

PSYCHOMETRIC PROPERTIES OF SLOVAK SHORT AND EXTRA-SHORT FORMS OF BIG FIVE INVENTORY-2 (BFI-2)

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ABSTRACT

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Objectives. The current study is focused on reporting psychometric properties of the BFI-2 short and extra-short forms in Slovakia.

Sample and settings. Data were collected from a Slovak general adult sample (N = 801, 51.2% females) using an online research panel.

Statistical analysis. Analysis focused on exploring the factor structure, gender differences, correlations with age and predictions of well-being criteria of the short forms and comparing these forms to the full BFI-2 item set.

Results. Random intercept exploratory factor analysis showed that most items loaded on their intended factor in the short form; in the extra-short form a few cases of weak loadings or cross-loadings occurred. Part-whole correlations with the full form were strong. Compared to the full form, the short forms also showed a similar pattern of gender differences and correlations with age, suggesting quite strong congruence of these forms. Focusing on the prediction of selected well-being criteria, the short forms retained 88-94% of explained variance com-

pared to the full form. In sum, these results suggest that short forms of the Slovak BFI-2 are appropriate when a short measure of the Big Five personality factors is needed but should be used with caution and whenever possible, full form should be used.

Limitations. Limitations of the current study lie mainly in embedded administration of BFI-2 shorter versions within full BFI-2, absenting investigation of test-retest stability and self-peer congruence of results obtained by the short forms of BFI-2.

key words:

BFI-2 short and extra-short form, Big Five personality, psychometric properties, Big Five Inventory 2, Slovak adaptation

klúčové slová:

BFI-2 krátka a extra-krátka verzia, osobnosť veľkej päťky, psychometrické vlastnosti, Inventár veľkej päťky 2, slovenská adaptácia

INTRODUCTION

The Big Five approach is one of the most used models for the description and assessment of personality (McCrae & Costa, 2008). Derived from analyses of the natural-language terms people use to describe themselves and others, it includes five robust personality traits, namely neuroticism, extraversion, agreeableness, conscientiousness and openness to experience (John, Naumann, & Soto, 2008; Hřebíčková, 2011). Because of the need to incorporate the Big Five in research, many psychometric measures of the Big Five personality traits have been developed since the model originated, and they have been widely used across many languages and cultures (e.g. Schmitt et al., 2007). The most frequently used measures are, for example, the 240-item NEO Personality Inventory-Revised and its shorter, 60-item version, the

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NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992), which have been used in the Czech and Slovak Republics (Ruisel & Halama, 2007; Hřebíčková, 2004), or the 44-item Big Five Inventory (John, Donahue & Kentle, 1991). Recently, Soto and John (2017a) presented a major revision of the BFI, named the BFI-2. This 60-item inventory is focused on measuring five broad domains consisting of 15 facets. Each facet is measured by 4 items, yielding 12 items per domain. This way a user can choose between broader description of general personality traits or focus on narrower facet traits. Main advantages of this inventory include ease of use – items are easily understandable, starting with “I am someone who” followed by statements about the self (e.g. “Tends to be lazy” or “Is emotionally stable, not easily upset”) and reduction of acquiescent response style impact by balancing pro-trait and contra-trait formulated items in all domains and facets. In their paper, Soto and John (2017a) showed stable factor structure, good reliability, test-retest stability and predictive power of the BFI-2. Quite similar results were also reported in German (Danner et al., 2019), Dutch (Denissen et al., 2019) and Slovak (Halama et al., 2020) adaptations.

Although administration of the BFI-2 is not very time consuming, there are specific situations when briefer measures are needed, such as large-scale household surveys, with *severe* constraints on assessment time, where personality is just one of many variables assessed. For example, a 15-item version of the original BFI has been used in the German Socio-Economic Panel Study (GSOEP; e.g., Asselmann & Specht, 2019) and the British Household Panel Survey (BHPS; e.g., Furnham & Cheng, 2019). Within the BFI family, the abbreviated, ten-item BFI-10 (Rammstedt & John, 2007) was developed and validated. Similarly, after development of the BFI-2, Soto and John (2017b) presented short (30-item) and extra-short (15-item) versions of this inventory. Their two main goals were to retain clear factor structure while adequately representing the breadth of content within each domain. They therefore selected one prototypical item per facet for the extra-short BFI-2-XS, and two items (one pro-trait and one contra-trait) per facet for the short BFI-2-S. This strategy was focused mainly on content validity, that is, to equally represent each facet, which may lead to relatively lower internal consistency. Soto and John (2017b) reported good psychometric properties of the short forms in terms of part-whole correlations, self-peer correlations, retest reliabilities, and factor structure, collectively suggesting comparability with the full form. Both shorter versions had similar correlation patterns with behavioral and well-being criteria compared to the full form; they also retained much of the full BFI-2’s predictive power, with an average of 93% relative predictive power for the BFI-2-S and 84% for the BFI-2-XS across self-reported and peer-reported criteria. The comparability of the full form to the short forms and adequate psychometric properties were also reported for the German version of the short forms by Rammstedt, Danner, Soto and John (2018).

With this background in mind, the aim of the present study is to explore the basic psychometric properties of the Slovak BFI-2 short and extra-short forms in a general adult Slovak sample. We will focus on and report descriptive statistics, internal consistency and factor structure. We will also focus on relations of BFI-2 with selected well-being measures as a method for comparison of ability to predict variance of external variables by full, short and extra-short version of BFI-2. We chose standard well-being variables (happiness, positive and negative affect, meaning in life), because the relationship of the Big five personality traits with these variables is well documented in empirical literature (e.g. Soto, 2015; Steger et al, 2008) and this makes them good tools for comparison analyses. These analyses altogether allow researchers and practitioners to make informed decisions about using the Slovak BFI-2 or one of its abbreviated versions.

