Lonely Me, Lonely You: Loneliness and the Longitudinal Course of Relationship Satisfaction | Supplement

Abstract

This document contains details on the analytical approach as well as supplemental tables and figures.

Keywords: loneliness, similarity, relationship satisfaction, partner relationships, dyadic response surface analysis

Dyadic Response Surface Analysis

All formula in this supplement are taken from Schönbrodt, Humberg, and Nestler (2018) and Weidmann, Schönbrodt, Ledermann, and Grob (2017). For detailed discussions on classical response surface analyses and the problems with difference scores and profile correlations, see Edwards (1993) and Edwards (1994). For more information on the Actor-Partner Interdependence Model, see Kenny, Kashy, and Cook (2006).

Estimation

Dyadic response surface analysis (DRSA) are a combination of response surface analysis and Actor-Partner Interdependence Models (APIM; see also Figure 2 in the manuscript and Figures S1 and S2 in this supplement). Specifically, the APIM is extended by higher-order polynomial terms to predict the outcome of interest. In the present paper, we used polynomials at the second degree (i.e., quadratic terms), but higher-order polynomials would be possible as well. For the models used in the current article, the formula for predicting women's relationship satisfaction (RS) by the combination of her own and her partner's loneliness (LS) is:

$$RS_w = b_{10} + b_{11}LS_w + b_{12}LS_m + b_{13}LS_w^2 + b_{14}LS_w \times LS_m + b_{15}LS_m^2 + e \qquad (1)$$

In this formula, RS_w is the woman's relationship satisfaction at W8, LS_w is the woman's score on loneliness at W1 and LS_m is the man's score on loneliness at W1, respectively. b_{10} represents the intercept and e the error term. Accordingly, relationship satisfaction for men is calculated as:

$$RS_m = b_{20} + b_{21}LS_m + b_{22}LS_w + b_{23}LS_m^2 + b_{24}LS_w \times LS_m + b_{25}LS_w^2 + e \quad (2)$$

In the unconstrained models, the parameters b_{11}, b_{12}, b_{13}, b_{14}, b_{15}, b_{21}, b_{22}, b_{23}, b_{24}, and b_{25} are estimated freely. In the constrained model, the corresponding parameters are set equal, so that:

$$\begin{aligned} b_{11} &= b_{21} \\ b_{12} &= b_{22} \\ b_{13} &= b_{23} \\ b_{14} &= b_{24} \\ b_{15} &= b_{25} \end{aligned} \quad (3)$$

The surface parameters are derived from these parameter estimates. Specifically, for women

$$\begin{aligned} a_{1f} &= b_{11} + b_{12} \\ a_{2f} &= b_{13} + b_{14} + b_{15} \\ a_{3f} &= b_{11} - b_{12} \\ a_{4f} &= b_{13} - b_{14} + b_{15} \end{aligned} \quad (4)$$

Accordingly, the surface parameters for men are calculated as:

$$\begin{aligned} a_{1m} &= b_{22} + b_{21} \\ a_{2m} &= b_{23} + b_{24} + b_{25} \\ a_{3m} &= b_{22} - b_{21} \\ a_{4m} &= b_{23} - b_{24} + b_{25} \end{aligned} \quad (5)$$

The parameters a_1 and a_2 further define the line of congruence (LOC), where all values of X correspond to the same value of Y (i.e., partners have the same score; $a_1 + a_2$). The parameter a_1 indicates linear trends of the LOC, the parameter a_2 determines its curvature. If significantly positive, a_2 indicates that congruence at both high and low scores of the predictor (e.g., loneliness) are associated with higher scores on the outcome (e.g., relationship satisfaction); that is, the response surface is u-shaped. If a_2 is negative, congruently high and low scores are associated with lower scores on the outcome. Similarly, the parameters a_3 and a_4 define linear and curvilinear trends of the line of incongruence (LOIC), respectively. Along the LOIC, high scores on X are accompanied by low scores on Y (e.g., women has high scores on loneliness, man has low scores).

Centering

A prerequisite for the DRSA to be interpretable is that the predictors are measured on commensurable scales (i.e., scale points need to have the same meaning for women and men). This can be achieved through centering. In different applications, different centering regimens might be appropriate (e.g., centering around grand mean, centering around scale midpoint, etc.).

For the DRSA in the present article, loneliness and relationship satisfaction at W8 were centered around the respective variable's grand mean for the prediction of later levels of satisfaction by similarity in loneliness at W1. When predicting changes in relationship satisfaction by similarity in loneliness (see Supplemental Figure S1), we only centered the loneliness scores around the sample mean, as the change scores for relationship satisfaction provide a meaningful metric with a sensible zero point. Finally, to examine the association of changes in loneliness with changes in relationship satisfaction (see Supplemental Figure S2), we residualized the women's and men's loneliness scores at W8 by partialling out loneliness scores at W1. The residualized scores for loneliness provided a meaningful and commensurable metric, so that no centering was applied for this analysis.

References

Edwards, J. R. (1993). Problems with the use of profile similarity indices in the study of congruence in organizational research. *Personnel Psychology*, *46*, 641–665. doi:10.1111/j.1744-6570.1993.tb00889.x

Edwards, J. R. (1994). The study of congruence in organizational behavior research: Critique and a proposed alternative. *Organizational Behavior and Human Decision Processes*, *58*, 51–100. doi:10.1006/obhd.1994.1029

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York: Guilford Press.

Schönbrodt, F. D., Humberg, S., & Nestler, S. (2018). Testing similarity effects with dyadic response surface analysis. *European Journal of Personality*, *32*, 627–641. doi:10.1002/per.2169

Weidmann, R., Schönbrodt, F. D., Ledermann, T., & Grob, A. (2017). Concurrent and longitudinal dyadic polynomial regression analysis of big five traits and relationship satisfaction: Does similarity matter? *Journal of Research in Personality*, *70*, 6–15. doi:10.1016/j.jrp.2017.04.003

Table S1
Descriptive Statistics for W2 Through W8

	Women		Men	
Variable	M	SD	M	SD
Relationship Satisfaction				
W2	8.05	2.07	8.14	1.94
W3	7.95	2.07	8.05	1.93
W4	7.81	2.14	7.87	2.16
W5	7.85	2.06	7.90	2.00
W6	7.79	2.03	7.88	1.98
W7	7.71	2.13	7.82	2.04
W8	7.82	1.97	7.84	2.01
Loneliness				
W8	1.80	1.07	1.59	0.93

Table S2
Loneliness as Predictor of Later Levels and Development of Relationship Satisfaction (APIM): Models without Covariates

		95% CI				
Effect	EST	LB	UB	p	$\beta_{♀}$	$\beta_{♂}$
Predicting Later Levels of Relationship Satisfaction						
Actor	−0.351	−0.450	−0.251	<.001	−.180	−.142
Partner	−0.183	−0.266	−0.100	<.001	−.075	−.092
Correlations						
Loneliness W1	.059	.016	.101	.006	—	—
Satisfaction W8	.400	.325	.475	<.001	—	—
Predicting Development of Relationship Satisfaction						
Actor	−0.181	−0.261	−0.101	<.001	−.125	−.103
Partner	−0.104	−0.173	−0.035	.003	−.058	−.074
Correlations						
Loneliness W1	.059	.017	.102	.006	—	—
Satisfaction Slopes	.367	.242	.492	<.001	—	—

Note. $N = 2,337$ couples. EST: For actor and partner effects, unstandardized regression weights are reported.

Table S3
Parameter Estimates of the Dyadic Response Surface Analyses

	Women				Men			
Parameter	EST	LB	UB	p	EST	LB	UB	p
Baseline Similarity and Later Levels of Satisfaction								
Actor Rating	−0.411	−0.636	−0.185	<.001	−0.695	−0.952	−0.438	<.001
Partner Rating	−0.427	−0.655	−0.199	<.001	−0.090	−0.320	0.139	.440
Actor Rating^2	0.068	−0.044	0.180	.236	0.196	0.047	0.345	.010
Actor × Partner	0.292	0.157	0.427	<.001	0.052	−0.099	0.203	.502
Partner Rating^2	0.141	0.024	0.258	.018	−0.045	−0.144	0.055	.379
Baseline Similarity and Development of Satisfaction								
Actor Rating	−0.378	−0.505	−0.252	<.001	−0.378	−0.505	−0.252	<.001
Partner Rating	−0.165	−0.277	−0.053	.004	−0.165	−0.277	−0.053	.004
Actor Rating^2	0.105	0.036	0.174	.003	0.105	0.036	0.174	.003
Actor × Partner	0.129	0.037	0.221	.006	0.129	0.037	0.221	.006
Partner Rating^2	0.018	−0.036	0.071	.521	0.018	−0.036	0.071	.521
Similarity in Change and Development of Satisfaction								
Actor Rating	−0.714	−0.834	−0.595	<.001	−0.714	−0.834	−0.595	<.001
Partner Rating	−0.402	−0.517	−0.287	<.001	−0.402	−0.517	−0.287	<.001
Actor Rating^2	0.076	0.004	0.147	.039	0.076	0.004	0.147	.039
Actor × Partner	−0.197	−0.302	−0.092	<.001	−0.197	−0.302	−0.092	<.001
Partner Rating^2	0.079	0.010	0.149	.026	0.079	0.010	0.149	.026

Note. $N = 2,337$ couples. EST: unstandardized regression weight. LB/UB: Lower and upper bound of 95% confidence interval. All models are controlled for age of the participants, relationship duration, shyness, and depressiveness.

