

# Measuring Thriving across Nations: Examining the Measurement Equivalence of the Comprehensive Inventory of Thriving (CIT) and the Brief Inventory of Thriving (BIT)

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**Background:** Positive psychological health is a multifaceted construct and fundamental to individuals' overall mental health. Yet, measures of positive psychological health tend to focus on only a few of these facets. Su, Tay, and Diener (2014) sought to address this by creating the Comprehensive and Brief Inventories of Thriving (CIT/BIT), integrative measures of well-being that assess positive psychological health broadly. **Method:** Given growing interest in cross-national comparisons in positive psychological health, the present study expands on this work by examining the measurement invariance of these two measures across 10 countries ( $N = 3,077$ ). First, a series of single-group confirmatory analyses were run to assess how well the CIT/BIT fit data from each country. Next, multi-group confirmatory analyses were run to assess measurement invariance. **Results:** Single-group confirmatory factor analysis supported the original 18-factor structure of the CIT when compared to alternative models (single factor, seven factor, bi-factor model) in seven of the 10 countries and the single-factor structure of the BIT across all countries. Results from the measurement invariance analysis indicated partial scalar invariance for the remaining seven countries on the CIT as well as partial scalar invariance across all countries for the BIT. **Conclusion:** The present study extends the initial work by Su et al. (2014) by providing evidence of the measurement invariance of the comprehensive and brief inventories of thriving across cultures. Although the factor structure of the CIT was inadmissible in three countries, the results provide a crucial first step for those interested in comparing positive psychological health across nations. Research in both using these measures and cross-cultural comparisons on positive psychological health is growing. We hope that the current efforts help facilitate this work towards furthering the understanding of positive psychological health.

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## INTRODUCTION

It has long been stressed that psychological health is not solely the absence of negative psychological states (e.g. ill-being, depression, anxiety), but also the presence of positive psychological states (e.g. well-being, happiness, purpose, meaning; Huppert & So, 2013; Seligman & Csikszentmihalyi, 2000; World Health Organization, 1946). Recently, several authors have noted that, while the conceptualisation of psychological health focuses on both positive and negative psychological states, research has tended to use psychological health metrics that predominantly assess negative psychological states (e.g. Bieda et al., 2017; Su, Tay, & Diener, 2014). While negative psychological states are certainly important, research in this vein only provides a partial picture of psychological health. Noting this incongruity, there has been a thrust in recent years focusing on the positive side of psychological health.

While research in this vein has recently enjoyed attention, two crucial points should be noted. First, although positive psychological health is a multifaceted construct, most measures tend to focus on a couple of specific facets. Second, despite a growing interest in comparing nations and cultures on positive psychological health (e.g. Bieda et al., 2017), research has mostly used Western samples, limiting the degree to which findings can be generalised across nations. Also, there have been calls for nations to supplement economic-based progress metrics with national evaluations of positive psychological health in order to determine how well a country is doing (Diener & Seligman, 2004). Hence, there is a need to validate an integrative measure of positive psychological health across different nations.

The present study addresses this need by examining the measurement invariance of the recently developed comprehensive and brief inventories of thriving (Su et al., 2014) across 10 different nations. These measures were designed to assess an integrative perspective of positive psychological health and validated in a Western sample. While some studies have replicated the factor structure of these measures *within* a different culture (Andolfi, Confalonieri, Nardò, & Traficante, 2015; Duan, Guan, & Gan, 2016), there is a need to demonstrate the measurement invariance of the comprehensive and brief inventories of thriving *across* different cultures. In the following, we briefly review different perspectives of positive psychological well-being and why establishing measurement invariance evidence between nations is a crucial first step in cross-cultural research, especially with respect to positive psychological health.

## Perspectives on Positive Psychological Health

How does one define positive psychological health? As noted earlier, this has been a standing question in the literature for some time and several different

perspectives have been proposed. In fact, differences in how one defines well-being can be traced back to long before contemporary research. The ancient Greek philosopher, Epicurus believed that positive psychological health should be thought of as the presence of positive emotions and the scarcity of negative emotions (Bergsma, Poot, & Liefbroer, 2008). This perspective differs from that of Aristotle, who believed that well-being is achieved through living a virtuous life—a life that is not defined by the consequences of an action, but the content of the said action. Divergent perspectives on positive psychological health continue into contemporary research and there is a growing consensus that not one approach alone is correct. Instead, positive psychological health is a multifaceted construct that subsumes these different perspectives.

Su et al. (2014) attempted to synthesise this literature and suggested seven core dimensions of positive psychological health: subjective well-being, supportive and enriching positive relationships, interest and engagement in daily activities, sense of mastery and accomplishment, autonomy, meaning and purpose in life, and optimism. Diener's (1984) conceptualisation of subjective well-being represents the first dimension. Subjective well-being asserts that well-being is subjectively experienced and represents a feeling of general satisfaction, a prevalence of positive emotions, and a scarcity of negative emotions. The second dimension, supportive and enriching positive relationships, highlights the importance of social connections to psychological health. Research has shown that social relations are an essential aspect of psychological health. They provide resources in times of stress and a sense of belongingness that facilitates positive psychological health (Lucas & Dyrenforth, 2006). Third, engagement, sometimes referred to as flow (Csikszentmihalyi, 1996), occurs when individuals are fully absorbed in their activities, experiencing a sense of energised excitement.

