

The psychometric properties of the Big Five inventory-10 (BFI-10) including correlations with subjective and psychological well-being

Beatrice Adriana Balgiu*, University Politehnica of Bucharest, Splaiul Independentei, 313, Bucharest, 060042, Romania

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Abstract

The article sums up the results of a psychometric study carried out on a sample of Romanian students ($N = 496$; 193 females) in order to assess the psychometric qualities of *Big Five Inventory-10 (BFI-10)*. The questionnaire measures the five factors of personality from the Five Factors model. The convergent validity is demonstrated by the fact that BFI-10 correlates with the measures for: subjective well-being (WB) like happiness, life satisfaction, positive and negative affect and psychological WB and its dimensions. Internal consistency is acceptable given that we evaluated an extra-short scale with two items per factor, although much reduced in comparison with the instruments with a large number of items. The confirmatory factorial analysis revealed a Five-Factor structure similar to the original structure with the modification of the factors such as extraversion, agreeableness and neuroticism. We consider that the application of BFI-10 must be accompanied and correlated with other instruments when it comes to assessing personality. It is necessary that the instrument BFI-10 should be perfected by redefining the items it contains.

Keywords: BFI-10, short-scale, CFA, psychometric properties.

* ADDRESS FOR CORRESPONDENCE: **Beatrice Adriana Balgiu**, University Politehnica of Bucharest, Splaiul Independentei, 313, Bucharest, 060042, Romania. **E-mail address:** beatrice.balgiu@upb.ro **Tel.:** +40-21-4029-271

1. Introduction

The creation of the first substantial assessment instruments built on the lexical hypothesis (Costa & McCrae, 1985, 1992) was followed by many lexical studies based on the Five Factor model and, consequently, by the appearance of instruments meant to measure the dimensions of the model, namely extraversion, agreeableness, conscientiousness, neuroticism and openness to experience. The Big Five personality traits have been assessed by means of a large number of different instruments of various lengths. The best known and the most used questionnaires built traditionally on the Five Factor model are NEO-PI-R (Costa & McCrae, 1992) with 240 items and 30 facets of adult personality, and its short versions NEO-FF-I with 60 items (Costa & McCrae, 1989). For NEO-PI-R, studies show the most reliable ability to obtain data for the assessment of the five mentioned supra-factors (Minulescu, 2008). The main limit of this instrument resides in the very large number of items, in the time and the focus required for its completion. Other personality assessment instruments are built around the psycho-lexical model which entails capturing meanings related to the semantics of personality. To this purpose, out of the most studied lists of adjectives and questionnaires, those that stand out are Short Adjective Check-List Big Five with 50 bipolar adjectives for the five scales (Perugini, Leone, Galuci & Lauriola, 1994), Big Factor Questionnaire (BFQ-2) with 156 items, called extraversion, amicability, conscientiousness and emotional stability (Caprara, Barbaranelli & Borgogni, 1993) and the Five Factor Personality Inventory built iteratively in three standardised versions: Dutch, English and German (Hendricks, Hofstee & DeRaad, 1999).

Due to practical reasons, the latest trend in psycho-diagnosis consists in turning to simplified instruments which require less time to complete (Crede, Harms, Niehorster & Gaye-Valentine, 2012; Donnellan, Oswald, Baird & Lucas, 2006; Gosling, Rentfrow & Swann, 2003). Thus, the personality assessment instruments that stand out are the Big Five Inventory-44 (BFI-44—John, Donahue & Kentle, 1991), the Ten Item Personality Inventory (TIPI—Gosling et al., 2003), the BFI-15 (Big Five Inventory-Short Version—Gerlitz & Schupp, 2005) and the BFI-10 (Rammstedt & John, 2007).