Table S4

Unadjusted Response Surface Parameters Estimated from the Dyadic Response Surface Analyses

	Women				Men			
Parameter	EST	LB	UB	p	EST	LB	UB	p
Baseline Similarity and Later Levels of Satisfaction								
a_1	−0.837	−1.128	−0.547	<.001	−0.811	−1.126	−0.496	<.001
a_2	0.495	0.294	0.695	<.001	0.199	−0.010	0.408	.062
a_3	0.003	−0.299	0.306	.984	−0.580	−0.906	−0.254	<.001
a_4	−0.086	−0.290	0.117	.407	0.103	−0.115	0.320	.356
Baseline Similarity and Development of Satisfaction								
a_1	−0.539	−0.736	−0.342	<.001	−0.539	−0.736	−0.342	<.001
a_2	0.245	0.101	0.389	.001	0.245	0.101	0.389	.001
a_3	−0.223	−0.351	−0.095	.001	−0.223	−0.351	−0.095	.001
a_4	−0.022	−0.156	0.111	.744	−0.022	−0.156	0.111	.744
Similarity in Change and Development of Satisfaction								
a_1	−1.074	−1.266	−0.882	<.001	−1.074	−1.266	−0.882	<.001
a_2	−0.070	−0.195	0.056	.279	−0.070	−0.195	0.056	.279
a_3	−0.311	−0.433	−0.188	<.001	−0.311	−0.433	−0.188	<.001
a_4	0.298	0.113	0.483	.002	0.298	0.113	0.483	.002

Note. $N = 2,337$ couples. EST: point estimate of surface parameter. LB/UB: Lower and upper bound of 95% confidence interval.

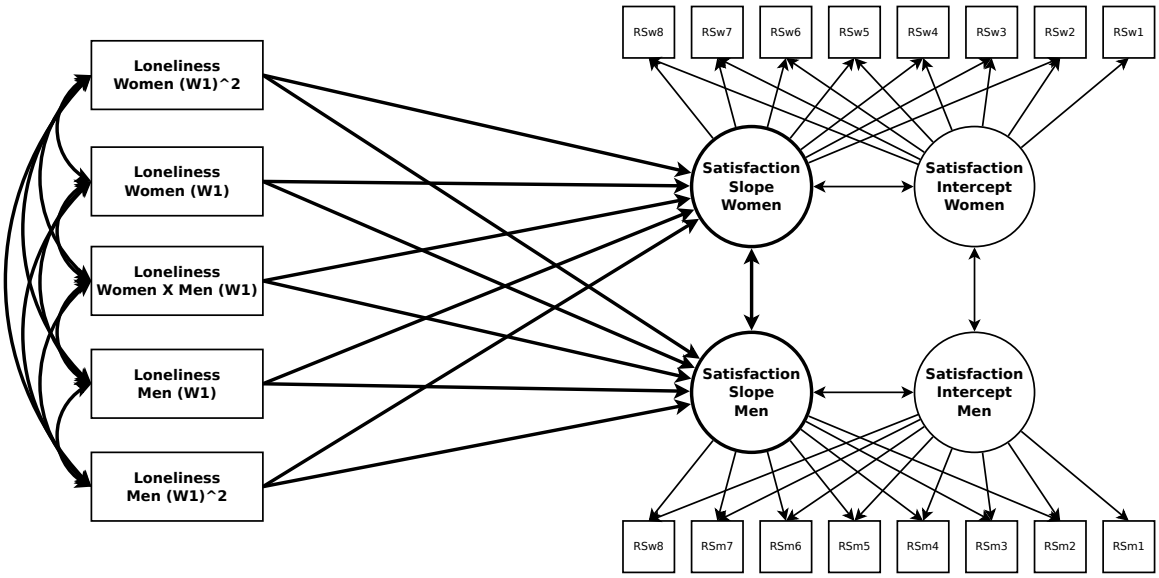

Figure S1. DRSA model for predicting changes in relationship satisfaction by similarity in loneliness at the first wave The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

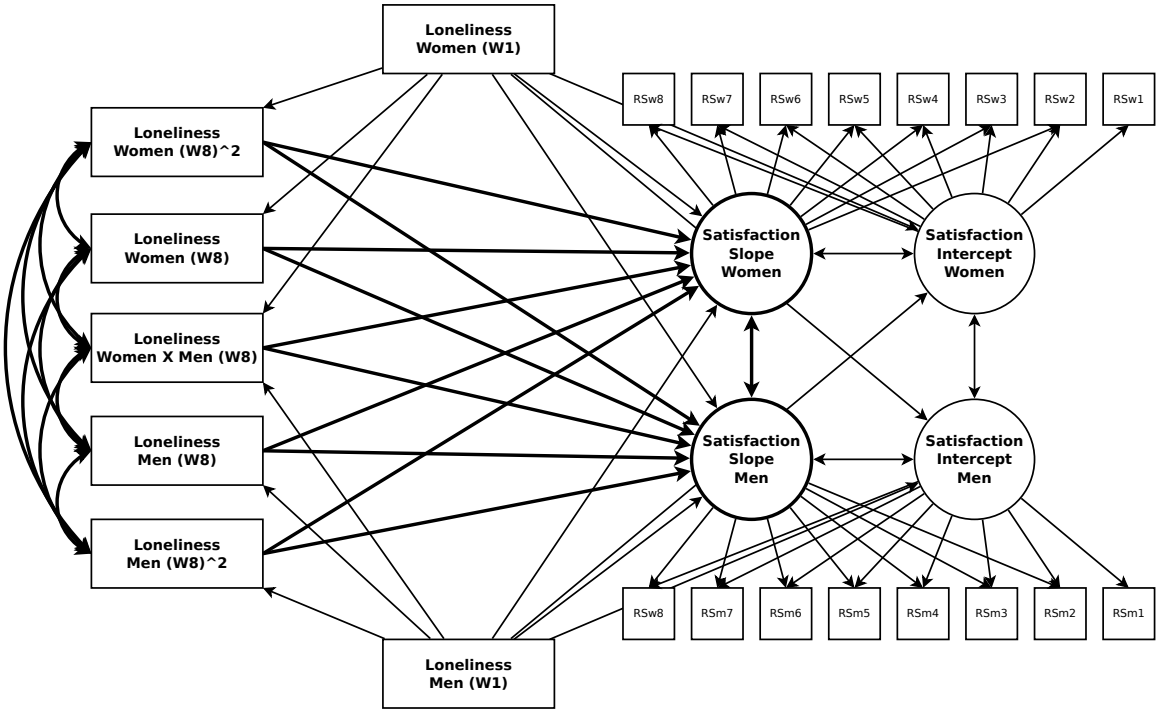

Figure S2. DRSA models for examining the association between the dyadic similarity in changes in loneliness and changes in relationship satisfaction. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

