

Statistical evaluation of six short Five Factor Model
personality measures aiming for potential inclusion in
the SOM Institute's national surveys.

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Introduction

The Five Factor Model (FFM) or the Big Five model is the leading model used to study normal personality within the area of trait psychology. This model has received much research exploring the validity and relevance of the five factors; Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism (e.g., Digman, 1990; Furnham, 2013). In recent years there has been a growing demand for short Five Factor Model (FFM) personality measures that can be used in settings where longer and more comprehensive instruments are not suitable. A number of short versions of FFM measures have been created (e.g. Credé, Harms, Niehorster, & Gaye-Valentine, 2012) to assess complex constructs in both time and cost-efficient ways. The use of short personality measures have also increased in research areas where personality traditionally has not been an area of focus for example in political science, media and communication (e.g., Modak 2010). For example has a personality inventory been included in the SOM research institute's annual national Swedish omnibus surveys since 2010 (e.g. Holmberg, Weibull & Gunnarsson 2011).

However, researchers argue that the increased use of these popular short instruments has not been followed by a sufficient number of psychometric evaluations. For example, there are few analyses that have sought to validate the factor structure or measurement invariance over various populations and settings (e.g. Ehrhart et al. 2009; Laverdière, Morin & St-Hilaire, 2013).

Purpose of the study

The personality instrument included in SOM surveys is based upon the FFM instrument - Health Relevant Personality Five Factor Instrument (HP5i) (Gustavsson 2003) and focuses mainly at measuring health relevant aspects of personality. The instrument consists of 15 items. Question have however been raised if a more general instrument (based upon fewer items and demonstrating acceptable statistical standards) could be found to replace the existing instrument. Therefore six popular short FFM instrument were evaluated and because the issue of factor structure as well as measurement invariance is of great importance when using short versions of FFM measures, the present study's overall objective was to analyze the fit of these six short FFM measures in a sample of Swedish adults. The factorial structure was explored, measurement invariance across gender and age was tested as well as factor loadings and inter factor correlations.

In the discussion of the poor model fit for many FFM instruments, the importance of other validation criteria has been suggested, for example, the importance of concurrent validity (e.g. McCrea et al. 1996; Credé et al., 2012). Therefore, the final analysis in this study tested the associations between the six FFM instruments and some important outcome variables.

Method

In the study 1014 Swedish adults participated, 497 (49%) females and 517 (51%) males. Age ranging from 19 to 72 years (mean 50,1; sd=14,37). The study consisted of a sample of Swedish adults which were included in panel survey, the Citizen Panel 2013, carried out by the Laboratory of Opinion Research (LORE), University of Gothenburg. Data utilized in this study were collected during May and June 2013. Each respondent filled out the six different personality instruments and additional measures over internet. For more information about sample and procedures see Citizen Panel 7, 2013 (Martinsson, J., Andreasson, M., Markstedt, E., Pettersson, L. 2013).

Instruments

FFM instruments

The instruments included in the study were the six short FFM measures presented below. Descriptive statistics as well as more detailed information for each instrument are presented in Appendix A.

Big Five Inventory (BFI 44; John, Donahue, & Kentle, 1991). The BFI is composed of 44 items with 8 to 10 items per factor. Participants respond on a 5-point Likert-type scale with response options of 1 = disagree strongly to 5 = agree strongly. The items consist of short phrases such as "does a thorough job" and "can be somewhat careless" (scored negatively) for the factor of conscientiousness.

Big Five Inventory-Ten Item (BFI 10; Rammstedt & John, 2007). The BFI 10 instrument was extracted from the full BFI instrument. The BFI 10 is composed of 10 items with 2 items for each factor. One item is scored in the positive direction for a respective domain and the other item is scored negatively.

Mini-International Personality Item Pool (Mini-IPIP; Donellan et al., 2006). The Mini-IPIP is a 20-item instrument with 4 items per factor. Items are scored on a 5-point Likert-type scale. The items consist of short phrases such as “Get chores done right away” and “Often forget to put things back in their proper place” (scored negatively) for the factor of conscientiousness.

Health Relevant Personality inventory (HP5i; Gustavsson et al. 2003; Gustavsson et al. 2008). The HP5i consists of 20 items (4 items per factor) and measures facets of each overall domain. For example, it measures impulsivity as a facet of low conscientiousness. Items are scored on a 4-point Likert-type scale with response options of 1 = disagree strongly to 4 = agree strongly. The items consist of short phrases such as “choosing rapidly with little thought” and “acting on the spur of the moment” for the factor of conscientiousness.

SOM/HP5i (Holmberg & Weibull, 2010)

The SOM/HP5i is a shorter version of the instrument HP5i and consists of 15 items (3 items per factor) and measures facets of each overall domain. For example, it measures impulsivity as a facet of low conscientiousness. Items are scored on a 4-point Likert-type scale with response options of 1 = disagree strongly to 4 = agree strongly. The items consist of short phrases such as “choosing rapidly with little thought” and “acting on the spur of the moment” for the factor of conscientiousness.

Ten-Item Personality Inventory (TIPI; Gosling et al., 2003). The TIPI consists of 10 items with 2 items for each factor, and each item consists of two trait descriptors. One item is scored in the positive direction for a respective domain (e.g., “dependable, self-disciplined” for conscientiousness), whereas the other item is scored negatively (e.g., “disorganized, careless” for conscientiousness). Items are scored on a 7-point Likert-type scale with responses of 1 = strongly disagree to 7 = strongly agree.

Other measures

Other measures originated from the SOM Research Institute’s annual national Swedish omnibus surveys that have been conducted for the past 27 years. The SOM Research Institute at the University of Gothenburg is an independent academic research organization that specializes in survey research on politics, media, and culture. Its studies on personality measures have been financed by The Sten A Olsson Foundation for Research and Culture (Holmberg & Weibull, 2010). The four different measures below have been included in several publications. For more information, see (SOM, 2014).

