Online Supplementary Materials

Yuehong 'Cassandra' Tai, Yue Hu, and Frederick Solt, "Democracy, Public Support, and Measurement Uncertainty," American Political Science Review.

A Replication Notes

Because the Dataverse replication files for Claassen (2020a) and Claassen (2020b) included only the point estimates of their variables, replicating those articles' analyses while incorporating the quantified uncertainty in their latent variables was not possible using only those files. Instead, it required re-collecting all of the data employed in those articles directly from their original sources, that is, in the terminology of Grossman and Pedahzur (2021), it required a primary replication rather than a secondary one. We describe this process for the latent variables here.

Democratic Support

First, for each item used in the two articles' measure of democratic support, we identified the original variable names and corresponding values in each survey dataset. We then used the `dcpo_setup` and `format_claassen` functions of the `DCPOtools` R package (Solt, Hu, and Tai 2019) to automate the process of generating a dataset of survey marginals. We encountered a number of miscodings in the original data that we corrected. For example, the item "necesitamos un líder fuerte que no tenga que ser eligido" was coded as `strong_lapop_2`, although according to the AmericasBarometer codebooks, this question and that coded as `strong_lapop_1` employed the identical language:

> Hay gente que dice que necesitamos un líder fuerte que no tenga que ser elegido a través del voto. AUT1 Otros dicen que aunque las cosas no funcionen, la democracia electoral, o sea el voto popular, es siempre lo mejor. ¿Qué piensa usted? [Leer alternativas]

We therefore coded both as `strong_lapop_1`. Other examples include inconsistent coding regarding what constitutes a "democracy-supporting" response and the inconsistent application of the stated rule regarding "don't know" and other nonresponses. Here we use the corrected data for the replications with uncertainty to ensure that issues of data quality did not distort the results presented. These survey marginals were then used to generate estimates of democratic support in Stan using the `supdem.stan.mod5.stan` script from the Claassen (2020a) Dataverse materials. Draws from the posterior distribution quantify the uncertainty in the estimates. Finally, for the GMM models, the original publication presented the observation number based on the trimmed data, i.e., "2435", while the tabulating function in the replication file (line 86) uses the full used-observation number, "4735." We follow the replication file in the tables of Appendix @ref(tables_not_plots) below.

Democracy

The democracy variables in the two articles are drawn from Version 8 of the V-Dem Dataset (Coppedge et al. 2018). This version of the dataset includes draws from the posterior distribution of the estimates to quantify their uncertainty. In our extension (the rightmost replication of each model in our Figures 1 and 2), we are able to extend the time series beyond the last year of Version 8, 2017, so we use the updated Version 10 instead. Version 10, however, does not include posterior draws of the estimates, but rather standard errors. For the purposes of incorporating this uncertainty into our analyses, we assumed these errors were normally distributed around the point estimates.

Corruption

The corruption variable used in Claassen (2020b) is the Corruption Perceptions Index, which provides point estimates and standard errors for the years from 2012 to 2018. For country-years beyond that range, we conservatively estimated standard errors by first identifying the country's maximum relative standard error (standard error/point estimate) during 2012-2018 and then multiplying this quantity by the country-year's point estimate. For the purposes

of incorporating this uncertainty into our analyses, we again assumed a normal distribution around the point estimates.

B Numeric Results for Figures 1 and 2

Table A.1: The Effect of Public Support on Democracy (Original Results)

	Pooled	Pooled-Regime	GMM	GMM-Regime
(Intercept)	0.647	0.765		
	(0.947)	(0.998)		
Democracy (t-1)	1.141	1.142	1.091	1.095
	(0.080)	(0.080)	(0.079)	(0.083)
Democracy (t-2)	−0.163	−0.164	−0.203	−0.200
	(0.080)	(0.079)	(0.051)	(0.050)
Support (t-1)	0.267		0.881	
	(0.094)		(0.366)	
Support in Democracy		0.318		0.810
		(0.108)		(0.344)
Support in Autocracy		0.090		0.917
		(0.210)		(0.672)
Log GDP Per Capita (t-1)	0.015	−0.001	0.388	0.366
	(0.123)	(0.130)	(0.174)	(0.186)
GDP Per Capita Growth (t-1)	0.007	0.007	−0.016	−0.014
	(0.017)	(0.017)	(0.020)	(0.021)
Regional Democracy (t-1)	0.008	0.008	0.055	0.051
	(0.005)	(0.004)	(0.028)	(0.030)
Percent Muslim (t-1)	−0.002	−0.002	−0.014	−0.013
	(0.003)	(0.003)	(0.009)	(0.009)
Resource Dependence (t-1)	−0.367	−0.373	−1.196	−1.128
	(0.244)	(0.242)	(0.683)	(0.694)
N observations	2435	2435	4735	4735
N countries	135	135	135	135
N instruments			122	124