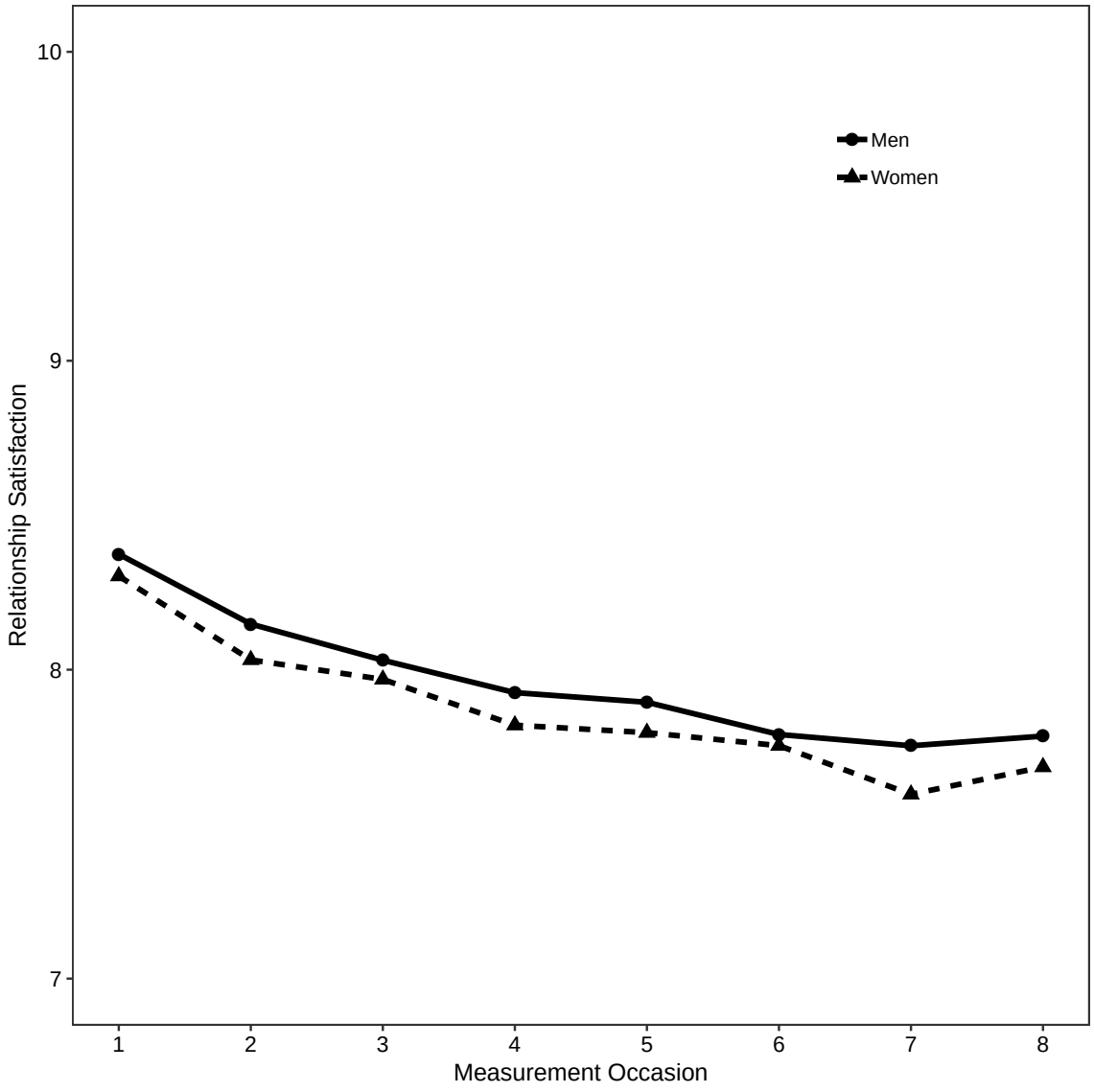

Figure S3. Development of relationship satisfaction for women and men across the study period of eight years. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

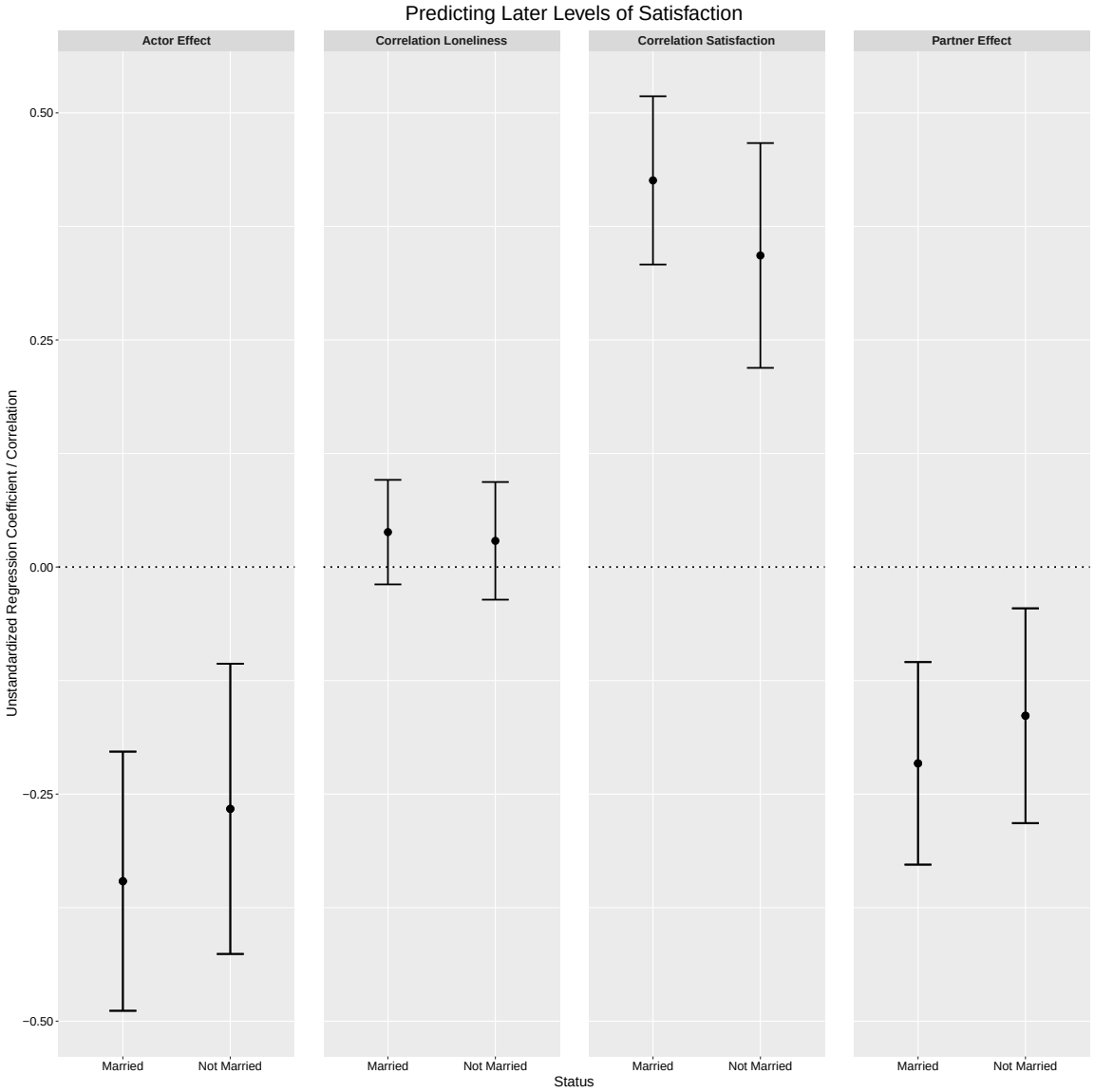

Figure S4. Results of APIM analysed separately for married (n = 1394) and unmarried (n = 933) couples. The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