Another aspect of positive psychological health is feelings of accomplishment and mastery. It can be thought of as having the right skills, the belief in using those skills, and the feelings of accomplishment after utilising those skills. The fifth dimension concerns the need for autonomy. A belief that one has control over one's life is an important indicator of positive psychological health (Ryan & Deci, 2000). Sixth, the degree to which one believes one's life has meaning and purpose is a core aspect of positive psychological health. Although often associated with a general sense of happiness, meaning and happiness are distinct from one another (McGregor & Little, 1998), with the former representing a sense of being connected to something greater than oneself (Seligman, 2011). Lastly, positive psychological health can be indicated by a sense of optimism. While not a phenomenological experience such as subjective well-being or accomplishment, optimism confers a mindset that has a positive outlook towards the future (Scheier & Carver, 1985).

Despite evidence that each of these dimensions is indicative of positive psychological health, most measures tend to focus on only a few of these constructs. For example, Ryff's (1995) measure of psychological well-being

addresses several of these dimensions (e.g. autonomy, mastery), but does not assess others (e.g. optimism, subjective well-being). Kern, Waters, Adler, and White (2015) developed a measure based on Seligman's PERMA model, which assesses positive emotions (an aspect of subjective well-being), engagement, social relationships, meaning, and accomplishment. Yet, this measure does not capture all of the seven core dimensions. Su et al. (2014) attempted to help remedy this situation through creating the comprehensive and brief inventories of thriving to assess a broad range of positive psychological health constructs. Although both measures demonstrated sound psychometric properties, these results were based solely on samples from the United States and the authors encourage future research to address cross-cultural applications of these measures.

## Cross-Cultural Research

Showing that a measure is equivalent across groups is a crucial prerequisite to testing hypotheses that are derived from group mean differences across multiple groups (Vandenberg & Lance, 2000) and is especially important for cross-cultural research on well-being. Well-being is inextricably tied to values, and nations have differing value systems (Diener & Suh, 2000), which may lead to differences in conceptualisation of well-being (Ratzlaff, Matsumoto, Kouznetsova, Raroque, & Ray, 2000). Indeed, research using both Schwartz's (1992) and Hofstede's (1984, 2001) frameworks suggests that cultures have different value systems, which may have implications for well-being measures. For example, individuals from a collectivistic culture may be less able to discern between self-worth and a sense of belonging (two facets of the comprehensive inventory of thriving) because of how much these two concepts are tied together in these cultures.

There is a pressing need to establish the measurement equivalence of the thriving measures across cultures as they are already being used across the globe. Andolfi and colleagues validated an Italian version of the comprehensive inventory of thriving for children and examined its relation with reading and writing ability (Andolfi et al., 2015; Andolfi, Tay, Confalonieri, & Traficante, 2017). Researchers have also validated a Chinese version of the brief inventory of thriving. Specifically, Duan et al. (2016) demonstrated that a Chinese version of the brief inventory of thriving had sound psychometric properties in a community and student sample. This study also showed that the brief inventory of thriving accounted for incremental variance in depression, anxiety, and stress over other well-being measures. Hausler et al. (2017) created a German version of both the comprehensive and brief inventories of thriving and confirmed the original factor structure using three diverse samples.

## The Current Study

The purpose of the current study is twofold. First, we seek to examine the original factor structure of the comprehensive and brief inventories of thriving across multiple nations. For the brief inventory of thriving, we examine the single-factor structure across different nations. The brief inventory of thriving was designed to broadly assess positive psychological health with a small (10) number of items. Hence, we did not believe that there was an alternative factor structure to examine. For the comprehensive inventory of thriving, we not only examine the original factor structure, but also three competing structures. Su et al. (2014) argued that 18 unidimensional factors indicated the seven core psychological constructs (Table 1). Specifically, the 54-item comprehensive inventory of thriving assesses these 18 unidimensional factors through three items per factor. This is the only model the authors examined. In the current paper, we also test three alternative factor structures. Specifically, the original 18-factor structure, a single-factor structure, a seven-factor structure (representing the seven core dimensions of psychological health), and a bi-factor structure representing the 18 unidimensional factors as well as one general factor.

Second, using the best fitting model for each measure, we conduct a multi-group confirmatory factor analysis (MG-CFA) across all nations. Data were collected from Argentina, Australia, China, Germany, India, Mexico, Russia, Singapore, Spain, and Turkey. As shown in Table 2, these countries have varying value systems according to both Schwartz (1992) and Hofstede (1984, 2001) and represent diverse samples optimal for cross-validation. It is our hope that evidence from the current work will facilitate future research seeking to make cross-cultural comparisons of well-being.

## METHOD

### Participants and Procedure

In addition to the original 1,090 United States participants (mean age 45.52,  $SD = 16.93$ ; 53.03% female), 195 participants from Argentina (mean age 42.48,  $SD = 15.24$ ; 61.14% female), 205 participants from Australia (mean age 42.09,  $SD = 16.92$ ; 53.66% female), 206 participants from China (mean age 36.14,  $SD = 11.48$ ; 55.61% female), 200 participants from Germany (mean age 39.08,  $SD = 15.29$ ; 55.00% female), 197 participants from India (mean age 38.57,  $SD = 14.42$ ; 48.47% female), 197 participants from Mexico (mean age 36.65,  $SD = 12.95$ ; 49.75% female), 199 participants from Russia (mean age 36.82,  $SD = 12.34$ ; 52.26% female), 197 participants from Singapore (mean age 33.93,  $SD = 10.47$ ; 47.21% female), 203 participants from

TABLE 1  
The Seven Core Dimension of Positive Psychological Health and 18 Facets

