

Covariance-Based Structural Equation Model

Standalone verified Python analysis

Test: Covariance-Based Structural Equation Model

Design: ML measurement model followed by latent-score structural regression for academic achievement.

Variables: G1, G2, G3, famrel, freetime, goout, studytime, failures

Null hypothesis: Social, study-time, and failure paths jointly explain no academic-score variance.

Formula: Measurement: $\Sigma = \Lambda \Phi \Lambda' + \Theta$; structural: $\eta = B \eta + \Gamma x + \zeta$.

Source rows: 649

Calculated metrics:

chi_square: 13.76397207713822

cfi: 0.9973982062491278

rmsea: 0.03334482463134081

social_path: -0.047089820120738896

studytime_path: 0.2030470703509362

failures_path: -0.3725739993744453

structural_r_squared: 0.20849058206409432

Independent reference values:

chi_square: 13.76397207713822

cfi: 0.9973982062491278

rmsea: 0.03334482463134081

social_path: -0.047089820120738896

studytime_path: 0.2030470703509362

failures_path: -0.3725739993744453

structural_r_squared: 0.20849058206409432

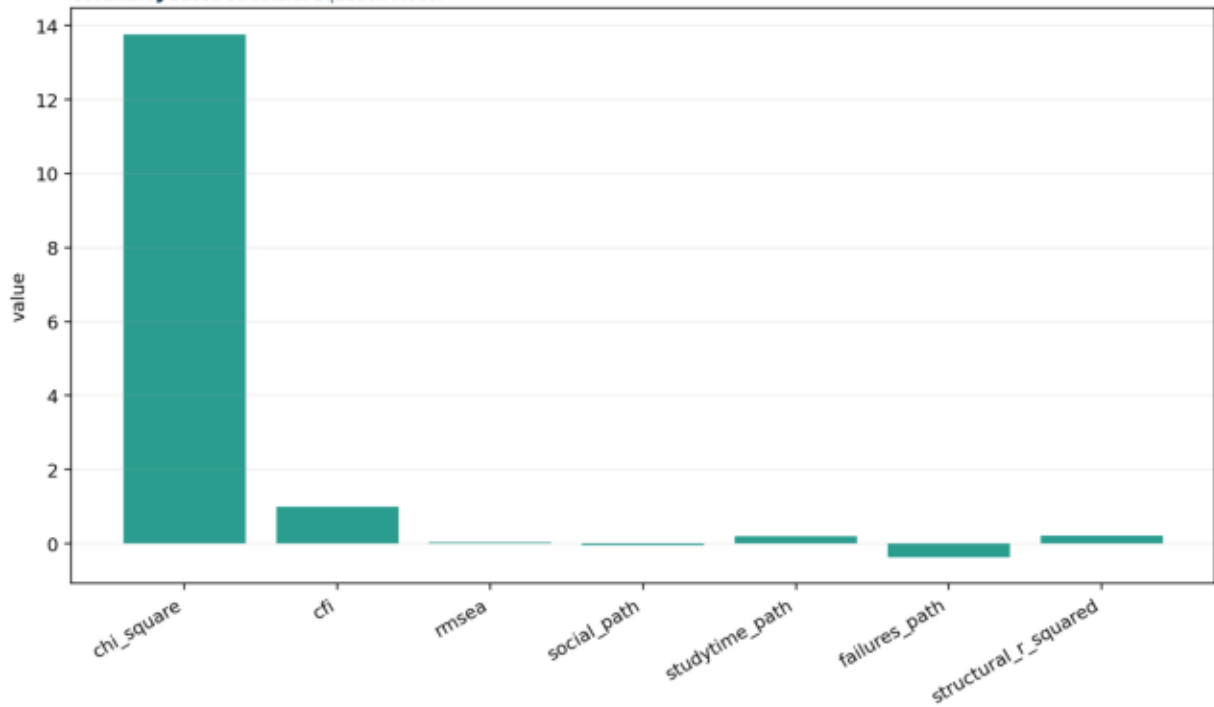
Interpretation:

CB-SEM evaluates covariance reproduction before score-based structural paths.