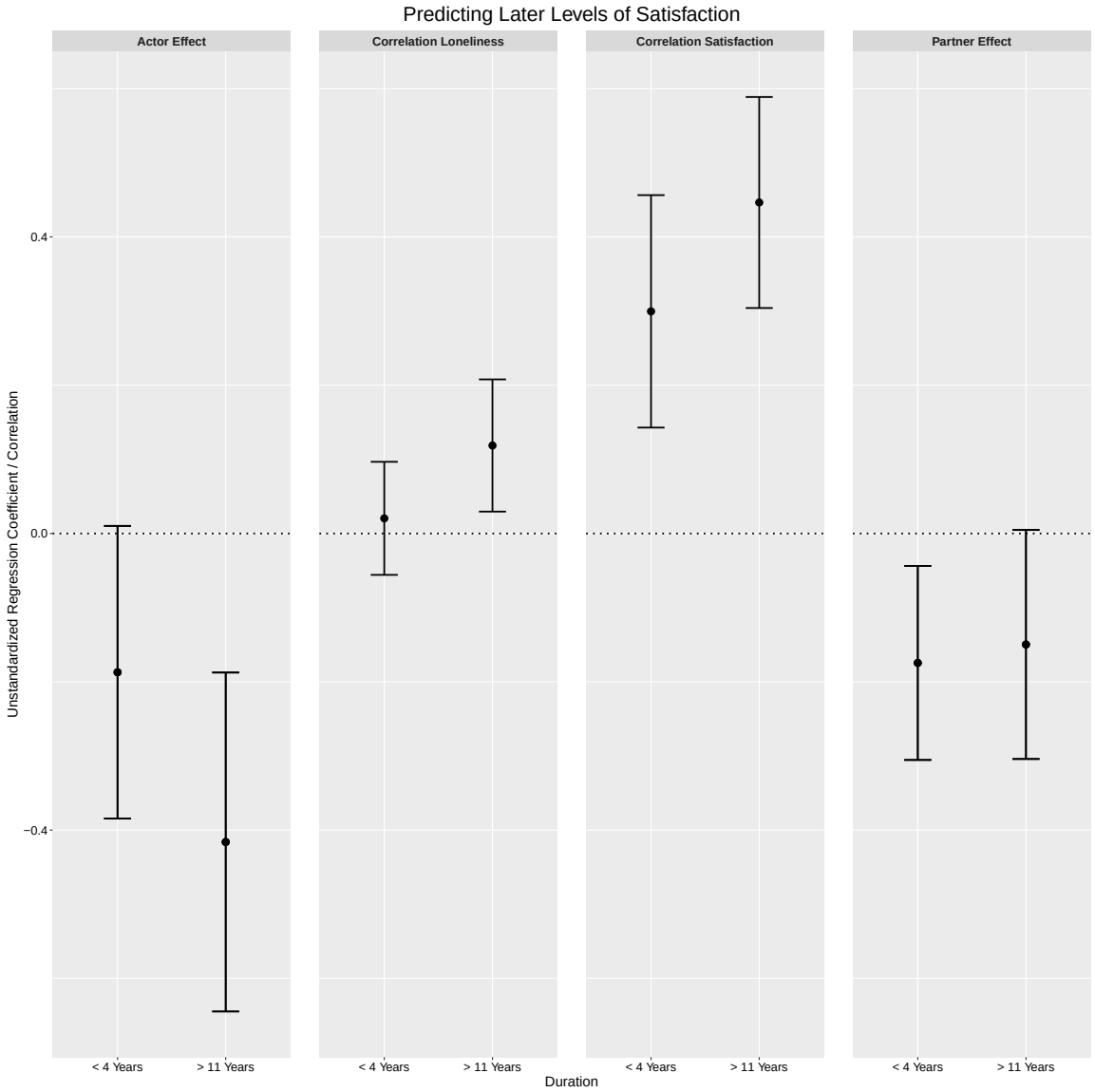

Figure S5. Results of APIM analysed separately for couples being together for less than four years (n = 617 couples) and for more than eleven years (n = 649 couples). The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

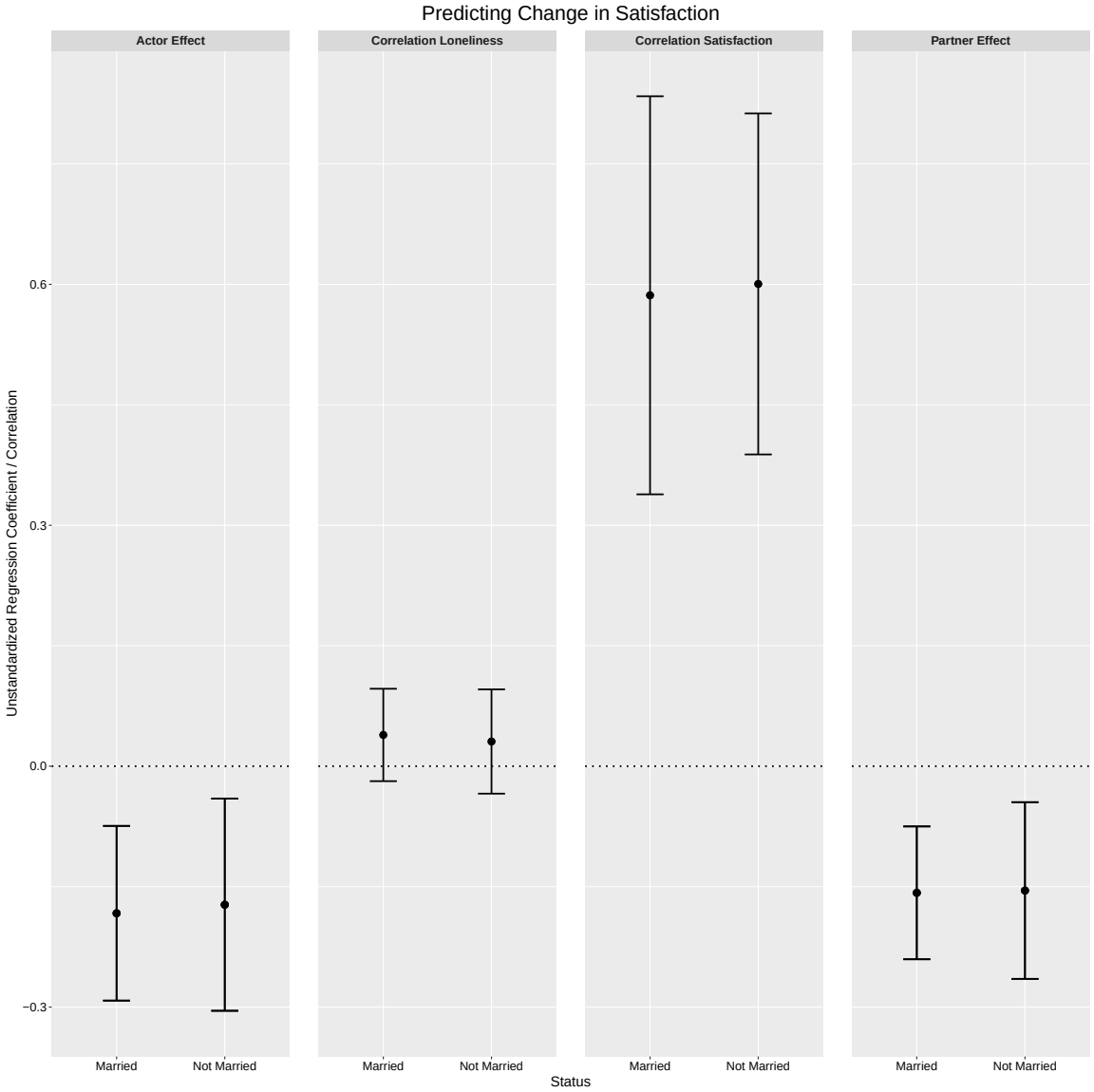

Figure S6. Results of APIM analysed separately for married (n = 1394) and unmarried (n = 933) couples. The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

