

# MODUL PELATIHAN

## STRUCTURAL EQUATION MODEL PARTIAL LEAST SQUARE (SEM-PLS) Menggunakan SmartPLS

Oleh:

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# TEKNIK MENGINSTAL SmartPLS

**Azuar Juliandi**

# SISTEM OPERASI KOMPUTER

SmartPLS dapat diinstal dan untuk 2 jenis sistem operasi:

- (1) Mac OS X
- (2) Windows

Khusus untuk sistem operasi “Windows”, SmartPLS menyediakan 2 jenis file instalasi aplikasi yang harus dipilih, yakni:

- (1) Sistem operasi Windows 32 Bit;
- (2) Sistem operasi Windows 64 Bit.

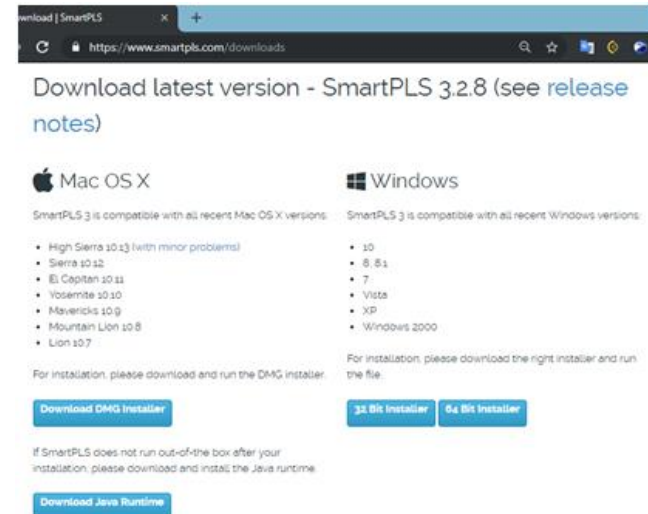
# DOWNLOAD

Download terlebih dahulu software SmartPLS di alamat: <https://www.smartpls.com>

Download-lah salah satu file yang sesuai dengan sistem operasi Windows Anda, apakah:

- ❑ [Windows 32 Bit](#)
- ❑ [Windows 64 Bit](#)
- ❑ [Mac-OS](#)

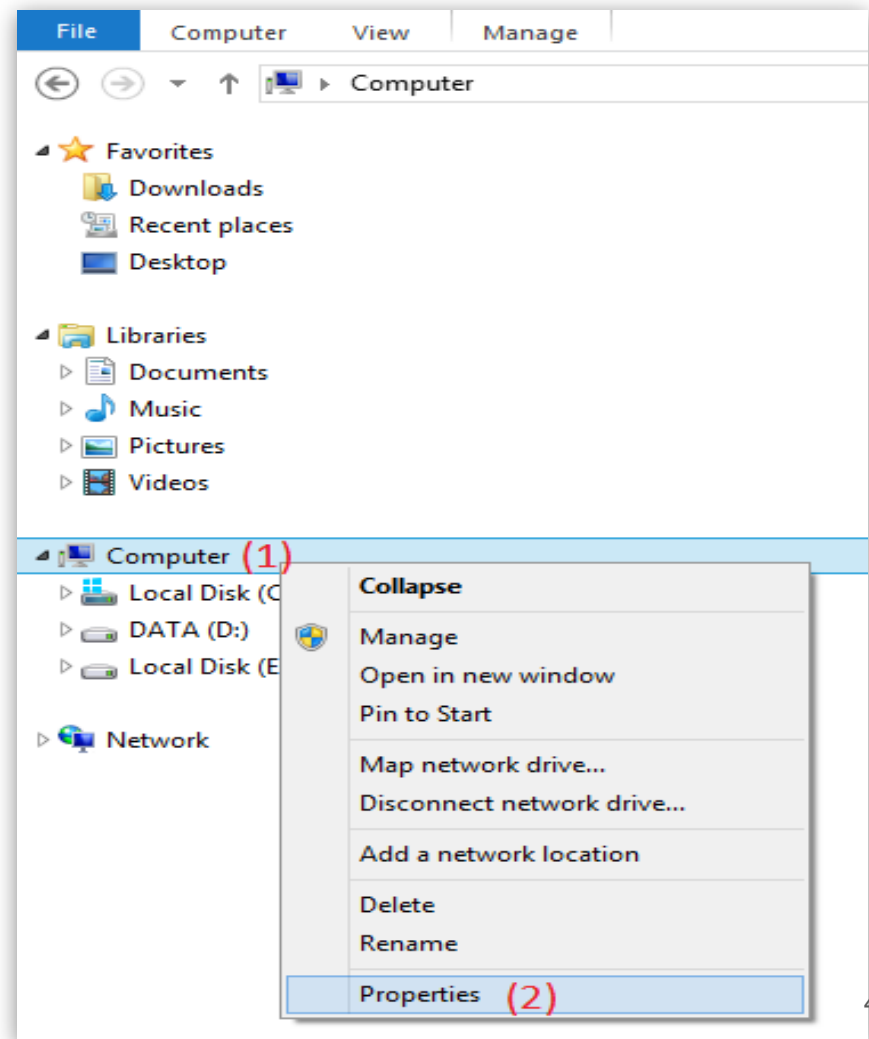
Jika SmartPLS tidak dapat dijalankan setelah diinstal, maka perlu mendownload dan menginstal “Java Runtime”. File instalasi java runtime terlihat pada link “[Download Java Runtime](#)” seperti di dalam gambar.



Untuk mengetahui secara pasti sistem operasi Windows, lakukan langkah-langkah berikut ini:

Buka Windows Explorer

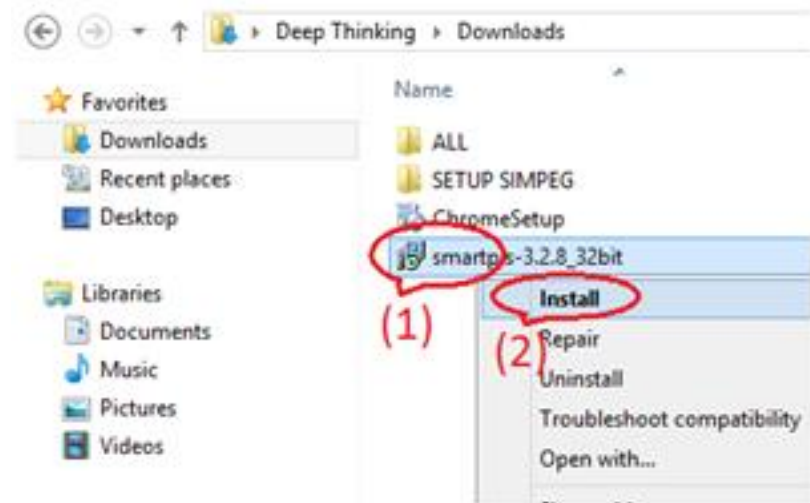
- 1) Klik kanan pada “Computer”
- 2) Klik kiri “Properties”



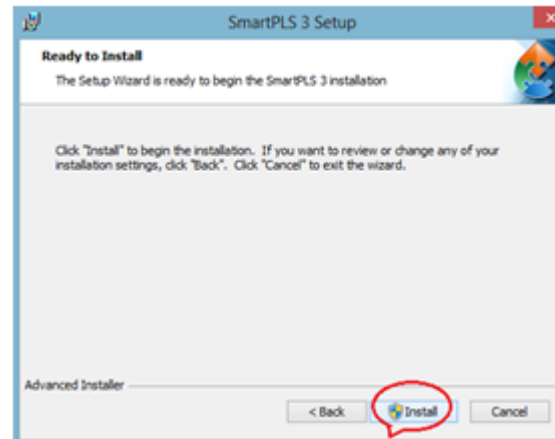
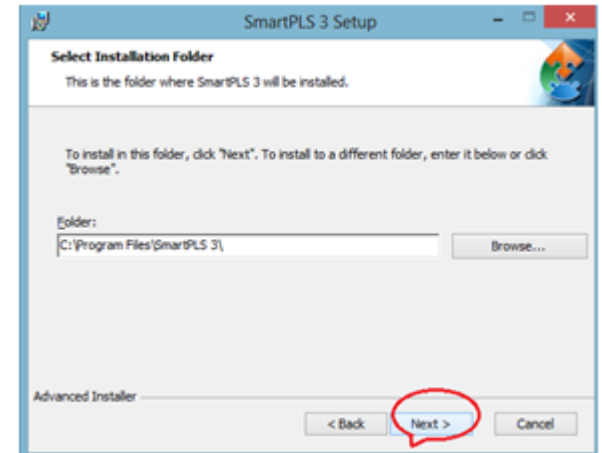
# INSTALL APLIKASI

Buka windows explorer

- 1) Klik kanan pada file yang telah didownload, contohnya “Smartpls-3.2.8”
- 2) Klik “install”



Selanjutnya, klik setiap muncul “Next” dan “Install”

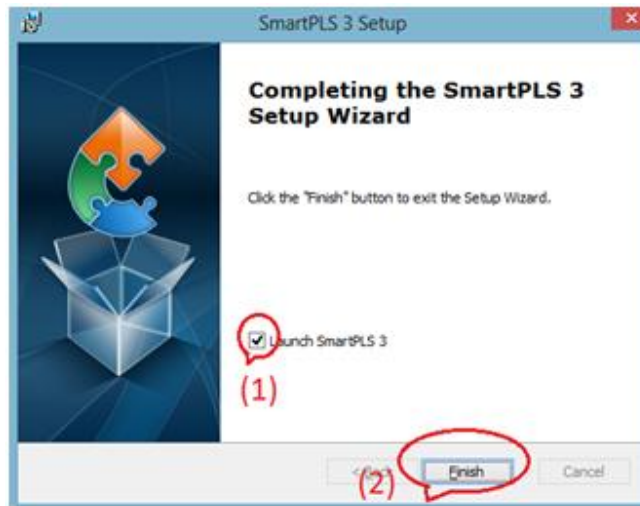
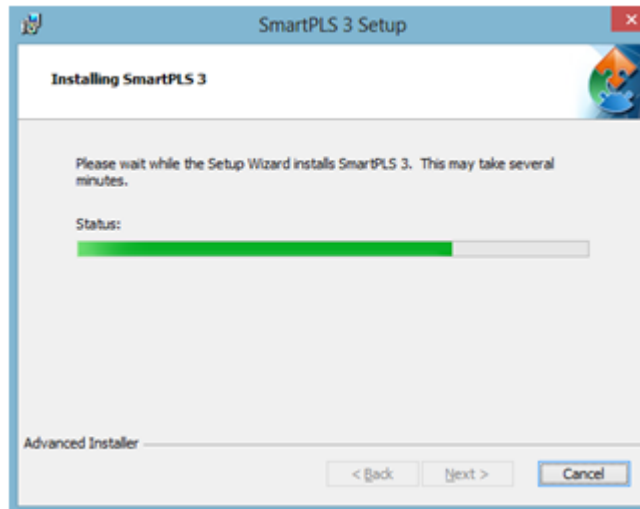




Proses instalasi membutuhkan waktu beberapa menit. Tunggu proses instalasi selesai.

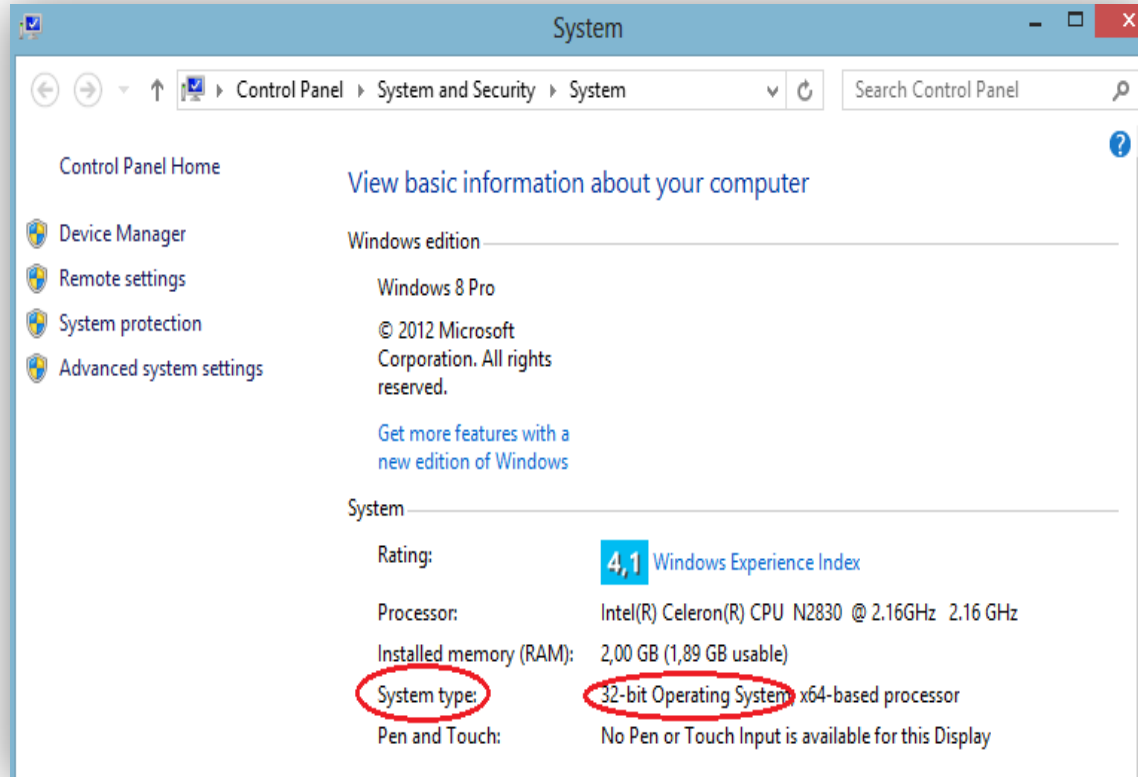
Jika proses instalasi sudah selesai:

- 1) Pastikan “Launch SmartPLS” terceklis
- 2) Klik “Finish”



Pada “System Type” terlihat sistem operasi. Contoh di dalam gambar adalah “32-bit operating system”.

