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The Reliability of MIPEX Indicators as Scales

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Support and Opposition to Migration: A cross national comparison of the politicization of migration (SOM)

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Abstract

This paper examines the reliability of the *Migrant Integration Policy Index* (MIPEX) as a scale. The MIPEX indicators are organized into several dimensions which are combined into six strands. The results of the reliability analysis suggest that overall, MIPEX is a reliable scale. Moreover, the individual strands are also reliable, although in most instances the scales could be improved by removing specific items. In contrast, however, most of the dimensions identified are not reliable. Using principal component analysis, it appears that the different strands and dimensions of MIPEX are not as distinct as presented. It seems that the number of indicators in MIPEX could be reduced, and the data are probably better presented in a different way than the six strands MIPEX uses.

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Introduction

The *Migrant Integration Policy Index 2007* (Niessen et al. 2007) measures the implementation of integration policies in 28 countries. Included are 25 of the EU member states, as well as 3 non-EU countries. A large number of indicators are used to capture differences in the laws and policies to integrate immigrant populations in the countries covered. The focus is on the policies in place rather than their realization and enforcement. In 2007, the indicators covered six strands (policy areas) that are thought to capture the opportunities of immigrants. To some extent based on Council of Europe conventions and directives from the European Union, MIPEX highlights best practice in each case, making the measure useful in policy contexts.

The fact that the implementation of integration policies is measured in the same way across countries is not only useful for policymakers interested in benchmarking policies, but has attracted the attention of academic researchers. The presentation of MIPEX suggests many qualities sought by researchers: standardized data collection across countries, to some extent coverage of data over time, as well as the inclusion of different areas of integration.

With its focus on policymaking and benchmarking, MIPEX is not designed as a scale. The presentation of the data, combined with the outlined qualities, however, implies that it is possible to use MIPEX data as a scale. Indeed, the presentation of the indicators suggests that MIPEX captures the extent to which laws and policies facilitate the integration of immigrants in the countries covered. The concept of integration is divided into six strands or policy areas. Each of these is divided into dimensions combining a number of specific indicators. This paper assesses the extent to which the data provided by MIPEX can be used as a scale of integration.

The reliability of the data is approached in terms of internal consistency. To this extent scale analysis is carried out, both on the overall data and the individual strands. Such considerations are complemented with scale analysis on individual dimensions, and factor analysis to examine unidimensionality of the different strands and dimensions.

The scale analysis makes use of Cronbach's alphas (Cronbach 1951), the most common approach in the literature. If a scale has a high alpha, this does not necessarily mean that a concept is unidimensionsal, since high alphas are also possible with clusters of items that intercorrelate highly, despite the clusters themselves not correlating highly. In this case, there are separate dimensions. At the same time, a low alpha is possible despite unidimensionality, in case where there is high random error.

There is no standard cut-off for alphas to decide whether a scale is considered reliable, although 0.7 is a common value for publications. Depending on the research, values between 0.6 and 0.8 are generally used, but an alpha of 0.7 already means that the standard error of measurement is greater than half the standard deviation (0.55). For this reason, an alpha of 0.8 should be preferred for confirmatory purposes (as opposed to exploratory purposes).

Principal Component Analysis (PCA) can be used to test the convergent validity of a scale. High factor loadings on the predicted factors are in this case an indicator of validity. Similarly, Cronbach's alpha can be considered a measure of construct validity, as it captures internal consistency.

The assumption of the analysis in this paper is that there is a latent variable, and that the items are either continuous or ordered. With ordered items and the aim of capturing the degree to which integration is facilitated, MIPEX data fulfils these criteria.

Data Quality and Missing Values

As a first step, I examined missing values in the data. For most variables, there are no or only a few missing values. There are a few variables where the number of missing values is very significant. Put differently, a few variables are responsible for most of the missing values observed. None of the countries fare significantly differently from the others in terms of missing values, although for one country complete data are available (figure 1).

Figure 1: Overall Summary of Missing Values

Missing values in MIPEX 2007 by variables, cases, and values: complete data (white) and incomplete data (black)

In order to get meaningful results with the analysis used in this paper, I was forced to remove the variables with too many missing values. I compared the results based on this reduced data set with the complete 2007 data, and differences are reported. In some cases the missing values mean that individual calculations are impossible or would be meaningless. For the subset of data, variables were removed if there were more than 10% missing values.

Scale Analysis

For the scale reliability of each dimension, standardized alphas from R are reported. The scale reliability of entire strands was done in SPSS, reporting unstandardized alphas. The differences are negligible, since the analysis is based on the subset with fewer missing values.

For each Strand

As a first step, I have examined the reliability of each of the six strands in MIPEX 2007. Table 1 outlines the Cronbach's alphas for each of the strands, as well the alpha that would be achieved by removing the item that would lead to the most significant increase. The reported alphas are for the reduced data set where variables with significant numbers of missing values are removed.

