Electronic Supplementary Material to "Individual Discount Rates: A Meta-Analysis of Experimental Evidence"

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April 28, 2021

Appendices

A Robustness Checks to Tests of Publication Bias

Table A1: Funnel asymmetry tests with standard errors clustered at the level of authors

	OLS	Fixed effects	Instrument	Precision
Standard error	0.535^{***}	0.875^{***}	0.316	1.031^{**}
(*publication bias*)	(0.0331)	(0.0146)	(0.194)	(0.455)
Constant	0.518^{***}	0.341^{***}	0.633^{***}	0.259^{***}
(*effect beyond bias*)	(0.125)	(0.00762)	(0.180)	(0.0391)
Observations	927	927	927	927
Clusters	31	31	31	31

Notes: The table reports the results of regression $\delta_{ij} = \delta_1 + \gamma_1 \cdot SE(\delta_{ij}) + u_{ij}$, where δ_{ij} denotes the i-th annualized discount rate estimated in the j-th study, and $SE(\delta_{ij})$ denotes its standard error. The table shows estimation by OLS, study-level fixed effects, instrumental variables (where the instrument for the standard error is the inverse of the square root of the number of observations in a study), and precision weighting (where estimates are weighted by the inverse of their standard error). Standard errors, clustered at the level of authors, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Funnel asymmetry tests for medians of individual-specific discounting

	OLS	Fixed effects	Instrument	Precision
Standard error	0.535***	0.875***	0.535***	1.012**
(*publication bias*)	(0.0282)	(0.0154)	(0.0282)	(0.453)
Standard error * Median	0.373	-1.093***	0.373	0.417
(*additional bias in median estimates*)	(0.259)	(0.0518)	(0.259)	(0.619)
Constant	0.509***	0.369***	0.509***	0.258***
(*effect beyond bias*)	(0.118)	(0.00817)	(0.118)	(0.0376)
Observations	927	927	927	927

Notes: The table reports the results of regression $\delta_{ij} = \delta_1 + \gamma_1 \cdot SE(\delta_{ij}) + \gamma_2 \cdot SE(\delta_{ij}) \cdot Median_{ij} + u_{ij}$, where δ_{ij} denotes the i-th annualized discount rate estimated in the j-th study, $SE(\delta_{ij})$ denotes its standard error, and *Median* is a dummy variable that equals 1 if the estimate of the discount rate is a median of individual-specific discounting. The table shows estimation by OLS, study-level fixed effects, instrumental variable (where the instrument for the standard error is the inverse of the square root of the number of observations in a study), and precision weighting (where estimates are weighted by the inverse of their standard error). Standard errors, clustered at the study level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Excluding estimates with unidentified discounting type

PANEL A: Linear models

	OLS	Fixed effects	Instrument	Precision
Standard error	1.112***	0.852**	-0.233	2.814***
(*publication bias*)	(0.210)	(0.359)	(1.598)	(0.684)
Constant	0.384***	0.414***	0.535***	0.194***
(*effect beyond bias*)	(0.0745)	(0.0403)	(0.192)	(0.0302)
Observations	507	507	507	507

PANEL B: Non-linear models

	WAAP of Ioannidis *et al.* (2017)	Stem-based method of Furukawa (2021)	Selection model of Andrews & Kasy (2019)	Endogenous kink of Bom & Rachinger (2019)
Effect beyond bias	0.305***	0.067*	0.218***	0.145***
	(0.016)	(0.040)	(0.130)	(0.004)
Observations	507	507	507	507

Notes: The table reports the results of regression $\delta_{ij} = \delta_1 + \gamma_1 \cdot SE(\delta_{ij}) + u_{ij}$, where δ_{ij} denotes the i-th annualized discount rate estimated in the j-th study, and $SE(\delta_{ij})$ denotes its standard error. Estimates for which the discounting model is not explicitly stated are omitted from estimations in this table. Panel A shows estimation by OLS, study-level fixed effects, instrumental variables (where the instrument for the standard error is the inverse of the square root of the number of observations in a study), and precision weighting (where estimates are weighted by the inverse of their standard error). Panel B shows the recently developed non-linear estimation techniques; WAAP stands for the Weighted Average of the Adequately Powered estimates. Standard errors, clustered at the study level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Funnel asymmetry tests in absolute value

