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Evaluations of the measurement of the concepts 'Political Satisfaction' and 'Quality of state services'

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Abstract

In this paper we study the concepts ‘Political satisfaction’ and ‘Quality of state services’, included in the European Social Survey since the first round. We test whether these concepts can be compared across countries and over time by testing for measurement invariance. The results show that the concepts ‘Political Satisfaction’and ‘Quality of State Services’ can only be compared in a limited number of countries in each round as well as over time. Besides detailing which countries can and cannot be compared, in the following pages we also estimate composite scores and their quality for both concepts under study. Finally, we highlight the importance of correction for measurement error when using ESS data by comparing correlations between the composite scores of both concepts uncorrected and corrected for measurement error.

1. Introduction

One of the aims of the European Social Survey (ESS) is "to chart stability and change in social structure, conditions and attitudes in Europe and to interpret how Europe's social, political and moral fabric is changing" (http://www.europeansocialsurvey.org/about/). In order to do so, the ESS has to assure that the concepts of interest are measured with equivalent instruments. If this is not guaranteed, the observed results cannot be distinguished between true change, clear stability, or differences across countries and systematic biases caused by either different understanding or responding to the measurement instruments. This concern with the quality of the data constitutes another aim of the ESS which is to "achieve and spread higher standards of rigour in cross-national research in the social sciences, including for example, "[..] the reliability of questions" (ibid.). The present study seeks to contribute to this latter aim of the ESS. For this purpose, we analyse the measurement invariance of two concepts included in the ESS core questionnaire since its foundation. Both concepts are considered complex constructs or concepts-by-postulation implying that their meaning is not immediately obvious. Consequently, both cannot be measured directly with a single question but need multiple indicators. Frequently, researchers operationalize concepts-by-postulation by computing an average score based on the observed indicators, which is also called index or composite score. In this study, we will also estimate the composite scores and their quality by employing the procedure developed by Saris and Gallhofer (2007).

The paper proceeds as follows: In the first part of this paper, we describe the measurement of the concepts 'Political Satisfaction'and 'Quality of State Services' in the ESS. In the following section, we introduce measurement invariance testing and conduct it across countries in the ESS Round 1 to 5 and afterwards in each country that participated at least in four rounds over time. In the final section we estimate the composite scores of the two concepts, their quality and highlight the importance of the correction for measurement error by comparing the observed correlation between both composite scores with the corrected correlation.

2. Political Satisfaction and Quality of State Services in the ESS

In political science, the study of political support has been present for decades. Cornerstone in this debate is David Easton's (Easton 1965, 1975) contribution, where he distinguished two different types of political support: diffuse and specific support. While specific support is the direct result of outputs that satisfy specific demands, under a short term utility perspective, diffuse support is, by contrast, not directly connect to these feelings of demand fulfilment. It rather refers to a sense of attachment to the political regime, the authorities or the political community in a way that is independent of specific benefits.

More recently, scholars argued that political support is rather continuous from the diffuse to the specific dimensions, i.e. from political community to regime principle, and from regime performance to regime institutions and to political actors. Both Dalton (2004) and Torcal and Montero (2006) argue that Easton's theory implies that every political object can be subject to both specific and diffuse support at the same time. However, independently of the hierarchy between specific and diffuse political support, the citizens' short term responses to the policy performance of a given government add to the explanation of political support. Therefore, the ESS includes measures on satisfaction with the economy, satisfaction with the government, as well as the evaluation of the health and education system since its foundation. Each of the described items is formulated as follows:

On the whole how satisfied are you with the present state of the economy in [country]?

Extremely dissatisfied										Extremely satisfied
00	01	02	03	04	05	06	07	08	09	10

Now thinking about the [country's] government, how satisfied are you with the way it is doing its job?

Extremely dissatisfied										Extremely satisfied
00	01	02	03	04	05	06	07	08	09	10

Please say what you think overall about the state of education in [country] nowadays?

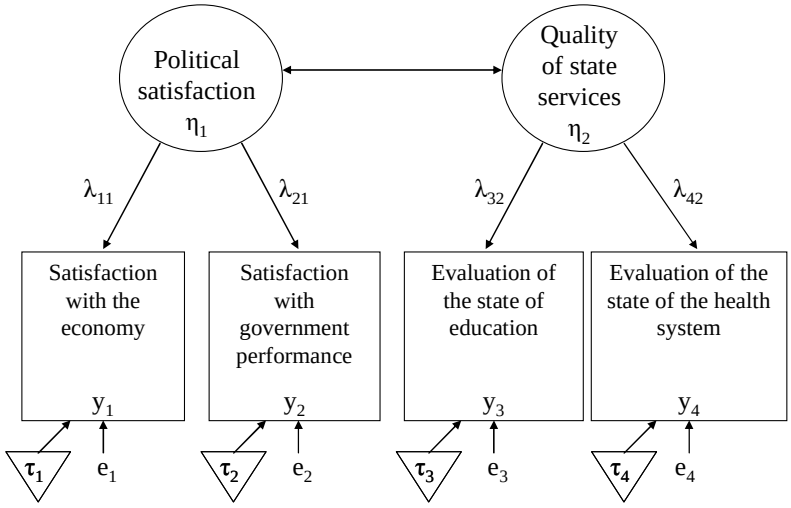
Extremely bad										Extremely good
00	01	02	03	04	05	06	07	08	09	10

Please say what you think overall about the state of health services in [country] nowadays?

Extremely bad										Extremely good
00	01	02	03	04	05	06	07	08	09	10

The first two measures are indicators of political satisfaction, while the latter two are indicators for the evaluation of the quality of state services. The model to be tested is presented in Figure 1.

Figure 1: Model for testing of measurement invariance



Where η_j are the j^{th} unobserved latent variable of interest (or the concept-by-postulation); y_{ij} are the i^{th} observed variable for the latent trait j; λ_{ij} are the loadings, τ_{ij} are the intercepts and e_{ij} are the disturbance terms. It is assumed that the disturbance terms have a mean of zero, and are uncorrelated with each other and with the latent variables. The latent variables (η_j) are correlated with each other. In order to assign a scale to the latent variables, for each one, the loading of the first observed variables (λ_{11} and λ_{32}) is fixed to one and the respective intercepts (τ_{11} and τ_{32}) to zero.

The aim of the present study is to test whether the concepts-by-postulation 'Political Satisfaction'and 'Quality of State Services' are in fact comparable across the countries involved in the ESS and within a country over time. In other words, we aim to establish whether the respondents interpret and respond to the questions we just presented in the same way, regardless of their national residence[1], personal characteristics or changes in these characteristics through time.

