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Money, Well-Being, and Loss Aversion: Does an Income Loss Have a Greater Effect on Well-Being Than an Equivalent Income Gain?

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Abstract
Higher income is associated with greater well-being, but do income gains and losses affect well-being differently? Loss aversion, whereby losses loom larger than gains, is typically examined in relation to decisions about anticipated outcomes. Here, using subjective-well-being data from Germany ($N = 28,723$) and the United Kingdom ($N = 20,570$), we found that losses in income have a larger effect on well-being than equivalent income gains and that this effect is not explained by diminishing marginal benefits of income to well-being. Our findings show that loss aversion applies to experienced losses, challenging suggestions that loss aversion is only an affective-forecasting error. By failing to account for loss aversion, longitudinal studies of the relationship between income and well-being may have overestimated the positive effect of income on well-being. Moreover, societal well-being might best be served by small and stable income increases, even if such stability impairs long-term income growth.

A large amount of prior research shows that higher income is associated with greater life satisfaction (Easterlin, 1973, 1995) and lower levels of psychopathology (e.g., Wood, Boyce, Moore, & Brown, 2012). However, previous studies have tended to treat increases in income as if they had as large an impact on well-being as do equivalent losses. In the present study, we tested for the first time, in two nationally representative samples from Germany and the United Kingdom, whether decreases in income have a disproportionately negative effect on well-being as indexed by life satisfaction and general psychological disorder.

Loss aversion is one of the most familiar biases in information processing. It represents the idea that "losses loom larger than gains" (Kahneman & Tversky, 1979, p. 279), so that anticipated losses have a greater influence on choice and predicted feelings about an outcome than

anticipated gains of the same magnitude. The concept was originally motivated by the study of choice under uncertainty (Kahneman & Tversky, 1979), but it has since been shown to be applicable across a range of real-world contexts (Camerer, 2000). Understanding the role of loss aversion in the relationship between income and subjective well-being (SWB) has theoretical and practical import.

It has been theorized that loss aversion is a decision-based error, such that when actual losses take place, they have no greater effect than equivalent gains (Rick, 2011); accordingly, different regions of the brain have

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been implicated in reward anticipation and outcomes (Knutson, Fong, Adams, Varner, & Hommer, 2001). An established argument is that people are subject to *affective-forecasting errors*, in which they overestimate the intensity of the negative feelings they expect to experience when suffering a loss. Consistent with this argument, loss aversion may not be detected for losses actually experienced rather than merely anticipated (Gilbert, Morewedge, Risen, & Wilson, 2004; Kermer, Driver-Linn, Wilson, & Gilbert, 2006). In intuitive terms, people underestimate how well they will be able to rationalize, explain away, or simply not think about a loss after it has been experienced.

Our key aim in the present study, therefore, was to establish whether loss aversion applies to actual losses and gains, as opposed to anticipated losses and gains, by examining whether the relationship between changes in income and changes in well-being differs according to whether the change in income was a loss or a gain. Some loss aversion may be apparent because higher incomes bring diminishing benefits to well-being (i.e., the same income increase will provide less benefit to people with higher incomes than to people with lower incomes). However, we examined effects of changes in log-transformed income rather than in untransformed income. Any gain/loss asymmetry attributable to diminishing benefits of untransformed income will be removed by the logarithmic transformation (Stevenson & Wolfers, 2008), so that any remaining effects reflect pure loss aversion.

In studies of how changes in income relate to changes in SWB, researchers typically do not consider the possibility that the relationship may be influenced differently by losses and gains (e.g., Ferrer-i-Carbonell & Frijters, 2004; Frijters, Haisken-DeNew, & Shields, 2004; Layard, Nickell, & Mayraz, 2008). Under experimental conditions, a loss is typically estimated to have twice as much influence on decisions as an equivalent gain (Novemsky & Kahneman, 2005). For example, applying this estimate to realized income changes, a drop in income from $50,000 to $45,000 would reduce well-being by approximately twice as much as an increase in income from $45,000 to $50,000 would increase it. Thus, longitudinal studies that fail to account for loss aversion may overestimate the positive effects of income on SWB, and such failure could carry important policy implications regarding raising individual and national income and well-being.

