

Appendix of: “Against all odds: On the robustness of probability samples against decreases in response rates”

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Appendix A

References to survey datasets

European Quality of Life Survey (EQLS) <https://www.eurofound.europa.eu/surveys/european-quality-of-life-surveys>; European Foundation for the Improvement of Living and Working Conditions (2018)

European Social Survey (ESS) <https://www.europeansocialsurvey.org/>; European Social Survey (2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018)

European Values Study (EVS) <https://europeanvaluesstudy.eu/>; Gedeshi, Kritzinger, et al. (2020) and Gedeshi, Zulehner, et al. (2020)

International Social Survey Programme (ISSP)
<http://www.issp.org/>; ISSP Research Group (2002, 2003, 2009, 2012a, 2012b, 2013a, 2013b, 2015a, 2015b, 2016a, 2016b, 2017a, 2017b, 2018a, 2018b, 2019a, 2019b, 2020, 2021)

Appendix B
R-Code for DAGitty

```
dag {
  bb="0,0,1,1"
  "Bias(Y*)" [pos="0.796,0.451"]
  "Nonsampling Errors" [latent,pos="0.801,0.648"]
  "Survey Characteristic" [pos="0.448,0.646"]
  "Survey Climate" [latent,pos="0.515,0.200"]
  Country [pos="0.198,0.426"]
  Nonresponse [pos="0.790,0.193"]
  Project [pos="0.076,0.635"]
  Selection [adjusted,pos="0.036,0.391"]
  Time [pos="0.173,0.202"]
  Y [pos="0.952,0.182"]
  "Nonsampling Errors" -> "Bias(Y*)"
  "Survey Characteristic" -> "Nonsampling Errors"
  "Survey Characteristic" -> Nonresponse
  "Survey Climate" -> Nonresponse
  Country -> "Nonsampling Errors"
  Country -> "Survey Characteristic"
  Country -> "Survey Climate"
  Country -> Project
  Country -> Selection
  Nonresponse -> "Bias(Y*)"
  Project -> "Survey Characteristic"
  Project -> Selection
  Time -> "Nonsampling Errors"
  Time -> "Survey Climate"
  Time -> Project
  Time -> Selection
  Y -> Nonresponse
}
```

Appendix C
Full regression tables

Table C1*Models estimating the effect of time on response rates.*

	Model 1.1		Model 1.2		Model 1.3		Model 1.4	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Time	-0.007*	0.001	-0.007*	0.001	-0.007*	0.002	-0.008*	0.002
Project: ESS	-	-	0.125*	0.015	-	-	0.137*	0.011
Project: EVS	-	-	0.102*	0.020	-	-	0.085*	0.016
Project: ISSP	-	-	0.029*	0.014	-	-	0.045*	0.011
Intercept	0.618*	0.014	0.566*	0.016	0.642*	0.025	0.585*	0.026
R^2	0.061		0.175		-		-	
AIC	-		-		-1035		-1169	
BIC	-		-		-1006		-1127	
Log Likelihood	-		-		523		593	
Variance: Country intercept	-		-		0.017		0.019	
Variance: Time slope	-		-		0.000		0.000	
Covariance: Country intercept, time	-		-		-0.001		-0.001	
Variance: Residual	-		-		0.012		0.010	
Number of surveys	774		774		774		774	
Number of countries	-		-		42		42	

* $p < 0.05$ **Table C2***Models estimating the effect of time on nonresponse bias.*

	Model 2.1		Model 2.2		Model 2.3		Model 2.4	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Time	-0.002	0.009	-0.002	0.009	-0.006	0.009	-0.006	0.009
Project: ESS	-	-	0.103	0.150	-	-	0.120	0.144
Project: EVS	-	-	-0.098	0.206	-	-	-0.086	0.197
Project: ISSP	-	-	0.111	0.141	-	-	0.141	0.138
Intercept	1.409*	0.130	1.330*	0.167	1.463*	0.162	1.381*	0.188
R^2	0.000		0.002		-		-	
AIC	-		-		2628		2638	
BIC	-		-		2656		2680	
Log Likelihood	-		-		-1308		-1310	
Variance: Country intercept	-		-		0.372		0.378	
Variance: Time slope	-		-		0.000		0.000	
Covariance: Country intercept, time	-		-		-0.007		-0.007	
Variance: Residual	-		-		1.598		1.599	
Number of surveys	774		774		774		774	
Number of countries	-		-		42		42	

