calculated according to Nakagawa et al. (2017).

[a] Both logistic models resulted in singular fits, i.e. the estimated variance-covariance matrices had less than full rank. This is likely due to the large number of variance-covariance parameters that had to be estimated with rather few data. Importantly, standard inferential procedures applied to singular models are less reliable. Hence, p-values should be interpreted with caution (Bolker, 2020: 49–50).

Supplemental Table S7

Results of linear regressions predicting changes in alternative SciPop Scores (2019 vs. 2020) with 2019 values of covariates

Predictors (2019 values)	Goertz score		Bollen score A: means		Bollen score B: CFA scores		Sartori score A: 75% percentile		Sartori score B: agree 6+ items	
	b	*p*	*b*	*p*	*b*	*p*	*b*	*p*	*b*	*p*
(Intercept)	1.51	.035 *	1.73	.005 **	0.39	.312	0.11	0.593	0.18	0.310
Science-related populist attitudes										
Goertz score	-0.66	< .001 ***								
Bollen score A: means			-0.53	< .001 ***						
Bollen score B: CFA scores					-0.54	< .001 ***				
Sartori score A: 75% percentile							-0.94	< .001 ***		
Sartori score B: agree 6+ items									-0.89	< .001 ***
Age	0.00	.574	-0.00	.787	-0.00	.839	0.00	.170	-0.00	.117
Gender (female)	0.05	.688	-0.04	.659	-0.00	.963	0.02	.615	-0.04	.194
Linguistic region (ref. French-speaking)										
German-speaking	-0.12	.497	-0.07	.589	-0.11	.268	-0.02	.686	-0.07	.144
Italian-speaking	-0.14	.537	-0.17	.353	-0.19	.150	-0.08	.287	-0.04	.476
Urbanity	0.02	.651	-0.00	> .999	-0.00	.861	0.00	.761	0.01	.324
Education (ref. secondary education)										
University degree	0.19	.155	0.22	.051	0.10	.212	-0.00	.956	-0.02	.601
Compulsory school	0.89	.028 *	0.54	.065	0.20	.362	-0.01	.905	-0.11	.291
Proximity to science	-0.07	.211	-0.11	.014 *	-0.08	.008 **	-0.03	.146	-0.02	.243
Political orientation (right)	0.03	.469	0.04	.279	0.03	.205	0.01	.448	-0.00	.991
Religiosity	-0.02	.724	0.00	.982	-0.00	.969	-0.01	.738	0.02	.063
Interest in science	0.02	.705	0.10	.058	0.05	.173	0.01	.537	0.01	.656
Trust in science	-0.05	.589	-0.12	.146	-0.06	.297	-0.02	.447	-0.04	.158
Trust in scientists	-0.14	.171	-0.08	.342	-0.08	.210	-0.03	.332	-0.01	.810
Affected by COVID-19 (2020 value)	-0.03	.796	-0.02	.833	-0.01	.925	0.00	.944	0.10	.003 **
Observations	130		139		115		140		115	
R² Adjusted	0.327		0.284		0.239		0.626		0.664	

