



PRO2514 - Pesquisa Quantitativa em Gestão de Operações

Modelagem de Equações Estruturais – Modelo Reflexivo

Prof. Dr. Renato de Oliveira Moraes



Objetivo da aula

- Capacitar os estudantes no uso de técnicas e softwares de modelagem de equações estruturais (variance-based)



Avaliação do modelo Reflexivo

Métricas do modelo de mensuração

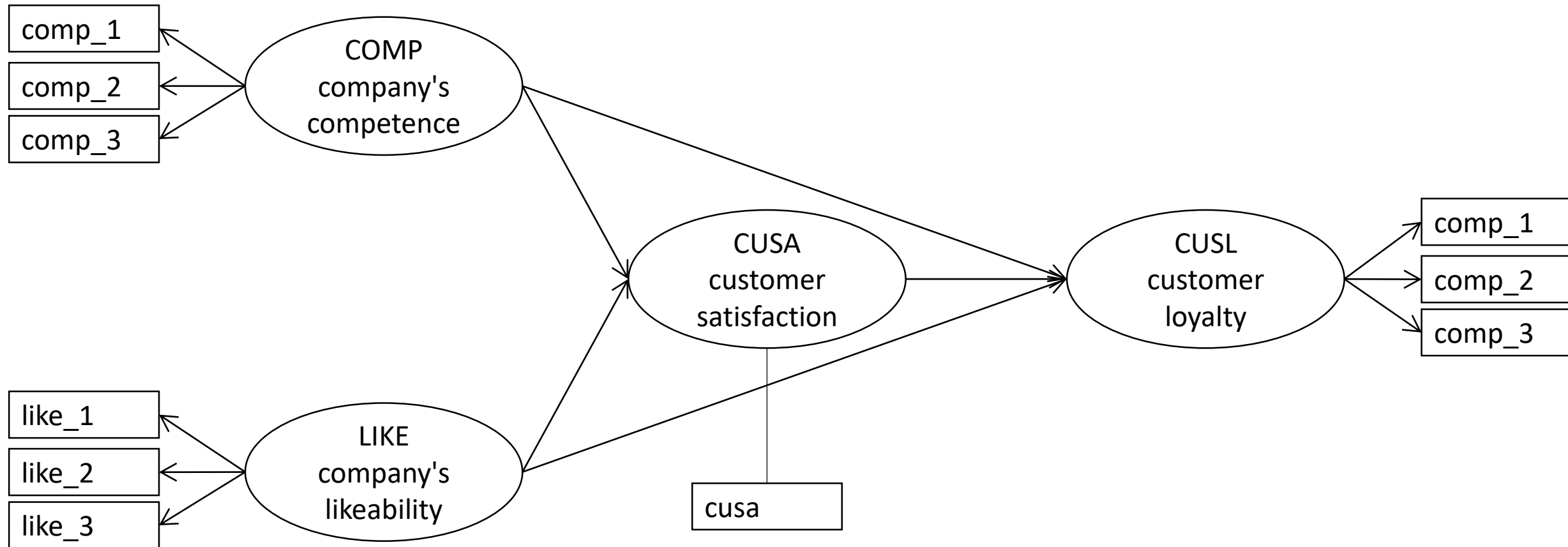
- Confiabilidade
- Validade convergente
- Validade discriminante

Métricas do modelo estrutural

- R^2 – variação explicada
- Significância e relevância dos outer weights
- f^2 poder de explicação dos constructos exógenos
- Q^2 relevância preditiva
- q^2 poder de predição dos constructos exógenos



Reputação Organizacional



Indicadores utilizados

Competence (COMP)

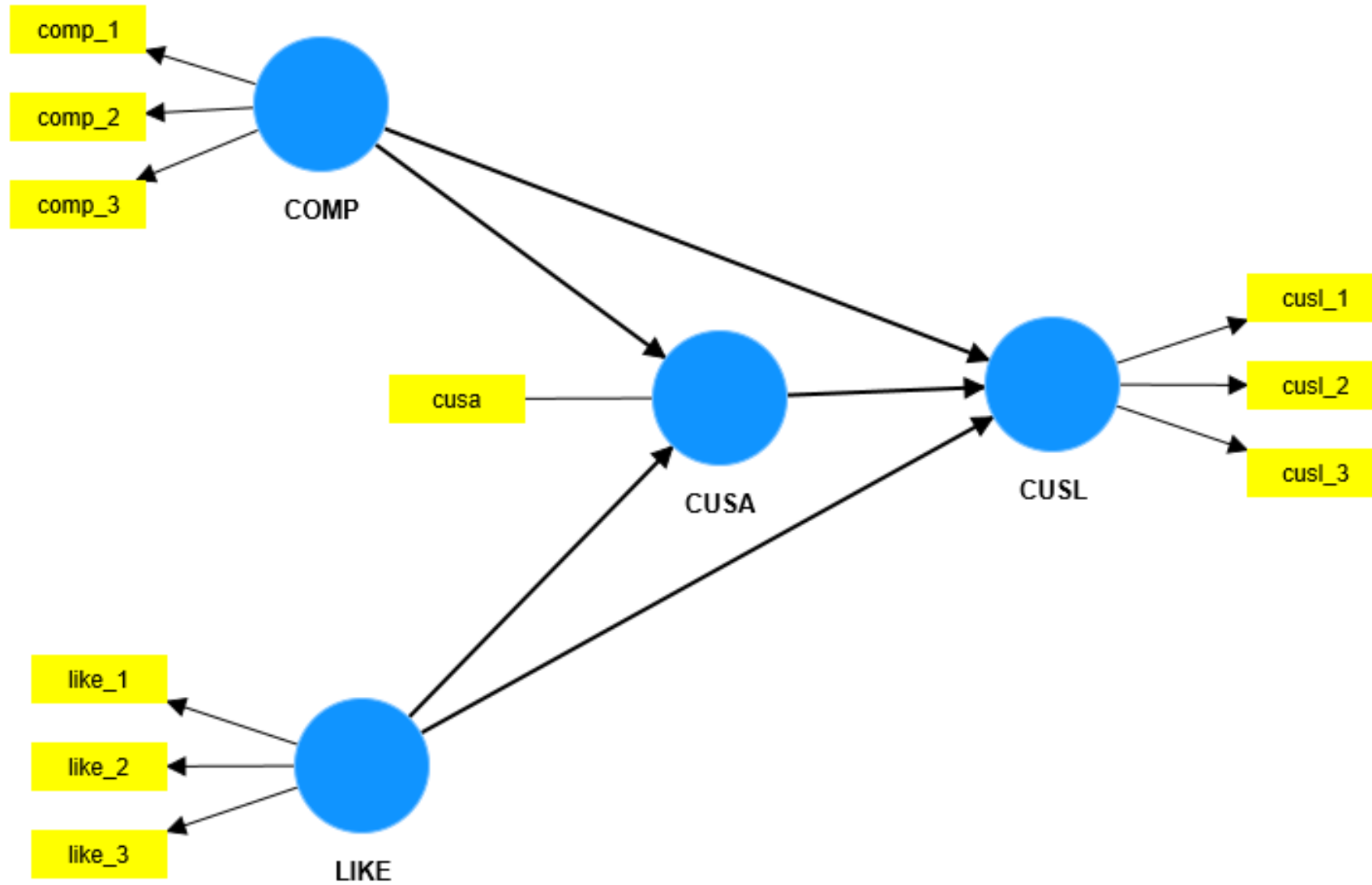
- comp_1: [The company] is a top competitor in its market.
- comp_2: As far as I know, [the company] is recognized worldwide.
- comp_3: I believe that [the company] performs at a premium level.

Likeability (LIKE)

- like_1: [The company] is a company that I can better identify with than other companies.
- like_2: [The company] is a company that I would regret more not having if it no longer existed than I would other companies.
- Like_3: I regard [the company] as a likeable company.

Customer Loyalty (CUSL)

- cusl_1: I would recommend [company] to friends and relatives.
- cusl_2: If I had to choose again, I would choose [company] as my mobile phone services provider.
- cusl_3: I will remain a customer of [company] in the future.





SmartPLS Edit Calculate

Back Save Convert Calculate Standard algorithms

ModeloReflexivo

Corporate Reputation Data Select

0 serviceprovider

1 servicetype

2 csor_1

3 csor_2

4 csor_3

5 csor_4

6 csor_5

7 csor_global

8 attr_1

9 attr_2

10 attr_3

11 attr_global

12 perf_1

13 perf_2

14 perf_3

Standard algorithms

- PLS-SEM algorithm
- Bootstrapping
- Confirmatory tetrad analyses (CTA)
- Importance-performance map analysis (IPMA)
- PLS second / OLS

Quadratic effect Moderating effect

PLS-SEM algorithm

The partial least squares structural equation modeling (PLS-SEM) is a composite-based estimator of latent variable structural equation models. Essentially, the PLS-SEM algorithm is a sequence of partial regressions.

1) PLS setup 2) Data 3)

Weighting scheme ☐ Factor ☒ Path ☐ PCA

Type of results Standardized

Initial weight Default

PLS-SEM algorithm

The partial least squares structural equation modeling (PLS-SEM) is a composite-based estimator of latent variable structural equation models. Essentially, the PLS-SEM algorithm is a sequence of partial regressions.