METHOD

Sample

The sample consisted of 801 Slovak participants, with 410 females (51.2%) and 391 males. The participants were between 18 and 76 years old (36.8% between 18 and 35 years, 31.1% between 36 and 50 years, and 32.1% older than 51). Mean age of participants was 42.64 years (SD = 14.86), 43.20 (SD = 14.18) for males and 42.11 (SD = 15.48) for females. The modal level of education was a high school degree (42.7%), followed by high school without graduation (30.1%), university degree (Mgr., Ing., etc.; 14.5%), elementary school (8.5%), bachelor degree (2.9%) and doctorate or higher degree (1.4%). Most of the participants reported Slovak nationality (92.9%). The data were collected through an online panel in October 2018 and the participants were recruited by a research agency from their own database. The participants were invited to meet gender and age quotas through research agency's online system. All participants agreed upon the informed consent before continuing with survey. The final sample consists only of participants who passed all three of the attention-check items included in the survey and answered every item. These participants were compensated for their participation by the research agency with credits that could be exchanged for products. Researchers interested in using our data shall contact the primary author.

Measures

Slovak Big Five Inventory-2 (BFI-2) is a 60-item inventory for assessing five broad personality trait domains – Extraversion, Agreeableness, Conscientiousness, Negative Emotionality (also known as Neuroticism) and Open-Mindedness – with each domain consisting of three narrower facet traits. The original, English-language BFI-2 was developed by Soto and John (2017a). Each domain is measured by 12 items, and each facet by 4 items. The BFI-2 uses items that start with the shared stem “*I am someone who...*” and continues with short statements (e.g. “*Is outgoing, sociable*”). Participants indicate the extent to which they agree or disagree with each item using a 5-point scale from “*Disagree strongly*” to “*Agree strongly*”. The full, 60-item Slovak BFI-2 was used for data collection (Halama et al., 2020). Halama et al. (2020) reported satisfactory psychometric properties with robust factor structure, convergent validity with NEO-FFI and meaningful associations with gender, age and well-being measures of Slovak BFI-2 full version. The items for the short and extra-short version are identical with the original version from Soto and John (2017b). Participants answered only full form and the scores for short and extra short forms were computed from those data.

Meaning in life questionnaire is a 10-item tool for measuring the presence of and search for meaning in life (Steger et al., 2006). Participants indicate their response to each item by a 7-point scale ranging from “*Absolutely Untrue*” to “*Absolutely True*”. Internal consistency (Cronbach's alpha) in our sample was adequate, .90 for the Presence subscale and .81 for the Search subscale.

Subjective Happiness Scale (Lyubomirsky & Lepper, 1999) measures participants' subjective feeling of happiness using four items rated on 7-point scales. Respondents compare themselves to other peers in terms of happiness and indicate how generally happy or unhappy they are. Internal consistency in our sample was .79.

Short form of the *International Positive and Negative Affect Schedule* (Thompson, 2007) was used to assess the feelings of positive and negative affect. This measuring tool consists of two scales, one for positive and one for negative affect, with five

items per scale. The participants indicated their general tendency to experience each positive or negative affective state (e.g., active, nervous) using a 5-point scale from “Not at all” to “Extremely.” Internal consistency was .77 for Positive affect and .81 for Negative affect scale.

Data analysis

The data were analyzed using the jamovi software (The jamovi project, 2019) and the MPlus software (Muthén & Muthén, 2017). Firstly, we recoded items and computed mean scores for used measures. We then computed descriptive statistics (mean and standard deviation) of full and short versions for full sample and also each gender separately. The internal consistency of measures was computed using Cronbach’s alpha and McDonald’s omega. Gender differences were computed using Student’s t-test for independent samples and the size of differences was accessed using Cohen’s d. Pearson correlation was used to access correlations between full and short versions’ domains and facets with itself or with age and well-being measures. We then used multiple linear regression to access the explained variance of well-being measures by BFI-2. Five separate models were used for each well-being measure as dependent variable with 1) BFI-2 full version domains, 2) BFI-2 full version facets, 3) BFI-2 short version domains, 4) BFI-2 short version facets and finally 5) BFI-2 extra short version domains. Enter method was used for each model. To explore the factor structure of short and extra short BFI-2 versions we used random intercept exploratory factor analysis (RI-EFA) proposed by Aichholzer (2014) with orthogonal Varimax rotation. This method of factor analysis is an extension of ordinary exploratory factor analysis that examines the factor structure of an item set while also accounting for individual differences in acquiescent responding: a respondent’s tendency to consistently agree or consistently disagree with items, regardless of their content (cf. Soto & John, 2017b), which improves the model fit to data compared to standard exploratory factor analysis (Aichholzer, 2011). In RI-EFA, each item is allowed to load on both the substantive factors and a method factor used to model acquiescence. The raw items were allowed to load on five orthogonal factors and on acquiescence factor. This analysis was used for original BFI-2 short and extra short versions (Soto, John, 2017b) and also Slovak BFI-2 full version (Halama et al., 2020).

RESULTS AND DISCUSSION

The present paper is focused on reporting basic psychometric properties of short and extra-short forms of the Slovak Big Five Inventory-2. Following Soto and John (2017b), we examined congruence between the full and abbreviated forms in areas of internal consistency, part-whole correlations, gender differences, correlations with age, factor structure and predictive power.

