



Measuring happiness: The higher order factor structure of subjective and psychological well-being measures

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ABSTRACT

The nature and structure of well-being is a topic that has garnered increasing interest with the emergence of positive psychology. Limited research to date suggests two separate but related factors of subjective well-being and psychological well-being. Subjective well-being comprises an affective component of the balance between positive and negative affect, together with a cognitive component of judgments about one's life satisfaction. Psychological well-being is conceptualised as having six components, including positive relations with others, autonomy, environmental mastery, self-acceptance, purpose in life and personal growth. In the current study, we used exploratory factor analysis and confirmatory factor analysis to examine the higher order factor structure of subjective and psychological well-being in a series of large UK samples. Analyses showed that subjective well-being and psychological well-being loaded separately onto two independent but related factors, consistent with previous research. Further, we demonstrated that these loadings did not vary according to gender, age or ethnicity, providing further support for the robustness of this higher order factor structure. The discussion locates these findings in context and explores future research directions on the associations between subjective and psychological well-being over time.

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1. Introduction

The nature and structure of well-being is a topic that has exercised the minds of moral philosophers for centuries, and which more recently has become a central focus for the discipline of positive psychology, the scientific study of optimal human functioning. Broadly speaking, well-being researchers have clustered into two camps, focusing either on subjective well-being or psychological well-being. Subjective well-being is understood as having an affective (emotional) component, of the balance between positive and negative affect, and a cognitive component, of judgments about one's life satisfaction. Psychological well-being has been defined as "engagement with existential challenges of life" (Keyes, Shmotkin, & Ryff, 2002, p. 1007) and in this vein is arguably best represented by Ryff's (1989) conception of the six factors of positive relations with others, self-acceptance, purpose in life, autonomy, environmental mastery and personal growth.

More broadly, these two research traditions have been linked to hedonic (subjective well-being) and eudaimonic (psychological

well-being) philosophy, an association made particularly prevalent through Ryan and Deci's (2001) influential review article in the *Annual Review of Psychology*. Whether or not the association of subjective well-being with hedonic philosophy, and the association of psychological well-being with eudaimonic philosophy are valid and appropriate linkages remains an open question. For example, Kashdan, Biswas-Diener, and King (2008) challenge eudaimonic conceptions of well-being as lacking any theoretical consistency and bearing no resemblance to Aristotle's seminal conception of eudaimonia, which was ultimately about the judgment of a life well-lived in relation to one's *daimon*. As Waterman (2008) argues, however, there is a fundamental disjunct, in that different interpretations have been made of eudaimonia, and other scholars have been arguably loose in their use of terminology and theoretical bases. Combined with the fact that eudaimonic approaches have only been under investigation for around 20 years, and hedonic approaches have been studied much more widely for more than twice that time, it is not surprising that subjective well-being is better understood and more rigorously defined (Waterman, 2008).

To further confuse this picture, researchers continue to question the most effective way to define psychological well-being (e.g., Samman, 2007). As noted above, Ryff (1989) and Ryff and Keyes (1995) proposed six dimensions of psychological well-being culled

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from an extensive literature review, including self-acceptance, purpose in life, personal growth, environmental mastery, positive relations with others, and autonomy. This classification has, however, been questioned on both psychometric and conceptual grounds (Christopher, 1999; van Dierendonck, 2004), and alternative approaches to the conceptualisation of psychological well-being have been proposed that draw from self-determination theory and include meaning, autonomy, competence and relatedness (Samman, 2007).

Given this plethora of perspectives about how to define subjective well-being and psychological well-being, it is not surprising that different measurement approaches have been put forward in each case. There tends to be more agreement about the measurement of subjective well-being, with the inclusion of the balance between positive and negative affect, and life satisfaction, with affect being measured using positive and negative affect measures specifically developed for the purpose (see e.g., Keyes et al., 2002) or the validated Positive and Negative Affect Scales (Watson, Clark, & Tellegen, 1988; see, e.g., Govindji & Linley, 2007) and life satisfaction being measured by the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985; see e.g., Govindji & Linley, 2007) or single life satisfaction items (see Keyes et al., 2002).