Table 1: Cronbach's Alpha for the Different Strands

	Strand 1	*Strand 2*	*Strand 3*	*Strand 4*	*Strand 5*	*Strand 6*
Cronbach's Alpha	0.71	0.77	0.63	0.89	0.75	0.89
Alpha if Item Removed	0.74	0.79	0.68	0.90	0.79	0.90

Notes: Cronbach's alpha for the six strands of MIPEX 2007. The reported values are for the data set with variable with large number of missing values removed. 'Alpha if item removed' gives the Cronbach's alpha for the item that would increase the alpha most.

For the first strand, a slightly higher alpha would be achieved by removing variable V113[1]. The same alpha is achieved when looking at the full data set rather than the reduced one. For the second strand, the alpha would be slightly higher when removing variable V2328. Because of missing values, the alpha for the second strand using the full data is 0.17, although this coefficient is not meaningful. For the third strand, the alpha would be increased by removing variable V3368. As in the second strand, the full data would lead to a meaningless 0.16. For the fourth strand, the removal of variable V4369 would increase the alpha slightly. With all variables in, the alpha for the fourth strand is 0.75, which could be increased to 0.78 when removing variable V4381. In the fifth strand, the removal of variable V5193 would increase the alpha slightly. Using the full data set, the alpha is 0.78, which could be increased to 0.81 by removing variable V5193. For the sixth strand, the alpha could be slightly increased by removing variable V62131, and the results of the full and reduced data set are equivalent.

With the exception of the third strand, all of the Cronbach's alphas are reasonably high. In each case, the removal of some of the items could increase the alphas, indicating that the scale might not be optimal.

[1] I have named the variables in MIPEX as follows: the first digit gives the strand [1..6], the second digit gives the dimension [1..5], the remaining digits give the variable number [1..141]. The dimension is counted separately for each strand, the variable number continues across strands and dimensions. This way, the strand and dimension of a variable are immediately apparent, whilst the variable number allows identifying any individual variable.

For each Dimension

As a second step, I have examined the alphas in individual dimensions within the separate strands. Following the presentation by MIPEX, it can be expected that each dimension of a strand should be internally coherent, which would be reflected by a high alpha. In some cases, however, there are just one or two indicators in a dimension, which make it impossible to calculate Cronbach's alphas. Where there are two items, I report Spearman rank correlations. Where possible, I report robust alphas, but in some cases, it was impossible to calculate robust alphas due to missing values and unreliable coding.

Table 2: Cronbach's Alpha for the Individual Dimensions

	Dimension 1	*Dimension 2*	*Dimension 3*	*Dimension 4*	*Dimension 5*
Strand 1					
Cronbach's Alpha	0.43	0.50	*	*	
Alpha if Item Removed	0.73	0.73			
Strand 2					
Cronbach's Alpha	*	0.73	0.60†	0.34	0.75
Alpha if Item Removed		0.79	0.68	0.40	‡
Strand 3					
Cronbach's Alpha	§	0.83†	0.60		
Alpha if Item Removed		0.85	0.63		
Strand 4					
Cronbach's Alpha	0.73	*	0.90†	0.92	
Alpha if Item Removed	0.90		‡	0.96	
Strand 5					
Cronbach's Alpha	0.69	0.50	0.52	*	
Alpha if Item Removed	0.83	0.65	0.57		
Strand 6					
Cronbach's Alpha	0.61	0.87	0.40	0.70	
Alpha if Item Removed	0.68	0.89	0.49	0.71	

*Notes: Cronbach's alpha for individual dimensions in the six strands of MIPEX 2007. The reported values are for the data set where variables with a large number of missing values are removed. 'Alpha if item removed' gives the Cornbach's alpha for the item that would increase the alpha most. Reported are robust alphas, based on the entire data. * Too few cases to calculate alpha (1 or 2 items), † robust alpha could not be calculated, ‡ alpha cannot be increased by removing items, § possibly unreliable coding, alpha 0.05 or 0.19 if one of the variables is removed.*

In the first strand, the alpha of the first dimension could be increased significantly by removing variable V113. A significant increase would also be possible in the second dimension by removing variable V216. For dimensions three and four, there are just two items per dimension. The Spearman rank correlation for the third dimension is 0.50, for the fourth dimension the correlation is 0.41.

For the second strand, the first dimension consists of a single item, and reliability is therefore given. For the second dimension, the alpha would be increased by removing variable V2212. The alpha of the third dimension could be increased by removing variable V2328; the alpha of the fourth dimension would be higher if variable V2431 is removed. The alpha of the fifth dimension could not be increased by removing any of the items.