Berdasarkan tipe sistem operasi di atas, maka pengguna perlu mendownload aplikasi SmartPLS yang sesuai dengan sistem operasinya.



# PILIHAN LISENSI PENGGUNAAN

SmartPLS akan memberikan 4 pilihan lisensi penggunaan:

	<b>Student</b>	<b>Profesional (1)</b>	<b>Profesional (2)</b>	<b>Profesional (3)</b>
<b>Batas waktu</b>	Selamanya	30 hari	Selamanya	Selamanya
<b>Kelengkapan fitur</b>	Terbatas	Lengkap	Lengkap	Lengkap
<b>Pembayaran</b>	Gratis	Gratis	Berbayar	Berbayar

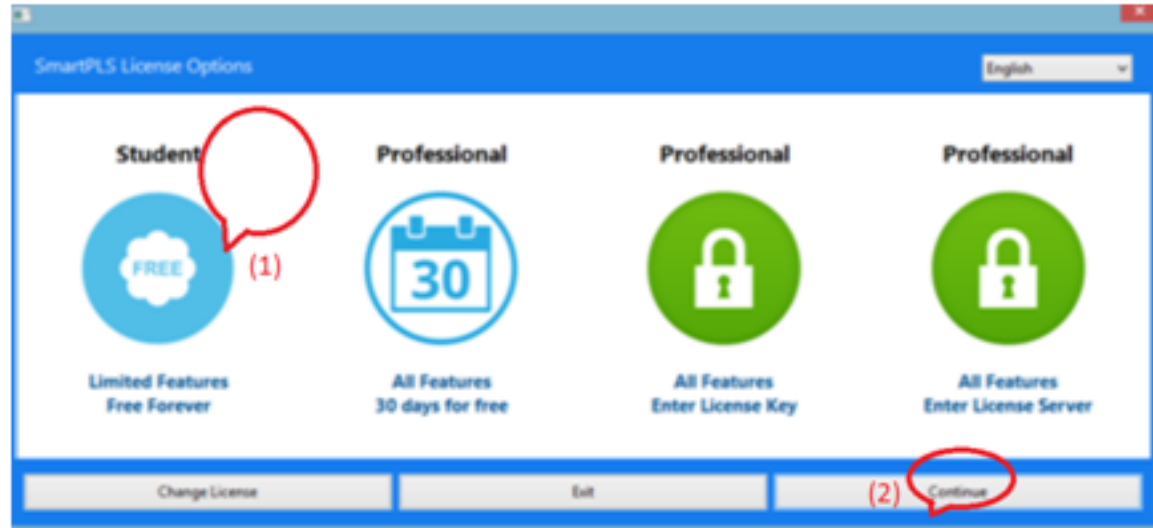
Untuk versi Student, jumlah sampel yang dapat dianalisis hanya 100

Untuk proses lisensi, pengguna harus terhubung ke internet.

Ketika SmartPLS meminta untuk memilih lisensi:

- (1) Pilihlah versi “Student”
- (2) Klik “Continue”

Tunggu hingga proses instalasi selesai.



**Terms of Use**

The 'Student License' is a single-computer license with limited functionalities. It is, unless otherwise announced by SmartPLS, free but does not give you access to all the functionalities of the software. For example, it does not allow you to use datasets with more than 100 observations, customize colors, fonts and borders, export results to Excel, R and HTML.

Change License

Exit

Continue

Requesting Student license from licensing server. Process may take up to 30s. Please wait ...

Change License

Exit

Continue



Student

**Your license is valid**

**Licensee**

SmartPLS (Student)

**Expires**

never

**License Key**

SmartPLS Student

Change License

Exit

START

# KONSEP DASAR PARTIAL LEAST SQUARE (PLS)

AZUAR JULIANDI

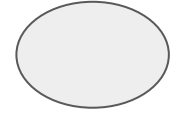


# Jenis-Jenis Analisis: Univariat, Bivariat, Multivariat

## 1) Analisis univariat

Analisis statistik untuk penelitian yang hanya menggunakan satu variabel (per-variabel). Umumnya hanya menggunakan statistik-statistik deskriptif, contoh statistik yang selalu digunakan:

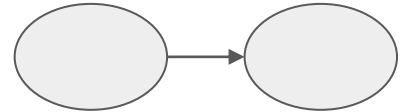
- Frekuensi
- Deskriptif: Mean, Median, Modus, Max, Min, Sum.
- Grafik-grafik, diagram-diagram Dsb.



## 1) Analisis bivariat

Analisis statistik untuk penelitian yang hanya menggunakan dua variabel, contohnya:

- Korelasi sederhana (simple correlation)
- Regresi sederhana (simple regression), Dsb.

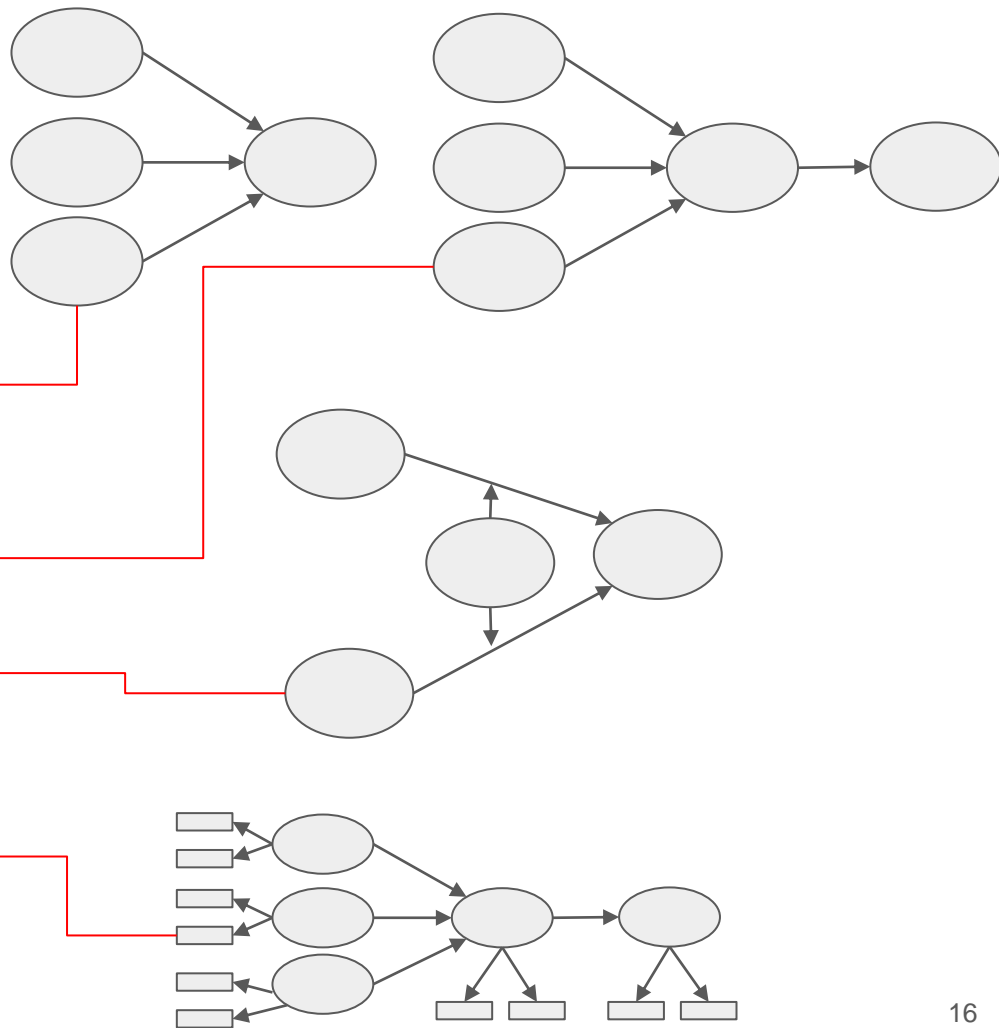


3)

### Analisis multivariat

Analisis statistik untuk penelitian yang menggunakan lebih dari dua variabel, contohnya:

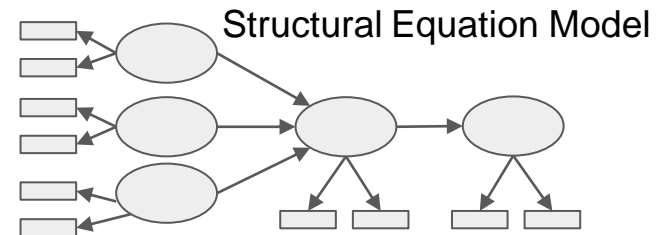
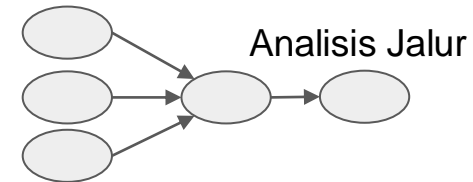
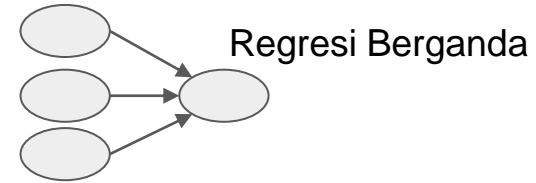
- Korelasi dan regresi berganda
- Analisis jalur (path analysis)
- Moderated Regression Analysis (MRA)
- Structural Equation Model (SEM) atau Model Persamaan Struktural



# Model Persamaan Struktural / Structural Equation Modeling (SEM)

Analisis multivariat generasi pertama, hanya mampu menganalisis suatu variabel secara serempak (misalnya regresi berganda, analisis jalur), namun tidak mampu menganalisis sekaligus variabel-variabel dan indikator-indikatornya. Untuk keperluan seperti itu, itu diperlukan SEM.

**SEM (Structural Equation Model)** atau **Model Persamaan Struktural** adalah analisis statistik untuk penelitian yang membutuhkan analisis secara “serempak/sekaligus” seluruh variabel-variabel dan indikator-indikatornya.



Penelitian terdiri dari 2 pendekatan dan masing-masing memiliki teknik analisis tersendiri:

- ❑ Exploratory research: Penelitian eksploratif, teori sedikit, kurang memadai, atau belum kuat.
- ❑ Confirmatory research: Penelitian konfirmatif, teori banyak, memadai, atau sudah kuat.