<i>Seven Core Dimensions</i>	<i>Unidimensional Facets</i>	<i>Items</i>
Relationship	Support	1. There are people I can depend on to help me
		2. There are people who give me support and encouragement
		3. There are people who appreciate me as a person (*)
	Community	4. I pitch in to help when my local community needs something done
		5. I invite my neighbors to my home
		6. I look for ways to help my neighbors when they are in need
	Trust	7. I can trust people in my society
		8. People in my neighborhood can be trusted
		9. Most people I meet are honest
	Respect	10. People respect me
		11. People are polite to me
		12. I am treated with the same amount of respect as others
	Loneliness	13. I feel lonely
		14. I often feel left out
		15. There is no one I feel close to
	Belonging	16. I feel a sense of belonging in my community (*)
		17. I feel a sense of belonging in my state or province
		18. I feel a sense of belonging in my country
Engagement	Flow	19. I get fully absorbed in activities I do
		20. In most activities I do, I feel energised (*)
Mastery	Skills	21. I get excited when I work on something
		22. I use my skills a lot in my everyday life
	Learning	23. I frequently use my talents
		24. I get to do what I am good at every day
		25. I learned something new yesterday
	Accomplishment	26. Learning new things is important to me
		27. I always learn something every day
		28. I am achieving most of my goals (*)
	Self-Efficacy	29. I am fulfilling my ambitions
		30. I am on track to reach my dreams
31. I can succeed if I put my mind to it (*)		
Self-Worth		32. I am confident that I can deal with unexpected events
		33. I believe that I am capable in most things
		34. What I do in life is valuable and worthwhile (*)
		35. The things I do contribute to society
		36. The work I do is important for other people

Table 1 (Continued)

<i>Seven Core Dimensions</i>	<i>Unidimensional Facets</i>	<i>Items</i>
Autonomy	(Lack of) Control	37. Other people decide most of my life decisions (R) 38. The life choices I make are not really mine (R) 39. Other people decide what I can and cannot do (R)
Meaning	Meaning and Purpose	40. My life has a clear sense of purpose (*) 41. I have found a satisfactory meaning in life 42. I know what gives meaning to my life
Optimism	Optimism	43. I am optimistic about my future (*) 44. I have a positive outlook on life 45. I expect more good things in my life than bad
Subjective Well-Being	Life Satisfaction	46. In most ways my life is close to my ideal 47. I am satisfied with my life 48. My life is going well (*)
	Positive Emotions	49. I feel positive most of the time 50. I feel happy most of the time 51. I feel good most of the time (*)
	Negative Emotions	52. I feel negative most of the time (R) 53. I experience unhappy feelings most of the time (R)
		54. I feel bad most of the time (R)

*Note:* (R) indicates item was reverse coded; (\*) indicates item was used in the brief inventory of thriving.

Spain (mean age 38.25,  $SD = 14.45$ ; 54.46% female), and 196 participants from Turkey (mean age 32.51,  $SD = 9.45$ ; 43.59% female) were recruited.

All participant responses were collected online via the Qualtrics insight platform after receiving approval from the Purdue University Internal Review Board. Individuals were qualified to participate if (1) they were at least 18 years old and (2) they were a native of one of our targeted countries and currently resided there. Qualtrics provided broad representative data from each of the nations with regard to gender, age, marital status, SES and level of education. Four attention checks (i.e. please select “strongly disagree” for this question) were inserted in the surveys and those who failed at least one were dropped from the study. Participants were compensated through Qualtrics and we paid Qualtrics \$6 per participant.

## Measures

*Comprehensive and Brief Inventories of Thriving.* The comprehensive and brief inventories of thriving exhibited good psychometric properties across five

TABLE 2  
National Means on Schwartz's and Hofstede's Cultural Dimensions

	<i>Schwartz's Cultural Values</i> <sup>1</sup>						
	<i>Harmony</i>	<i>Embedded</i>	<i>Hierarchy</i>	<i>Mastery</i>	<i>Affective Autonomy</i>	<i>Intellectual Autonomy</i>	<i>Egalitarian</i>
Argentina	3.98	3.52	2.10	3.92	3.73	4.34	4.96
Australia	3.99	3.59	2.29	3.97	3.86	4.35	4.79
China	3.78	3.74	3.49	4.41	3.30	4.18	4.23
Germany							
East	4.46	3.16	1.77	4.00	4.28	4.68	4.95
Germany							
West	4.62	3.03	1.87	3.86	4.11	4.99	5.07
Germany							
India	3.92	3.97	3.05	4.28	3.48	4.02	4.45
Mexico	4.50	3.90	2.13	3.90	2.83	4.36	4.73
Russia	3.90	3.81	2.72	3.96	3.51	4.30	4.38
Singapore	3.76	4.00	2.82	3.88	3.30	3.86	4.60
Spain	4.47	3.31	1.84	3.80	3.67	4.99	5.23
Turkey	4.23	3.77	2.97	3.98	3.37	4.45	4.77
United States	3.46	3.67	2.37	4.09	3.87	4.19	4.68

  

	<i>Hofstede's Cultural Dimensions</i> <sup>2</sup>					
	<i>Power Distance</i>	<i>Individualism</i>	<i>Masculinity</i>	<i>Uncertainty Avoidance</i>	<i>Long-Term Orientation</i>	<i>Indulgence</i>
Argentina	49	46	56	86	20	62
Australia	36	90	61	51	21	71
China	80	20	66	30	87	24
Germany	35	67	66	65	83	40
India	77	48	56	40	51	26
Mexico	81	30	69	82	24	97
Russia	93	39	36	95	81	20
Singapore	74	20	48	8	72	46
Spain	57	51	42	86	48	44
Turkey	66	37	45	85	46	49
United States	40	91	62	46	26	68