Subjective health – The concept of subjective health is related to subjective well-being (e.g., Diener et al., 2003). The item is phrased as, “How do you judge your general health status?”

Self-esteem – A single item phrased as, “Generally speaking, how do you judge your self-confidence?”

The two measures above are rated on an 11-point Likert-type scale with responses of 0 = very bad to 10 = very good.

Life satisfaction – This single item is related to the Satisfaction With Life Scale (e.g., Diener, 2003). The item is phrased as, “Generally speaking, how satisfied are you with the life you are living?” This item is rated on an 4-point Likert-type scale with responses of 1 = not satisfied at all to 4 = very satisfied.

Ideological left-right self-placement – This single item is phrased as, “Political attitudes can be rated on a scale between left- and right-wing opinions, where do you consider yourself on such a scale?” This item is rated on a 5-point scale from 1 = strong left-wing attitudes to 5 = strong right-wing attitudes.

Analyses

The dominant method of exploring and analyzing psychometric qualities within the area of personality research is the use of different factor analytic methods. Problems arise, however, when confirmatory factor analysis (CFA) fails to replicate factor structures that have been established with exploratory factor analysis (EFA). Recently, exploratory structural equation modeling (ESEM) has been developed as an alternative psychometric model. ESEM is an integration of CFA and EFA and has the ability to overcome some of the limitations with CFA and EFA.

We used Mplus to test for factor structure, measurement invariance, and concurrent validity (Muthén & Muthén, 2008).

First, factor structures and factor correlations were analyzed by means of both CFA and ESEM methods in order to test the overall model fit.

Second, full measurement invariance of the five instruments over gender and age were tested with the ESEM and CFA methods (Configural - factor structure, Metric - factor loadings, and Scalar - item intercept). Two age groups were formed ranging from 19 years to 52 years and from 53 years to 72 years .

The estimations were carried out using the Maximum Likelihood estimator. Based on previous theoretical and empirical knowledge about the FFM, the target rotation (Marsh et al., 2014) was considered to be the most appropriate for the ESEM solution. Considering all of the parameters that needed to be estimated, in combination with the more relaxed

assumptions of the ESEM method, the two shortest measures—BFI 10 and TIPI (10 items)—will most likely not be applicable for the ESEM method.

The model fit was evaluated by the χ^2 test, the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). CFI values $> .95$, RMSEA $< .06$, and SRMR $< .08$ are generally considered to be indicators of excellent fit (Hu & Bentler, 1999), and CFI values $> .90$ and RMSEA $< .08$ are considered to be indicators of acceptable fit (Marsh, Hau, & Wen, 2004). These cut-offs were used as rule of thumb to compare the model fit for the different instruments. Due to the ongoing discussion of the appropriate levels of these cut-offs for model fit as well as the aim of this study, additional analyses were performed even though some instruments demonstrated initially poor model fit.

Results

Descriptive statistics

Descriptive statistics for each instrument are presented in Appendix A.

Factor structure, measurement invariance and factor loadings

Fit indices and range of factor loadings are presented in Table 1 to Table 5.

BFI 44 (44 items)

Table 1

BFI 44 - Fit indices and range of factor loadings for CFA and ESEM methods.

Method	chi-2	Df	P	RMSEA	CFI	SRMR	Factor loadings*
CFA Baseline	5367	892	<.001	.071	.663	.088	E= .83-.23 A= .64-.40 C= .62-.42 N= .75-.43 O= .67-.35
ESEM Baseline	2918	736	<.001	.055	.836	.038	E = .89-.28 A = .60-.22 C = .62-.17 N = .77-.39 O = .65-.31
ESEM Sex							
<i>Configural</i>	3836	1472	<.001	.057	.841	.042	
<i>Metric</i>	4182	1667	<.001	.056	.831	.051	
<i>Scalar</i>	4372	1706	<.001	.057	.821	.053	
ESEM Age							
<i>Configural</i>	3855	1472	<.001	.066	.920	.033	
<i>Metric</i>	4135	1667	<.001	.055	.837	.049	
<i>Scalar</i>	4409	1706	<.001	.057	.821	.052	

Note: df= degree of freedom, RMSEA=root mean-square error of approximation, CFI= comparative fit index, SRMR=standardized root mean-square residual, *= range of standardized values for factor loadings, E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness.

As seen in Table 1 fit indices for BFI 44 are according to general standards and suggested recommendations unacceptable when tested with the CFA method. Since the CFA method are inappropriate for these data no further investigation of full measurement invariance were performed. The ESEM method demonstrated in total better fit indices than the CFA method but still not satisfactory, one unacceptable fit indicator was revealed. However,

when only one indicator were below acceptable levels, test of full measurement invariance were performed with the ESEM method. As expected, unacceptable fit were generally found both over gender and age, though the Configural analyses show acceptable fit over age groups. This potentially indicates better fit for the instrument over age groups, at least for these data. Factor loadings were generally low when analyzed with CFA method, below what other studies have found e.g. (Denissen et al 2008; Zackrisson 2010). Factor loadings were even lower when analyzed by the ESEM method.

Mini-IPIP (20 items)

Table 2

Mini-IPIP - Fit indices and range of factor loadings for CFA and ESEM methods.

Method	chi-2	Df	P	RMSEA	CFI	SRMR	Factor loadings*
CFA Baseline	821	160	<.001	.065	.851	.060	E=.77-.63 A=.73-.62 C=.72-.53 N=.79-.52 O=.79-.38
ESEM Baseline	500	100	<.001	.064	.910	.031	E = .74-.68 A = .75-.59 C = .72-.52 N = .81-.49 O = .85-.31
ESEM Sex							
<i>Configural</i>	621	200	<.001	.066	.917	.034	
<i>Metric</i>	729	275	<.001	.059	.910	.043	
<i>Scalar</i>	770	290	<.001	.059	.905	.045	
ESEM Age							
<i>Configural</i>	618	200	<.001	.066	.920	.033	
<i>Metric</i>	713	275	<.001	.058	.916	.043	
<i>Scalar</i>	814	290	<.001	.061	.900	.048	

Note: df= degree of freedom, RMSEA=root mean-square error of approximation, CFI= comparative fit index, SRMR=standardized root mean-square residual, *= range of standardized values for factor loadings, E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness.

