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Postprint / Postprint
Zeitschriftenartikel / journal article

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*Earlier versions of this article were presented at the RC33 conference, Amsterdam 2004, RC28 conference, Oslo 2005 and first EASR conference, Barcelona 2005. Work on this article was conducted with the help of the German Israeli Foundation (GIF), Project No. I-769-241.4. The work of the third author on this research was supported by Israel Science Foundation Grant No. 921/02-1.*

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*This is a pre-copy-editing, author-produced PDF of an article accepted for publication in* **Public Opinion Quarterly** 2008 72(3):420-445 *following peer review. The definitive publisher-authenticated version is available online at*

http://poq.oxfordjournals.org/cgi/content/abstract/72/3/420

*or under*

doi:10.1093/poq/nfn035

# Bringing Values Back In: The Adequacy of the European Social Survey to Measure Values in 20 countries

Abstract

Values are prominent in public discourse today. Theorists have long considered values central to understanding attitudes and behavior. The Schwartz (1992) theory of basic human values has promoted a revival of empirical research on values. The semi-annual European Social Survey (ESS) includes a new 21-item instrument to measure the importance of the ten basic values of the theory. Representative national samples in 20 countries responded to the instrument in 2002-3. We briefly describe the theory and the ESS instrument and assess its adequacy for measuring values across countries. Using multiple group confirmatory factor analyses, augmented with mean-structure information, we assess the configural and measurement (metric) invariance of the values—necessary conditions for equivalence of the meaning of constructs, and scalar invariance—a precondition for comparing value means across countries. Only if such equivalence is established can researchers make meaningful and clearly interpretable cross-national comparisons of value priorities and their correlates. The ESS values scale demonstrates configural and metric invariance, allowing researchers to use it to study relationships among values, attitudes, behavior and socio-demographic characteristics across countries. Comparing the mean importance of values across countries is possible only for subsets of countries where scalar invariance holds.

Key words: Human values scale, European Social Survey, multi-group confirmatory factor analysis, configural invariance, measurement invariance, scalar invariance, cross-national comparison

## Introduction

Values are central to public discourse today. Competing groups demand priority for the values they hold dear, arguing that conflicting values are unworthy. Theorists have long considered values central to understanding attitudes and behavior (e.g., Allport, Vernon and Lindsay, 1960; Kluckhohn, 1951; Williams, 1968). They view values as deeply rooted, abstract motivations that guide, justify, and explain attitudes, norms, opinions, and actions (cf. Feldman, 2003; Halman and de Moor, 1994; Rokeach, 1973; Schwartz, 1992).

In practice, survey researchers distinguish little between values and attitudes (Halman and de Moor, 1994: p.22). The confounding of values and attitudes reflects, in part, the absence of a comprehensive theory of the basic motivations that are socially expressed as values. It also reflects the lack of reliable, theory-based instruments to measure basic values (Hitlin and Piliavin 2004; Rohan 2000).

In 1992, Schwartz introduced a theory of basic human values, building on common elements in earlier approaches (e.g., Rokeach 1973). It includes ten motivationally distinct values presumed to encompass the major value orientations recognized across cultures. He also presented a first instrument to measure these values that he validated cross-culturally (Schwartz, 1992). An alternative instrument, also validated across cultures, was presented in 2001 (Schwartz, Melech, Lehmann, Burgess, Harris and Owens 2001). This theory and two instruments have promoted a revival of empirical research on relations of values to attitudes and behavior, both within and across cultures (overviews in Hitlin and Piliavin 2004; Schwartz 2005a,b). Recently, the European Social Survey (ESS) incorporated a third, short instrument to measure the ten basic values in its semi-annual studies of attitudes and opinions. The 2006 pilot study of the American National Elections Survey also includes a version of the values

instrument. This article briefly describes the theory of basic values and the ESS instrument, and then assesses the adequacy of this instrument for measuring values within and across countries.

Political attitudes and choice are one important domain to which basic values are relevant (e.g., Knutsen, 1995; Miller and Shanks, 1996; Rokeach, 1973; Zaller, 1992). Values may enable people to organize their political evaluations in a relatively consistent manner; they may provide a general structure to political attitudes (Feldman, 2003). This structuring process is one path through which values may influence political preferences. Converse (1964) likened values to "a sort of glue to bind together many more specific attitudes and beliefs." Schwartz (1994) argued that systematic variations in the priority individuals give to different basic values underlie political ideologies. Thus, values may influence political choice through their effects on ideologies.

The particular values that structure ideological discourse and underlie political choice depend upon the issues that are central in a given political context. Consider three examples of studies based on the Schwartz (1992) theory and instruments. In the Israeli political arena of 1988, protection of religious practice competed with free expression of a secular life style. There, the key values that differentiated party supporters were tradition versus self-direction (Barnea and Schwartz, 1998).

In the Italian elections of 2001, the center-right placed particular emphasis on entrepreneurship and the market economy, security, and family and national values. In contrast, the center-left advocated social welfare, concern for social justice, equality, and tolerance of diverse, even potentially disruptive groups. The basic values that related significantly to political preferences were security and power (right) vs. universalism and benevolence (left) (Caprara, Schwartz, Capanna, Vecchione, and Barbaranelli, 2006).

In a study of political preferences in 14 countries, Barnea (2003) found two main patterns. Where political competition revolved around issues of national security vs. equal rights and freedoms for all, the key values that structured voters' preferences were security and conformity vs. universalism and self-direction. Where the focus of political competition revolved around the distribution of material resources, the key values were universalism and benevolence vs. power and achievement.

Other studies have revealed systematic relations of basic values to a wide variety of attitudes and opinions in many countries, using one or another of the Schwartz instruments. For example, basic values exhibit predicted associations with attitudes toward war, right-wing authoritarianism, and social dominance orientation (Cohrs, Moschner, Maes and Kielmann, 2005); attitudes toward human rights (Spini and Doise, 1998); interpersonal trust, political activism, and attitudes toward immigration (Schwartz, 2007); environmental attitudes (Schultz and Zelezny, 1999); and materialism (Burroughs and Rindfleisch, 2002).

Not only are individual differences in basic value priorities important, but the prevailing value emphases in societies also relate systematically to national differences in widespread attitudes and public policy (Schwartz, 2006b). Hence, basic values have predictive and explanatory potential both at the individual and societal levels. Moreover, values can reflect major social change in societies and across nations. And values may influence the direction of social change and its speed. A simple survey method for measuring basic values, such as the ESS instrument, may therefore prove widely useful.

The ESS values scale was administered to representative national samples in 20 countries in 2002-3, in 25 countries in 2004-5, and will be included in future ESS rounds (www.europeansocialsurvey.org). The full dataset from the first two ESS rounds, now in the

public domain (http://ess.nsd.uib.no), includes a vast amount of information of interest to political scientists, sociologists, and others. Thousands of researchers have begun to use these data (reported in **http://naticent02.uuhost.uk.uu.net/news**).