[1] The target population of the ESS is described as persons 15 years or older who are resident within private households, regardless of nationality and citizenship or language. (ESS6 Sampling Guidelines - *European Social Survey*, page 2)

3. Measurement invariance

Measurement invariance means that respondents' answers do not depend on their group characteristics (Mellenbergh 1989; Meredith and Millsap 1992; Meredith 1993). We sequentially test here for the three different levels of invariance testing, respectively: configural, metric, and scalar invariance. Configural invariance, also called pattern invariance, requires that the model of interest fits across countries and over time. Metric invariance is a necessary condition for comparing (unstandardized) relationships with other variables, and it requires that the loadings are the same across groups.

$$\begin{aligned} \lambda_{1i} &= \lambda_{1j} \ldots = \lambda_1 \\ \lambda_{2i} &= \lambda_{2j} \ldots = \lambda_2 \\ \lambda_{3i} &= \lambda_{3j} \ldots = \lambda_3 \\ \lambda_{4i} &= \lambda_{4j} \ldots = \lambda_4 \end{aligned} \qquad (1)$$

λ: Loading

i, j: Different countries

These two requirements are sufficient for comparison of relationships with other variables. However, for the comparison of the latent means the requirement of scalar invariance must hold. Scalar invariance implies that the intercepts of the items are also equal across groups (Horn 1983; Meredith 1993; Steenkamp and Baumgartner 1998).

$$\begin{aligned} \tau_{1i} &= \tau_{1j} \ldots = \tau_1 \\ \tau_{2i} &= \tau_{2j} \ldots = \tau_2 \\ \tau_{3i} &= \tau_{3j} \ldots = \tau_3 \\ \tau_{4i} &= \tau_{4j} \ldots = \tau_4 \end{aligned} \qquad (2)$$

τ = Intercept

i, j: Different countries

Therefore, if scalar invariance holds and the latent means are equal, then the means of the composite scores, i.e. the average score based on several observed variables, can be compared.

For estimation we use the maximum likelihood estimator of LISREL 8.57 (Jöreskog and Sörbom 2005). For model evaluation and testing we rely on JRule software (Van der Veld et al. 2008) based on the procedure developed by Saris, Satorra and van der Veld (2009). Saris et al. (2009) showed that the commonly used evaluation procedures for structural equation models cannot be trusted as test statistics and Fit indices are unequally sensitive for different misspecifications. They propose rather than testing the model as a whole, to test it on the parameter level by using the modification index (MI) as test statistic for detection of misspecifications (expressed as expected parameter change; EPC) in

combination with the power of the MI test. The different situations for model evaluations are presented in Table 1.

Table 1: JRule procedure for model evaluation

	High power	**Low power**
Significant MI	Inspect EPC (EPC)	Misspecification present (m)
Non significant MI	No misspecification (nm)	Inconclusive (I)

The criterion for misspecifications is arbitrary and must therefore be set by the researcher. For this study, we opted for a strict criterion of a deviation of 0.1 for the loadings and .7 for the intercepts.

4. Metric invariance per round

The first step is to determine whether the configural invariance assumption holds. We find that the model we presented in Figure 1 fits in all countries and in all rounds except very few cases where some correlated errors were found. However, these are not consistent over rounds and cannot therefore be seen as systematic deviations which would require considering a different model. As a result, overall configural invariance for both concepts 'Political Satisfaction'and 'Quality of State Services' was established.

The following level of measurement invariance we proceed to test is metric invariance. As mentioned, the metric invariance requirement holds when not only the model is the same for all the groups, but also the loadings. In other words, we test if the items are related to the concepts of interest equally in all countries and within countries across time. For the concept of 'Political satisfaction', we find the smallest number of invariant countries in Round 3, where only 52% of the 23 countries are metric invariant, and the biggest number of invariant countries in R2 where 72% of the 25 countries are metric invariant. Only one country, France, is metric invariant in all five rounds. Denmark, Germany, the Netherlands, Portugal, Slovenia, Sweden and Switzerland are metric invariant in four out of five rounds, although not in the same rounds. Invariant in three out of the five rounds are Finland and Spain. All other countries are metric invariant in less than 60% of the rounds they participated. Table 2 and Table 3 summarize these findings.

Table 2: Loadings after metric invariance testing of 'Political Satisfaction' per round across countries

λ **Political satisfaction**

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Invariant Countries	**1.02 (.01)**	**1.03 (.01)**	**.98 (.02)**	**1.17 (.01)**	**1.06 (.01)**	
Austria	Inv.	Inv.	*	-	-	**2/3**
Belgium	Inv.	.85 (.05)	.76 (.05)	.76 (.07)	.75 (.09)	**1/5**
Bulgaria	-	-	1.19 (.08)	Inv.	Inv.	**2/3**
Croatia	-	-	-	Inv.	Inv.	**2/2**
Cyprus	-	-	Inv.	*	Inv.	**2/3**
Czech Republic	Inv.	Inv.	-	Inv.	Inv.	**4/4**
Denmark	Inv.	Inv.	1.18 (.09)	Inv.	Inv.	**4/5**
Estonia	-	1.22 (.06)	1.2 (.06)	Inv.	Inv.	**2/4**
Finland	Inv.	Inv.	1.32 (.08)	Inv.	1.22 (0.07)	**3/5**
France	Inv.	Inv.	Inv.	Inv.	Inv.	**5/5**
Germany	Inv.	Inv.	Inv.	Inv.	1.33 (0.07)	**4/5**
Greece	Inv.	Inv.	-	Inv.	1.57 (0.06)	**3/4**
Hungary	.74 (.07)	Inv.	1.24 (.06)	Inv.	*	**2/5**
Iceland	-	-	Inv.	-	-	**1/5**
Ireland	-	-	1.34 (.08)	Inv.	*	**2/3**
Israel	Inv.	1.35 (.07)	-	1.47 (.1)	1.38 (.09)	**1/4**
Italy	Inv.	-	-	-	-	**1/1**
Latvia	-	-	-	Inv.	-	**1/1**
Luxembourg	1.35 (.09)	Inv.	-	-	-	**1/2**
Netherlands	Inv.	Inv.	1.24 (.08)	Inv.	Inv.	**4/5**
Norway	.84 (.06)	Inv.	1.19 (.09)	1.6 (0.15)	1.57 (.12)	**1/5**
Poland	.85 (.05)	Inv.	Inv.	.94 (.07)	Inv.	**3/5**
Portugal	Inv.	Inv.	Inv.	Inv.	1.24 (.07)	**4/5**
Romania	-	-	-	Inv.	-	**1/1**
Russia	-	-	Inv.	1.01 (.05)	Inv.	**2/3**
Slovakia	-	Inv.	Inv.	Inv.	Inv.	**4/4**
Slovenia	Inv.	1.18 (.07)	Inv.	Inv.	Inv.	**4/5**
Spain	Inv.	*	*	Inv.	Inv.	**3/5**
Sweden	Inv.	Inv.	Inv.	0.85 (0.1)	Inv.	**4/5**
Switzerland	1.22 (.09)	Inv.	Inv.	Inv.	Inv.	**4/5**
Turkey	-	Inv.	-	1.43 (0.06)	-	**1/2**
Ukraine	-	.7 (.05)	Inv.	.9 (.06)	Inv.	**2/4**
United Kingdom	1.27 (.06)	1.26 (.06)	1.33 (0.06)	Inv.	Inv.	**2/5**
Number of invariant countries out of total	15/21	18/25	12/23	20/29	18/26	
Percentage of countries that are invariant	71%	72%	52%	69%	69%	

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; "Inv." stands for invariant, "*" not configural invariant; highlighted in grey those countries that are metric invariant over all rounds they participated.