More info

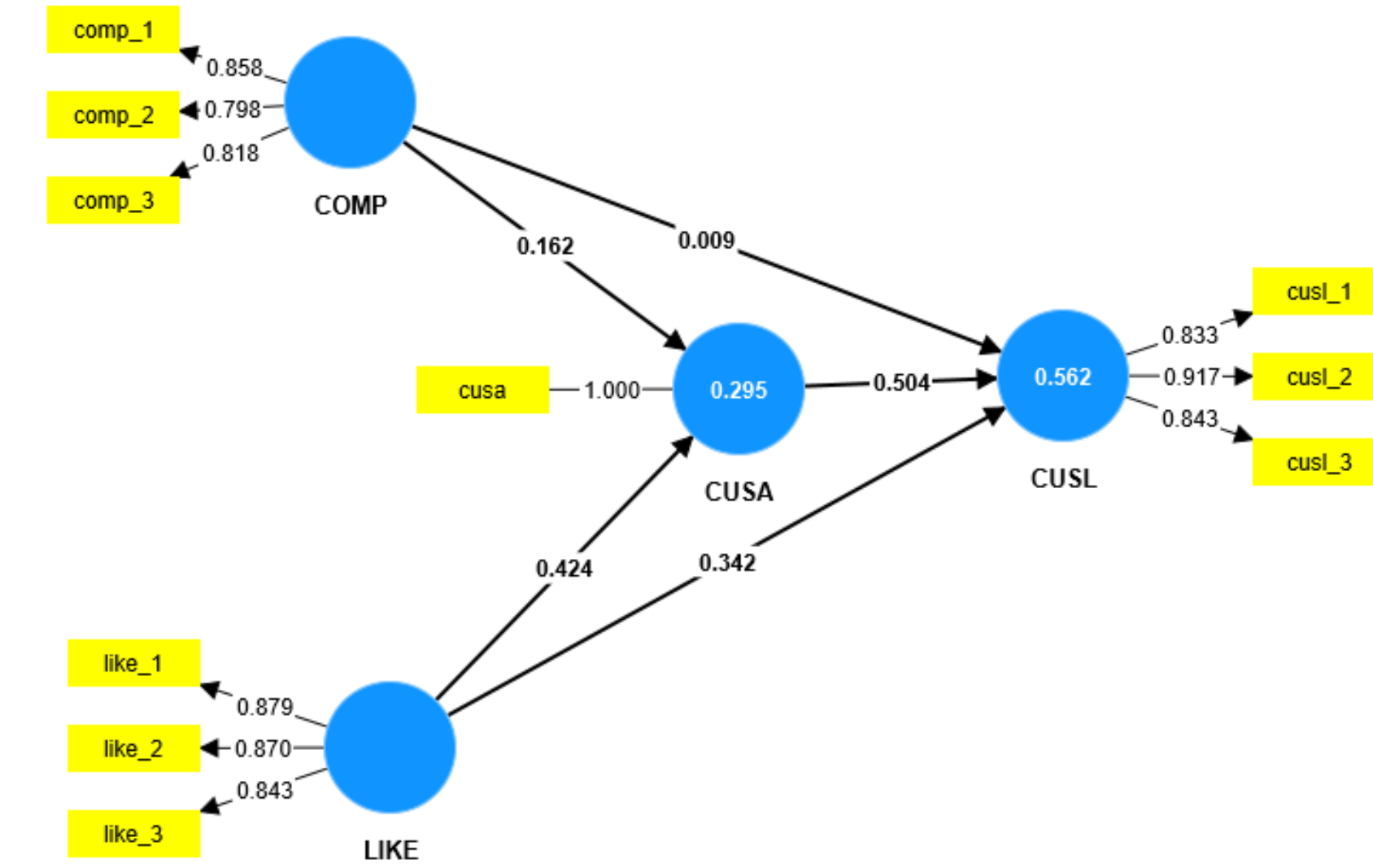
PLS setup Data

Missing values

Missing value algorithm Mean replacement

Weighting vector

Weighting vector None





ModeloReflexivo - PLS results

- Corporate Reputation Data
 - Outer loadings
 - Outer weights
 - Latent variables
 - Residuals
- ▼ **Quality criteria**
 - R-square
 - f-square
 - Construct reliability and validity
 - Discriminant validity
 - Collinearity statistics (VIF)
- Model fit
- Model selection criteria
- ▼ **Algorithm**
 - ▼ Setting
 - ☐ Data file
 - ☐ Data setup
 - ☐ PLS-SEM algorithm
 - ☐ Construct outer weighting mode
 - Stop criterion changes
 - Posthoc minimum sample size
 - Execution log
- ▼ **Model and data**
 - Inner model

Execution log

Reading score matrix of complete data set
Processing missing values for scores of complete data set
Calculating full data set.
Running PLS-SEM iterations, at most 3000.
Calculating report matrices and charts.
All calculations done.



ModeloReflexivo - PLS results

Corporate Reputation Data

- ▶ Outer loadings
- ▶ Outer weights
- ▶ Latent variables
- ▶ Residuals
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 - Posthoc minimum sample size**
 - Execution log

Posthoc minimum sample size

[Zoom](#) (100%)



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	Path coefficients	Alpha 1%, power 80%	Alpha 5%, power 80%	Alpha 1%, power 90%	Alpha 5%, power 90%
COMP → CUSA	0.162	383.000	236.000	496.000	327.000
COMP → CUSL	0.009	119,233.000	73,452.000	154,647.000	101,742.000
CUSA → CUSL	0.504	40.000	25.000	52.000	34.000
LIKE → CUSA	0.424	56.000	35.000	73.000	48.000
LIKE → CUSL	0.342	86.000	53.000	112.000	74.000



ModeloReflexivo - PLS results

Corporate Reputation Data

- ▶ Outer loadings
- ▶ Outer weights
- ▶ Latent variables
- ▶ Residuals
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- ▼ Model and data

Stop criterion changes

[Zoom](#) (100%)

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	comp_1	comp_2	comp_3	cusa	cusl_1	cusl_2	cusl_3	like_1	like_2	like_3
Iteration 0	0.401	0.401	0.401	1.000	0.386	0.386	0.386	0.386	0.386	0.386
Iteration 1	0.536	0.341	0.328	1.000	0.368	0.421	0.365	0.419	0.378	0.359
Iteration 2	0.536	0.340	0.328	1.000	0.369	0.420	0.365	0.418	0.378	0.360
Iteration 3	0.536	0.340	0.328	1.000	0.369	0.420	0.365	0.418	0.378	0.360
Iteration 4	0.536	0.340	0.328	1.000	0.369	0.420	0.365	0.418	0.378	0.360
Iteration 5	0.536	0.340	0.328	1.000	0.369	0.420	0.365	0.418	0.378	0.360



Avaliação do modelo de mensuração

Constructos Reflexivos

- Confiabilidade
- Validade convergente
- Validade discriminante

Constructos Formativos

- Validade de Conteúdo
- Significância e relevância dos outer weights
- Validade Convergente
- Colinearidade entre indicadores



Avaliação do modelo de mensuração

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ModeloReflexivo - PLS results

Corporate Reputation Data

- ▶ Total effects
- ▶ Outer loadings
- ▶ Outer weights
- ▶ Latent variables
- ▶ Residuals

▼ Quality criteria

- ▶ R-square
- ▶ f-square

▼ Construct reliability and validity

- ☐ Overview
- ☐ Cronbach's alpha - Bar chart
- ☐ Composite reliability (rho_a) - Bar chart
- ☐ Composite reliability (rho_c) - Bar chart
- ☐ Average variance extracted (AVE) - Bar chart
- ▶ Discriminant validity
- ▶ Collinearity statistics (VIF)
- Model fit
- Model selection criteria

Construct reliability and validity - Overview

[Zoom](#) (100%)

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	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
COMP	0.776	0.832	0.865	0.681
CUSL	0.831	0.839	0.899	0.748
LIKE	0.831	0.836	0.899	0.747



Confiabilidade da escala do constructo reflexivo

$$\left(\begin{array}{c} \text{Confiabilidade} \\ \text{composta: } \rho_c \end{array} \right) \leq \left(\begin{array}{c} \text{Valor real da} \\ \text{confiabilidade} \end{array} \right) \leq \left(\begin{array}{c} \text{Alpha de} \\ \text{Cronbach: } \alpha \end{array} \right)$$

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
COMP	0.776	0.832	0.865
CUSL	0.831	0.839	0.899
LIKE	0.831	0.836	0.899



Confiabilidade

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
COMP	0.776	0.832	0.865
CUSL	0.831	0.839	0.899
LIKE	0.831	0.836	0.899

Confiabilidade < 0,6	→ inaceitável
0,6 < Confiabilidade < 0,7	→ aceitável
0,7 < Confiabilidade < 0,9	→ satisfatório
Confiabilidade > 0,9	→ indesejável
Confiabilidade > 0,95	→ problemático

Confiabilidade (consistência interna)

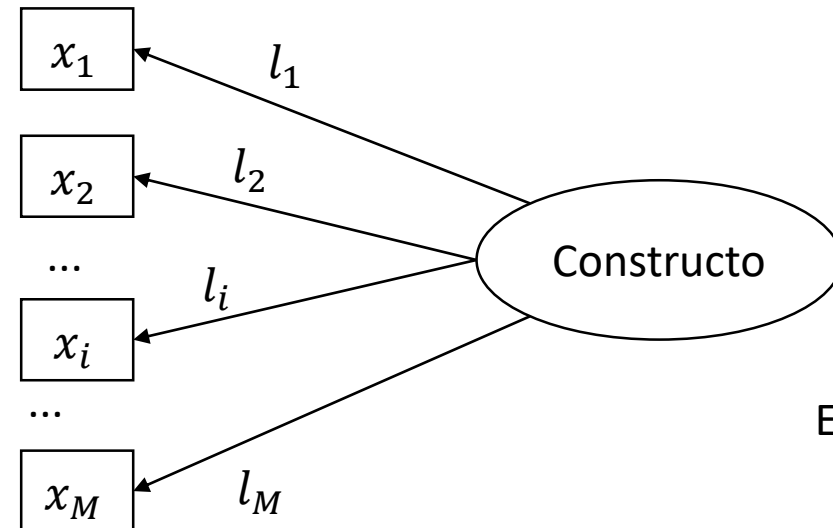
Alpha de Cronbach

$$\alpha = \left(\frac{M}{M-1} \right) \left(1 - \frac{\sum_{i=1}^M s_i^2}{s_t^2} \right)$$

Obs	x_1	x_2	...	x_i	...	x_M	$\sum x_i$
1							
2							
....							
N							
Variância	s_1^2	s_2^2	...	s_i^2	...	s_M^2	s_t^2

Confiabilidade composta (composite reliability)

$$\rho_c = \frac{\left(\sum_{i=1}^M l_i \right)^2}{\left(\sum_{i=1}^M l_i \right)^2 + \sum_{i=1}^M \text{var}(e_i)}$$



Erro de medição
 $e_i = 1 - (l_i)^2$



Avaliação do modelo de mensuração

Constructos Reflexivos

- Confiabilidade
- **Validade convergente**
- Validade discriminante

Constructos Formativos

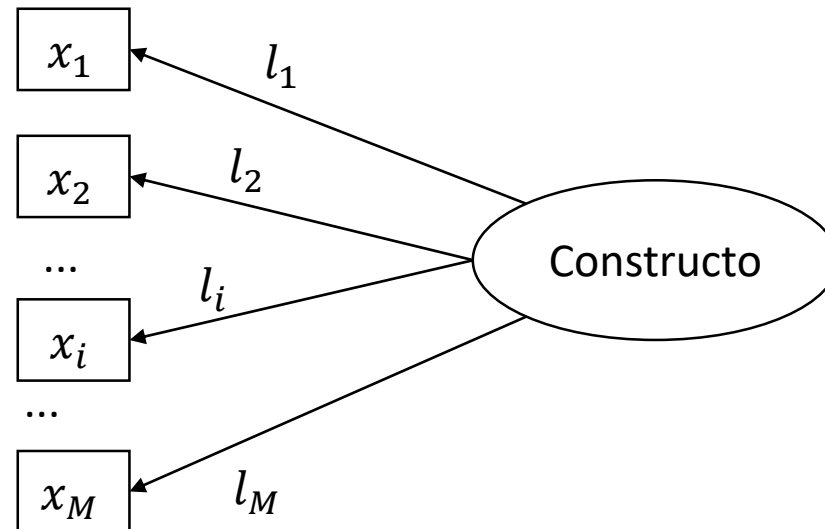
- Validade de Conteúdo
- Significância e relevância dos outer weights
- Validade Convergente
- Colinearidade entre indicadores