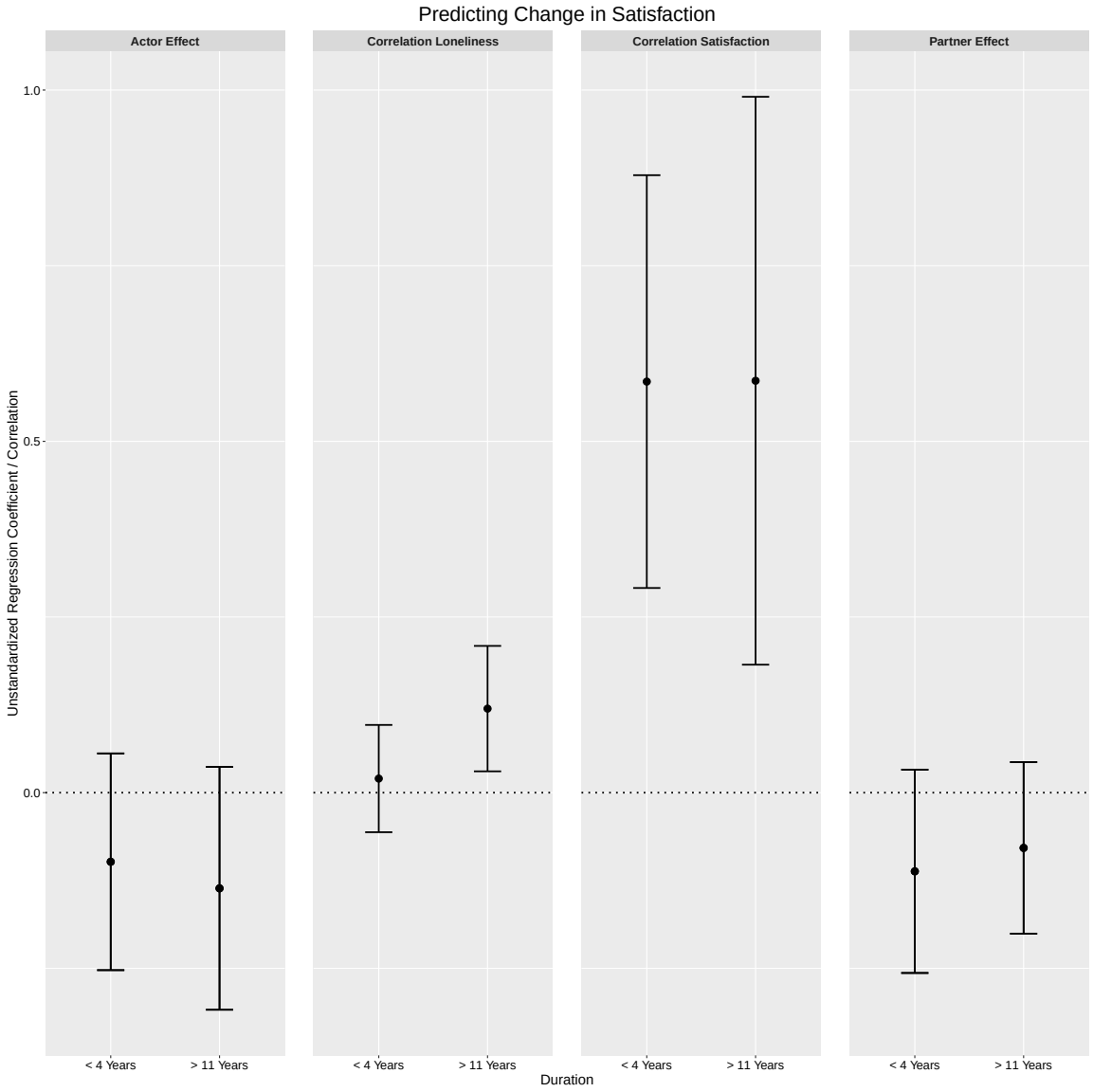

Figure S7. Results of APIM analysed separately for couples being together for less than four years (n = 617 couples) and for more than eleven years (n = 649 couples). The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

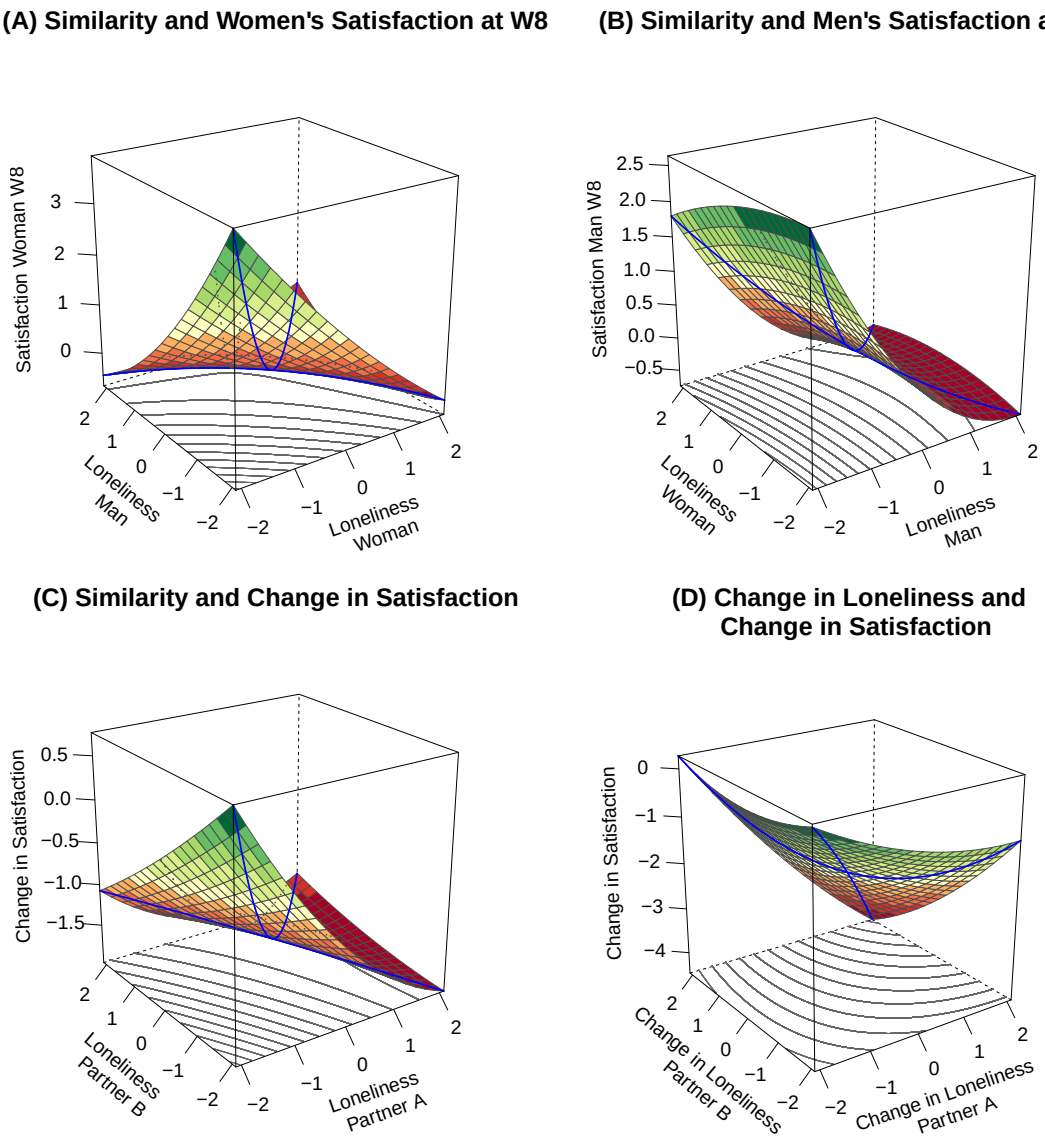

Figure S8. Response surface plots. These plots are colored versions of those shown in Figure 5 of the main article. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