Given the spreading impact of the ESS and the significant role the new human values scale may play in research, it is crucial to examine its validity.[1] The current article assesses how well the ESS human values scale measures the ten basic values in the Schwartz theory. It then examines the equivalence of meaning across countries of the values that are measured. Only if such equivalence is established can researchers make meaningful and clearly interpretable cross-national comparisons of value priorities and their correlates (Billiet 2003). We employ multiple group confirmatory factor analyses augmented with mean-structure information (see Sörbom 1974, and Sörbom 1978) on the data from the first round of the ESS to address these issues.

## The Theory of Basic Values

Before presenting the ESS values scale and assessing its validity, a brief overview of the theory from which it derives is necessary. The theory defines values as desirable, transsituational goals, varying in importance, that serve as guiding principles in people's lives. It derives ten, motivationally distinct, broad and basic values from three universal requirements of the human condition: needs of individuals as biological organisms, requisites of coordinated social interaction, and survival and welfare needs of groups (Schwartz 1992, 2005a). For example, *conformity* values derive from the prerequisites of interaction and of group survival. For interaction to proceed smoothly and for groups to thrive, individuals must restrain impulses and inhibit actions that might

[1] We discuss validity only in the sense of consistency (Bollen 1989), not in the sense of construct validity. The latter would require examining both antecedents and consequences of value priorities, an objective beyond the scope of this paper.

hurt others. *Self-direction* values derive from organismic needs for mastery and from the interaction requirements of autonomy and independence.

The ten basic values cover the distinct content categories found in earlier value theories, in value questionnaires from different cultures, and in religious and philosophical discussions of values. The core motivational goal of each basic value, presented in Table 1, defines it. The theory also explicates the structure of dynamic relations among the ten basic values. The main source of the value structure is the fact that actions in pursuit of any value have consequences that conflict with some values and are congruent with other values.[2] For example, pursuing achievement values may conflict with pursuing benevolence values. Seeking success for self is likely to obstruct actions aimed at enhancing the welfare of others who need one's help. But pursuing both achievement and power values may be compatible. Seeking personal success for oneself tends to strengthen and to be strengthened by actions aimed at enhancing one's own social position and authority over others.

Table 1 about here

The schematic circular structure in Figure 1 portrays the pattern of relations of conflict and congruity among values. The closer any two values in either direction around the circle, the more similar their underlying motivations. The more distant any two values, the more antagonistic their underlying motivations. The division of the domain of value items into ten distinct values is an arbitrary convenience. The circular arrangement of values represents a continuum of related motivations, like the circular continuum of colors, rather than a set of discrete motivations. One could reasonably partition the domain of value items into broader or more fine-tuned distinct value constructs, depending on how finely one wishes to discriminate among motivations. Reflecting the indeterminacy of the optimal number of value constructs, items from adjacent values often

[2] For a discussion of other sources, see Schwartz (2006a).

intermix in empirical studies. Thus, the theory specifies the motivational order of value items around the circle and it suggests distinguishing 10 value constructs for scientific convenience. The theory leaves the width of the value constructs and the absolute distances among them unspecified, hence the width of the slices in Figure 1 is arbitrary.

Figure 1 about here

Two dimensions summarize the structure of relations among the basic values (Figure 1): The self-enhancement vs. self-transcendence dimension opposes power and achievement values—that emphasize self-interest—to universalism and benevolence values—that entail concern for the welfare and interests of others. The openness to change vs. conservation dimension opposes self-direction and stimulation values—that emphasize independent action, thought, and feeling and readiness for new experience—to security, conformity, and tradition values—that emphasize self-restriction, order, and resistance to change. The dashed lines around hedonism indicate that it shares elements of both openness to change and of self-enhancement.

Research with two earlier instruments provides evidence supporting this structure in samples from 67 nations (Fontaine et al. forthcoming; Schwartz 2005a,b; Schwartz and Boehnke 2004). Although individuals differ in the *importance* they attribute to various values, the same motivational *structure* apparently organizes these values across cultures. These studies provide no strict tests of measurement invariance, however. The current study subjects the new ESS human values scale to such tests.

## The ESS Human Values Scale

The ESS Human Values Scale is derived from the earlier 40-item Portrait Values Questionnaire (PVQ: Schwartz, et al. 2001; Schwartz 2005b). Space limitations in the ESS required reducing the number of items. Some items were dropped and others were revised to

encompass additional ideas in order to preserve coverage of the content of the ten different values. The ESS scale includes verbal portraits of 21 different people, gender-matched with the respondent. Each portrait describes a person's goals, aspirations, or wishes that point implicitly to the importance of a value. For example: "Thinking up new ideas and being creative is important to her. She likes to do things in her own original way" describes a person for whom self-direction values are important. Respondents' own values are inferred from their self-reported similarity to people described implicitly in terms of particular values.[3]

Regarding each portrait, respondents answer: "How much like you is this person?" Six labeled responses range from "not like me at all" to "very much like me." The upper panel of Table 2 presents the format of the survey and, below, in the first two columns, the items, grouped by type of value. Two portraits operationalize each value, with three for universalism because of its very broad content. The score for the importance of each value is the mean response to the items that measure it. Translation into each native language followed procedures explained in Harkness, Van de Vijver and Mohler (2003; Ch. 3).

Table 2 about here

Strict probability samples, representating the non-institutionalized population 15 years and older in each of 20 countries, completed the human values scale in round 1 of the ESS. The value scale was administered following a face-to-face interview of approximately one hour in respondents' homes on a wide variety of topics. 86% of respondents completed the survey in the presence of the interviewer (66% orally, 20% written). The interviewer picked up the written values scale later from 2%, and 12% (almost all in Finland and Sweden and half in Norway) returned it by post. The countries, with numbers of respondents who completed the values scale,

[3] All the items are double-barrelled because each includes two sentences. Schwartz (2003) discusses the rationale for this and presents evidence suggesting that it does not create a problem in this case.

are: Austria (2,257), Belgium (1,899), Czech Republic (1,360), Denmark (1,506), Finland (2,000), France (1,503), Germany (2,919), Great Britain (2,052), Greece (2,566), Hungary (1,685), Ireland (2,046), Israel (2,499), Netherlands (2,364), Norway (2,036), Poland (2,110), Portugal (1,510), Slovenia (1,519), Spain (1,729), Sweden (1,999), Switzerland (2,037), total =39,596. Detailed information on the population, selection procedure, response rates, dates of data collection and exact question wording in the various languages are available at http://ess.nsd.uib.no.

Testing Invariance

A key concern when applying a theory and an instrument in different countries or over time is to ensure that measurement of the relevant constructs is invariant cross-nationally or over-time (Harkness et al. 2003; Cheung and Rensvold 2000, 2002). The meaning of measurement invariance is "Whether or not, under different conditions of observing and studying phenomena, measurement operations yield measures of the same attribute" (Horn and McArdle 1992 p. 117). If invariance is not tested, interpretations of between-group comparisons are problematic (Vandenberg and Lance 2000). Absent invariance, observed differences in means or other statistics might reflect differences in systematic biases of response across countries or different understanding of the concepts, rather than substantive differences (Steenkamp and Baumgartner 1998). Equally important, findings of no difference between countries do not ensure the absence of "real" differences.