Two previous studies have explored loss aversion by using SWB data, though neither provided a complete and clear test. Vendrik and Woltjer (2007) examined loss aversion in the context of relative income. They focused on the extent to which a person's income deviates from the average income of similar others, showing that life satisfaction is more greatly influenced when an income is below, rather than above, the average income of similar

people. Although their work is an important contribution to the literature on relative income, they did not assess income changes. Di Tella, Haisken-De New, and Mac-Culloch (2010) did consider income losses and gains from one year to the next; however, they assessed loss aversion with respect to anticipated income changes. That is, they considered whether expected future income increases and decreases differentially relate to current life satisfaction. Although they found significant differences, such a test does not help establish whether loss aversion relates to the actual experience of a loss or is merely an affective-forecasting error.

Method

Participants

German Socio-Economic Panel (GSOEP). Our first sample consisted of participants from the GSOEP, a longitudinal study of German households. The data set, begun in 1984 in what was West Germany, has since been expanded to include what was East Germany to maintain a representative sample of the entire German population (see Haisken-DeNew & Frick, 2005). We used data from nine waves of the GSOEP from 2001 to 2009, calculating income changes for each year after 2001 using the difference in income between the current year and the previous year. This data set included 163,000 observations from 28,723 participants (52% female, 48% male; age range = 19–100 years, M = 48.88, SD = 16.99) for whom household income and life-satisfaction scores were available for 2 consecutive years.

British Household Panel Survey (BHPS). Our second sample consisted of participants from the BHPS, a longitudinal study of British households. Data collection for this sample began in 1991 and has since expanded the sample sizes from Scotland, Wales, and Northern Ireland by adding more participants from those areas (see Taylor, Brice, Buck, & Prentice-Lane, 2010). We used data from 10 waves of the BHPS from 1998 to 2007, calculating income changes for each year after 2001 using the difference in income between the current year and the previous year. This data set included 119,079 observations from 20,570 participants (55% female, 45% male; age range = 18–100 years, M = 47.84, SD = 17.45) for whom household income and general-psychological-disorder scores were available for 2 consecutive years.

Measures

Life satisfaction. Life satisfaction was measured each year in the GSOEP using a one-item scale. Participants responded to the question "How satisfied are you with

your life, all things considered?" on an 11-point scale ranging from 0 (*totally unhappy*) to 10 (*totally happy*). Participants' scores ($M = 6.92$, $SD = 1.77$) were standardized ($M = 0$, $SD = 1$) across the entire sample for ease of comparison with general-psychological-disorder scores. Single-item scales, although typical for large data sets, may result in an underestimation of true effect sizes. Lucas and Donnellan (2007), however, show that the reliability of the life-satisfaction measure in the GSOEP is at least .67.

General psychological disorder. General psychological disorder was measured in the BHPS using the 12-item version of the General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988). Respondents answered items in the GHQ-12 (e.g., "thinking of self as worthless," "feeling unhappy and depressed") with 1 if they believed the symptom was present and 0 if not present. Overall scores ranged from 0 to 12. We used the GHQ-12 as a continuous measure of general psychological disorder (Bowling, 2001; Goldberg & Williams, 1988). Higher scores represent worsening distress. Participants' scores ($M = 1.88$, $SD = 3.02$) were standardized ($M = 0$, $SD = 1$) across the entire sample for ease of comparison with life-satisfaction scores.

Household income. The principal predictor variable in our analysis was the participant's household income. In the GSOEP, this was reported as the net monthly income (in euros) of a participant's household. In the BHPS, this was reported as the gross yearly income (in pounds sterling) of a participant's household. So that our income

variable more accurately captured individual spending power, we deflated household income by the yearly price level (2005 = 1). We also deflated by the size of the participant's household, using the Organization for Economic Cooperation and Development's equivalence scale, given by 1 + (number of adults – 1) × 0.6 + number of children × 0.4. To account for the diminishing marginal benefits of having a higher income, we calculated the natural logarithm of this variable.

Demographic characteristics. We controlled for a number of other variables that might confound the correlation between changes in well-being and changes in household income, including change in employment status, formation or dissolution of the participant's household, and change in health. These sociodemographic factors were included in the analyses as control variables (see Table 1).

Analytic strategy

To understand how income changes relate to changes in well-being, we predicted SWB (life satisfaction in the GSOEP, psychological disorder in the BHPS) in a particular year, T (SWB_T), after controlling for SWB in the previous year (SWB_{T-1}). Our estimation therefore reflected residualized changes in well-being and avoided issues surrounding regression to the mean (Allison, 1990). Our main independent variable was the change in the logarithm of a participant's household income from the previous year ($\log Y_T - \log Y_{T-1} = \Delta \log Y_T$). To discern whether there were differences between losses and gains in

Table 1. Results of Multilevel Regressions Showing the Effects of Income Changes on Life Satisfaction in the German Socio-Economic Panel ($N = 163{,}000$) and on General Psychological Disorder in the British Household Panel Survey ($N = 110{,}079$)