Validade Convergente

- AVE (Average variance extracted)

$$AVE = \left(\frac{\sum_{i=1}^M l_i^2}{M} \right)$$

- outer loading

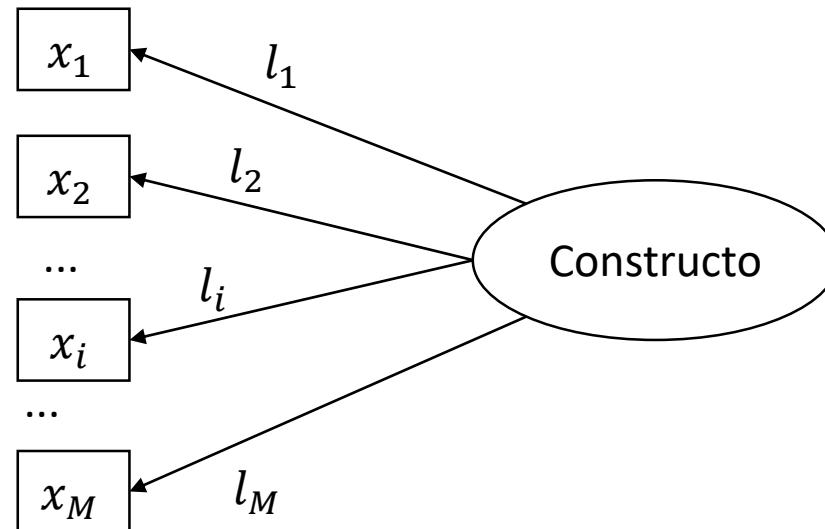


Validade Convergente

- AVE (Average variance extracted)

$$AVE = \left(\frac{\sum_{i=1}^M l_i^2}{M} \right) \geq 0,5$$

- outer loading





ModeloReflexivo - PLS results

Corporate Reputation Data

- ▶ Total effects
- ▶ Outer loadings
- ▶ Outer weights
- ▶ Latent variables
- ▶ Residuals
- ▼ **Quality criteria**
 - ▶ R-square
 - ▶ f-square
 - ▼ **Construct reliability and validity**
 - ☐ Overview
 - ☐ Cronbach's alpha - Bar chart
 - ☐ Composite reliability (rho_a) - Bar chart
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 - ▶ Discriminant validity
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 - Model fit
 - Model selection criteria

Construct reliability and validity - Overview

Zoom (100%)

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	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
COMP	0.776	0.832	0.865	0.681
CUSL	0.831	0.839	0.899	0.748
LIKE	0.831	0.836	0.899	0.747



AVE - Average variance extracted (Validade convergente)

Average variance extracted (AVE)	
5	0.681
3	0.748
3	0.747

$$AVE = \left(\frac{\sum_{i=1}^M l_i^2}{M} \right) \geq 0,5$$

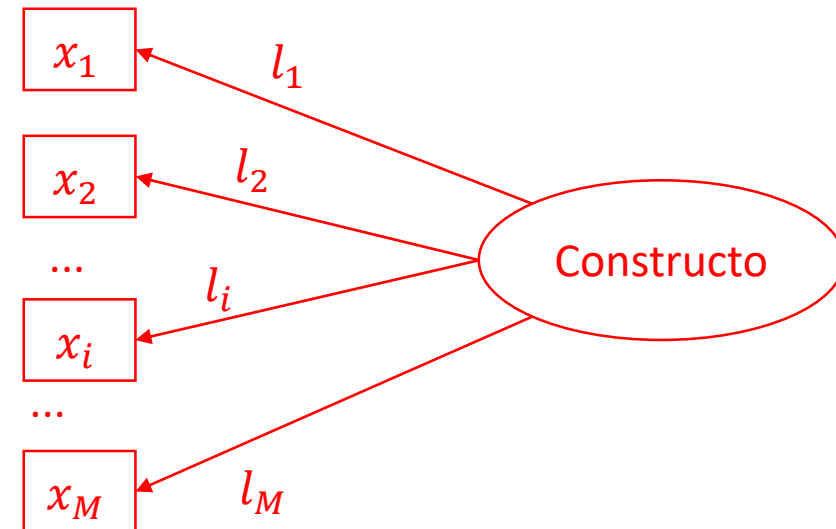
Validade Convergente

- AVE (Average variance extracted)

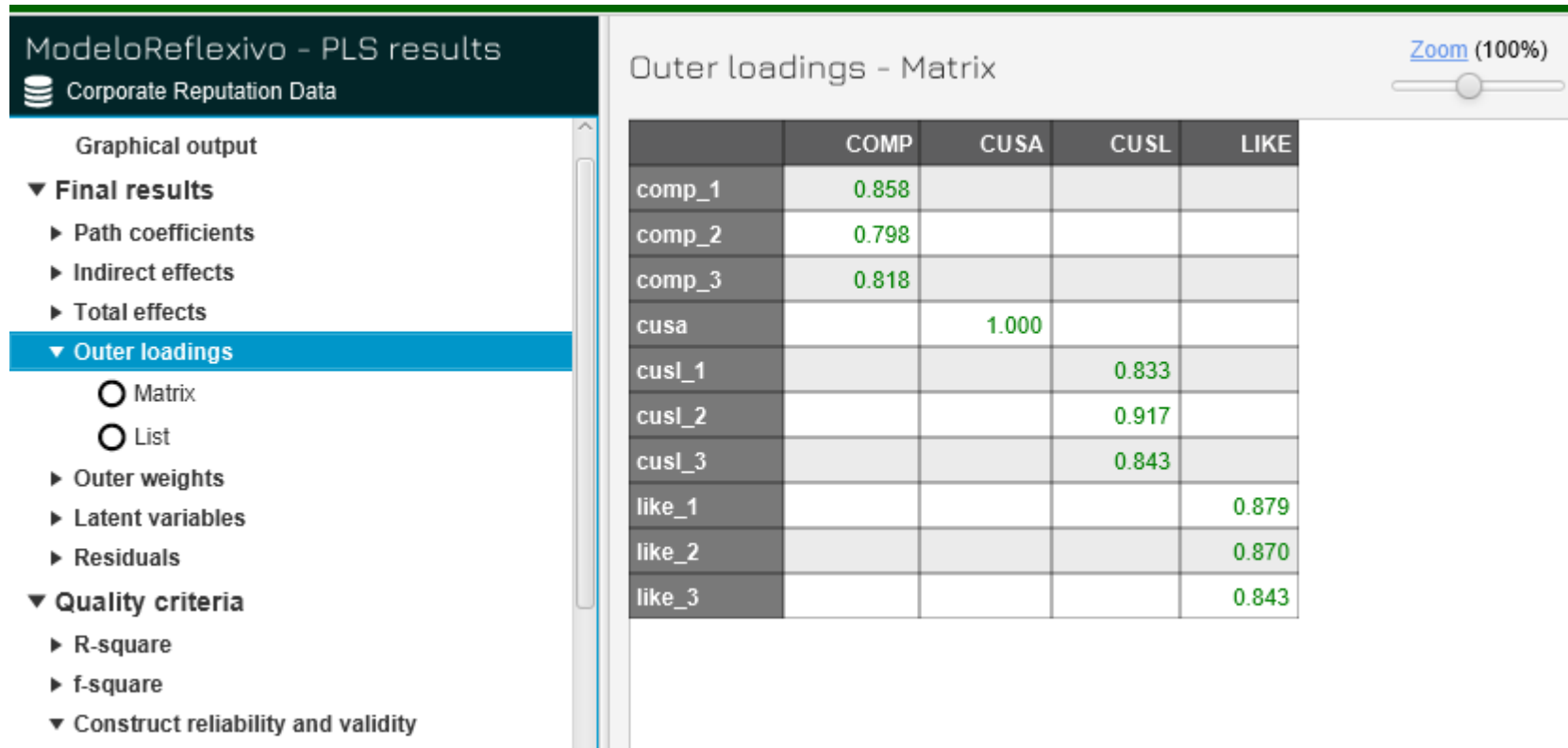
$$AVE = \left(\frac{\sum_{i=1}^M l_i^2}{M} \right) \geq 0,5$$