The first dimension of the third strand is characterized by possibly unreliable coding. The alpha is 0.05, which could be increased by removing variable V3138, although the meaning of the scale is unclear. For the second dimension, a higher alpha could be achieved by removing variable V3254. The alpha in the third dimension would be higher with variable V3368 removed.

For the fourth strand, the alpha of the first dimension could be improved significantly by removing variable V4169. For the second dimension, there are too few items to calculate Cronbach's alpha, and the nature of the values makes it impossible to determine a meaningful correlation. Just two values exist for each of the variable (2, 3; 1, 3), with no variability between countries. For the third dimension, the alpha could not be improved by removing any of the variables. The alpha of the fourth dimension could be increased further by removing variable V4483.

For the fifth strand, the first three dimensions could all be increased by removing one of the variables: V5193, V52106, and V53112 respectively. The fourth dimension consists of two variables, which are only correlated weakly (Spearman rank correlation 0.14).

For the sixth strand, the alpha of the first dimension could be increased by removing variable V61116. The alpha of the second dimension would be slightly higher by removing variable V62131. A higher alpha in the third dimension would be achieved by removing variable V63126; in the fourth dimension a higher alpha would be achieved by removing variable V64138.

MIPEX as an Overall Scale

In a third step, I have made the assumption that MIPEX is a single scale for a latent concept. To this end, I have included all variables of the reduced sample, and the Cronbach's alpha is 0.93. With the full set, no alpha can be calculated, and the removal of the variable with more than 10% missing values was a necessary step. The high alpha indicates that MIPEX overall appears to capture a latent concept, a finding that contrasts with some of the individual strands and most of the dimensions identified by MIPEX.

Exploratory Factor Analysis

Overall

The presentation of the MIPEX data implies that there are six distinct strands. If this is achieved with the indicators used, the six strands would appear in a factor analysis. Overall, there are 19 factors with an eigenvalue greater than 1. Principal component analysis can be used to check if the data can be reduced. Taking factors with an eigenvalue greater than 1, a principal component analysis on all variables identifies 21 factors. This suggests that the six strands perhaps cannot be captured appropriately with the indicators used.

By extracting exactly 6 factors, it can be tested to what extent the six strands used by MIPEX are reflected in the data, with a view on reducing the data. It is not the case that the variables of the different strands clearly correspond to the factors identified by principal component analysis. It appears that the empirical reality is messier than what is implied by the MIPEX presentation. Highlighted in table 3 are the highest factor loading per variable (orange) and all factor loadings greater than 0.4 (yellow), a common cut-off in the literature.

Table 3: Principal Component Analysis on MIPEX Data

	A	*B*	*C*	*D*	*E*	*F*
V111	.666	.331	.069	.031	-.039	.107
V112	.599	.139	.250	-.076	.456	-.311
V113	-.063	.367	.382	.319	-.208	.363
V124	.613	-.426	.316	-.195	.055	-.039
V125	.474	-.250	-.011	-.253	.322	-.139
V126	.273	-.014	.010	.478	.388	-.256
V137	.456	.280	.254	-.185	-.384	.104
V138	.824	-.249	-.054	-.125	.040	-.124
V149	-.108	.498	.471	-.388	-.022	.088
V1410	.545	.129	-.187	.043	.204	-.158
V2111	.701	-.162	.102	-.046	.097	.270
V2212	.212	.372	.220	.055	.305	-.261
V2213	.129	.396	-.328	.012	.125	.018
V2214	.226	.596	.262	.189	.289	-.228
V2215	.326	.605	.095	.181	.342	-.017
V2316	.211	.715	-.099	-.058	-.308	-.281
V2317	.074	.630	-.234	.228	-.098	-.017
V2318	.315	.668	-.194	.074	-.287	-.394
V2319	-.195	.515	.261	-.476	-.173	-.076
V2325	.270	.340	.159	-.150	.182	.095
V2326	.483	.185	.017	-.017	.109	.446
V2327	-.112	.541	.273	-.082	.460	.222
V2328	-.053	-.068	.193	-.659	.260	-.318
V2429	.377	.575	.087	.209	-.107	-.346
V2430	.199	.417	.517	-.079	-.169	-.083
V2431	.521	-.427	.140	.003	-.401	-.283
V2432	.458	.098	.008	.423	-.356	.009
V2533	.434	.058	.189	.450	.392	-.075
V2534	.447	.129	.135	.293	.446	-.322
V2535	.226	-.257	.138	.288	-.102	.100
V2536	.180	-.492	.426	.184	.201	-.111
V2537	.242	-.205	.408	.474	.325	.106
V3138	-.155	-.154	.305	.375	.069	-.087
V3139	.313	.068	.378	.163	.103	.233
V3140	-.131	.102	.298	.207	.366	.118
V3141	.284	.410	.352	.313	-.131	.129