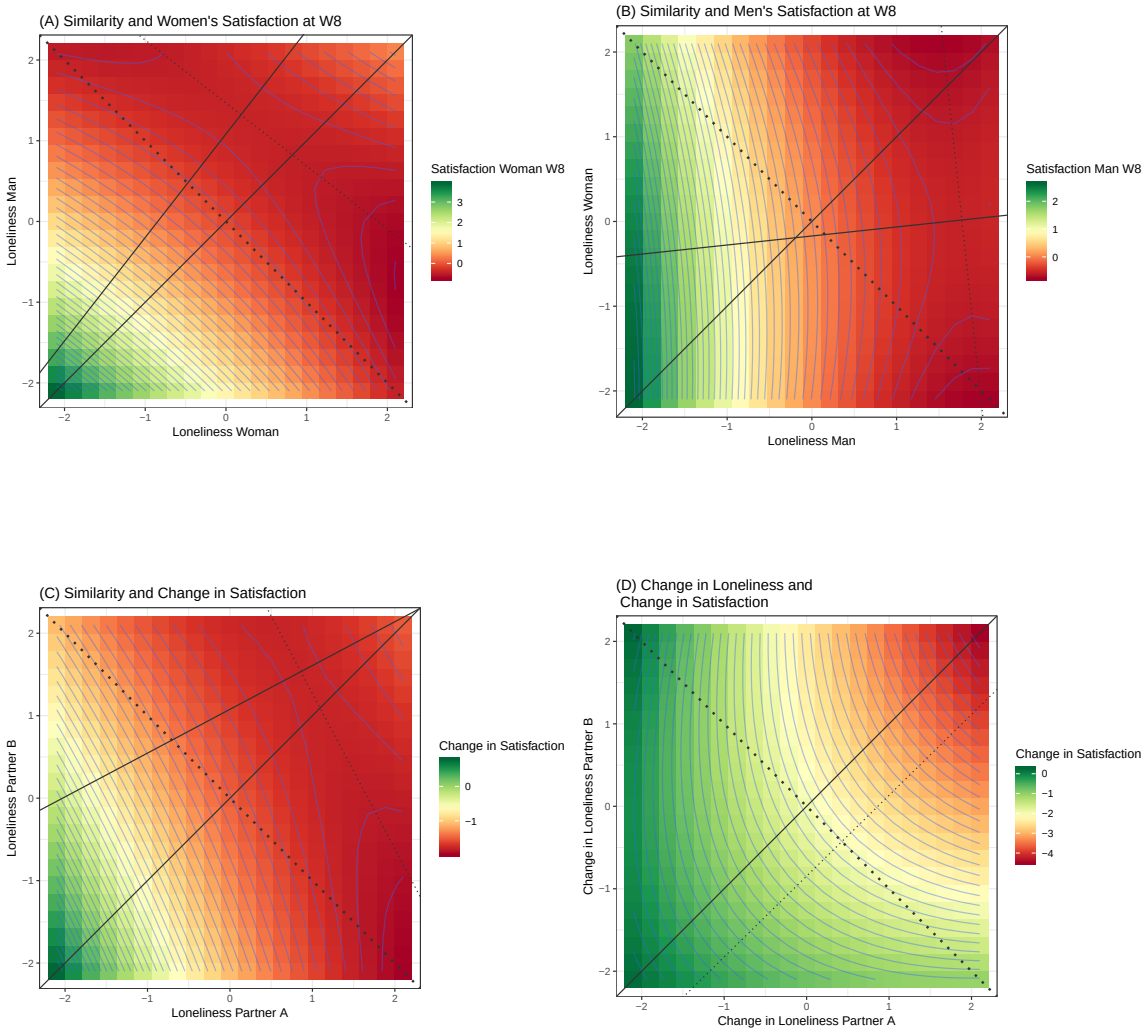

Figure S9. Contour plots. These plots are equivalent to those shown in Figure 5 of the main article but provide a 2-dimensional projection. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

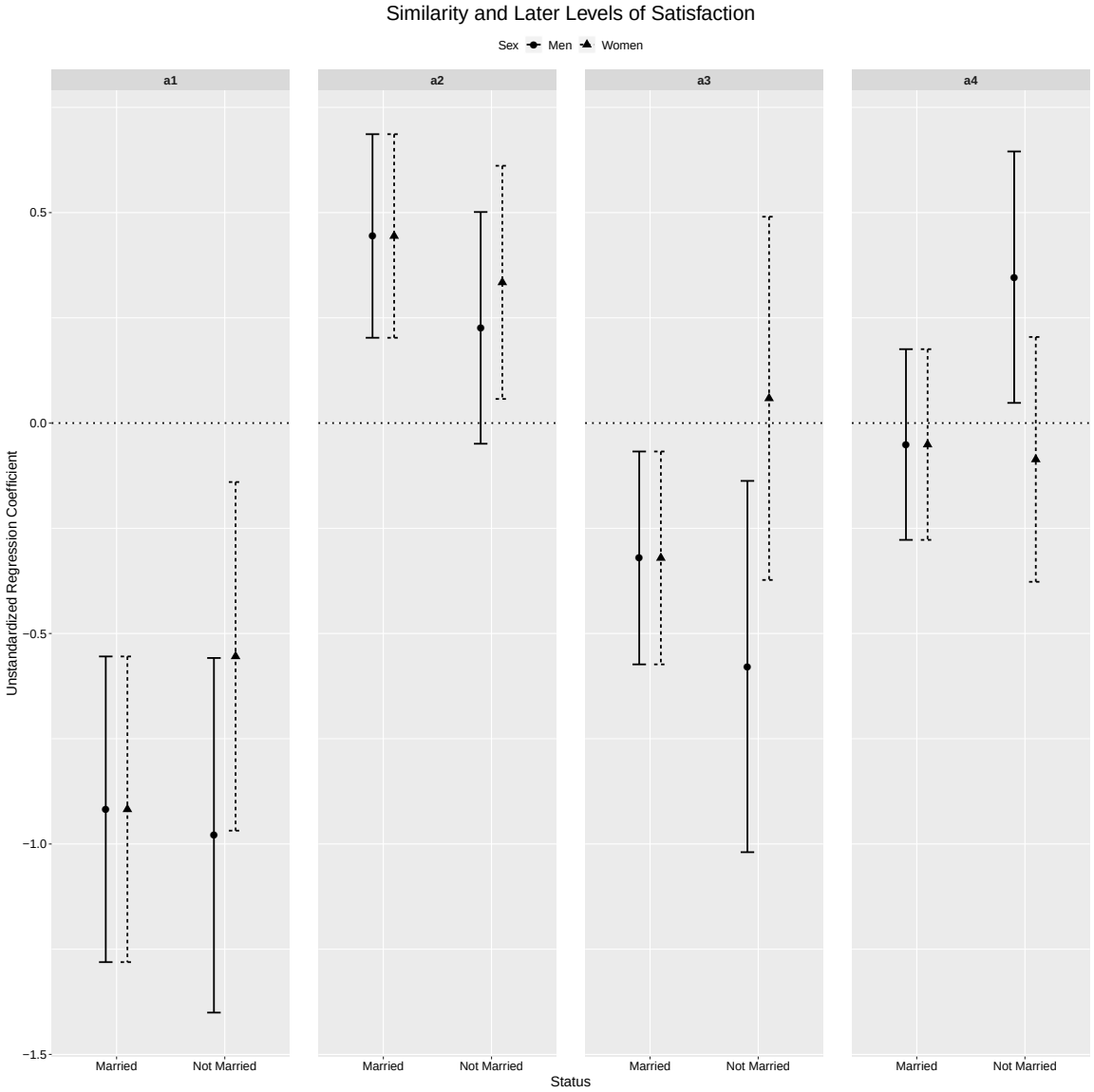

Figure S10. Results of DRSA analysed separately for married (n = 1394) and unmarried (n = 933) couples. The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

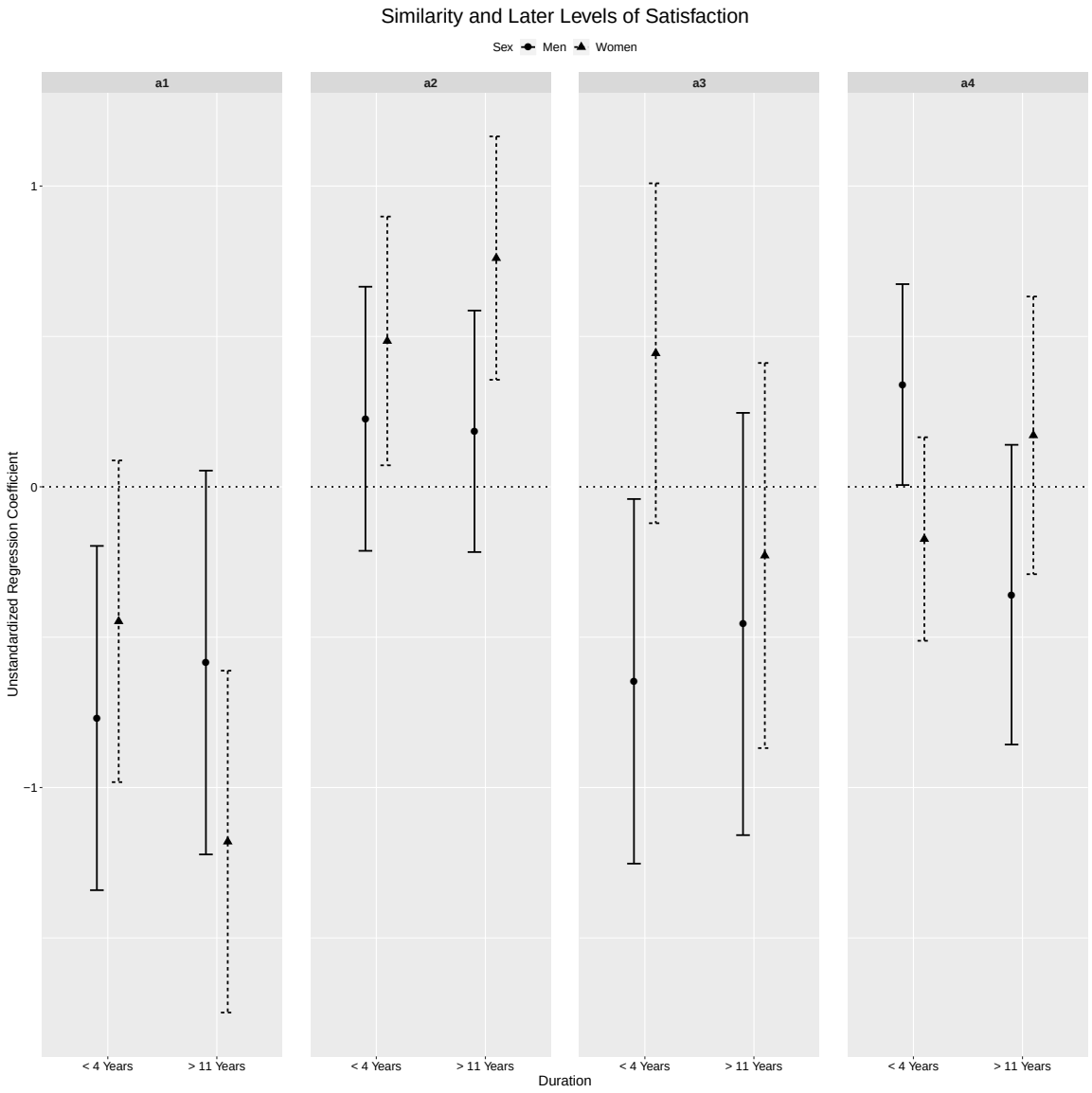

Figure S11. Results of DRSA analysed separately for couples being together for less than four years (n = 617 couples) and for more than eleven years (n = 649 couples). The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