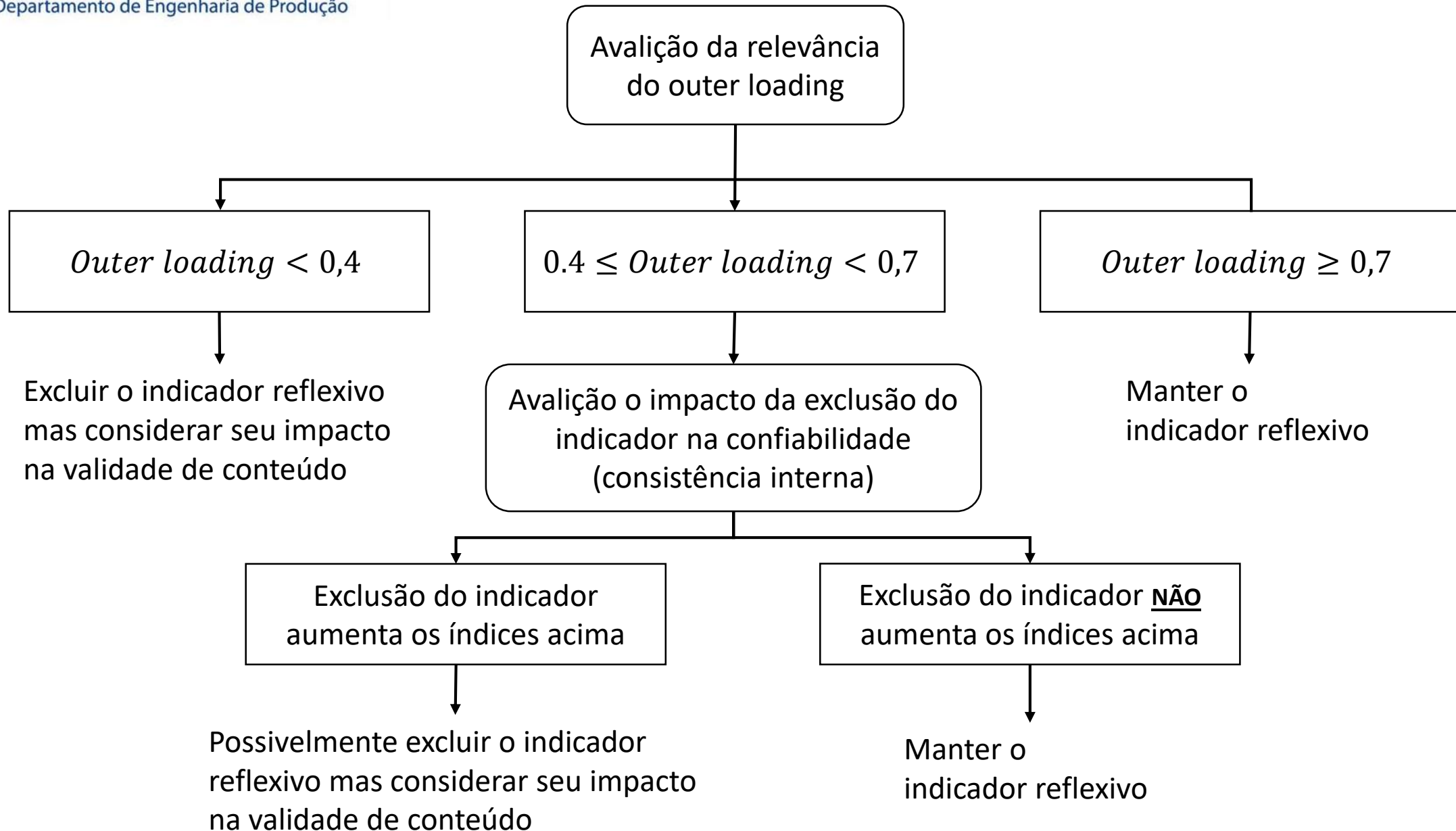
- outer loading

Comunalidade – (outer loading)²



Outer Loadings (Validade Convergente)







Avaliação do modelo de mensuração

Constructos Reflexivos

- Confiabilidade
- Validade convergente
- **Validade discriminante**

Constructos Formativos

- Validade de Conteúdo
- Significância e relevância dos outer weights
- Validade Convergente
- Colinearidade entre indicadores



Validade Discriminante

- Cross-loadings Analysis
- Fornell-Larcker
- HTMT (heterotrait-monotrait ratio)

Cross-loadings Analysis (Validade Discriminante)

ModeloReflexivo - PLS results

Corporate Reputation Data

- Outer loadings
 - ☐ Matrix
 - ☐ List
- Outer weights
- Latent variables
- Residuals
- Quality criteria
 - R-square
 - f-square
 - Construct reliability and validity
 - Discriminant validity
 - ☐ Heterotrait-monotrait ratio (HTMT) - Matrix
 - ☐ Heterotrait-monotrait ratio (HTMT) - List
 - ☐ Heterotrait-monotrait ratio (HTMT) - Bar chart
 - ☐ Fornell-Larcker criterion
 - ☒ Cross loadings
- Collinearity statistics (VIF)
- Model fit
- Model selection criteria

Discriminant validity - Cross loadings

	COMP	CUSA	CUSL	LIKE
comp_1	0.858	0.464	0.465	0.607
comp_2	0.798	0.286	0.304	0.460
comp_3	0.818	0.272	0.296	0.497
cusa	0.436	1.000	0.689	0.528
cusl_1	0.430	0.536	0.833	0.557
cusl_2	0.396	0.655	0.917	0.573
cusl_3	0.341	0.593	0.843	0.461
like_1	0.602	0.510	0.561	0.879
like_2	0.523	0.434	0.530	0.870
like_3	0.544	0.420	0.499	0.843



Validade Discriminante

- Cross-loadings Analysis
- Fornell-Larcker
- HTMT (heterotrait-monotrait ratio)

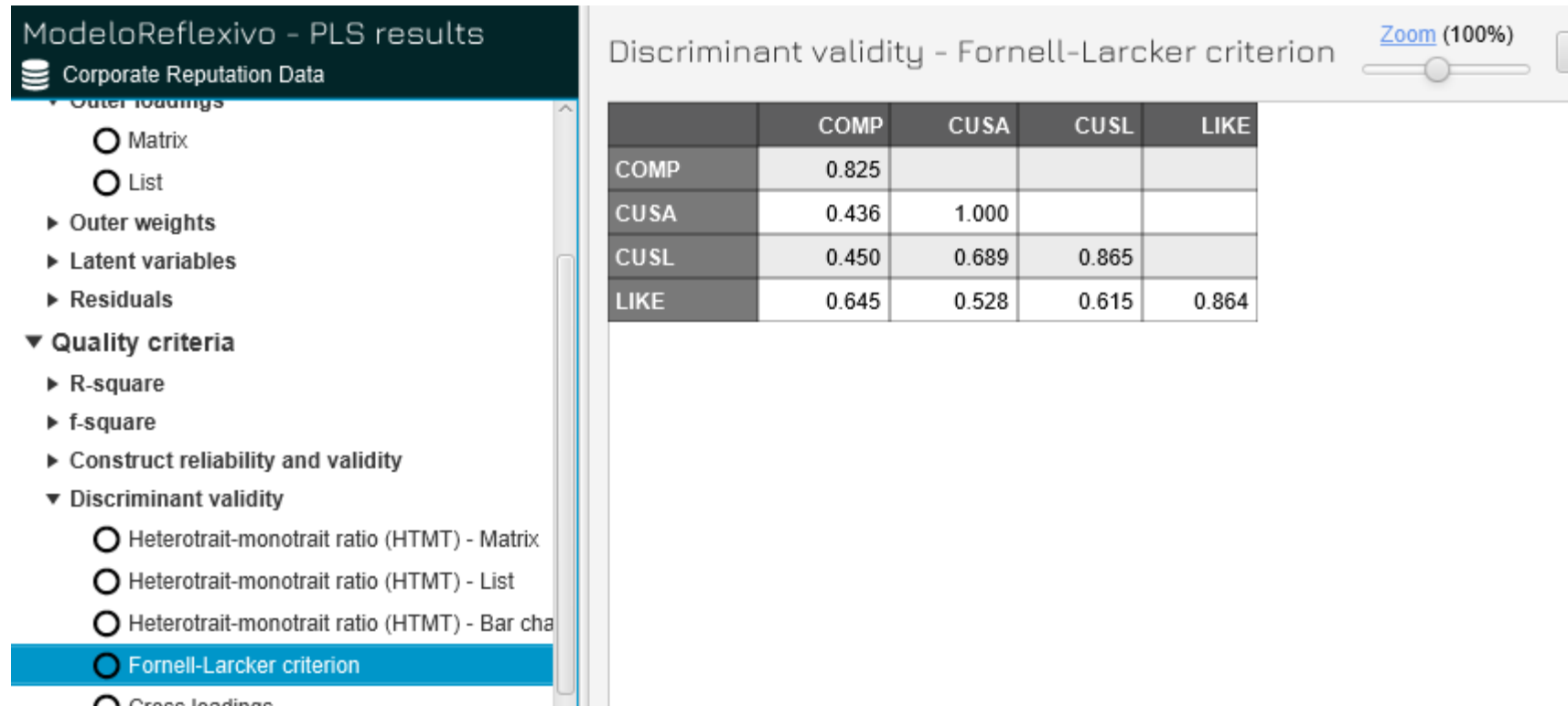
Fornell-Larcker (Validade Discriminante)

Formato SmartPLS

	Y_1	Y_2	Y_3	Y_4
Y_1	$\sqrt{AVE_{Y_1}}$			
Y_2	$Corr_{Y_1 Y_2}$	$\sqrt{AVE_{Y_2}}$		
Y_3	$Corr_{Y_1 Y_3}$	$Corr_{Y_2 Y_3}$	$\sqrt{AVE_{Y_3}}$	
Y_4	$Corr_{Y_1 Y_4}$	$Corr_{Y_2 Y_4}$	$Corr_{Y_3 Y_4}$	$\sqrt{AVE_{Y_4}}$

$$\sqrt{AVE_{Y_i}} > Corr_{Y_i Y_j}$$

Fornell-Larcker (Validade Discriminante)



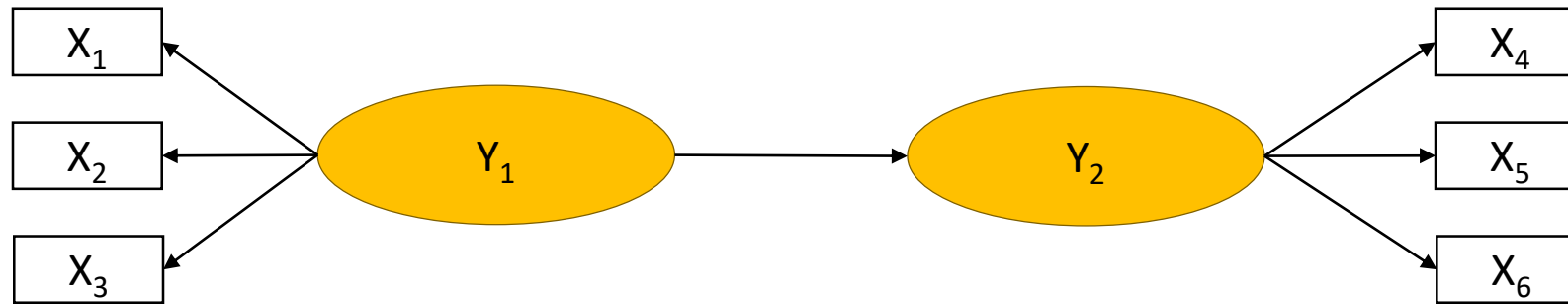
Squared correlations; AVE in the diagonal.



