A Well-Being Snapshot in a Changing World - Online Appendix

By Daniel J. Benjamin, Kristen B. Cooper, Ori Heffetz, and Miles Kimball

A1. Scale Frames

Here we outline our methodology for pooling data across our different scale-label schemes. We will refer to each scheme as a *scale frame*. Below is an example of a scale frame. Note the labels at 0 and 100 that say "the lowest you can imagine" and "the highest you can imagine", and at 25 and 75 that say "extremely low" and "extremely high."

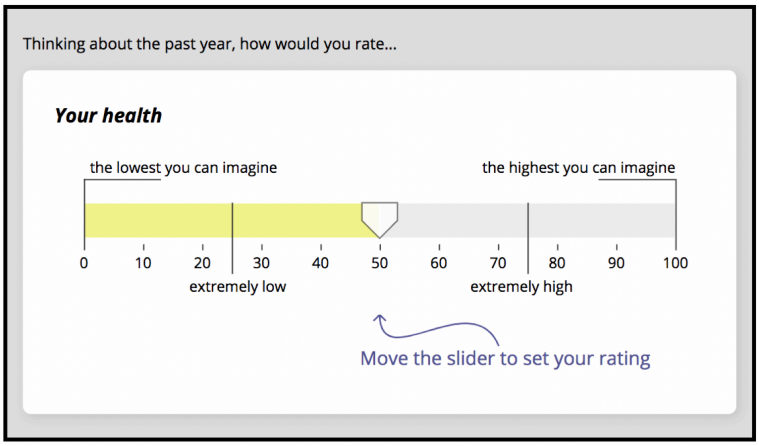

Figure A1. "Extreme" scale frame

Our dataset contains ratings from four scale frames. In addition to the "extreme" frame shown above, we collect data for: (1) an "extraordinary" scale frame with labels at 0 and 100 that say "lowest you can imagine" and "highest you can imagine", and at 25 and 75 that say "extraordinarily low" and "extraordinarily high"; (2) a "base year" scale frame with labels at 10 and 90 that say "lowest of anyone, anywhere on Earth" and "highest of anyone, anywhere on Earth"; and (3) an "endpoint-only" scale frame with labels at 0 and 100 that say "lowest you can imagine" and "highest you can imagine." To pool these ratings, we use the following methodology:

Let r_{ijf} be individual i's rating of aspect j using the scale frame f. For each aspect-frame pair, we calculate average ratings across individuals, μ_{jf}. We then choose one frame as a "reference" scale frame (f_{ref}). For the results in this paper, we use the "extreme" frame as the reference frame. Ratings for this scale frame are unaltered. To transform ratings for each alternate scale frame, f, we regress aspect averages for f_{ref} on aspect averages for f using the specification:

$$\mu_{jf_{\text{ref}}} = \beta_{0f} + \beta_{1f}\mu_{jf} + \epsilon_{jf}. \tag{A1}$$

Note that this specification allows responses to be shifted and stretched across scale frames; it assumes that responses in a given scale frame are, on average, a linear transformation of responses in another scale frame.

For each scale frame, we use the estimated coefficients to predict individual ratings as if they were in the reference scale frame. Specifically,

$$\hat{r}_{ijf_{\text{ref}}} = \hat{\beta}_{0f} + \hat{\beta}_{1f} r_{ijf}. \tag{A2}$$

We use (A2) to transform all individual ratings on frames other than the reference frame. We pool all values of $\hat{r}_{ijf_{\text{ref}}}$ and $r_{ijf_{\text{ref}}}$ to conduct our analysis.

A2. Regression specification

Here we outline our methodology for estimating differences in levels across demographic groups for different aspect themes, $\boldsymbol{s} = \{s_1, s_2, ...\}$.

Let r_{ij} be individual i's rating of aspect j. To avoid estimating possible interactions between aspect means and demographics, we demean all ratings at the aspect level. For a given theme, s, we limit our sample to obervations for which $j \in s$. The model is specified as follows:

$$r_{ij} - \mu_j = \beta_0 + \boldsymbol{\beta_X} \boldsymbol{X}_i + \epsilon_{ij}, \tag{A3}$$

for which

- μ_j is the rating average for aspect j across individuals
- $\boldsymbol{X}_i$ is a vector of demographic variables.