Table 1 presents descriptive statistics and internal consistency for the short and extra-short forms of the Slovak BFI-2. Cronbach’s alpha of the full version was very good, ranging between .77 and .84 ($M = .80$) for the Big Five domains and .50 to .72 ($M = .63$) for the 15 facets. The domains of the short form had acceptable internal consistency ranging from .65 to .73 ($M = .68$). Cronbach’s alphas for short form facets ranged from .28 (Assertiveness) to .63 for Creative Imagination ($M = .43$). For the extra-short form, domain alphas ranged from .36 (Agreeableness) to .64 (Negative Emotionality), with a mean of .47. On average, similar values were reached using McDonald’s omega: .81 for full version’s domains, .64 for facets, .69 for short version’s domains and .43 for facets, and finally .48 for extra-short form’s domains. These values were some-

what lower, but still comparable, to the mean alphas of .73 for the short domains, .53 for the short facets, and .53 for the extra-short domains previously obtained for the German BFI-2 short forms (Rammstedt et al., 2018). They reflect the extreme brevity of the 2-item short facet scales and 3-item extra-short domain scales, as well as the decision to preserve content breadth when the internal consistency of short forms is not in primary focus (Soto & John, 2017b; see also Smith, McCarthy, & Anderson, 2000; Stanton et al., 2002; Gosling, Rentfrow, & Swann, 2003; Rammstedt & John, 2007).

To compare short forms to the full item set of the BFI-2, we computed correlations between full, short and extra-short participants' domain and facet scores. Part-whole correlations between scores from the full and the short version ranged between .92 (Agreeableness) and .95 (Negative emotionality) for domains ($M = .93$) and from .81 (Intellectual Curiosity) to .91 (Depression) for facets ($M = .87$), suggesting relatively high congruence between full and short form domain and facet scores. Slightly lower were part-whole correlations between the full and extra-short domains, ranging from .75 (Conscientiousness) to .87 (Negative emotionality) with a mean of .82. Similar results were previously obtained for the German short forms (Rammstedt et al., 2018). Correlations between the short and extra-short version were $M = .89$, between .87 (Conscientiousness) and .91 (Negative emotionality). These results indicate that despite the fact that the short and extra-short forms contain only one half or one quarter of the full-form items, respectively, they explain most of the variance of the full form, with a mean of 87% for the short form domains, 75% for the short form facets, and 67% for the extra-short form domains.

The gender differences and correlations with age of both short forms are displayed in Table 2. For both the short and extra-short forms, gender differences were found in Agreeableness (Cohen's $d = -.38$ and $-.41$, respectively) and Negative Emotionality ($d = -.43$ and $-.48$, respectively) domains. Significant gender differences were also found for 12 out of 15 facets of the short form, although most of these were only small in size (mean absolute $d = .27$). A very similar pattern of gender differences was found in the full Slovak BFI-2; column-vector congruence correlations comparing the pattern of gender differences were .93, .93 and .98 for full versus short, full versus extra-short, and short versus extra-short forms respectively.

Correlations with age were significant for the Agreeableness ($r = .13$ and $.15$ for the short and extra-short forms, respectively, and Conscientiousness ($r = .08$ and $.09$) domains, as well as the short Respectfulness ($r = .14$), Trust ($r = .12$), and Organization ($r = .13$) facets. These correlations were comparable to the full form, with congruence correlations of .83, .85 and .93 for full versus short, full versus extra-short, and short versus extra-short forms, respectively. These results indicate that the Slovak BFI-2 short forms accurately capture age and gender differences in the Big Five domains and facets.

To compare inter-method convergence and discrimination, we computed correlations between all facets of the short and full form, as well as correlations between domains in all three forms. In Table 3 we present facet correlations in the full and short form. Same-domain facet correlations of the BFI-2 S ranged from .33 (Aesthetic Sensitivity and Intellectual Curiosity) to .51 (Anxiety and Depression), with a mean of .40, while different-domain facet absolute correlations were lower, ranging from .00 to .47 ($M = .20$). A similar pattern was identified in full BFI-2 item set although correlations were slightly stronger for both same-domain facet correlations ($M = .50$; range = .38 to .64) and different-domain facet correlations ($M = .25$; range = .00 to .51). Overall congruence of facet correlations in the full and short form is very high ($R = .98$), indicating that the Slovak BFI-2-S clearly retains the full measure's pattern of facet intercorrelations.

Table 1 Descriptive statistics, internal consistency and part-whole correlations of BFI-2 full and short forms

BFI-2 Domains	Mean (SD)		Internal consistency			Part-whole correlations			
	Full	S	XS	S	XS	Full & S	Full & XS	S & XS	
Extraversion	3.29 (.57)	3.26 (.66)	3.01 (.81)	.78/.78	.65/.66	.50/.50	.93	.83	.88
Agreeableness	3.79 (.53)	3.72 (.61)	3.74 (.67)	.77/.78	.65/.66	.36/.39	.92	.80	.88
Conscientiousness	3.73 (.59)	3.76 (.61)	3.80 (.67)	.83/.84	.69/.70	.43/.45	.93	.75	.87
Negative Emotionality	2.87 (.66)	2.87 (.72)	2.89 (.85)	.84/.84	.73/.74	.64/.65	.95	.87	.91
Open-Mindedness	3.57 (.58)	3.43 (.65)	3.40 (.71)	.79/.79	.67/.68	.40/.41	.92	.83	.88
<i>Facets</i>									
Sociability (E)	3.27 (.81)	3.27 (.91)		.70/.71	.45/.46		.90		
Assertiveness (E)	3.13 (.65)	3.02 (.82)		.50/.51	.28/.28		.86		
Energy Level (E)	3.48 (.69)	3.50 (.87)		.60/.61	.50/.50		.86		
Compassion (A)	3.93 (.63)	3.93 (.73)		.54/.55	.30/.32		.83		
Respectfulness (A)	4.13 (.66)	4.00 (.80)		.64/.66	.39/.42		.89		
Trust (A)	3.31 (.68)	3.24 (.84)		.55/.56	.41/.41		.86		
Organization (C)	3.79 (.77)	3.62 (.84)		.70/.73	.44/.44		.87		
Productiveness (C)	3.71 (.70)	3.98 (.77)		.64/.67	.48/.49		.86		
Responsibility (C)	3.68 (.64)	3.67 (.71)		.62/.63	.32/.33		.87		
Anxiety (N)	3.02 (.72)	2.86 (.91)		.59/.61	.54/.54		.87		
Depression (N)	2.76 (.81)	2.81 (.89)		.72/.73	.53/.53		.91		
Emotional Volatility (N)	2.84 (.77)	2.94 (.88)		.66/.66	.40/.40		.88		
Aesthetic Sensitivity (O)	3.39 (.88)	3.18 (1.01)		.72/.74	.53/.53		.90		
Intellectual Curiosity (O)	3.59 (.62)	3.52 (.69)		.52/.53	.22/.22		.81		
Creative Imagination (O)	3.73 (.70)	3.58 (.83)		.67/.70	.63/.64		.88		