*Note:* <sup>1</sup>Values were pulled from an online resource provided by the author: [https://www.researchgate.net/publication/304715744\\_The\\_7\\_Schwartz\\_cultural\\_value\\_orientation\\_scores\\_for\\_80\\_countries](https://www.researchgate.net/publication/304715744_The_7_Schwartz_cultural_value_orientation_scores_for_80_countries)

<sup>2</sup>Values were retrieved from the author's website: <https://geert-hofstede.com/countries.html>

large US samples with diverse demographics (see Su et al., 2014). To examine the measurement equivalence of the scales across cultures, we hired professional translators to translate the comprehensive and brief inventories of thriving into

various languages (i.e. Chinese, German, Russian, Spanish and Turkish). Since the same language might be spoken in multiple targeted countries where differences in language use exist, we made sure that all word uses were tailored to each specific country. The resulting translations were then given to a different group of interpreters to back-translate them into English. Each country had at least one back-translator, all of whom were native speakers. As an example, three native interpreters separately translated the Mexican, Argentinian and Spanish versions (all written in Spanish) into English. The authors compared the back-translated scales with the original English surveys to ensure consistency in the meanings of each item. Any inconsistency was reported to the translators for modification. The results were satisfactory. The final surveys were pilot-tested in each individual country and further modifications were made when necessary.

The comprehensive inventory of thriving consists of 54 items representing 18 different facets of positive functioning. Three items measure each of the 18 facets and the participants are asked to respond on a 5-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*). The brief inventory of thriving consists of 10 selected items from the comprehensive inventory of thriving. Table 1 provides an English version of the item list. Translations of these measures can be found in the online supplementary material.

## Analysis

The data were first checked for missing values and only full responses were used in the analysis. Of the 3,085 original responses, only eight responses were excluded. In addition, demographic information (age, gender, marital status, education) was collected. The main analysis was conducted in three phases: single-group confirmatory factor analysis (CFA), multi-group CFA, and exploration of alternative models. All analyses were conducted using the lavaan package (Rosseel, 2012) in the R software (R Core Team, 2013). Maximum likelihood estimation with robust standard errors was used to account for potential skewness in the data (Yuan & Bentler, 2000).

*Single-Group CFA.* First, a single-group CFA examined how well the comprehensive and brief inventories of thriving fit data from each country. For the comprehensive inventory of thriving, multiple factor structures were tested and goodness-of-fit indices were compared. A single-factor structure was examined for the brief inventory of thriving. If the results suggested model misspecifications, the modification indices were examined to identify the underlying issue. We used four goodness-of-fit indices to evaluate model fit: (1) the Comparative Fit Index (CFI; Bentler, 1990), (2) the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), (3) the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990), and (4) the Standardised Root Mean Square Residual (SRMR; Bentler, 1995). We chose not to rely on the traditional chi-square statistics

because the large sample size made it overly easy to reject the null hypothesis (Brannick, 1995; Kelloway, 1995). A relatively good fit between the hypothesised model and the observed data was signified by  $CFI > .95$ ,  $TLI > .95$ ,  $RMSEA < .06$ , and  $SRMR < .08$  (Hu & Bentler, 1999). Acceptable fit was marked by  $CFI > .90$ ,  $TLI > .90$ ,  $RMSEA < .08$ , and  $SRMR < .10$  (Browne & Cudeck, 1992). The best fitting model was then used in the multi-group CFA.

If a best fitting model could not be found for a particular country, then data from that country were not included in the second phase. Specifically, if none of the proposed factor structures resulted in an admissible solution, that country was dropped from the measurement invariance analysis. An inadmissible solution may arise for several reasons (e.g. linear dependency between observations or factors, sampling variation, negative error variances, unstable factor specification) and these issues were explored in the third phase.

*Multi-Group CFA.* The second phase evaluated measurement invariance of the comprehensive and brief inventories of thriving through a series of nested model comparisons with an increasing number of constraints (Vandenberg & Lance, 2000). The baseline model examined configural invariance, which compares the equality in the factor structures across samples. If there is sufficient evidence for configural invariance, a new model places constraints on factor loadings to be equal across groups, which tests for metric invariance. If there is evidence of metric invariance, a third model constrains the intercepts to be equal across groups to test for scalar invariance. Since increasing constraints always decrease the fit of the model, we followed the recommendations of Cheung and Rensvold (2002) and Chen (2007) to determine whether there was a significant drop in fit. Specifically, they suggest that a  $\Delta CFI$  smaller or equal to .01 indicates that the two models are invariant. If at any stage  $\Delta CFI$  exceeded .01, we examined the partial invariance by identifying and freeing constraints that were not equivalent between groups. Modification indices were examined to identify which parameters were to be freely estimated (i.e. allowed to differ between nations).

*Exploratory Alternative Solutions.* If the single-group CFA revealed an inadmissible solution, alternative solutions were tested through a thorough analysis of the results. As noted earlier, inadmissible solutions could arise for several reasons and several steps can be taken to find a better fitting solution. For example, model re-specification using top-down (i.e. theory driven) or bottom-up (e.g. exploratory factor analysis) approaches could reveal a factor structure that fits the data. Alternatively, an investigation into the covariance matrix could reveal a linear dependency between two or more factors, leading to model re-specification. Steps were taken to identify and report the underlying cause of the inadmissible solutions.