Multiple- group confirmatory factor analysis (MGCFA: Jöreskog 1971) is among the most powerful techniques for testing measurement invariance.[4] We draw upon the Steenkamp

[4]Lubke and Muthen (2004) argue that an analysis of Likert data under the assumption of multivariate normality may distort the factor structure differently across groups. They propose fitting a model for ordered categorical outcomes. However, De Beuckelaer (2005) demonstrates in simulation studies that using Likert scales and skewed data does not significantly affect the probability of incorrect conclusions in MGCFA. Moreover, the values scale has six

and Baumgartner (1998) procedural guidelines for facilitating assessing measurement invariance in cross-national studies with a confirmatory factor analytic approach. We follow a step-wise procedure from the least to the most demanding form of invariance.

The lowest level of invariance is 'configural' invariance, which requires that the items in an instrument exhibit the same configuration of loadings in each of the different countries (Horn and McArdle 1992). That is, the analysis should confirm that the same items measure each construct in all countries in the cross-national study[5]. Configural invariance is supported if a single model specifying which items measure each construct fits the data well in all countries, all item loadings are substantial and significant, and the correlations between the factors are less than one. The latter requirement guarantees discriminant validity between the factors (Steenkamp and Baumgartner 1998).

Configural invariance does not ensure that people in different countries understand each of the items the same way. Although the same items form a factor that represents each construct, the factor loadings may still be different across countries. The next higher level of invariance, 'measurement' or 'metric' invariance, assesses a necessary condition for equivalence of meaning. This level requires that the factor loadings between items and constructs are invariant across countries (Rock, Werts and Flaugher 1978). It is tested by restricting the factor loading of each item on its corresponding construct to be the same across countries. Measurement invariance is supported if this model fits the data well in a multiple-group confirmatory factor analysis.

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categories rather than the usual five in Likert scales. Although the Proportional Odds Model (POM) technique has more statistical power (low type II error) than MGCFA, recent studies suggest that POM has an inflated type I error, and that MGCFA is more flexible (Welkenhuysen-Gybels and Billiet 2002; Welkenhuysen-Gybels 2004).

[5] The test allows sequentially adding cross-loadings if indicated by the program so long as the same cross-loadings are allowed across all countries.

Configural and metric invariance are tested by examining information only about covariation among the items. A third level of invariance is necessary to justify comparing the means of the underlying constructs across countries. This is often a central goal of cross-national research. Such comparisons are meaningful only if the items exhibit 'scalar' invariance (Meredith 1993; Steenkamp and Baumgartner 1998). Scalar invariance signifies that cross-country differences in the means of the observed items result from differences in the means of their corresponding constructs. To assess scalar invariance, one constrains the intercepts of the underlying items to be equal across countries, and tests the fit of the model to the data.

In sum, meaningful comparison of construct means across countries requires three levels of invariance, configural, metric and scalar. Only if all three types of invariance are supported, can we assume that scores are not biased and confidently carry out mean comparisons. We adopt a 'bottom-to-top' test strategy, starting with the weakest constraints and proceeding to the most severe. This enables us to establish first whether even weak forms of invariance are absent. We test all countries together because theory implies that the measurement model should hold for them all.[6]

Data Analysis

The data analysis starts with 20 separate CFAs. This is followed by a simultaneous MGCFA in order to assess configural invariance. We then modify the model slightly, following the modification indices that are compatible with theory, in order to specify an acceptable model that is invariant across the 20 countries. Next, we conduct metric and scalar invariance tests. Finally, we test for invariance of the structural covariances across countries (which is not a necessary condition for the comparison of means).

[6] Several sources provide details on measuring invariance (e.g., Cheung and Rensvold 2002; De Beuckelaer 2005; Steenkamp and Baumgartner 1998; Vandenberg 2002; Vandenberg and Lance 2000).

First, we computed a Pearson (product moment) intercorrelation matrix plus standard deviations for each country. We then converted these into covariance matrices as input for estimating the confirmatory factor analyses. We used pairwise deletion for missing values because, with fewer than five percent missing values as observed here, pairwise deletion is better than listwise and is adequate (see Brown 1994; Schafer and Graham 2002).[7] Correlations among the items ranged from negative for indicators of value constructs that are theoretically opposed to highly positive for indicators of adjacent value constructs or of the same construct (see Figure 1).

Our first question is: How well does the ESS human values scale measure the ten basic values in the Schwartz theory across the 20 countries? Byrne (2001, pp. 175-176) notes the importance of conducting single-group analyses prior to tests of multi-group invariance. We therefore began by performing separate confirmatory factor analyses in each country on the a priori model of ten values with their respective indicators. We used the Amos 6.0 software package in all of the analyses (Arbuckle 2005). The analyses revealed that all of the items had a factor loading of .4 or higher on their respective factors in every one of the countries. However, in every country, at least two pairs of constructs were dependent on each other.

In order to solve the problem of the non-positive definite covariance matrices[8] of the constructs, we unified the pairs of strongly associated values. Table 3 reports the number of distinct values found in each country and lists the pairs of values that were unified into one construct. After unifying strongly associated value constructs, the formal test of dimensionality suggested that there were between five and eight distinct values in the different countries. Of the

[7]Simulations demonstrate that results of pairwise deletion are robust when there are fewer than 5% missing values and that the improvement of newer methods is minimal (Schafer and Graham 2002). Therefore, the gain from using full information maximum likelihood for the problem of missing values is minimal here. Comparing our results with the FIML procedure produced no differences in the unstandardized regression coefficients until the third place after the comma.

[8]The problem of non-positive definite covariance matrix of the constructs means that some constructs are associated to each other so strongly that they cannot be separated.

61 pairs of value constructs that were unified across the 20 countries, 59 are pairs of values that are adjacent in the value circle of the Schwartz theory (Figure 1). Thus, they represent closely linked motivations and do not violate the theorized circular motivational structure. They do, however, suggest that the ESS value scale may not capture all of the fine-tuned distinctions in the theory.

Table 3 about here

We next tested for configural invariance across the 20 countries by computing the confirmatory factor analysis for the 20 countries simultaneously. We expected to find approximately the average number of distinguishable values found in the 20 separate country analyses. We started with the a priori model of ten values with their respective indicators. Three pairs of values were very highly intercorrelated, power with achievement, conformity with tradition, and universalism with benevolence. This produced a problem of non-positive definite matrices of the constructs. The high intercorrelations indicated that the pairs of values were too close to be modeled separately. We therefore unified each pair into a single construct to form seven distinct values that we tested in all subsequent analyses.

Figure 2 shows the model with the seven value constructs and the relations between indicators and constructs. Note that the value constructs that were unified represent values that are adjacent in the value circle of the Schwartz theory; each unified construct shares a broad basic motivational goal. Thus, these findings support the theorized circular motivational structure. They again suggest, however, that the ESS value scale may not capture all of the fine-tuned distinctions in the theory.