Note. S – short form, XS – extra-short form. Internal consistency values left of the forward slash are for Cronbach's alpha and values right of the forward slash are for McDonald's omega. All correlations are significant $p < .05$.

Table 2 BFI-2 S and XS gender differences and correlations with age

Domains	Females mean (SD)			Males mean (SD)			Gender Cohen's d			Age		
	Full	S	XS	Full	S	XS	Full	S	XS	Full	S	XS
Extraversion	3.29 (.54)	3.27 (.63)	3.02 (.81)	3.30 (.60)	3.26 (.69)	3.00 (.81)	.01	-.03	-.02	.07	.04	.05
Agreeableness	3.88 (.49)	3.84 (.56)	3.87 (.64)	3.69 (.55)	3.61 (.63)	3.60 (.68)	-.36	-.38	-.41	.12	.13	.15
Conscientiousness	3.75 (.57)	3.75 (.59)	3.75 (.66)	3.71 (.62)	3.77 (.64)	3.85 (.69)	-.07	.04	.14	.11	.08	.09
Negative Emotionality	3.00 (.60)	3.02 (.67)	3.08 (.79)	2.74 (.69)	2.71 (.73)	2.69 (.86)	-.41	-.43	-.48	-.10	-.06	-.02
Open-Mindedness	3.57 (.56)	3.41 (.65)	3.39 (.71)	3.58 (.59)	3.44 (.64)	3.40 (.70)	.02	.05	.02	.05	.04	.01
<i>Facets</i>												
Sociability (E)	3.31 (.77)	3.37 (.88)		3.22 (.85)	3.17 (.94)		-.12	-.22		.11	.02	
Assertiveness (E)	3.08 (.61)	2.96 (.80)		3.18 (.70)	3.09 (.84)		.16	.16		.03	.03	
Energy Level (E)	3.48 (.68)	3.49 (.86)		3.49 (.70)	3.51 (.88)		.03	.02		.01	.05	
Compassion (A)	4.03 (.60)	4.05 (.70)		3.83 (.64)	3.80 (.74)		-.32	-.34		.07	.04	
Respectfulness (A)	4.21 (.63)	4.12 (.77)		4.04 (.68)	3.86 (.80)		-.27	-.33		.11	.14	
Trust (A)	3.40 (.65)	3.33 (.82)		3.21 (.70)	3.15 (.85)		-.28	-.22		.11	.12	
Organization (C)	3.77 (.75)	3.51 (.84)		3.82 (.79)	3.73 (.84)		.06	.26		.09	.13	
Productiveness (C)	3.72 (.68)	3.97 (.77)		3.71 (.71)	3.98 (.77)		-.02	.01		.11	.05	
Responsibility (C)	3.76 (.61)	3.75 (.67)		3.60 (.67)	3.59 (.74)		-.24	-.23		.07	-.01	
Anxiety (N)	3.14 (.69)	3.01 (.90)		2.89 (.73)	2.69 (.90)		-.36	-.35		-.06	-.07	
Depression (N)	2.90 (.78)	2.95 (.87)		2.62 (.82)	2.66 (.89)		-.35	-.34		-.07	-.05	
Emotional Volatility (N)	2.96 (.71)	3.09 (.83)		2.71 (.81)	2.79 (.90)		-.34	-.35		-.13	-.04	
Aesthetic Sensitivity (O)	3.53 (.80)	3.26 (.97)		3.24 (.94)	3.10 (1.04)		-.33	-.16		.09	.07	
Intellectual Curiosity (O)	3.52 (.63)	3.49 (.69)		3.67 (.61)	3.55 (.70)		.23	.09		.03	.03	
Creative Imagination (O)	3.64 (.69)	3.48 (.85)		3.82 (.69)	3.68 (.80)		.25	.24		-.02	-.01	

Note. S – short form, XS – extra-short form. Negative Cohen's d values indicate higher score for females. Absolute gender differences of .16 and higher are significant at $p < .05$. Absolute age correlations of .08 and higher are significant at $p < .05$.