The purpose of the present study is to research on the psychometrical properties of BFI-10 with regard to a sample of Romanian students. This is a questionnaire developed by Rammstedt and John (2007) for the analysis of the Five Factors made of 10 items; each factor entails two items: extraversion (items 1 and 6), agreeableness (items 2 and 7), conscientiousness (items 3 and 8), neuroticism (items 4 and 9) and openness (items 5 and 10). The scale for the assessment of the items is from 1—strongly disagree to 5—strongly agree, and five of the items have a reversed score. The inventory consists in items taken from BFI-44; in order to select them, both the experts' consensual assessment and empirical item analyses were used in order to retain the most representative traits for each of the Big Five factors. The items selected from BFI-44 include less than 25% of the scales BFI-44 and they predict almost 70% of the variance of the scales. The questionnaire was developed on samples of American students ($N = 1,627$) and German students ($N = 833$), and reliability was checked by means of a second test after a period of 6–8 weeks in both cultures. The test–retest correlations varied between 0.68 and 0.84. The average of stability coefficients after the second test was $r = 0.75$ (0.72 in the American sample and 0.78 in the German sample), suggesting that scales BFI-10 have respectable stability levels. The convergent validity was realised by means of the correlations with NEO-PI-R. The highest correlations were obtained for the scales extraversion (between 0.69 and 0.79, depending on the sample), neuroticism (between 0.71 and 0.73) and conscientiousness (0.70), and weaker for openness (between 0.61 and 0.63), and agreeableness (between 0.51 and 0.65), the latter being accounted for by the conceptual differences between NEO-PI-R and BFI-10 in defining these two constructs. The authors consider that BFI-10 exhibits external good validity (with peer ratings) and a Five-Factor structure retaining a substantial part of the reliability and the validity of the original instrument BFI-44.

Subsequent studies continued the validation of the questionnaire in various cultural contexts. For example, Pejic, Tenjovic and Knezevic (2014) conducted research on 112 participants and their close

ones ($N = 203$), research in which they reported low reliability for openness and agreeableness, good correlations between BFI-10 and NEO-PI-R, and acceptable correlations with peer ratings. Thalmayer, Saucier and Eigenhuis (2011) found that BFI-10 has predictive validity compatible with BFI-44. Ryser (2015) obtained four factors by means of confirmatory factor analyses, and general result patterns demonstrated that the models showed marginal fit. The instrument does not adequately capture the Big Five personality traits. However, the BFI-10 benefit greatly from modifications that improve their psychometric quality. According to John and Srivastava (1999), models can be improved by using correlations of the residuals. Carciofo, Yang, Song, Du and Zhang (2016) validated the version in the Chinese language of BFI-10 in the case of five studies. With the help of principal component analysis, the authors showed that the structure of the instrument varies, depending on the samples, between five factors (for four of the studies) and four factors (in the case of a sample). The Cronbach alpha coefficients obtained varied between 0.03 and 0.75, according to the analysed dimension and the sample used.

2. The Big Five personality traits and well-being

Research on the personality characteristics of individuals with developed well-being (WB) is likely to lead to information which can help individual psychological WB (PWB) improve. One of the best-known studies of the kind (DeNeve & Cooper, 1998) was carried out on 137 distinct personality constructs in correlation with WB and it revealed that personality traits are strong predictors of subjective WB. Another meta-analysis based only on NEO-PI inventory obtained correlations which are much more developed than those between personality factors and WB obtained by DeNeve and Cooper (Steel, Schmidt & Schultz, 2008).

Regarding the relation between the Big Five Factors and PWB there is also a consensus of results which associate personality with PWB. Siegler and Brummet (2000) analysed the relationship between personality and PWB in a sample of 2,379 of adults and they reached the conclusion that extraversion, openness and neuroticism (negatively) are strongly correlated with PWB.

Other studies show that all five personality factors were significantly correlated with PWB (Hicks & Mehta, 2018). In addition, it was shown that extraversion and conscientiousness are predictors of the following dimensions of PWB: self-acceptance, controlling the environment and the purpose of life. Openness is a predictor of personal development, while agreeableness predicts positive interpersonal relations; finally, autonomy is predicted by Neuroticism (Schmutte & Ryff, 1997). In a piece of research on students, the total score of PWB, as conceived by Ryff and Singer (1998), was predicted by all personality traits, with extraversion and conscientiousness having the greatest contribution (Balgiu & Cotet, 2017). In their research on 507 college students and 227 North Americans in middle adulthood, they reported that the strongest predictor for most WB variables is neuroticism and the second predictor is conscientiousness.