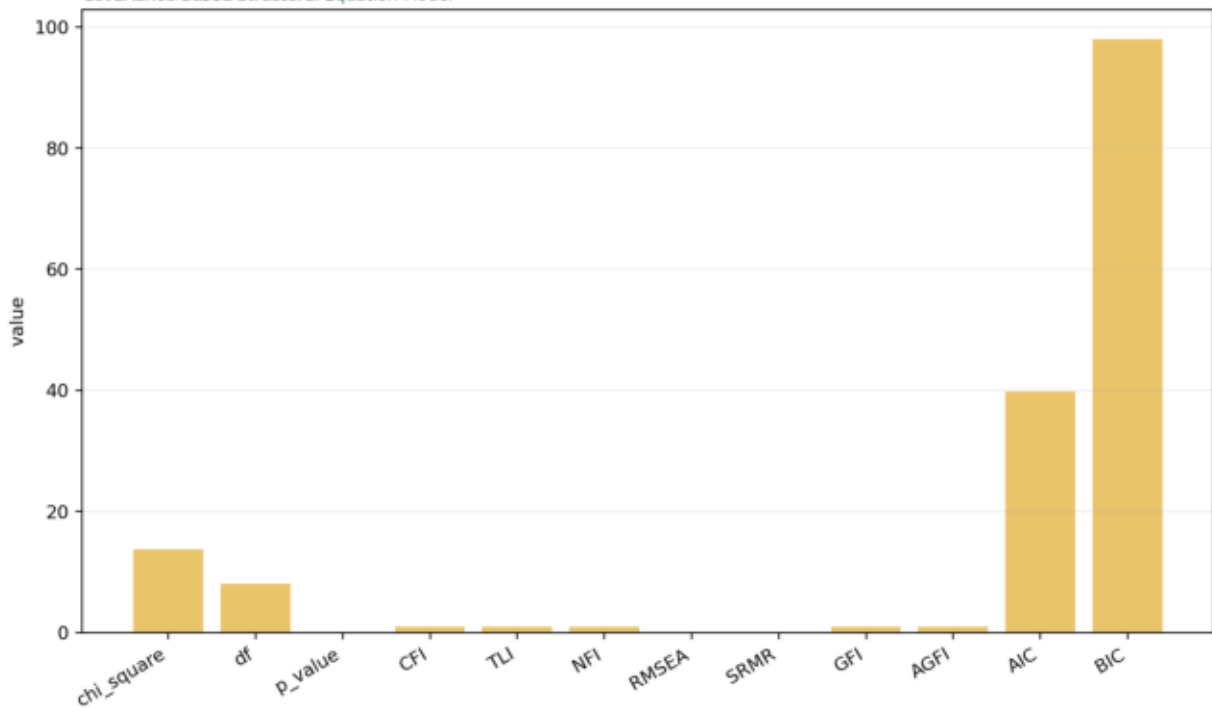
Structural R-squared=0.208491.