Validade Discriminante

- Cross-loadings Analysis
- Fornell-Larcker
- HTMT – Heterotrait-Monotrait Ratio of Correlations

HTMT – Heterotrait-Monotrait Ratio of Correlations



	x1	x2	x3	x4	x5	x6
x1						
x2	0,770					
x3	0,701	0,665				
x4	0,426	0,339	0,393			
x5	0,423	0,345	0,385	0,574		
x6	0,274	0,235	0,250	0,318	0,335	

Correlações (Coef Pearson) entre os indicadores

	x1	x2	x3	x4	x5	x6
x1						
x2	0,770					
x3	0,701	0,665				
x4	0,426	0,339	0,393			
x5	0,423	0,345	0,385	0,574		
x6	0,274	0,235	0,250	0,318	0,335	

Monotrait-heteromethod
Correlações entre os indicadores do mesmo constructo

Heterotrait-heteromethod
Correlações entre os indicadores de um constructo com os indicadores de outro constructo



Correlações (Coef Pearson) entre os indicadores

	x1	x2	x3	x4	x5	x6
x1						
x2	0,770					
x3	0,701	0,665				
x4	0,426	0,339	0,393			
x5	0,423	0,345	0,385	0,574		
x6	0,274	0,235	0,250	0,318	0,335	

Valor Médio = 0,712

Valor Médio = 0,409

Valor Médio = 0,341



Média das correlações

	Y_1	Y_2
Y_1	0,712	
Y_2	0,341	0,409

$$HTMT(Y_1; Y_2) = \frac{0,341}{\sqrt{0,712 \times 0,409}} = 0,632$$



HTMT - valores

	Y_1	Y_2
Y_1		
Y_2	0,632	

$$HTMT < 1 \rightarrow OK \begin{cases} HTMT < 0,85 \text{ (Kline, 2011)} \\ HTMT < 0,95 \text{ (Gold et al, 2001)} \end{cases}$$

$HTMT \cong 1 \rightarrow \textit{Problemas de Validade Discriminante}$



ModeloReflexivo - PLS results

Corporate Reputation Data

Outer loadings

☐ Matrix

☐ List

Outer weights

Latent variables

Residuals

Quality criteria

R-square

f-square

Construct reliability and validity

Discriminant validity

☒ Heterotrait-monotrait ratio (HTMT) - Matrix

☐ Heterotrait-monotrait ratio (HTMT) - List

☐ Heterotrait-monotrait ratio (HTMT) - Bar chart

☐ Fornell-Larcker criterion

☐ Cross loadings

Discriminant validity - Heterotrait-monotrait ratio (HTMT)

	COMP	CUSA	CUSL	LIKE
COMP				
CUSA	0.465			
CUSL	0.532	0.755		
LIKE	0.780	0.577	0.737	

HTMT - valores

Construct	CUSA	CUSL	COMP	LIKE
CUSA				
CUSL	0,755			
COMP	0,465	0,532		
LIKE	0,577	0,737	0,780	

$$HTMT < 1 \rightarrow OK \begin{cases} HTMT < 0,85 \text{ (Kline, 2011)} \\ HTMT < 0,95 \text{ (Gold et al, 2001)} \end{cases}$$

$HTMT \cong 1 \rightarrow \text{Problemas de Validade Discriminante}$



Avaliação do modelo Reflexivo

Métricas do modelo de mensuração

- Confiabilidade
- Validade convergente
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Métricas do modelo estrutural

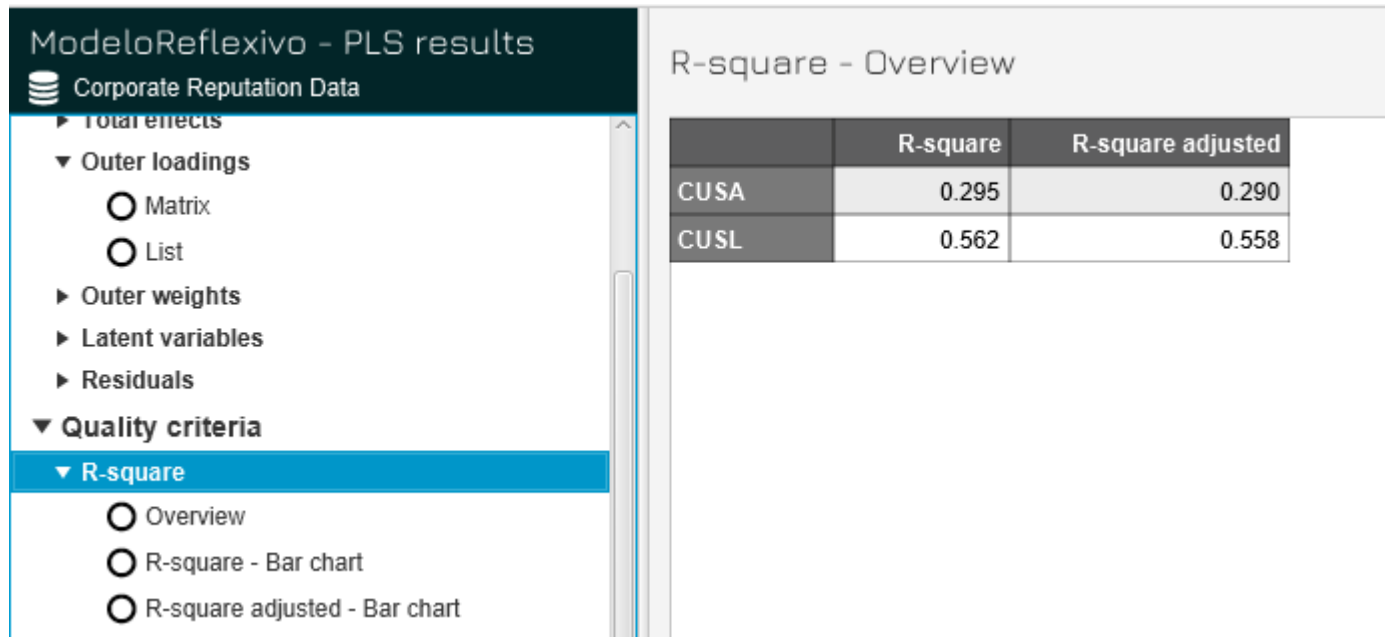
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Modelo Estrutural

- R^2 explicação dos constructos endógenos
- Coeficientes do modelo estrutural
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R^2 – explicação dos constructos endógenos





Coeficiente de Determinação

R^2 – explicação dos constructos endógenos

Valores	R^2 (*)	R^2 (**)
Substancial	0,67	0,75
Moderado	0,33	0,50
Fraco	0,19	0,25

(*) Chin, 1998

(**) Hair et al (2017)

	R Square	
CUSA	0,2946	Fraco
CUSL	0,5620	Moderado



R^2 explicação dos constructos endógenos

Comparação de modelos

$$R_{Ajustado}^2 = 1 - (1 - R^2) \frac{n - 1}{n - k - 1}$$

Onde

n: número de observações na amostra

k: número de constructos exógenos



R^2 – explicação dos constructos endógenos

Construct	Coefficient of determination (R^2)	Adjusted R^2
CUSA	0,2946	0,2904
CUSL	0,5619	0,5581



Modelo Estrutural

- R^2 explicação dos constructos endógenos
- Coeficientes do modelo estrutural
- f^2 poder de explicação dos constructos exógenos
- Q^2 relevância preditiva
- q^2 poder de predição dos constructos exógenos

Coeficientes do modelo estrutural

 Edit

 Save

 Excel

 HTML

 Create data file

 Compare

ModeloReflexivo - PLS results
Corporate Reputation Data

▼ Graphical

Graphical output

▼ Final results

▼ Path coefficients

☐ Matrix

☐ List

☐ Bar chart

► Indirect effects

► Total effects

► Outer loadings

► Outer weights

► Latent variables

► Residuals

▼ Quality criteria

Path coefficients - Matrix

	COMP	CUSA	CUSL	LIKE
COMP		0.162	0.009	
CUSA			0.504	
CUSL				
LIKE		0.424	0.342	

Coeficientes do modelo estrutural

ModeloReflexivo - PLS results

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▼ Graphical

Graphical output

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▶ f-square

▶ Construct reliability and validity

▶ Discriminant validity

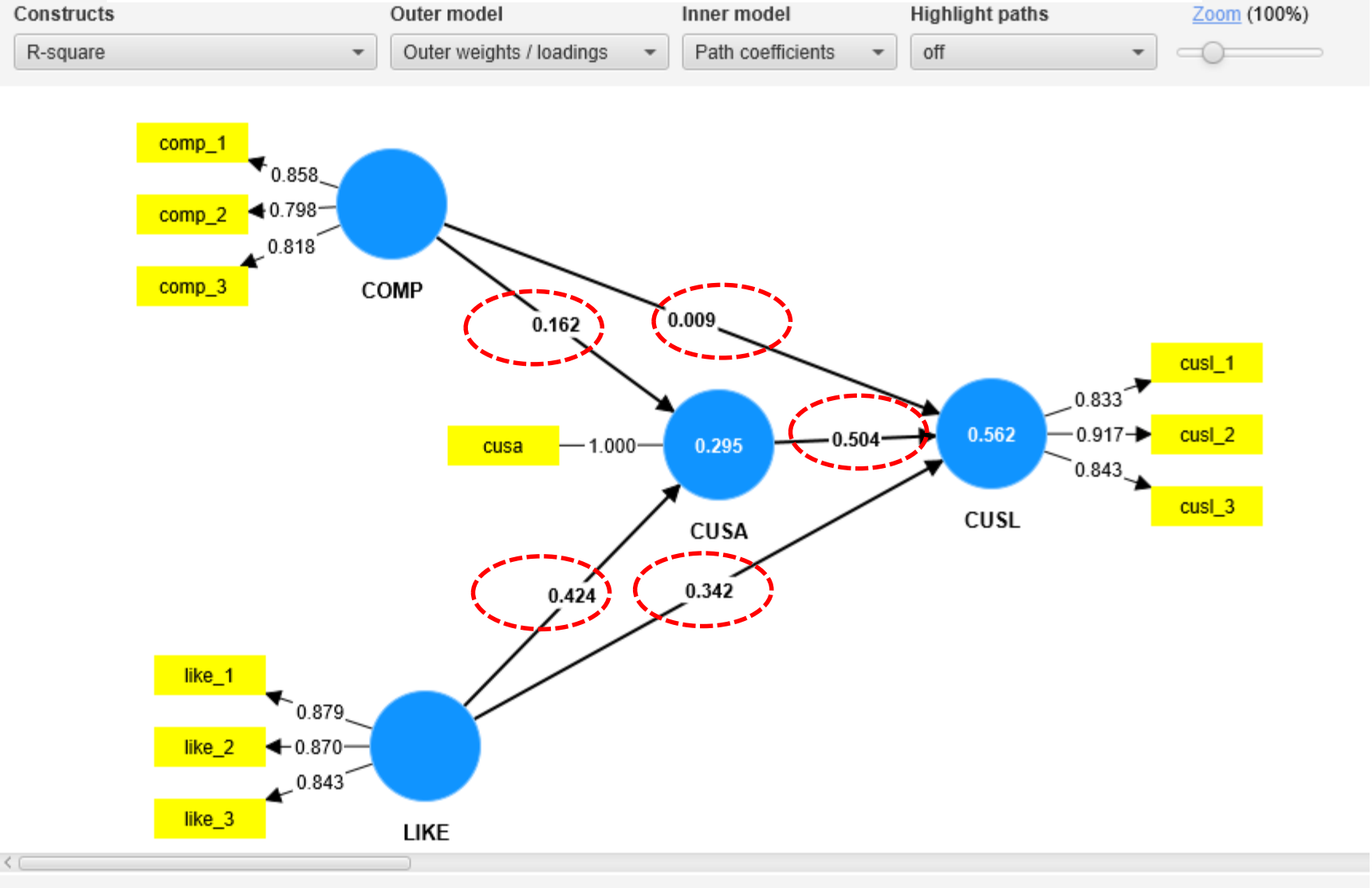
▶ Collinearity statistics (VIF)