For the results reported here, $\boldsymbol{X}_i$ includes continuous variables for

- Age (demeaned, 1 unit = 10 years)
- Age^2 (demeaned, then squared, 1 unit = (10 years)^2)
- log(Income in \$)

and indicator variables for

- Male (omitted category: female)
- Having at least one child (omitted category: having no children)
- Unmarried, has romantic partner (omitted category: married)
- Unmarried, no romantic partner (omitted category: married)
- Completed high school or less (omitted category: bachelor's degree)
- Completed some years of college (omitted category: bachelor's degree)
- Completed a graduate degree (omitted category: bachelor's degree)
- Race = black (omitted category: white)
- Race = hispanic (omitted category: white)
- Race = asian (omitted category: white)
- Unemployed (omitted category: full-time employment)

- Reported "part time employee", "disabled", "homemaker", "student", "other", "declined" as employment status (omitted category: full-time employment)
- Reponse of "a little important", "pretty important", and "very important" to the question "How important is religion in your life?" (omitted category: responded "not important")
- Republican (omitted category: Democrat)
- Independent or reported "other" as political party affiliation (omitted category: Democrat)
- State of residence in the Mid-West (omitted category: South)
- State of residence in the North-East (omitted category: South)
- State of residence in the West (omitted category: South).

$\boldsymbol{X}_i$ also includes indicator variables for missing respondent data for each categorical variable (gender, marital status, education, race, religious importance, employment status, political affiliation, state of residence, and number of children). While these missing-data variables are included in the regression, we do not report their estimated coefficients as we are unable to interpret them. The number of respondents with missing data for each demographic variable is reported in online appendix table A1.

We use OLS regression to get estimates for the model specified in (A3). Standard errors are clustered by individual. We run the model seven times, once for each aspect theme. The estimates of interest, $\hat{\boldsymbol{\beta}}_{\boldsymbol{X}}$, are shown in the columns of table 1. To assess significance, we use a false discovery rate (FDR) threshold of 10% for the 147 estimates shown in table 1, calculated using the Benjamini and Hochberg (1995) algorithm (details in online appendix section A4).

A3. Interaction model specification

Here we outline our methodology for estimating differences in $\hat{\boldsymbol{\beta}}_{\boldsymbol{X}}$ across aspect themes. First, we denote one theme, s_{ref}, as the reference theme. Estimates for all other themes will be compared against estimates for this reference theme. For the results reported in online appendix table A3 (and to denote coefficients with a † in table A1), we chose Satisfaction as the reference theme. The other six themes are Affect, Growth, Autonomy, Job, Calmness, and Belonging.

Let r_{ij} be individual i's rating of aspect j. To avoid estimating possible interactions between aspect means and demographics, we demean all ratings at the aspect level. The model is specified as follows:

$$r_{ij} - \mu_j = \beta_0 + \boldsymbol{\beta}_{\boldsymbol{I}}\boldsymbol{I}_{sj} + \boldsymbol{\beta}_{\boldsymbol{X}}\boldsymbol{X}_i + \boldsymbol{\beta}_{\boldsymbol{IX}}(\boldsymbol{I}_{sj} \times \boldsymbol{X}_i) + \epsilon_{ij}, \tag{A4}$$

for which

- $\boldsymbol{I}_{sj}$ is a vector of indicator variables for if aspect j is in each theme in $\boldsymbol{s} = \{s_1, s_2, ...\}$, other than s_{ref}.

Other variables in (A4) are identical to those defined for (A3).

We use OLS regression to get estimates for the model specified in (A4). Standard errors are clustered by individual. Note that $\hat{\boldsymbol{\beta}}_{\boldsymbol{X}}$ can be interpreted as the relationship

between ratings on a 0–100 scale for aspects in the reference theme (Satisfaction) and the demographic variables in $\boldsymbol{X}_i$. These estimates are listed in online appendix table A3 under the first column, "Satisfaction." $\hat{\boldsymbol{\beta}}_{\boldsymbol{IX}}$ can be interpreted as how these relationships change for the other six themes. These estimates are reported in the six right-most columns of online appendix table A3. To assess significance, we use a false discovery rate (FDR) threshold of 10%, calculated using the Benjamini and Hochberg (1995) algorithm (details in online appendix section A4).