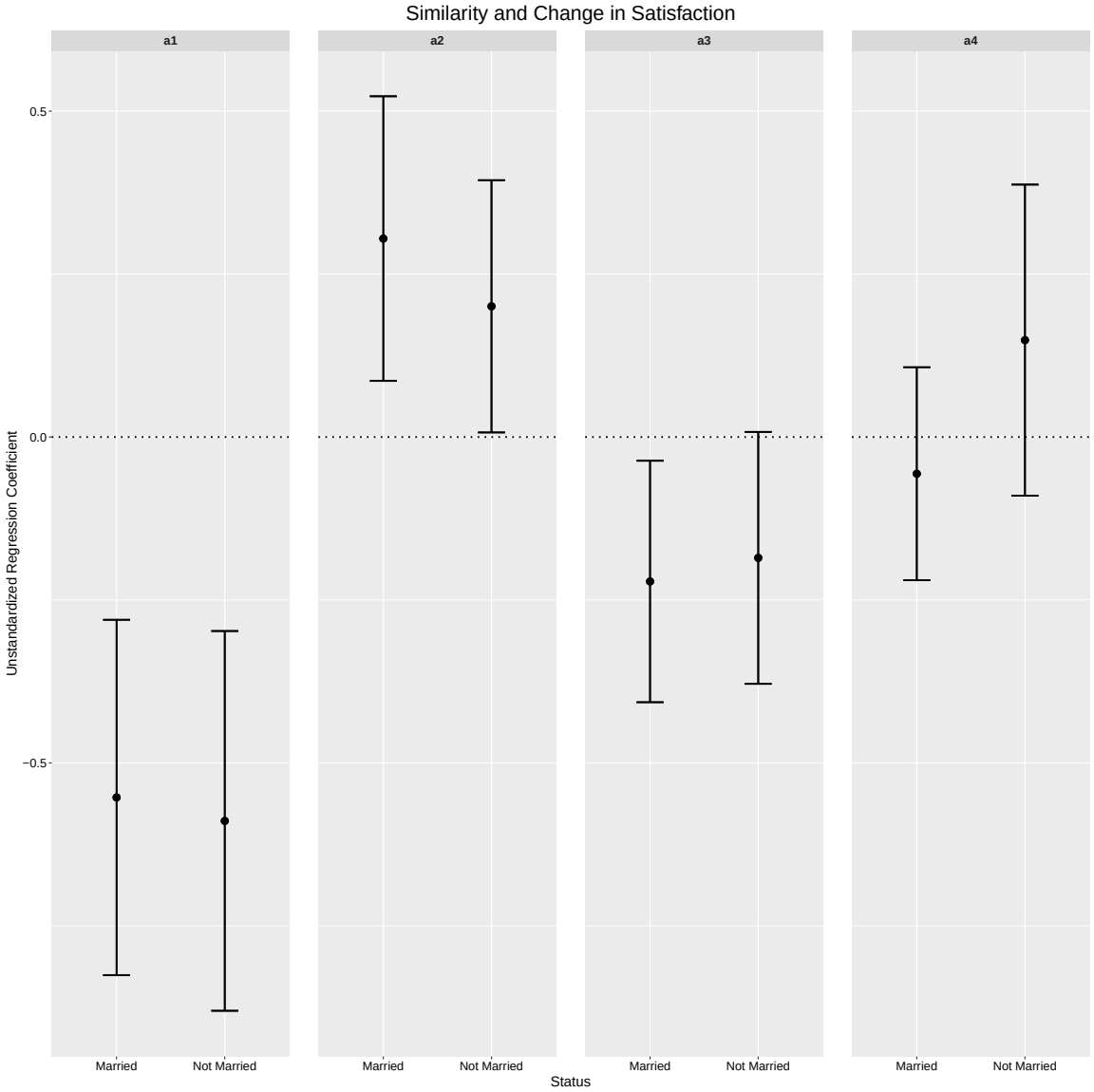

Figure S12. Results of DRSA analysed separately for married (n = 1394) and unmarried (n = 933) couples. The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

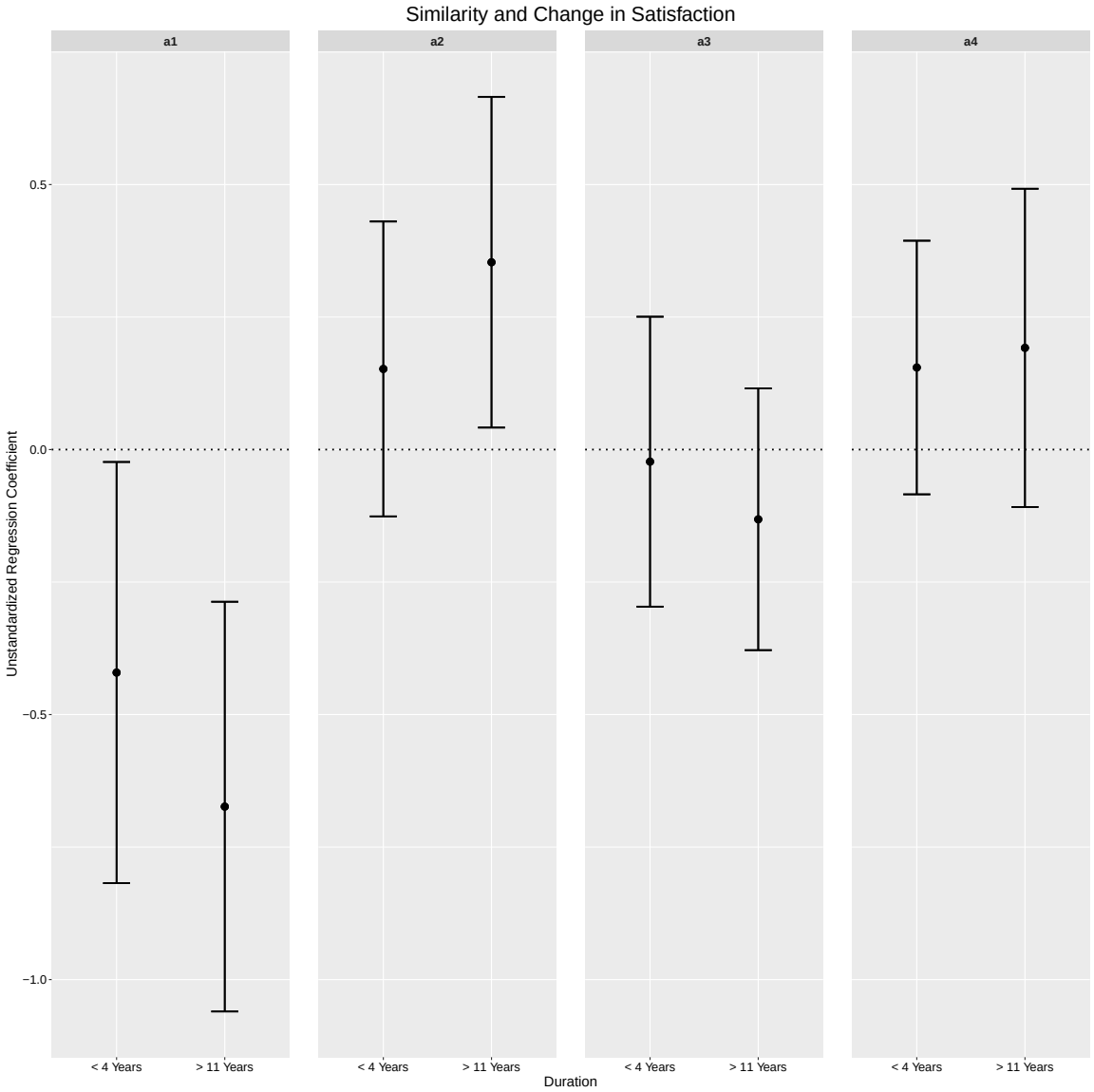

Figure S13. Results of DRSA analysed separately for couples being together for less than four years (n = 617 couples) and for more than eleven years (n = 649 couples). The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