Table 3: Loadings after metric invariance testing of 'Quality of State Services' per round across countries

$\lambda_{\text{Quality of state services}}$

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Invariant Countries	**1.14 (.02)**	**1.15 (.02)**	**1.1 (.02)**	**1.07 (.02)**	**.99 (.01)**	
Austria	.88 (.05)	.9 (.05)	*	-	-	**0/3**
Belgium	Inv.	.83 (.07)	.79 (.06)	.73 (.06)	*	**2/5**
Bulgaria	-	-	.87 (.05)	Inv.	Inv.	**2/3**
Croatia	-	-	-	1.29 (.09)	1.16 (.07)	**0/2**
Cyprus	-	-	Inv.	*	1.62 (.15)	**1/3**
Czech Republic	Inv.	Inv.	-	1.63 (.13)	1.45 (.01)	**2/4**
Denmark	Inv.	Inv.	1.34 (.13)	1.4 (.11)	1.27 (0.01)	**2/5**
Estonia	-	1.22 (.06)	.95 (.06)	Inv.	Inv.	**2/4**
Finland	1.69 (.12)	2.01 (0.14)	1.29 (.1)	1.78 (.12)	1.73 (.13)	**0/5**
France	Inv.	Inv.	Inv.	Inv.	Inv.	**5/5**
Germany	Inv.	Inv.	Inv.	1.35 (.08)	*	**3/5**
Greece	Inv.	Inv.	-	Inv.	Inv.	**4/4**
Hungary	Inv.	.95 (.07)	1.33 (.09)	Inv.	*	**2/5**
Iceland	-	Inv.	-	-	-	**1/1**
Ireland	-	-	1.29 (.09)	1.51 (.09)	*	**0/3**
Israel	.69 (.07)	*	-	.51 (.05)	.62 (.05)	**1/4**
Italy	Inv.	-	-	-	-	**1/1**
Latvia	-	-	-	1.26 (.09)	-	**0/1**
Luxembourg	.92 (.07)	Inv.	-	-	-	**1/2**
Netherlands	1.29 (.07)	1.61 (.11)	1.49 (.13)	Inv.	1.58 (.18)	**1/5**
Norway	Inv.	1.64 (.12)	1.32 (.1)	1.25 (.09)	*	**1/5**
Poland	Inv.	Inv.	Inv.	Inv.	1.17 (.08)	**4/5**
Portugal	Inv.	Inv.	Inv.	.78 (.05)	Inv.	**4/5**
Romania	-	-	-	Inv.	-	**1/1**
Russia	-	-	Inv.	Inv.	Inv.	**3/3**
Slovakia	-	Inv.	Inv.	1.27 (.07)	Inv.	**3/4**
Slovenia	Inv.	Inv.	Inv.	Inv.	Inv.	**5/5**
Spain	.92 (.06)	*	*	.85 (.05)	.67 (.06)	**0/5**
Sweden	Inv.	Inv.	1.47 (.14)	Inv.	Inv.	**4/5**
Switzerland	Inv.	.99 (.07)	Inv.	Inv.	1.23 (.11)	**3/5**
Turkey	-	1. (.05)	-	Inv.		**1/2**
Ukraine	-	Inv.	Inv.	Inv.	Inv.	**4/4**
United Kingdom	Inv.	Inv.	Inv.	1.2 (.08)	Inv.	**4/5**
Number of invariant countries out of total	**15/21**	**15/25**	**11/23**	**14/29**	**12/26**	
Percentage of countries that are invariant	**71%**	**60%**	**48%**	**48%**	**46%**	

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; "Inv." stands for invariant, "*" not configural invariant; highlighted in grey those countries that are metric invariant over all rounds they participated.

For the concept ‘Quality of State Services’, we find the smallest number of invariant countries in Round 5, where only 46% of the 26 countries are metric invariant. The highest number of metric invariant countries we find in round 1 (71%). France and Slovenia are the only two countries that have metric invariant measures in all five rounds, Greece and the Ukraine in all four rounds they participated. Poland, Portugal, Sweden and the United Kingdom are metric invariant in four out of the five rounds they participated, and Germany and Switzerland in three out of five rounds. All remaining countries are metric invariant in less than 60% of the rounds they participated.

5. Scalar invariance per round

The subsequent step is testing for scalar invariance. If this level of invariance is established, then the means of the latent variables (or factor means) can be compared. The testing of scalar invariance can only be conducted with those countries for which metric invariance was previously established. For the concept ‘Political Satisfaction’we find the lowest number of scalar invariant countries in Round 3 (22%) and the highest number of scalar invariant countries in Round 4 (55%). The results are presented in Table 4. Similar to the findings of the metric invariance test, the pattern of invariant countries is not the same in each round. The only two countries that are scalar invariant in each round they participated are the Czech Republic and Croatia, although the latter only participated in two rounds.

Table 4: Intercepts after scalar invariance testing of 'Political Satisfaction'across countries