Table A.2: The Effect of Public Support on Democracy (With Uncertainty)

	Pooled	Pooled-Regime	GMM	GMM-Regime
Democracy (t-1)	0.806	0.804	0.778	0.779
	(0.067)	(0.066)	(0.044)	(0.045)
Democracy (t-2)	0.143	0.145	0.127	0.126
	(0.066)	(0.065)	(0.041)	(0.043)
Support (t-1)	1.468		2.799	
	(0.821)		(1.817)	
Support in Democracy		1.739		3.083
		(0.887)		(1.890)
Support in Autocracy		0.722		1.915
		(1.434)		(2.586)
Log GDP Per Capita (t-1)	0.643	0.584	0.225	0.218
	(0.516)	(0.542)	(0.163)	(0.177)
GDP Per Capita Growth (t-1)	0.031	0.032	−0.008	−0.002
	(0.080)	(0.081)	(0.084)	(0.092)
Regional Democracy (t-1)	0.018	0.018	0.050	0.050
	(0.009)	(0.009)	(0.036)	(0.038)
Percent Muslim (t-1)	−0.018	−0.019	−0.033	−0.035
	(0.014)	(0.015)	(0.027)	(0.030)
Resource Dependence (t-1)	−3.381	−3.389	−4.004	−4.104
	(1.357)	(1.344)	(2.235)	(2.213)
N observations	2435	2435	4735	4735
N countries	135	135	135	135
N instruments			122	122

Table A.3: The Effect of Public Support on Democracy (Uncertainty & More Data)

	Pooled	Pooled-Regime	GMM	GMM-Regime
Democracy (t-1)	0.809	0.814	0.873	0.876
	(0.072)	(0.071)	(0.043)	(0.040)
Democracy (t-2)	0.140	0.136	0.182	0.183
	(0.071)	(0.070)	(0.044)	(0.045)
Support (t-1)	−0.119		−0.510	
	(0.392)		(0.476)	
Support in Democracy		−0.032		−0.622
		(0.442)		(0.583)
Support in Autocracy		−0.333		−0.310
		(0.578)		(0.709)
Log GDP Per Capita (t-1)	0.270	0.263	0.121	0.119
	(0.249)	(0.249)	(0.091)	(0.093)
GDP Per Capita Growth (t-1)	0.012	0.011	0.022	0.022
	(0.033)	(0.035)	(0.035)	(0.034)
Regional Democracy (t-1)	0.014	0.014	−0.086	−0.088
	(0.022)	(0.022)	(0.063)	(0.063)
Percent Muslim (t-1)	−0.005	−0.005	−0.005	−0.005
	(0.004)	(0.004)	(0.006)	(0.006)
Resource Dependence (t-1)	0.350	0.328	0.749	0.791
	(0.544)	(0.534)	(0.669)	(0.663)
N observations	2813	2813	5483	5483
N countries	143	143	143	143
N instruments			130	130

Table A.4: The Effect of Democracy on Change in Public Support (Original)