* $p < 0.05$

Table C3*Models estimating the effect of response rate on nonresponse bias.*

	Model 3.1		Model 3.2		Model 3.3	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Response rate	0.298	0.621	0.099	0.641	-0.409	0.331
Time	0.004	0.011	0.004	0.011	-	-
Sample type: Household	0.575*	0.122	0.600*	0.123	-	-
Sample type: Area	0.444*	0.154	0.560*	0.182	-	-
Fieldwork length (100 days)	0.145	0.081	0.102	0.086	-	-
Face-to-face	-0.181	0.150	-0.232	0.167	-	-
Project: ESS	-	-	0.274	0.180	-	-
Project: EVS	-	-	-0.017	0.204	-	-
Project: ISSP	-	-	0.108	0.173	-	-
Intercept	0.767	0.449	0.805	0.484	1.595*	0.181
AIC	2579		2586		-	
BIC	2644		2666		-	
Log Likelihood	-1275		-1276		-	
Variance: Country intercept	4.627		4.627		-	
Variance: Time slope	10.192		10.334		-	
Variance: Response rate slope	-0.066		-0.065		-	
Variance: Residual	-6.866		-6.914		-	
Covariance: Country intercept, time	0.001		0.001		-	
Covariance: Country intercept, response rate	0.098		0.097		-	
Covariance: Response rate, time	1.424		1.422		-	
Number of surveys	774		774		774	
Number of countries	42		42		-	
R^2	-		-		0.002	

* $p < 0.05$

Appendix D
Robustness checks: Tables

Results from models 3.1 and 3.3 re-estimated without surveys in the top 1% with regard to item nonresponse bias, i.e. those where bias exceeds 4.6. We further drop data from countries that have just one survey in the remaining subset.

Table D1

Models estimating the effect of response rate on nonresponse bias.

	Model A3.1		Model A3.2	
	Coef.	S.E.	Coef.	S.E.
Response rate	0.250	0.322	0.240	0.341
Time	0.001	0.007	0.002	0.007
Fieldwork length (100 days)	0.068	0.061	0.070	0.065
Sample type: Household	0.339*	0.089	0.345*	0.090
Sample type: Area	0.458*	0.109	0.514*	0.134
Project: ESS	-	-	0.067	0.133
Project: EVS	-	-	-0.005	0.150
Project: ISSP	-	-	0.084	0.124
Intercept	0.775*	0.240	0.707*	0.260
AIC	2045.028		2058.161	
BIC	2105.141		2132.146	
Log Likelihood	-1009.514		-1013.080	
Variance: Country intercept	0.536		0.533	
Variance: Time slope	1.312		1.302	
Variance: Response rate slope	-0.003		-0.003	
Variance: Residual	-0.838		-0.833	
Covariance: Country intercept, time	0.000		0.000	
Covariance: Country intercept, response rate	0.005		0.005	
Covariance: Response rate, time	0.792		0.794	
Number of surveys	753		753	
Number of countries	42		42	

* $p < 0.05$

Appendix E
Robustness Checks: Figures

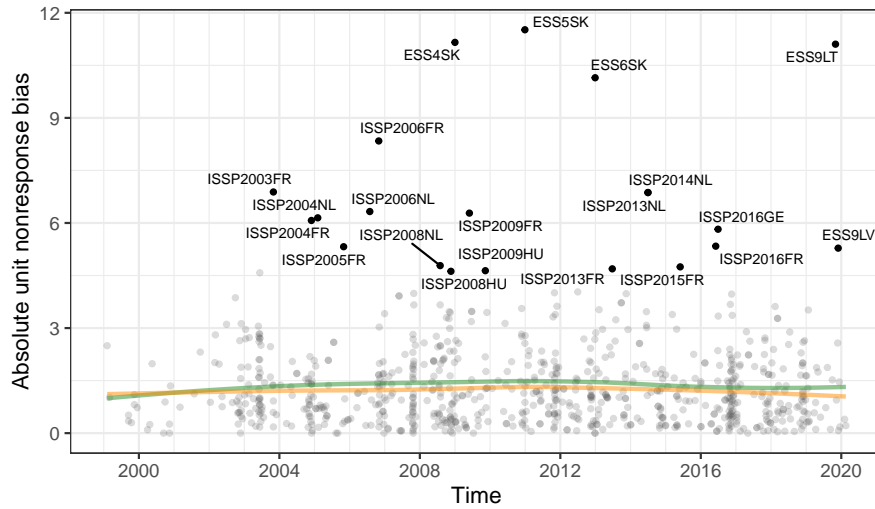


Figure E1

Changes in absolute unit nonresponse bias over time. The green curve indicates the LOESS trend for all observations. The orange curve indicates the LOESS trend after excluding outliers with unit nonresponse bias exceeding 4.6. FR = France, GE = Georgia, HU = Hungary, IT = Italy, LT = Lithuania, LV = Latvia, NL = the Netherlands, SK = Slovakia.

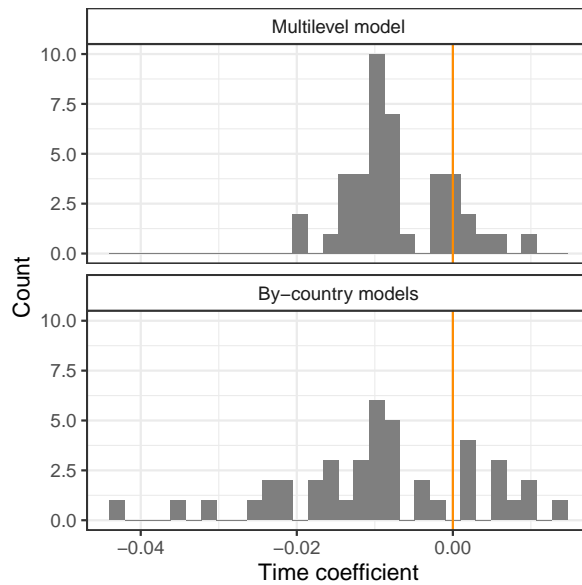


Figure E2

Distribution of the effect of time on response rates from the multi-level model and from by-country OLS models. Adjustment set 3: country