Another piece of research carried out on Australian managers revealed that extraversion, neuroticism and conscientiousness correlate similarly both with subjective WB and PWB, suggesting that these traits represent general predispositions for the general WB (Grant, Langan-Fox & Anglim, 2009). More recently, in a sample of Swedish teenagers, Garcia (2011) concluded that neuroticism, extraversion, conscientiousness, persistence and self-directivity correlate with WB very positively.

3. Method

Objective: the investigation of psychometric properties of BFI-10 on a sample of Romanian subjects.

Participants and procedure: we used a sample of 496 undergraduates (193 females) from a large public university ($Mage = 19.20$; $S.D. = 1.18$). Data collection for the study took place in academic years 2017/2018. The students were informed on the confidentiality of the results. The method used

for translation of the BFI-10 was forward translation. The instrument was translated in Romanian and next in the English language. Both versions did not differ noticeably.

3.1. Other administered questionnaires

1. *Oxford Happiness Questionnaire—OHQ* (Hills & Argyle, 2002) consists of 29 items designed to measure enduring happiness or subjective WB (e.g., *I am well satisfied with everything in my life*). Participants indicated their agreement with each statement using a six-point scale ranging from 1—strongly disagree to 6—strongly agree. The averaged responses to the 29 items form an aggregate measure of dispositional happiness. Cronbach's alpha was 0.92 (Hills & Argyle, 2002).
2. *Satisfaction with Life Scale—SWLS* (Diener, Emmons, Larsen & Griffin, 1985) takes into account cognitive assessment of life satisfaction. The SWLS is a short five-item instrument designed to measure global cognitive judgments of satisfaction with one's life. The SWLS is a seven-point Likert style response scale ($\alpha = 0.79$ – 0.89). Sample item: *In most ways my life is close to my ideal*.
3. *Scale of Positive and Negative Experience—SPANE* (Diener et al., 2009) assess a broad range of pleasant and unpleasant feelings by asking people to report their feelings in terms of their duration after recalling their activities and experiences during the previous 4 weeks. The SPANE consists of 12 items: six items assess positive feelings (SPANE-P), and the other six assess negative feelings (SPANE-N) on a scale from 1—very rarely or never to 5—very often or always ($\alpha = 0.89$ – 0.92 —Li, Bai & Wang, 2013).
4. *Short psychological well-being—SPWB* developed by Ryff and Singer (1998) is a self-report inventory with 18 items grouped in six subscales: Autonomy (*I believe in my own opinions even if they differ from others*); Environmental control (*I manage my day-to-day responsibilities well*); Personal growth (*For me, life was a continuous learning, growth and development process*); Positive relationship with the other people (*People describe me as a person who likes spending time with others*); Life purpose (*Some people wander aimlessly in their life, but I am not one of them*) and Self-acceptance (*In general, I like most parts of my personality*). Every scale has three items (eight of them reverse) assessed on a scale from 1—strongly disagree to 6—strongly agree; $\alpha = 0.61$ – 0.83 —van Dierendonck (2005).

4. Results and discussions

Table 1 shows the descriptive statistics. The gender difference shows an increase in scores for conscientiousness ($t = -3.03$; $p = 0.003$), neuroticism ($t = -5.69$; $p = 0.000$) and openness ($t = -4.06$; $p = 0.000$) in favour of female subjects. The absolute values of the indicator skewness were between 0.033 and -0.900 , except for item 2 which obtained a score of -2.44 . For kurtosis, the values were between 0.204 and -1.03 , except for item 2 which obtained a value of 8.87.