V3142	.093	.046	.430	-.172	-.467	-.127
V3243	.477	.688	-.148	-.121	-.224	.073
V3244	.201	.733	-.098	-.197	-.153	.297
V3245	.414	.742	-.134	-.138	-.054	-.054
V3246	.093	.504	.152	-.535	-.151	.300
V3247	.215	.590	-.142	-.266	-.051	.061
V3252	.251	.016	-.134	-.632	-.017	.126
V3253	.411	-.237	.226	-.668	.123	.142
V3254	-.120	.428	.331	-.231	.316	-.036
V3255	.156	-.016	.376	-.536	.377	.012
V3356	.013	-.084	.417	.590	-.248	.035
V3357	.333	-.274	.522	.038	-.100	-.033
V3358	.220	-.097	-.060	.276	-.170	-.392
V3359	.128	.490	.357	.224	-.364	-.125
V3360	.575	-.431	-.074	-.171	-.087	-.001
V3361	.440	-.052	.187	.124	.207	.173
V3362	.425	-.074	-.064	-.136	-.215	-.292
V3363	.277	-.132	.497	.354	-.298	.315
V3364	.008	.522	.441	-.454	.123	.125
V3365	.180	-.050	.498	.420	.233	.124
V3366	-.038	.173	.315	.176	-.250	.402
V3367	-.064	-.170	-.042	.452	.159	.488
V3368	-.070	-.094	-.096	-.098	-.451	-.275
V4169	.380	.155	-.194	-.112	-.076	-.083
V4171	.375	-.014	.123	-.445	.391	.169
V4172	.331	-.177	.245	-.519	.470	-.092
V4273	.469	-.170	.085	-.182	-.449	.002
V4274	.469	-.170	.085	-.182	-.449	.002
V4375	.618	-.105	.556	-.056	-.015	.163
V4377	.593	-.217	.617	-.194	-.017	-.079
V4379	.443	-.638	.215	-.135	.057	-.156
V4381	.592	-.408	.356	-.234	-.008	-.184
V4483	.747	-.014	.045	-.291	.109	-.010
V4484	.697	-.387	.071	.082	.200	.185
V4486	.836	-.352	.167	.174	.030	-.011
V4487	.836	-.352	.167	.174	.030	-.011
V5188	.529	-.098	-.393	-.085	.148	.412
V5189	.654	.124	-.027	.084	-.207	-.153
V5190	.682	-.143	-.120	.044	-.137	.082
V5191	.370	.004	-.392	-.193	.387	-.068
V5192	.494	-.003	-.507	-.146	.302	.025
V5193	-.143	-.562	-.236	-.138	.081	-.296
V5294	.236	.586	-.130	-.177	-.120	.055
V52100	.399	.292	.343	-.499	-.287	-.130
V52102	.233	.266	.130	-.094	.078	.118
V52103	-.176	.137	.216	-.481	.049	.082
V52104	.471	.325	-.147	-.093	.447	.084
V52105	-.085	.453	-.018	.183	.006	.006
V52106	.091	.182	-.048	.567	.564	-.097
V52107	-.037	-.279	-.289	.032	.366	-.301

V53108	.018	.223	.240	.197	.071	.138
V53109	.273	.312	.238	.086	.073	-.039
V53110	.593	-.117	-.081	-.176	.115	.056
V53111	.381	-.050	-.157	-.726	-.032	.097
V53112	.677	-.137	.240	.037	.031	.160
V54113	.037	.042	-.532	-.158	-.461	.281
V54114	.627	-.124	-.386	-.039	.115	.096
V61115	.494	.345	-.496	.149	.167	-.053
V61116	.216	.228	-.194	-.357	.317	-.149
V61117	.553	-.026	-.201	.012	-.012	-.619
V61118	.519	.220	-.082	.250	-.339	-.427
V62119	.539	.023	-.528	.050	.176	.155
V62120	.347	-.171	-.406	.045	.174	-.296
V62121	.546	-.155	-.183	.088	-.427	.103
V62122	.546	-.155	-.183	.088	-.427	.103
V62123	.673	-.167	-.407	-.083	-.154	.266
V62124	.530	-.174	-.445	-.095	-.094	.385
V63125	.606	-.015	-.033	.329	-.293	-.256
V63126	.485	.373	-.291	.251	.002	-.388
V63127	.153	-.283	.466	.146	.015	-.063
V63128	.569	-.184	-.026	.096	-.295	.397
V62129	.424	-.343	-.202	-.156	-.368	.248
V62130	.242	.382	-.181	.444	-.260	-.424
V62131	.192	-.016	.195	.433	-.036	.448
V62132	.394	.252	-.321	.357	-.022	.264
V62133	.509	.436	.185	.242	-.170	.289
V64134	.023	.187	-.688	.148	.301	.120
V64135	.323	-.008	-.316	.304	.278	.386
V64136	-.022	.229	-.035	.070	.213	.818
V64137	.449	.112	-.584	.078	.250	.228
V64138	.414	-.019	-.019	.068	-.185	-.403
V64139	.159	.397	.241	.072	.448	-.358
V64140	.343	-.060	.003	.334	.209	.053

Notes: PCA on all variables in MIPEX except those with significant numbers of missing values. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4. Six factors were extracted, on the assumption that they would match the six strands of MIPEX.

