Additional analyses relating to:

Boyce, C. J., Brown, G. D. A., & Moore, S. C. (2010). Money and happiness: Rank of income, not income, affects life satisfaction, *Psychological Science.*

This note describes, for the sake of completeness, some additional analyses to follow up those reported in the above-referenced paper. The key conclusion of the paper, which included a longitudinal analysis, was that rank of income, not absolute income, affects life satisfaction. Here we show that the conclusion remains under a variety of additional analytic assumptions.

Below we present alternative analyses that account for possible additional clustering in the data (86,679 observations) at the individual as well as the group level (individuals were tested on more than one occasion, which enabled the fixed effects [longitudinal] analysis reported in the paper).

A pooled OLS model with clustering at both individual and group levels

In Table 1 below, which shows comparison of the explanatory effect of income rank and absolute income on life satisfaction, we cluster only at the individual level since there are no group level variables. Rank of income dominates absolute income, with the latter having no independent effect. In Table 2, which shows the explanatory effect of income rank and various reference group incomes on life satisfaction, we cluster at both the individual and group levels. With the standard errors adjusted to account for possible additional clustering, the t-statistics change. This analysis again favours the rank hypothesis over the absolute income hypothesis, with the latter having no independent effect, although for the age-defined reference groups an independent effect of reference group income also emerges. This was not seen in the analyses that used regionally defined or age/gender defined reference groups.

A hierarchical model that accounts for the multilevel structure of the data

In Table 3, which shows the explanatory effect of income rank and absolute income on life satisfaction, we use a hierarchical model to accommodate the fact that individuals generate multiple observations. Again rank dominates. In Table 4, which shows the explanatory effect of income rank and various reference group incomes on life satisfaction, we again use a hierarchical model to represent the fact that individuals generate multiple observations and are also within the same groups. We observe that although rank is significant in all of the regressions, and absolute income has no independent effect when rank is included, when gender/education reference groups are considered the mean reference group income also has an effect. This may be attributable to lack of control for education and gender in this model.

A fixed effect model that controls for unobserved individual heterogeneity

In Table 5, which shows the explanatory effect of income rank and absolute income on life satisfaction, the results of the fixed effect analysis confirm that the within-individual variation in income rank provides a superior explanation of the within-individual variation of life satisfaction. In Table 6, which shows the explanatory effect of income rank and various reference group incomes on life satisfaction, there is also evidence that income rank, not absolute income matters even in this highly conservative analysis.

Table 2: Results of Pooled OLS regression analyses that compared the logarithm of mean income and income rank according to various reference groups as predictors of life satisfaction

	Dependent Variable: Life Satisfaction (standardized)								
Reference Group:	Region			Gender and Education			Age		
Independent Variables:	1	2	3	4	5	6	7	8	9
Log(Household Income[b])	-0.004	0.101	-0.004	-0.007	0.101	-0.007	0.003	0.103	0.013
	(0.32)	(13.42)**	(0.33)	(0.56)	(13.41)**	(0.55)	(0.20)	(15.06)**	(1.05)
Income Rank[a]	0.294		0.294	0.289		0.289	0.270		0.244
	(8.39)**		(8.37)**	(8.93)**		(8.92)**	(8.62)**		(7.68)**
Log(Mean Reference Group Income[b])		-0.050	0.011		-0.213	-0.130		-0.365	-0.263
		(0.52)	(0.12)		(0.93)	(0.57)		(5.22)**	(3.70)**
Observations	86679	86679	86679	86679	86679	86679	86679	86679	86679
R-Squared	0.0838	0.0826	0.0838	0.0839	0.0826	0.0839	0.0838	0.0831	0.0840

Absolute value of t-statistics in parentheses (standard errors were adjusted to account for clustering at both the individual and group levels).

* significant at 5% level; ** significant at 1% level

All analyses included demographic controls: age, gender, education, marital status, children, housing ownership, labor force status and disabilities, and dummy variables identifying both region and wave. In all cases, these variables accounted for significant variation in life satisfaction.

a. Based on the individual's household income adjusted for household size and deflated by regional living costs

b. Adjusted for household size and deflated by regional living costs

Table 3: Results of hierarchical regression analyses that compared the logarithm of absolute income and income rank by sample as predictors of life satisfaction

	Dependent Variable: Life Satisfaction (standardized)		
Independent Variables:	1	2	3
Income Rank[a]	0.186		0.182
	(13.17)**		(6.94)**
Log(Household Income[b])		0.059	0.002
		(11.18)**	(0.19)
Log-Likelihood	-106153	-106177	-106153
Observations	86679	86679	86679