$\tau_{\text{Political satisfaction}}$

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Invariant Countries	**.44(.05)**	**-.1(.04)**	**-.01(.06)**	**-.07(.03)**	**-.3(.05)**	
Austria	-.98(.07)	-.9(.06)	o	-	-	**0/3**
Belgium	Inv.	o	.76(.05)	o	o	**1/4**
Bulgaria	-	-	1.19(.08)	Inv.	.81(.06)	**1/3**
Croatia	-	-	-	Inv.	Inv.	**2/2**
Cyprus	-	-	o	o	Inv.	**1/3**
Czech Republic	Inv.	Inv.	-	Inv.	Inv.	**4/4**
Denmark	-.48(.09)	-1.	1.18(.09)	-1.15(.08)	-1.21(.09)	**0/5**
Estonia	-	-	1.2(.06)	Inv.	Inv.	**2/3**
Finland	Inv.	Inv.	1.32(.08)	-.55(.06)	o	**2/5**
France	1.01(.06)	.55(.05)	o	.69(.05)	Inv.	**1/5**
Germany	Inv.	Inv.	Inv.	Inv.	o	**4/5**
Greece	.84(.05)	1.06(.05)	-	Inv.	o	**1/4**
Hungary	o	Inv.	1.24(.06)	Inv.	o	**2/5**
Iceland	-	-1.18(.11)	-	-	-	**0/1**
Ireland	-	-	1.34(.08)	Inv.	o	**1/3**
Israel	o	o	-	o	o	**0/4**
Italy	Inv.	-	-	-	-	**1/1**
Latvia	-	-	-	Inv.	-	**1/1**
Luxembourg	o	Inv.	-	-	-	**1/2**
Netherlands	-.68(.07)	Inv.	1.24(.08)	Inv.	-.88(.08)	**2/5**
Norway	o	-1.86(.07)	1.19(.09)	o	o	**0/5**
Poland	o	-.73(.05)	o	o	-.89(.08)	**0/5**
Portugal	Inv.	Inv.	o	Inv.	o	**3/5**
Romania	-	-	-	Inv.	-	**1/5**
Russia	-	-	-1.1(.06)	o	.46(.06)	**0/3**
Slovakia	-	Inv.	o	Inv.	Inv.	**3/4**
Slovenia	Inv.	o	Inv.	Inv.	Inv.	**4/5**
Spain	Inv.	o	o	Inv.	Inv.	**3/5**
Sweden	Inv.	Inv.	Inv.	o	-.88(.1)	**3/5**
Switzerland	o	Inv.	Inv.	Inv.	-1.19(.06)	**3/4**
Turkey	-	1.11(.08)	-	o	-	**0/2**
Ukraine	-	o	Inv.	o	-	**1/3**
United Kingdom	o	o	1.33(.06)	Inv.	.57(.07)	**1/5**
Nº of invariant countries out of total	**9/21**	**10/25**	**5/23**	**16/29**	**8/26**	
% of countries that are invariant	**43%**	**40%**	**22%**	**55%**	**31%**	

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; "Inv." stands for invariant,"o" not metric invariant; highlighted in grey those countries that are metric invariant over all rounds they participated.

As to the concept 'Quality of State Services', the assumption of scalar invariance was established in even less countries. The lowest number of countries that are scalar invariant is found in Round 4 (17%) and the highest number of scalar invariant countries is in Round 1 (43%). Only Slovenia is scalar invariant in all five rounds it participated. Italy and Romania are also scalar invariant in all rounds they participated but because Italy only

participated once and the Romanian data were only part of the integrated data file once, no conclusions should be drawn. As found before, there is no distinct pattern, meaning that not always the same countries are scalar invariant in each round. The results are presented in Table 5.

Table 5: Intercepts after scalar invariance testing of 'Quality of State Services' across countries