Figure 2 about here

We proceeded to improve the model by adding paths suggested by the modification indices. These indices revealed that four items intended to measure particular value constructs also had significant, secondary loadings on other value constructs. Table 4 presents the chi square values, degrees of freedom, and fit statistics for the basic model of seven values (1) and the models after sequentially adding paths for the items with an additional loading on another value construct (2, 3, and 4). Each model produced some improvement in several of the fit indices.[9]

Table 4 about here

Model 2 allowed a positive path from power item #2 to the combined conformity-tradition value construct, a negative path to the combined universalism/benevolence value construct, and a negative path from tradition item #9 to the combined power/achievement value construct. Model 3 allowed a negative path from stimulation item #15 to the combined universalism/benevolence value construct. Finally, model 4 allowed a positive path from power item #17 to the combined conformity/tradition value construct. These paths appear as broken lines in Figure 2.

Following these modifications, the various fit indices indicate a fit between the model and the data that is satisfactory for not rejecting a model according to Hu and Bentler (1999) and Marsh, Hau and Wen (2004) (RMR=0.06, NFI=0.90, CFI=0.91, RMSEA=0.01, PCLOSE=1 and AIC and BCC lower than in previous models). Hence, the configural invariance of the seven factor model cannot be rejected. That is, we can treat the specification of the items that index each of the seven factors as invariant across the 20 countries.

Interestingly, all the modifications introduced in models 2-4 entail adding paths between single indicators and motivationally opposed latent factors that were formed by combining two

[9] Because of the large number of cases, the chi square values are very high.

value constructs. The negative paths indicate that the association between the opposing latent value constructs did not capture all of the opposition for three items. The positive paths indicate that these associations overestimated the opposition for two items. The need for these modifications may be due to the reduction from ten original factors to seven. For example, the unified power-achievement latent construct yielded an overall association with the conformity-tradition construct that required adding positive paths for the two power items. In the theorized motivational circle of values, power is closer to conformity-tradition than achievement is. We would therefore expect the power items to correlate less negatively with conformity-tradition than the achievement items with which they were combined. Perhaps, had the number of indicators in the ESS scale not been reduced to two per construct (three for universalism), permitting retention of all ten factors, the added paths would not have been necessary.

As noted, the ESS value scale captures the order of motivations postulated by the value theory, but the CFAs do not support all of the fine-tuned distinctions in the theory. On the other hand, multi-dimensional scaling analyses of the same values data in each of the countries do support these distinctions (Schwartz 2007). These analyses also yielded structures that correspond with the theorized circular motivational structure of values. Moreover, in 15 of the 20 countries, it was possible to partition the 2 dimensional MDS space into distinct regions for each of the 10 values. Partitioning in the remaining countries yielded distinct regions for eight values and a joint region for two values adjacent in the value circle. Whereas MDS focuses on the differences among items, CFA focuses on what they have in common. This may explain why CFA supports fewer distinctions. It is apparently more sensitive to the very limited number of items per construct, especially because items intended to measure theoretically adjacent constructs are necessarily substantially correlated.

We next turn to our second question: To what extent do the values that are measured have equivalent meanings across countries? We address this question by testing measurement or metric invariance in a second step of the analysis with multiple-group confirmatory factor analysis. This step constrains the factor loadings between the indicators and the constructs in the model to be the same in all of the countries. If the factor loadings are invariant, we can conclude that the meaning of the values, as measured by the indicators in the ESS, may be identical in the 20 countries. Because configural invariance is a prerequisite for metric invariance, we conducted this test on the model of seven value factors including the modifications made in the test of configural invariance (see broken lines in Figure 2).

Table 5 summarizes the fit indices for sequentially more constrained models. The first row repeats the indices for the unconstrained, configural invariance model. The second row provides the indices for the metric invariance model that constrains the loadings of each item on its respective factor to be the same in each of the 20 countries. These indices suggest a reasonable fit for the metric invariance model too, a fit sufficient not to reject the model. The increase in AIC and BCC shows that one does better allowing variation in the loadings, but the constrained model is quite good itself (Hu and Bentler 1999; Marsh et al. 2004) (RMR=0.08, NFI=0.89, CFI=0.91, RMSEA=0.01 and PCLOSE=1.0).[10] All factor loadings in the configurally invariant model are high, including those that are statistically different across countries. The statistical differences and similarities may support partial measurement invariance of some of the constructs in some countries. However, the constrained (metrically invariant) model is substantially more parsimonious and meaningful than the model with only configural invariance, and it is reasonable to accept it (Little 1997).

Table 5 about here

[10]As the sample size is very large, we do not apply the chi-square difference test (Cheung and Rensvold 2002).

Table 6 summarizes the invariant factor loadings between indicators and values for the 20 countries in the metric invariance model. All the item loadings for the metric invariance model are significant. Appendix A reports the standardized factor loadings for each country separately. The items with added paths based on the modification indexes are at the bottom of the table.

Table 6 about here

The third step of the multiple-group confirmatory factor analysis tests for scalar invariance, a necessary condition for comparing value means across countries. This step of MGCFA is augmented with mean-structure information (see Sörbom 1974, and Sörbom 1978)[11]. It constrains the intercepts of the indicators in the model, in addition to the factor loadings between the indicators and the constructs, to be the same in all of the countries. If the factor loadings and the intercepts are invariant, one can legitimately compare value means. Where scalar invariance holds, value means should be computed as parameters of the SEM model and not from composite scores calculated from the observed variables. This is because SEM controls for measurement errors of the observed indicators (Sörbom 1974).

The fit indices for the scalar invariance model suggest that one should reject this more restrictive model. The increase in AIC and BCC is very large, and both CFI and NFI decrease substantially. Only PCLOSE and RMSEA suggest a good fit (NFI=0.80, CFI=0.82, RMSEA=0.02 and PCLOSE=1.0). We therefore conclude that the scale does not meet the requirements of scalar invariance. In other words, one cannot use these data to compare priorities on all seven values across the full set of 20 countries. However, partial scalar invariance may hold for some or all of the values across sub-sets of countries.[12] This would allow mean

[11] This type of Multiple-Group CFA is often referred to in the literature as Mean- and Covariance Structure [MACS] modeling.
[12] In partial scalar invariance, the intercepts of at least two indicators per construct must be equal.

comparisons of these values across the countries in the sub-set (Byrne, Shavelson and Muthen 1989; Steenkamp and Baumgartner 1998).

To illustrate, consider the sub-set of Denmark and Spain. To assess partial scalar invariance, we first set all intercepts to be equal in both countries (i.e., we constrain full scalar invariance). Then, following the modification indices suggested by the program, we released the equality constraints for the intercepts of the indicators TR9, CO16, UN3, BE18, and AC13. This resulted in an acceptable model fit (CFI=0.92, NFI=0.90, RMSEA=0.04, Pclose=1.00), permitting mean comparisons of all seven values.[13] The comparisons reveal that people in Spain attribute significantly more importance to power/achievement (mean difference .42), security (.91), conformity/tradition (.10), and universalism/benevolence (.12) values. By contrast, Danish people attribute significantly more importance to hedonism (.40) and self-direction (.11) values. People in the two countries do not differ in their mean level of stimulation values.