Table 2 demonstrates fit indices for the Mini-IPIP instrument. When analyzed with the CFA method the indicators were found to be just below levels of moderate and acceptable fit, as also found elsewhere e.g. (Donellan 2006). Subsequently, no further investigations of full measurement invariance were performed using the CFA method. The ESEM method revealed however considerably better fit indices than the CFA method and test of full measurement invariance were performed. These tests showed full measurement invariance over gender and age, as also found elsewhere (by a modified CFA methods) (Lavendry 2013).

Factor loadings identified by the CFA method can be regarded as moderate, thus acceptable and in line with previous research e.g. (Donellan 2006), yet one loading is below 0.4. Slightly lower factor loadings were provided with the ESEM method.

HP5i (20 items)

Table 3

HP5i - Fit indices and range of factor loadings for CFA and ESEM methods.

Method	chi-2	Df	P	RMSEA	CFI	SRMR	Factor loadings*
CFA Baseline	514	160	<.001	.048	.891	.050	E= .69-.40 A= .75-.54 C=.76-.62 N= .69-.24 O= .68-.46
CFA Sex							
<i>Configural</i>	752	320	<.001	.053	.879	.056	
<i>Metric</i>	774	335	<.001	.052	.877	.058	
<i>Scalar</i>	863	350	<.001	.055	.856	.061	
CFA Age							
<i>Configural</i>	789	320	<.001	.055	.878	.056	
<i>Metric</i>	809	335	<.001	.054	.877	.058	
<i>Scalar</i>	868	350	<.001	.055	.865	.061	
ESEM Baseline	238	100	<.001	.038	.957	.022	E = .62-.45 A = .84-.45 C = .77-.61 N = .64-.31 O = .63-.45
ESEM Sex							
<i>Configural</i>	361	200	<.001	.041	.955	.027	
<i>Metric</i>	485	275	<.001	.040	.941	.040	
<i>Scalar</i>	534	290	<.001	.042	.931	.043	
ESEM Age							
<i>Configural</i>	390	200	<.001	.044	.951	.027	
<i>Metric</i>	496	275	<.001	.041	.942	.038	
<i>Scalar</i>	548	290	<.001	.043	.933	.041	

Note: df= degree of freedom, RMSEA=root mean-square error of approximation, CFI= comparative fit index, SRMR=standardized root mean-square residual, *= range of standardized values for factor loadings, E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. Factor rotation: MLR.

As seen in Table 3 fit indices for HP5i, when analyzed with CFA methods, were found to be in levels just below the threshold of acceptable fit. Full measurement invariance was then tested revealing unacceptable levels of the CFI indicator both over age and gender. The ESEM method shows better fit and even up to levels of excellent fit according to general

recommendations and standards. Further ESEM analyses indicated also that the instruments are invariant over gender and age. Factor loadings identified by the CFA method can be regarded as moderate, thus acceptable and in line with previous research e.g. (Gustavsson 2003), yet one factor loading are as low as 0.24.

SOM/HP5i (15 items)

Table 4 SOM/HP5i 15 items - Fit indices and range of factor loadings for CFA and ESEM models.

Model	chi-2	Df	P	RMSEA	CFI	SRMR	Factor loadings*
CFA Baseline	232	80	.0001	.044	.934	.042	E= .69 - .52 A= .75 - .47 C= .78 - .59 N= .72 - .48 O= .68 - .58
CFA Sex							
<i>Configural</i>	341	160	<.001	.049	.928	.047	
<i>Metric</i>	363	170	<.001	.049	.923	.050	
<i>Scalar</i>	406	180	<.001	.051	.910	.053	
CFA Age							
<i>Configural</i>	343	160	<.001	.049	.932	.047	
<i>Metric</i>	356	170	<.001	.048	.931	.050	
<i>Scalar</i>	391	180	<.001	.049	.922	.053	
ESEM Baseline							
ESEM Baseline	67	40	.0052	.026	.988	.014	E = .65-.56 A = .36-.95 C =.56-.84 N = .51-64 O = .59-.62
<i>Configural</i>							
<i>Configural</i>	111	80	.0124	.028	.988	.019	
<i>Metric</i>	189	130	.0005	.031	.976	.033	
<i>Scalar</i>	213	140	.0001	.033	.971	.035	
ESEM Age							
<i>Configural</i>	saknas						
<i>Metric</i>	165	130	.0198	.024	.987	.030	
<i>Scalar</i>	204	140	.0003	.031	.976	.033	

Note: df= degree of freedom, RMSEA=root mean-square error of approximation, CFI= comparative fit index, SRMR=standardized root mean-square residual, *= range of standardized values for factor loadings, E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. Factor rotation: MLR.

As seen in Table 4 fit indices for SOM/HP5i, when analyzed with CFA methods, were found to be in levels above the threshold of acceptable fit. Full measurement invariance was then tested revealing acceptable levels of the CFI indicator both over age and gender. The ESEM method shows even better fit and up to levels of excellent fit according to general recommendations and standards. Both CFA and ESEM analyses indicated that the instruments are invariant over gender and age. Factor loadings identified can be regarded as acceptable both with CFA and ESEM method. For example, compared to the slightly longer HP5i instrument the SOM/HP5i instrument demonstrates ubiquitously better model fit and factor loadings.

TIPI (10 items)

Table 5

TIPI - Fit indices and range of factor loadings for CFA method.