Model fit

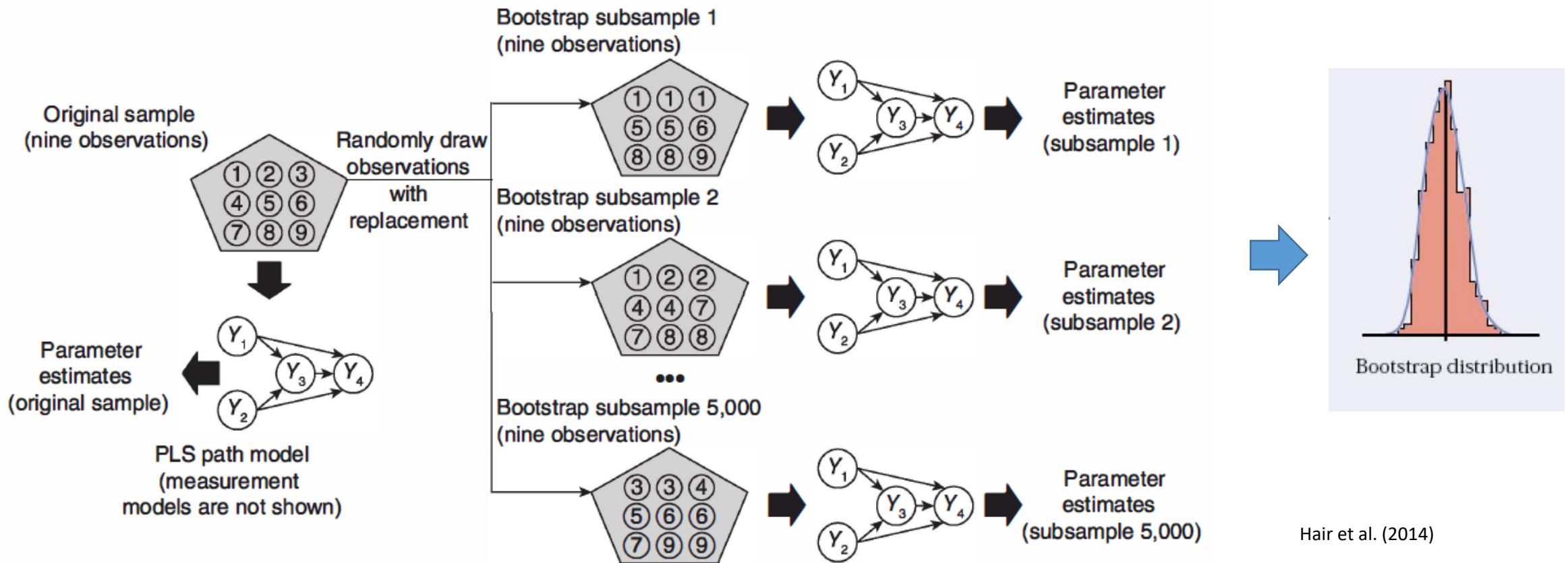
Model selection criteria

▼ Algorithm

▶ Setting



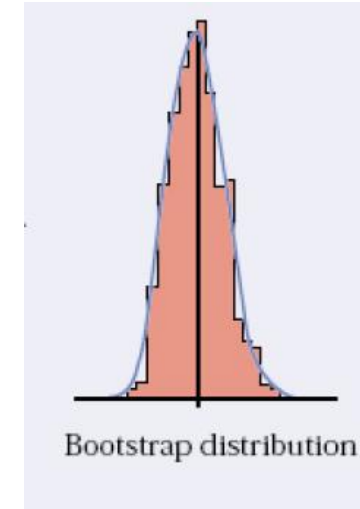
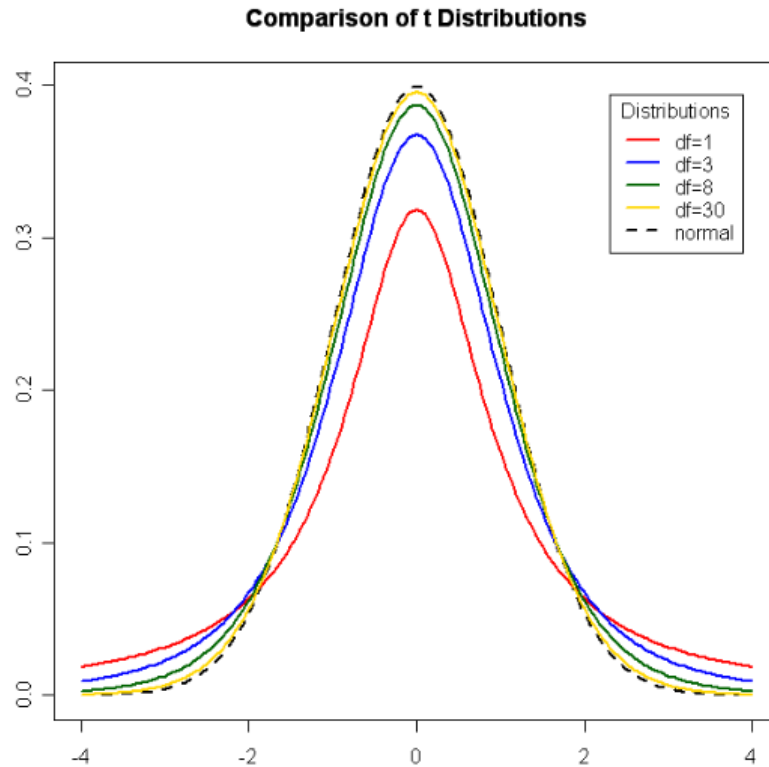
Bootstrapping



Hair et al. (2014)

Bootstrapping

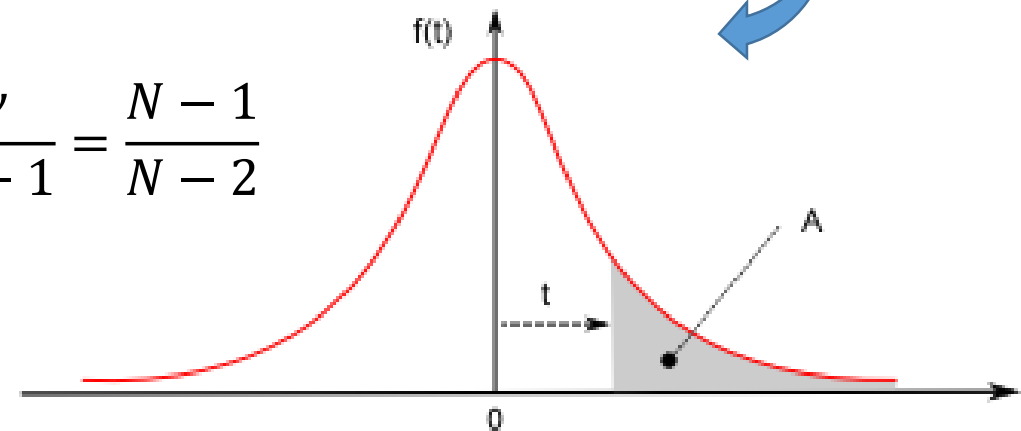
Student's t distribution



$t = \beta / SE$, $SE = \text{std error}$

$$\mu = 0$$

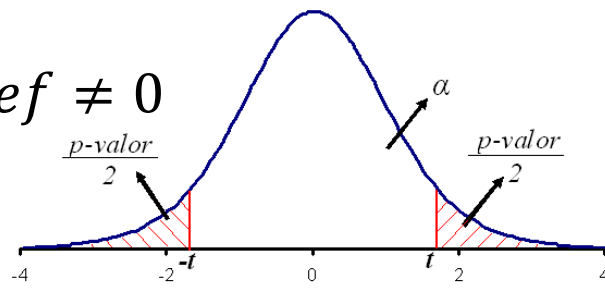
$$\sigma^2 = \frac{v}{v-1} = \frac{N-1}{N-2}$$



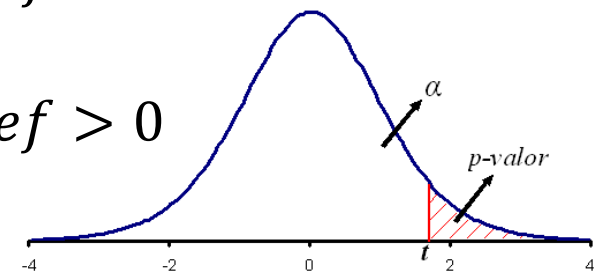
Assessment of the structural model

Student's t test

$$\begin{cases} H_0: Coef = 0 \\ H_1: Coef \neq 0 \end{cases}$$



$$\begin{cases} H_0: Coef \leq 0 \\ H_1: Coef > 0 \end{cases}$$



t Table

cum. prob	t _{.50}	t _{.75}	t _{.80}	t _{.85}	t _{.90}	t _{.95}	t _{.975}	t _{.99}	t _{.995}	t _{.999}	t _{.9995}
p one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
Z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level α										



SmartPLS Edit Calculate

Back Save Convert Calculate

ModeloReflexivo

Corporate Reputation Data

0 serviceprovider

1 servicetype

2 csor_1

3 csor_2

4 csor_3

5 csor_4

6 csor_5

7 csor_global

8 attr_1

9 attr_2

10 attr_3

11 attr_global

12 perf_1

13 perf_2

14 perf_3

Standard algorithms

- PLS-SEM algorithm
- Bootstrapping**
- Confirmatory tetrad analyses (CTA)
- Importance-performance map analysis
- PLSpredict / CVPAT
- Finite mixture (FIMIX) segmentation
- Prediction-oriented segmentation (POS)
- Bootstrap multigroup analysis
- Permutation multigroup analysis

Consistent algorithms

- Consistent PLS-SEM algorithm
- Consistent PLS-SEM bootstrapping
- Consistent Bootstrap multigroup analysis
- Consistent Permutation multigroup analysis

MET

MET

Bootstrapping

Bootstrapping is a nonparametric procedure that can be used to test statistical significance of PLS-SEM results such path coefficients, outer weights, Cronbach's alpha, HTMT, and R² values. [More info](#)

BT setup PLS setup Data

[Subsamples](#) 5000

☒ Do parallel processing

[Amount of results](#) Most important (faster)

☐ Generate results per sample

[Confidence interval method](#) Percentile bootstrap

[Test type](#) Two tailed

[Significance level](#) 0.05

[Random number generator](#) Fixed seed

☒ Open report



Bootstraping

Bootstraping is a nonparametric procedure that can be used to test statistical significance of PLS-SEM results such path coefficients, outer weights, Cronbach's alpha, HTMT, and R² values.

