

SEM Syntax

Jamovi

Structural Equation Modeling



1	PE =~ PE1 + PE2 + PE3
2	EE =~ EE1 + EE2 + EE3
3	SI =~ SI1 + SI2 + SI3 + SI4
4	FC =~ FC1 + FC2 + FC3
5	BI =~ BI2 + BI3 + BI4
6	AU =~ AU2 + AU3 + AU4
7	AU~BI+FC
8	BI~PE+EE+SI
9	



▼ | Model options

Estimation

Method

Automatic ▼

ML likelihood approach

Automatic ▼

Data

Missing values

Delete listwise ▼

Constraints tests



Univariate



Cumulative

Standard Errors

- ☐ Automatic
- ☐ Standard
- ☐ Robust
- ☐ Pseudo ML
- ☒ Bootstrap

Bootstrap settings

- ☐ percentiles
- ☐ normal
- ☒ adjusted bias-corrected
- ☐ basic
- Bootstrap Rep.
- ☐ Parallel Computation

Confidence Intervals

- ☒ Estimates
- ☒ Betas
- Confidence level %

Constraints

- ☐ Fix exogenous covariates
- ☒ Correlated dependent vars (y)
- ☒ Correlated latent vars

Intercepts

- ☒ Mean structure
- ☒ Observed variables
- ☐ Latent variables

Estimates

- ☒ Indirect Effects

Scale / standardize variables

- ☒ Latent vars.: Fix first indicator (to 1)
- ☐ Latent vars.: Fix residual variances (to 1)
- ☐ Observed vars.: Standardize before estimation

▼ | Output options

Information

- ☐ Show parameters labels
- ☐ Show syntax examples
- ☐ Show Lavaan Options

Additional outputs

- ☒ Additional fit measures
- ☐ Mardia's coefficients
- ☒ Reliability indices
- ☒ HTMT

R-squared

- ☐ None
- ☒ Endogenous
- ☐ All

Covariances and correlations

- ☐ Observed
- ☐ Model-implied (fitted)
- ☐ Residual
- ☐ Model-implied latent

Modification indices

- ☒ Modification indices
- ☐ Hide low indices

Threshold 10

Save Predicted

- ☐ Factor Scores
- ☐ Indicators
- ☐ Dependent variables

Measurement model										
Latent	Observed	Estimate	SE	95% Confidence Intervals		β	β 95% Confidence Intervals		z	p
				Lower	Upper		Lower	Upper		
PE	PE1	1.000	0.0000	1.000	1.00	0.887	0.840	0.934		
	PE2	1.048	0.0438	0.960	1.14	0.934	0.904	0.963	23.9	0.00
	PE3	0.957	0.0415	0.873	1.04	0.890	0.845	0.936	23.0	0.00
EE	EE1	1.000	0.0000	1.000	1.00	0.886	0.844	0.928		
	EE2	0.961	0.0371	0.891	1.03	0.896	0.858	0.935	25.9	0.00
	EE3	0.968	0.0402	0.896	1.05	0.854	0.787	0.921	24.1	0.00
SI	SI1	1.000	0.0000	1.000	1.00	0.834	0.778	0.891		
	SI2	1.067	0.0808	0.908	1.23	0.834	0.771	0.896	13.2	0.00
	SI3	1.085	0.0553	0.996	1.21	0.896	0.856	0.936	19.6	0.00
	SI4	0.996	0.0600	0.884	1.13	0.856	0.802	0.910	16.6	0.00
FC	FC1	1.000	0.0000	1.000	1.00	0.838	0.767	0.908		
	FC2	1.030	0.0623	0.895	1.14	0.892	0.823	0.962	16.5	0.00
	FC3	1.082	0.0708	0.959	1.25	0.856	0.797	0.915	15.3	0.00
BI	BI2	1.000	0.0000	1.000	1.00	0.907	0.870	0.945		
	BI3	0.927	0.0422	0.838	1.00	0.862	0.814	0.910	21.9	0.00
	BI4	0.983	0.0363	0.914	1.06	0.907	0.870	0.943	27.1	0.00
AU	AU2	1.000	0.0000	1.000	1.00	0.884	0.840	0.928		
	AU3	0.960	0.0445	0.864	1.04	0.899	0.849	0.949	21.5	0.00
	AU4	1.001	0.0478	0.907	1.09	0.923	0.895	0.952	20.9	0.00