Table 3 Facet correlations of BFI-2 full and short forms

BFI-2 facets	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Sociability		.44	.20	.13	.20	.09	.24	.18	.32	-.43	-.21	.14	.17	.27	
2. Assertiveness	.33		.42	.02	-.04	.01	.16	.24	.23	-.25	-.36	-.11	.17	.31	.37
3. Energy level	.40	.35		.27	.27	.30	.31	.50	.37	-.33	-.45	-.32	.32	.40	.51
4. Compassion	.23	.04	.17		.55	.41	.24	.29	.34	-.12	-.14	-.25	.28	.25	.29
5. Respectfulness	.10	-.02	.20	.49		.44	.31	.34	.41	-.21	-.22	-.38	.23	.19	.25
6. Trust	.21	.04	.30	.36	.33		.18	.24	.20	-.26	-.28	-.36	.22	.12	.18
7. Organization	.03	.13	.28	.16	.26	.19		.56	.57	-.27	-.31	-.35	.12	.17	.25
8. Productiveness	.15	.24	.45	.22	.29	.23	.42		.56	-.27	-.34	-.33	.19	.25	.36
9. Responsibility	.16	.20	.33	.29	.29	.24	.44	.44		-.23	-.30	-.32	.17	.23	.28
10. Anxiety	-.27	-.22	-.37	-.12	-.20	-.24	-.33	-.26	-.18		.64	.59	-.03	-.11	-.23
11. Depression	-.33	-.31	-.47	-.11	-.16	-.19	-.35	-.31	-.27	.51		.57	-.05	-.21	-.31
12. Emotional Volatility	-.07	-.03	-.24	-.17	-.28	-.31	-.30	-.21	-.16	.51	.39		-.09	-.24	-.27
13. Aesthetic Sensitivity	.07	.21	.20	.18	.13	.14	.05	.13	.10	-.04	-.03	-.03		.40	.38
14. Intellectual Curiosity	.00	.17	.19	.12	.14	.07	.20	.18	.20	-.08	-.16	-.18	.33		.51
15. Creative Imagination	.19	.32	.39	.16	.12	.14	.20	.32	.24	-.21	-.26	-.13	.40	.36	

Note. The upper-right part of table presents full form correlation, lower-left part presents correlations in the short form. Correlations of same domain facets are bolded. Absolute correlations of .07 or higher are significant at $p < .05$.

The comparison of domain correlations in the full and short forms is presented in Table 4. Overall, there is a similar pattern of correlations between these forms, but, again, correlations in both short forms (especially the BFI-2-XS) are weaker than those in the full form. The congruence of these correlations between forms is high, .99 for full versus short, .97 for full versus extra-short, and finally .98 for short versus extra-short. As Table 4 shows, domain correlations are moderate in all three forms of BFI-2 (mean absolute $r = .37$ for the full version, .32 for the short version, and .22 for the extra-short version). Additional analyses of the Slovak BFI-2 and NEO-FFI (Halama et al., 2020), as well as the German BFI-2 (Rammstedt et al., 2018), suggest that these relatively high domain intercorrelations reflect the reduced discriminant validity of data from online research panels, rather than an issue specific to the Slovak BFI-2.

Table 4 Correlations of BFI-2 domains in the full and short forms

BFI-2 domains	1	2	3	4	5
1. Extraversion		.24	.38	-.46	.45
2. Agreeableness	.24/.11		.42	-.36	.35
3. Conscientiousness	.36/.21	.39/.31		-.42	.33
4. Negative emotionality	-.42/-.31	-.32/-.20	-.42/-.42		-.24
5. Open-Mindedness	.33/.20	.23/.18	.29/.17	-.19/-.09	

Note. The upper-right part of the table presents full form correlations, lower-left part presents correlations in the shorter forms. Values left from a slash are for the short form, values right to a slash are for the extra-short form. All correlations are significant at $p < .05$.

The results of random intercept exploratory factor analysis of short and extra short BFI-2 versions' items are presented in Table 5. In the short form, 29 of the 30 items (97%) loaded primarily on the intended domain, and 29 items (97%) had an intended absolute loading of at least .30. Overall, the mean absolute loading of items on their intended factor was .48, ranging from .27 to .66, while the mean absolute loading for other factors was only .12, ranging from .01 to .44. This model had acceptable fit (CFI = .93, TLI = .90).

The loading pattern of the extra-short form was somewhat less clear. Of the 15 items, 11 (73%) loaded primarily on their intended domain, and 12 items (80%) had an intended absolute loading of at least .30. However, the overall difference between same and other-domain loadings still held. Mean loading of items on their intended factor was .44 (ranging from .12 to .68), while only .12 (ranging from .00 to .47) for other-domain loadings. This model provided good fit (CFI = .97, TLI = .92). Taken together, these results indicate a robust Big Five structure for the BFI-2-S items, and a weaker but still recognizable structure for the BFI-2-XS items.

Correlations with well-being indicators were computed in order to examine the external validity of the BFI-2 short and extra-short forms. Results are presented in Table 6. Overall, the Slovak BFI-2 full, short and extra-short forms display meaningful correlations with meaningfulness, happiness, positive and negative emotions. As expected, the strongest correlations of well-being measures were with Extraversion and Negative Emotionality domains and facets, both in the full and short forms (cf. Soto, & John, 2017a; Hayes, & Joseph, 2003). Correlations with search for meaning in life were generally quite low, except for the Open-Mindedness domain and its facets, which were small to medium in size. The mean absolute correlation for the full form was .35 for domains and .28 for facets; the corresponding means were .33 for the

Table 5 Loadings of the BFI-2 S and XS form items in a random intercept EFA with Varimax rotation