Following similar procedures, one can find the items whose equality constraints should be released to obtain partial scalar invariance across various sub-sets of countries. We found, for example, that it is legitimate to compare the importance to Danes and to Belgians of all seven values. Partial scalar invariance also allows mean comparisons between Belgium and Spain for five values (security, self-direction, power/achievement, conformity/tradition, and universalism/benevolence). Researchers interested in comparisons among particular countries can test which values show full or partial scalar invariance for those countries and may be compared. In sum, although one should not compare the seven values simultaneously across the

[13] In multiple-group confirmatory factor analysis, mean comparison of latent variables is done by setting the mean values of the constructs to zero in one group and then estimating the mean difference in the other groups. Mean differences are on the original scale net of measurement error. Arbuckle (2005) provides computation details**.** Alternatives are proposed by Little, Slegers and Card (2006).

20 countries, one can compare means for some values across sub-sets of countries where scalar invariance or partial scalar invariance hold.

As noted above, the value theory does not specify the distances of the value constructs from one another around the circle. As a further question, we asked whether the pattern of distances is the same across countries. We tested this possibility by constraining the covariances among the factors to be the same. The fourth row in Table 5 reports the fit statistics for this model. The RMR and NFI fit indexes indicate a relatively poor fit (RMR=0.12, NFI=0.86, CFI=0.88), and substantial increases in AIC and BCC also indicate a significant loss of fit. We reject therefore a model which postulates equivalence of structural covariances across countries. The relations among the seven values are not invariant. The pattern of distances between the values is not the same in all countries. This finding suggests that societal factors may influence the strength of opposition and/or congruence among the different values.[14]

## Discussion and Conclusions

The semi-annual European Social Survey is a major source of data for researchers across the social sciences. Its 21-item human values scale, designed to measure the full range of distinct, basic values in population surveys, has quickly attracted interest. Six presentations at the 1st European Association for Survey Research Conference discussed data using the scale. Given the interest in this new scale and its potential use in surveys around the world, it was crucial to assess its validity. This article examined the fit of the ESS values instrument to the theory on which it was based. It then investigated the appropriateness of this instrument for studying values across 20 countries, using data from the first round of the ESS. We addressed three questions:

[14] For example, using MDS to assess the value structure, Fontaine, Poortinga, Delbeke, and Schwartz (Forthcoming) find that the opposition of self-direction and universalism values to power and security values is greater in societies with a more autonomous culture and with higher socio-economic development.

1) How well does the ESS human values scale measure the ten basic values in the Schwartz theory?
2) To what extent do the values that are measured have equivalent meanings across countries?
3) To what extent can the values scale be used to compare latent means across the 20 countries?

Separate confirmatory factor analyses in each country supported the adequacy of the ESS scale for measuring the 10 values of the Schwartz theory. However, very high correlations between some pairs of values in these analyses and in the multi-group CFA across countries caused a problem of non-positive definite covariance matrices. To solve this problem, we unified these pairs into single value constructs. This yielded seven distinct values in the multi-group CFA: security, self-direction, stimulation, hedonism and combined tradition/conformity, universalism/benevolence, and power/achievement values. We further modified the multi-group model by adding paths from four items to other constructs. This model supported the configural invariance of the seven value factors across the 20 countries.

The three combined value constructs were formed by unifying values that are adjacent in the value structure. Hence, the ESS human values scale captures the motivational circle of values in the theory on which it is based. The emergence of only seven distinguishable values may be a consequence of the fact that the ESS included only 21 items to measure all 10 value constructs, constructs that are correlated according to the theory. This compares with 40 items in the full Portrait Values Questionnaire and 45 in the Schwartz Value Survey, both of which discriminated the ten values successfully (Bamberg, Davidov, Herrmann, Schmidt and Schwartz, under review; Schwartz and Boehnke 2004). As noted, MDS analyses of the ESS scale in 20 countries, an

approach less sensitive to high correlations among items, supported discrimination of the 10 value constructs (Schwartz 2007). Nonetheless, the current analyses suggest one can use the scale to measure only seven distinct values with confidence.

The critical question for use of the values scale in different countries and for comparing value relations in one country to those in another is whether the values it measures have similar meanings in each country. The test of measurement (metric) invariance addressed this question. It led to the conclusion that the meaning of the values, as measured by the indicators of the ESS, is probably the same in the 20 countries. Thus, the ESS human values scale, when used to measure seven distinct values, meets the tests of configural and metric invariance of the latent factors across countries. In spite of cultural differences, people in Europe appear to understand the meaning given to the values by their indicators in a similar manner[15].

The final question concerned the comparability of value means across countries. The test of scalar invariance addressed this question. The scale failed to exhibit scalar invariance across the 20 countries. Hence, one should not compare the mean importance of the values across all 20 countries simultaneously. However, as illustrated for Denmark and Spain, one can compare means for values across sub-sets of countries where scalar invariance or partial scalar invariance are found.

The findings of the current research justify employing the human values scale in survey research for numerous purposes. One can examine change in value scores across time as an indicator of fundamental societal change in response to historical, demographic, and social

[15] The current research reveals the levels of configural, metric, and scalar invariance of the ESS values instrument only in the countries studied here. One cannot generalize from this to future studies in these or other countries. Such studies should repeat the current analyses to reassess invariance. The statistical method presented here can establish necessary conditions for equivalence of meaning. Cognitive interviews offer a supplementary tool to assess the equivalence of meaning of the values instrument in various countries.

structural developments (e.g., impacts on peoples' basic values of wars, dropping birthrates, and inflation). Values, measured with the ESS scale may also be used to understand differences among national populations in their responses to government policies (e.g., toward immigration) and to major events (e.g., terror attacks). Future studies may also address the way different values mediate the effects of individuals' socio-demographic characteristics (e.g., age, education, occupation) on their attitudes and opinions (e.g., prejudice against out-groups, trust in institutions).

Because the human values scale demonstrates meaning equivalence across countries, researchers can also legitimately assess and draw conclusions about similarities and differences in the relations of value priorities to other variables across countries (Van de Vijver and Leung 1997; De Beuckelaer 2005, Ch. 5). Within country studies have shown many meaningful associations between individuals' value priorities and their attitudes (e.g., political preferences, left-right orientation, views on abortion, marriage, and religion) and behavior (e.g., voting, political activism, membership in voluntary organizations) (see summaries in Schwartz, 2005b, 2006a, 2007). Researchers can now test whether these and other patterns of value/attitude and value/behavior relations generalize across countries. If they find differences between countries in relations of value priorities to attitudes and behavior, the evidence for meaning equivalence makes it legitimate to seek explanations for such country differences.[16]

Without establishing configural and metric invariance, as done in the current research, none of the above applications of the ESS human values scale could be undertaken with confidence. This study provides the critical legitimacy for such comparative work—evidence for

[16]In studies that relate individuals' values to other variables, it is crucial to correct individual differences in use of the response scale, as explained in Schwartz (2003, p.275) and Schwartz (2006a). The ESS website describes procedures for making this correction (http://www.europeansocialsurvey.org/).

equivalence of the meanings of the values across countries. As interdependence among nations increases, such comparative work becomes more and more important. Indeed, the problem of meaning equivalence applies to within country studies of diverse ethnic groups as well. The current research can serve as an example of what needs to be done to assess equivalence of meaning , rather than to assume it, as has been typical in comparative survey research.