The alfa Cronbach coefficients obtained (extraversion— $\alpha = 0.45$, agreeableness— $\alpha = 0.24$), conscientiousness— $\alpha = 0.62$, neuroticism— $\alpha = 0.55$ and openness— $\alpha = 0.36$) are acceptable given that, on the one hand, three of them are over 0.45 (the minimum allowed for the two-item scales) except for agreeableness and openness, and, on the other hand, by comparing them with alfa values reported by other BFI-10 validation studies. For example, Thalmayer et al. (2011) report alfa coefficients for BFI-10 between 0.43 (agreeableness) and 0.72 (extraversion). Crede et al. (2012) obtain alfa coefficients, between 0.37 (agreeableness) and 0.65 (extraversion), and in the case of five studies on Chinese students Carciofo et al. (2016) obtained values between 0.59 and 0.75 for extraversion, between 0.03 and 0.46 for agreeableness, between 0.25 and 0.46 for conscientiousness, between 0.33 and 0.62 for neuroticism and between 0.36 and 0.52 for openness.

The lowest value of the alfa coefficient in all the studies mentioned above is obtained for agreeableness ($\alpha = 0.03$) (Carciofo et al., 2016). The fact that all the authors mentioned above report alfa coefficients relatively moderated in comparison with the personality inventories with more than 100 items could possibly show the heterogeneity of items (how many aspects of a trait are covered by

the items in the scale) and, thus, the need to re-create the items in the scale. Mention must be made of the fact that for short scales such as BFI-10 or TIPI there is a compromise between the internal consistency and the length of the scale (and, therefore, of the time of administration), although high internal consistency could show redundancy and the narrowing of the scale (Furnham, 2008). As Furnham (2008) shows, alfa coefficients are influenced by the number of items in the scale, therefore it was only natural that the consistency items for the two-item scales should be moderate or even low.

Table 1. Descriptive analysis

Variables	M	S.D.	Male	Female	t	α
Extraversion	6.66	1.70	6.72	6.17	–	0.45
Agreeableness	8.41	1.38	8.35	8.53	–	0.26
Conscientiousness	6.55	1.75	6.36	6.85	–3.03	0.60
Neuroticism	5.51	2.05	5.10	6.14	–5.69	0.55

The convergent validity was analysed with instruments which assess subjective and PWB. For the subjective WB, the analysed indicators were happiness, life satisfaction, positive and negative affect. PWB was assessed by means of the six dimensions proposed by Riff's and Singer's model (1998): autonomy, environmental control, personal growth, positive relationships with others, life purpose, self-acceptance. Scales extraversion, agreeableness and conscientiousness make positive correlations with happiness ($r = 0.26, 0.14$ and 0.33 , respectively), life satisfaction ($r = 0.25, 0.12$ and 0.26 , respectively), positive affective states ($r = 0.22, 0.16$ and 0.18 , respectively), PWB—the total score of the six dimensions ($r = 0.32, 0.32$ and 0.34 , respectively) and negative with SPANE-N (negative affective states) ($r = -0.18, -0.17$ and -0.13 , respectively). The factor openness correlates only with personal growth and positive relationships within PWB. The factor neuroticism correlates negatively with all the variables measured by the other tests, and it correlates positively with the negative affective state ($r = 0.34$).

Table 2. Inter-correlation between BFI-10 and other instruments

Variables	E	A	C	N	O
OHQ Happiness	0.26**	0.14*	0.33**	-0.21**	0.10
SWLS Life satisfaction	0.25**	0.12*	0.26**	-0.28**	0.03
Positive affect	0.22**	0.16*	0.18**	-0.14*	0.10
SPANE Negative affect	-0.18**	-0.17**	-0.13*	0.33**	0.01
Autonomy	0.21**	0.15*	0.10	-0.28**	0.11
Control	0.00	0.18**	0.34**	-0.32**	-0.07
SPWB Personal growth	0.15*	0.17**	0.24**	-0.06	0.15**
Relationships	0.38**	0.21**	0.09	-0.20**	0.11*
Life purpose	-0.00	0.21**	0.19**	-0.02	0.03
Self-acceptance	0.32**	0.18**	0.25**	-0.29**	0.01
Total SPWB	0.32**	0.32**	0.34**	-0.34*	0.11

E = extraversion; A = agreeableness; C = conscientiousness; N = neuroticism; O = openness.