Based on the principal component analysis in table 3, it is also possible to examine whether the different strands of MIPEX are likely to be unidimensional. Factor analysis is more suited for confirming latent factors, and in this case leads to a very similar picture as the one presented in table 3. Each strand will also be examined in more detail below. As visible in table 3, for the first strand, the strongest associations are mostly with factor A. This suggests that the strand probably captures a single latent concept, although some of the variables included do not seem to match this well. These variables might be removed without affecting significantly the overall picture of MIPEX data. The situation seems similar for the second strand, where most variables are associated with factor B. Again, there are some variables which do not fit well, suggesting that some of the variables capture something else rather than the latent concept.

For the third strand, the principal component analysis in table 3 suggests that rather than a single concept, probably two different concepts are captured. High associations can be found with factor B and factor C. Factor B was associated with most variables of the second strand, indicating that the different strands in MIPEX might not stand for different latent concepts, making data reduction along the MIPEX strands more difficult. The fourth strand seems more uniform, with most variables associated with factor A. This is the same factor for which high associations were identified for the first strand, suggesting that rather than being distinct concepts, there is possibly a single latent concept for strands 1 and 4.

The situation for the fifth strand is much messier than for the other strands. No single factor seems to suggest itself as the dominant one, and high associations can be found with factors A, B, C, and D. The variables in this strand do not appear to measure a single concept, but something of a more confused nature. It seems difficult to speak of a unidimensional concept. This contrasts with the final strand, where the strongest associations are with factor A. On the one hand, this means that the sixth strand appears to be closer to a unidimensional concept; on the other hand this means that the sixth strand seems to capture the same latent concept as the first and fourth strand.

Taken together, the results of the principal component analysis in table 3 and the equivalent factor analysis seem to suggest that the different strands in MIPEX do not refer to unidimensional latent concepts. In terms of data reduction, four different latent concepts—as reflected by four factors identified—might be more appropriate to describe the nature of MIPEX data. These four strands, however, do not correspond to the strands identified by MIPEX. Some of the strands appear to mostly measure the same latent concept, whilst for the fifth strand it seems difficult to identify a clear underlying concept.

In the following, I will further examine the situation for each strand in more detail. As above, equivalent factor analyses were used in addition, to test the assumption of a single underlying factor. In all instances, the analysis is based on the data set that removed variables with significant numbers of missing values. For the first strand, using a principal component analysis and eigenvalues greater than 1 as the criteria, no additional insights can be gained. In line with the analysis based on table 3 and the reliability analysis presented above, it appears that there is a single underlying concept, but some of the variables included in the first MIPEX strand do not fit well: they seem to capture something else. The reliability of the first strand could be improved significantly by removing these variables.

Table 4: Principal Component Analysis on Strand 1

	1	2	3	4	5
V111	.672	.440	.140	.079	-.061
V112	.835	.174	.111	.050	-.336
V113	-.256	.770	.165	.339	.216
V124	.658	.023	-.511	.236	.407
V125	.670	-.259	-.389	.323	-.233
V126	.372	.101	.657	.455	.267
V137	.168	.540	-.120	-.653	.375
V138	.761	-.181	-.113	-.241	.333
V149	-.042	.709	-.390	.002	-.485
V1410	.575	-.080	.519	-.443	-.298

Notes: PCA on all variables in strand 1 except those with significant numbers of missing values. Extracted were factors with an eigenvalue > 1. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4.

The situation is similar for the second strand, where the two separate factors once again become visible. For the reliability of the strand as a scale, this lack of unidimensionality is not problematic, but the removal of variables unrelated to neither of these factors could increase the reliability of the second strand. Given that about half of the variables are associated with the same factor as identified for the first strand, it might be useful to focus only on variables associated with factor B in table 3, and trying to identify the latent concept for these variables only.