Note: ***$p < .001$, **$p < .01$, *$p < .05$.
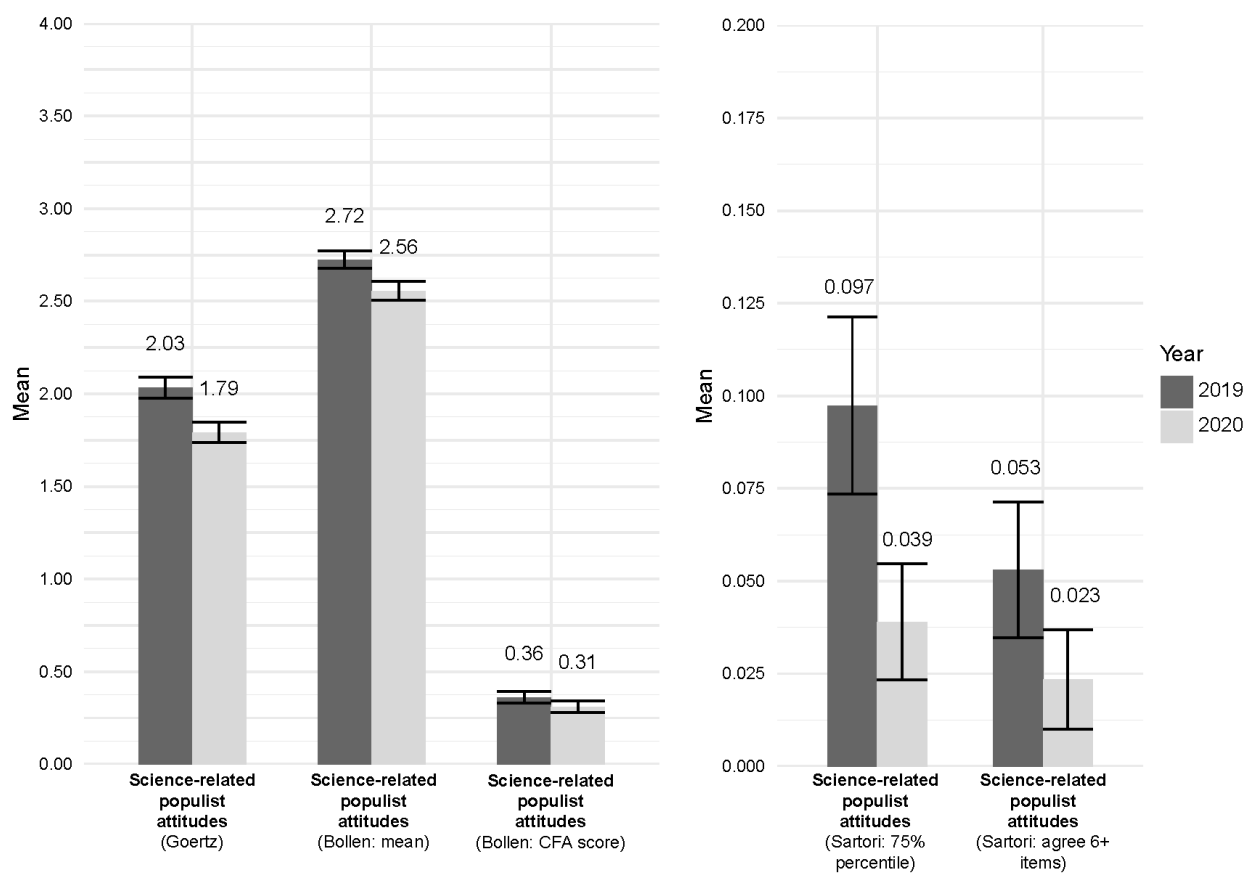
Supplemental Figures
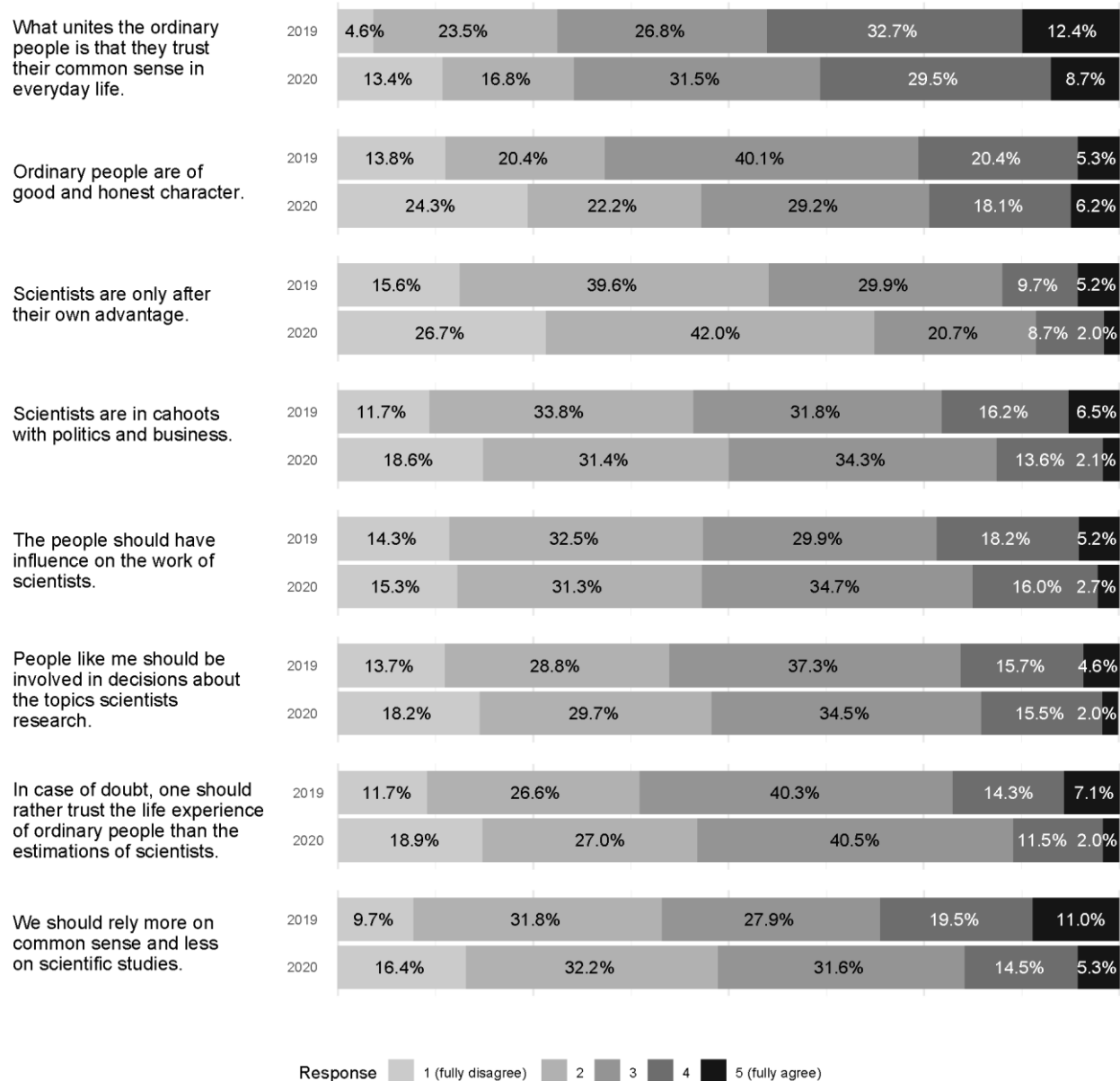
Supplemental Figure S1. *Relative response