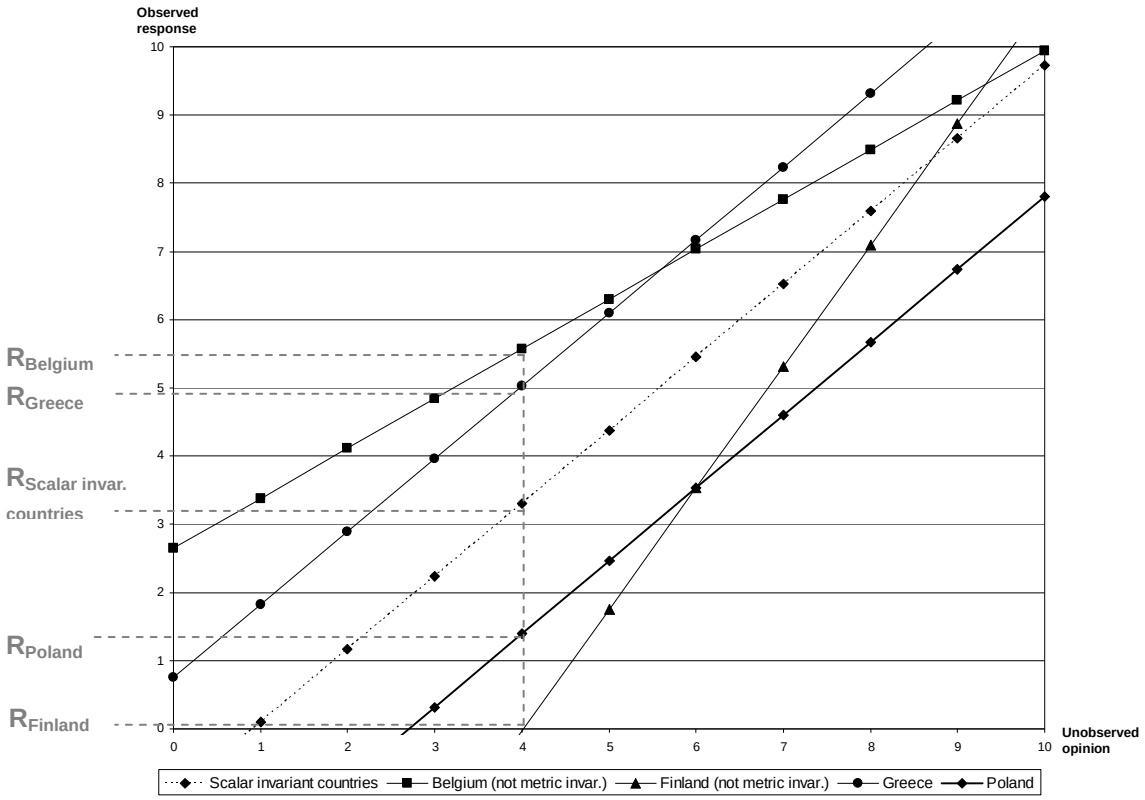
τ Quality of state services

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Invariant Countries	**-.94 (.09)**	**-.1(.04)**	**-1.43(.09)**	**-.97(.09)**	**-.3(.07)**	
Austria	o	o	o	-	-	**0/3**
Belgium	.01(.12)	o	.79(.06)	o	o	**0/5**
Bulgaria	-	-	.87(.05)	Inv.	-1.29(.07)	**1/3**
Croatia	-	-	-	-	o	**0/1**
Cyprus	-	-	Inv.	o	o	**1/3**
Czech Republic	Inv.	-1.77(.11)	-	o	o	**1/4**
Denmark	-1.64(.13)	-1.84(.13)	1.34(.13)	o	o	**0/5**
Estonia	-	-1.99(.1)	.95(.06)	Inv.	Inv.	**2/4**
Finland	o	o	1.29(.1)	o	o	**0/5**
France	.15(.1)	.18(.1)	.18(.1)	.17(.09)	.97(.08)	**0/5**
Germany	-.13(.09)	0(.08)	Inv.	o	o	**1/5**
Greece	Inv.	Inv.	-	*.75(.09)*	Inv.	**3/4**
Hungary	-1.94(.1)	o	1.33(.09)	Inv.	o	**1/5**
Iceland	-	Inv.	-	-	-	**1/1**
Ireland	-	-	1.29(.09)	o	o	**0/3**
Israel	o	o	-	o	o	**0/4**
Italy	Inv.	-	-	-	-	**1/1**
Latvia	-	-	-	o	-	**0/1**
Lithuania	-	-	-	-	o	**0/1**
Luxembourg	o	1.03(.11)	-	-	-	**0/2**
Netherlands	o	o	1.49(.13)	*.75(.09)*	o	**0/5**
Norway	Inv.	o	1.32(.1)	o	o	**1/5**
Poland	Inv.	-2.73(.1)	-2.46(.11)	-2.89(.11)	o	**1/5**
Portugal	Inv.	Inv.	Inv.	o	Inv.	**4/5**
Romania	-	-	-	Inv.	-	**1/1**
Russia	-	-	Inv.	Inv.	-.84(.06)	**2/3**
Slovakia	-	-.17(.15)	-2.89(.11)	o	-1.59(.08)	**0/4**
Slovenia	Inv.	Inv.	Inv.	Inv.	Inv.	**5/5**
Spain	o	o	o	o	o	**0/5**
Sweden	Inv.	Inv.	1.46(.14)	*.75(.09)*	Inv.	**3/5**
Switzerland	-.43(.11)	o	Inv.	*.75(.09)*	o	**1/5**
Turkey	-	o	-	*.75(.09)*	-	**0/2**
Ukraine	-	Inv.	-2.15(.09)	-2.01(.08)	-1.35(.07)	**1/4**
United Kingdom	Inv.	Inv.	Inv.	o	Inv.	**4/5**
Nº of invariant countries out of total	**9/21**	**7/25**	**7/23**	**5/29**	**5/26**	
% of countries that are invariant	**43%**	**28%**	**30%**	**17%**	**19%**	

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; "Inv." stands for invariant,"o" not metric invariant; highlighted in grey those countries that are metric invariant over all rounds they participated.

In Figure 2 we illustrate the issue of measurement invariance graphically by displaying the response functions, i.e. the relationship between the unobserved opinion and the observed response. We present the response function of the scalar invariant countries in Round 4 for the 'Quality of State Services' concept, as well as of Greece and Poland, the two most deviating countries that are metric but not scalar invariant, and also Belgium and Finland, the most deviating countries that are neither metric nor scalar invariant. The grey dashed line illustrates which response we observe in each of the five cases even though the unobserved opinion is the same (in this case category 4).

Figure 2: Scalar invariance and deviations



6. Metric invariance in each country over time

Given the low number of countries per round which can be considered measurement invariant in both concepts under study, we continue by analyzing measurement invariance within each country over time. However, to avoid determining that a country is not measurement invariant just by chance rather than systematic error, we only include countries that participated in at least 4 rounds of the ESS. The results of the test for metric invariance for the concept 'Political Satisfaction'are presented in Table 6.

Table 6: Loadings after metric invariance testing of 'Political Satisfaction'over time

λ **Political satisfaction**

	R1	**R2**	**R3**	**R4**	**R5**	**Number of invariant rounds out of total**
Belgium	.81(.03)	.81(.03)	.81(.03)	.81(.03)	.81(.03)	**5/5**
Switzerland	1.13(.04)	1.13(.04)	***.96(.06***)	1.13(.04)	1.13(.04)	**4/5**
Czech Republic	1.06(.03)	1.06(.03)	-	1.06(.03)	1.06(.03)	**4/4**
Germany	.98(.02)	.98(.02)	.98(.02)	***1.09(.05***)	***1.32(.07***)	**3/4**
Spain	1.13(.03)	***.78(.07***)	1.13(.03)	1.13(.03)	1.13(.03)	**4/5**
Finland	1.12(.03)	1.12(.03)	***1.32(.08***)	1.12(.03)	1.12(.03)	**4/5**
France	.94(.03)	.94(.03)	.94(.03)	***1.12(.04***)	***1.12(.04***)	**3/5**
Greece	1.03(.02)	1.03(.02)	-	***1.22(.05***)	***1.58(.06***)	**2/4**
Hungary	***.74(.07***)	1.17(.04)	1.17(.04)	1.17(.04)	***.82(.08***)	**3/5**
Denmark	***.87(.09***)	***.94(.08***)	1.21(.05)	1.21(.05)	1.21(.05)	**3/5**
Netherlands	1.18(.04)	***.93(.06***)	1.18(.04)	1.18(.04)	1.18(.04)	**4/5**
Norway	.89(.04)	.89(.04)	***1.19(.09***)	***1.6(.15***)	***1.57(.12***)	**2/5**
Poland	.92(.03)	.92(.03)	.92(.03)	.92(.03)	***1.08(.06***)	**4/5**
Portugal	1.02(.03)	1.02(.03)	1.02(.03)	1.02(.03)	***1.24(.07***)	**4/5**
Sweden	1.03(.03)	1.03(.03)	1.03(.03)	1.03(.03)	1.03(.03)	**5/5**
Slovenia	1.1(.03)	1.1(.03)	1.1(.03)	1.1(.03)	1.1(.03)	**5/5**
Slovakia	-	.91(.05)	.91(.05)	***1.25(.07***)	.91(.05)	**3/4**
Ukraine	-	***.69(.05***)	.89(.04)	.89(.04)	***1.01(.05***)	**2/4**
United Kingdom	1.27(.03)	1.27(.03)	1.27(.03)	1.27(.03)	**.98(.06**)	**4/5**

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; highlighted in grey those countries that are metric invariant over all rounds they participated; italic and bold indicated that the loading is not invariant to the other rounds.

In the case of the concept 'Political Satisfaction', only 4 out of 19 countries are metric invariant over all rounds, namely: Belgium, Czech Republic, Sweden and Slovenia. As for the measures of the concept 'Quality of State Services', we find metric invariant over all rounds in 6 out of the 19 countries, expressly: Belgium, the Czech Republic, Hungary, Poland, Slovenia and Slovakia. The results of the test for metric invariance for the concept 'Quality of State Services' are presented in Table 7.