Reliability indices

Variable	α	ω_1	ω_2	ω_3	AVE
PE	0.929	0.931	0.931	0.931	0.817
EE	0.910	0.910	0.910	0.909	0.771
SI	0.915	0.916	0.916	0.917	0.731
FC	0.893	0.896	0.896	0.900	0.742
BI	0.926	0.922	0.922	0.914	0.797
AU	0.929	0.929	0.929	0.930	0.813

Table X
Discriminant Validity (Fornell–Larcker Criterion)

Construct	PE	EE	SI	FC	BI	AU
PE	0.904	0.850	0.831	0.754	0.232	0.169
EE	0.850	0.878	0.829	0.904	0.232	0.169
SI	0.831	0.829	0.855	0.789	0.232	0.169
FC	0.754	0.904	0.789	0.861	0.232	0.169
BI	0.232	0.232	0.232	0.232	0.893	0.169
AU	0.169	0.169	0.169	0.169	0.169	0.902

Note. Diagonal values represent the square root of AVE. Off-diagonal values represent standardized correlations among constructs. Discriminant validity is supported when diagonal values exceed inter-construct correlations (Fornell and Larcker, 1981)

Heterotrait-monotrait (HTMT) ratio of correlations

	PE	EE	SI	FC	BI	AU
PE	1.000	0.852	0.835	0.769	0.697	0.694
EE	0.852	1.000	0.830	0.906	0.792	0.739
SI	0.835	0.830	1.000	0.784	0.824	0.838
FC	0.769	0.906	0.784	1.000	0.799	0.673
BI	0.697	0.792	0.824	0.799	1.000	0.887
AU	0.694	0.739	0.838	0.673	0.887	1.000

User model versus baseline model

	Model
Comparative Fit Index (CFI)	0.950
Tucker-Lewis Index (TLI)	0.940
Bentler-Bonett Non-normed Fit Index (NNFI)	0.940
Relative Noncentrality Index (RNI)	0.950
Bentler-Bonett Normed Fit Index (NFI)	0.924
Bollen's Relative Fit Index (RFI)	0.908
Bollen's Incremental Fit Index (IFI)	0.951
Parsimony Normed Fit Index (PNFI)	0.762