In empirical research, a small number of studies have investigated the structure of subjective well-being and psychological well-being, and confirmatory factor analysis suggests that subjective well-being and psychological well-being are two related, but distinct, constructs. For example, using a single item measure of life satisfaction, together with newly-developed measures of positive and negative affect, and the 18-item short form of the Psychological Well-Being Scales, Keyes et al. (2002) found that PWB and SWB correlated at .84, but that their constituent components both loaded on separate and distinct higher order factors, a finding replicated in China by Biao bin, Xue, and Lin (2004).

Given the lack of current empirical agreement on the structure of well-being, the use of non-validated measures in previous studies, and the potential associations between subjective and psychological well-being, the current study set out to examine these issues using two large UK samples and validated well-being measures. Using first exploratory factor analysis, and second confirmatory factor analysis, we sought to explore whether the factor structure of subjective and psychological well-being in a UK population would mirror findings from the United States and China. To ensure a robust operationalisation of the well-being constructs with validated well-being measures, we used the most widely employed measures, namely the Satisfaction with Life Scale (Diener et al., 1985) to measure life satisfaction, the Positive and Negative Affect Scales (Watson et al., 1988) to measure positive and negative affect, and the Scales of Psychological Well-being (Ryff & Keyes, 1995) to measure psychological well-being and the six dimensions of autonomy, environmental mastery, positive relations with others, personal growth, self-acceptance and purpose in life.

2. Method

2.1. Participants

Participants (total $n = 2593$) were drawn from studies previously conducted to examine other research questions, but where those studies included the measures of interest for the current project. All participants were recruited by the second author and participation was voluntary. Participants were not provided with any incentive, monetary or otherwise, for their participation.

Sample 1 ($n = 539$) included 249 males and 290 females, with a mean age of 22.21 years ($SD = 2.79$ years, range = 18–30 years). Participants were primarily of a white ethnic origin (74%) or Indian ethnic origin (14%), and were college students at a major British university.

Sample 2 ($n = 422$) included 183 males and 239 females, with a mean age of 31.12 years ($SD = 9.33$ years, range = 18–63 years). Participants were primarily of a white ethnic origin (72%) or Indian ethnic origin (16%), and were adults recruited from the local community.

Sample 3 ($n = 498$) included 252 males and 246 females, with a mean age of 20.36 years ($SD = 1.71$ years, range = 18–23 years). Participants were primarily of a white ethnic origin (59%), Indian ethnic origin (16%), or Black African ethnic origin (8%), and were college students at a major British university.

Sample 4 ($n = 849$) included 396 males and 453 females, with a mean age of 34.08 years ($SD = 6.73$ years, range = 24–79 years). Participants were primarily of a white ethnic origin (63%), Indian ethnic origin (15%), or Black African ethnic origin (7%) and were adults recruited from the local community.

Sample 5 ($n = 285$) included 130 males and 155 females, with a mean age of 32.19 years ($SD = 8.77$ years, range = 19–63 years). Participants were primarily of a white ethnic origin (65%), Indian ethnic origin (15%), or Black African ethnic origin (8%), and were adults recruited from the local community.

The age intervals of Samples 1 and 3 were short because they were college student samples, as indicated, and the age intervals of Samples 2, 4 and 5 were longer because they were general community samples, and not constrained only to college students. Regrettably, we do not know anything else about the samples that would allow us to compare across them.

2.2. Measures

Satisfaction with Life Scale (SWLS; Diener et al., 1985). Participants rated five items (e.g., “The conditions of my life are excellent”) on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), giving a potential range of 5–35. Higher scores indicate higher levels of life satisfaction. Cronbach’s alpha for the overall sample was $\alpha = .82$.

Positive and Negative Affect Scales (PANAS; Watson et al., 1988). The PANAS is a 20-item scale that measures 10 positive (e.g., “interested”, “excited”) and 10 negative (e.g., “irritable”, “nervous”) affects, using single adjectives that were rated on a 1 (very slightly or not at all) to 5 (extremely) frequency scale for the past week. We opted to use this relatively short time frame given concerns about the accuracy of temporal recall over longer time periods (cf., Schwarz, 1999), and the fact that by opting for a shorter timeframe for a variable that is more transitive, such as affect, we could manage these concerns. The PANAS has excellent psychometric properties, and is one of the most widely used measures of positive and negative affect. Cronbach’s alpha for the overall sample was $\alpha = .81$ for positive affect and $\alpha = .85$ for negative affect.