	<b>EXPLORATORY</b> Teori yang mendukung penelitian <b>tidak harus</b> kuat, bisa belum memadai	<b>CONFIRMATORY</b> Teori yang mendukung penelitian <b>harus cukup kuat/memadai</b>
<b>Teknik generasi pertama</b>	<ul style="list-style-type: none"> <li>❑ Cluster analysis</li> <li>❑ Exploratory factor analysis</li> <li>❑ Multidimensional scaling</li> </ul>	<ul style="list-style-type: none"> <li>❑ Analysis of variance (Anava)</li> <li>❑ Logistic regression</li> <li>❑ Multiple regression</li> </ul>
<b>Teknik generasi kedua</b>	<ul style="list-style-type: none"> <li>❑ Partial Least Square - Structural Equational Modeling (PLS-SEM) → Software: SmartPLS, Warp PLS, Tetrad, PLS-PM</li> </ul>	<ul style="list-style-type: none"> <li>❑ Covariance-based Structural Equational Modeling (CB-SEM) → Software: AMOS, Lisrell, EQS, M-Plus</li> </ul>

# Perbedaan PLS dan CB-SEM

	<b>PLS Partial Least Square</b>	<b>CB-SEM Covariance Based SEM</b>
Tujuan	Prediksi	Konfirmasi teori
Asumsi Normalitas Data	Tidak diperlukan	Diperlukan
Jumlah Sampel	Boleh kecil ( $\geq 30$ )	Harus besar ( $\geq 100$ )
Bentuk Konstruk	Reflektif & Formatif	Formatif
Jumlah Indikator	Maksimum 1000	Maksimum 100
Software	SmartPLS, Warp PLS, Tetrad, PLS-PM	AMOS, Lisrell, EQS, M-Plus

# Kriteria PLS

- ❑ Tidak terpengaruh oleh kekurangan data. Tidak ada masalah dengan sampel yang kecil. Namun ukuran sampel yang lebih besar akan meningkatkan ketepatan estimasi PLS.
- ❑ Tidak memerlukan asumsi distribusi (asumsi normalitas), karena PLS tergolong statistik non-parametrik.
- ❑ Skala pengukuran dapat berupa data berskala metrik (rasio dan interval), data berskala kuasi metrik (ordinal), atau binary (nominal).
- ❑ Mudah menggabungkan model pengukuran reflektif dan formatif.
- ❑ Menangani model yang kompleks dengan banyak hubungan model struktural.
- ❑ Dapat digunakan untuk tujuan prediksi
- ❑ Dapat digunakan sebagai masukan untuk analisis selanjutnya
- ❑ Memiliki kekuatan statistik yang tinggi (High levels of statistical power)

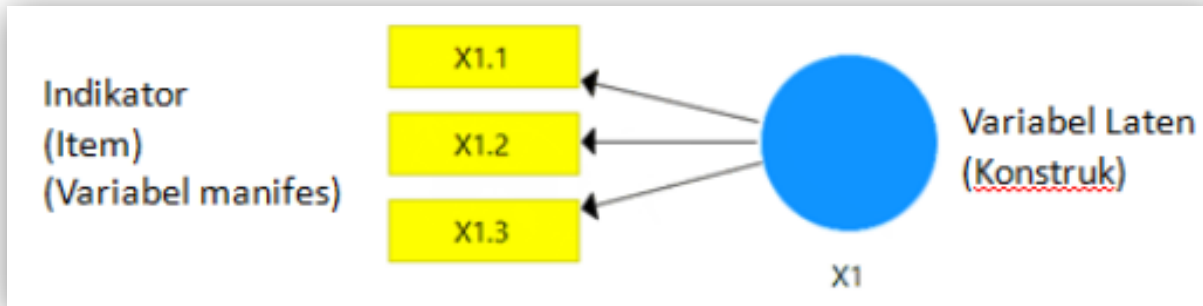
# Variabel Dalam PLS

## ❑ Konstruk:

- ❑ Disebut juga variabel laten
- ❑ Konstruk adalah suatu ukuran yang abstrak, tidak dapat diamati langsung.
- ❑ Di dalam model jalur, konstruk direpresentasikan dengan gambar lingkaran atau oval
- ❑ Jenis variabel laten:
  - ❑ Variabel eksogen: sama dengan variabel independen/variabel bebas, yakni variabel yang bersifat mempengaruhi variabel lain
  - ❑ Variabel endogen: sama dengan variabel dependen/variabel terikat. Namun demikian, variabel endogen juga dapat berperan ganda, yakni berperan sebagai variabel bebas, sekaligus juga variabel terikat

## ❑ Indikator:

- ❑ Umumnya disebut sebagai item atau variabel manifes atau observed variables.
- ❑ indikator adalah pengamatan yang terukur langsung (data mentah).
- ❑ Direpresentasikan dalam model jalur dengan gambar persegi panjang.



# Model Struktural (Inner Models)

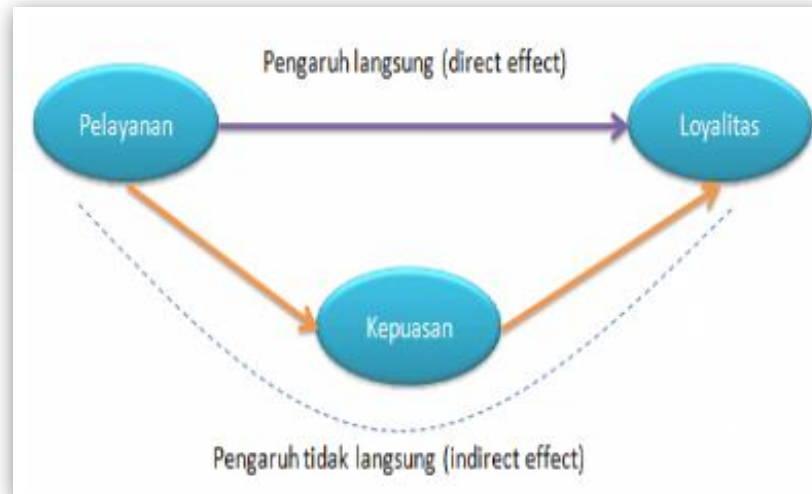
- ❑ Model struktural adalah model yang mendeskripsikan hubungan antar variabel laten (konstruk)
- ❑ Hubungan variabel laten didasarkan kepada teori, logika, atau pengalaman praktis yang diamati para peneliti sebelumnya
- ❑ *Contoh: Pengaruh pelayanan terhadap kepuasan, berlanjut terhadap loyalitas*
  - *Pelayanan berperan sebagai variabel laten “eksogen” (variabel bebas)*
  - *Loyalitas berperan sebagai variabel laten “endogen” (variabel terikat)*
  - *Disebut juga variabel laten endogen, jika berperan sekaligus sebagai variabel laten eksogen (variabel bebas) dan endogen (variabel terikat), contohnya kepuasan.*





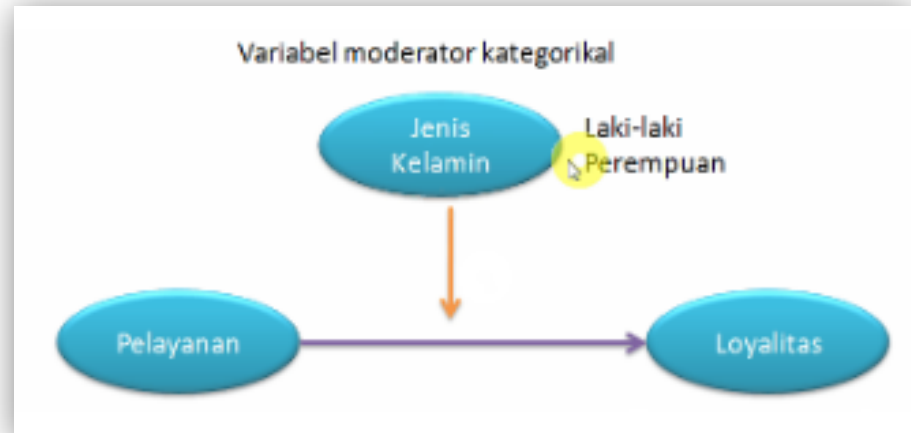
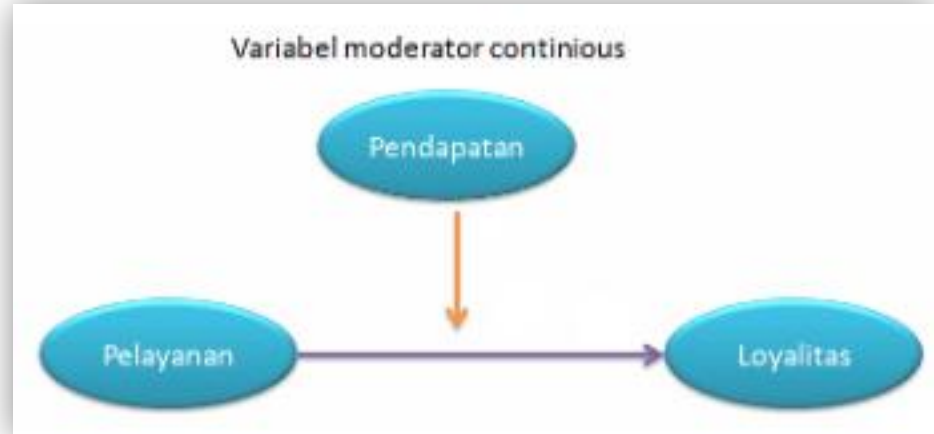
## Contoh model struktural yang mengandung variabel mediator/mediasi/intervening

- ❑ Variabel mediator/intervening adalah variabel yang mengantarai hubungan variabel eksogen (bebas) dan endogen (terikat).
- ❑ Ada 2 pengaruh yang terjadi:
  - ❑ Pengaruh Langsung (direct effect)
  - ❑ Pengaruh Tidak langsung (indirect effect)
- ❑ Contoh:
  - ❑ Kepuasan berperan sebagai variabel laten endogen (terikat), yakni dipengaruhi pelayanan
  - ❑ Kepuasan juga berperan sebagai variabel laten endogen (bebas), yakni mempengaruhi loyalitas
  - ❑ Kepuasan juga berperan sebagai variabel mediasi/intervening, karena mengantarai hubungan pelayanan (variabel eksogen/bebas) dan loyalitas (variabel endogen/terikat).



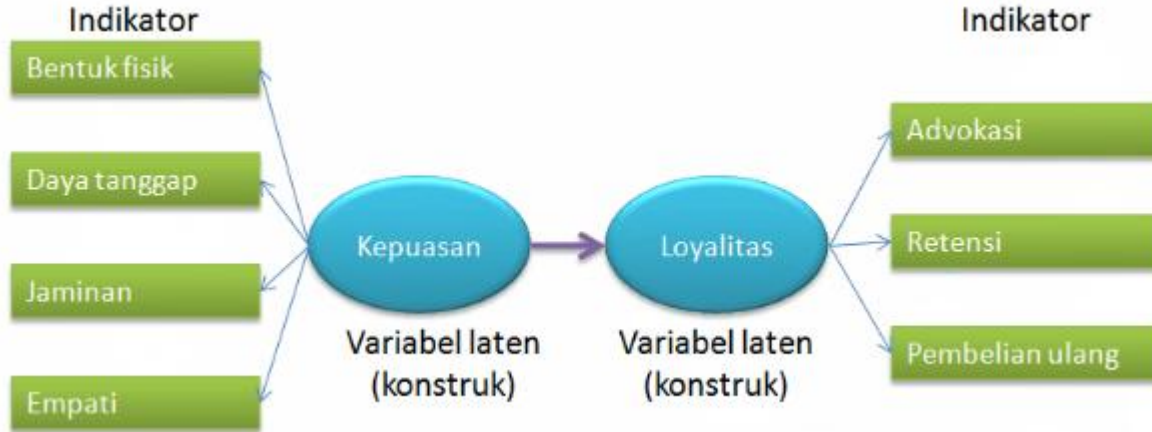
## Contoh model struktural yang mengandung variabel moderator

- ❑ Variabel moderator adalah variabel yang dapat merubah kekuatan atau bahkan arah hubungan variabel eksogen (bebas) dan endogen (terikat).
- ❑ Ada 2 jenis variabel moderator:
  - ❑ Continuous: ketika variabel moderator diukur secara metrik
    - ❑ Contoh: Pendapatan mempengaruhi hubungan pelayanan dengan loyalitas
  - ❑ Categorical: ketika variabel moderator diukur secara kategori
    - ❑ Contoh: jenis kelamin (laki-laki dan perempuan) mempengaruhi hubungan pelayanan dengan loyalitas



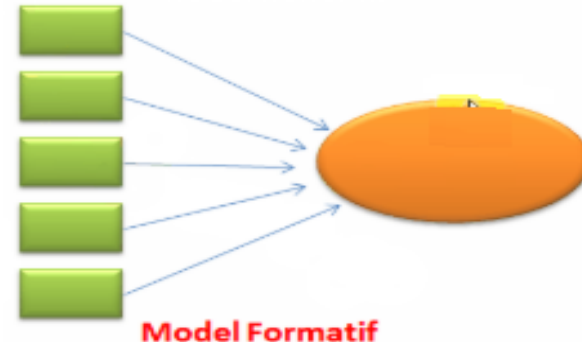
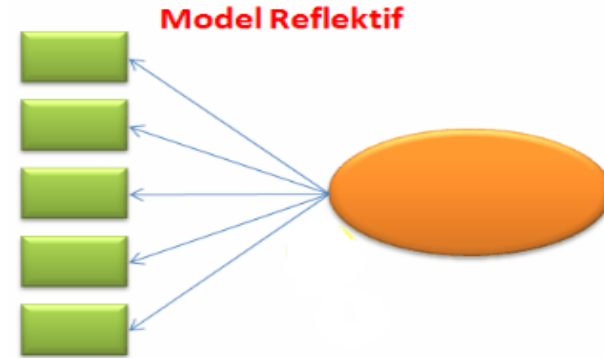
# Model Pengukuran (Outer Models)