Fit indices

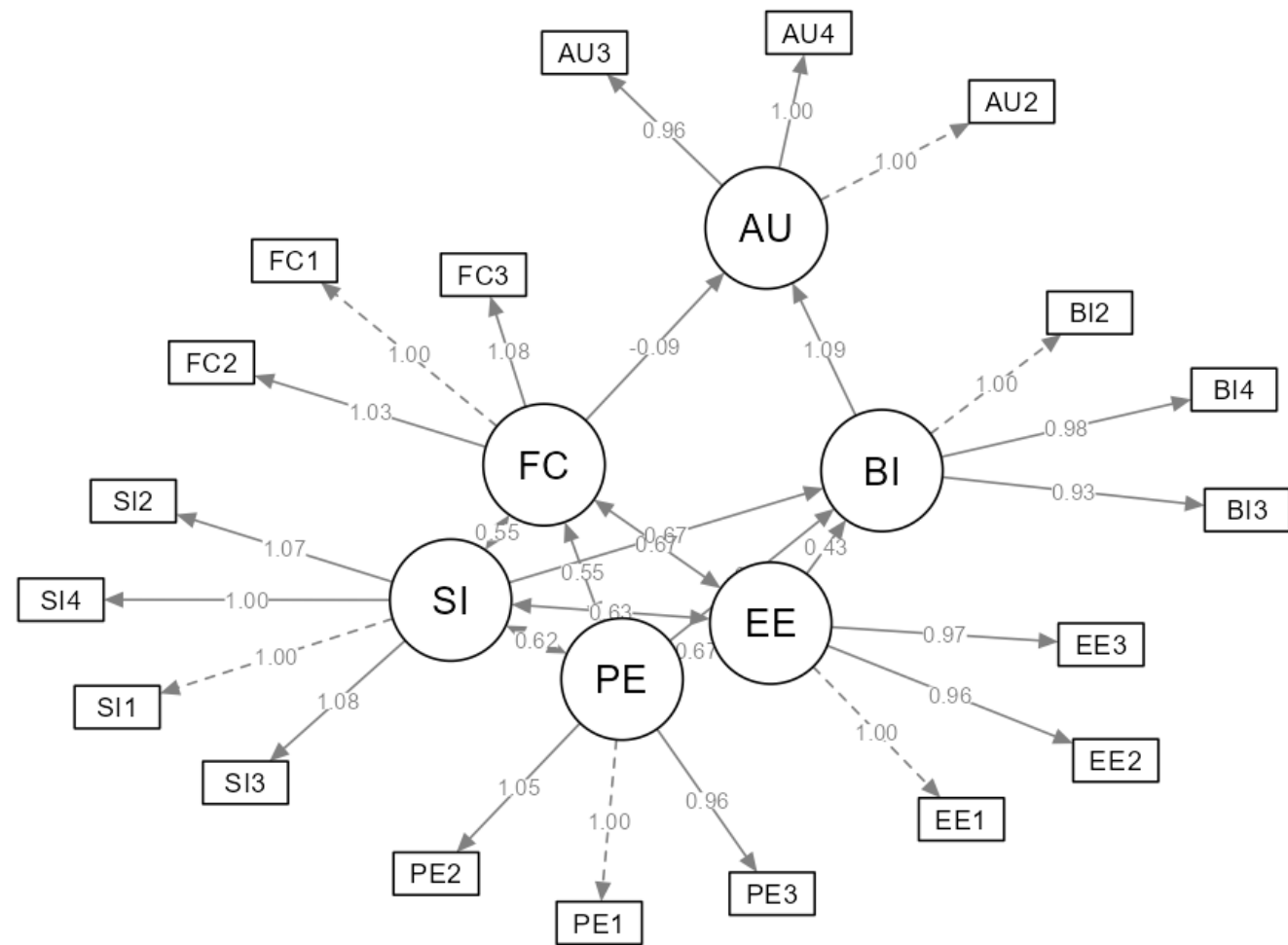
		95% Confidence Intervals		RMSEA p
SRMR	RMSEA	Lower	Upper	
0.038	0.084	0.074	0.094	4.03e-8

Parameters estimates

Dep	Pred	Estimate	SE	95% Confidence Intervals		β	β 95% Confidence Intervals		z	p
				Lower	Upper		Lower	Upper		
AU	BI	1.0919	0.168	0.750	1.40386	0.9665	0.729	1.2041	6.487	8.74e-11
AU	FC	-0.0860	0.166	-0.375	0.30754	-0.0735	-0.349	0.2020	-0.519	0.60394
BI	PE	-0.2065	0.126	-0.498	0.00214	-0.2134	-0.467	0.0398	-1.635	0.10202
BI	EE	0.4253	0.139	0.162	0.71381	0.4434	0.166	0.7213	3.060	0.00221
BI	SI	0.6688	0.162	0.416	1.05238	0.6599	0.367	0.9529	4.130	3.62e0-5

Defined parameters

Label	Desc ription	Parameter	Estimate	SE	95% Confidence Intervals		β	β 95% Confidence Intervals		z	p
					Lower	Upper		Lower	Upper		
IE1	PE $\Rightarrow$ BI $\Rightarrow$ AU	p22* p20	-0.225	0.150	-0.522	0.010	-0.206	-0.450	0.0371	-1.507	0.1317
IE2	EE $\Rightarrow$ BI $\Rightarrow$ AU	p23* p20	0.464	0.198	0.159	0.891	0.429	0.120	0.7374	2.346	0.0190
IE3	SI $\Rightarrow$ BI $\Rightarrow$ AU	p24* p20	0.730	0.199	0.421	1.171	0.638	0.331	0.9443	3.674	2.39e-4