	OLS	Fixed effects	Instrument	Precision
Standard error	0.534***	0.872***	0.534***	1.040**
(*bias in positive estimates*)	(0.0304)	(0.0158)	(0.0304)	(0.456)
Standard error * Negative	-2.104***	-0.610	-2.104***	-2.306***
(*bias in negative estimates*)	(0.371)	(0.730)	(0.371)	(0.743)
Constant	0.523***	0.344***	0.523***	0.260***
(*effect beyond bias*)	(0.114)	(0.00899)	(0.114)	(0.0374)
Observations	927	927	927	927

Notes: The table reports the results of regression $|\delta_{ij}| = \delta_1 + \gamma_1 \cdot SE(\delta_{ij}) + \gamma_2 \cdot SE(\delta_{ij}) \cdot Negative_{ij} + u_{ij}$, where δ_{ij} denotes the i-th annualized discount rate estimated in the j-th study, $SE(\delta_{ij})$ denotes its standard error, and *Negative* is a dummy variable that equals 1 if the estimate of the discount rate is negative. The table shows estimation by OLS, study-level fixed effects, instrumental variables (where the instrument for the standard error is the inverse of the square root of the number of observations in a study), and precision weighting (where estimates are weighted by the inverse of their standard error). Standard errors, clustered at the study level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

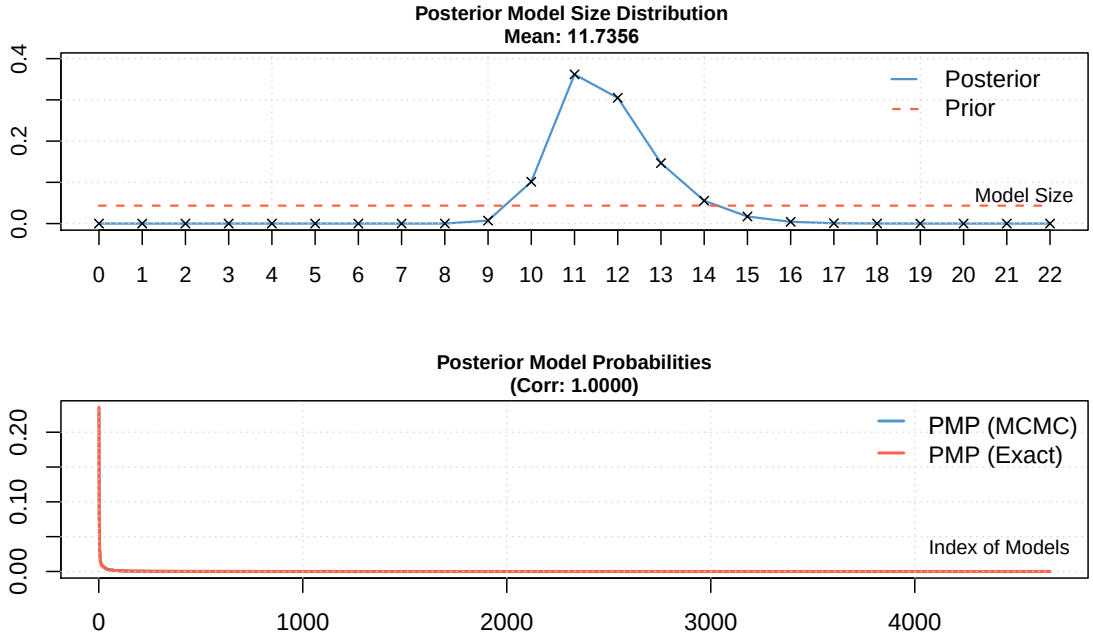
B Robustness Checks and Additional Statistics to BMA

Table B1: Summary of the benchmark BMA estimation

Mean no. regressors	*Draws*	*Burn-ins*	*Time*	*No. models visited*
11.7356	$2 \cdot 10^6$	$1 \cdot 10^6$	2.350162 mins	402,090
Modelspace	*Models visited*	*Topmodels*	*Corr PMP*	*No. obs.*
$4.19 \cdot 10^6$	9.60%	100%	1.0000	927
Model prior	*g-prior*	*Shrinkage-stats*		
Random/11	UIP	Av = 0.9989		

Notes: We employ the priors recommended by Eicher *et al.* (2011) and George (2010), the unit information prior (the prior has the same weight as one observation in the data) and the dilution prior (accounting for potential collinearity). The results of this BMA exercise are reported in **??**

Figure B1: Model size and convergence for the benchmark BMA model



Notes: The figure depicts the posterior model size distribution and the posterior model probabilities of the BMA exercise reported in **??**.