Method	chi-2	Df	P	RMSEA	CFI	SRMR	Factor loadings*
CFA Baseline	339	27**	.0001	.108	.778	.069	E= .96- .59 A= .62 - .17 C= .80 - .41 N= .96 - .47 O= .74 - .50
CFA Sex							
<i>Configural</i>	409	54	<.001	.117	.802	.072	
<i>Metric</i>	412	59	<.001	.111	.803	.072	
<i>Scalar</i>	425	64	<.001	.108	.798	.075	
CFA Age							
<i>Configural</i>	382	54	<.001	.112	.817	.069	
<i>Metric</i>	383	59	<.001	.106	.819	.069	
<i>Scalar</i>	435	64	<.001	.110	.792	.074	

Note: df= degree of freedom, RMSEA=root mean-square error of approximation, CFI= comparative fit index, SRMR=standardized root mean-square residual, *= range of standardized values for factor loadings, E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness.

As seen in Table 5 fit indices for Tipi are according to general standards and suggested recommendations far below acceptable fit when analyzed with the CFA method. Ranges of factor loadings are wide and differ from .96 to .17! The ESEM method is not applicable for the 10-item instruments.

BFI 10 (10 items)

Table 6

BFI 10 - Fit indices and range of factor loadings for CFA method.

Method	chi-2	Df	P	RMSEA	CFI	SRMR	Factor loadings*
CFA Baseline	119	26**	.0001	.060	.894	.038	E= .75 - .74 A= .42 - .20 C= .92 - .30 N= .86 - .54 O= .75 - .32
CFA Sex							
<i>Configural</i>	138	52	<.001	.058	.916	.040	
<i>Metric</i>	142	57	<.001	.055	.917	.042	
<i>Scalar</i>	194	62	<.001	.066	.871	.048	
CFA Age							
<i>Configural</i>	121	52	<.001	.052	.934	.038	
<i>Metric</i>	155	57	<.001	.060	.906	.044	
<i>Scalar</i>	N/A***		<.001				

Note: df= degree of freedom, RMSEA=root mean-square error of approximation, CFI= comparative fit index, SRMR=standardized root mean-square residual, *= range of standardized values for factor loadings, E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. ***Method did not terminate normally.

For BFI 10 the fit indices, as seen in Table 6, are when analyzed with the CFA method at acceptable levels and also indicating full measurement invariance over gender and age. Ranges of factor loadings are as also found for the TIPI instrument wide, and differ from .92 to .20. The ESEM method is not applicable for the 10-item instruments.

In sum the results illustrate, when the instruments are analyzed with traditional CFA method, misfit or moderate model fit for several two of the well-established five factor instruments. Both BFI 44 and TIPI demonstrate fit indices far below levels of recommended standards. For the BFI 10, HP5i and SOM/HP5i instruments fit indices, when analyzed with CFA method, showed to be just below or above recommended standards. Best model fit with both the CFA and ESEM models were found for the SOM/HP5i instrument.

Inter factor correlations

Table 7

Inter factor correlations for the FFM instruments, ESEM **bold** numbers and CFA regular numbers

	E	A	C	N	O
BFI 44					
E		-.32	.27	-.26	.34
A	.08		-.38	.27	-.23
C	-.19	-.09		-.36	.07
N	.19	.14	-.23		-.02
O	-.22	-.02	.15	.06	
Mini-IPIP					
E		.38	.11	-.07	.24
A	.35		.15	.02	.36
C	-.10	-.14		-.19	-.04
N	-.06	.06	.19		-.04
O	-.20	-.33	-.06	-.02	
Hp5i					
E		-.14	.07	-.54	-.31
A	-.11		.35	.05	.46
C	.09	.33		.19	.08
N	-.36	.06	.14		-.09
O	-.24	.42	.06	-.12	
SOM/Hp5i					
E		-.16	.04	-.59	-.37
A	-.14		.37	.04	.46
C	.03	.34		.19	.12
N	-.41	.03	.19		-.01
O	-.29	.38	.12	-.06	
TIPI					
E		-.69	.32	-.09	.56
A	**		-.54	.37	-.63
C				-.42	.37
N					-.19
O					
BFI 10					
E		.31	-.29	-.34	-.18
A	**		-.23	-.44	.10
C				.21	-.18
N					-.15
O					

Note: E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness, *p<.05. ** ESEM method not applicable.

Inter factor correlations for all instruments are presented in Table 6. Several instruments shows high inter factor correlations between some factors both with ESEM and CFA methods. For the BFI 44 instrument results show factor correlations mostly in line with what has been reported elsewhere e.g Denissen et al 2008, Zackrisson 2010, Fossati et al 2011. Regarding the IPIP instrument results were similar to those reported by Donellan 2006 and Lavriere 2013 showing moderate inter factor correlations. For the Hp5i instrument two high

correlations were found, one above .4 and one above .3. Similar pattern were found for the SOM/HP5i instrument. Inter factor correlations for the 10-item instrument TIPI were high, four above .3 and one above .5. Finally, the BFI 10 instrument shows acceptable inter factor correlations except for one correlation above .3.

Concurrent validity

Table 8

Associations between FFM instruments and the additional measures given as standardized regression estimates derived from the manifest factor scale scores.

	Subjective health	Life satisfaction	Self Esteem	Left-Right orientation
Extraversion				
BFI 44	.12	.22	.34	.08
IPIP	.12	.18	.32	.13
Hp5i	.27	.36	.32	-.02
SOM/HP5i	.25	.34	.28	.04
TIPI	.12	.22	.34	.08
BFI 10	.11	.21	.26	.06
Agreeableness				
BFI 44	.04	.06	-.09	-.10
IPIP	-.01	.04	-.08	-.18
Hp5i	.04	.10	-.06	-.06
SOM/HP5i	-.05	.11	-.04	-.06
TIPI	-.04	.06	-.06	-.07
BFI 10	.05	.05	-.00	-.08
Conscientiousness				
BFI 44	.09	.06	.12	.08
IPIP	.14	.09	.13	.14
Hp5i	.02	.03	.02	.02
SOM/HP5i	-.01	.03	.01	.03
TIPI	.16	.11	.14	.12
BFI 10	.11	.09	.08	.04
Neuroticism				
BFI 44	-.35	-.32	-.45	-.16
IPIP	-.37	-.37	-.43	-.12
Hp5i	-.30	-.25	-.40	-.22
SOM/HP5i	-.32	-.27	-.43	-.23
TIPI	-.30	-.26	-.39	-.15
BFI 10	-.30	-.25	-.44	-.16
Openness				
BFI 44	-.04	-.04	.06	-.16
IPIP	.01	-.01	.02	-.06
Hp5i	.06	-.07	.04	-.16
SOM/HP5i	.07	-.07	.04	-.13
TIPI	.03	-.03	.07	-.07
BFI 10	-.00	-.01	.00	-.13