More info

BT setup

PLS setup

Data

Progress

Reading score matrix of complete data set

-

Processing missing values for scores of complete data set

0 s

Calculating full data set.

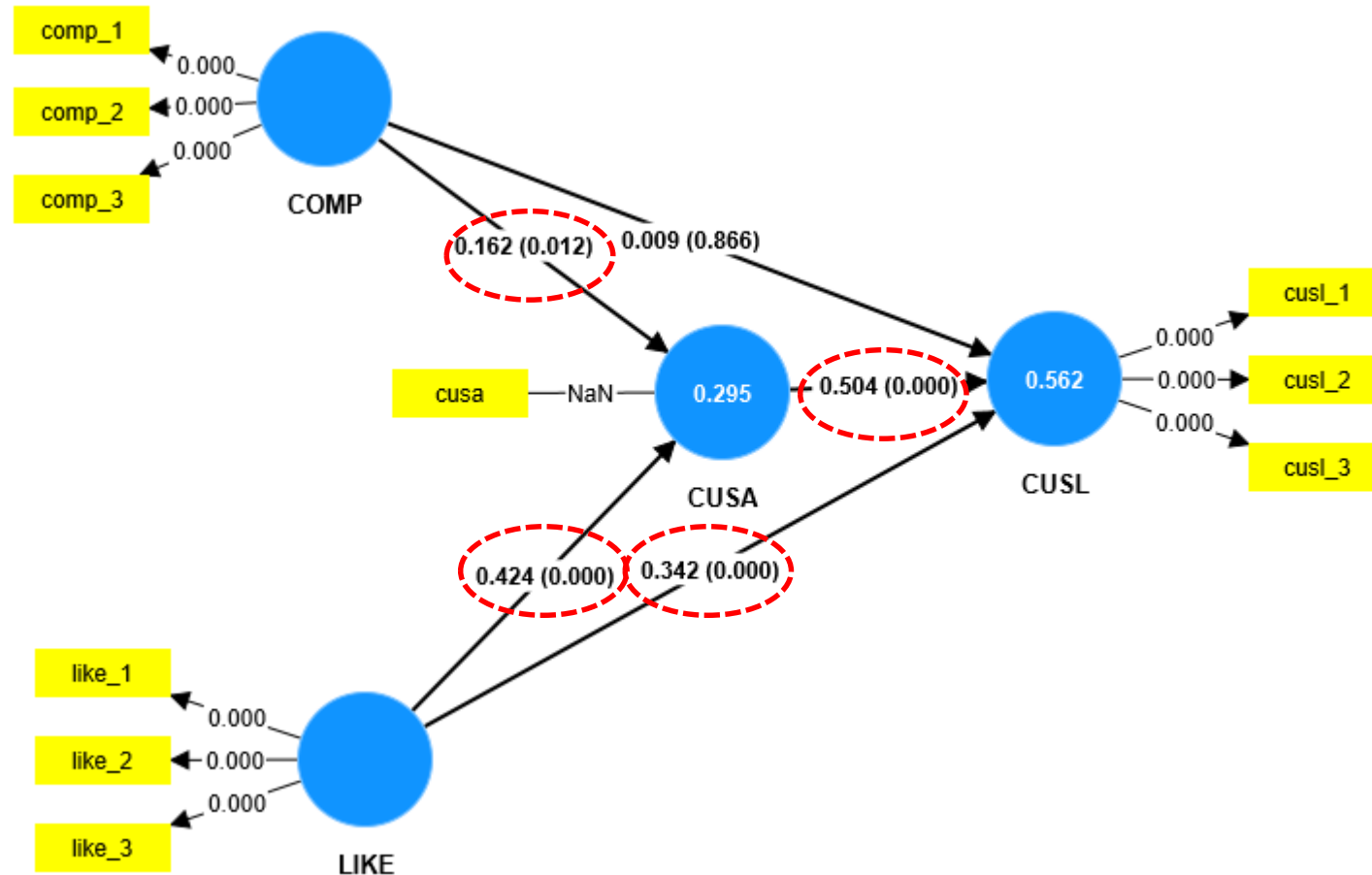
Calculating original sample

0 s

Running 5000 samples [Sample 1851]

37 % (3 s)

Coeficientes do Modelos Estrutural





Coeficientes do Modelos Estrutural (Coeficientes de caminho)

ModeloReflexivo - BT results

Corporate Reputation Data

▼ Graphical

Graphical output

▼ Final results

▼ Path coefficients

☒ Mean, STDEV, T values, p values

☐ Confidence intervals

☐ Confidence intervals bias corrected

Path coefficients - Mean, STDEV, T values, p values

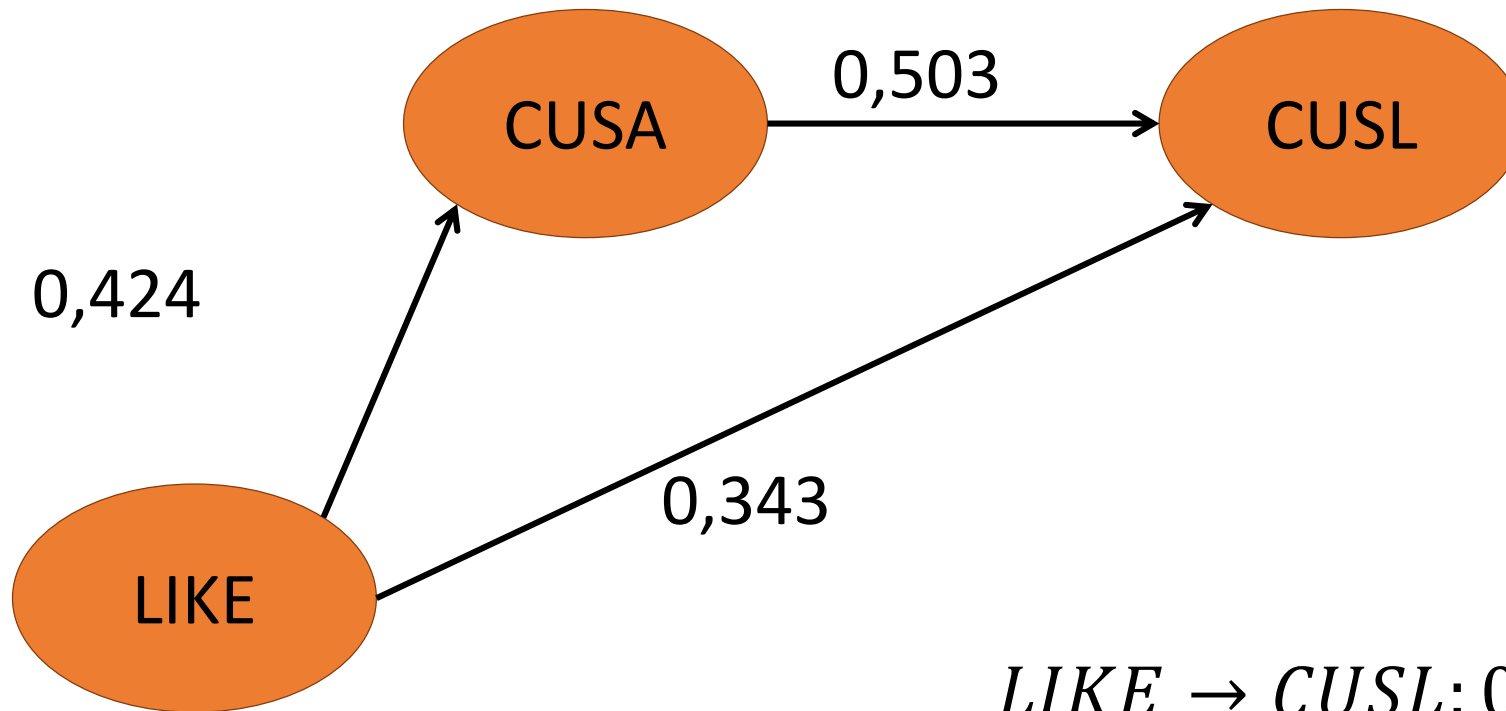
Zoom (100%)

Copy to Excel

Copy to R

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
COMP → CUSA	0.162	0.162	0.065	2.508	0.012
COMP → CUSL	0.009	0.012	0.054	0.169	0.866
CUSA → CUSL	0.504	0.503	0.042	11.933	0.000
LIKE → CUSA	0.424	0.425	0.059	7.145	0.000
LIKE → CUSL	0.342	0.341	0.056	6.100	0.000

Efeito Total



$$LIKE \rightarrow CUSL: 0,343 + 0,424 \times 0,503$$

$$LIKE \rightarrow CUSL: 0,5563$$



Efeito total

ModeloReflexivo - BT results

Corporate Reputation Data

▼ Graphical

Graphical output

▼ Final results

- ▶ Path coefficients
- ▶ Total indirect effects
- ▶ Specific indirect effects

▼ Total effects

- ☒ Mean, STDEV, T values, p values
- ☐ Confidence intervals
- ☐ Confidence intervals bias corrected

Total effects - Mean, STDEV, T values, p values

[Zoom](#) (100%)

[Copy to Excel](#)

[Copy to R](#)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
COMP -> CUSA	0.162	0.162	0.065	2.508	0.012
COMP -> CUSL	0.091	0.093	0.065	1.392	0.164
CUSA -> CUSL	0.504	0.503	0.042	11.933	0.000
LIKE -> CUSA	0.424	0.425	0.059	7.145	0.000
LIKE -> CUSL	0.556	0.555	0.061	9.130	0.000