Scales of Psychological Well-being (Ryff & Keyes, 1995). Eighteen items assess six dimensions of psychological well-being (three items per dimension: autonomy, environmental mastery, positive relations with others, personal growth, purpose in life, and self-acceptance). Participants responded using a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree), giving a potential range of 18–108. Six items are reverse scored. Cronbach’s alphas for the overall sample were $\alpha = .73$ for autonomy, $\alpha = .75$ for environmental mastery, $\alpha = .78$ for personal growth, $\alpha = .79$ for positive relations with others, $\alpha = .69$ for purpose in life, and $\alpha = .81$ for self-acceptance, all of which are highly impressive given that these are three-item subscales.

2.3. Procedure

All participants completed paper versions of the measures as part of questionnaire batteries being run for other surveys. All participants provided informed consent, were informed of their right to withdraw from the study, and were debriefed upon completion. Participants were not paid for their involvement, but student participants received research credit for completing the surveys. Ethical approval for the studies was granted by the University of Leicester.

2.4. Data analyses

The exploratory and confirmatory factor analyses reported below are based on the subscale or scale level for each of the variables, because this is the appropriate level of analysis for the research question we were seeking to answer: we are not seeking to establish which items load on which factors (this has already been demonstrated in the scale development work for each of the scales), but rather to establish the factor structure of the constructs of subjective and psychological well-being. This also follows the approach of other studies in this area, for example, the work of Keyes et al. (2002). Descriptive information for the scales and subscales is also provided in Table 1.

Tests of normality assumptions showed that the data were normally distributed. Tests of the significance of kurtosis and skewness are not considered appropriate with large samples, as very small standard errors will always produce significant results. That said, as shown in Table 1, the values of kurtosis and skewness still fall within the acceptable range of -1 to 1 (Tabachnik & Fidell, 2001). As a further test of the normality assumption, we made judgments of normality based on visual examination of the histograms for each of the variables included (Tabachnik & Fidell, 2001). In each case, the variables were sufficiently normally distributed for use in maximum likelihood estimation in the CFA (which in any case is robust against moderate departures from normality; Tabachnik & Fidell, 2001).

3. Results

3.1. Exploratory factor analysis

Exploratory factor analysis using the maximum likelihood method was performed separately on Samples 1 ($n = 539$ students)

and Sample 2 ($n = 422$ adults), using the totals of each of the scales, or subscales, as appropriate (e.g., the total of the Satisfaction with Life Scale, the total of the PANAS positive affect subscale, the total of the positive relationships with others subscale on the Scales of Psychological Well-being). For both samples, the participant to variable ratio exceeded 45:1, and the N was close to 450. This suggests the factor structure and loadings will be very robust. When making comparisons across age, we opted for a cut-off point of 30 years to delineate the two groups for comparison. This decision was based on findings from the personality literature indicating that personality is relatively stable by the age of 30 years (McCrae & Costa, 1990).

The decision on the number of factors to extract was based on parallel analysis. Monte Carlo analyses by Velicer, Eaton, and Fava (2000) and Zwick and Velicer (1986) have shown that of all of the criteria for deciding on the number of factors to extract (e.g. scree plot, Kaiser criterion), parallel analysis provides the most accurate results. As neither procedure is currently represented in the common statistical packages, we used the SPSS syntax developed by O'Connor (2000).

Parallel analysis involves identifying how many factors have eigenvalues higher than values which may be expected to occur through chance. Two sets of parallel analysis were performed, where in each case ten thousand random datasets were created that had the same number of cases and variables as either Sample A or B. The results were consistent; for each sample, only the first two eigenvalues of the real datasets exceeded chance values. This strongly suggests there are two factors underlying the data. This is consistent with the scree plots, presented in Figs. 1 and 2. The scree plots appear identical as many of the eigenvalues only differ between the samples at the second decimal point.