Note: Regression estimates above 0.06 are statistically significant at $p > .05$ level

In general, similar pattern of regression estimates with the different additional measures were found, and most inventories exhibited fairly similar estimates across all four types of criteria variables. On the other hand, there were some differences between inventories in their level of predictive capabilities for particular criteria. For example, the strongest associations between FFM factors and subjective health as well as life satisfaction were found for the neuroticism factor identified by the Mini-IPIP instrument, followed by the extraversion factor identified by the HP5i instrument. Regarding right-wing political orientation then strongest associations were found for low neuroticism and low openness shown by the HP5i and the BFI 44 instruments.

Discussion

Short measures of personality have been developed to allow for the assessment of individuals in research settings that lack time and space for longer measures. The use of short personality measures have also increased in research areas where personality has not traditionally been an area of focus, for example, in political science and the field of media and communications (e.g., Holmberg, Weibull & Gunnarsson 2011; Modak 2010). Even though the Five Factor approach to personality is supported by an impressive body of research, the issue of factor structure is still central for both short and more extensive instruments (e.g., Marsh et al., 2014).

Since 2010 has a personality inventory been included in the SOM research institute's annual national Swedish omnibus surveys (SOM 2014). Question have however been raised if a more general instrument (based upon fewer items and demonstrating acceptable statistical standards) could be found to replace the existing instrument. Therefore, the main aim of this study was to evaluate six popular and frequently used short FFM measures in a population of Swedish adults.

Factor structure and measurement invariance

Results showed that the best fit indices were found for the SOM/HP5i and the HP5i instruments. Indicators for the Mini-IPIP and BFI 10 were lower as also found elsewhere (e.g., Donellan et al., 2006). Even lower indices of good fit were identified for the BFI 44 instrument and the TIPI instrument, and these have also been reported elsewhere (e.g., Ehrhart et al., 2009; Zachrisson, 2010). Five of the instruments, except SOM/HP5i, showed suboptimal fit and resulted in indices below the recommended levels and accepted standards when analyzed with the CFA model (Hu & Bentler, 1999; Marsh et al., 2004). The ESEM method resulted in an overall better fit to the data than the CFA.

Personality instruments are most often used with the implicit assumption that the factor structure should not be affected by features associated with demographic characteristics or other key variables. However, when drawing conclusions about group differences, for example, the test of this implied assumption is commonly ignored (e.g., Marsh et al., 2014; Laverdière et al., 2013). The current findings based upon the ESEM method are important in this regard because the SOM/HP5i, Mini-IPIP and HP5i instruments were shown to be

relatively invariant over the two important demographic variables of age and gender. Also the invariant analysis of the BFI 10 instrument using the CFA model showed indices just below acceptable levels.

Analyses of factor correlations for the BFI and HP5i instruments showed generally moderate to high correlations, and this is in line with what has been reported elsewhere (e.g., Zackrisson 2010; Gustavsson et al., 2008). For the Mini-IPIP instrument, the results were similar to those reported by Donellan et al. (2006) and Laverdière et al., (2013) and showed moderate inter-factor correlations. Inter-factor correlations for the 10-item TIPI instrument were high. This result was not in line with that of Gosling et al. (2003) but was virtually the same as Ehrhart et al. (2009). This means that many high inter-factor correlations were found, but compared to Ehrhart et al. a different pattern between different factors was revealed. Finally, the BFI 10 instrument showed factor correlations at moderate levels. In summary, several factor correlations were found to be at high magnitude indicating considerable cross loadings. Due to the initial suboptimal model fit found for most of the instruments when analyzed with the CFA method, as well as for the BFI instrument when analyzed with the ESEM method, comparisons between the magnitudes of factor correlations should be interpreted with caution.

Concurrent validity

The discussion of suboptimal model fit for many FFM instruments has highlighted the increased importance of other validation criteria than just structural validity, for example, the importance of concurrent validity (e.g., McCrea et al., 1996; Credé et al., 2012). Because fit indices based on the CFA method (and the ESEM method for the BFI 44 instrument) were below recommended thresholds, further analyses were performed on manifest scale scores. The research field of subjective well-being explores how people evaluate their lives and includes, for example, measures of life satisfaction and subjective health. Although many personality traits have been linked with subjective well-being, a significant amount of theoretical and empirical work has focused on the moderate to strong correlations between the traits of neuroticism and extraversion. High levels of extraversion and low levels of neuroticism are found to be associated with high levels of subjective health as well as high levels of life satisfaction (e.g., Diener et al., 2003; Donellan et al., 2006). For example, meta-analyses have shown average correlations between extraversion and subjective well-being as high as .38, and even stronger correlations have been shown with the neuroticism factor (Diener et al., 2003). The strongest associations between FFM factors and subjective health found in the present study were for the neuroticism factor identified by the Mini-IPIP (-.37) and BFI (-.35) instruments. The strongest correlation with life satisfaction was found for extraversion in the HP5i instrument (.36).

