Structural Equation Modeling of PIAAC Data

Overview of Models and Examples

Path analysis

Data

Norwegian PIAAC data obtained from the public-use files (see OECD, 2016a,b)

Models

Models	Description
REG1	Regression models with two manifest predictors CURIOUS and LIFE (i.e., scale means) of problem-solving performance PSTRE (a) Model with PV1 and total weights (b) Model with PV1-PV10 and total weights (c) Model with PV1-PV10, total weights, clustering, and stratification (d) Model with PV1-PV10, total weights, and replication weights (e) Model REG1d with equal regression coefficients—Option 1 (f) Model REG1d with equal regression coefficients—Option 2
PATH2	Path models with the relations CURIOUS → LIFE → PSTRE (a) Model with all paths included and two forms of estimating the direct and indirect effects (b) Model without the *c*-path (c) Model PATH2a with gender as a grouping variable (d) Model PATH2c with equal *a*- and *b*-paths across gender (e) Model PATH2c with equal indirect effects across gender
PATH3	Path models with complex relations among background variables, CURIOUS, LIFE, and PSTRE (a) Model with all possible paths and two correlated mediators (b) Model PATH3 without the *c*-paths

Confirmatory factor analysis (CFA)

Data

Norwegian PIAAC data obtained from the public-use files (see OECD, 2016a,b)

Models

Models	Description
CFA1	CFA models with a single latent variable representing CURIOUS (a) Model with continuous treatment of indicators and the MLR estimator (b) Model CFA1a modified by including a residual covariance (c) Model CFA1b with categorical treatment of indicators and the WLSMV estimator
CFA2	CFA models with two latent variables representing SKILLS (a) Model with two correlated factors (b) Model with two correlated factors and residual correlations

Structural equation models (SEM)

Data

Norwegian PIAAC data obtained from the public-use files (see OECD, 2016a,b)

Models

Models	Description
SEM1	Structural equation models with complex relations among background variables, CURIOUS, LIFE, and PSTRE and latent variables representing CURIOUS and LIFE (a) Model with all possible paths and two correlated mediators (as PATH3a) (b) Model SEM1a with two modifications (a residual covariance and a uniform DIF effect of FEMALE)

Multi-group structural equation models (MGSEM)

Data

- Norwegian PIAAC data obtained from the public-use files (see OECD, 2016a,b)
- PIAAC data for 27 participating countries, excluding the data from Austria, Cyprus, the Russian Federation, and Turkey (see Borgonovi & Pokropek, 2017), obtained from the public-use files (see OECD, 2016c)
- Country-level data on the Human Development Index (HDI) 2012 (https://countryeconomy.com/hdi?year=2012) and Hofstede's Uncertainty Avoidance Index (UAI; https://www.hofstede-insights.com/product/compare-countries/)

Models

Models	Description
MGCFA1	Multi-group CFA of the latent variable CURIOUS across gender (a) Model CFA1b with a grouping option (b) Model MGCFA1a with configural measurement invariance (c) Model MGCFA1a with metric measurement invariance (d) Model MGCFA1a with scalar measurement invariance (e) Model MGCFA1a with strict measurement invariance (f) Model MGCFA1a with multiple levels of measurement invariance
MGSEM2	Multi-group SEM with complex relations among background variables, CURIOUS, LIFE, and PSTRE and latent variables representing CURIOUS and LIFE (a) Model SEM1b with configural measurement invariance across gender (b) Model SEM1b with metric measurement invariance across gender (c) Model SEM1b with metric measurement invariance and invariance of regression coefficients across gender
MGCFA3	Multi-group CFA of the latent variable CURIOUS across countries (a) Model MGCFA1a with configural measurement invariance (b) Model MGCFA1a with metric measurement invariance (c) Model MGCFA1a with scalar measurement invariance (d) Convenience option to run MGCFA3a-d simultaneously

Alignment methods

Data

- PIAAC data for 27 participating countries, excluding the data from Austria, Cyprus, the Russian Federation, and Turkey (see Borgonovi & Pokropek, 2017), obtained from the public-use files (see OECD, 2016c)
- Country-level data on the Human Development Index (HDI) 2012 (https://countryeconomy.com/hdi?year=2012) and Hofstede's Uncertainty Avoidance Index (UAI; https://www.hofstede-insights.com/product/compare-countries/)

Models

Models	Description
ALIGN1	Exploratory alignment optimization method based on model CFA1b (a) Free alignment method (b) Fixed alignment method (Poland as the reference country)
ALIGN2	Alignment-with-CFA based on models CFA1b and ALIGN1a

Multilevel structural equation models (MSEM)

Data

- PIAAC data for 27 participating countries, excluding the data from Austria, Cyprus, the Russian Federation, and Turkey (see Borgonovi & Pokropek, 2017), obtained from the public-use files (see OECD, 2016c)
- Country-level data on the Human Development Index (HDI) 2012 (https://countryeconomy.com/hdi?year=2012) and Hofstede's Uncertainty Avoidance Index (UAI; https://www.hofstede-insights.com/product/compare-countries/)

Models

Models	Description
MCFA1	Multilevel single-factor model of CURIOUS with two levels: Level 1 (within)—individual participants, Level 2 (between)—countries (a) CFA at level 1, null model at level 2 (b) CFA at level 1, independence model at level 2 (c) CFA at level 1, saturated model at level 2 (d) CFA at level 1 modified, saturated model at level 2 (e) Saturated model at level 1, CFA at level 2 (f) Saturated model at level 1, CFA at level 2 modified (g) CFA at level 1 modified, CFA at level 2 modified (*final model*) (h) Model MCFA1g with cross-level metric invariance (i) Model MCFA1g with cross-level metric and residual invariance (j) Model MCFA1d with a random factor loading
MSEM2	Multilevel structural equation model with country-level predictors HDI and UAI of CURIOUS (a) MSEM based on MCFA1f and including HDI2012 and UAI as correlated predictors (b) MSEM based on MCFA1g and including HDI2012 and UAI as correlated predictors

PIAAC Cycle 1: Country Selection

Country	Frequency	Percent	Valid Percent	Cumulative Percent	ISO Code
Belgium	5463	3.0	3.0	3.0	56
Canada	26683	14.7	14.7	17.7	124
Chile	5212	2.9	2.9	20.6	152
Czech Republic	6102	3.4	3.4	24.0	203
Denmark	7328	4.0	4.0	28.0	208
Estonia	7632	4.2	4.2	32.2	233
Finland	5464	3.0	3.0	35.2	246
France	6993	3.9	3.9	39.1	250
Germany	5465	3.0	3.0	42.1	276
Greece	4925	2.7	2.7	44.8	300
Ireland	5983	3.3	3.3	48.1	372
Israel	5538	3.1	3.1	51.2	376
Italy	4621	2.5	2.5	53.7	380
Japan	5278	2.9	2.9	56.7	392
Korea	6667	3.7	3.7	60.3	410
Lithuania	5093	2.8	2.8	63.1	440
Netherlands	5170	2.9	2.9	66.0	528
New Zealand	6177	3.4	3.4	69.4	554
Norway	5128	2.8	2.8	72.2	578
Poland	9366	5.2	5.2	77.4	616
Singapore	5468	3.0	3.0	80.4	702
Slovak Republic	5723	3.2	3.2	83.6	703
Slovenia	5331	2.9	2.9	86.5	705
Spain	6055	3.3	3.3	89.9	724
Sweden	4469	2.5	2.5	92.3	752
United Kingdom	8892	4.9	4.9	97.2	826
United States	5010	2.8	2.8	100.0	840
Total	**181236**	**100.0**	**100.0**		

References

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