	ECM	ECM-Regime	FD	FD-Regime	ECM Corrup	ECM Corrup-Regime	FD Corrup	FD Corrup-Regime
Democratic Mood (t-1)	0.473	0.473			0.433	0.432		
	(0.026)	(0.025)			(0.028)	(0.028)		
Democratic Mood (t-2)	−0.487	−0.487			−0.451	−0.450		
	(0.025)	(0.025)			(0.027)	(0.027)		
Liberal Democracy (Difference)	−0.058		−0.076		−0.067		−0.082	
	(0.023)		(0.028)		(0.031)		(0.034)	
Liberal Democracy (t-1)	0.007				0.002			
	(0.003)				(0.004)			
Electoral Democracy (Difference)		0.014		0.011		0.028		0.021
		(0.031)		(0.033)		(0.039)		(0.040)
Electoral Democracy (t-1)		0.002				0.006		
		(0.006)				(0.006)		
Minoritarian Democracy (Difference)		−0.053		−0.076		−0.066		−0.087
		(0.022)		(0.025)		(0.029)		(0.029)
Minoritarian Democracy (t-1)		0.003				−0.004		
		(0.006)				(0.006)		
Log GDP Per Capita (Difference)	0.063	0.062			0.037	0.034		
	(0.040)	(0.040)			(0.044)	(0.045)		
Log GDP per capita (Difference)			0.108	0.102			0.089	0.082
			(0.052)	(0.053)			(0.051)	(0.051)
Log GDP (t-1)	0.003	0.004			−0.003	−0.003		
	(0.002)	(0.002)			(0.003)	(0.003)		
Corruption (Difference)					−0.008	−0.007	−0.022	−0.021
					(0.016)	(0.016)	(0.017)	(0.017)
Corruption (t-1)					−0.012	−0.013		
					(0.004)	(0.004)		
N observations	2300	2300	2435	2435	1949	1949	2040	2040
N countries	135	135	135	135	135	135	135	135

Table A.5: The Effect of Democracy on Change in Public Support (With Uncertainty)

	ECM	ECM-Regime	FD	FD-Regime	ECM Corrup	ECM Corrup-Regime	FD Corrup	FD Corrup-Regime
Democratic Mood (t-1)	−0.024	−0.024			−0.031	−0.030		
	(0.029)	(0.030)			(0.031)	(0.032)		
Democratic Mood (t-2)	0.002	0.001			0.003	0.001		
	(0.029)	(0.030)			(0.031)	(0.032)		
Liberal Democracy (Difference)	−0.002		0.001		−0.002		0.001	
	(0.007)		(0.011)		(0.008)		(0.011)	
Liberal Democracy (t-1)	−0.002				−0.003			
	(0.006)				(0.007)			
Electoral Democracy (Difference)		−0.002		0.002		−0.001		0.001
		(0.007)		(0.010)		(0.007)		(0.010)
Electoral Democracy (t-1)		−0.001				−0.002		
		(0.007)				(0.007)		
Minoritarian Democracy (Difference)		−0.002		−0.001		−0.002		0.000
		(0.007)		(0.009)		(0.007)		(0.010)
Minoritarian Democracy (t-1)		−0.002				−0.003		
		(0.006)				(0.007)		
Log GDP Per Capita (Difference)	−0.016	−0.020			−0.032	−0.030		
	(0.081)	(0.084)			(0.089)	(0.085)		
Log GDP per capita (Difference)			0.029	0.026			0.019	0.024
			(0.102)	(0.103)			(0.102)	(0.107)
Log GDP (t-1)	0.006	0.006			−0.003	−0.003		
	(0.005)	(0.005)			(0.006)	(0.006)		
Corruption (Difference)					−0.001	−0.001	0.001	0.001
					(0.020)	(0.020)	(0.032)	(0.031)
Corruption (t-1)					−0.012	−0.012		
					(0.008)	(0.007)		
N observations	2300	2300	2435	2435	2080	2080	2172	2172
N countries	135	135	135	135	135	135	135	135

Table A.6: The Effect of Democracy on Change in Public Support (Uncertainty & More Data)

	ECM	ECM-Regime	FD	FD-Regime	ECM Corrup	ECM Corrup-Regime	FD Corrup	FD Corrup-Regime
Democratic Mood (t-1)	−0.030	−0.030			−0.042	−0.043		
	(0.026)	(0.027)			(0.028)	(0.029)		
Democratic Mood (t-2)	0.008	0.008			0.009	0.009		
	(0.026)	(0.028)			(0.028)	(0.028)		
Liberal Democracy (Difference)	0.001		0.000		0.001		0.000	
	(0.006)		(0.009)		(0.006)		(0.010)	
Liberal Democracy (t-1)	0.002				0.003			
	(0.004)				(0.004)			
Electoral Democracy (Difference)		0.004		0.000		0.004		0.000
		(0.006)		(0.010)		(0.007)		(0.010)
Electoral Democracy (t-1)		0.006				0.006		
		(0.006)				(0.006)		
Minoritarian Democracy (Difference)		−0.002		−0.001		−0.002		−0.001
		(0.006)		(0.008)		(0.006)		(0.009)
Minoritarian Democracy (t-1)		−0.004				−0.003		
		(0.006)				(0.007)		
Log GDP Per Capita (Difference)	−0.007	−0.004			−0.020	−0.024		
	(0.073)	(0.072)			(0.076)	(0.075)		
Log GDP per capita (Difference)			−0.036	−0.027			−0.037	−0.031
			(0.095)	(0.093)			(0.098)	(0.098)
Log GDP (t-1)	0.003	0.003			−0.011	−0.011		
	(0.004)	(0.004)			(0.005)	(0.005)		
Corruption (Difference)					−0.011	−0.010	0.004	0.005
					(0.019)	(0.018)	(0.029)	(0.029)
Corruption (t-1)					−0.022	−0.023		
					(0.006)	(0.006)		
N observations	2674	2674	2815	2815	2405	2405	2499	2499
N countries	143	143	143	143	141	141	141	141