Table B2: Alternative BMA priors and frequentist model averaging

	Bayesian model averaging (BRIC)			Frequentist model averaging		
Variable:	Post. mean	Post. SD	PIP	Mean	SE	p-value
Constant	-0.244	NA	1.000	-0.393	0.140	0.005
Standard error	0.549	0.021	1.000	0.572	0.024	0.000
Estimation characteristics						
Hyperbolic discounting	0.039	0.061	0.351	0.132	0.062	0.035
Exponential discounting	0.006	0.029	0.074	0.089	0.075	0.235
Delay	0.000	0.002	0.040	-0.002	0.009	0.843
Front-end delay	0.013	0.041	0.141	0.109	0.064	0.089
Lab experiment	0.156	0.101	0.777	0.124	0.075	0.100
Experimental characteristics						
Real reward	-0.005	0.026	0.075	-0.031	0.067	0.648
Matching task	0.017	0.045	0.160	0.017	0.066	0.791
Health domain	0.346	0.088	0.993	0.317	0.091	0.001
Other domain	0.441	0.069	1.000	0.424	0.072	0.000
Negative framing	-0.148	0.106	0.735	-0.139	0.077	0.073
Neutral framing	0.003	0.030	0.045	0.017	0.089	0.851
Stakes						
Subject pool characteristics						
Sample size	0.075	0.014	1.000	0.084	0.017	0.000
Students	0.877	0.111	1.000	0.825	0.132	0.000
Students * Lab experiment	-0.753	0.144	1.000	-0.670	0.160	0.000
Males only	0.013	0.052	0.089	0.098	0.110	0.374
Females only	-0.001	0.022	0.040	0.000	0.012	1.000
North America	0.012	0.040	0.125	0.113	0.066	0.085
Asia	0.385	0.103	0.991	0.384	0.095	0.000
Africa	3.170	0.118	1.000	3.295	0.137	0.000
Publication characteristics						
Citations	-0.003	0.011	0.094	-0.014	0.022	0.527
Publication year	0.121	0.026	1.000	0.104	0.029	0.000
Observations	927			927		
Studies	56			56		

Notes: Response variable = annualized estimates of the discount rate. SD = standard deviation, PIP = Posterior inclusion probability, SE = standard error. The first specification from the left uses Bayesian model averaging with an alternative model prior, the beta-binomial prior advocated by Ley & Steel (2009) and Zellner's g prior BRIC according to Fernandez *et al.* (2001). The second specification, frequentist model averaging, applies Mallow's model averaging estimator (Hansen, 2007) using the orthogonalization of covariate space suggested by Amini & Parmeter (2012) to reduce the number of estimated models. All variables are described in **??**.

Table B3: Alternative specifications of the baseline BMA model

	Bayesian model averaging (without SE)			Bayesian model averaging (with stakes)			Bayesian model averaging (known model)		
Variable:	P. mean	P. SD	PIP	P. mean	P. SD	PIP	P. mean	P. SD	PIP
Constant	0.790	NA	1.000	0.180	NA	1.000	-0.704	NA	1.000
Standard error				0.567	0.023	1.000	0.856	0.110	1.000
Estimation characteristics									
Hyperbolic discounting	-0.383	0.068	1.000	0.001	0.013	0.039			
Exponential discounting	-0.505	0.084	1.000	0.004	0.023	0.055	0.000	0.012	0.043
Delay	-0.010	0.018	0.306	0.004	0.011	0.122	-0.098	0.017	1.000
Front-end delay	-0.403	0.062	1.000	0.050	0.069	0.398	0.185	0.111	0.808
Lab experiment	0.278	0.148	0.855	0.097	0.122	0.445	0.311	0.073	0.997
Experimental characteristics									
Real reward	0.166	0.140	0.664	-0.041	0.077	0.267	-0.001	0.020	0.051
Matching task	0.335	0.117	0.972	0.007	0.032	0.071	0.002	0.024	0.056
Health domain	0.110	0.144	0.442	0.979	0.173	1.000	0.382	0.095	0.996
Other domain	0.031	0.075	0.201	0.646	0.097	1.000	0.420	0.083	1.000
Negative framing	-0.409	0.092	0.999	-0.033	0.074	0.201	-0.030	0.075	0.179
Neutral framing	0.017	0.076	0.101	0.010	0.059	0.049	0.002	0.035	0.044
Stakes				-0.478	0.094	1.000			
Subject pool characteristics									
Sample size	-0.050	0.027	0.856	0.120	0.018	1.000	0.142	0.029	1.000
Students	0.933	0.193	1.000	0.398	0.296	0.755	-0.007	0.043	0.075
Students * Lab experiment	-0.684	0.254	0.960	-0.395	0.339	0.643	-0.001	0.044	0.066
Males only	0.005	0.042	0.071	0.016	0.061	0.092	0.015	0.063	0.085
Females only	-0.006	0.043	0.073	0.000	0.020	0.029	0.004	0.034	0.050
North America	0.005	0.030	0.093	-0.002	0.018	0.049	0.146	0.111	0.704
Asia	0.306	0.175	0.835	0.073	0.146	0.244	0.351	0.108	0.975
Africa	2.570	0.155	1.000	3.242	0.134	1.000			
Publication characteristics									
Citations	0.003	0.012	0.100	-0.041	0.045	0.511	-0.001	0.009	0.059
Publication year	0.374	0.038	1.000	0.017	0.036	0.232	0.013	0.034	0.173
Observations	927			777			507		
Studies	56			51			32		