- ❑ Model pengukuran adalah model yang mendeskripsikan hubungan antar variabel laten (konstruk) dengan indikatornya
- ❑ Hubungan variabel tersebut kepada teori pengukuran.
- ❑ *Contoh:*
  - *Kepuasan (laten) mempunyai indikator bentuk fisik, daya tanggap, jaminan dan empati*
  - *Loyalitas mempunyai indikator advokasi, retensi dan pembelian ulang*



# Model Hubungan Reflektif dan Formatif

- ❑ Model reflektif:
  - ❑ Arah panah berawal dari variabel laten menuju kepada Indikator
  - ❑ Artinya, indikator (secara teori) merupakan cerminan/ukuran/aspek dari variabelnya. Dengan demikian, indikator tidak mempengaruhi variabel.
- ❑ Model formatif:
  - ❑ Arah panah berawal dari Indikator menuju kepada variabel laten
  - ❑ Artinya, indikator (secara teori) merupakan cerminan/ukuran/aspek dari variabelnya, namun sekaligus juga merupakan sesuatu yang dapat mempengaruhi variabel

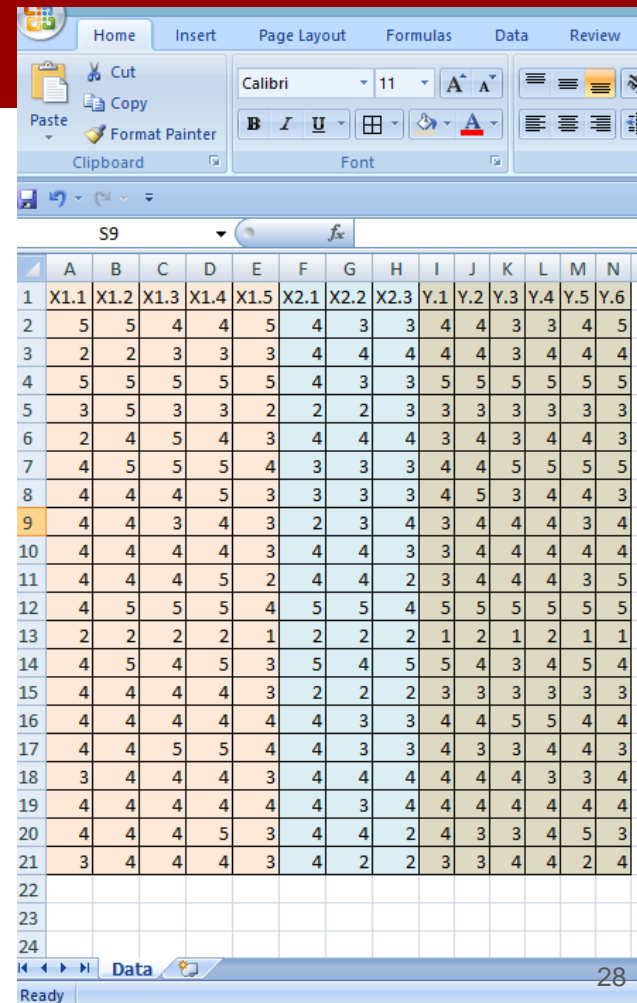


# Membangun Model PLS di SmartPLS

# Persiapan Data di Excel

- ❑ Kemaslah rekap data di Excel.  
(Catatan: Untuk SmartPLS versi Student, maksimal sampel hanya 100). Misalnya di dalam gambar, terdapat:
  - ❑ Sampel: 20 sampel
  - ❑ Variabel: ada 3 (X1, X2, dan Y)
    - ❑ Variabel X1: terdiri dari 5 item indikator: X1.1 s.d. X1.5
    - ❑ Variabel X2: terdiri dari 3 item indikator: X2.1 s.d. X2.3
    - ❑ Variabel Y: terdiri dari 6 item indikator: Y.1 s.d. Y.6.

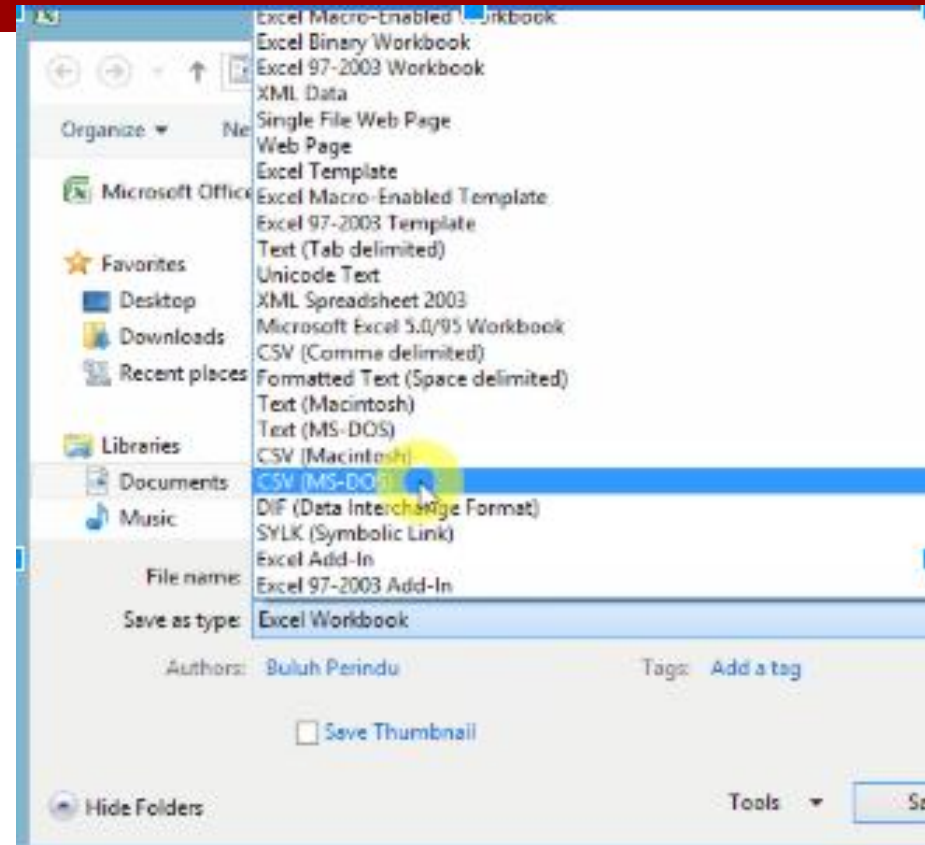
[DOWNLOAD CONTOH](#)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	X1.1	X1.2	X1.3	X1.4	X1.5	X2.1	X2.2	X2.3	Y.1	Y.2	Y.3	Y.4	Y.5	Y.6
2	5	5	4	4	5	4	3	3	4	4	3	3	4	5
3	2	2	3	3	3	4	4	4	4	4	3	4	4	4
4	5	5	5	5	5	4	3	3	5	5	5	5	5	5
5	3	5	3	3	2	2	2	3	3	3	3	3	3	3
6	2	4	5	4	3	4	4	4	3	4	3	4	4	3
7	4	5	5	5	4	3	3	3	4	4	5	5	5	5
8	4	4	4	5	3	3	3	3	4	5	3	4	4	3
9	4	4	3	4	3	2	3	4	3	4	4	4	4	4
10	4	4	4	4	3	4	4	3	3	4	4	4	4	4
11	4	4	4	5	2	4	4	2	3	4	4	4	3	5
12	4	5	5	5	4	5	5	4	5	5	5	5	5	5
13	2	2	2	2	1	2	2	2	1	2	1	2	1	1
14	4	5	4	5	3	5	4	5	5	4	3	4	5	4
15	4	4	4	4	3	2	2	2	3	3	3	3	3	3
16	4	4	4	4	4	4	3	3	4	4	5	5	4	4
17	4	4	5	5	4	4	3	3	4	3	3	4	4	3
18	3	4	4	4	3	4	4	4	4	4	4	4	3	4
19	4	4	4	4	4	4	3	4	4	4	4	4	4	4
20	4	4	4	5	3	4	4	2	4	3	3	4	5	3
21	3	4	4	4	3	4	2	2	3	3	4	4	2	4
22														
23														
24														

# Persiapan Data di Excel

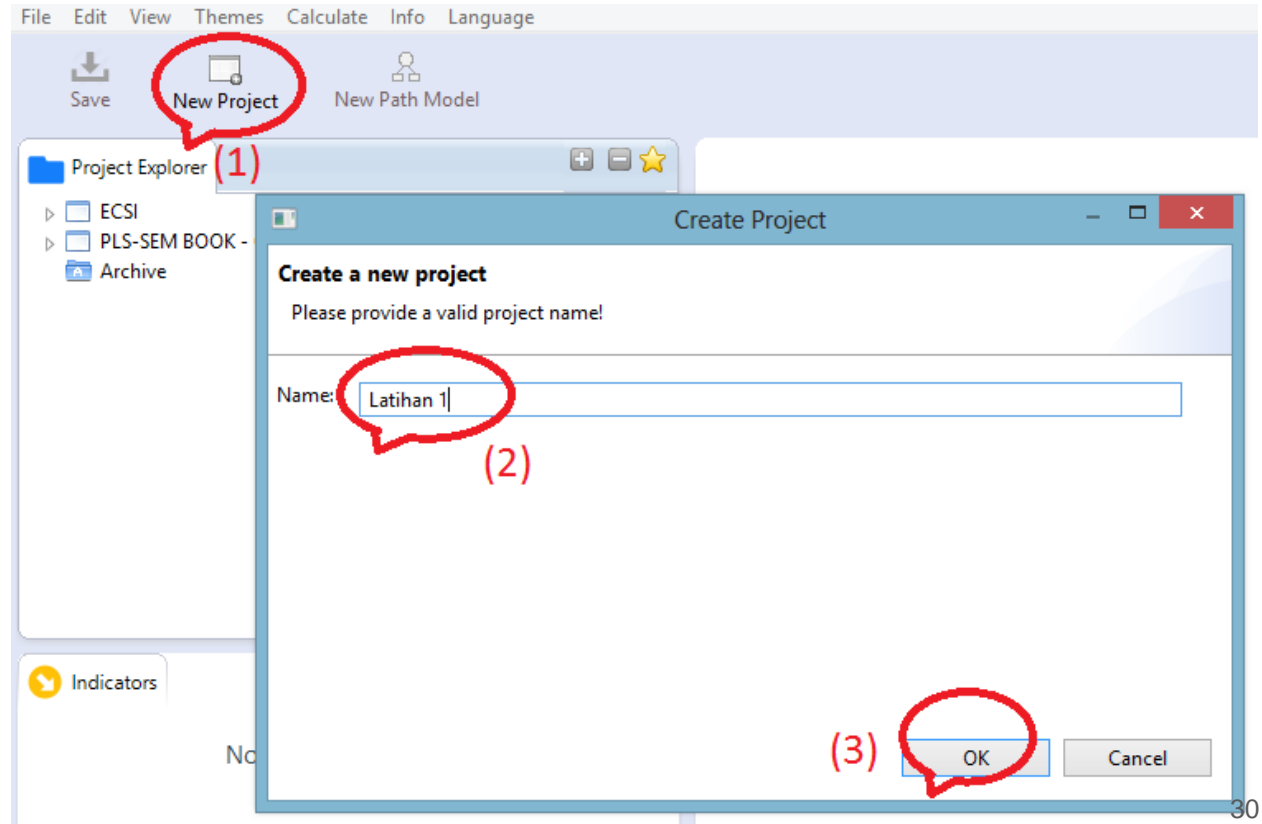
- Simpan data tersebut:
  - Pada “File name”, ketikkan nama file Anda, misalnya “Data”
  - Pada “Save as type”, pilih “CSV (MS-Dos)”, dan “SAVE”
  - Jika muncul dialog, klik “OK”; “YES”;



# New Project (Membuat proyek analisis yang baru)

Membuat Project Baru:

- 1) Klik "New Project"
- 2) Ketikkan nama project, misalnya "Latihan 1", lalu klik OK