CFA ใน Jamovi

Structural Equation Modeling



```
1 PE=~PE1+PE2+PE3+PE4
2 EE=~EE1+EE2+EE3+EE4
3 SI=~SI1+SI2+SI3+SI4
4 FC=~FC1+FC2+FC3+FC4
5 AU=~AU1+AU2+AU3+AU4
6 BI=~BI1+BI2+BI3+BI4
7 |
```



Ctrl + Shift + Enter to run

☐ Do not run

▼ | Model options

Estimation

Method

Automatic ▼

ML likelihood approach

Automatic ▼

Data

Missing values

Delete listwise ▼

Constraints tests



Univariate



Cumulative

Standard Errors

- ☐ Automatic
☐ Standard
☐ Robust
☐ Pseudo ML
☒ Bootstrap

Bootstrap settings

- ☒ percentiles
☐ normal
☐ adjusted bias-corrected
☐ basic
Bootstrap Rep.
☐ Parallel Computation

Confidence Intervals

- ☒ Estimates
☒ Betas
Confidence level %

Constraints

- ☐ Fix exogenous covariates
☒ Correlated dependent vars (y)
☒ Correlated latent vars

Intercepts

- ☒ Mean structure
☒ Observed variables
☐ Latent variables

Estimates

- ☒ Indirect Effects

Scale / standardize variables

- ☒ Latent vars.: Fix first indicator (to 1)
☐ Latent vars.: Fix residual variances (to 1)
☐ Observed vars.: Standardize before estimation

▼ | Multi-group analyses

Factor for multi-group analysis

Equality constraints

- | | | |
|-------------------------------------|---|---|
| ☐ Loadings | ☐ Threshold | ☐ Regressions |
| ☐ Intercepts | ☐ Residuals | ☐ Latent variances |
| ☐ Means | ☐ Residual covariances | ☐ Latent covariances |

▼ | Multi-level analysis

Factor for multi-level cluster

Show

- ☐ ICC
- ☐ Between-Within Means

▼ | Exploratory SEM options

Rotation

Method

Geomin



Algorithm

gpa



☐ Orthogonal

☐ Standardize observed vars

Rotations options

Geomin Epsilon

0.001

Orthomax Gamma

1

Oblimin Gamma

0

▼ | Output options

Information

- ☐ Show parameters labels
- ☐ Show syntax examples
- ☐ Show Lavaan Options

Additional outputs

- ☐ Additional fit measures
- ☐ Mardia's coefficients
- ☐ Reliability indices
- ☐ HTMT

R-squared

- ☐ None
- ☒ Endogenous
- ☐ All

Covariances and correlations

- ☐ Observed
- ☐ Model-implied (fitted)
- ☐ Residual
- ☐ Model-implied latent

Modification indices

- ☐ Modification indices
- ☐ Hide low indices

Threshold 10

Save Predicted

- ☐ Factor Scores
- ☐ Indicators
- ☐ Dependent variables

▼ | Path diagram

☐ **Path diagram**

☐ show residuals ☐ show intercepts

Paths

- ☒ Coefficients
☐ Betas
☐ Labels
☐ None

Layout

Type ▼
Rotate ▼

Nodes

Node Size ▼
Manifest shapes ▼
Latent shapes ▼
Abbreviate ▼

SEM>Jamovi

Structural Equation Modeling



- PETotal
- EE1
- EE2
- EE3
- EE4
- EETotal
- SI1
- SI2
- SI3
- SI4
- SITotal
- FC1
- FC2
- FC3
- FC4
- FCTotal
- BI1
- BI2
- BI3
- BI4