We use the same model to estimate differences in $\hat{\boldsymbol{\beta}}_{\boldsymbol{X}}$ for the Autonomy and Job themes. Specifically, the model is run with $\boldsymbol{s} = \{s_{\text{autonomy}}, s_{\text{job}}\}$ and $s_{\text{ref}} = s_{\text{autonomy}}$. Significant differences are denoted with a ‡ in table 1.

A4. Detailed methodology: false discovery rate control

Let N be the total number of hypotheses we test, R be the total number of hypotheses we declare as significant, and a be the number of hypotheses declared significant, but are actually null. Our approach to handling false positives is to bound the expected proportion of false positives, a/N, i.e., the false discovery rate (FDR). We first specify a false discovery rate threshold, q, that bounds our expected FDR. To test for significance, we employ Benjamini and Hochberg's (1995) algorithm. It is as follows:

1) Compute a p-value for each hypothesis $i = 1, 2, ..., N$.
2) Reindex the p-values from least to greatest: $p_1 \leq p_2 \leq p_3 \leq ... \leq p_N$.
3) Find the largest index, $i_{\max}$ such that $p_i \leq \frac{i}{N} q$.
4) Declare all hypotheses $i \leq i_{\max}$ as significant.

Table A1—Sample Demographics

		Frequency	Percent
Age	Under 18	0	0.0
(0 missing)	18-29	488	31.0
	30-39	543	34.5
	40-49	270	17.1
	50-59	162	10.3
	60-69	96	6.1
	70+	17	1.1
Gender	Female	919	58.3
(6 missing)	Male	651	41.3
Income	Less than $20,000	191	12.1
(0 missing)	$20,000 - $39,999	405	25.7
	$40,000 - $59,999	353	22.4
	$60,000 - $79,999	266	16.9
	$80,000 - $99,999	159	10.1
	$100,000 or more	202	12.8
Children	No children	810	51.4
(1 missing)	At least 1 child	765	48.5
Marital status	Married	688	43.7
(33 missing)	Unmarried, has partner	379	24.0
	Unmarried, no partner	476	30.2
Education	High school or less	158	10.0
(2 missing)	Some college	573	36.4
	Bachelor's degree	594	37.7
	Graduate degree	249	15.8
Race	White	1227	77.9
(49 missing/multiracial)	Black	121	7.7
	Hispanic	84	5.3
	Asian	95	6.0
Employment Status	Employed full-time	892	56.6
(0 missing)	Other employment status	577	36.6
	Unemployed	107	6.8
Religious Importance	Religion is important	912	57.9
(17 missing)	Religion is not important	647	41.1
Political Affiliation	Democrat	853	54.1
(41 missing)	Republican	466	29.6
	Independent	216	13.7
Region	South	556	35.3
(missing 78)	Mid-West	323	20.5
	North-East	266	16.9
	West	353	22.4

Note: Number of individuals: 1576. Race: "multiracial" coded as missing (42 respondents). Religious Importance: "a little important", "pretty important", and "very important" coded as "Religion is important." Employment Status: "disabled", "homemaker", "student", "other", "declined" coded as "other employment status." Political Affiliation: "other" coded as "independent" (30 respondents).