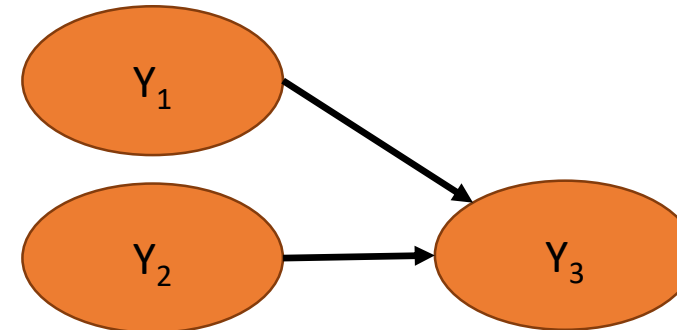
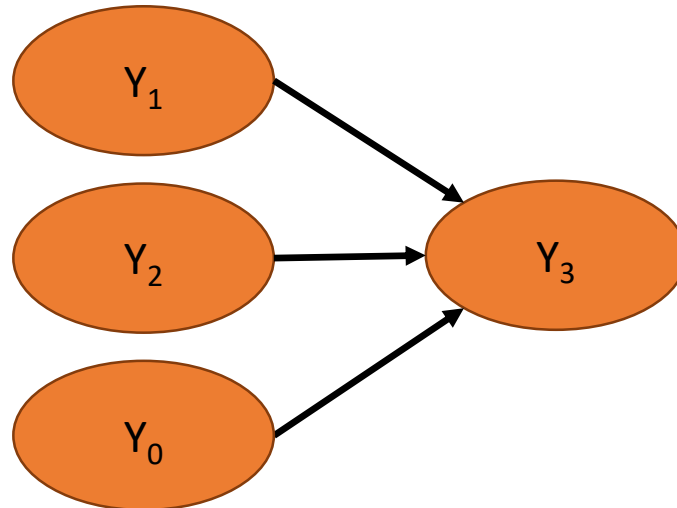
Modelo Estrutural

- R^2 explicação dos constructos endógenos
- Coeficientes do modelo estrutural
- f^2 poder de explicação dos constructos exógenos
- Q^2 relevância preditiva
- q^2 poder de predição dos constructos exógenos



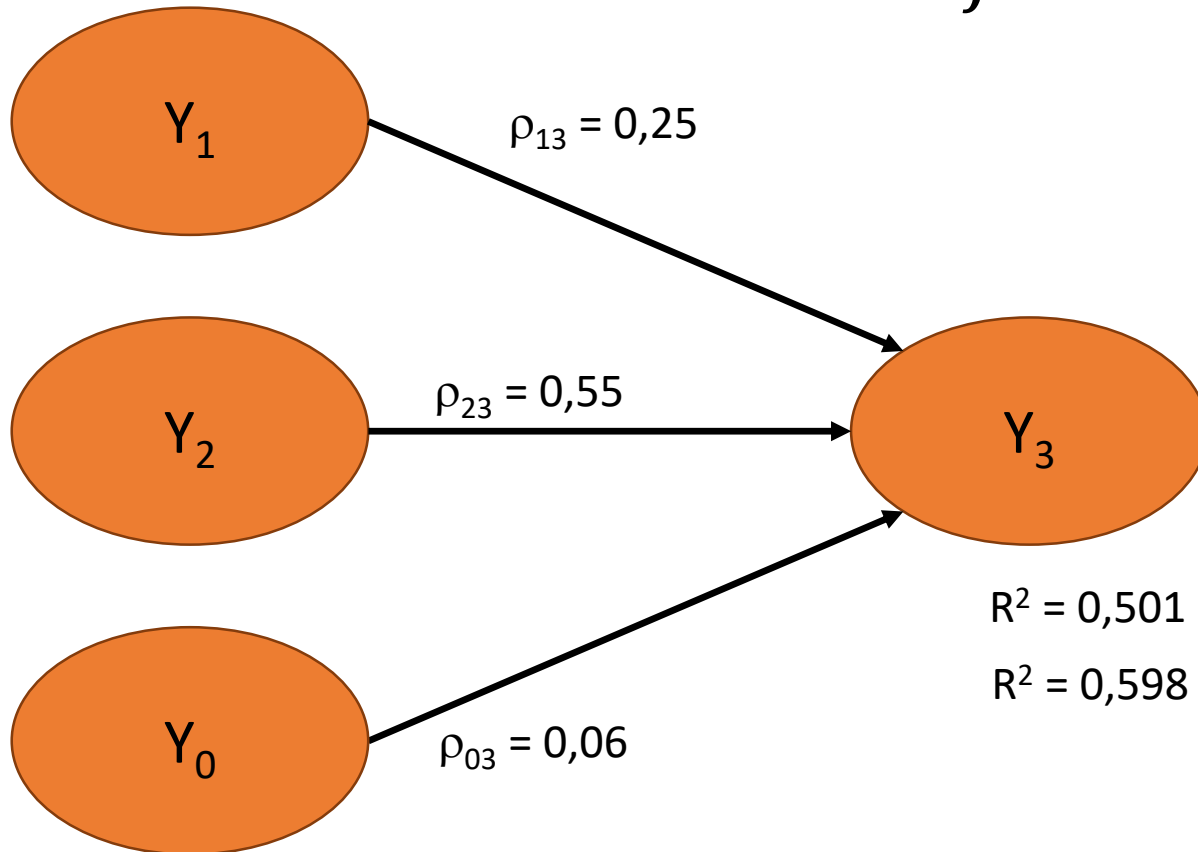
f^2 poder de explicação dos constructos exógenos

- Refere-se ao impacto de um constructo exógeno no R^2 de um constructo endógeno
- Ele é determinado avaliando a mudança no valor do R^2 de um constructo endógeno quando um constructo exógeno é excluído do modelo



f^2 poder de explicação dos constructos exógenos

$$f^2 = \frac{R_{Included}^2 - R_{Excluded}^2}{1 - R_{Included}^2}$$



f^2	Intensidade do efeito
$f^2 < 0,02$	Irrelevante
$0,02 \leq f^2 < 0,15$	Pequeno
$0,15 \leq f^2 < 0,35$	Médio
$f^2 \geq 0,35$	Grande

$$f^2 = \frac{0,598 - 0,501}{1 - 0,598} = 0,241$$



f^2 poder de explicação dos constructos exógenos

ModeloReflexivo - BT results	
Corporate Reputation Data	
▼ Graphical	
Graphical output	
▼ Final results	
▶ Path coefficients	
▶ Total indirect effects	
▶ Specific indirect effects	
▶ Total effects	
▶ Outer loadings	
▶ Outer weights	
▼ Quality criteria	
▶ R-square	
▶ R-square adjusted	
▼ f-square	
☐ Mean, STDEV, T values, p values	

f-square - Mean, STDEV, T values	
	Original sample (O)
COMP -> CUSA	0.022
COMP -> CUSL	0.000
CUSA -> CUSL	0.410
LIKE -> CUSA	0.149
LIKE -> CUSL	0.136

f^2 poder de explicação dos constructos exógenos

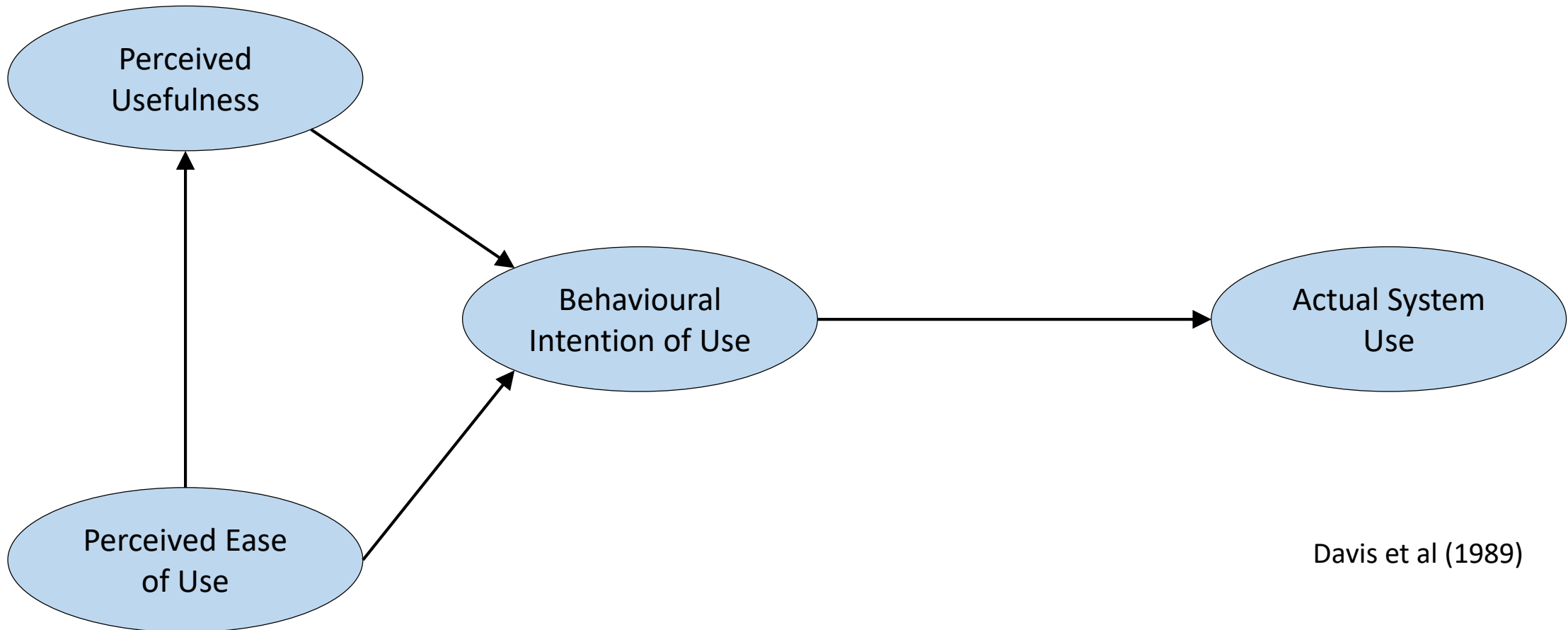
Valor de f^2		Constructos Endógenos	
		CUSA	CUSL
Constructos Exógenos	CUSA		0,410
	COMP	0,022	0,000
	LIKE	0,149	0,136

Alto

Pequeno/nulo

Médio/Pequeno

Exercício – Technology Acceptance Model (TAM)



Davis et al (1989)

Exercício – Technology Acceptance Model (TAM)