C The Method of Composition

In our analysis models, we have latent variables in both sides of the equations: public democratic support, democracy, and corruption. Since measurement uncertainty associated with these latent variables can propagate into the inferences over coefficient parameters in models, we incorporate uncertainty by employing the "Method of Composition" (Tanner 1993, 52), which has often been applied in analyses with latent variables in political science (see, e.g., Treier and Jackman 2008; Kastellec et al. 2015; Caughey and Warshaw 2018).

As Caughey and Warshaw (2018, A–15) explained, the main idea of MOC is to estimate the marginal distribution of coefficient parameter vector β, integrating over the uncertainty in latent variables θ. More explicitly, MOC integrates the joint density of β and θ over the distribution of θ.

$$p(\beta, \theta | w, y, Z) = p(\beta | \theta, w, y) p(\theta | Z). \tag{1}$$

where θ is latent variables with measurement errors conditional on data Z and a measurement model, w is other predictors without errors, Z is indicators for latent variables θ, and y is the outcome variable. In this way, we incorporate uncertainty in measuring predictor θ, and uncertainty in the effects of latent variables θ and other variables w on outcome variable y (Treier and Jackman 2008, 215).

To sample from the conditional density and the marginal density in the right side of the equation, we follow iterative Monte Carlo procedure described by Treier and Jackman (2008), at iteration t,

1. We sample θ^t from its posterior distribution $p(\theta|Z)$.

2. For each analysis model, we run the model with θ^t, and w, and save the coefficient estimates $\widehat{\beta}^t$ and variance-covariance matrix of $\widehat{\beta}^t$, $\widehat{V}^t$, both of which change due to the uncertainty in θ.

3. We sample $\tilde{\beta}^t$ from the multivariate normal density with mean vector $\widehat{\beta}^t$ and variance-

covariance matrix $\hat{V^t}$.

In the step 3, the marginal distribution of a parameter vector β was estimated, integrating over $p(\theta|Z)$:

$$p(\beta|w,y) = \int_{\theta} p(\beta|\theta,w,y)p(\theta|Z)\,d\theta \tag{2}$$

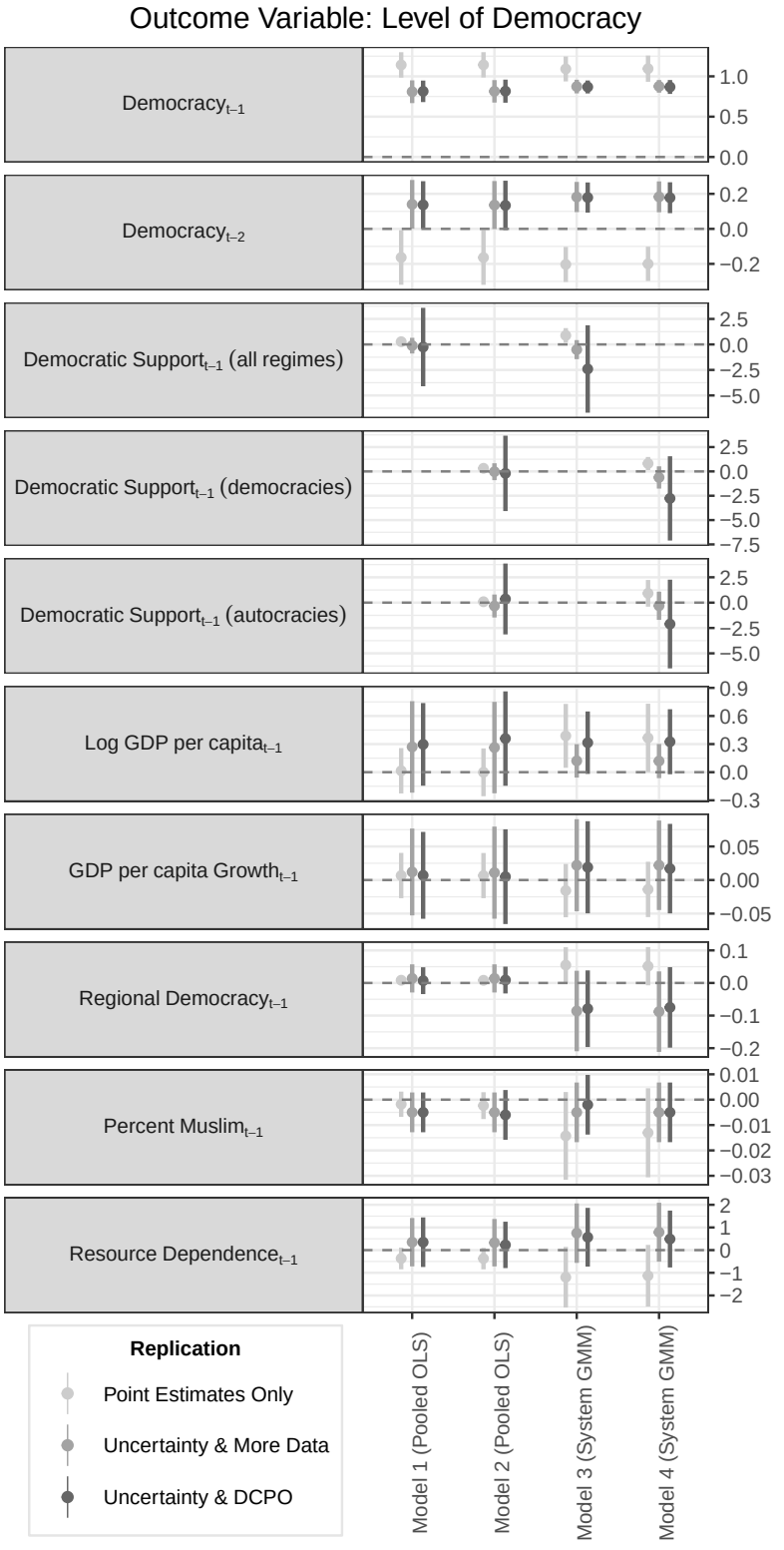
In our re-analyses, we incorporate uncertainty for five variables, public support for democracy, liberal democracy, electoral democracy, the liberal component index, and the corruption perceptions index. For each of these five latent variables, we take 900 draws from its posterior distribution. We duplicate the dataset of variables "without" measurement error 900 times, and assign them to each a different random draw from the distributions of variables with measurement error, which yields 900 datasets. In the next step, we run each of analysis models with these 900 datasets independently and save the resulting estimates of coefficients and the matrix of variance-covariance for each run. We then draw one sample from the multivariate normal distribution with the mean vector of coefficient estimates and variance-covariance matrix produced from each run. This procedure finally yields 900 samples of estimated coefficients drawn from the joint density of β and θ. We calculate point estimates and standard errors based on these 900 samples.

D DCPO Replication

To make fuller use of the available survey data, we also replicated the tests of the classic arguments on democracy and public support using the DCPO model put forward in Solt (2020b) on our expanded data set. The DCPO model has several advantages over the Claassen (2019) model used in Claassen (2020a, 2020b). First, while the Claassen (2019) model dichotomizes responses and so discards some information provided by the 50 ordinal survey items (of 52 total) employed in Claassen (2020a, 2020b), the DCPO model makes use of all of the information available from these ordinal items (Solt 2020b, 5). Second, as the DCPO model includes both parameters for the dispersion of each survey item and for the standard deviation of aggregate public opinion in each country-year, it is a complete population-level item-response model and so, unlike the Claassen (2019) model, is explicitly derived from an individual-level model of survey responses (Solt 2020b, 3–4; see also McGann 2014). Third, to produce more sensible estimates of uncertainty for observations at the extremes of the scale (see Linzer and Staton 2015, 229), the DCPO model places bounds on its estimates of public opinion (Solt 2020b, 8). Further commending the DCPO model to us—and demonstrating that its advantages make a difference—the validation tests in Solt (2020b, 10–12) reveal that it fits survey data on democratic support better than the Claassen (2019) model does.