Table A2—Mean Ratings by Demographic Group and Aspect Theme

	Satisfaction	Affect	Growth	Autonomy	Job	Calmness	Belonging
Age							
18-29	58.8	56.1	60.6	61.6	57.6	57.0	56.0
30-39	60.5	58.1	61.5	62.4	58.1	59.2	56.7
40-49	59.6	58.1	60.7	63.2	59.8	57.6	57.5
50-59	61.5	61.3	60.1	61.4	59.6	59.1	60.1
60-69	64.8	64.6	63.0	65.2	59.7	61.9	61.2
70+	67.6	68.2	59.3	55.3	53.5	66.3	58.6
Gender							
Female	60.1	58.4	60.8	61.8	57.9	57.8	56.8
Male	61.2	59.1	61.4	63.5	59.6	59.9	58.3
Income							
Less than $20,000	56.7	57.3	59.2	60.1	55.3	57.1	54.0
$20,000 - $39,999	55.8	55.2	62.2	59.7	54.7	54.8	54.4
$40,000 - $59,999	57.4	56.3	60.8	59.8	56.2	55.8	54.6
$60,000 - $79,999	63.7	59.8	61.0	64.5	60.7	61.5	60.5
$80,000 - $99,999	66.9	64.3	58.9	65.7	62.7	62.0	61.5
$100,000 or more	68.3	63.8	62.3	68.3	66.5	65.1	63.1
Children							
No children	57.6	56.4	60.8	61.4	56.3	57.5	55.4
At least 1 child	63.2	60.7	61.3	63.3	60.8	59.7	59.4
Marital status							
Married	64.5	61.5	61.5	63.8	60.9	60.0	59.6
Unmarried, has partner	60.1	58.5	61.9	62.5	59.8	59.3	58.5
Unmarried, no partner	55.1	54.5	59.4	60.6	54.6	56.2	54.0
Education							
High school or less	59.5	58.1	64.7	63.7	57.4	57.3	59.2
Some college	59.7	57.8	60.0	61.4	57.9	58.4	56.8
Bachelor's degree	60.3	58.7	61.0	62.8	58.5	58.3	56.9
Graduate degree	62.3	59.6	61.0	62.6	60.6	60.3	58.3
Race							
White	60.5	58.7	60.9	62.7	58.4	58.8	57.7
Black	61.5	59.8	62.7	63.2	63.0	60.4	60.0
Hispanic	60.2	58.8	63.1	62.1	59.7	58.9	57.1
Asian	58.1	56.7	59.4	58.7	55.4	55.7	54.8
Employment Status							
Employed full-time	63.0	60.9	61.2	63.9	61.7	60.1	59.8
Other employment status	58.3	56.2	60.6	61.4	55.3	57.3	54.7
Unemployed	49.4	50.8	62.2	55.2	48.5	52.3	50.2
Religious Importance							
Religion is important	63.6	61.5	60.9	63.5	60.7	60.4	60.5
Religion is not important	56.0	54.4	61.3	60.8	55.5	56.1	53.0
Political Affiliation							
Democrat	58.7	57.7	60.9	61.1	57.6	57.5	56.8
Republican	63.7	61.0	60.5	63.6	60.6	60.3	59.6
Independent	60.5	56.8	61.2	64.9	58.3	58.6	54.6
Region							
South	61.0	59.3	62.1	63.2	59.9	59.9	58.0
Mid-West	60.0	59.0	60.7	63.1	57.2	58.8	57.9
North-East	60.9	57.9	60.8	62.6	60.6	58.0	57.9
West	60.2	57.7	59.6	62.2	57.3	57.3	56.8