## RESULTS

Table 3 provides means and standard deviations with regard to the age, gender, marital status, and education of the sample. Between-group comparisons indicated that there were significant differences in age between samples,  $F(10, 3065) = 23.27, p < .05$ . In addition, there was not a significant difference in the gender composition of the sample,  $F(10, 3065) = 1.80, p > .05$ .

### Single-Group Confirmatory Factor Analysis

*Comprehensive Inventory of Thriving.* Table 4 summarises the results for the single-group CFA for each of the four models tested. While the single-factor model produced admissible solutions for all countries, the goodness-of-fit statistics were well below the desired threshold. Much like the single-factor model, the seven-factor model resulted in admissible solutions, but the goodness-of-fit statistics were well below satisfactory. The bi-factor model produced acceptable goodness-of-fit statistics; however, six countries had inadmissible solutions. Finally, the 18-factor model produced acceptable goodness-of-fit statistics and had admissible solutions for all but three countries (Argentina, Mexico, and China). Specifically, these latter three countries had a covariance matrix that was not positive definite, which may indicate a linear dependency between two or more factors in these samples. Hence, these three countries were dropped from the measurement invariance analysis for the comprehensive inventory of thriving. Means, standard deviations, and factor loadings for all countries using the 18-factor model are reported in the online supplementary materials.

*Brief Inventory of Thriving.* The goodness-of-fit indices indicated that the single-factor structure of the brief inventory of thriving fit the data well for all countries with the exception of Russia and Turkey (Table 5). Means, standard deviations, and factor loadings from these analyses are reported in the online supplementary material. An investigation of modification indices suggested that strong associations between two pairs of items were causing the misfit. In both the Russia and Turkey data, items 48 and 51 were strongly associated with each other. In the Russia data, there was also a strong relationship between items 3 and 16. The second pair of items that were associated with each other in the Turkey data were items 34 and 40. After allowing the residuals to correlate, the goodness-of-fit statistics were acceptable for both the Russia and Turkey data and these models were used in subsequent tests of measurement invariance.

### Measurement Invariance

*Comprehensive Inventory of Thriving.* Table 6 summarises the results from the MG-CFA for the comprehensive inventory of thriving. Tests of

TABLE 3  
Descriptive Statistics for Each Country

	USA	Argentina	Australia	China	Germany	India	Mexico	Russia	Singapore	Spain	Turkey
Sample Size (N)	1090	195	205	206	200	197	197	199	197	203	196
Age											
<i>M</i>	45.52	42.48	42.09	36.14	39.08	38.57	36.65	36.82	33.93	38.25	32.51
<i>SD</i>	16.93	15.24	16.92	11.48	15.29	14.42	12.95	12.34	10.47	14.45	9.45
Gender (%) Female	53.03	61.14	53.66	55.61	55.00	48.47	49.75	52.26	47.21	54.46	43.59
Marital Status (%)											
Married	45.81	39.90	40.98	76.59	35.50	65.82	57.36	56.28	45.69	38.12	49.49
Domestic Partner	5.24	25.39	16.10	1.95	28.50	1.53	9.14	17.09	1.52	18.81	46.43
Single	34.31	19.69	32.20	20.49	29.00	30.10	26.90	20.60	52.28	36.63	4.08
Divorced	11.04	11.40	8.29	.49	4.50	.51	5.08	5.03	.00	4.95	.00
Widowed	3.59	3.63	2.44	.49	2.50	2.04	1.52	1.01	.51	1.49	.00
Education (%)											
No HS Diploma	4.13	5.18	9.76	0.49	23.74	0.51	5.10	.00	4.57	.99	2.55
High School	20.84	18.13	21.46	3.90	26.26	5.61	14.8	4.02	19.29	6.93	17.86
Vocation/Trade School	7.44	25.91	16.59	0.98	23.74	0.51	9.69	9.05	6.09	13.37	1.53
Some College	29.57	25.39	17.07	19.02	2.53	5.10	9.18	9.55	7.61	30.70	14.8
College Degree	25.99	16.58	17.07	65.85	5.56	20.92	55.1	68.84	27.41	30.20	52.55
Graduate Work	12.03	8.81	18.05	9.76	18.18	67.35	6.12	8.54	35.03	10.40	10.71
Employment Status (%) <sup>1</sup>											
Full Time	35.90	30.24	30.24	89.32	47.00	60.41	53.81	62.31	73.10	40.59	54.08
Part Time	29.23	23.41	23.41	1.94	14.50	13.20	15.74	17.59	7.11	13.37	10.20
Unemployed	11.79	5.85	5.85	0.49	7.00	7.11	10.15	4.02	6.60	19.80	8.16
Other	18.46	18.46	38.54	8.25	29.50	17.77	16.75	13.57	11.68	24.75	26.53

Note: <sup>1</sup>Employment Status question data were not collected for the United States sample.