Table 2 presents factor loadings for both samples. The solution is readily interpretable; Factor 1 represents psychological well-being, and Factor 2 represents subjective well-being. The solution is exceptionally clean, with all variable loadings very strongly and uniquely on the one factor.

3.2. Confirmatory factor analysis

Multigroup confirmatory factor analysis (CFA; covariance structural equation modeling with AMOS) was performed on the remaining samples (Samples 3–5; $n = 1632$ students and adults), to directly compare the one and two factor structures, and to test

Table 1
Descriptive statistics, including skewness and kurtosis.

	N statistic	Minimum statistic	Maximum statistic	Mean statistic	Standard deviation statistic	Skewness		Kurtosis	
						Statistic	Standard error	Statistic	Standard error
Life satisfaction	2593	5.00	35.00	19.9942	5.81090	.005	.048	-.416	.096
Autonomy	2593	3.00	18.00	10.7385	3.06166	-.038	.048	-.275	.096
Environ. mastery	2593	3.00	18.00	10.5438	3.14780	-.081	.048	-.274	.096
Personal growth	2593	3.00	19.00	11.0555	3.18562	.032	.048	-.361	.096
Positive relations	2593	3.00	18.00	10.7775	3.10096	.027	.048	-.387	.096
Purpose in life	2593	3.00	18.00	10.9217	2.99853	-.047	.048	-.324	.096
Self-acceptance	2593	3.00	18.00	10.8592	3.10761	-.012	.048	-.396	.096
Negative affect	2593	10.00	49.00	27.6464	8.49970	.073	.048	-.705	.096
Positive affect	2593	10.00	50.00	28.8704	7.98896	-.017	.048	-.432	.096

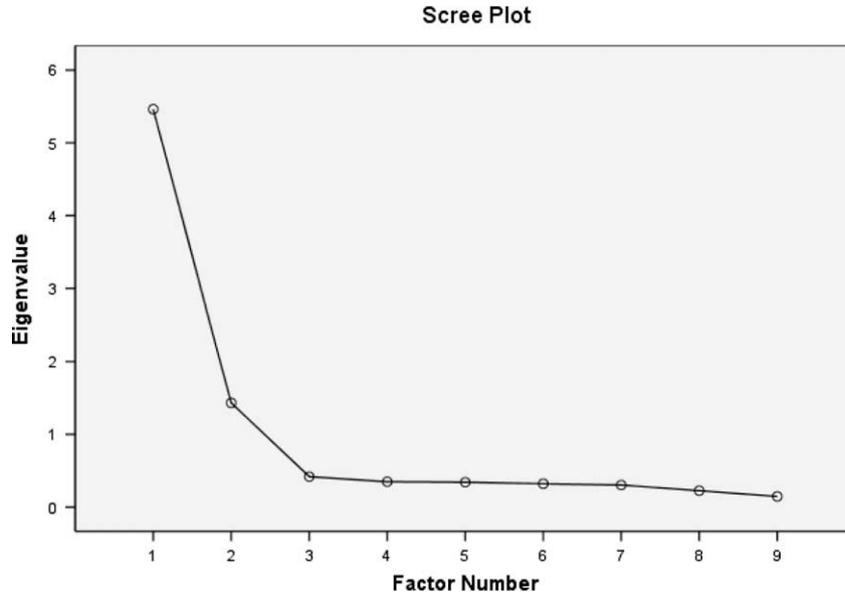


Fig. 1. Scree plot for Sample 1 (students).