Latent Endogenous Variables

AU

AU1

AU2

AU3

AU4

BI

Add New Latent



Latent Exogenous Variables

SI4

FC

FC1

FC2

FC3

FC4

Add New Latent

▼ | Endogenous models

Defined Factors

AU

BI

PE

EE

SI

FC



Endogenous Variables Models

Endogenous = AU

FC

BI

Endogenous = BI

SI

EE

PE

▼ | Variances and covariances

AU
BI
PE
EE
SI
FC
AU1
AU2



Select pairs

Correlated

- ☒ Dependent vars (y)
- ☒ Latent vars

▼ | Model options

Estimation

Method

Automatic ▼

ML likelihood approach

Automatic ▼

Data

Missing values

Delete listwise ▼

Constraints tests



Univariate



Cumulative

Parameters options

Standard Errors

- ☐ Automatic
☐ Standard
☐ Robust
☐ Pseudo ML
☒ Bootstrap

Bootstrap settings

- ☐ percentiles
☐ normal
☒ adjusted bias-corrected
☐ basic
Bootstrap Rep.
☐ Parallel Computation

Confidence Intervals

- ☒ Estimates
☒ Betas
Confidence level %

Constraints

- ☐ Fix exogenous covariates

Intercepts

- ☒ Mean structure
☒ Observed variables
☐ Latent variables

Estimates

- ☒ Indirect Effects

Scale / standardize variables

- ☒ Latent vars.: Fix first indicator (to 1)
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- ☒ HTMT

R-squared

- ☐ None
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Covariances and correlations

- ☐ Observed
- ☐ Model-implied (fitted)
- ☒ Residual
- ☐ Combined into one table
- ☐ Model-implied latent

Modification indices

- ☒ Modification indices
- ☐ Hide low indices

Threshold 10

Save Predicted

- ☐ Factor Scores
- ☐ Indicators
- ☐ Dependent variables

▼ | Path diagram

☒ Path diagram **Path diagram**

☐ show residuals ☐ show intercepts

Paths

- ☐ Coefficients
☒ Betas
☐ Labels
☐ None

Layout

Type ▼
Rotate ▼

Nodes

Node Size ▼
Manifest shapes ▼
Latent shapes ▼
Abbreviate ▼

Factor loadings ควรมากกว่า 0.70 (Hair et al., 2019)

Composite reliability (CR) ควรมากกว่า 0.70 (Hair et al., 2019)

Average variance extracted (AVE) ควรมากกว่า 0.50 (Fornell and Larcker, 1981)

Discriminant validity ควรมีค่า HTMT น้อยกว่า 0.90 (Henseler, Ringle and Sarstedt, 2015)

Comparative Fit Index (CFI) ควรมากกว่า 0.90 (Hu and Bentler, 1999)

Root Mean Square Error of Approximation (RMSEA) ควรน้อยกว่า 0.08 (Hu and Bentler, 1999)

Standardized Root Mean Square Residual (SRMR) ควรน้อยกว่า 0.08 (Hu and Bentler, 1999)

Measurement model										
Latent	Observed	Estimate	SE	95% Confidence Intervals		β	β 95% Confidence Intervals		z	p
				Lower	Upper		Lower	Upper		
PE	PE1	1.000	0.0000	1.000	1.000	0.917	0.886	0.948		
	PE2	1.031	0.0210	0.994	1.077	0.911	0.881	0.941	49.1	0.00
	PE3	0.980	0.0379	0.908	1.055	0.892	0.854	0.931	25.9	0.00
	PE4	0.964	0.0453	0.878	1.064	0.882	0.841	0.922	21.3	0.00
EE	EE1	1.000	0.0000	1.000	1.000	0.876	0.840	0.911		
	EE2	0.980	0.0291	0.922	1.036	0.897	0.862	0.932	33.7	0.00
	EE3	0.989	0.0240	0.943	1.036	0.847	0.793	0.900	41.2	0.00
	EE4	0.968	0.0314	0.910	1.030	0.903	0.875	0.931	30.9	0.00
SI	SI1	1.000	0.0000	1.000	1.000	0.813	0.761	0.865		
	SI2	1.014	0.0648	0.894	1.149	0.759	0.693	0.826	15.6	0.00
	SI3	1.017	0.0505	0.916	1.119	0.829	0.770	0.888	20.1	0.00
	SI4	1.054	0.0484	0.964	1.159	0.854	0.811	0.897	21.8	0.00
FC	FC1	1.000	0.0000	1.000	1.000	0.841	0.781	0.901		
	FC2	1.023	0.0292	0.967	1.080	0.878	0.823	0.933	35.0	0.00
	FC3	1.106	0.0573	1.014	1.248	0.878	0.841	0.915	19.3	0.00
	FC4	0.920	0.0517	0.821	1.030	0.741	0.665	0.817	17.8	0.00
AU	AU1	1.000	0.0000	1.000	1.000	0.879	0.848	0.910		
	AU2	0.974	0.0376	0.899	1.051	0.882	0.843	0.921	25.9	0.00
	AU3	0.938	0.0344	0.873	1.007	0.895	0.859	0.930	27.3	0.00
	AU4	0.991	0.0293	0.930	1.046	0.929	0.909	0.949	33.9	0.00
BI	BI1	1.000	0.0000	1.000	1.000	0.906	0.881	0.931		
	BI2	0.904	0.0262	0.852	0.955	0.924	0.901	0.946	34.5	0.00
	BI3	0.926	0.0308	0.866	0.986	0.879	0.847	0.910	30.0	0.00
	BI4	0.914	0.0290	0.856	0.971	0.903	0.871	0.935	31.5	0.00