Table 7: Loadings after metric invariance testing of the 'Quality of State Services' over time

$\lambda_{\text{Quality of state services}}$

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Belgium	.84(.03)	.84(.03)	.84(.03)	.84(.03)	.84(.03)	**5/5**
Switzerland	1.19(.05)	***.98(.07)***	1.19(.05)	1.19(.05)	1.19(.05)	**4/5**
Czech Republic	1.4(.05)	1.4(.05)	-	1.4(.05)	1.4(.05)	**4/4**
Germany	1.18(.03)	1.18(.03)	1.18(.03)	***1.35(.08)***	***1.18(.03)***	**3/5**
Spain	.89(.03)	***.89(.03)***	.89(.03)	.89(.03)	.67(.06)	**2/5**
Finland	1.8(.06)	1.8(.06)	***1.29(.1)***	1.8(.06)	1.8(.06)	**4/5**
France	1.05(.03)	1.05(.03)	1.05(.03)	***1.05(.03)***	***1.05(.03)***	**2/5**
Greece	1.13(.02)	1.13(.02)	-	1.13(.02)	***.97(.03)***	**3/4**
Hungary	1.01(.04)	1.01(.04)	1.01(.04)	1.01(.04)	1.01(.04)	**5/5**
Denmark	1.29(.06)	***.91(.1)***	1.29(.06)	1.29(.06)	1.29(.06)	**4/5**
Netherlands	1.55(.07)	***1.31(.07)***	1.55(.07)	***1.17(.09)***	1.55(.07)	**3/5**
Norway	1.24(.04)	***1.64(.12)***	1.24(.04)	1.24(.04)	1.24(.04)	**4/5**
Poland	1.12(.04)	1.12(.04)	1.12(.04)	1.12(.04)	1.12(.04)	**5/5**
Portugal	1.13(.03)	1.13(.03)	1.13(.03)	1.13(.03)	***.99(.06)***	**4/5**
Sweden	1.1(.04)	1.1(.04)	***1.47(.14)***	1.1(.04)	1.1(.04)	**4/5**
Slovenia	1.08(.03)	1.08(.03)	1.08(.03)	1.08(.03)	1.08(.03)	**5/5**
Slovakia	-	1.17(.04)	1.17(.04)	1.17(.04)	1.17(.04)	**4/4**
Ukraine	-	***1.25(.08)***	1.02(.04)	1.02(.04)	1.02(.04)	**3/4**
United Kingdom	1.15(.03)	1.15(.03)	1.15(.03)	1.15(.03)	***.92(.07)***	**4/5**

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; highlighted in grey those countries that are metric invariant over all rounds they participated; italic and bold indicated that the loading is not invariant to the other rounds.

7. Scalar invariance in each country over time

Like before, we conduct subsequent scalar invariance testing only for those countries for which metric invariance was established. For the concept of 'Political Satisfaction'we find that only the Czech Republic and Slovenia are scalar invariant across all rounds. Belgium is scalar invariant over time with the exception of Round 5, Poland with the exception of Round 1, and Sweden with the exception of Round 4. Spain and Finland are both also scalar invariant in four out of the five rounds they participated but differently to the previous group of countries, the round in which scalar invariance was not established was not metric invariant to begin with. The results are presented in Table 8.

Table 8: Intercepts after scalar invariance testing of 'Political Satisfaction'over time

τ **Political satisfaction**

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Belgium	.1(.04)	.1(.04)	.1(.04)	.1(.04)	***-.98(.07)***	**4/5**
Switzerland	***-.26(.23)***	-.76(.29)	o	-.76(.29)	***-1.75(.3)***	**2/5**
Czech Republic	-.33(.1)	-.33(.1)	-	-.33(.1)	-.33(.1)	**4/4**
Germany	.25(.09)	.25(.09)	***-.79(.15)***	o	o	**2/5**
Denmark	o	o	***-3.4(.38)***	***-1.92(.27)***	***-2.05(.32)***	**0/5**
Spain	.56(.07)	o	.56(.07)	.56(.07)	.56(.07)	**4/5**
Finland	-1.26(.18)	-1.26(.18)	o	-1.26(.18)	-1.26(.18)	**4/5**
France	o	o	.15(.15)	***.74(.11)***	.15(.15)	**2/5**
Greece	.56(.09)	.56(.09)	-	o	o	**2/4**
United Kingdom	-2.62(.18)	-2.62(.18)	-2.62(.18)	***.46(.1)***	o	**3/5**
Hungary	o	-.27(.08)	-.27(.08)	-.27(.08)	o	**3/5**
Netherlands	o	-.82(.18)	-.82(.18)	***-.39(.17)***	-.82(.18)	**3/5**
Norway	-1(.24)	-1(.24)	o	o	o	**2/5**
Poland	***.34(.08)***	-.99(.11)	-.99(.11)	-.99(.11)	-.99(.11)	**4/5**
Portugal	-.38(.09)	-.38(.09)	-.38(.09)	***-1.54(.14)***	o	**3/5**
Sweden	-.03(.14)	-.03(.14)	***-.82(.16)***	-.03(.14)	-.03(.14)	**4/5**
Slovenia	-.35(.1)	-.35(.1)	-.35(.1)	-.35(.1)	-.35(.1)	**5/5**
Slovakia	o	-.11(.15)	-.11(.15)	o	-.11(.15)	**3/5**
Ukraine	o	o	.27(.07)	.27(.07)	o	**2/5**

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; "o" not metric invariant; highlighted in grey those countries that are metric invariant over all rounds they participated; italic and bold indicated that the loading is not invariant to the other rounds.

Scalar invariance of the concept 'Quality of State Services' is established for more countries over time. The Czech Republic, France, the United Kingdom, Hungary, and Slovenia are found to be scalar invariant over all rounds they participated. Belgium is scalar invariant with the exception of Round 3. Denmark, Germany, Norway, Spain and Sweden are also scalar invariant in four out of the five rounds and the exception is the round for which metric invariance was not established. All remaining countries are scalar invariant in less than four rounds. The results are presented in Table 9.

Table 9: Results of scalar invariance testing of the quality of state services over time

τ **Quality of state services**

	R1	R2	R3	R4	R5	Number of invariant rounds out of total
Belgium	1.48(.25)	1.48(.25)	***1.68(.22)***	1.48(.25)	1.48(.25)	4/5
Switzerland	-1.07(.43)	o	o	-1.07(.43)	-1.07(.43)	3/5
Czech Republic	-3.68(.3)	-3.68(.3)	-	-3.68(.3)	-3.68(.3)	4/4
Germany	-.59(.12)	-.59(.12)	-.59(.12)	o	-.59(.12)	4/5
Denmark	-3.71(.44)	o	-3.71(.44)	-3.71(.44)	-3.71(.44)	4/5
Spain	1.12(.16)	1.12(.16)	1.12(.16)	1.12(.16)	o	4/5
Finland	-7.4(.5)	-7.4(.5)	o	-7.4(.5)	-7.4(.5)	4/5
France	.71(.17)	.71(.17)	.71(.17)	.71(.17)	.71(.17)	5/5
Greece	-.69(.09)	-.69(.09)	-	-.69(.09)	o	3/5
United Kingdom	-1.41(.18)	-1.41(.18)	-1.41(.18)	-1.41(.18)	-1.41(.18)	5/5
Hungary	-1.64(.17)	-1.64(.17)	-1.64(.17)	-1.64(.17)	-1.64(.17)	5/5
Netherlands	-2.71(.35)	o	-2.71(.35)	o	-2.71(.35)	3/5
Norway	-2.47(.29)	o	-2.47(.29)	-2.47(.29)	-2.47(.29)	4/5
Poland	***-1.62(.19)***	-2.84(.27)	***-1.95(.2)***	-2.84(.27)	-2.84(.27)	3/5
Portugal	-.91(.14)	-.91(.14)	-.91(.14)	***-2.53(.2)***	o	3/5
Sweden	-1.57(.26)	-1.57(.26)	o	-1.57(.26)	-1.57(.26)	4/5
Slovenia	-1.04(.19)	-1.04(.19)	-1.04(.19)	-1.04(.19)	-1.04(.19)	5/5
Slovakia	o	***-.28(.25)***	-2.13(.23)	-2.13(.23)	-2.13(.23)	3/5
Ukraine	o	o	-1.41(.14)	-1.41(.14)	-1.41(.14)	3/5