** $p < 0.01$; * $p < 0.05$

It was only natural to obtain a relation between factors extraversion, agreeableness, conscientiousness, neuroticism, openness and subjective and PWB, a relation corroborated by many studies (Kokko, Tolvanen & Pulkkinen, 2013; Siegler & Brummet, 2000; Steel, Schmidt & Schultz, 2008).

The following is based both on the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA). The underlying cause for the choice of both types of analysis was the fact that the exploratory analysis was the foundation for the CFA. Although both methods were used as part of the psychometric assessments for BFI-10, certain authors claim that neither EFA nor CFA is efficient for short scales (Donellan et al., 2006). For EFA we used the main component analysis with varimax rotation. The test Kaiser–Meyer–Olkin = 0.60 (bigger than the minimal accepted level 0.5) and Bartlett sphericity test ($\chi^2 = 541.050$; $p = 0.000$), led to the conclusion that the test meets the criteria for the factorial analysis

(Field, 2009; Hair, Anderson, Tantham & Black, 1998; Kaiser, 1974). The extraction of the factors initially led to four components. The next step consisted in the specification of the solution for five factors.

In the rotated matrix (Table 3), items E1 (0.789) and E6 (0.653) loaded on factor 1 (corresponding to Extraversion), item A2 loaded on factor 2 (corresponding to Agreeableness), items C3 (0.889) and C8 (0.737) loaded on factor 3 (corresponding to Conscientiousness), items A7 (–0.643), N3 (0.630). N9 (0.828) loaded on factor 4 (corresponding to Neuroticism), while items O5 (0.840) and O10 (0.631) loaded on factor 5 (corresponding to Openness). One can notice that E6 loads on factor 1 corresponding to extraversion and it also has a moderate loading in factor 2 corresponding to agreeableness.

For agreeableness, the major loading is just for item A2. The scale agreeableness is assessed by the authors of the inventory as less consistent (Rammstedt & John, 2007). The latter warn with regard to the existence of a deficiency of the scale agreeableness (differences of correlation between BFI-44 and BFI-10) and recommends the introduction of a third item, only when the psycho-diagnosis of agreeableness is crucial: *Is considerate and kind to almost everyone* (Rammstedt & John, 2007). The resulting three-item scale increases the part-whole correlation from 0.74 to 0.81, and the retest correlation from 0.68 to 0.70, and, in addition, it increases the correlation with NEO-PI-R.

The comparison of the present study with another piece of research (Carciofo et al., 2016) made on a sample of items gathered from five studies ($N = 1,620$) shows similarities regarding the extracted factors. Thus, A7 loaded both in the factor corresponding to agreeableness and negatively in the factor corresponding to conscientiousness. Similarly, E6 loads in factor 1 corresponding to extraversion and in factor 2 corresponding to agreeableness. In addition, for the factor agreeableness, Ryser (2015) found a weak correlation of the items which measure this dimension. Items that were supposed to measure the same trait did not produce similar scores which lead to weak internal validity for this dimension (Ryser, 2015).

Next, we move to the CFA to test the psychometric characteristics of the instrument and to estimate to what extent the observed items measured the latent theoretical Big Five construct. CFA was run to ascertain the factor structure of BFI-10. In order to assess the model fit, different indexes of fit obtained by the maximum likelihood were examined: chi-square value, df, incremental fit index (IFI), normed of FI (NFI), comparative FI (CFI), root mean square error of approximation (RMSEA) and Akaike’s information criterion (AIC) to compare models.

First, we replicated the theoretical model based on the theoretical assumptions. Thus, we built a Five-Factor model in which the corresponding items were allotted to the corresponding items.