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*Table 1. Definitions of the Motivational Types of Values in Terms of their Core Goal*

POWER: Social status and prestige, control or dominance over people and resources

ACHIEVEMENT: Personal success through demonstrating competence according to social standards

HEDONISM: Pleasure and sensuous gratification for oneself

STIMULATION: Excitement, novelty, and challenge in life

SELF-DIRECTION: Independent thought and action-choosing, creating, exploring

UNIVERSALISM: Understanding, appreciation, tolerance and protection for the welfare of all people and for nature

BENEVOLENCE: Preservation and enhancement of the welfare of people with whom one is in frequent personal contact

TRADITION: Respect, commitment and acceptance of the customs and ideas that traditional culture or religion provide the self

CONFORMITY: Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms

SECURITY: Safety, harmony and stability of society, of relationships, and of self

Table 2: The ESS Human Values Scale: Format, item means and standard deviations (N=39,399)

Here we briefly describe some people. Please read each description and think about how much each person is or is not like you. Tick the box to the right that shows how much the person in the description is like you.

| | HOW MUCH LIKE YOU IS THIS PERSON? | | | | | |
|---|---|---|---|---|---|---|
| | Very much like me | Like me | Some-what like me | A little like me | Not like me | Not like me at all |
| 1. Thinking up…. | 1 | 2 | 3 | 4 | 5 | 6 |

| Value | Item # (according to its order in the ESS questionnaire) and Wording (Male Version) | Mean (Std. Dev.) |
|---|---|---|
| Self-Direction (SD) | 1. Thinking up new ideas and being creative is important to him. He likes to do things in his own original way. | 2.5 (1.2) |
| | 11. It is important to him to make his own decisions about what he does. He likes to be free to plan and not depend on others. | 2.1 (1.1) |
| Universalism (UN) | 3. He thinks it is important that every person in the world be treated equally. He believes everyone should have equal opportunities in life. | 2.1 (1.0) |
| | 8. It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them. | 2.4 (1.1) |
| | 19. He strongly believes that people should care for nature. Looking after the environment is important to him. | 2.2 (1.0) |
| Benevolence (BE) | 12. It's very important to him to help the people around him. He wants to care for their well-being. | 2.3 (1.0) |
| | 18. It is important to him to be loyal to his friends. He wants to devote himself to people close to him. | 2.0 (.9) |
| Tradition (TR) | 9. It is important to him to be humble and modest. He tries not to draw attention to himself. | 2.8 (1.3) |
| | 20. Tradition is important to him. He tries to follow the customs handed down by his religion or his family. | 2.7 (1.4) |

Table 2. (contd.)

| | | |
|---|---|---|
| Conformity (CO) | 7. He believes that people should do what they're told. He thinks people should follow rules at all times, even when no-one is watching. | 3.1 (1.4) |
| | 16. It is important to him always to behave properly. He wants to avoid doing anything people would say is wrong. | 2.7 (1.3) |
| Security (SEC) | 5. It is important to him to live in secure surroundings. He avoids anything that might endanger his safety. | 2.3 (1.2) |
| | 14. It is important to him that the government insures his safety against all threats. He wants the state to be strong so it can defend its citizens. | 2.4 (1.2) |
| Power (PO) | 2. It is important to him to be rich. He wants to have a lot of money and expensive things. | 4.1 (1.3) |
| | 17. It is important to him to get respect from others. He wants people to do what he says. | 3.2 (1.4) |
| Achievement (AC) | 4. It's important to him to show his abilities. He wants people to admire what he does. | 3.2 (1.4) |
| | 13. Being very successful is important to him. He hopes people will recognize his achievements. | 3.2 (1.4) |
| Hedonism (HE) | 10. Having a good time is important to him. He likes to "spoil" himself. | 2.9 (1.4) |
| | 21. He seeks every chance he can to have fun. It is important to him to do things that give him pleasure. | 3.0 (1.4) |
| Stimulation (ST) | 6. He likes surprises and is always looking for new things to do. He thinks it is important to do lots of different things in life. | 3.0 (1.4) |
| | 15. He looks for adventures and likes to take risks. He wants to have an exciting life. | 3.9 (1.5) |

Table 3: Number of values found in each country after unifying values to solve the problem of non-positive definite matrices of the constructs in single-country CFAs

| Country | Number of Values | Unified Values[A] |
|---|---|---|
| Austria | 8 | POAC, COTR |
| Belgium | 6 | POAC, COTR, UNBE, STSD |
| Czech Republic | 7 | POAC, UNBE, COTR |
| Denmark | 8 | COTR, POAC |
| Germany | 7 | POAC, UNBE, COTR |
| Finland | 8 | COTR, POAC |
| France | 7 | COTR, POAC, UNBE |
| Great Britain | 8 | COTR, POAC |
| Greece | 5 | POAC, COTR, UNBE, HEST, STSD |
| Hungary | 5 | UNBE, COTR, POAC, SECUN, HESD |
| Ireland | 6 | POAC, COTR, UNBE, HEST |
| Israel | 7 | UNBE, POAC, STSD |
| Netherlands | 8 | COTR, POAC |
| Norway | 8 | POAC, COTR |
| Poland | 6 | UNBE , COTR, HEST, POAC |
| Portugal | 7 | COTR, UNBE, HEST |
| Slovenia | 5 | COTR, UNBE, HEST, POAC, STSD |
| Spain | 8 | COTR, POAC |
| Sweden | 8 | COTR, POAC |
| Switzerland | 7 | COTR, POAC, UNBE |

[A]For abbreviations of values, see Table 2

Table 4. Fit measures for a multi-group confirmatory factor analysis of seven values, constraining configural invariance across 20 countries, with modifications *

| Model | RMR | NFI | CFI | RMSEA | PCLOSE | AIC | BCC | Chi Square | df |
|---|---|---|---|---|---|---|---|---|---|
| 1. basic model | .090 | .866 | .879 | .014 | 1.000 | 32,079 | 32,109 | 29,559 | 3,360 |
| 2. adding paths for items #2, #9 | .081 | .879 | .892 | .013 | 1.000 | 29,164 | 29,195 | 26,524 | 3,300 |
| 3. adding a path for item #15 | .072 | .892 | .905 | .013 | 1.000 | 26,371 | 26,403 | 23,691 | 3,280 |
| 4. adding a path for item #17 | .064 | .901 | .914 | .012 | 1.000 | 24,589 | 24,622 | 21,869 | 3,260 |

* RMR = root mean square residual; NFI = the Bentler-Bonett normed fit index; CFI = the comparative fit index; RMSEA = root mean square error of approximation; PCLOSE = probability of close fit; AIC = the Akaike information criterion; BCC = the Browne-Cudeck criterion; df = the number of degrees of freedom. For details see for example Arbuckle (2005).