Table 5: Principal Component Analysis on Strand 2

	1	*2*	*3*	*4*	*5*	*6*	*7*
V2111	.159	.557	.057	.168	-.041	.390	-.150
V2212	.624	-.064	.322	.352	.073	-.125	-.217
V2213	.438	.005	.115	-.544	-.113	.222	-.210
V2214	.778	.010	.448	-.292	.047	-.133	-.029
V2215	.749	.273	.123	-.099	-.255	-.151	-.138
V2316	.772	-.349	-.372	.147	.204	-.039	-.106
V2317	.501	-.327	-.390	.348	-.330	-.226	.154
V2318	.797	-.256	-.432	-.070	.159	-.074	-.009
V2319	.381	-.445	-.014	.169	.252	.281	-.408
V2325	.537	.152	.174	-.061	-.248	.218	-.346
V2326	.261	.210	-.286	.192	-.187	.633	.310
V2327	.215	-.411	.475	.396	-.390	-.084	.308
V2328	-.187	-.364	.539	.068	.516	.273	.053
V2429	.703	-.049	-.219	.014	.327	.024	.208
V2430	.380	-.340	.248	.409	.326	.078	.322
V2431	-.168	.536	-.350	.139	.548	.100	-.052
V2432	.374	.331	-.271	-.442	.145	-.222	.213
V2533	.378	.712	.143	.000	-.041	.144	.322
V2534	.403	.609	.341	-.239	.184	-.067	.299
V2535	-.057	.624	-.327	.463	-.018	-.171	-.143
V2536	-.068	.488	.308	.276	.364	-.394	-.163
V2537	.171	.643	.150	.426	-.228	.029	-.145

Notes: PCA on all variables in strand 2 except those with significant numbers of missing values. Extracted were factors with an eigenvalue > 1. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4.

For the third strand, unidimensionality does not appear to be given, and the situation seems less clear. In contrast to the results presented in table 3, in the analysis based on eigenvalues greater than 1, it seems less clear whether two or three underlying concepts are captured. As before, the reliability of the scale is not affected by the lack of unidimensionality, but a presentation that does not imply a single dimension seems to be warranted. As it was the case for the second strand, the removal of some variables appears to be suited to increase the reliability of the strand.

Table 6: Principal Component Analysis on Strand 3

	1	2	3	4	5	6	7	8	9
V3138	-.337	.028	-.208	-.425	-.358	.387	-.065	.518	-.068
V3139	.027	.527	.431	-.130	-.264	.173	-.105	-.465	.114
V3140	-.099	.386	-.342	.444	-.278	-.288	.354	.020	.071
V3141	.388	.410	-.090	-.357	-.169	-.242	.180	.061	-.236
V3142	.107	.508	.026	.404	.520	-.241	.178	.099	-.004
V3243	.829	.068	.167	-.362	.017	-.189	.110	-.056	.015
V3244	.856	.100	-.230	-.230	.034	.113	-.014	.015	-.075
V3245	.819	.045	.135	-.344	.000	-.231	.100	.003	.003
V3246	.848	.187	-.086	.119	-.002	.088	-.272	-.020	.092
V3247	.795	-.006	-.074	-.272	.003	.051	-.411	.080	-.079
V3252	.403	-.248	.539	.373	.034	.212	.139	-.228	.006
V3253	.338	-.111	.480	.464	-.094	.069	-.330	.288	.096
V3254	.445	.090	-.443	.186	-.137	.248	.322	.333	.380
V3255	.338	.048	.262	.641	-.404	.015	-.015	.093	.249
V3356	-.307	.727	-.165	-.130	.066	-.078	-.152	.272	-.054
V3357	-.130	.567	.346	.360	-.012	.030	-.194	.240	-.158
V3358	-.113	.155	.446	-.433	.173	-.259	.024	.196	.590
V3359	.058	.585	-.138	-.025	.481	.233	.402	-.100	-.092
V3360	-.169	-.217	.621	-.021	-.127	.255	.138	.054	-.354
V3361	-.022	.150	.471	-.241	-.289	.443	.332	.151	-.083
V3362	-.084	-.037	.504	-.244	.509	.408	.191	.118	.264
V3363	-.134	.756	.410	-.146	.086	.014	-.175	-.115	-.038
V3364	.469	.285	-.204	.362	.211	.435	.078	-.070	-.188
V3365	-.159	.649	.319	.029	-.358	-.366	-.030	.062	-.065
V3366	-.033	.429	-.392	.042	-.032	.529	-.252	.000	.069
V3367	-.374	.309	-.332	-.139	-.191	.272	-.159	-.460	.314
V3368	-.199	-.063	.002	.093	.757	-.048	-.313	.124	-.034

Notes: PCA on all variables in strand 3 except those with significant numbers of missing values. Extracted were factors with an eigenvalue > 1. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4.

The fourth strand seems to capture a single latent concept, and except of a single variable, all the variables are highly associated with a single factor. The removal of variable V4169 was already suggested as a means to increase the reliability of dimension 4.1 of the fourth strand. Once again, this variable appears to be strongly associated with a different concept, and is not strongly associated with the single factor identified in table 7.