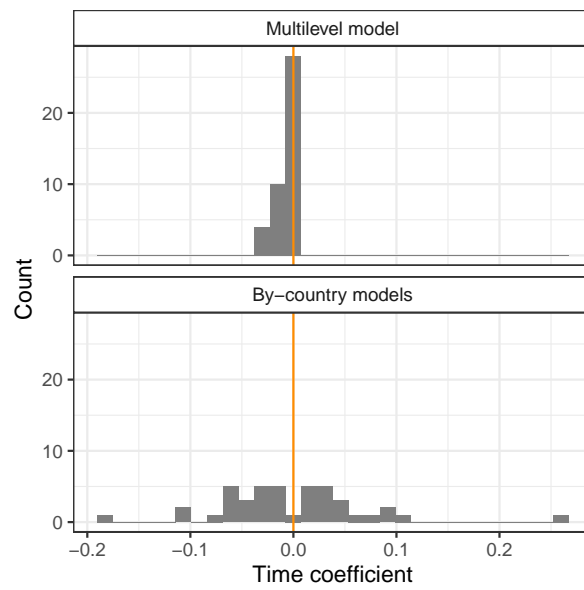


Figure E3

Distribution of effect of time on nonresponse bias from the multi-level model and from by-country OLS models. Adjustment set 3: country

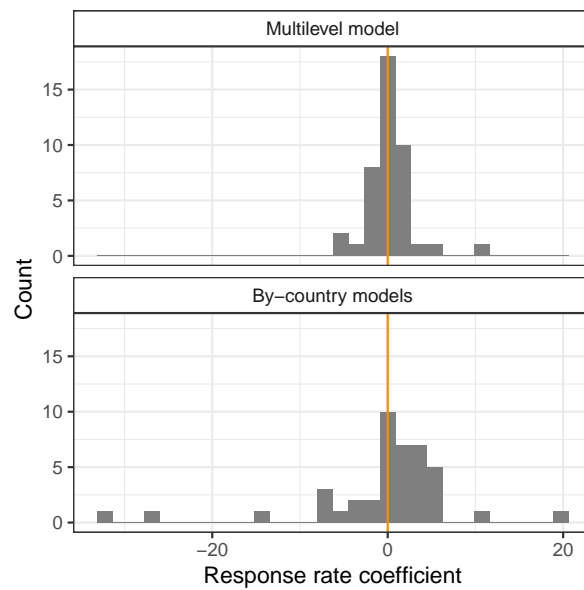


Figure E4

Distribution of coefficients for response rate from the multi-level model and from by-country OLS models. Adjustment set 2: country, time, survey characteristics, and project.

Appendix F
Absolute nonresponse bias over time in the Eurobarometer

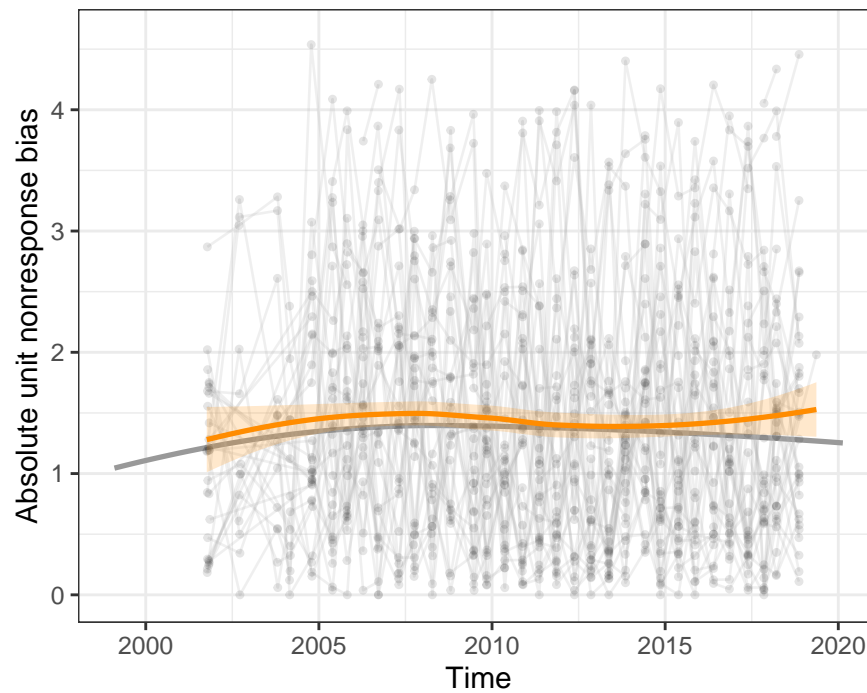


Figure F1

Absolute nonresponse bias over time in the Eurobarometer. The grey curve indicates the LOESS trend in all surveys including EB, EQLS, ESS, EVS, and ISSP

Appendix G

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