Table 5. Fit measures for a multi-group confirmatory factor analysis of seven values, constraining metric (measurement), scalar, and structural covariances invariance across 20 countries *

| Model type | RMR | NFI | CFI | RMSEA | PCLOSE | AIC | BCC | Chi Square | df |
|---|---|---|---|---|---|---|---|---|---|
| 1. Unconstrained: configural invariance only | .064 | .901 | .914 | .012 | 1.000 | 24,589 | 24,622 | 21,869 | 3,260 |
| 2. Metric (measurement) invariance | .075 | .890 | .905 | .012 | 1.000 | 26,227 | 26,251 | 24,229 | 3,621 |
| 3. Scalar invariance | --** | .802 | .816 | .016 | 1.000 | 45,894 | 45,921 | 43,588 | 3,887 |
| 4. Structural covariances invariance | .115 | .860 | .876 | .013 | 1.000 | 31,805 | 31,816 | 30,871 | 4,153 |

* RMR = root mean square residual; NFI = the Bentler-Bonett normed fit index; CFI = the comparative fit index; RMSEA = root mean square error of approximation; PCLOSE = probability of close fit; AIC = the Akaike information criterion; BCC = the Browne-Cudeck criterion; df = the number of degrees of freedom. For details see for example Arbuckle (2005).

** The RMR index is not provided by the program Amos when means and intercepts are estimated.

Table 6. Unstandardized regression coefficients for 20 countries in the measurement invariant model (all coefficients are significant, $p<0.01$)

| | SD | UNBE | COTR | SEC | POAC | HE | ST |
|---|---|---|---|---|---|---|---|
| SD1 | 1.00 | | | | | | |
| SD11 | .87 | | | | | | |
| UN3 | | 1.00 | | | | | |
| UN8 | | 1.14 | | | | | |
| UN19 | | 1.11 | | | | | |
| BE12 | | 1.03 | | | | | |
| BE18 | | 1.19 | | | | | |
| TR9 | | | .87 | | **-.29** | | |
| TR20 | | | .85 | | | | |
| CO7 | | | 1.00 | | | | |
| CO16 | | | 1.11 | | | | |
| SEC4 | | | | 1.00 | | | |
| SEC15 | | | | .99 | | | |
| PO2 | | **-.50** | **.03** | | 1.00 | | |
| PO17 | | | **.37** | | .78 | | |
| AC4 | | | | | 1.19 | | |
| AC13 | | | | | 1.28 | | |
| HE10 | | | | | | 1.00 | |
| HE21 | | | | | | 1.01 | |
| ST6 | | | | | | | 1.00 |
| ST15 | | **-.99** | | | | | 1.35 |

The path coefficients added to the original model in the modification process are in bold. Empty cells represent no direct relation between the values and the indicators.

*Figure 1: Structural relations among the 10 values and the two dimensions*

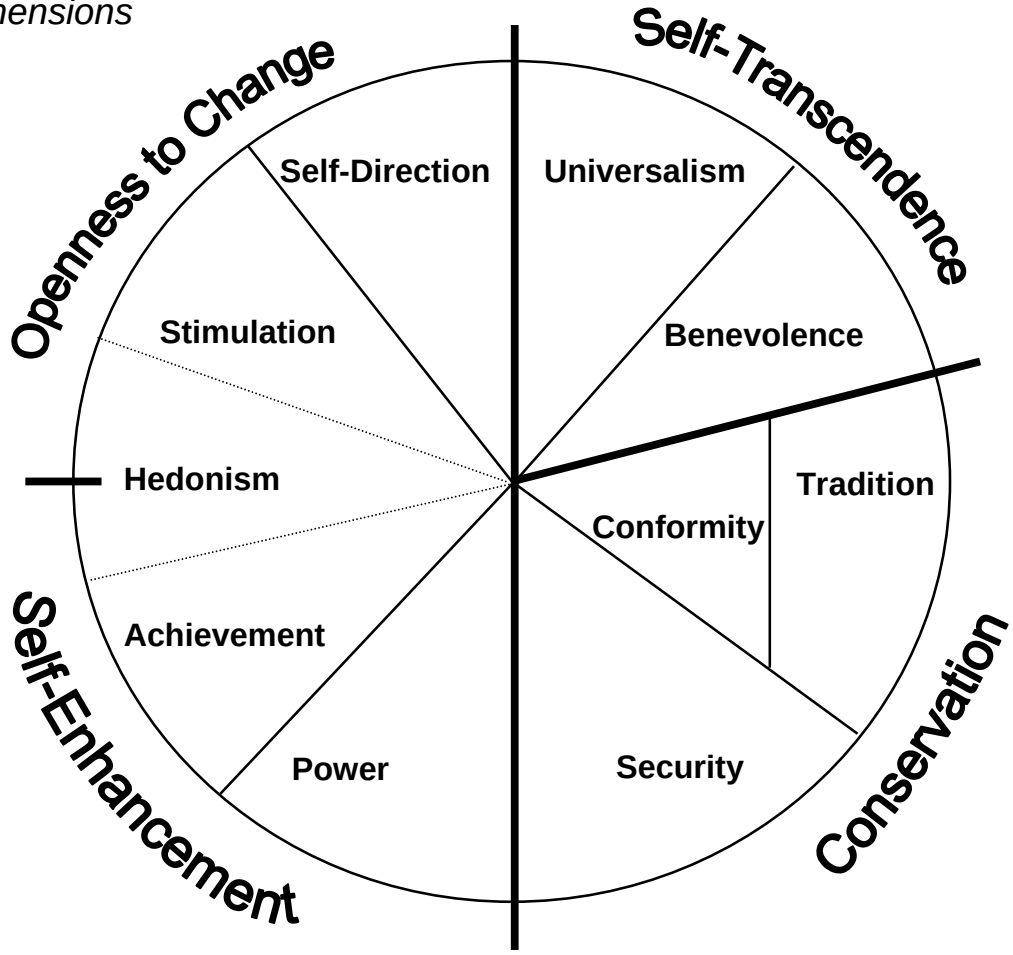
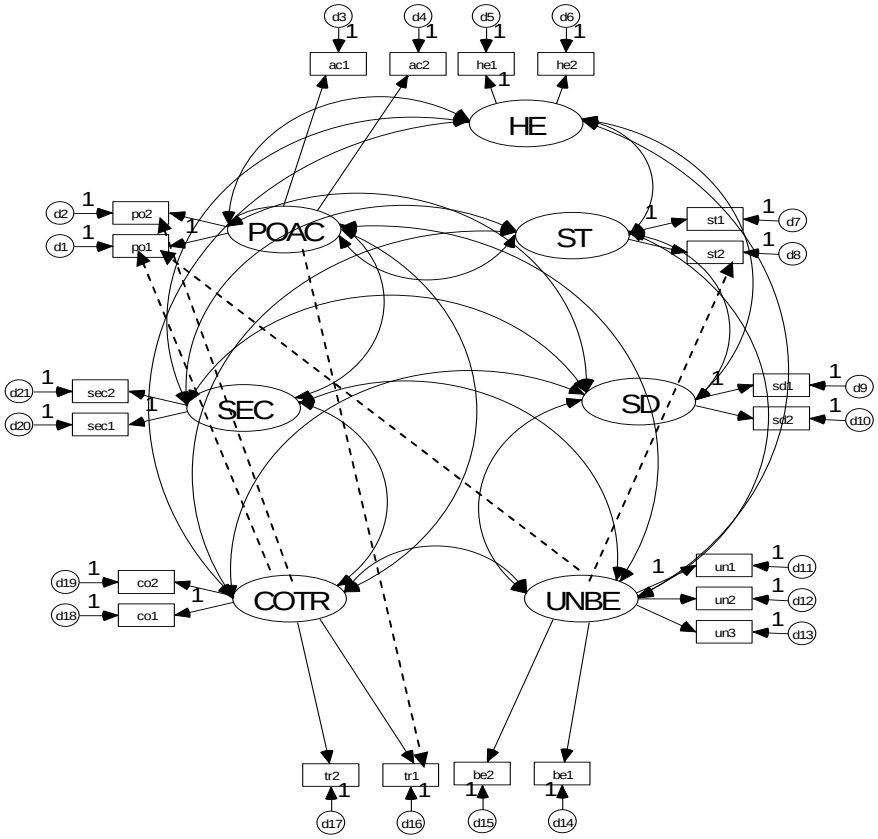


*Figure 2. A confirmatory factor analysis with seven value constructs**




*Note: Broken lines indicate paths added subsequently based on the modification indices (see text). In order to set the metric for a factor, it is necessary to fix the factor loading of one of the indicators to one.