Predictor	Regression 1		Regression 2		Regression 3		Regression 4	
	b	SE	b	SE	b	SE	b	SE
Subjective well-being at $T-1$ (β_1)	0.282	0.003**	0.227	0.003**	0.227	0.004**	0.219	0.004**
Change in log-transformed income from $T-1$ to T (β_2)	0.049	0.013**	0.053	0.012**	0.023	0.008**	0.014	0.008
Income-loss dummy (β_3)	–0.019	0.005**	–0.014	0.005**	0.006	0.006	0.001	0.006
Negative change in log-transformed income from $T-1$ to T (β_4)	0.081	0.019**	0.045	0.018*	–0.073	0.012**	–0.045	0.012**

Note: T = a particular year; $T-1$ = the year before T. Regressions 1 and 2 used the life-satisfaction variable from the German Socio-Economic Panel (GSOEP), and Regressions 3 and 4 used the General Health Questionnaire (12-item scale) from the British Household Panel Survey (BHPS). Both measures of well-being were standardized ($M = 0$, $SD = 1$) across the respective samples. No additional controls were included in Regressions 1 and 3. Regressions 2 and 4 included the following control variables: year dummy variables, age, gender, current education level (number of years in GSOEP, highest academic qualification in BHPS), current marital status, square root of current household size, current health, whether there were children present in the household, current disability status, current employment status, and changes from one year to the next (i.e., $T-1$ to T) in education level, marital status, the square root of household size, health (health satisfaction in GSOEP, subjective health status in BHPS), parental status, disability status, and employment status. We recoded any missing values for the control variables with sample-wide averages and included a dummy variable to indicate that a variable with a previously missing value had been recoded in this way.
*$p < .05$. **$p < .01$.

income, we constructed a dummy variable to indicate that the change in income was due to a loss (L_T). We constructed an interaction of this loss dummy with the change-in-income variable ($\Delta \log Y_T \times L_T$). Our regression model was as follows:

$$SWB_T = \beta_0 + \beta_1 SWB_{T-1} + \beta_2 \Delta \log Y_T + \beta_3 L_T + \beta_4 L_T \times \Delta \log Y_T + \ldots + \varepsilon,$$

where $\Delta \log Y_T = \log Y_T - \log Y_{T-1}$; $L_T = 1$ if $Y_T < Y_{T-1}$, otherwise $L_T = 0$.

We first estimated this model without incorporating loss aversion ($\beta_3 = \beta_4 = 0$). Next, we modeled loss aversion by allowing the intercept (β_3) and slope (β_4) coefficients to differ according to whether people experienced reductions or gains in income over the previous year. A β_3 value significantly different from zero would suggest that the change in well-being experienced by people who lose income, regardless of magnitude, is different from that for people who gain income or have no change in income. A β_4 value significantly different from zero would indicate slope differences between losses and gains, which would imply that equivalent increases and decreases in log-transformed income influence well-being differently. The equation was first estimated with no controls and then with controls. Because people were observed at multiple times, we performed multilevel regressions.

Results

We began our multilevel analysis by estimating the effect of changes to income on residualized life satisfaction in the GSOEP. First, we established a basic relationship without accounting for any differential effects between gains and losses. We found a positive relation between changes in income and changes in life satisfaction (with controls: $b = 0.09$, $p < .01$; without controls: $b = 0.11$, $p < .01$), such that, after controlling for correlated factors, we found that a 1-unit rise in log-transformed income (income becoming about 2.7 times larger) was accompanied by a 0.09-*SD* rise in life satisfaction; by assumption, a 1-unit decrease in log-transformed income was accompanied by a 0.09-*SD* decrease in life satisfaction.