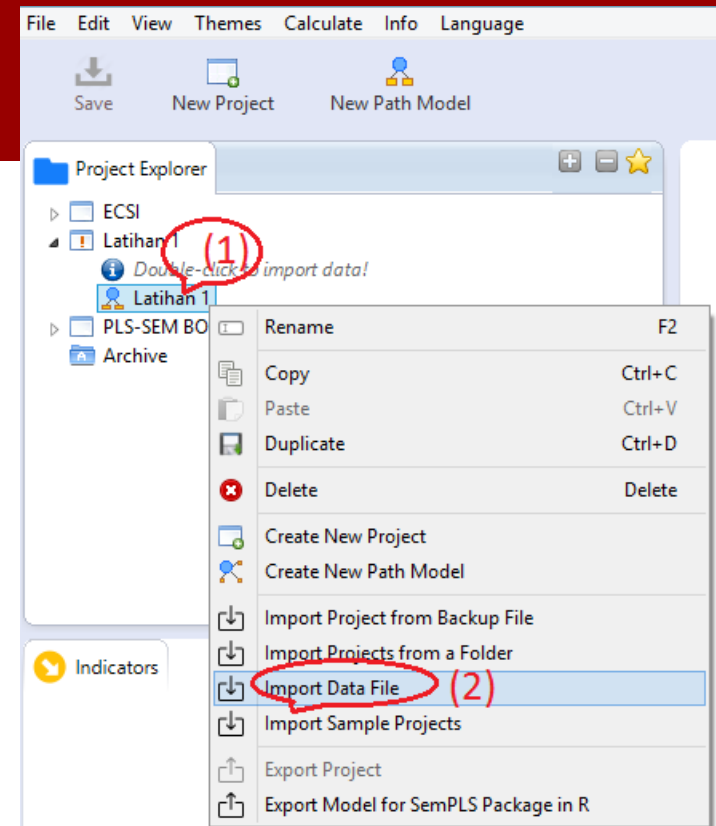




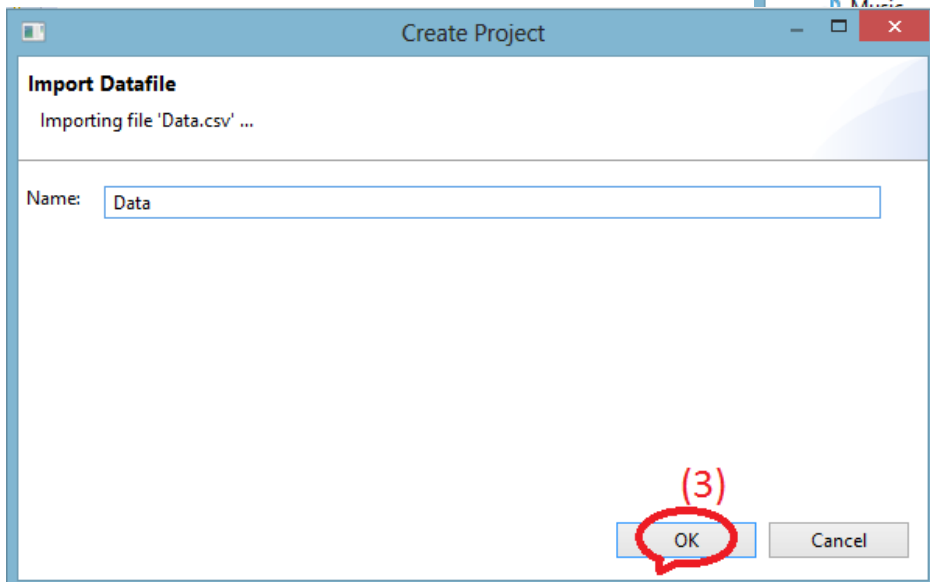
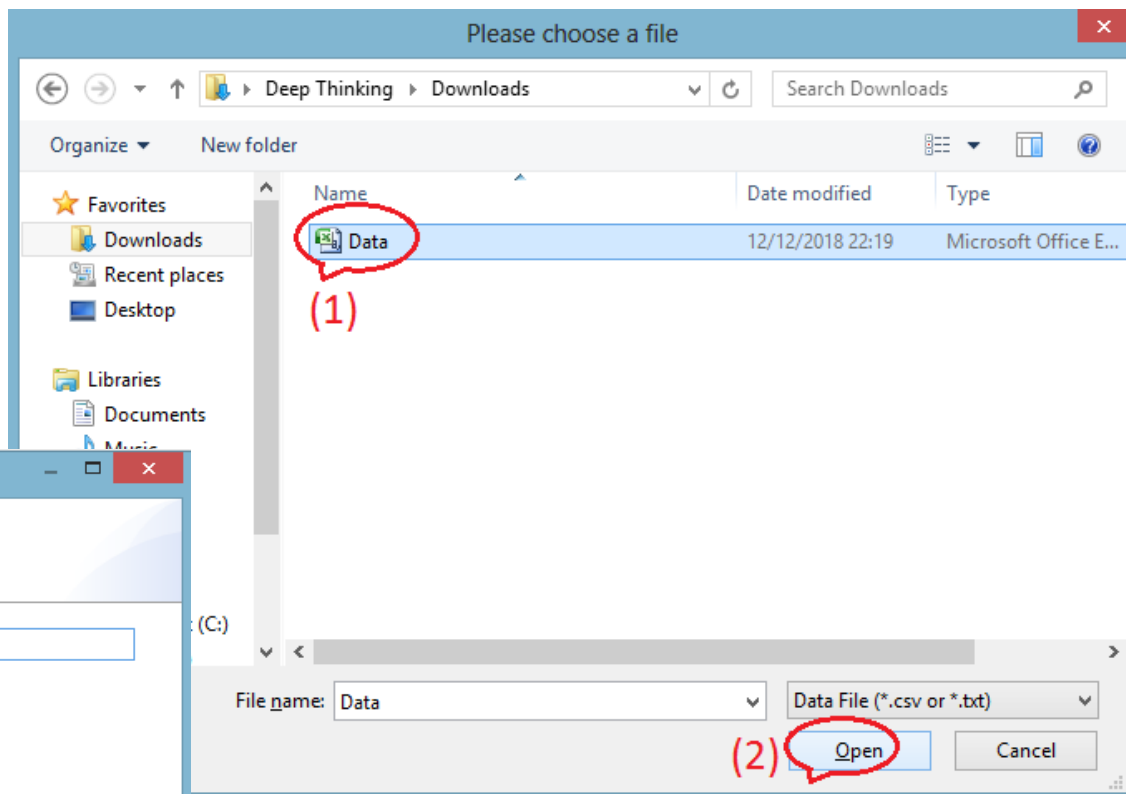
# Mengimport Data

Mengimport data:

- 1) Klik kanan pada “Latihan 1”
- 2) Import data file



- 1) Pilih file yang telah disimpan di Excel,
- 2) klik OPEN
- 3) Klik OK



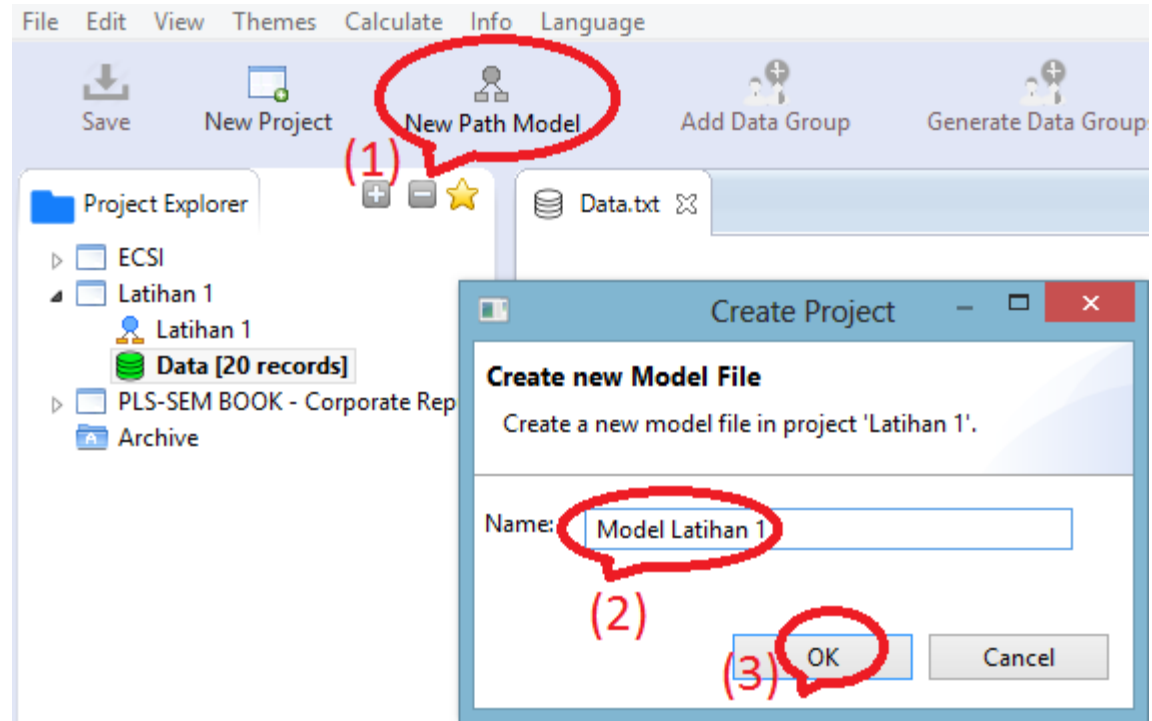
# Hasil impor data akan diperlihatkan

The screenshot displays the SmartPLS software interface. The top menu bar includes File, Edit, View, Themes, Calculate, Info, and Language. The toolbar contains icons for Save, New Project, New Path Model, Add Data Group, Generate Data Groups, and Clear Data Groups. The Project Explorer on the left shows a folder structure with 'Data [20 records]' highlighted in red. The main window shows the 'Data.txt' file settings: Delimiter: Semicolon, Encoding: UTF-8, Value Quote Character: None, Sample size: 20, Number Format: US (e.g. 1.000.23), Indicators: 14, and Missing Value Marker: None. Below the settings is a table of indicators with columns for No., Missing, Mean, Median, and Min. The table is circled in red.


Indicators:	Indicator	Correlations	Raw File	No.	Missing	Mean	Median	Min
X1.1				1	0	3.650	4.000	2.000
X1.2				2	0	4.100	4.000	2.000
X1.3				3	0	4.000	4.000	2.000
X1.4				4	0	4.200	4.000	2.000
X1.5				5	0	3.250	3.000	1.000
X2.1				6	0	3.600	4.000	2.000
X2.2				7	0	3.250	3.000	2.000
X2.3				8	0	3.150	3.000	2.000
Y.1				9	0	3.650	4.000	1.000
Y.2				10	0	3.800	4.000	2.000

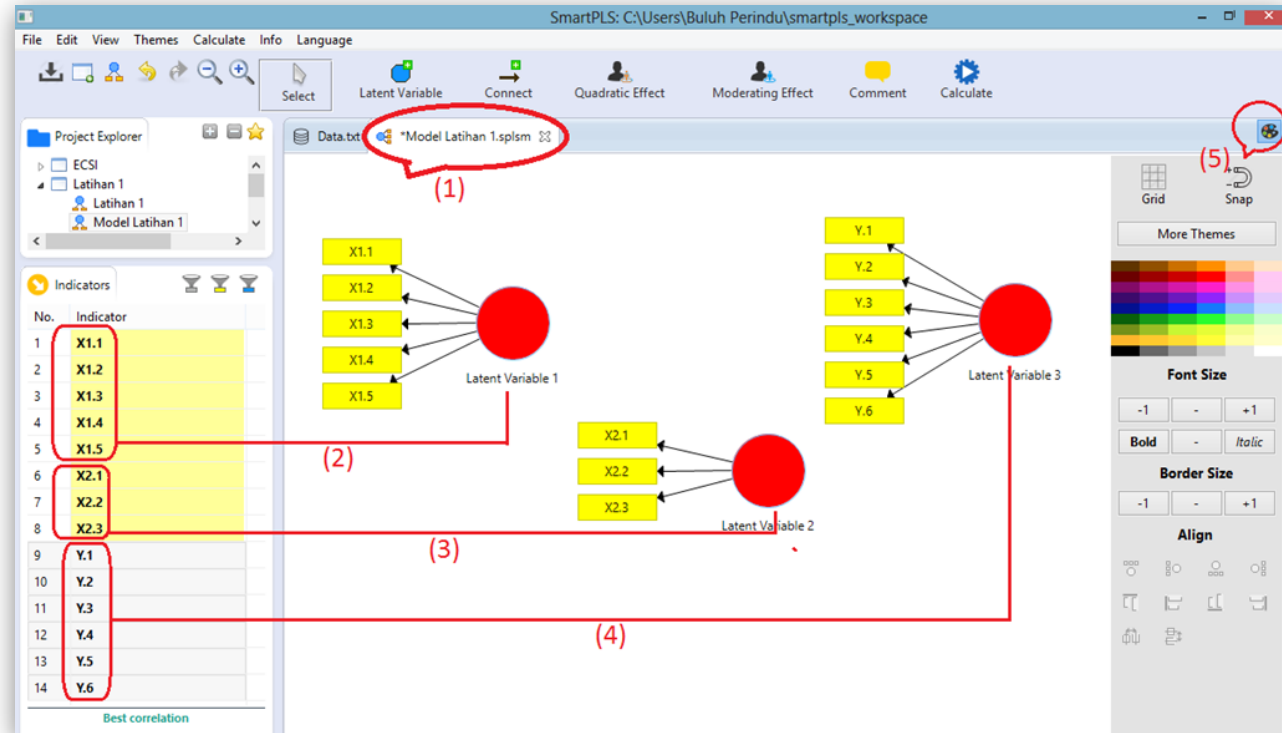
# New Path Model (Membuat Gambar Model Jalur untuk Analisis yang Baru)