Table 7: Principal Component Analysis on Strand 4

	1	*2*	*3*	*4*
V4169	.141	.427	-.180	.721
V4171	.409	.678	-.319	-.418
V4172	.510	.624	-.307	-.399
V4273	.474	.365	.781	.134
V4274	.474	.365	.781	.134
V4375	.792	-.148	-.132	-.121
V4377	.848	-.096	-.098	-.265
V4379	.739	-.299	.218	-.356
V4381	.797	-.221	.196	-.292
V4483	.629	.486	-.301	.348
V4484	.741	-.301	-.341	.288
V4486	.873	-.280	-.067	.303
V4487	.873	-.280	-.067	.303

Notes: PCA on all variables in strand 4 except those with significant numbers of missing values. Extracted were factors with an eigenvalue > 1. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4.

In connection with table 3, I suggested that there are possibly four different latent concepts combined in the fifth strand. Based on the analysis with eigenvalues greater than one, it appears that two or three different factors may dominate. The reliability of the strand is of course not affected by its lack of unidimensionality, but the removal of some of the variables would probably increase the reliability.

Table 8: Principal Component Analysis on Strand 5

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
V5188	.834	-.083	-.023	.071	.142	-.041	-.199	-.061
V5189	.661	.365	-.151	.064	-.158	-.289	.139	-.150
V5190	.686	-.006	-.022	.259	.120	-.447	.307	.120
V5191	.705	-.357	-.092	-.082	.095	.245	-.337	.051
V5192	.806	-.345	-.091	.108	.054	.333	.030	.000
V5193	-.279	-.588	.293	.273	.151	.251	.317	.134
V5294	.446	.446	.066	-.321	-.361	.449	-.001	.104
V52100	.240	.215	.368	-.039	-.771	.042	-.109	.003
V52102	.492	.145	-.009	-.482	.014	-.263	.083	-.492
V52103	.248	.165	.276	-.560	.476	-.252	.193	.099
V52104	.647	.106	-.328	-.128	.099	.080	.269	.239
V52105	.280	.322	-.434	-.177	-.019	.186	.267	.577
V52106	-.028	.344	-.466	.457	.006	.356	.240	-.359
V52107	.242	-.310	-.561	-.107	.245	.066	-.447	-.061
V53108	-.150	.648	.135	.270	.416	.036	-.304	.080
V53109	.050	.689	.297	.091	.290	.152	-.233	-.003
V53110	.445	.263	.414	.541	.180	.122	.008	.020
V53111	.519	-.222	.583	-.233	-.017	.052	-.269	.170
V53112	.278	-.082	.006	.546	-.248	-.500	-.189	.313
V54113	.274	-.169	.624	.020	.136	.209	.355	-.154
V54114	.824	-.133	-.030	.276	-.065	.037	.031	-.245

Notes: PCA on all variables in strand 5 except those with significant numbers of missing values. Extracted were factors with an eigenvalue > 1. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4.

For the sixth strand, the results presented above can be replicated. It appears that there is largely one factor, with some variables that capture something else. The removal of these items might increase the reliability of the strand as scale.

Table 9: Principal Component Analysis on Strand 6

	1	2	3	4	5	6	7
V61115	.723	.163	.429	-.068	-.206	-.123	-.220
V61116	.414	-.144	.443	-.143	.429	.088	.281
V61117	.568	.501	.008	-.266	-.069	.226	-.008
V61118	.337	.706	-.027	.080	-.257	-.011	-.029
V62119	.775	-.126	.058	-.284	-.293	.093	-.082
V62120	.784	-.018	.036	-.377	.107	.024	-.120
V62121	.771	-.020	-.355	-.120	.222	-.297	.082
V62122	.771	-.020	-.355	-.120	.222	-.297	.082
V62123	.904	-.166	-.209	-.034	.047	-.182	-.192
V62124	.848	-.311	-.209	-.111	.009	-.168	-.168
V63125	.271	.562	-.232	.496	.090	.010	-.038
V63126	.549	.504	.340	-.080	-.414	-.089	-.043
V63127	-.108	.206	-.111	.373	.445	.255	-.565
V63128	.409	-.037	-.640	.271	-.097	.309	.255
V62129	.636	-.199	-.474	-.091	-.104	.052	.081
V62130	.393	.512	.023	.053	-.370	.271	.348
V62131	-.005	-.129	-.077	.670	-.279	-.457	.119
V62132	.474	-.042	.242	.635	-.034	-.242	-.129
V62133	.516	.074	.079	.576	.131	.104	.009
V64134	.469	-.261	.459	-.029	-.038	.066	-.150
V64135	.583	-.399	.045	.205	.094	.428	.225
V64136	.206	-.668	.232	.334	-.321	.094	.140
V64137	.763	-.262	.273	.080	-.075	.045	-.053
V64138	.488	.356	-.067	.032	.550	-.073	.223
V64139	.171	.205	.694	.099	.424	-.170	.301
V64140	.372	-.073	.081	.191	.111	.533	-.185

Notes: PCA on all variables in strand 6 except those with significant numbers of missing values. Extracted were factors with an eigenvalue > 1. Highlighted in orange are the highest factor loadings for each variable, highlighted in yellow are any factor loadings greater than 0.4.