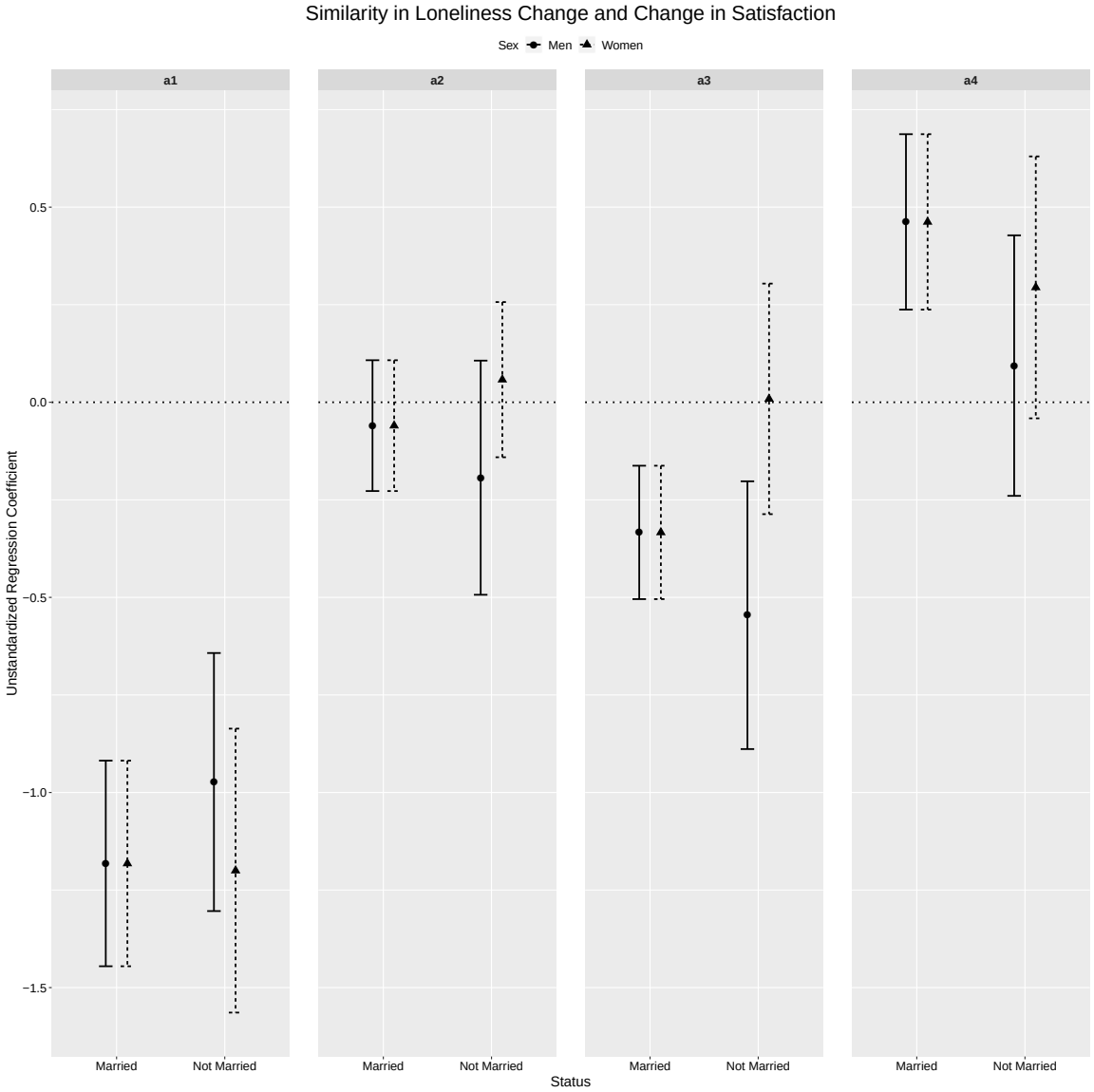

Figure S14. Results of DRSA analysed separately for married (n = 1394) and unmarried (n = 933) couples. The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.

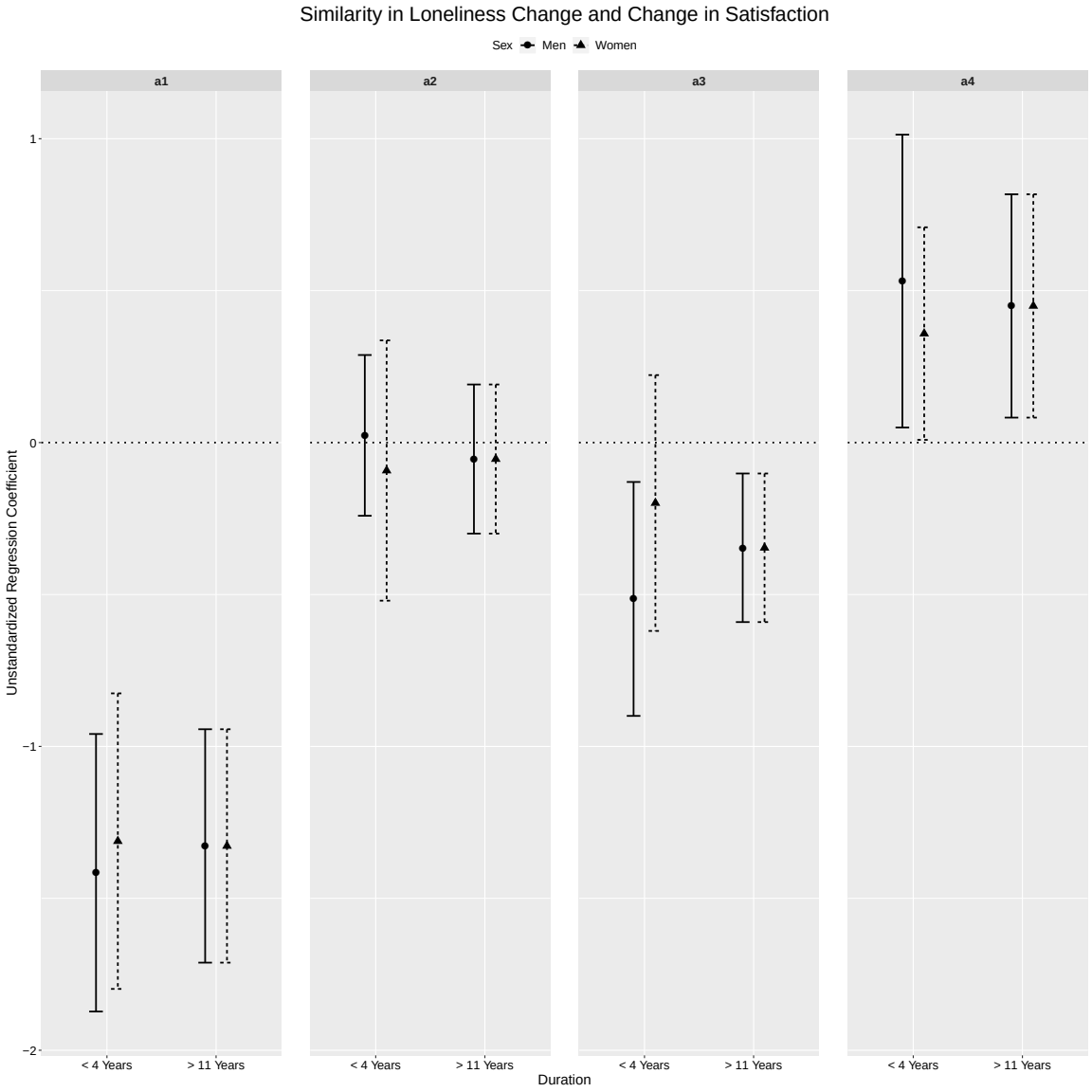

Figure S15. Results of DRSA analysed separately for couples being together for less than four years (n = 617 couples) and for more than eleven years (n = 649 couples). The error bars denote 95% confidence intervals. The figure is licenced under CC-BY 4.0 International and is available at https://osf.io/tjuay/.