We employ the superior DCPO model to our expanded dataset using the `DCPO` package for R (Solt 2020a). We then use the estimated public support from the DCPO model to replicate all of the analyses presented in the text. Figures A.1 and Figures A.2 display these results as the righthand set of results, with the replication of the articles' original results based only on point estimates on the left and our extension with uncertainty and more data, but the articles' original, Claassen (2019), model in the middle for comparison.

Even with the advantages of the DCPO model, there is no evidence to support the conclusions of Claassen (2020a, 2020b) that public support sustains democratic regimes or that public support responds thermostatically to changes in democracy.

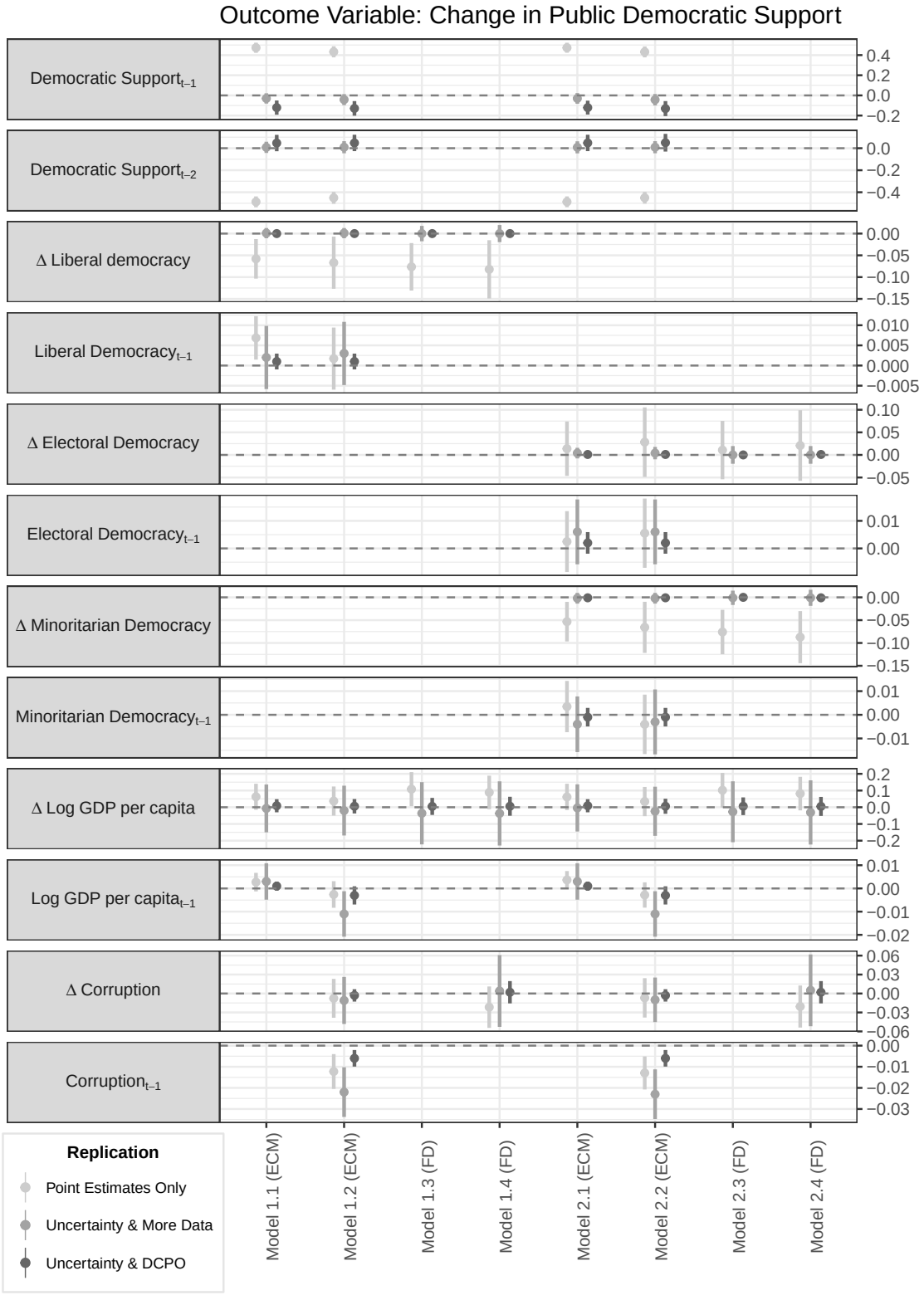


Replications of Claassen (2020a), Table 1, 128, with DCPO.