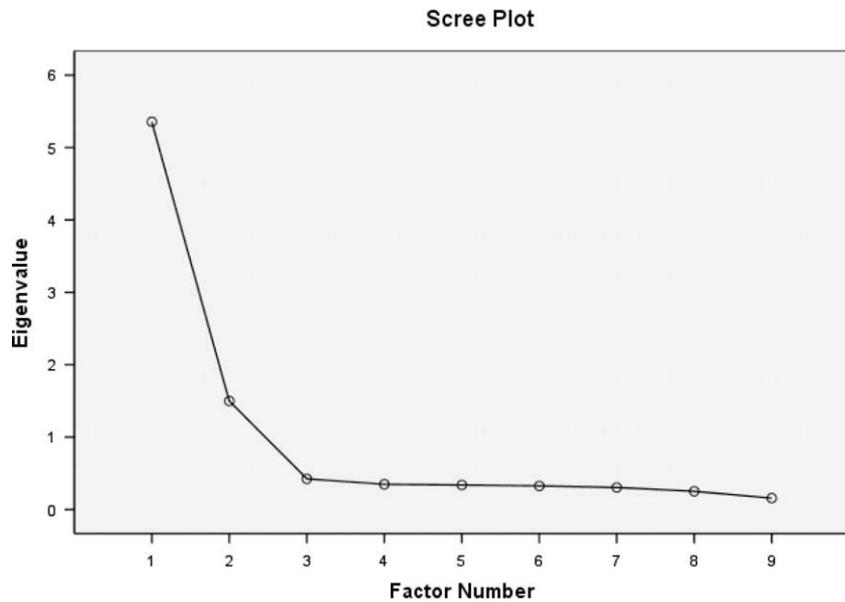


Fig. 2. Scree plot for Sample 2 (adults).

Table 2
Factor Loadings for Sample 1 and Sample 2.

	S1 (N = 539 students)		S2 (N = 422 adults)	
	Factor		Factor	
	1	2	1	2
Personal growth	.84	.00	.79	.04
Positive relationships	.82	.01	.85	-.02
Self acceptance	.82	.00	.82	.03
Autonomy	.81	.01	.81	.01
Purpose in life	.81	.01	.81	.00
Environmental mastery	.74	.04	.76	.00
Positive PANAS	-.03	.95	.00	.94
Negative PANAS	-.02	-.89	-.01	-.88
Satisfaction with life	.04	.83	.01	.82

whether the structure is invariant across samples and demographic groups. The one factor model had all PWB and SWB vari-

ables loading on the same factor. The two factor model had the PWB and SWB variables loading on separate factors (see Fig. 3).

Table 3 presents separate comparisons of the one factor and two factor model for all participants, three samples, gender, age, and ethnicity. Overall fit was assessed with the standardized root-mean-square residual (SRMR), and the comparative fit index (CFI). As the chi squared test is highly sensitive to sample size, Hu and Bentler (1999) recommended basing model fit assessments on values of SRMR ≤ .08, CFI ≥ .95. In their Monte Carlo analysis, they demonstrated that the combined use of the SRMR and the CFI led to the lowest sum of Type I and Type II errors (Hu & Bentler, 1999). Adopting these values, in every case, the one factor model failed to exhibit a good fit. In contrast, in most cases the two factor model exhibited very good fit. This suggests that PWB and SWB are different constructs.

We also compared directly the one and two factor models with the Δχ² and ΔAIC (Akaike Information Criterion) statistics. Both

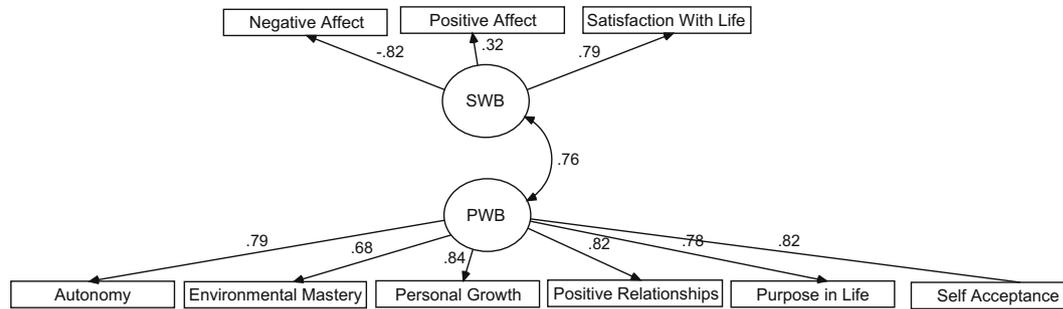


Fig. 3. The two factor model. Note: All participants in Samples 3–5, standardized estimates, all significant at $p < .001$.

Table 3
Comparison of one and two factor models across sample, gender, age, and ethnicity.