frequencies for SciPop Scale items in 2019 and 2020.*
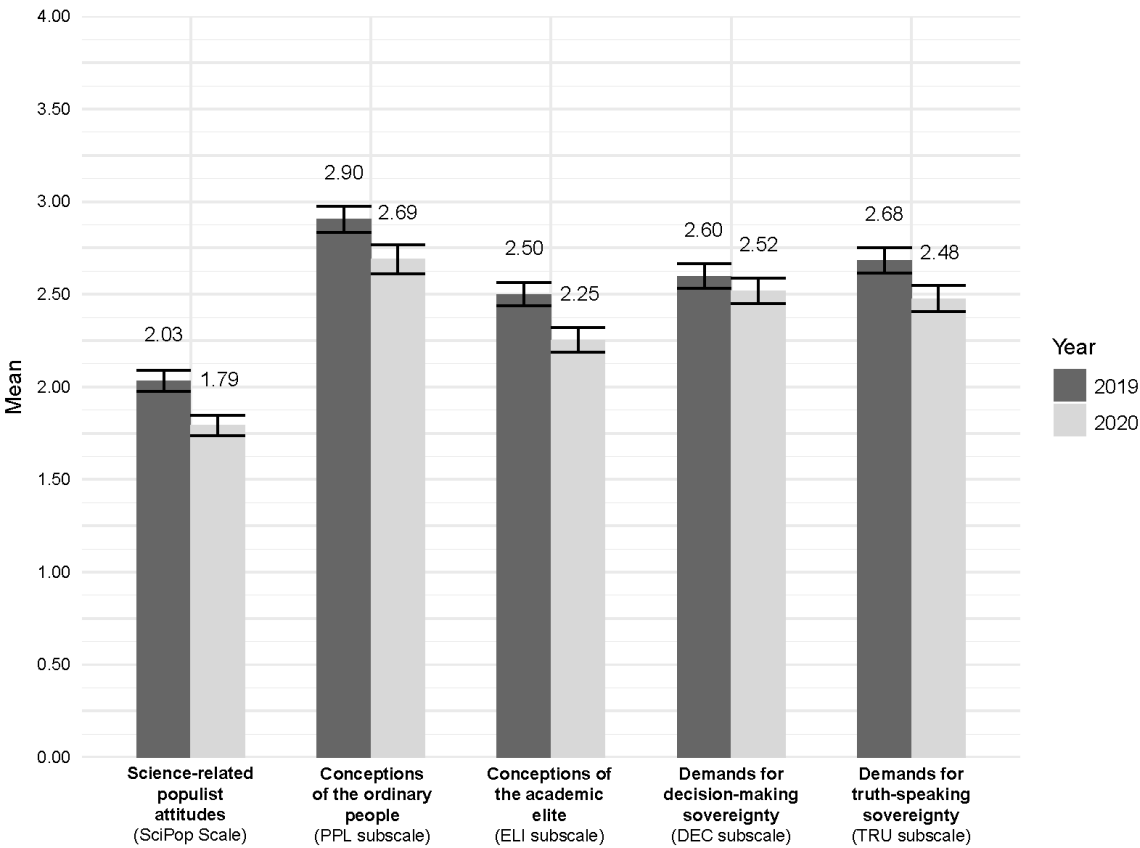
Supplemental Figure S2. *Mean Goertzian SciPop Score and subscale scores in 2019 and 2020.*