Domain and item text	1	2	3	4	5
<i>1. Extraversion</i>					
Tends to be quiet.	-.58/-.68	.03/.02	.05/-.07	.15/.15	.05/.04
Is dominant, acts as a leader.	.41/.33	-.29/-.31	.10/.30	-.02/-.04	.22/.10
Is full of energy.	.46/.31	.03/.04	.26/.46	-.35/-.33	.23/.07
Is outgoing, sociable.	.54	.27	.01	-.12	.15
Prefers to have others take charge.	-.27	-.05	-.18	.20	-.23
Is less active than other people.	-.33	-.09	-.29	.18	-.22
<i>2. Agreeableness</i>					
Is compassionate, has a soft heart.	.21/.11	.46/.35	.02/.11	.10/.04	.14/.15
Is sometimes rude to others.	.08/.07	-.55/-.57	-.20/-.07	.20/.22	-.02/-.03
Assumes the best about people.	.25/.19	.33/.27	.07/.22	-.10/-.09	.10/.09
Can be cold and uncaring.	-.07	-.53	-.14	.11	-.06
Is respectful, treats others with respect.	.08	.47	.16	-.04	.11
Tends to find fault with others.	-.02	-.42	-.09	.28	-.04
<i>3. Conscientiousness</i>					
Tends to be disorganized.	.06/.07	-.09/-.15	-.34/-.12	.44/.47	-.03/-.03
Has difficulty getting started on tasks.	-.19/.01	-.12/-.16	-.41/-.48	.22/.27	-.12/.05
Is reliable, can always be counted on.	.11/.02	.26/.32	.42/.39	-.02/-.08	.19/.08
Keeps things neat and tidy.	-.04	.04	.66	-.13	.07
Is persistent, works until the task is finished.	.10	.18	.56	-.09	.19
Can be somewhat careless.	-.12	-.13	-.48	.15	.01
<i>4. Negative Emotionality</i>					
Worries a lot.	-.09/-.07	-.06/-.05	-.04/-.06	.65/.63	-.01/.01
Tends to feel depressed, blue.	-.23/-.20	-.08/-.12	-.15/-.09	.59/.67	-.03/-.03
Is emotionally stable, not easily upset.	.06/.00	.02/-.05	.08/.17	-.56/-.53	.11/.08
Is relaxed, handles stress well.	.23	.08	.09	-.56	.11
Feels secure, comfortable with self.	.31	-.12	.23	-.43	.14
Is temperamental, gets emotional easily.	.21	-.36	-.03	.51	.01
<i>5. Open-Mindedness</i>					
Is fascinated by art, music, or literature.	.02/.02	.15/.11	.01/.18	.11/.13	.48/.42
Has little interest in abstract ideas.	.06/.06	-.05/-.02	-.01/-.03	.11/.12	-.34/-.57
Is original, comes up with new ideas.	.26/.16	-.03/-.04	.19/.45	-.08/-.09	.56/.28
Has few artistic interests.	-.04	-.11	.01	.02	-.57
Is complex, a deep thinker.	-.07	.03	.30	-.05	.38
Has little creativity.	-.07	-.05	-.15	.16	-.63

Note. Values on the left-hand side of the forward slash are for the short form, values on the right side are for the XS form. EFA – Exploratory factor analysis. Random intercept EFA constrains each item to load on an acquiescence method factor, in addition to the substantive factors. The average loading on the acquiescence method factor was .17 (range = .14–.23) for the short form and .18 (range = .15–.24). Absolute loadings $\geq .30$ are bolded.

Table 6 Correlations of BFI-2 full, short and extra-short forms with well-being measures

Scale / form	MLQ-presence			MLQ-search			SHS			I-PANAS positive			I-PANAS negative		
	Full	S	XS	Full	S	XS	Full	S	XS	Full	S	XS	Full	S	XS
Extraversion	.44	.39	.34	.12	.12	.09	.42	.38	.33	.50	.47	.40	-.38	-.35	-.26
Agreeableness	.36	.35	.34	.14	.15	.19	.31	.28	.28	.25	.22	.19	-.42	-.39	-.33
Conscientiousness	.47	.44	.40	.11	.09	.04	.33	.33	.31	.48	.45	.39	-.33	-.36	-.43
Negative Emotionality	-.47	-.43	-.38	.04	.05	.12	-.56	-.54	-.49	-.36	-.33	-.27	.68	.66	.63
Openness	.30	.27	.21	.29	.29	.28	.20	.17	.13	.47	.43	.36	-.22	-.16	-.12
Sociability	.31	.24	.06	.06	.06	.06	.31	.28	.31	.23	.23	.23	-.33	-.28	
Assertiveness	.28	.23	.07	.08	.08	.08	.23	.17	.17	.35	.34	.34	-.22	-.18	
Energy level	.46	.42	.17	.14	.14	.14	.45	.42	.42	.54	.51	.51	-.33	-.32	
Compassion	.24	.21	.12	.11	.11	.11	.19	.18	.18	.21	.13	.13	-.25	-.24	
Respectfulness	.29	.29	.10	.08	.08	.08	.25	.23	.23	.23	.19	.19	-.38	-.34	
Trust	.33	.31	.11	.16	.16	.16	.31	.25	.25	.15	.19	.19	-.37	-.32	
Organization	.38	.33	.05	.03	.03	.03	.27	.27	.27	.35	.30	.30	-.29	-.34	
Productiveness	.44	.40	.15	.11	.11	.11	.31	.29	.29	.48	.43	.43	-.26	-.27	
Responsibility	.38	.32	.08	.08	.08	.08	.25	.21	.21	.40	.35	.35	-.29	-.25	
Anxiety	-.32	-.34	.06	.02	.02	.02	-.44	-.41	-.41	-.25	-.24	-.24	.57	.57	
Depression	-.50	-.44	.06	.08	.08	.08	-.60	-.55	-.55	-.36	-.36	-.36	.62	.54	
Emotional Volatility	-.37	-.26	-.02	.03	.03	.03	-.39	-.33	-.33	-.30	-.21	-.21	.55	.49	
Aesthetic Sensitivity	.19	.14	.28	.25	.25	.25	.10	.05	.05	.30	.27	.27	-.10	-.07	
Intellectual Curiosity	.21	.16	.20	.18	.18	.18	.17	.13	.13	.34	.27	.27	-.20	-.12	
Creative Imagination	.33	.32	.20	.22	.22	.22	.23	.22	.22	.49	.46	.46	-.25	-.18	

Note. Correlations of .07 and stronger are significant at $p < .05$. MLQ – Meaning in Life Questionnaire, SHS – Subjective Happiness Scale, I-PANAS – International Positive and Negative Affect Schedule. Full – BFI-2 full item set, S – BFI-2 short form, XS – BFI-2 extra-short form.

short form domains, .25 for the short form facets, and .29 for the extra-short domains. Overall congruence of correlation matrices is very high: .995 for the full versus short form, .987 for the full versus XS form and .993 for the short versus XS form. These results indicate that the Slovak BFI-2 short forms retain meaningful associations with well-being outcomes.