"-" Indicates that the country did not participate or is not part of the ESS integrated file in this round; "o" not metric invariant; highlighted in grey those countries that are metric invariant over all rounds they participated; italic and bold indicated that the loading is not invariant to the other rounds.

8. Quality of the composite scores

Although metric and scalar invariance was established only in a limited number of countries, ESS data users might still want to operationalise the concepts as composite scores for analyses within countries. Therefore, we calculate hereafter the composite scores and evaluate their quality. The composite scores are the average of the two indicators of each concept and they are calculated by the unweighted sum of the two indicators of each concept:

Political satisfaction = Satisfaction with the economy + Satisfaction with the government
Quality of state services = Evaluation of education + Evaluation of the health system

The quality of the composite scores can be defined as

Quality of composite score = 1 – (error variance/ total variance)

This means that the quality of a composite score equals 1 minus the proportion of the error variance of the total variance of the composite score. The error variance of the composite score is in this case[2] equal to the sum of the error variances of the two indicator variables, while the total variance has been computed directly from the composite score. The quality

[2] without correlated errors.

index ranges from 0 to 1, where 0 means only error and 1 means perfect measurement without errors. Although there is no clear cut-off point for what is considered good quality, the estimation of the composite scores' quality allows correcting for measurement error. The quality of the composite scores in each country and round are presented in Table 10.

Table 10: Quality of composite scores 'Political Satisfaction'and 'Quality of State Services'

	Round 1		Round 2		Round 3		Round 4		Round 5	
	Pol.Sat.	State Services	Pol.Sat.	State Services	Pol.Sat.	State Services	Pol.Sat.	State Services	Pol.Sat.	State Services
Austria	0.69	0.68	0.72	0.68	0.58	0.70	-	-	-	-
Belgium	0.70	0.49	0.76	0.58	0.76	0.54	0.65	0.58	0.60	0.57
Bulgaria	-	-	-	-	0.67	0.74	0.74	0.71	0.69	0.69
Croatia	-	-	-	-	-	-	0.80	0.66	0.69	0.75
Cyprus	-	-	-	-	0.65	0.70	0.56	0.62	0.66	0.61
Czech Republic	0.76	0.62	0.78	0.66	-	-	0.74	0.67	0.82	0.64
Denmark	0.61	0.52	0.70	0.52	0.70	0.53	0.59	0.58	0.71	0.56
Estonia	-	-	0.80	0.66	0.80	0.69	0.81	0.65	0.83	0.61
Finland	0.77	0.53	0.75	0.57	0.76	0.52	0.72	0.60	0.73	0.60
France	0.73	0.58	0.72	0.60	0.71	0.58	0.73	0.58	0.75	0.61
Germany	0.73	0.60	0.76	0.66	0.75	0.67	0.71	0.63	0.66	0.66
Greece	0.85	0.75	0.76	0.75	-	-	0.80	0.82	0.78	0.80
Hungary	0.67	0.65	0.80	0.66	0.81	0.73	0.79	0.71	0.61	0.72
Iceland	-	-	.69	.65	-	-	-	-	-	-
Ireland	-	-	0.76	0.59	0.75	0.53	0.81	0.67	0.64	0.61
Israel	0.60	0.63	-	-	-	-	0.58	0.46	0.75	0.67
Italy	0.76	0.65	-	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	-	0.80	0.72	-	-
Lithuania	-	-	-	-	-	-	-	-	0.78	0.75
Luxembourg	0.74	0.59	0.70	0.63	-	-	-	-	-	-
Netherlands	0.54	0.69	0.73	0.69	0.74	0.63	0.68	0.60	0.65	0.55
Norway	0.62	0.56	0.64	0.59	0.56	0.57	0.52	0.57	0.58	0.57
Poland	0.75	0.54	0.74	0.58	0.63	0.61	0.73	0.57	0.74	0.58
Portugal	0.72	0.70	0.77	0.78	0.77	0.67	0.75	0.60	0.77	0.75
Romania	-	-	-	-	-	-	0.82	0.83	-	-

Table 10 continued

	Round 1		Round 2		Round 3		Round 4		Round 5	
	Pol.Sat.	State Services	Pol.Sat.	State Services	Pol.Sat.	State Services	Pol.Sat.	State Services	Pol.Sat.	State Services
Russia	-	-	-	-	.78	.80	0.74	0.78	0.79	0.83
Slovakia	-	-	0.78	0.43	0.51	0.59	0.69	0.71	0.70	0.70
Slovenia	0.79	0.68	0.74	0.69	0.75	0.67	0.63	0.69	0.78	0.81
Spain	0.78	0.63	0.55	0.63	0.61	0.63	0.76	0.61	0.75	0.64
Sweden	0.70	0.65	0.75	0.63	0.63	0.64	0.58	0.61	0.75	0.57
Switzerland	0.65	0.47	0.68	0.63	0.66	0.57	0.62	0.59	0.68	0.60
Turkey	-	-	0.80	0.75	-	-	0.79	0.79	-	-
Ukraine	-	-	0.63	0.70	0.78	0.74	0.79	0.71	0.80	0.73
United Kingdom	0.76	0.65	0.77	0.68	0.78	0.60	0.76	0.61	0.68	0.60

- Indicates that the country did not participate or is not part of the ESS integrated file.

Generally speaking, the quality of the composite scores is moderate to high in most cases. In this matter, the concept 'Political Satisfaction'shows to have composite scores with higher quality than 'Quality of State Services'. There are no clear examples of countries systematically showing low quality composite scores when it comes to the first concept. However, this is not the case of 'Quality of State Services'. Here, countries such as Belgium, Denmark, Norway and Poland consistently show lower quality when compared to the other countries. Even though it cannot be said that the composite scores in these countries are of low quality (0.49-0.61), they are still systematically lower than most of the other cases. Low quality indicates that the relationship between the composite scores and other variables will be considerably underestimated. This highlights the importance of correcting for measurement error. We illustrate how large the differences can be by comparing the observed correlations (r_{xy}) between the two concepts of interest in this study and latent correlation corrected for measurement error ($r_{\eta 1\, \eta 2}$). The correlation corrected for measurement error is computed as: $r_{\eta 1 \eta 2} = \frac{r_{xy}}{\sqrt{Q_x Q_y}}$

where x and y are the observed composite scores and Q_x and Q_y are the estimates of the qualities of the composite scores. Table 11 presents the results.