In recent years there has been a growing emphasis on the role of psychological factors such as personality in the shaping of political behaviors and attitudes (Holmberg, Weibull & Gunnarsson 2011; Mondak, 2010). Previous research in the area of personality and ideological self-placement has found relations between conservative or right-wing political attitudes and the personality factor of conscientiousness. High levels of the factor openness, and to some extent neuroticism, have been found to be correlated with left-wing ideological

self-placement (e.g., Gerber, Huber, Doherty, & Dowling, 2010; Holmberg, Weibull & Gunnarsson 2011; Mondak, 2010). However, these correlations have thus far been found to be weak or moderate (Holmberg, Weibull & Gunnarsson 2011; Mondak, 2010). For example, one study reported magnitudes of .20 between liberal attitudes and openness and .10 between conscientiousness and conservative attitudes (Gosling et al., 2003). In the present study, the strongest associations between right-wing self-placement and conscientiousness were found for the Mini-IPIP (.14) instrument. The weakest associations between right-wing orientation and openness were found for the BFI (-.16) and HP5i (-.16) instruments, and the weakest association with neuroticism was found with the HP5i (-.22) instrument.

Longer scales are likely to have greater content validity and are also likely to result in more reliable scale scores. However, as seen in this study and elsewhere (e.g. Creed et al., 2012, Thalmeyer, Saucier & Eigenhuis, 2011) the number of items is not always the key in reaching reasonable associations with the same outcome. This suggests that simply making scales longer or shorter does not necessarily increase or decrease their validity and that careful scale design and item selection can make up for a lack of several different items. Moreover, inventories that are narrower and measure at the facet level can increase predictive power over broader FFM measures (e.g., Paunonen, 2003; Gustavsson et al., 2003).

Limitations

The two age groups in this study were split based on the median age, and it is possible that splitting the sample into other age groups would have given other results. In addition, the determination of model fit is not without its critics, especially with respect to the determination of thresholds for fit indices.

Conclusions

In this study, five out of six short FFM instruments were found to provide suboptimal model fit according to general standards and recommendations when analyzed with traditional CFA method. When analyzed with the ESEM method, better fit indices from an FFM perspective were observed.

Based on the results from the analyses of the measures in this study of Swedish adults, the SOM/HP5i instrument appears to be the most capable short FFM instruments. Regarding the two shortest instruments analyzed in this study, the BFI 10 demonstrated considerable better statistical measures than the TIPI instrument.

Even if similar pattern of regression estimates with the different additional measures were found, and most inventories exhibited fairly similar estimates across all four types of criteria variables, it is important to highlight that differences occurs. Inventories differ considerable in their level of predictive capabilities for particular criteria.

Taken together, based upon the SOM research institutes current requirements and needs (meaning for example an even short and more general instrument then the present) the BFI 10 seems to best match the requests, at least according to the evaluation performed in this study.

Awareness of the limitations of using short instrument is, however, always needed when results are analyzed and conclusions are drawn from research using such brief personality instruments.

References

- Ashton, M., Lee, K., Perugini, M., Szarota, P., de Vries, R. E., Di Blas, L., et al. (2004). A six-factor structure of personality-descriptive adjectives: Solutions from psycholexical studies in seven languages. *Journal of Personality and Social Psychology, 86*, 356–366. doi:10.1037/0022-3514.86.2.356
- Credé, M., Harms, S., Niehorster, S., & Gaye-Valentine, A. (2012). An Evaluation of the Consequences of Using Short Measures of the Big Five Personality Traits. *Journal of Personality and Social Psychology 102:4*, 874–888; doi: 10.1037/a0027403
- Diener, E., Oishi, S., & Lucas, R. E. (2003). Personality, culture, and subjective well-being: Emotional and cognitive evaluations of life. *Annual Review of Psychology, 54*, 403–425.
- Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The Mini-IPIP scales: Tiny-yet-effective measures of the big five factors of personality. *Psychological Assessment, 18*, 192–203.
- Ehrhart, M. G., Ehrhart, K. H., Roesch, S. C., Chung-Herrera, B. G., Nadler, K., & Bradshaw, K. (2009). Testing the latent factor structure and construct validity of the Ten-Item Personality Inventory. *Personality and Individual Differences, 47*, 900-905.
- Furnham A, Guenole N, Levine SZ, Chamorro-Premuzic T. (2013). The NEO Personality Inventory-Revised: factor structure and gender invariance from exploratory structural equation modeling analyses in a high-stakes setting. *Assessment, 20(1)*, 14-23. doi: 10.1177/1073191112448213.
- Gerber, A., Huber, G., Doherty, D., & Dowling, C. (2010). Personality and Political Attitudes: Relationships across Issue Domains and Political Contexts. *American Political Science Review, 104, 1*, doi:10.1017/S0003055410000031
- Gosling, S., Rentfrow, P., & Swann, W. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37*,) 504-528
- Gustavsson, J.P., Eriksson, A-K., Hilding, A., Gunnarsson, M., & Östenson, C-G. (2008). Measurement invariance of personality traits from a five-factor model perspective: multi-group confirmatory factor analyses of the HP5 inventory. *Scandinavian Journal of Psychology, 49*, 459–467 DOI: 10.1111/j.1467-9450.2008.00654.x