- 1) Klik “New Path Model”
- 2) Pada “Name”, namai gambar model, misalnya : Model Latihan 1
- 3) Klik “OK”



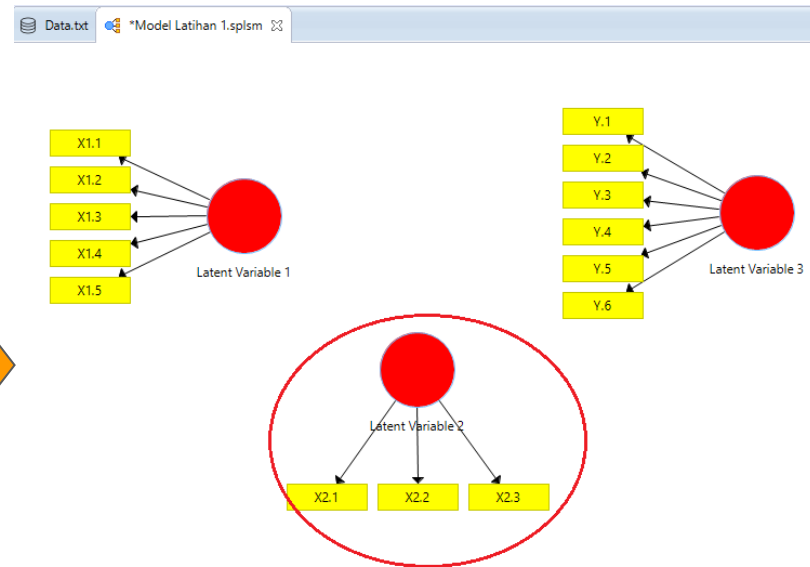
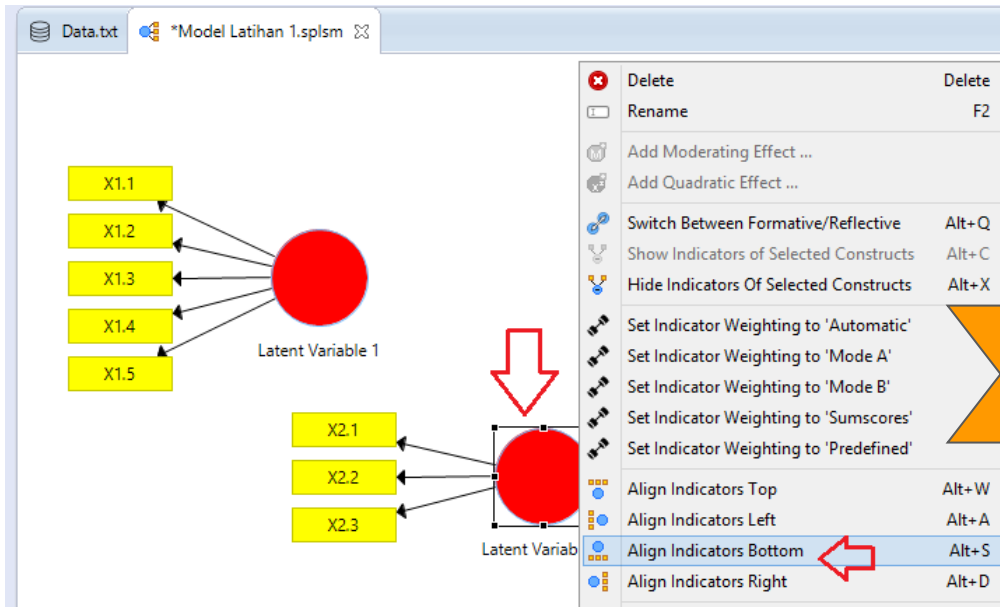
Blok indikator. Caranya adalah untuk suatu variabel (misanya X1) klik pada indikator pertama dari variabe X1 (yakni X1.1), pada keyboard komputer tekan "Shift" , lalu klik pada indikator terakhir dari variabel X1 (yakni X1.5).

- 1) Blok nama-nama indikator X1, yakni X1.1 s.d. X1.5, lalu drag/pindahkan ke kanan
- 2) Blok nama-nama indikator X2, yakni X2.1 s.d. X2.3, lalu drag/pindahkan ke kanan
- 3) Blok nama-nama indikator Y, yakni Y.1 s.d. Y.6, lalu drag/pindahkan ke kanan
- 4) Jika perlu, klik icon  jika menu warna mengganggu

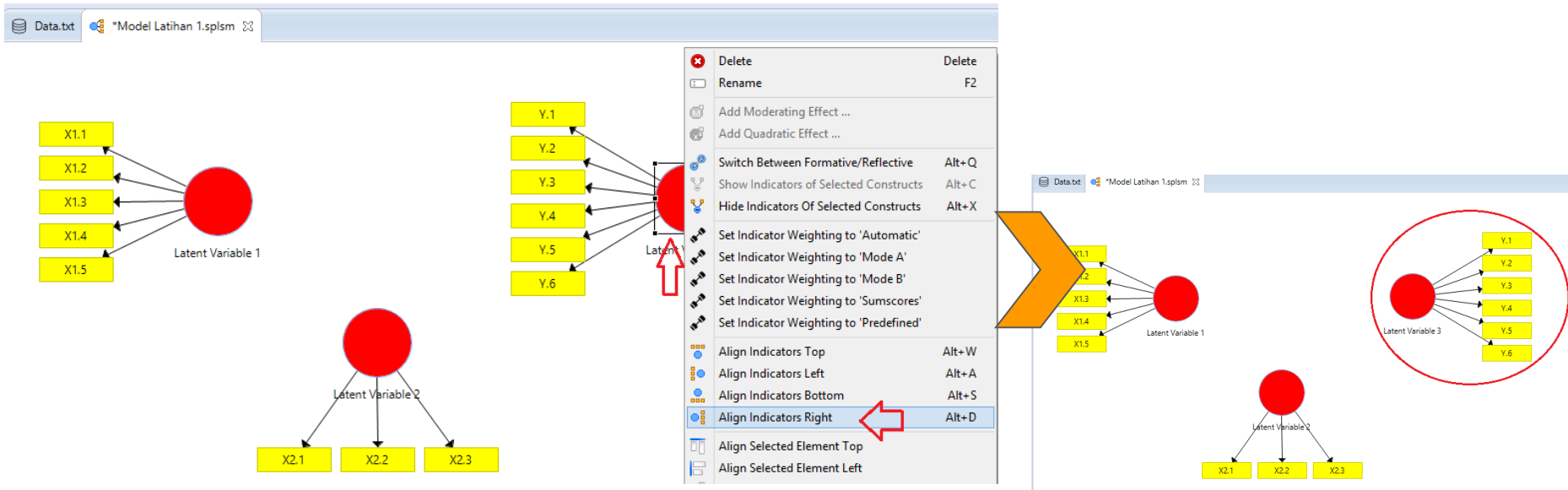


# Merapikan gambar model

- ❑ Latent Variable 1: Tidak perlu dirapikan
- ❑ Latent Variable 2: Klik kanan pada gambar Latent variable 2, pilih “Align Indicators Bottom” untuk memposisikan indikator-indikator berada di bawah variabel laten 2



- Latent Variables 3: Klik kanan pada gambar Latent variable 3, pilih “Align Indicators Right” untuk memposisikan indikator-indikator berada di kanan variabel laten 3

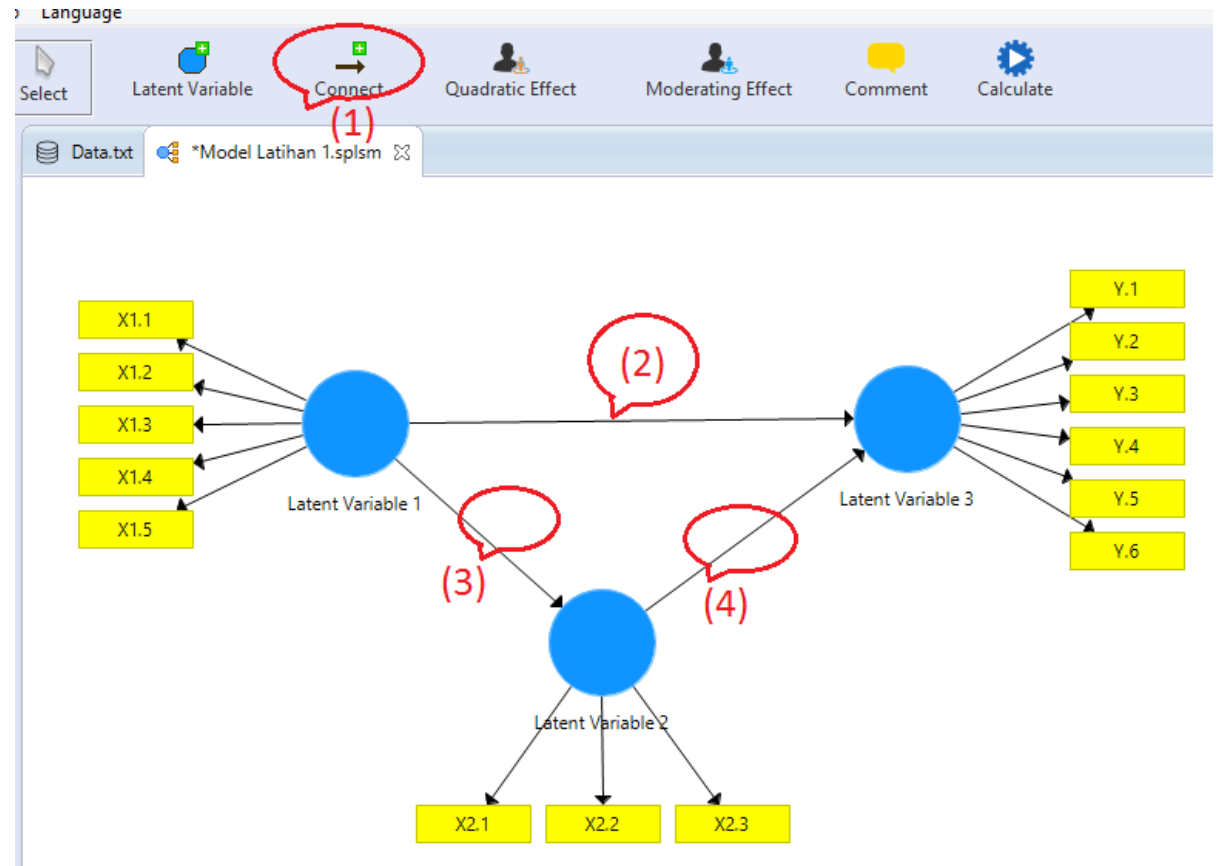


- Geser posisi variabel (latent variable 1, latent variable 2, latent variable 3), pada posisi yang sesuai jika terlihat belum rapi/belum simetris.