Table 11: Correlation between composite scores observed and corrected for measurement error

	Round 1			Round 2			Round 3			Round 4			Round 5		
	Observ. corr.	Corr. corrected	Diff.	Observ. corr.	Corr. corrected	Diff.	Observ. corr.	Corr. corrected	Diff.	Observ. corr.	Corr. corrected	Diff.	Observ. corr.	Corr. corrected	Diff.
Austria	0.42	0.62	0.19	0.46	0.66	0.20	0.48	0.76	0.27						
Belgium	0.36	0.61	0.25	0.39	0.59	0.20	0.41	0.64	0.23	0.35	0.57	0.22	0.28	0.48	0.20
Bulgaria							0.52	0.74	0.22	0.45	0.62	0.17	0.44	0.63	0.20
Croatia										0.45	0.62	0.17	0.42	0.58	0.16
Cyprus							0.44	0.65	0.21	0.41	0.69	0.28	0.51	0.80	0.29
Czech Republic	0.38	0.55	0.17	0.39	0.54	0.15				0.40	0.57	0.17	0.41	0.57	0.16
Denmark	0.31	0.55	0.24	0.34	0.57	0.23	0.39	0.63	0.25	0.42	0.72	0.30	0.45	0.72	0.26
Estonia				0.49	0.67	0.18	0.54	0.73	0.19	0.44	0.61	0.17	0.47	0.66	0.19
Finland	0.48	0.75	0.27	0.47	0.72	0.25	0.42	0.67	0.25	0.44	0.68	0.23	0.43	0.64	0.22
France	0.41	0.63	0.22	0.44	0.67	0.23	0.40	0.62	0.22	0.41	0.63	0.22	0.43	0.63	0.21
Germany	0.42	0.64	0.22	0.51	0.72	0.21	0.54	0.76	0.22	0.45	0.67	0.22	0.47	0.71	0.24
Greece	0.63	0.78	0.16	0.55	0.73	0.18				0.54	0.66	0.13	0.54	0.68	0.14
Hungary	0.32	0.49	0.17	0.48	0.66	0.18	0.47	0.61	0.14	0.42	0.56	0.14	0.36	0.54	0.18
Iceland				0.40	0.59	0.19									
Ireland				0.47	0.70	0.23	0.47	0.75	0.28	0.49	0.66	0.17	0.38	0.61	0.23
Israel	0.27	0.43	0.17							0.36	0.70	0.34	0.35	0.50	0.14
Italy	0.48	0.68	0.20												
Latvia										0.37	0.49	0.12			
Lithuania												0.00	0.48	0.63	0.15
Luxembourg	0.47	0.71	0.24	0.50	0.76	0.25									
Netherlands	0.44	0.72	0.28	0.46	0.65	0.19	0.38	0.55	0.18	0.42	0.66	0.24	0.34	0.57	0.23
Norway	0.42	0.72	0.29	0.47	0.76	0.29	0.45	0.80	0.35	0.43	0.79	0.36	0.48	0.83	0.35
Poland	0.42	0.66	0.24	0.43	0.66	0.23	0.42	0.68	0.26	0.39	0.60	0.21	0.50	0.76	0.26
Portugal	0.45	0.63	0.18	0.44	0.57	0.13	0.51	0.70	0.20	0.43	0.64	0.21	0.41	0.53	0.13
Romania										0.52	0.63	0.11			
Russia							0.53	0.67	0.14	0.50	0.66	0.16	0.62	0.77	0.15
Slovakia				-0.05	-0.09	**0.04**	0.45	0.83	**0.37**	0.48	0.69	0.21	0.39	0.56	0.17
Slovenia	0.49	0.66	0.18	0.51	0.72	0.21	0.49	0.68	0.20	0.40	0.61	0.21	0.28	0.35	0.07
Spain	0.46	0.66	0.20	0.40	0.67	0.28	0.41	0.67	0.25	0.42	0.62	0.20	0.36	0.52	0.16
Sweden	0.43	0.64	0.21	0.49	0.71	0.22	0.36	0.56	0.21	0.27	0.45	0.18	0.34	0.52	0.18
Switzerland	0.39	0.70	0.32	0.42	0.64	0.22	0.43	0.70	0.27	0.36	0.59	0.23	0.41	0.64	0.23
Turkey				0.56	0.73	0.16				0.53	0.68	0.14			
Ukraine				0.45	0.67	0.23	0.44	0.58	0.14	0.35	0.47	0.12	0.48	0.63	0.15
United Kingdom	0.46	0.66	0.20	0.54	0.75	0.21	0.50	0.73	0.23	0.43	0.64	0.20	0.39	0.60	0.22

- Indicates that the country did not participate or is not part of the ESS integrated file.

The results in Table 11 show how large the differences are between the observed (uncorrected) correlations and the correlations corrected for measurement error. The differences range from 0.04 in Round 2 in Slovakia, to .38 in Round 3, curiously, also in Slovakia. This table also shows that the observed correlations are consistently underestimated when compared to the correlations corrected for measurement error. Therefore, adopting procedures to correct for measurement error is an essential step when using ESS data.

9. Conclusion

This study of the measurement of the concepts-by-postulation of 'Political Satisfaction'and 'Quality of State Services' has shown that even though the concepts comply, for the most part, with the configural invariance requirement, they show low levels of metric and scalar invariance across countries. Albeit this being the case, no clear patterns of countries or languages were found. Due to these poor results, it was decided to test measurement invariance within countries across time. Here we found that the results are much better, even though there are only two countries for the first concept (Czech Republic, Slovenia) and five countries for the second (Czech Republic, France, United Kingdom, Hungary, Slovenia), with full measurement invariance (configural, metric and scalar). This indicates that for the particular case of both concepts under analysis here, the means and relationships with other variables cannot be compare between all the countries.

Invariance testing is not suited to help find the particular reasons for why such differences exist. However, these can be due to cognitive differences or cultural patterns between the countries in the ESS, in addition to systematic errors such as translation differences. In any case, for more disclosure further research is necessary.

Finally, we also proceed to estimate the quality of the composite scores for the concepts 'Political Satisfaction'and 'Quality of State Services'. The quality estimates range from .43 to .85, they are roughly stable across time within countries but rather different between countries. These differences highlight the importance of introducing correction for measurement error procedures, such as the one described by Saris and Gallhofer (2007), when analyzing ESS data.

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