- Gustavsson, J.P., Jönsson, E., Linder, J., & Weinryb, R. (2003). The HP5 inventory: definition and assessment of five healthrelevant personality traits from a five-factor model perspective. *Personality and Individual Differences, 35*, 69–89
- Holmberg, S & Weibull, L (2010) Människans fem personlighetsegenskaper. In Sören Holmberg & Lennart Weibull (Eds.) Nordiskt ljus. Göteborg: SOM-institutet, Göteborgs universitet.
- Holmberg, S, Weibull, L & Gunnarsson M (2011) Personlighet och ideologisk vänsterhögerposition. In Sören Holmberg, Lennart Weibull & Henrik Oscarsson (Eds.) Lycksalighetens ö. Göteborg: SOM-institutet, Göteborgs universitet.
- Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). The Big Five Inventory— Versions 4a and 5. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.
- Laverdière, O., Morin, A., & St-Hilaire, F. (2013). Factor structure and measurement invariance of a short measure of the Big Five personality traits. *Personality and Individual Differences, 55*:7, 725-868
- Marsh, H., Morin, J.S., Parker, P., & Kaur, G. (2014). Exploratory Structural Equation Modeling: An Integration of the Best Features of Exploratory and Confirmatory Factor Analysis. *Annual Review of Clinical Psychology, 10*:3.1 -3.26
- Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralising Hu & Bentler's (1999) findings. *Structural Equation Modeling, 11*, 320–341. doi:10.1207/s15328007sem1103_2
- Marsh, H. W., Lüdtke, O., Muthén, B., Asparouhov, T., Morin, A. S., Trautwein, U., et al. (2010). A new look at the big five factor structure through exploratory structural equation modeling. *Psychological Assessment, 22*, 471–491.
- Martinsson, J., Andreasson, M., Markstedt, E., Pettersson, L., (2013). *Technical Report Citizen Panel 7 – 2013*, Gothenburg: University of Gothenburg, LORE.
- McCrae, R. R., Zonderman, A. B., Costa, P. T., Bond, M. H., & Paunonen, S. V. (1996). Evaluating the replicability of factors in the revised NEO personality inventory: Confirmatory factor analysis versus Procrustes rotation. *Journal of Personality and Social Psychology, 70*, 552–566.
- Mondak, J.J. (2010). *Personality and the foundation of Political Behaviour*. Cambridge university press, New York.

Muthén, L. K., & Muthén, B. (2008). *Mplus user's guide*. Los Angeles CA: Muthén & Muthén.

Paunonen, S. V. (2003). Big Five factors of personality and replicated predictions of behavior. *Journal of Personality and Social Psychology, 84*, 411–422. doi: 10.1037/0022-3514.84.2.411

Rammstedt, B., & John, O. (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

Thalmeyer, A. G., Saucier, G., & Eigenhuis, A. (2011). Comparative validity of brief and medium-length Big Five and Big Six personality questionnaires. *Psychological Assessment, 23*, 995–1009.

Zakrisson, I. (2010). Big Five Inventory (BFI): *Utprovning för svenska förhållanden*. *Social Science Reports from Mid Sweden University, Mitt Universitetet*, 851 70 Sundsvall.

Web references

SOM, (2014). SOM institute at University of Gothenburg. <http://www.som.gu.se/> 2014-10-29

Appendix A

Items and response alternatives for the instruments are presented in Swedish.

Table 1

Descriptive statistics for the BFI 44 and the BFI 10 instruments, percentage distribution over the five response alternatives.

BFI 44 – BFI 10 item	FFM-factor*	BFI 10**	Response alternatives					Total %
			Stämmer absolut inte	Stämmer ganska dåligt	Stämmer varken bra eller dåligt	Stämmer ganska bra	Stämmer absolut	
Är pratsam	E		4	15	30	37	14	100
Tenderar att hitta fel hos andra	A R	10	12	36	31	18	3	100
Gör ett grundligt jobb	C	10	1	2	9	53	35	100
Är deprimerad, nere	N		45	27	19	8	2	100
Är originell, kommer med nya idéer	O		2	12	31	45	10	100
Är reserverad	E R	10	15	31	28	22	4	100
Är hjälpsam och osjälvisk mot andra	A		1	2	16	59	22	100
Kan vara något vårdslös	C R		28	38	21	12	1	100
Är avspänd, hanterar stress väl	N R	10	4	16	26	45	9	100
Är nyfiken på många olika saker	O		1	4	14	51	30	100
Är full av energi	E		2	11	33	42	12	100
Startar gräl med andra	A R		60	29	9	2	0	100
Är pålitlig i arbetet	C		1	0	3	33	63	100
Kan vara spänd	N		9	29	30	27	5	100
Är sinnrik, en djup tänkare	O		4	18	31	35	12	100
Sprider mycket entusiasm	E		2	9	38	41	10	100
Har en förlåtande läggning	A		1	9	20	53	17	100
Tenderar att vara oorganiserad	C R		27	43	17	11	2	100
Oroar mig mycket	N		14	31	24	23	8	100
Har livlig fantasi	O	10	5	17	30	34	14	100
Tenderar att vara tystlåten	E R		19	30	27	19	5	100
Är i allmänhet tillitsfull	A	10	1	3	11	60	25	100
Tenderar att vara lat	C R	10	24	33	26	14	3	100
Är känslomässigt stabil, blir inte upprörd	N R		5	14	24	39	18	100
Är uppfinningsrik	O		1	10	29	44	16	100
Har en självhävdande personlighet	E		13	34	33	18	2	100
Kan vara kall och distanserad	A R		24	33	25	16	2	100
Framhävdar tills uppgiften är slutförd	C		1	6	19	49	25	100
Kan vara lynnig	N		27	36	25	11	1	100
Värdesätter konstnärliga, estetiska upplevelser	O		4	15	22	36	23	100
Är ibland blyg, hämmad	E R		11	28	25	29	7	100
Är omtänksam och vänlig mot nästan alla	A		0	1	13	57	29	100
Gör saker effektivt	C		0	3	18	55	24	100
Förblir lugn i spända situationer	N		1	8	26	51	14	100
Föredrar rutinarbete	O R		14	32	32	18	4	100
Är utåtriktad, sällskaplig	E	10	2	11	24	45	18	100
Är ibland ohövlig mot andra	A R		31	41	20	7	1	100
Gör upp planer och fullföljer dem	C		1	9	25	52	13	100
Blir lätt nervös	N	10	18	39	24	16	3	100
Tycker om att reflektera, leka med ideer	O		1	6	24	43	26	100
Har få konstnärliga intressen	O R	10	20	26	23	22	9	100
Tycker om att samarbeta med andra	A		2	5	21	50	22	100
Blir lätt distraherad	C R		10	40	31	15	4	100
Har en utvecklad smak för konst, musik eller litteratur	O		9	18	27	28	18	100

Note: *FFM factors; E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. R= item reversed meaning scoring backwards. **Marked items composes the BFI 10 instrument

Table 2

Descriptive statistics for the HP5i and the SOM/HP instruments, percentage distribution over the four response alternatives.