Reliability indices

Variable	α	ω_1	ω_2	ω_3	AVE
PE	0.945	0.945	0.945	0.945	0.811
EE	0.932	0.932	0.932	0.931	0.773
SI	0.894	0.886	0.886	0.869	0.660
FC	0.899	0.902	0.902	0.904	0.698
AU	0.942	0.942	0.942	0.951	0.802
BI	0.945	0.946	0.946	0.946	0.814

Heterotrait-monotrait (HTMT) ratio of correlations

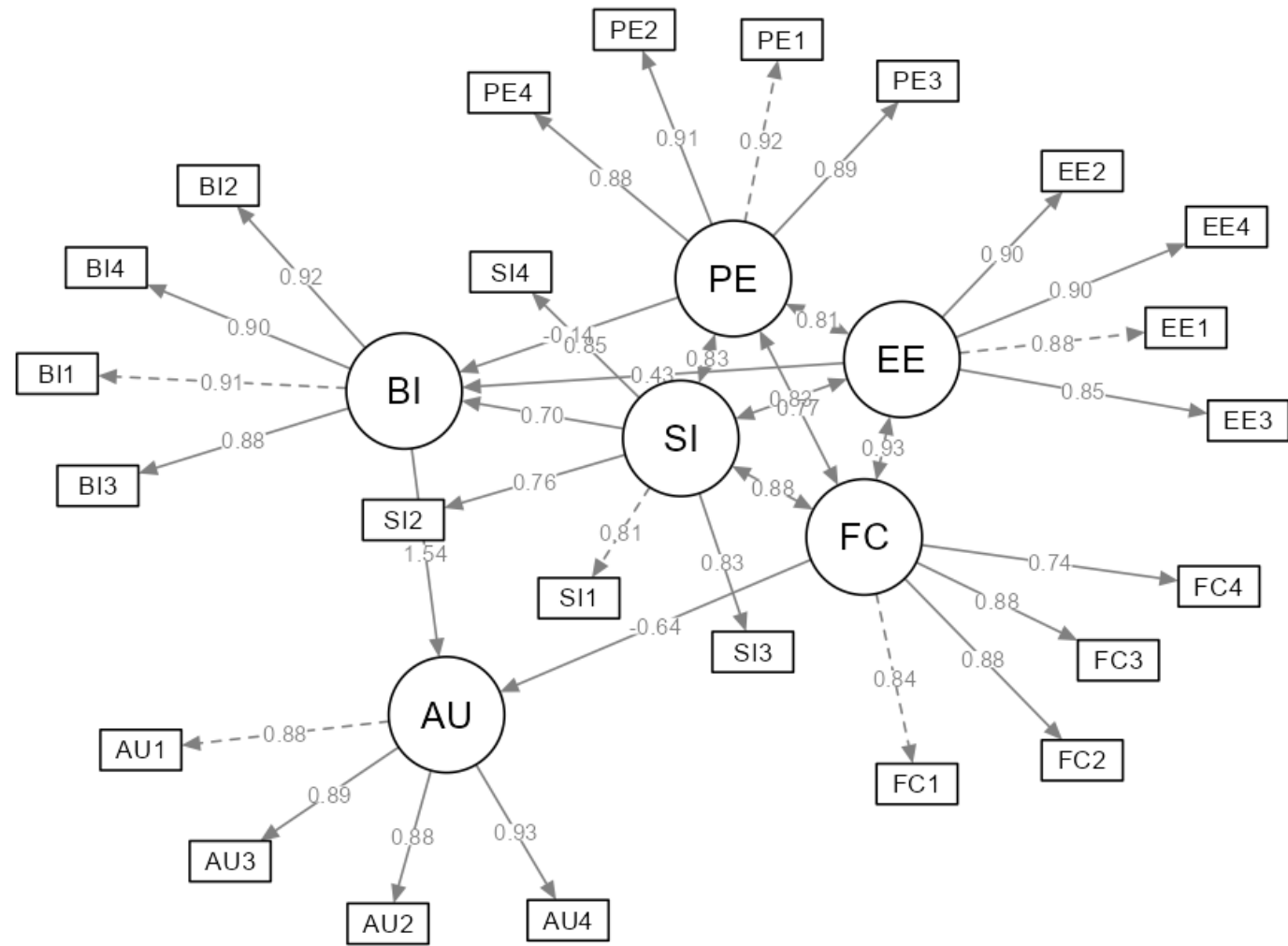
	PE	EE	SI	FC	AU	BI
PE	1.000	0.816	0.816	0.789	0.730	0.803
EE	0.816	1.000	0.820	0.904	0.804	0.905
SI	0.816	0.820	1.000	0.867	0.890	0.916
FC	0.789	0.904	0.867	1.000	0.794	0.946
AU	0.730	0.804	0.890	0.794	1.000	0.947
BI	0.803	0.905	0.916	0.946	0.947	1.000