# Connect (Membuat Garis Penghubung Antar Variabel)

- 1) Klik “Connect” untuk mengaktifkan pembuatan garis penghubung
- 2) Klik pada X1 dan klik pada X2
- 3) Klik pada X2 dan klik pada Y
- 4) Klik pada X1 dan klik pada Y

Klik kembali “Connect” untuk “menonaktifkan” pembuatan garis, atau tekan “Esc” pada sudut kiri “keyboard komputer”





# Rename (Merubah Nama Variabel Laten menjadi Nama Simbol Variabel)

Rubah nama Latent Variable 1 menjadi X1:

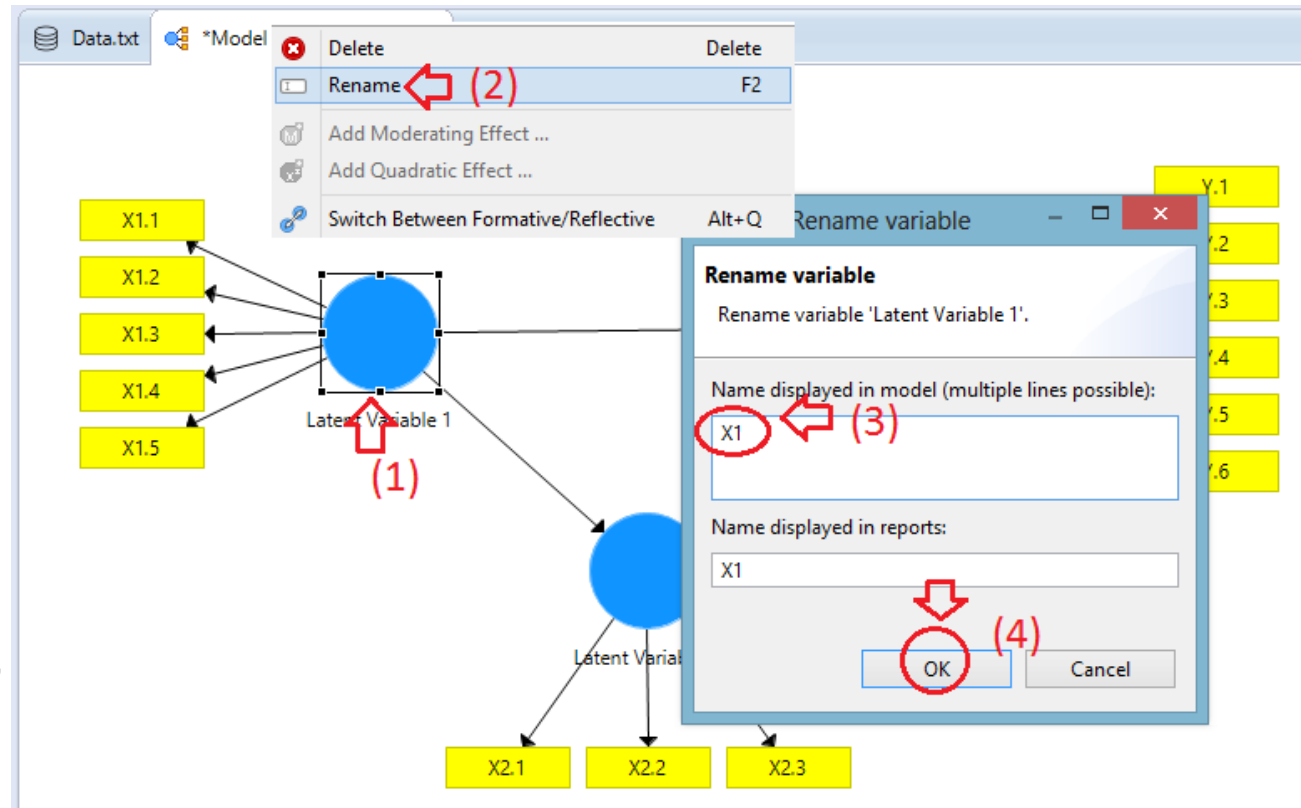
- 1) Klik kanan pada gambar “Latent Variable 1”
- 2) Klik “Rename”
- 3) Ketikkan X1,
- 4) Klik OK

Lakukan cara yang sama untuk merubah nama variabel lainnya:

Latent Variable 2 menjadi X2  
Latent Variable 3 menjadi Y

Catatan:

Untuk nama variabel, anda boleh saha menggunakan simbol X, Y, Z, atau simbol lainnya, seperti singkatan nama variabel, contoh: Kepuasan Pelanggan, rubah menjadi KP, dsb.



# Kalkulasi PLS Algorithm & Bootstrap

Azuar Juliandi

# PLS Algorithm

## Algoritma Partial Least Squares

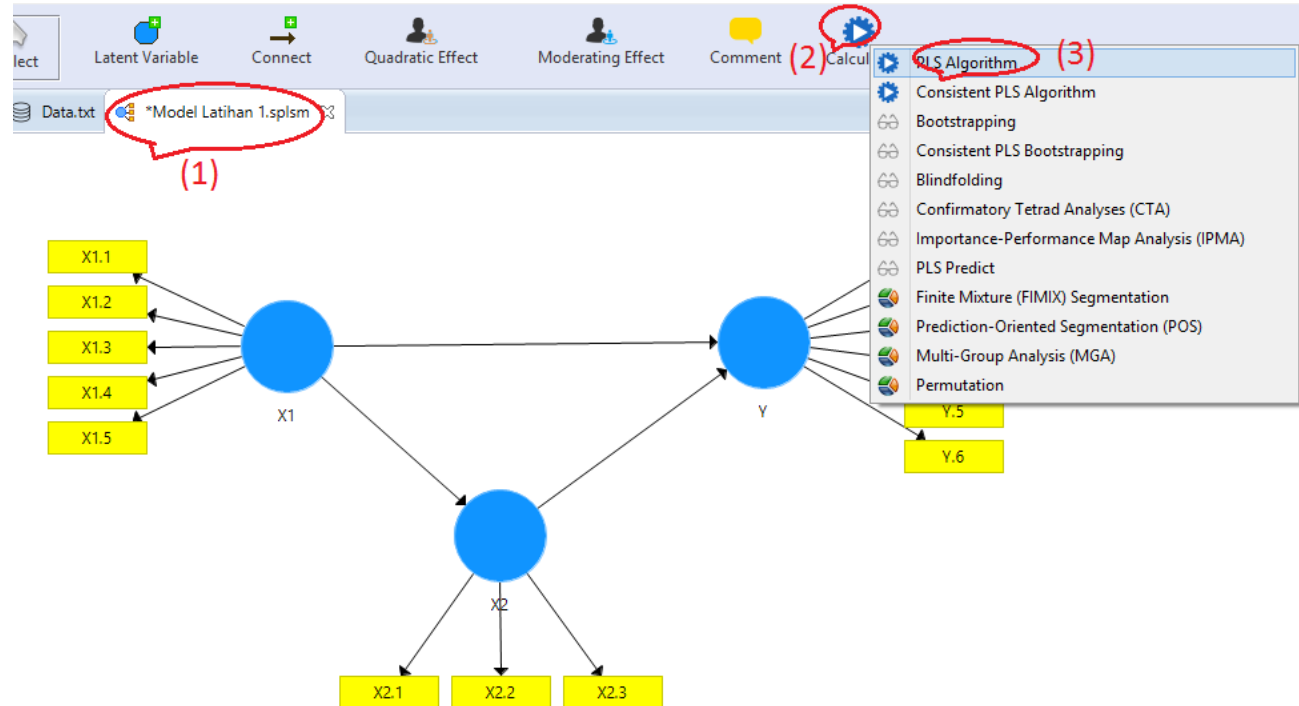
Metode PLS Path Modeling ini dikembangkan oleh Wold (1982). Pada dasarnya, algoritma PLS adalah rangkaian regresi.

Dengan melakukan kalkulasi PLS Algorithm, maka akan diperoleh informasi yang akan digunakan untuk menganalisis data penelitian, khususnya untuk melihat nilai-nilai yang biasa digunakan untuk analisis PLS-SEM:

- ❑ Outer model (pengujian indikator):
  - ❑ Validitas & reliabilitas konstruk (construct reliability & validity)
  - ❑ Validitas diskriminan (discriminant validity)
  - ❑ Dsb
- ❑ Inner model (pengujian hipotesis antarvariabel)
  - ❑ Koefisien jalur/pengaruh langsung (path coefficient/direct effect),
  - ❑ Pengaruh tidak langsung (indirect effect)
  - ❑ Dsb.

<b>Final Results</b>	<b>Quality Criteria</b>
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>
<a href="#">Latent Variable</a>	<a href="#">Model Fit</a>
<a href="#">Residuals</a>	<a href="#">Model Selection Criteria</a>

# PLS Algorithm



- 1) Klik tab gambar, misalnya “Model Latihan 1.splsm”
- 2) Klik “Calculate”
- 3) Klik “PLS Algorithm”

# Klik “Start Calculation”. Abaikan yang lain

**Partial Least Squares Algorithm**

The PLS path modeling method was developed by Wold (1982). In essence, the PLS algorithm is a sequence of regressions in terms of weight vectors. The weight vectors obtained at convergence satisfy fixed point equations (see Dijkstra, 2010, for a general analysis of these equations).

[Read more](#)

**Setup** | **Weighting**

**Basic Settings**

Weighting Scheme:  Centroid  Factor  Path

Maximum Iterations: 300

Stop Criterion ( $10^{-X}$ ): 7

**Advanced Settings**

Configure [individual initial weights](#)

**Basic Settings**

**Weighting Scheme**

PLS-SEM allows the user to apply three structural model weighting schemes:

- (1) centroid weighting scheme,
- (2) factor weighting scheme, and
- (3) path weighting scheme (default).

While the results differ little for the alternative weighting schemes, path weighting is the recommended approach. This weighting scheme provides the highest  $R^2$  value for endogenous latent variables and is generally applicable for all kinds of PLS path model specifications and estimations. Moreover, when the path model includes higher-order constructs (often called second-order models), researchers should usually not use the centroid weighting scheme.

**Maximum Iterations**

This parameter represents the maximum number of iterations that will be used for calculating the PLS results. This number should be sufficiently large (e.g., 300 iterations). When checking the PLS-SEM result, one must make sure that the algorithm did not stop because the maximum number of iterations was reached but due to the stop criterion. Note: The selection of 0 for the maximum number of iterations allows you to obtain results of the sum scores approach.

After Calculation: [Open Full Report](#) [Close](#) [Start Calculation](#)

Hasil perhitungan PLS  
Algorithm akan diperlihatkan.

The screenshot shows the SmartPLS software interface. At the top, there are several utility buttons: 'Hide Zero Values', 'Increase Decimals', 'Decrease Decimals', 'Export to Excel', and 'Export to Web'. Below these are file tabs: 'Data.txt', '\*Model Latihan 1.splsm', and 'PLS Algorithm (Run No. 3)'. The 'PLS Algorithm (Run No. 3)' tab is circled in red. The main content area is titled 'Path Coefficients' and contains a table with the following data:

	X1	X2	Y
X1		0,416	0,661
X2			0,382
Y			

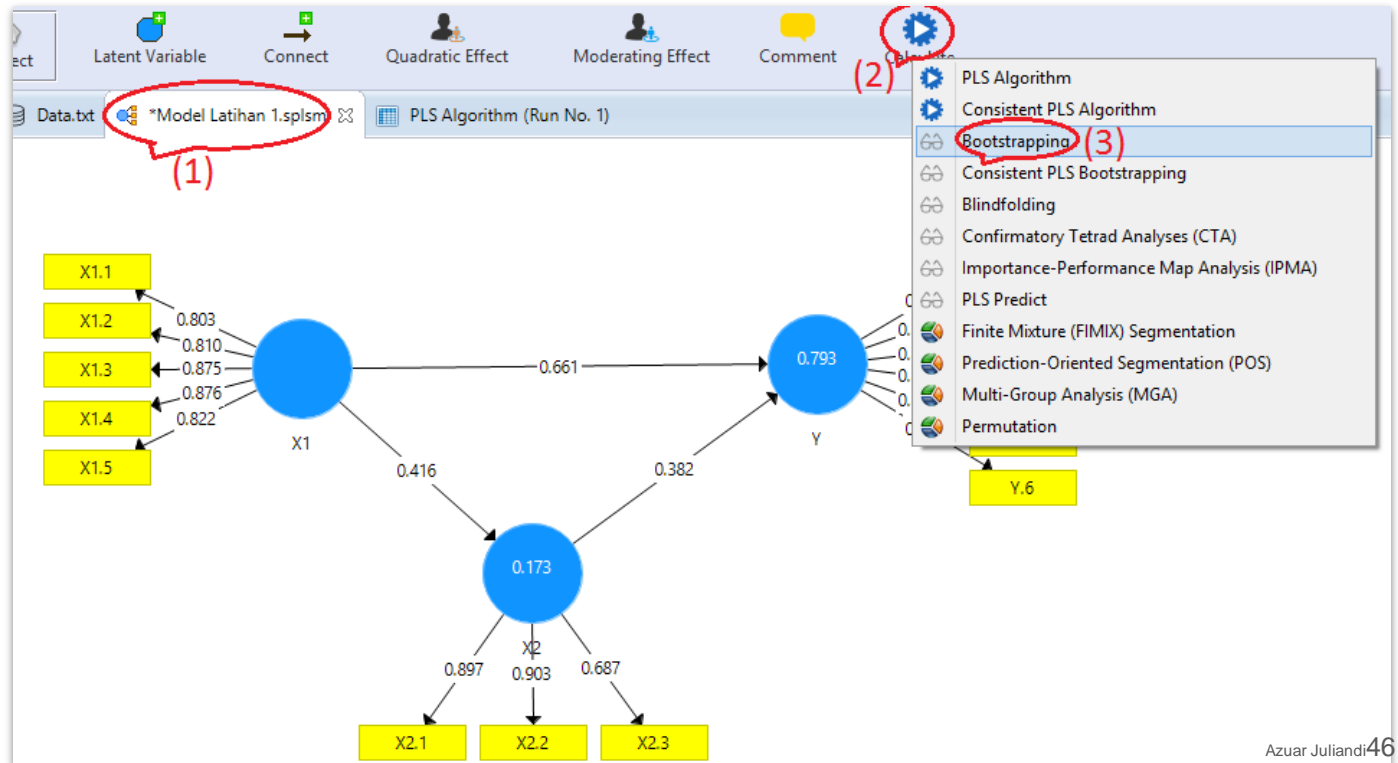
Below the table is a navigation menu with four columns: 'Final Results', 'Quality Criteria', 'Interim Results', and 'Base Data'. Each column contains several blue hyperlinks. A red circle highlights the 'Final Results' column links.