TABLE 4  
Results of Single-Group Confirmatory Factor Analysis of the Comprehensive Inventory of Thriving

<i>Model – CIT</i>	$\chi^2$ (df)	<i>CFI</i>	<i>TLI</i>	<i>RMSEA</i>	<i>SRMR</i>
One-factor model					
USA	17146.246 (1377)	.586	.569	.103	.089
Argentina	4074.357 (1377)	.578	.562	.101	.090
Australia	5299.448 (1377)	.562	.545	.118	.095
China	3433.702 (1377)	.744	.734	.085	.075
Germany	4750.294 (1377)	.608	.592	.111	.089
India	5019.918 (1377)	.507	.448	.116	.105
Mexico	4715.601 (1377)	.546	.528	.111	.100
Russia	5370.952 (1377)	.486	.466	.121	.107
Singapore	4763.915 (1377)	.585	.569	.112	.090
Spain	5061.235 (1377)	.521	.502	.115	.100
Turkey	5232.509 (1377)	.525	.507	.120	.099
Seven-factor model					
USA	12154.178 (1356)	.716	.701	.086	.077
Argentina	3312.754 (1356)	.694	.667	.086	.080
Australia	4180.670 (1356)	.685	.667	.101	.085
China	2815.972 (1356)	.818	.808	.072	.067
Germany	3860.236 (1356)	.709	.693	.096	.080
India	3872.945 (1356)	.659	.641	.097	.091
Mexico	3845.647 (1356)	.661	.643	.097	.090
Russia	3909.840 (1356)	.671	.653	.097	.095
Singapore	3859.057 (1356)	.693	.676	.097	.080
Spain	3928.693 (1356)	.666	.647	.097	.092
Turkey	3845.282 (1356)	.694	.677	.097	.082
Bi-factor model					
USA	2625.134 (1170)	.962	.953	.034	.028
Argentina <sup>a</sup>	1671.096 (1170)	.922	.904	.047	.044
Australia <sup>a</sup>	2013.841 (1170)	.906	.885	.059	.040
China <sup>a</sup>	1688.512 (1170)	.935	.921	.046	.044
Germany <sup>a</sup>	1894.521 (1170)	.916	.897	.056	.040
India	2053.481 (1170)	.880	.854	.062	.048
Mexico <sup>a</sup>	2015.812 (1170)	.885	.859	.061	.048
Russia	2012.387 (1170)	.892	.867	.060	.051
Singapore	1832.898 (1170)	.919	.901	.054	.041
Spain <sup>a</sup>	2049.442 (1170)	.886	.860	.061	.049
Turkey	1830.342 (1170)	.919	.901	.054	.042
18-factor model					
USA	2955.777 (1224)	.954	.947	.036	.033
Argentina <sup>a</sup>	1818.944 (1224)	.907	.891	.050	.056
Australia	2204.281 (1224)	.891	.872	.063	.057
China <sup>a</sup>	1819.096 (1224)	.926	.913	.049	.045
Germany	2072.326 (1224)	.901	.885	.059	.060
India	2120.984 (1224)	.879	.858	.061	.055
Mexico <sup>a</sup>	2027.833 (1224)	.891	.872	.058	.057
Russia	2105.156 (1224)	.887	.867	.060	.058

Table 4 (Continued)

<i>Model – CIT</i>	$\chi^2$ ( <i>df</i> )	<i>CFI</i>	<i>TLI</i>	<i>RMSEA</i>	<i>SRMR</i>
Singapore	1967.778 (1224)	.909	.893	.056	.050
Spain	2106.649 (1224)	.885	.866	.060	.054
Turkey	2025.649 (1224)	.901	.885	.058	.060

*Note:* *df* = degrees of freedom; *CFI* = comparative fit index; *TLI* = Tucker-Lewis Index; *RMSEA* = root mean square error of approximation; *SRMR* = standardised root mean square residual.

<sup>a</sup>Covariance matrix was not positive definite.

TABLE 5  
Results of Single-Group Confirmatory Factor Analysis for the Brief Inventory of Thriving

<i>Model – BIT</i>	$\chi^2$ ( <i>df</i> )	<i>CFI</i>	<i>TLI</i>	<i>RMSEA</i>	<i>SRMR</i>
Single-factor model					
USA	242.057 (35)	.950	.936	.074	.032
Argentina	60.964 (35)	.959	.947	.062	.045
Australia	64.380 (35)	.968	.959	.064	.037
China	74.474 (35)	.961	.950	.074	.034
Germany	63.804 (35)	.967	.957	.064	.039
India	71.446 (35)	.934	.916	.073	.045
Mexico	69.688 (35)	.945	.930	.071	.046
Russia	117.314 (35)	.865	.826	.109	.066
Singapore	63.706 (35)	.967	.958	.065	.039
Spain	89.723 (35)	.925	.904	.088	.047
Turkey	130.615 (35)	.862	.822	.118	.071
Single-factor model ( $\Theta_{48,51}$ ; $\Theta_{3,6}$ ; $\Theta_{34,40}$ free)					
USA	170.912 (32)	.967	.953	.063	.028
Argentina	53.206 (32)	.967	.953	.059	.042
Australia	57.688 (32)	.972	.961	.063	.035
China	57.190 (32)	.975	.965	.062	.029
Germany	59.364 (32)	.968	.956	.065	.038
India	56.962 (32)	.955	.937	.063	.041
Mexico	55.825 (32)	.962	.947	.061	.042
Russia	79.860 (32)	.922	.089	.087	.055
Singapore	52.482 (32)	.976	.967	.057	.036
Spain	65.934 (32)	.954	.935	.072	.043
Turkey	81.039 (32)	.929	.900	.088	.060

*Note:* *df* = degrees of freedom; *CFI* = comparative fit index; *TLI* = Tucker-Lewis Index; *RMSEA* = root mean square error of approximation; *SRMR* = standardised root mean square residual.

measurement invariance for the comprehensive inventory of thriving were conducted using the 18-factor model for eight countries (the United States, Australia, Germany, India, Russia, Singapore, Spain, Turkey). The goodness-of-fit

TABLE 6  
Measurement Invariance of the 18-Factor Comprehensive Inventory of Thriving<sup>a</sup>