Notes: Response variable = annualized estimates of the individual discount rate. P. mean = posterior mean, P. SD = posterior standard deviation, PIP = posterior inclusion probability. We employ Bayesian model averaging (BMA) using unit information prior (Eicher *et al.*, 2011) and the dilution prior suggested by George (2010) which accounts for collinearity. In the first specification from the left, we exclude the variable *Standard error*; in the second specification we introduce variable *Stakes* into the model (which reduces the number of observations to 777); in the third specification we use only those observations where the type of discounting can be explicitly identified. All variables are described in **??**.

Table B4: BMA specifications accounting for non-linearity and exact delay

	Bayesian model averaging (money * non-linearity)			Bayesian model averaging (exact delay)		
Variable:	Post. mean	Post. SD	PIP	Post. mean	Post. SD	PIP
Constant	-0.242	NA	1.000	-0.748	NA	1.000
Standard error	0.549	0.021	1.000	0.611	0.027	1.000
Estimation characteristics						
Hyperbolic discounting	0.039	0.068	0.326			
Exponential discounting	0.005	0.028	0.068	0.057	0.094	0.334
Delay	0.000	0.002	0.037	0.002	0.008	0.134
Front-end delay	0.013	0.040	0.132	0.173	0.115	0.775
Lab experiment	0.153	0.102	0.766			
Experimental characteristics						
Real reward	-0.005	0.026	0.072	-0.004	0.053	0.114
Matching task	0.016	0.045	0.152	0.158	0.113	0.747
Health domain	0.346	0.089	0.992	0.304	0.147	0.889
Other domain	0.442	0.071	1.000	0.658	0.100	1.000
Money domain * non-linearity correction	0.001	0.035	0.090			
Negative framing	-0.146	0.107	0.724	-0.007	0.034	0.098
Neutral framing	0.003	0.030	0.042	0.053	0.152	0.165
Subject pool characteristics						
Sample size	0.075	0.014	1.000	0.166	0.032	1.000
Students	0.877	0.111	1.000	1.184	0.178	1.000
Students * Lab experiment	-0.752	0.144	1.000	-0.992	0.142	1.000
Males only	0.012	0.050	0.082	0.081	0.152	0.284
Females only	-0.001	0.021	0.037	0.011	0.062	0.086
North America	0.011	0.039	0.116	0.037	0.076	0.260
Asia	0.382	0.104	0.989	0.288	0.169	0.831
Africa	3.169	0.117	1.000	3.146	0.200	1.000
Publication characteristics						
Citations	-0.003	0.011	0.089	0.000	0.013	0.080
Publication year	0.121	0.027	1.000	0.151	0.041	0.994
Observations	927			568		
Studies	56			28		

Notes: Response variable = annualized estimates of the discount rate. SD = standard deviation, PIP = Posterior inclusion probability, SE = standard error. We employ Bayesian model averaging (BMA) using unit information prior (Eicher *et al.*, 2011) and the dilution prior suggested by George (2010), which accounts for collinearity. In the first specification we include variable *Money domain * non-linearity correction*, interaction of *Money domain* with a correction for non-linearity of utility functions; in the second specification we estimate a model on a subsample of estimates for which the exact time horizon is coded (which reduces the number of observations to 568 and eliminates variables *Hyperbolic discounting* and *Lab experiment* due to high collinearity). All variables are described in **??**.

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