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

All analyses included demographic controls: age, gender, education, marital status, children, housing ownership, labor force status and disabilities, and dummy variables identifying both region and wave. In all cases, these variables accounted for significant variation in life satisfaction.

a. Based on the individual's household income adjusted for household size and deflated by regional living costs

b. Adjusted for household size and deflated by regional living costs

Table 4: Results of hierarchical regression analyses that compared the logarithm of mean income and income rank according to various reference groups as predictors of life satisfaction

	Dependent Variable: Life Satisfaction (standardized)								
Reference Group:	Region			Gender and Education			Age		
Independent Variables:	1	2	3	4	5	6	7	8	9
Log(Household Income[b])	0.005	0.061	0.006	0.013	0.059	0.001	0.003	0.071	0.004
	(0.50)	(11.38)**	(0.60)	(1.49)	(11.03)**	(0.14)	(0.33)	(13.13)**	(0.44)
Income Rank[a]	0.175		0.173	0.203		0.174	0.205		0.202
	(6.88)**		(6.75)**	(9.13)**		(7.35)**	(8.35)**		(8.19)**
Log(Mean Reference Group Income[b])		-0.121	-0.083		-0.224	-0.163		-0.207	-0.126
		(1.93)	(1.33)		(7.91)**	(5.52)**		(2.23)**	(1.35)
Observations	86679	86679	86679	86679	86679	86679	86679	86679	86679
Log-Likelihood	-106300	-106322	-106299	-106488	-106502	-106475	-109606	-109639	-109605

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

All analyses included demographic controls: age, marital status, children, housing ownership, labor force status and disabilities. Additionally, dummy variables identifying wave, education and gender were included in the analyses relating to regional and age reference groups. Dummy variables identifying region were included only in analyses relating to gender/education and age reference groups. In all cases, these variables accounted for significant variation in life satisfaction. gender, education

a. Based on the individual's household income adjusted for household size and deflated by regional living costs

b. Adjusted for household size and deflated by regional living costs

Table 5: Results of fixed effect regression analyses that compared the logarithm of absolute income and income rank by sample as predictors of life satisfaction

	Dependent Variable: Life Satisfaction (standardized)		
Independent Variables:	1	2	3
Income Rank[a]	0.096		0.059
	(5.78)**		(2.02)**
Log(Household Income[b])		0.033	0.016
		(5.63)**	(1.55)
R-Squared (within)	0.0103	0.0103	0.0104
Observations	86679	86679	86679

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

All analyses included demographic controls: age, gender, education, marital status, children, housing ownership, labor force status and disabilities, and dummy variables identifying both region and wave. In all cases, these variables accounted for significant variation in life satisfaction.

a. Based on the individual's household income adjusted for household size and deflated by regional living costs

b. Adjusted for household size and deflated by regional living costs

Table 6: Results of fixed effect regression analyses that compared the logarithm of mean income and income rank according to various reference groups as predictors of life satisfaction

	Dependent Variable: Life Satisfaction (standardized)								
Reference Group:	Region			Gender and Education			Age		
Independent Variables:	1	2	3	4	5	6	7	8	9
Log(Household Income[b])	0.018	0.034	0.019	0.017	0.034	0.018	0.016	0.034	0.018
	(1.80)	(5.64)**	(1.83)	(1.71)	(5.65)**	(1.77)	(1.63)	(5.69)**	(1.77)
Income Rank[a]	0.052		0.051	0.055		0.053	0.058		0.054
	(1.84)		(1.80)	(2.08)*		(2.03)*	(2.21)*		(2.00)*
Log(Mean Reference Group Income[b])		-0.050	-0.040		-0.324	-0.310		-0.080	-0.059
		(0.64)	(0.51)		(1.63)	(1.55)		(1.35)	(0.98)
Observations	86679	86679	86679	86679	86679	86679	86679	86679	86679
R-Squared (within)	0.0104	0.0103	0.0104	0.0104	0.0103	0.0104	0.0104	0.0103	0.0104

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

All analyses included demographic controls: age, gender, education, marital status, children, housing ownership, labor force status and disabilities, and dummy variables identifying both region and wave. In all cases, these variables accounted for significant variation in life satisfaction.

a. Based on the individual's household income adjusted for household size and deflated by regional living costs

b. Adjusted for household size and deflated by regional living costs