<i>Model</i>	$\chi^2$ ( <i>df</i> )	<i>CFI</i>	$\Delta$ <i>CFI</i>	<i>TLI</i>	<i>RMSEA</i>	<i>SRMR</i>
Configural	17190.75 (9768)	.926		.913	.050	.046
Metric	17707.02 (10020)	.924	.002	.913	.050	.054
Scalar	19280.08 (10272)	.910	.013	.900	.053	.056
Partial Scalar						
$\tau_{13}$ free	19190.97 (10265)	.911	.012	.901	.053	.055
$\tau_{13}, \tau_9$ free	19064.53 (10258)	.912	.011	.902	.053	.055
$\tau_{13}, \tau_9, \tau_{25}$ free	18975.95 (10251)	.914	.010	.903	.052	.055

*Note:* *df* = degrees of freedom; *CFI* = comparative fit index; *TLI* = Tucker-Lewis Index; *RMSEA* = root mean square error of approximation; *SRMR* = standardised root mean square residual.

<sup>a</sup>Results exclude Argentina, China, and Mexico samples.

indices suggested good model fit across all countries for tests of configural, metric, and scalar invariance; however, the  $\Delta$ CFI exceeded .01 when comparing the metric to the scalar model. Hence, modification indices were examined and subsequently released. Allowing the intercepts of items 13, 9, and 25 to be freely estimated between groups brought the  $\Delta$ CFI to .01, which is evidence of partial scalar variance.

*Brief Inventory of Thriving.* Tests of measurement invariance for the brief inventory of thriving were conducted using the single-factor model specified earlier (Table 7) for all countries. Although goodness-of-fit statistics indicated that the models fit well across tests of configural, metric, and scalar invariance, the

TABLE 7  
Measurement Invariance of the Single-Factor Brief Inventory of Thriving

<i>Model</i>	$\chi^2$ ( <i>df</i> )	<i>CFI</i>	$\Delta$ <i>CFI</i>	<i>TLI</i>	<i>RMSEA</i>	<i>SRMR</i>
Configural	814.616 (352)	.962		.947	.069	.037
Metric	1016.529 (442)	.953	.009	.947	.068	.075
Scalar	1640.625 (532)	.909	.044	.916	.086	.089
Partial Scalar						
$\tau_{16}$ free	1539.419 (522)	.917	.036	.921	.083	.086
$\tau_{16}, \tau_{31}$ free	1438.137 (512)	.924	.029	.927	.080	.084
$\tau_{16}, \tau_{31}, \tau_{20}$ free	1348.467 (502)	.931	.022	.932	.078	.082
$\tau_{16}, \tau_{31}, \tau_{20}, \tau_{28}$ free	1274.270 (492)	.936	.017	.936	.075	.080
$\tau_{16}, \tau_{31}, \tau_{20}, \tau_{28}, \tau_3$ free	1210.371 (482)	.940	.013	.939	.073	.078
$\tau_{16}, \tau_{31}, \tau_{20}, \tau_{28}, \tau_3, \tau_{34}$ free	1157.486 (472)	.944	.009	.941	.072	.077

*Note:* *df* = degrees of freedom; *CFI* = comparative fit index; *TLI* = Tucker-Lewis Index; *RMSEA* = root mean square error of approximation; *SRMR* = standardised root mean square residual.

$\Delta$ CFI exceeded .01 when comparing the scalar and metric models. Modification indices were examined to determine the source of the misfit. By releasing constraints from items 16, 31, 20, 28, 3, and 34 the  $\Delta$ CFI decreased to below .01, hence demonstrating partial scalar invariance.

## Alternative Solutions

On the comprehensive inventory of thriving, three countries failed to produce admissible solutions for all models: Argentina, Mexico, and China. Using the 18-factor model as the basis, further investigation revealed issues with the flow construct for Argentina and Mexico. The reliability of the flow factor in both of these samples was very low ( $\alpha = .37$ ). Specifically, item 19 was not strongly correlated with items 20 or 21 for Argentina or Mexico. In addition, item 19 poorly loaded onto the flow factor for both Argentina ( $\lambda = .23$ ) and Mexico ( $\lambda = .12$ ). Neither dropping this item from the analysis nor allowing this item to load onto any of the other 17 factors revealed admissible solutions. An admissible solution was only achieved by dropping the flow factor entirely for both the Argentina (CFI = .91; TLI = .90; RMSEA = .050; SRMR = .055) and Mexico samples (CFI = .90; TLI = .88; RMSEA = .058; SRMR = .056).

Examination of the covariance/correlation matrices for China revealed that several latent factors were strongly related to one another ( $r_s > .90$ ). However, there was not enough evidence to suggest that any specific factor was the underlying cause. Therefore, exploratory tests of both theory driven alternative models (e.g. two-factor hedonic/eudaimonic well-being; three-factor hedonic/eudaimonic/social well-being) and bottom-up alternative models (e.g. exploratory factor analysis) were explored. Although some of these models produced admissible solutions, none produce sufficient goodness-of-fit values.

## DISCUSSION

Interest in cross-cultural comparisons on positive psychological health is increasing. An important prerequisite to examining these differences is making sure that responses on positive psychological health measures are equivalent. The present study sought to demonstrate measurement invariance for two integrative measures of positive psychological health. Our results suggest that, in some cases, the comprehensive and brief inventories of thriving may be an adequate tool to assess cross-cultural differences in well-being. Specifically, this study provided partial scalar invariance evidence for the brief inventory of thriving for all countries and partial scalar invariance evidence for the comprehensive inventory of thriving for most countries. However, it is important to note that the 18-factor structure of the comprehensive inventory of thriving could not be established for three countries (Argentina, China, Mexico). Below, we discuss our results, limitations, and directions for future research.