Group	n	Model 1: One factor				Model 2: Two factor				Model Comparisons	
		χ^2	SRMR	CFI	AIC	χ^2	SRMR	CFI	AIC	$\Delta\chi^2$	Δ AIC
<i>All participants (Samples 3–5)</i>											
All	1632	795.30	.06	.91	831.34	423.50	.04	.95	461.48	371.80	369.86
<i>Between sample comparisons</i>											
Sample 3	498	220.91	.05	.93	256.91	121.43	.04	.96	159.43	99.48	97.48
Sample 4	849	470.13	.07	.90	506.13	251.88	.05	.94	289.88	218.25	216.25
Sample 5	285	180.82	.08	.88	216.83	129.17	.06	.92	167.17	51.65	49.66
<i>Between gender group comparisons</i>											
Men	778	431.08	.06	.90	467.08	232.70	.05	.95	270.76	198.38	196.32
Women	854	414.65	.06	.90	450.65	240.75	.05	.95	278.75	173.90	171.90
<i>Between age comparisons</i>											
18–30	860	384.33	.06	.91	420.33	212.37	.04	.96	250.37	171.96	169.96
30+	772	432.37	.07	.90	468.37	231.29	.05	.95	269.30	201.08	199.07
<i>Between Ethnicity comparisons</i>											
White	1009	547.52	.07	.90	583.52	279.73	.05	.95	317.73	267.79	265.79
Black	205	97.31	.06	.93	133.31	67.99	.05	.96	105.99	29.32	27.32
Indian Sub.	359	191.16	.06	.91	227.16	107.21	.04	.95	145.21	83.95	81.95

statistics directly compare the fit of the two models after adjusting for differences in the degrees of freedom. In every case the $\Delta\chi^2$ was significant at .001 and the Δ AIC was greater than 27 (conventionally Δ AIC > 15 is considered very substantial). These results again strongly support the superiority of the two factor model over the one factor model.

3.3. Invariance between groups

We tested whether the two factor model was invariant across (a) sample, (b) gender, (c) age, and (d) ethnicity, using multigroup confirmatory factor analysis (CFA). Multigroup CFA involves two steps. In Step 1, separate CFAs are performed for each of the groups. In Step 2, two models are compared for difference in fit. The fit of the first model (the 'unconstrained model') is simply the sum of the chi squared statistics from the separate CFAs in Step 1. In this model, the values of factor loadings and factor covariances have been free to vary between groups. The second model

(the 'constrained model') is a single CFA which constrains the factor loadings and factor correlations to be equal across the groups. Invariance of the measure across groups is inferred if the fit of the constrained model is not significantly worse than the unconstrained model. As the models are nested, the difference in the fit between the chi squared values of the two models is itself chi squared distributed, with number of degrees of freedom equal to the difference between the degrees of freedom of the competing models (see Byrne, 2004).

The results are presented in Table 4. Each of the constrained models (representing invariance across groups) had equally good fit using the CFI and SRMR. $\Delta\chi^2$ was non-significant for any of the comparisons, supporting invariance (this is very strong evidence, given the very high power due to sample size). Finally the AIC values were actually smaller for the constrained model, suggesting that the constrained model had a better fit to the data. The results suggest that the factor loadings and factor covariances were equal across all comparisons. The two factor model is there-

Table 4
Invariance of the two factor model across demographic groups.

Comparison	Groups	Model 1: Free				Model 2: Constrained				Model Comparisons		
		χ^2	SRMR	CFI	AIC	χ^2	SRMR	CFI	AIC	$\Delta\chi^2$	p	Δ AIC
Sample	3	525.32	.05	.95	601.32	536.50	.05	.95	592.50	11.18	.94	8.82
Gender	2	473.51	.05	.95	595.51	483.35	.05	.95	539.35	9.84	.45	56.16
Age	2	443.66	.04	.95	519.66	453.57	.04	.95	510.27	9.91	.45	9.39
Ethnicity	3	454.98	.05	.95	570.98	477.14	.06	.95	551.14	22.16	.33	19.84

Note: Model comparison $df = 10$ (gender and age) $df = 20$ (sample and ethnicity).

Table 5
Unstandardized and standardized estimates for the two factor model.