Lastly, we compared the predictive power of all three Slovak BFI-2 forms. Each of our well-being outcome measures was predicted from the BFI-2 full domains and facets, short form domains and facets, and extra-short form domains in separate analyses using simultaneous entry. Results are shown in Table 7. As expected, the full form has slightly higher overall predictive power compared to the short and extra-short form. However, the short forms retained 88% to 94% of the explained variance relative to the full item set. On average, the full form domains explained 2% more compared to the short form and 4% more compared to the extra-short form; and explained 3% more comparing the full and short form facets. These results indicate that the Slovak BFI-2 short forms retain much of the full form's predictive power.

Table 7 Predictive power of BFI-2 domains and facets for full, short and extra-short form

Measure	Full domains	Full facets	S domains	S facets	XS domains
MLQ-presence	.36	.38	.32	.34	.30
MLQ-search	.10	.11	.11	.12	.13
SHS	.35	.41	.33	.36	.30
I-PANAS positive	.40	.42	.37	.40	.32
I-PANAS negative	.50	.51	.48	.48	.46
<i>Overall mean</i>	.34	.37	.32	.34	.30
<i>Proportion retained</i>	–	–	.94	.92	.88

Note. MLQ – Meaning in Life Questionnaire, SHS – Subjective Happiness Scale, I-PANAS - International Positive and Negative Affect Schedule. Full – BFI-2 full item set, S – BFI-2 short form, XS – BFI-2 extra-short form. Each table entry is the R^2 value for a criterion variable predicted from a set of domain or facet scales.

In sum, the short form of the Slovak BFI-2 generally showed good psychometric properties, as indicated by strong congruence with the full form in terms of part-whole correlations, predictive power and factor structure. The extra-short version showed slightly worse congruence with the full form, and its factor structure was also less clear due to weaker intended factor loadings and a higher number of unintended loadings. These results likely reflect the extreme brevity of the extra-short form (3 items per Big Five domain), which necessarily impairs reliability and validity.

Based on our results, we conclude that the both short and extra-short forms can be used for measuring the Big Five personality factors in Slovakia, but users should take caution and consider the limitations of these short forms. If it is possible for researchers or users, we recommend using the full form of BFI-2, or at least the short form. The extra-short form should only be used when there are *severe constraints* on assessment time, as they can provide only a rough estimation of the Big Five trait domains. Whenever possible, the full or short form should be used: in exchange for slightly greater assessment time (approximately 6 minutes for the full form or 3 minutes for the short form, as compared with 1-2 minutes for the extra-short form), users gain higher measurement precision and the possibility of assessing not only broad trait domains but also narrower facets.

Limitations and future directions

The main limitation of this study lies in embedded administration of BFI-2 shorter versions within full BFI-2. Future research should verify our results by separate administration. Other limitations of the current study lie mainly in absention of investigation of test-retest stability and self-peer congruence of results obtained by the short forms of BFI-2. Regarding predictive power, future studies should focus on other self or peer reported criteria. In terms of international research, measurement invariance with the original version (Soto & John, 2017b) should be verified.

CONCLUSIONS

The present paper reports psychometric properties of the Slovak BFI-2 short and extra-short forms. Based on strong part-whole correlations, congruence of gender differences, correlations with age, inter-method correlations with the full form, results of exploratory factor analysis, and trait-outcome associations, we conclude satisfactory psychometric properties for both shorter forms, although users interested in using the extra-short form should take caution and consider whether small gains in assessment time outweigh the disadvantages of lower measurement precision. Shorter forms of the Slovak BFI-2 should be therefore used only when usage of full form would be problematic and we do not recommend it's usage in clinical context.

REFERENCES

- Aichholzer, J. (2014). Random intercept EFA of personality scales. *Journal of Research in Personality, 53*, 1-4.
- Asselmann, E., & Specht, J. (2019). Till death do us part: Transactions between losing one's spouse and the Big Five personality traits. *Journal of Personality, 88*(7), 659-675.
- Costa Jr., P. T., & McCrae, R. R. (1992). *NEO Personality Inventory-Revised (NEO-PI-R) and Neo Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
- Danner, D., Rammstedt, B., Bluemke, M., Lechner, C., Berres, S., Knopf, T. et al. (2019). Das Big-Five Inventar 2: Validierung eines Persönlichkeitsinventars zur Erfassung von 5 Persönlichkeitsdomänen und 15 Facetten [The Big Five Inventory-2: Validating a personality inventory to capture 5 personality domains and 15 facets]. *Diagnostica, 1*-12.
- Denissen, J. J. A., Geenen, R., Soto, C. J., John, O. P., & van Aken, M. A. G. (2019). The Big Five Inventory-2 (BFI-2): Replication of psychometric properties of the Dutch adaptation and first evidence for the discriminant predictive validity of the facet scales. *Journal of Personality Assessment, 102*(2), 1-16.
- Furnham, A., Cheng, H. (2019). The change and stability of NEO scores over six-years: A British study and a short review. *Personality and Individual Differences, 144*, 105-110.
- Hayes, N., & Joseph, S. (2003). Big 5 correlates of three measures of subjective well-being. *Personality and Individual Differences, 34*(4), 723-727.
- Halama, P., Kohút, M., Soto, C. J., & John, O. P. (2020). Slovak Adaptation of the Big Five Inventory (BFI-2): Psychometric properties and initial validation. *Studia Psychologica, 62*(1), 74-87.
- Hřebíčková, M. (2004). NEO osobnostní inventář podle NEO-PI-R P. T. Costy a R. R. McCrae. Praha: Testcentrum.
- Hřebíčková, M. (2011). *Pětifaktorový model v psychologii osobnosti*. Praha: Grada Publishing as.
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory—Versions 4a and 54*. Berkeley: University of California at Berkeley, Institute of Personality and Social Research.
- John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 114-158). New York: The Guilford Press.
- Lyubomirsky, S., & Lepper, H. S. (1999). A measure of subjective happiness: Preliminary reliability and construct validation. *Social Indicators Research, 46*(2), 137-155.
- McCrae, R. R., & Costa, P. T. J. (2008). Empirical and theoretical status of the five-