Figure A.1: The Effect of Public Support on Democracy

Table A.7: The Effect of Public Support on Democracy (Uncertainty & DCPO)

	Pooled	Pooled-Regime	GMM	GMM-Regime
Democracy (t-1)	0.814	0.816	0.868	0.868
	(0.068)	(0.073)	(0.041)	(0.044)
Democracy (t-2)	0.137	0.134	0.179	0.178
	(0.069)	(0.072)	(0.044)	(0.045)
Support (t-1)	−0.256		−2.405	
	(1.961)		(2.186)	
Support in Democracy		−0.203		−2.772
		(1.976)		(2.208)
Support in Autocracy		0.360		−2.109
		(1.783)		(2.231)
Log GDP Per Capita (t-1)	0.297	0.359	0.315	0.325
	(0.225)	(0.257)	(0.170)	(0.177)
GDP Per Capita Growth (t-1)	0.007	0.005	0.019	0.017
	(0.033)	(0.036)	(0.035)	(0.034)
Regional Democracy (t-1)	0.007	0.009	−0.079	−0.075
	(0.021)	(0.021)	(0.060)	(0.063)
Percent Muslim (t-1)	−0.005	−0.006	−0.002	−0.005
	(0.004)	(0.005)	(0.006)	(0.006)
Resource Dependence (t-1)	0.350	0.231	0.569	0.490
	(0.558)	(0.522)	(0.661)	(0.640)
N observations	2813	2813	5483	5483
N countries	143	143	143	143
N instruments			130	130



Replications of Claassen (2020b), Table 1−2, 47−49 with DCPO. Models denoted 'ECM' are error−correction models; those marked 'FD' are first−difference models.

Figure A.2: The Effect of Democracy on the Change of Public Support

Table A.8: The Effect of Public Support on Democracy (Uncertainty & DCPO)

	ECM	ECM-Regime	FD	FD-Regime	ECM Corrup	ECM Corrup-Regime	FD Corrup	FD Corrup-Regime
Democratic Mood (t-1)	−0.121	−0.121			−0.129	−0.131		
	(0.036)	(0.035)			(0.037)	(0.038)		
Democratic Mood (t-2)	0.047	0.048			0.048	0.050		
	(0.038)	(0.038)			(0.038)	(0.041)		
Liberal Democracy (Difference)	0.000		0.000		0.000		0.000	
	(0.002)		(0.003)		(0.002)		(0.003)	
Liberal Democracy (t-1)	0.001				0.001			
	(0.001)				(0.001)			
Electoral Democracy (Difference)		0.001		0.000		0.001		0.001
		(0.002)		(0.003)		(0.002)		(0.003)
Electoral Democracy (t-1)		0.002				0.002		
		(0.002)				(0.002)		
Minoritarian Democracy (Difference)		−0.001		0.000		−0.001		−0.001
		(0.002)		(0.003)		(0.002)		(0.003)
Minoritarian Democracy (t-1)		−0.001				−0.001		
		(0.002)				(0.002)		
Log GDP Per Capita (Difference)	0.009	0.009			0.006	0.006		
	(0.020)	(0.020)			(0.022)	(0.023)		
Log GDP per capita (Difference)			0.005	0.006			0.006	0.005
			(0.026)	(0.027)			(0.029)	(0.029)
Log GDP (t-1)	0.001	0.001			−0.003	−0.003		
	(0.001)	(0.001)			(0.002)	(0.002)		
Corruption (Difference)					−0.003	−0.003	0.002	0.002
					(0.005)	(0.005)	(0.009)	(0.009)
Corruption (t-1)					−0.006	−0.006		
					(0.002)	(0.002)		
N observations	2674	2674	2815	2815	2405	2405	2499	2499
N countries	143	143	143	143	141	141	141	141

References

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Declarations

The authors affirm this research did not involve human subjects.

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