User model versus baseline model

	Model
Comparative Fit Index (CFI)	0.851
Tucker-Lewis Index (TLI)	0.829
Bentler-Bonett Non-normed Fit Index (NNFI)	0.829
Relative Noncentrality Index (RNI)	0.851
Bentler-Bonett Normed Fit Index (NFI)	0.830
Bollen's Relative Fit Index (RFI)	0.806
Bollen's Incremental Fit Index (IFI)	0.851
Parsimony Normed Fit Index (PNFI)	0.725

Fit indices

		95% Confidence Intervals		RMSEA p
SRMR	RMSEA	Lower	Upper	
0.047	0.139	0.133	0.145	7.99e-15



Parameters estimates

Dep	Pred	Estimate	SE	95% Confidence Intervals		β	β 95% Confidence Intervals		z	p
				Lower	Upper		Lower	Upper		
AU	FC	-0.756	0.2172	-1.281	-0.4573	-0.642	-0.983	-0.3001	-3.48	5.03e-4
AU	BI	1.662	0.1940	1.408	2.1345	1.540	1.218	1.8617	8.57	0.000
BI	SI	0.784	0.1449	0.505	1.0768	0.701	0.475	0.9259	5.41	6.41e-8
BI	EE	0.449	0.0869	0.284	0.6392	0.432	0.261	0.6040	5.17	2.39e-7
BI	PE	-0.144	0.0993	-0.337	0.0355	-0.138	-0.323	0.0479	-1.45	0.147

Defined parameters

Label	Description	Parameter	Estimate	SE	95% Confidence Intervals		β	β 95% Confidence Intervals		z	p
					Lower	Upper		Lower	Upper		
IE1	SI $\Rightarrow$ BI $\Rightarrow$ AU	p27* p26	1.302	0.291	0.857	1.944	1.079	0.681	1.4760	4.474	7.69e-6
IE2	EE $\Rightarrow$ BI $\Rightarrow$ AU	p28* p26	0.746	0.198	0.442	1.232	0.666	0.330	1.0014	3.758	1.71e-4
IE3	PE $\Rightarrow$ BI $\Rightarrow$ AU	p29* p26	-0.239	0.180	-0.618	0.061	-0.212	-0.509	0.0848	-1.326	0.185