HP5i HP- SOM/HP5 item	FFM-factor*	SOM/HP5**	Response alternatives				Total %
			<i>Stämmer inte alls</i>	<i>Stämmer inte särskilt bra</i>	<i>Stämmer ganska bra</i>	<i>Stämmer precis</i>	
Jag känner mig ofta olustig och obehaglig till mods utan påtaglig anledning.	N		41	42	14	3	100
Jag är bra på att komma med spydiga kommentarer.	A R		29	38	29	4	100
Jag har en tendens att handla på ögonblickets ingivelse utan att tänka mig för så noga.	C R		25	49	24	2	100
Jag har lätt för att njuta av livet.	E		3	16	64	17	100
Jag brukar inte analysera mina känslor så noga.	O R	<i>no</i>	19	37	39	5	100
Jag blir lätt stressad om jag uppmanas att skynda på med ett arbete.	N		19	49	27	5	100
Om man blir illa behandlad av någon tycker jag i princip att man ska ge igen.	A R		23	49	24	5	100
Det händer ofta att jag lite förhastat ger mig in på saker.	C R		16	53	28	3	100
Jag tycker att folk gärna överdriver känslornas betydelse.	O R		20	53	24	3	100
Jag känner mig ofta glad och litet upprymd inför mötet med en god vän.	E		2	7	57	34	100
Jag spänner mig ofta så hårt att jag blir trött.	N		39	41	15	4	100
Om någon vill argumentera mot mig drar jag mig inte för att komma med vassa och spydiga svar.	A R		25	45	25	5	100
Jag brukar "tala först och tänka sedan".	C R		31	49	18	2	100
Jag har ofta svårt att förstå vad folk menar när de talar om sina känslor.	O R		44	44	10	2	100
Jag försöker fylla min tid med sådant som jag känner kan engagera mig.	E	<i>no</i>	2	11	60	27	100
Jag kan rycka till häftigt vid oväntade ljud.	N	<i>no</i>	19	35	32	14	100
Den som förolämpar mig eller mina närmaste kan räkna med bråk.	A R	<i>no</i>	25	46	24	5	100
Jag anser mig vara impulsiv.	C R	<i>no</i>	21	47	28	4	100
Jag föredrar att slippa engagera mig i andra människors problem.	O R		26	45	26	3	100
Jag tycker livet är fullt av intressanta saker	E		1	8	44	47	100

Note: *FFM factors; E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. R= item reversed meaning scoring backwards. **Marked items are not included in the SOM/HP5 instrument

Table 3

Descriptive statistics for the Mini IPIP instrument, percentage distribution over the five response alternatives.

Mini IPIP item	FFM-factor*	Response alternatives					Total %
		<i>Stämmer inte alls</i>	<i>Stämmer inte särskilt bra</i>	<i>Stämmer delvis</i>	<i>Stämmer ganska bra</i>	<i>Stämmer precis</i>	
Är den som håller igång på ett party	E	18	31	35	13	3	100
Sympatiserar med andras känslor	A	1	6	33	46	14	100
Gör hushållsarbete genast	C	6	20	35	29	10	100
Har ofta förekommande humörsvängningar	N	24	39	26	8	3	100
Har en vild fantasi	O	11	27	30	22	10	100
Pratar inte mycket	E R	19	35	28	14	4	100
Är ointresserad i andra människors problem	A R	32	44	18	5	1	100
Glömmer ofta att lägga tillbaka saker på sin plats	C R	29	35	22	10	4	100
Är avslappnad för det mesta	N R	2	12	30	47	9	100
Är ointresserad av abstrakta idéer	O R	24	36	27	10	3	100
Pratar med en massa olika människor under en fest	E	7	26	34	24	8	100
Känner andra människors känslor	A	2	13	35	38	12	100
Tycker om ordning	C	1	4	21	48	26	100
Blir lätt upprörd	N	16	40	30	11	3	100
Har svårt att förstå abstrakta idéer	O R	25	39	27	8	1	100
Håller mig i bakgrunden	E R	13	31	38	15	3	100
Är egentligen inte intresserad av andra	A R	37	42	15	5	1	100
Skapar oreda omkring mig	C R	43	38	13	4	2	100
Känner mig sällan nere	N R	7	23	27	31	12	100
Är fantasilös	O R	40	43	13	4	0	100

Note: *FFM factors; E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. R= item reversed meaning scoring backwards.

Table 4

Descriptive statistics for the TIPI instrument, percentage distribution over the seven response alternatives.

TIPI item	FFM-factor*	Response alternatives							Total %
		<i>Håller inte alls med</i>	<i>Håller inte med</i>	<i>Håller inte riktigt med</i>	<i>Varken eller</i>	<i>Håller med lite</i>	<i>Håller med</i>	<i>Håller med fullständigt</i>	
Utåtriktad, entusiastisk	E	2	4	9	14	20	38	13	100
Kritisk, grälsjuk	A R	28	36	13	8	12	3	1	100
Pålitlig, självdisciplinerad	C	1	1	2	5	15	53	23	100
Ängslig, lätt upprörd	N	20	32	13	12	15	6	2	100
Öppen för nya erfarenheter, komplex	O	1	2	3	10	19	48	17	100
Reserverad, tyst	E R	21	24	12	13	18	9	3	100
Sympatisk, varm	A	0	1	3	15	27	43	11	100
Rörig, slarvig	C R	27	29	12	11	14	6	1	100
Lugn, emotionellt stabil	N R	1	4	9	11	18	42	15	100
Konventionell, okreativ	O R	23	33	16	15	9	3	1	100

Note: *FFM factors; E=Extraversion, A=Agreeableness, C=Conscientiousness, N=Neuroticism, O=Openness. R= item reversed meaning scoring backwards.

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