Note. Error bars represent standard errors.

Supplemental Figure S3. *Mean Goertzian SciPop Score and alternative SciPop Scores in 2019 and 2020.*

Note. Error bars represent standard errors.

References

Bolker B (2020) lme4: Linear Mixed-Effects Models using 'Eigen' and S4. R package version 1.1-26. Available at: https://cran.r-project.org/web/packages/lme4/ (accessed 14 October 2021).

Decker EH, Kerkhoff AJ and Moses ME (2007) Global patterns of city size distributions and their fundamental drivers. *PloS One* 2(9).

Mede NG, Schäfer MS and Füchslin T (2021) The SciPop Scale for measuring science-related populist attitudes in surveys: Development, test, and validation. *International Journal of Public Opinion Research* 33(2): 273–293.

Nakagawa S, Johnson PCD and Schielzeth H (2017) The coefficient of determination R2 and intra-class correlation coefficient from generalized linear mixed-effects models revisited and expanded. *Journal of the Royal Society, Interface* 14(134).

Rico G and Anduiza E (2019) Economic correlates of populist attitudes: an analysis of nine european countries in the aftermath of the great recession. *Acta Politica* 54(3): 371–397.

Stier S, Kirkizh N, Froio C, et al. (2020) Populist attitudes and selective exposure to online news: A cross-country analysis combining web tracking and surveys. *The International Journal of Press/Politics* 25(3): 426-446.

van Hauwaert SM, Schimpf C and Dandoy R (2019) Populist demand, economic development and regional identity across nine European countries: Exploring regional patterns of variance. *European Societies* 21(2): 303–325.

Vehrkamp R and Merkel W (2020) Populismusbarometer 2020: Populistische Einstellungen bei Wählern und Nichtwählern in Deutschland 2020 [Populism Barometer 2020: Populist Attitudes among Voters and Non-voters in Germany 2020]. Available at: doi.org/10.11586/2020044 (accessed 14 October 2021).

Wuttke A, Schimpf C and Schoen H (2020) When the whole is greater than the sum of its parts: On the conceptualization and measurement of populist attitudes and other multidimensional constructs. *American Political Science Review* 114(2): 356–374.