Table A3—Self-Reported Ratings by Demographic Group and Aspect Theme

Aspect theme	Satisfaction	Affect	Growth	Autonomy	Job	Calmness	Belonging
	Baseline	Interactions					
Demeaned Age	−1.0	1.1*	1.7	1.0	0.7	0.9	1.0*
(in decades)	(0.8)	(0.4)	(0.8)	(0.6)	(0.5)	(0.4)	(0.4)
Demeaned-Age^2	1.5*	−0.2	−1.6*	−1.3*	−0.9*	−0.6*	−0.7*
	(0.4)	(0.2)	(0.4)	(0.3)	(0.3)	(0.2)	(0.2)
Male	0.4	−0.6	0.3	0.9	0.2	0.9	0.4
	(1.7)	(0.8)	(1.7)	(1.2)	(1.0)	(0.9)	(0.9)
Log (Income in $)	4.0*	−2.1*	−3.4*	−1.0	−0.5	−0.4	−0.9
	(1.2)	(0.6)	(1.2)	(0.8)	(0.7)	(0.7)	(0.7)
At least 1 child	0.7	−1.4	−0.9	−0.4	1.3	−1.0	−0.3
	(1.9)	(0.9)	(1.9)	(1.4)	(1.1)	(1.1)	(1.1)
Unmarried, has partner	−2.6	1.1	3.7	3.0	4.0*	3.4*	3.1*
	(2.3)	(0.9)	(2.2)	(1.4)	(1.2)	(1.1)	(1.1)
Unmarried, no partner	−6.3*	0.9	3.8	5.4*	4.2*	4.3*	3.6*
	(2.1)	(1.0)	(2.3)	(1.6)	(1.3)	(1.3)	(1.2)
High school or less	−0.7	0.1	4.6	1.6	0.5	−0.6	3.3
	(2.9)	(1.1)	(2.7)	(1.7)	(1.6)	(1.5)	(1.5)
Some college	0.4	−1.0	−1.3	−0.6	0.5	0.1	0.4
	(1.6)	(0.9)	(2.0)	(1.4)	(1.1)	(1.1)	(1.0)
Graduate Degree	−0.7	−0.7	0.8	0.2	1.0	0.9	−0.3
	(3.0)	(1.1)	(2.7)	(1.6)	(1.3)	(1.1)	(1.2)
Black	1.3	0.0	0.9	−0.6	3.0	0.8	0.2
	(2.4)	(2.0)	(2.4)	(2.0)	(1.8)	(1.5)	(1.5)
Hispanic	2.3	−0.3	−0.5	−2.5	0.3	−0.7	−1.2
	(3.6)	(1.3)	(3.8)	(1.9)	(1.5)	(2.0)	(2.0)
Asian	−3.1	1.7	2.8	−1.0	0.0	0.2	0.0
	(2.8)	(1.3)	(2.4)	(1.6)	(1.8)	(1.4)	(1.4)
Unemployed	−6.1	1.0	8.6*	2.6	−1.8	3.6*	1.7
	(3.3)	(2.1)	(3.0)	(2.9)	(1.9)	(1.5)	(2.3)
Other empl. status	−4.2*	−0.8	4.0	3.1*	−0.9	1.7	0.0
	(1.8)	(0.9)	(1.9)	(1.3)	(1.0)	(1.1)	(1.0)
Religion important	6.8*	−0.2	−7.2*	−4.6*	−2.4*	−2.7*	0.1
	(1.6)	(0.7)	(1.7)	(1.1)	(1.0)	(0.9)	(0.9)
Republican	0.8	−1.5	−1.0	−0.3	−0.8	−0.2	−1.7
	(1.9)	(0.8)	(1.8)	(1.2)	(1.0)	(0.9)	(1.0)
Independent	2.7	−2.1	−4.3	2.0	−1.3	−0.6	−3.7*
	(2.0)	(1.3)	(2.2)	(1.8)	(1.5)	(1.5)	(1.5)
Mid-West	−1.1	1.3	−1.0	0.4	−2.0	−0.6	0.9
	(1.8)	(1.0)	(2.0)	(1.6)	(1.3)	(1.2)	(1.1)
North-East	0.8	−1.9	−1.6	−0.7	0.3	−2.6	−0.6
	(2.0)	(1.0)	(1.9)	(1.5)	(1.3)	(1.2)	(1.3)
West	0.4	−1.3	−3.2	−0.9	−1.2	−2.3	−0.3
	(2.5)	(1.0)	(2.4)	(1.5)	(1.2)	(1.1)	(1.2)

Note: The table reports estimated coefficients from a single, stacked regression. The dependent variable is aspect rating, demeaned at the aspect level. The independent variables are the demographic variables from online appendix table 1; six indicators for membership in the aspect themes, with Satisfaction as the omitted theme; and a full set of interactions between the demographic variables and the six theme indicators. The first column reports the estimated coefficients on the demographic variables, which capture differences across demographic groups in mean ratings for aspects in the baseline (i.e., omitted) theme, Satisfaction. The other columns report the coefficients on the demographic-by-theme interactions, which capture the differences across demographic groups between mean ratings for aspects in a given theme relative to mean ratings for aspects in the Satisfaction theme. SEs are clustered by respondent. *Significant using a false discovery rate of 10%. Number of observations: 35,470 (1576 individuals). Separate "Missing" categories (not shown) are used for each categorical variable. Omitted categories: Female, No children, Married, Bachelor's degree, White, Employed full-time, Religion not important, Democrat, and South.