Primary Metrics

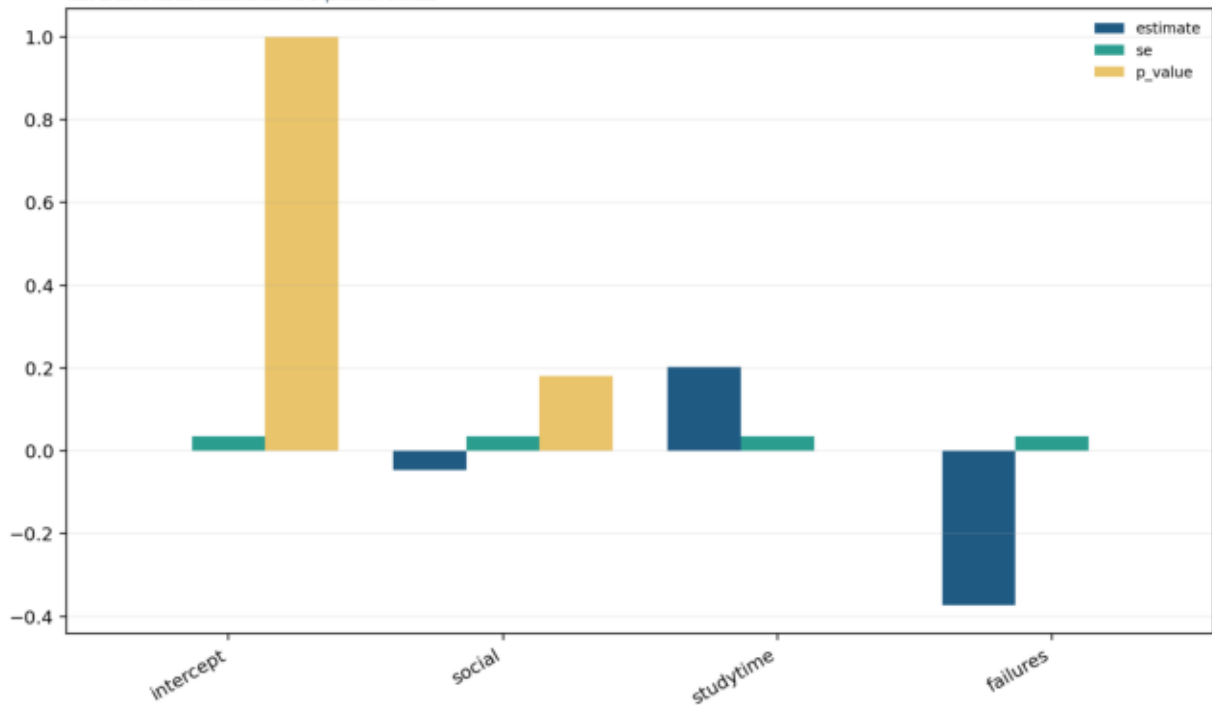
Conducting a Structural Equation Model



Cbsem Measurement Fit
Measurement Model

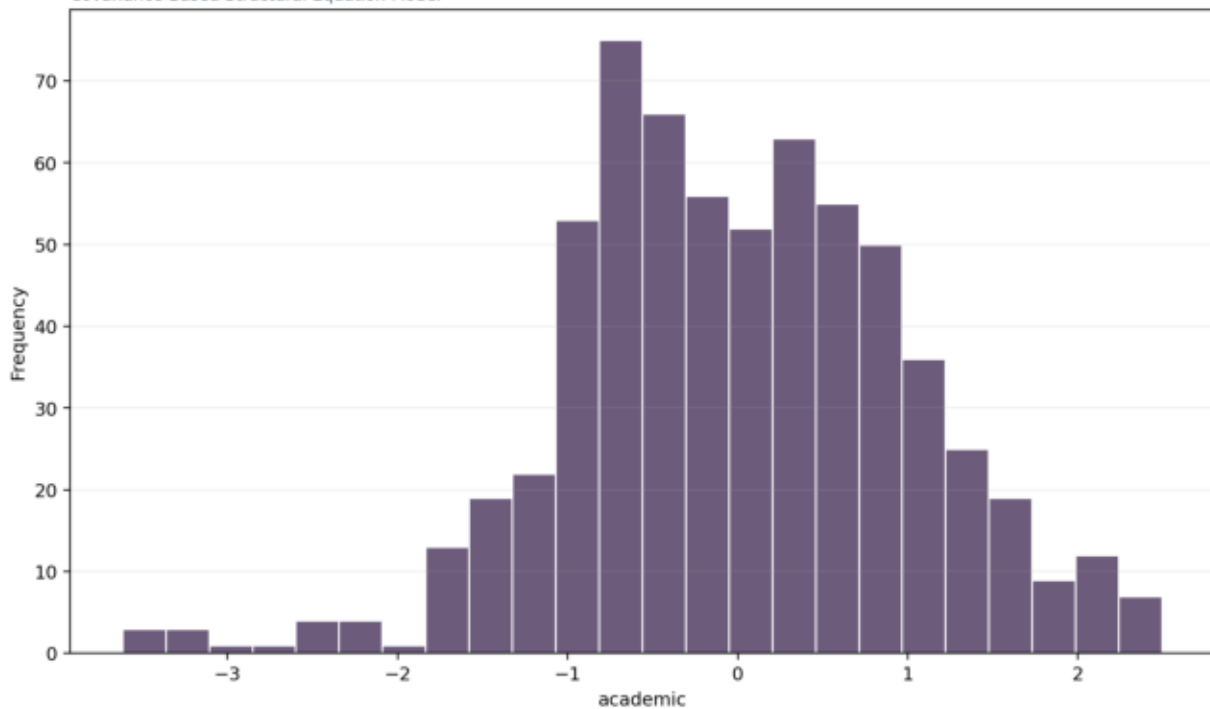


Cbsem Structural Coefficients

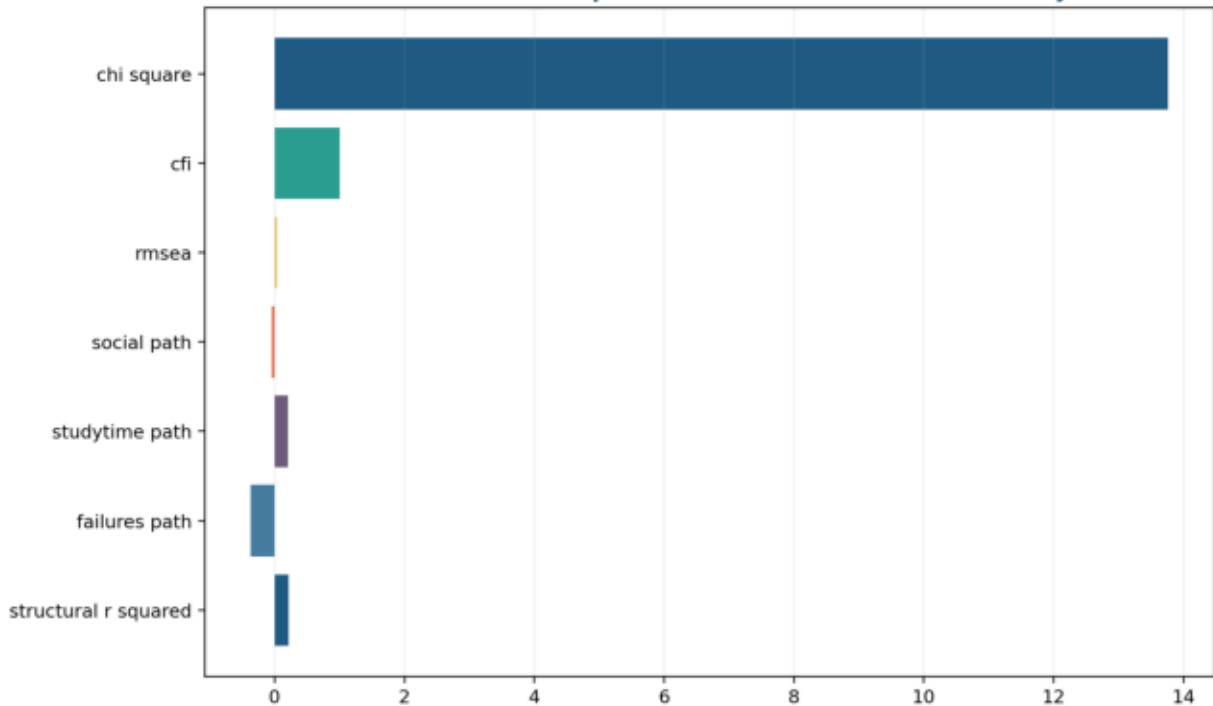


Latent Score Data

Model: 5-Parameter Logistic Equation Model



Covariance-Based Structural Equation Model verified result summary



Primary Metrics

metric	value
chi_square	13.764
cfi	0.997398
rmsea	0.0333448
social_path	-0.0470898
studytime_path	0.203047
failures_path	-0.372574
structural_r_squared	0.208491

Cbsem Measurement Fit

index	value
chi_square	13.764
df	8
p_value	0.0881286
CFI	0.997398
TLI	0.995122
NFI	0.993829
RMSEA	0.0333448
SRMR	0.0356632
GFI	0.992635
AGFI	0.980667
AIC	39.764
BIC	97.9446

Cbsem Structural Coefficients

term	estimate	se	p_value
intercept	0	0.0350037	1
social	-0.0470898	0.0352034	0.181482
studytime	0.203047	0.0355113	1.65087e-08
failures	-0.372574	0.0354738	6.29231e-24

Latent Score Data