Next, we differentiated between income changes that took place as a result of a loss and those that took place as a result of a gain (Table 1). Regression 1 showed that losses and gains had differential effects on life satisfaction and that both the intercept and the slope coefficients differed between losses and gains. The coefficients in Regression 1 suggest that experiencing a loss of any size resulted in a drop in life satisfaction of 0.02 *SD* (β_3). The magnitude of the loss was also important. Overall, a 1-unit increase in log-transformed income was accompanied by a 0.05-*SD* rise in life satisfaction (β_2), whereas a
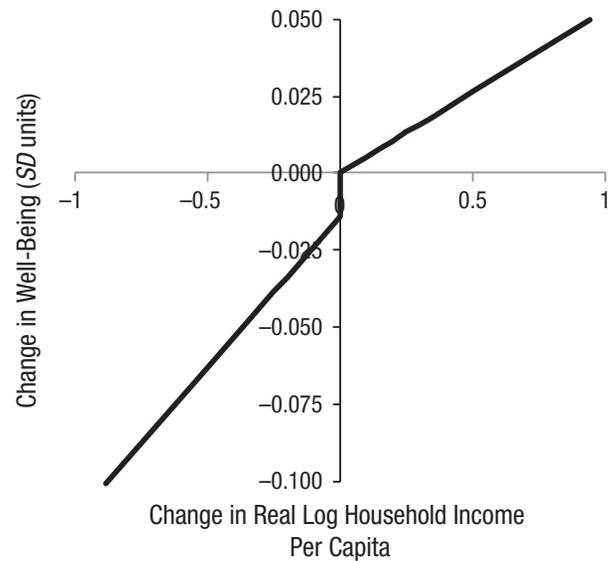
Fig. 1. Mean change in life satisfaction as a function of change in real log-transformed income per capita. The results from this regression are based on data from the German Socio-Economic Panel (Table 1, Regression 2).

corresponding loss in log-transformed income resulted in a 0.13-*SD* reduction in life satisfaction ($\beta_2 + \beta_3 + \beta_4$). The coefficients from Regression 2, which account for a full set of controls for confounding factors, also support loss aversion. They suggest that a 1-unit rise in log-transformed income was accompanied by a life-satisfaction increase of 0.05 *SD* (β_2), whereas an equivalent income reduction was accompanied by a life-satisfaction reduction of 0.11 *SD* ($\beta_2 + \beta_3 + \beta_4$). At this level of income change, the ratio of the positive and negative effects was approximately 2, which matches estimates of the anticipated loss-aversion effect found under experimental conditions (Novemsky & Kahneman, 2005). We used the results from Regression 2 to trace out an implied functional relationship between change in income and change in well-being (Fig. 1).

We then performed the same analyses for the BHPS data using the GHQ-12. The results were even more striking. When we did not account for any differential effect of gains and losses, the result was a marginal relationship in which higher income was associated with lower psychological disorder ($b = -0.01$, $p < .01$), but this relationship was statistically nonsignificant when controls were added to the model ($b = -0.01$, $p > .05$). However, income gains and losses were differentially associated with changes in psychological disorder (Regressions 3 and 4). The results of Regression 4, which included controls, suggest that income gains were not significantly positively associated with improved psychological disorder, but a 1-unit reduction in log-transformed income was associated with a significant 0.03-*SD* rise in psychological disorder ($\beta_2 + \beta_3 + \beta_4$).

Discussion

In the present study, we found evidence for loss aversion using two different measures of well-being[1] from two nationally representative longitudinal data sets. The results provide robust real-world evidence that loss aversion characterizes experienced losses, and the observed magnitude of loss aversion is generally consistent with previous observations in a wide range of domains (Novemsky & Kahneman, 2005).

Our results suggest caution in the interpretation of previous studies that have examined the impact of changes in income on changes in well-being. Previous research has been interpreted as showing the size of the relationship between income increases and well-being. However, if loss aversion is not accounted for, the apparent effect of income increases on well-being may be inflated by the greater effect of income losses. Our results suggest that increases in income may have a much lower effect on well-being than equal decreases in income, and treating them in the same way would lead to misspecification.

Social scientists have long been interested in why improvements to national well-being have not always accompanied economic growth (Easterlin, 2010). Loss aversion may provide part of the explanation. Lucas (2003) argued that removing all fluctuations of consumption in the economy would benefit well-being only as much as would an increase in consumption of 1/20 of 1%. However, if reductions in consumption are more detrimental to well-being than increases are positive, then the benefits of large national income increases may be wiped out by relatively small economic declines. To the extent that a national well-being index might form an important target for policy makers (Diener & Seligman, 2004; Stiglitz, Sen, & Fitoussi, 2009), stable lower incomes, at both the personal and the national levels, may be preferable to the riskier pursuit of higher incomes overall.

Author Contributions

C. J. Boyce and A. M. Wood developed the study concept with important theoretical input from G. D. A. Brown. All authors contributed to the study design. C. J. Boyce analyzed the data with critical econometric guidance from J. Banks. All authors contributed to the interpretation of the results. C. J. Boyce drafted the manuscript, and A. M. Wood and G. D. A. Brown provided critical revisions. All authors approved the final version of the manuscript for submission.

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Note

1. Although the relationship between income and life satisfaction in the BHPS was generally weak, the results supported our hypothesis.

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