## Comprehensive Inventory of Thriving

Overall, we found that the 18-factor structure of the comprehensive inventory of thriving generalised to most of the countries we sampled, with the exception of Argentina, Mexico, and China. Although goodness-of-fit statistics indicated that the 18-factor model fit these data well, the solutions were inadmissible and could not be used in the measurement invariance analysis. With respect to Argentina and Mexico, we believe that the inadmissible solutions were caused by two factors: small sample size and poor factor loadings of item 19. Both small samples and low factor loadings are known to increase the likelihood of inadmissible solutions (Gagne & Hancock, 2006). When the flow items were removed from the model, we were able to fit a 17-factor structure with sufficient goodness-of-fit statistics. Further, it is possible that the underlying issue is not with the concept of flow, but with the translation of a single item. Specifically, the small item in both countries loaded poorly onto the latent construct of flow and both measures were translated into Spanish.

These same trends were not apparent when investigating the Chinese data. Neither tests of alternative models nor exploratory factor analysis revealed a viable solution for the Chinese data. One potential explanation concerns the strength to which those from the Chinese culture associate different aspects of well-being with one another. For example, there is evidence of shifting cultural values in China, where the desire to modernise is resulting in concepts such as mastery to be highly valued (Yang, 1996). It could be the case that the idea of mastery over one's environment is inextricably tied to happiness and meaningful life in contemporary Chinese cultures. This suggests that the participants did not discern between these concepts, leading to inadmissible solutions. Examination of the correlation matrix from the 18-factor model suggests that this may be a possibility as there were strong relationships between the concepts of mastery, meaning, and subjective well-being ( $r_s > .90$ ).

## Brief Inventory of Thriving

The brief inventory was designed to quickly assess positive psychological health with 10 items, and demonstrated sound psychometric properties in the current study. Specifically, the single-factor structure of the brief inventory of thriving fit the data well in each nation and there was evidence of partial scalar invariance. Overall, these results support the use of the brief inventory of thriving for cross-cultural comparisons.

## Limitations

It is important to note the limitations of the current efforts. First, this study attempted to validate complex factor structures in the comprehensive inventory

of thriving with relatively small samples. We believe that small samples were one of the reasons why the single-group CFA from the Argentina, China, and Mexico data did not produce admissible solutions. Further, although the results from inadmissible solutions should be interpreted with caution, the bi-factor model appeared to fit the data better than the 18-factor model for the comprehensive inventory of thriving. Yet, we were unable to examine this structure as six of the countries resulted in non-positive definite covariance matrices.

Relatedly, our samples may not have been truly representative of an entire nation. It is difficult to argue that 200 individuals are representative of the population of nations. Not only may our results represent a subsample of a population, but they may also not represent the same subsample between nations. As noted earlier, there were age differences between the nations. This has implications for the generalisability of the results as age has also been shown to influence how one thinks about well-being (Pinquart & Sörenson, 2001). Consequently, future measurement invariance work should focus on establishing the psychometric properties of these measures in both larger and more representative samples.

## Future Directions and Conclusions

Despite these limitations, our results suggest that both the comprehensive and brief inventories of thriving could be used in comparing positive psychological health across cultures. Countries are moving towards integrating assessments of psychological health as indicators of societal progress (Diener & Seligman, 2004). However, many existing measures only represent a small portion of mental health. The comprehensive and brief inventories of thriving were designed to assess positive psychological health more broadly, and our results indicate that these measures may be a viable option. Hence, studying mean differences between cultures on these measures could facilitate our understanding of cultural differences between nations.

Further, this study has implications for our understanding of how different cultures value different aspects of positive psychological health. Culture plays an important role in determining both the form and value of well-being (Diener & Suh, 2000). Although measurement invariance results cannot directly inform this idea (Church, 2010; Hui & Triandis, 1985), it presents indirect evidence that different cultures may hold similar understandings of positive psychological health. It could be informative for future research to use the results from this study to examine not only mean differences, but also the weight different cultures place on these aspects of positive psychological health.

In conclusion, the present study extends the initial work by Su et al. (2014) by providing evidence of the measurement invariance of the comprehensive and brief inventories of thriving across cultures. Although the factor structure of the comprehensive inventory of thriving was inadmissible in three countries

(Argentina, China, and Mexico), the results provide a crucial first step for those interested in comparing positive psychological health across nations. Research in both using these measures and cross-cultural comparisons on positive psychological health is growing. We hope that the current efforts help facilitate this work towards furthering the understanding of positive psychological health.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

**Table S1.** Standardized factor loading from confirmatory factor analysis for each country on the comprehensive inventory of thriving.

**Table S2.** Standardized factor loading from confirmatory factor analysis for each country on the brief inventory of thriving.

**Table S3.** Means and Standard Deviations of the Comprehensive Inventory of Thriving Subscales and the Brief Inventory of Thriving

**Table S4** Reliability Estimates of the Comprehensive Inventory of Thriving Subscales and the Brief Inventory of Thriving

**Appendix S1.** Chinese Translation of the BIT and CIT.

**Appendix S2.** German Translation of the BIT and CIT.

**Appendix S3.** Russian Translation of the BIT and CIT.

**Appendix S4.** Spanish Translation of the BIT and CIT (Argentina).

**Appendix S5.** Spanish Translation of the BIT and CIT (Mexico).

**Appendix S6.** Spanish Translation of the BIT and CIT (Spain).

**Appendix S7.** Turkish Translation of the BIT and CIT.

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