academic	social	studytime	failures
-1.58802	0.30562	0.0835885	-0.374017
-0.466377	0.154013	0.0835885	-0.374017
0.259033	-0.628356	0.0835885	-0.374017
0.846341	-1.48118	1.28912	-0.374017
0.242599	-0.628356	0.0835885	-0.374017
0.245557	0.224471	0.0835885	-0.374017
0.370184	0.843067	0.0835885	-0.374017
0.117972	-0.769273	0.0835885	-0.374017
1.53888	-1.1658	0.0835885	-0.374017
0.245557	0.29493	0.0835885	-0.374017
0.846341	-0.476749	0.0835885	-0.374017
-0.00369699	-0.850422	1.28912	-0.374017
0.259033	-0.161368	-1.12194	-0.374017
0.245557	0.69146	0.0835885	-0.374017
0.954533	0.446537	1.28912	-0.374017
1.9098	0.843067	-1.12194	-0.374017
0.600045	-1.0142	1.28912	-0.374017
0.721714	-0.312975	0.0835885	-0.374017
-1.38878	2.16288	-1.12194	4.683
0.137365	-1.55164	-1.12194	-0.374017
0.475418	-0.557898	0.0835885	-0.374017
0.0127378	0.224471	-1.12194	-0.374017
0.475418	-0.020451	0.0835885	-0.374017
-0.571611	1.15845	0.0835885	-0.374017
-0.449942	-0.628356	1.28912	-0.374017
-0.233558	-2.11194	-1.12194	-0.374017