Appendix A: Standardized factor loadings and cross loadings for each country (based on the metric invariance model)

| Item | Value Factor | AT | BE | CH | CZ | DE | DK | ES | FI | FR | GB | GR | HU | IE | IL | NL | NO | PL | PT | SE | SL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HE10 | HE | .71 | .68 | .75 | .76 | .80 | .69 | .80 | .82 | .75 | .77 | .59 | .60 | .73 | .76 | .61 | .76 | .81 | .80 | .73 | .68 |
| HE21 | HE | .62 | .66 | .65 | .73 | .75 | .71 | .80 | .83 | .66 | .78 | .64 | .68 | .75 | .75 | .64 | .77 | .80 | .67 | .75 | .69 |
| ST6 | ST | .72 | .66 | .61 | .64 | .66 | .72 | .68 | .74 | .63 | .70 | .71 | .60 | .69 | .69 | .68 | .74 | .67 | .73 | .72 | .64 |
| ST15 | ST | .92 | .79 | .79 | .86 | .84 | .96 | .91 | .89 | .83 | .92 | .80 | .74 | .91 | .84 | .89 | .98 | .87 | .93 | .95 | .74 |
| PO2 | POAC | .60 | .59 | .60 | .66 | .63 | .56 | .58 | .67 | .62 | .66 | .55 | .59 | .63 | .49 | .63 | .66 | .55 | .59 | .65 | .52 |
| PO17 | POAC | .47 | .45 | .41 | .51 | .45 | .43 | .45 | .54 | .42 | .48 | .45 | .44 | .47 | .40 | .49 | .50 | .40 | .44 | .50 | .44 |
| SEC5 | SEC | .72 | .66 | .66 | .61 | .67 | .60 | .75 | .65 | .74 | .61 | .72 | .70 | .63 | .56 | .64 | .62 | .58 | .68 | .64 | .61 |
| SEC14 | SEC | .70 | .64 | .67 | .57 | .65 | .57 | .69 | .60 | .73 | .59 | .71 | .66 | .61 | .59 | .68 | .60 | .60 | .67 | .58 | .62 |
| CO7 | COTR | .61 | .51 | .53 | .57 | .59 | .60 | .54 | .63 | .55 | .63 | .46 | .46 | .60 | .56 | .59 | .62 | .60 | .58 | .59 | .54 |
| CO16 | COTR | .74 | .64 | .59 | .69 | .71 | .65 | .74 | .70 | .70 | .75 | .66 | .66 | .73 | .71 | .72 | .67 | .71 | .70 | .64 | .69 |
| UN3 | UNBE | .60 | .45 | .42 | .50 | .47 | .37 | .62 | .52 | .51 | .47 | .58 | .46 | .56 | .49 | .49 | .46 | .55 | .63 | .54 | .49 |
| UN8 | UNBE | .63 | .51 | .54 | .57 | .54 | .48 | .66 | .58 | .59 | .58 | .60 | .56 | .60 | .51 | .57 | .57 | .49 | .65 | .59 | .51 |
| SD1 | SD | .68 | .54 | .47 | .63 | .60 | .57 | .68 | .52 | .51 | .60 | .65 | .53 | .54 | .46 | .53 | .62 | .53 | .67 | .58 | .54 |
| SD11 | SD | .69 | .54 | .52 | .60 | .60 | .54 | .67 | .47 | .44 | .58 | .64 | .56 | .56 | .50 | .55 | .52 | .60 | .68 | .52 | .55 |
| UN19 | UNBE | .67 | .49 | .52 | .64 | .55 | .49 | .66 | .56 | .58 | .55 | .66 | .67 | .59 | .47 | .56 | .50 | .62 | .68 | .54 | .57 |
| AC4 | POAC | .71 | .65 | .61 | .74 | .69 | .62 | .67 | .76 | .66 | .72 | .67 | .68 | .72 | .65 | .70 | .71 | .64 | .67 | .71 | .64 |
| AC13 | POAC | .77 | .71 | .69 | .77 | .75 | .70 | .76 | .82 | .70 | .77 | .72 | .75 | .77 | .74 | .79 | .78 | .74 | .77 | .79 | .74 |
| TR20 | COTR | .56 | .46 | .47 | .45 | .51 | .49 | .51 | .49 | .47 | .50 | .58 | .48 | .57 | .47 | .51 | .48 | .57 | .59 | .47 | .54 |
| TR9 | COTR | .57 | .48 | .52 | .49 | .55 | .47 | .58 | .50 | .56 | .54 | .48 | .54 | .54 | .56 | .47 | .49 | .46 | .59 | .52 | .62 |
| BE18 | UNBE | .69 | .56 | .58 | .61 | .60 | .62 | .67 | .56 | .60 | .57 | .61 | .60 | .61 | .58 | .59 | .54 | .62 | .70 | .62 | .49 |
| BE12 | UNBE | .68 | .58 | .56 | .59 | .59 | .58 | .72 | .59 | .61 | .62 | .65 | .63 | .64 | .57 | .61 | .60 | .62 | .77 | .64 | .60 |
| TR9 | POAC | -.17 | -.18 | -.17 | -.20 | -.18 | -.15 | -.21 | -.19 | -.18 | -.18 | -.20 | -.20 | -.19 | -.16 | -.17 | -.17 | -.18 | -.19 | -.18 | -.19 |
| PO2 | UNBE | -.23 | -.16 | -.18 | -.21 | -.20 | -.17 | -.22 | -.20 | -.22 | -.21 | -.19 | -.22 | -.21 | -.17 | -.20 | -.21 | -.18 | -.25 | -.23 | -.18 |
| PO2 | COTR | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .01 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| ST15 | UNBE | -.42 | -.28 | -.30 | -.38 | -.36 | -.31 | -.40 | -.34 | -.40 | -.39 | -.32 | -.38 | -.38 | -.31 | -.37 | -.36 | -.32 | -.43 | -.41 | -.33 |
| PO17 | COTR | .25 | .20 | .21 | .20 | .23 | .23 | .20 | .23 | .21 | .24 | .18 | .19 | .22 | .23 | .22 | .23 | .17 | .23 | .23 | .23 |

The last 5 rows indicate the path coefficients added to the original model in the modification process.