Table 3 Components matrix

Items	Factors				
	1	2	3	4	5
E1	0.789	–0.245	–0.007	0.040	0.030
E6	0.653	0.463	0.132	–0.120	0.053
A2	–0.082	0.854	0.146	–0.027	0.026
A7	–0.230	0.199	0.189	–0.643	0.117
C3	0.063	–0.052	0.889	–0.108	0.023
C8	–0.028	0.364	0.737	–0.067	–0.039
N4	–0.440	–0.046	0.100	0.630	0.037
N9	–0.043	0.105	–0.024	0.828	0.039
O5	–0.108	–0.119	0.020	–0.062	0.840
O10	0.331	0.343	–0.044	0.065	0.631
%	14.30	13.23	14.30	15.36	12.12

By resorting to specialised literature, we created a first four-factor model (extraversion, conscientiousness, neuroticism and openness) out of which we eliminated agreeableness, while the

structure of the other factors remained intact (CMIN = 3.65). The second four-factor model is made of four factors: the dimension agreeableness was taken out, while item A7 from the structure of agreeableness was introduced in the factor neuroticism, and item A2 was introduced in the structure of factor extraversion. Item E6 was taken out. The result is shown in Table 4 (CMIN = 3.38). Finally, a Five-Factor model was created, a model in which A7 was introduced in the structure of agreeableness. In order to improve the degree of fit of the model covariation between E7 and E8 was produced.

Table 4. Confirmatory factor models

Default model	χ^2	df	IFI	NFI	CFI	RMSEA	AIC	CMIN/df
Model 1 with 4 factors	54.9	15	0.883	0.846	0.879	0.074	112.884	3.65
Model 2 with 4 factors	74.32	22	0.864	0.817	0.858	0.070	138.372	3.38
Model 3 with 5 factors	65.9	23	0.917	0.878	0.914	0.062	126.931	2.86

Table 4 shows that the Five-Factor structure seems to be the best fitting model; the statistical adequacy proves to be satisfactory: $\chi^2 = 65.9$; $df = 23$; $\chi^2/df = 2.86$ (CMIN = 2.86), IFI = 0.917; NFI = 0.878; CFI = 0.914; RMSEA = 0.062; (also see Figure 1). The values obtained for the Five-Factor model shows an acceptable level of statistical adequacy (Bryne, 2010).

5. Conclusions

The present study aimed at testing the psychometric properties of scale BFI-10 in the case of a Romanian group of students. The internal consistency of the inventory is acceptable given the fact that a scale with two items per factor is involved, although much shorter in comparison with instruments with a large number of items. The weakest alpha index is related to agreeableness and openness. This is consistent with other studies on the validation of the instrument (Carciofo et al., 2016; Ryser, 2015). The results of the CFA show that the items in the dimension agreeableness did not seem to assess a consistent latent factor. The convergent validity results from the fact that factors extraversion, agreeableness, conscientiousness and neuroticism (negatively) correlate significantly with all the applied measures: for subjective WB (happiness, life satisfaction, positive and negative affect) and with the total score of the PWB.

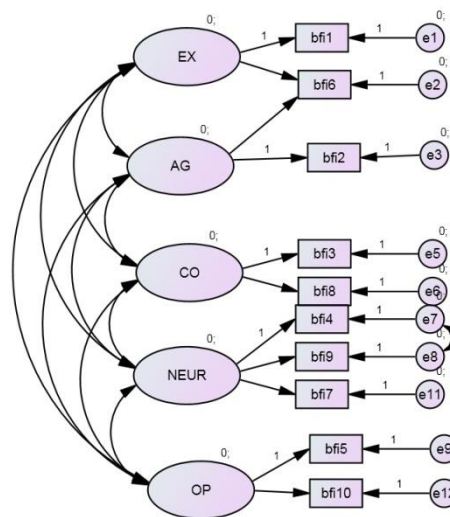


Figure 1. CFA of the BFI-10 (Five-Factor model)

CFA reveals a Five-Factor structure similar to the original structure, but extraversion, agreeableness and neuroticism are indistinctly constituted. The obtained results lead us to consider that BFI-10 can be applied didactically for the exemplification of the Big Five model, or when personality is assessed if

the time is limited. This is in line with previous literature (Pejic et al., 2014; Ryser, 2015). As Ryser (2015) showed, a study based on Big Five personality mini-markers should thoroughly examine the structure of the mini-markers before carrying out further analyses. If it is used as a diagnosis, BFI-10 needs to be accompanied by and correlated with other scales and personality questionnaires. It is necessary that the instrument BFI-10 should be perfected by redefining the items it contains.

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