Taken together, the result of the overall factor analysis together with the analysis of the individual strands suggests that the different strands of MIPEX might not reflect six different latent concepts as implied by the presentation of the data by MIPEX. Some of the strands appear to capture a single latent concept, but not all of the variables included seem to capture this. In other words, the removal of variables not closely associated with the principal factor could increase the reliability of the scale. This is the case for strands 1, 4, and 6.

For the other factors, it appears that multiple latent concepts are picked up. Again, in addition to the variables associated with the different factors, there are variables associated with factors other than the dominant ones. The removal of these variables could increase the reliability of the scales. The fact that different factors could be identified suggests that different presentations of the data might be warranted: the presentation by MIPEX implies a separate underlying concept for each strand. The analysis here suggests that the different strands are not as independent as implied, and that some of the strands may actually capture two or more latent concepts.

Are There Easier Ways to Express MIPEX?

Based on the analysis presented, it appears that overall MIPEX is able to capture a latent concept. Each strand is reasonably reliable to be used as a scale, but the differences are not as clear as implied by the way MIPEX presents the data. Some of the different strands appear to measure the same latent concept; others appear to capture multiple concepts. It might be that the theory behind the different strands used in MIPEX needs to be revised—provided that the strands are based on clear theory rather than on an ad-hoc basis inspired by European Union directives. Without revision, it is unclear whether the indicators actually measure what they claim. Once a clear link between theory and indicators is established and confirmed by reliability analysis, it appears possible to reduce the number of indicators for the concepts captured. In the absence of more or better theory, it can be attempted to identify the latent concept underlying the four key factors identified in table 3.

Conclusion

In this paper I have examined the reliability of MIPEX 2007 as an overall scale, but also looked at the reliability of individual strands and dimensions. I removed variables with significant numbers of missing values in order to obtain meaningful results. Overall, MIPEX appears to be highly reliable, and most of the strands are also reliable measures. Individual dimensions identified by MIPEX, however, tend not to be reliable. Based on scale analysis, I highlighted the fact that most scales based on individual strands could be improved by removing individual items, at times significantly.

Using factor analysis, I complemented the scale analysis to examine whether the different scales were unidimensional, as implied by the presentation by MIPEX. Only three of the six strands appear to be unidimensional, and of all the strands there are variables that seem to be associated with latent concepts other than the key factors. Using principal component analysis, the analysis on the overall data in table 3 suggests that four factors would probably be enough to describe the data. What is more, the factors identified do not correspond to the strands identified by MIPEX.

It seems appropriate to problematize the use of MIPEX as an explanatory variable unless more theory is provided on the latent concepts that are supposed to be measured. With more and better theory it would be possible to optimize the scales. Where there is no reason to use the MIPEX strands, it is perhaps appropriate to consider different ways to present the data. The results of the principal component analysis in table 3 together with theoretical consideration are probably the best guides to this end. A different approach is the use of confirmatory factor analysis to verify that the MIPEX strands are better than other solutions. Without additional theory it is difficult to be certain whether MIPEX data are comparable to concepts they imply to measure.

It is probably possible to simplify MIPEX data by focusing on a smaller number of items. This is of course not an option if the individual items are of concern in a particular study; but when the interest is on MIPEX in a general sense, this is an option. In either case, MIPEX 2007 has the advantage of providing comparable data in 28 countries, which is a great benefit for comparative studies. Depending on the analysis, however, it seems appropriate not to be constrained by the data presentation chosen by MIPEX, but use the variables in a different way. In this case, theory together with reliability analysis can be useful to inform the choices. In contrast, relying on data not collected within the MIPEX framework may mean that cross-national comparability is reduced, as data are rarely collected in such a systematic way.

Theory can also inform us whether it is meaningful to expect Mokken scales rather than scales in an additive sense. Mokken scales imply that the implementation of a particular policy means that other policies at a lower level are likely to be implemented, too. Such scales would be appropriate if it is the case that countries tend to implement some measures first and then others later in a relatively linear fashion. In any case, the overall reliability of the scales suggests that MIPEX can be used empirically. With a stronger link to theoretical considerations, however, the data might be used in a better way.

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