Variable	Unstandardized estimate	Standard error	Standardized estimate	R ²	Significance
Positive Affect	−7.27	.29	.32	.10	p < .001
Negative Affect	2.56	.31	−.82	.67	p < .001
Satisfaction with life	4.75	.20	.79	.62	p < .001
Self-acceptance	2.58	.10	.82	.67	p < .001
Purpose in life	2.37	.09	.78	.61	p < .001
Positive relations	2.55	.10	.82	.67	p < .001
Personal growth	2.82	.10	.84	.71	p < .001
Environmental mastery	2.22	.10	.68	.46	p < .001
Autonomy	2.52	.10	.79	.62	p < .001

Note. For the two factor model as a whole, combining the subjective well-being and psychological well-being factors, R² = .58.

fore invariant across (a) sample, (b) gender, (c) age, and (d) ethnicity. The two factor model is presented for all participants in Fig. 3. Overall, these results demonstrate, with a very high degree of consistency and replicability, that the higher order factor structure of subjective and psychological well-being in a UK population presents subjective well-being and psychological well-being as two distinct but related constructs. For completeness, the unstandardized estimate and standard error, the standardized estimates, the R² values and level of significance for the nine specific measures of the model are included in Table 5.

4. Discussion

In this study, we set out to explore the higher order factor structure of subjective and psychological well-being, and to see if the factor structure found would replicate that found in the United States and China. We found that it did, providing preliminary evidence for the cross-cultural replicability of the higher order factor structure of subjective and psychological well-being, albeit only across three different cultures, as well as demonstrating factor invariance according to gender, age and ethnicity: the structure of subjective and psychological well-being did not vary according to whether respondents were male or female, young or old, or from different ethnic backgrounds.

These findings raise important questions about the associations between subjective and psychological well-being, and speak to those questions which are only now being debated in the academic literature (see Kashdan et al., 2008; Waterman, 2008). Specifically, Kashdan et al. proposed that subjective well-being and psychological well-being are far more closely associated than previously believed, and argued that subjective well-being may be a prerequisite of psychological well-being, citing evidence that the induction of positive affect led participants to report higher levels of meaning in life (King, Hicks, Krull, & Del Gaiso, 2006).

Waterman (2008) extended this argument from a theoretical and logical perspective, noting the asymmetry of relationships between subjective and psychological well-being. Waterman argued that there are three possible categories of this relationship. First, occasions when both hedonia and eudaimonia are present. Second, occasions when hedonia, but not eudaimonia, is present. Third, occasions when neither hedonia nor eudaimonia are present. Given that hedonia arises from getting the things one wants, and because eudaimonia (e.g., self-realization and the expression of virtue) are among the things that one wants, Waterman argues that it necessarily follows that it is not logically possible to experience eudaimonia in the absence of hedonia. From the current data, it is

noteworthy that positive affect loaded the lowest of all the variables in the model, thus supporting Waterman's hypothesis that positive affect may not lie at the core of well-being. This remains an intriguing prospect for future research, since it has typically been assumed that well-being is at its core simply positive affect (Kashdan et al., 2008). It is also worth noting that much of the empirical work conducted to date has been cross-sectional rather than longitudinal: future research should examine the potential longitudinal associations and predictions of subjective well-being from psychological well-being, and vice versa, paying attention to the many excellent recommendations made by both Kashdan et al. (2008) and Waterman (2008).

Overall, this study has provided supporting evidence for the cross-cultural replicability of the higher order factor structure of subjective and psychological well-being, as well as demonstrating factor invariance across gender, age and ethnicity. Given that this is the first study of its kind to use fully validated measures in the assessment of subjective and psychological well-being, however, one should be cautious about drawing substantial conclusions from it, and further research is required. Most notably, our samples only included relatively small percentages of diverse ethnic populations, and all respondents completed the surveys in English. Further, we used relatively short time frames for the assessment of affect, as is consistent in affect research (Watson et al., 1988) and because of the potential bias that may be introduced by asking participants to rate subjective variables over extended periods of time (Schwarz, 1999). As such, future researchers may wish to consider extending the timeframe for which responses are collected. Future research should also investigate the question of the cross-cultural replicability of the factor structure of measures of subjective and psychological well-being by using indigenous-language translations of these measures, and collecting data from participants from the indigenous populations of different cultures.

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