- factor model of personality traits. In G. Boyle, G. Matthews, & D. Saklofske (Eds.), *Sage handbook of personality theory and assessment* (Vol. 1, pp. 273-294). Los Angeles: Sage.
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide*. Eighth edition. Los Angeles, CA: Muthén & Muthén.
- Rammstedt, B., Danner, D., Soto, C. J., & John, O. P. (2018). Validation of the short and extra-short forms of the Big Five Inventory-2 (BFI-2) and their German adaptations. *European Journal of Psychological Assessment, 36*(1), 149-161.
- Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*, 203-212.
- Ruisel, I., & Halama, P. (2007). *NEO-FFI. NEO päťfaktorový osobnostný inventár*. Praha: Testcentrum-Hogrefe.
- Schmitt, D. P., Allik, J., McCrae, R. R., & Benet-Martínez, V. et al. (2007). The geographic distribution of Big Five personality traits: Patterns and profiles of human self-description across 56 nations. *Journal of Cross-Cultural Psychology, 38*(2), 173-212.
- Smith, G. T., McCarthy, D. M., & Anderson, K. G. (2000). On the sins of short-form development. *Psychological Assessment, 12*, 102-111.
- Soto, C. J. (2015). Is happiness good for your personality? Concurrent and prospective relations of the big five with subjective well-being. *Journal of Personality, 83*(1), 45-55.
- Soto, C. J., & John, O. P. (2017a). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology, 113*, 117-143.
- Soto, C. J., & John, O. P. (2017b). Short and extra-short forms of the Big Five Inventory-2: The BFI-2-S and BFI-2-XS. *Journal of Research in Personality, 68*, 69-81.
- Stanton, J. M., Sinar, E. F., Balzer, W. K., Smith, P. C. (2002). Issues and strategies for reducing the length of self-report scales. *Personnel Psychology, 55*, 167-194.
- Steger, M. F., Frazier, P., Oishi S., & Kaler, M. (2006). The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology, 53*(1), 80-93.
- Steger, M. F., Kashdan, T. B., Sullivan, B. A., & Lorentz, D. (2008). Understanding the search for meaning in life: Personality, cognitive style, and the dynamic between seeking and experiencing meaning. *Journal of Personality, 76*(2), 199-228.
- The jamovi project (2019). *jamovi* (Version 0.9) [Computer Software]. Retrieved from <https://www.jamovi.org>
- Thompson, E. R. (2007). Development and validation of an internationally reliable short-form of the Positive and Negative Affect Schedule (PANAS). *Journal of Cross-Cultural Psychology, 38*(2), 227-242.

SÚHRN

Ciele. Táto štúdia sa zameriava na informovanie o psychometrických vlastnostiach krátkej a extra-krátkej verzie BFI-2 na Slovensku.

Súbor. Dáta boli zbierané u všeobecnej populácie dospelých Slovákov (N = 801; 51,2 % žien) prostredníctvom online panela výskumnej agentúry.

Analýzy. Analýzy boli zamerané na skúmanie faktorovej štruktúry krátkych foriem BFI-2, rodových rozdielov, korelácie s vekom a predikciu well-beingu ako aj porovnanie týchto informácií s plnou verzou BFI-2.

Výsledky. Exploračná faktorová analýza preukázala, že väčšina položiek krátkej verzie bola sýtená zamýšľanými faktormi avšak v extra-krátkej verzii sa vyskytli aj slabšie korelácie, alebo korelácie s inými faktormi. Korelácie medzi plnou verzou a skrátenejšími verziami boli silné. V skrátenejších verziách boli zistené podobné rozdiely medzi rodmi ako aj korelácie s vekom v porovnaní s plnou verzou, čo poukazuje na pomerne vysokú kongruenciu týchto verzií. Skrátenešie verzie vysvetľovali 88-94 % variability v porovnaní s plnou verzou v rámci predikcie well-beingu. Výsledky poukázali, že skrátenešie verzie sú vhodným nástrojom v prípadoch, kedy je potrebný krátky nástroj pre meranie piatich veľkých črt, no mali by byť použité opatrne a kedykoľvek je to možné, mala by byť uprednostnená plná verzia BFI-2.

Limitácie. Limitácie tejto štúdie sa týkajú najmä toho, že krátke verzie BFI-2 neboli administrované samostatne, no prostredníctvom plnej verzie. Ďalšie limitácie sa týkajú absencie skúmania stability v čase, či zhody medzi sebahodnotením a hodnotením inou osobou.