Final Results	Quality Criteria	Interim Results	Base Data
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>	<a href="#">Stop Criterion Changes</a>	<a href="#">Setting</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>		<a href="#">Inner Model</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>		<a href="#">Outer Model</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>		<a href="#">Indicator Data (Original)</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>		<a href="#">Indicator Data (Standardized)</a>
<a href="#">Latent Variable</a>	<a href="#">Model Fit</a>		<a href="#">Indicator Data (Correlations)</a>
<a href="#">Residuals</a>	<a href="#">Model Selection Criteria</a>		

# Bootstrapping

- ❑ Bootstrapping merupakan prosedur resampling (pen-sample-an kembali/pengulangan sampel)
- ❑ Bootstrapping adalah suatu prosedur non-parametrik, merupakan metode untuk memecahkan masalah data yang tidak normal terutama jika sampelnya hanya kecil/sedikit.
- ❑ Bootstrapping memungkinkan pengujian signifikansi statistik dari berbagai hasil PLS-SEM seperti koefisien jalur, Cronbach's alpha, HTMT dan nilai  $R^2$ .
- ❑ Di dalam bootstrapping, sub-sampel diciptakan dengan pengamatan acak diambil (dengan penggantian) dari data set asli. Untuk memastikan stabilitas hasil, jumlah sub-sampel harus menjadi besar. Untuk pemeriksaan awal, kita dapat menggunakan sejumlah kecil bootstrap sub-sampel (misalnya, 500). Untuk persiapan hasil akhir, bagaimanapun, peneliti harus menggunakan sejumlah besar bootstrap sub-sampel (misalnya, 5.000).

- 1) Klik tab gambar, misalnya “Model Latihan 1.splsm”
- 2) Klik “Calculate”
- 3) Klik “Boostrapping”





- 1) Klik pada tab Setup
- 2) Ketikkan “5000” pada “Subsamples”
- 3) Klik/ceklis “Complete Boot Straping”
- 4) Klik “Start Calculation”

# Hasil perhitungan bootstrapping akan ditampilkan

Data.txt \*Model Latihan 1.splsm PLS Algorithm (Run No. 3) **Bootstrapping (Run No. 3)**

## Path Coefficients

	Mean, STDEV, T-Values, P-Values	Confidence Intervals	Confidence Intervals Bias Corrected	Samples	Cc
	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> X2	0.416	0.414	0.250	1.662	<b>0.097</b>
X1 -> Y	0.661	0.669	0.147	4.492	<b>0.000</b>
X2 -> Y	0.382	0.368	0.167	2.283	<b>0.022</b>

## 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](#)

[Average Variance Extracted \(AVE\)](#)

[Composite Reliability](#)

[rho A](#)

[Cronbach's Alpha](#)

[Heterotrait-Monotrait Ratio \(HTMT\)](#)

[Latent Variable Correlations](#)

## Model Fit

[SRMR](#)

[d ULS](#)

[d G](#)

## Histograms

[Path Coefficients Histogram](#)

[Indirect Effects Histogram](#)

[Total Effects Histogram](#)

## Base Data

[Setting](#)

[Inner Model](#)

[Outer Model](#)

[Indicator Data \(Original\)](#)

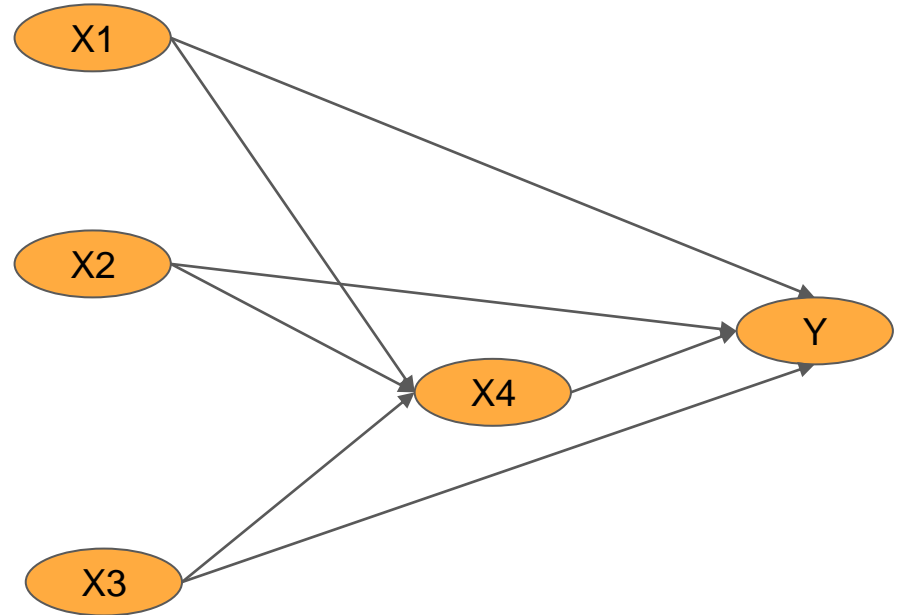
[Indicator Data \(Standardized\)](#)

# Analisis PLS ber-Variabel Intervening/Mediasi/Mediator

Azuar Juliandi

# SEM Bervariabel Intervening

- ❑ Variabel intervening adalah variabel yang mengantari (**memediasi**) hubungan variabel eksogen (bebas) dengan variabel endogen (terikat)
- ❑ Contoh: Variabel eksogen/bebas ada 3 (X1, X2, X3), variabel intervening ada 1 (X4), variabel endogen/terikat ada 1 (Y),



# Rumusan Masalah/Tujuan Penelitian/Hipotesis

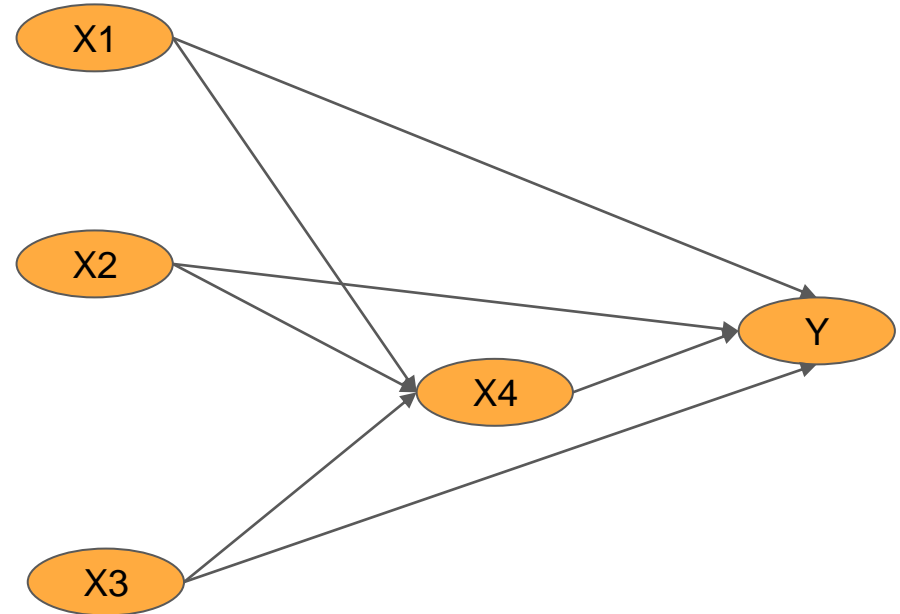
Rumusan Masalah/Tujuan Penelitian/Hipotesis:

A. Pengaruh Langsung:

- 1)  $X1 \rightarrow X4$
- 2)  $X2 \rightarrow X4$
- 3)  $X3 \rightarrow X4$
- 4)  $X1 \rightarrow Y$
- 5)  $X2 \rightarrow Y$
- 6)  $X3 \rightarrow Y$
- 7)  $X4 \rightarrow Y$

B. Pengaruh Tidak Langsung

- 1)  $X1 \rightarrow X4 \rightarrow Y$  atau  $X4$  memediasi  $X1 \rightarrow Y$
- 2)  $X2 \rightarrow X4 \rightarrow Y$  atau  $X4$  memediasi  $X2 \rightarrow Y$
- 3)  $X3 \rightarrow X4 \rightarrow Y$  atau  $X4$  memediasi  $X3 \rightarrow Y$



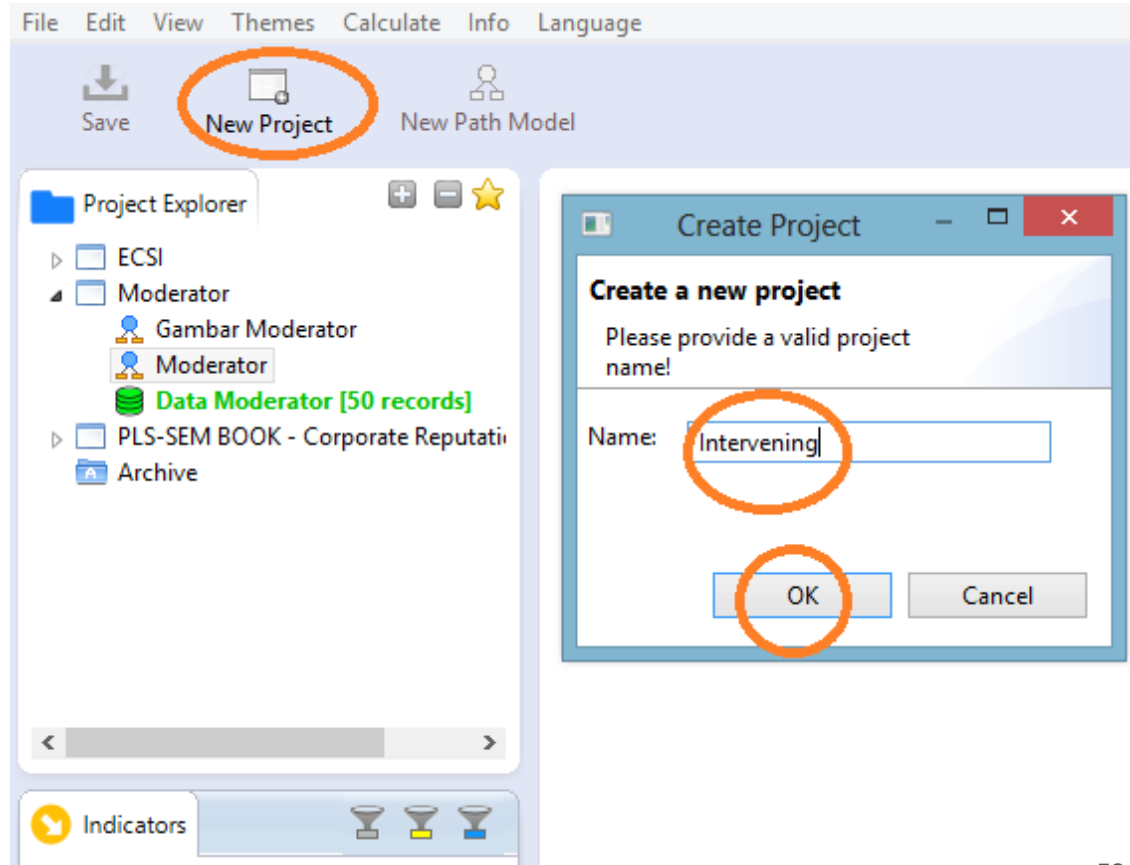
# Data

- ❑ [Download Contoh Data](#) (Data dikemas dalam di Excel dengan save as type: CSV-MS DOS)
- ❑ Sampel: 50
- ❑ Variabel terdiri dari 4:
  - ❑ Variabel eksogen/bebas (X1, X2, X3), indikatornya:
    - ❑ X1.1; X1.2; X1.3
    - ❑ X2.1; X2.2; X2.3
    - ❑ X3.1; X3.2; X3.3
  - ❑ Variabel endogen intervensi/mediator/mesiasi (X4), indikatornya:
    - ❑ X4.1; X4.2; X4.3
  - ❑ Variabel endogen/terikat (Y), indikatornya:
    - ❑ Y.1; Y.2; Y.3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	X1.1	X1.2	X1.3	X2.1	X2.2	X2.3	X3.1	X3.2	X3.3	X4.1	X4.2	X4.3	Y.1	Y.2	Y.3
2	2	3	3	2	2	2	2	2	3	2	2	2	3	3	3
3	4	4	4	5	4	5	4	5	5	4	5	4	5	4	4
4	3	3	3	5	5	4	2	2	2	3	4	3	3	3	4
5	4	3	4	5	4	5	5	4	5	4	4	4	3	5	4
6	3	4	3	5	4	5	4	4	4	3	3	3	4	4	5
7	3	4	3	4	4	5	5	3	3	3	4	3	3	3	5
8	4	4	4	4	5	5	4	5	4	4	4	3	5	4	4
9	4	4	3	4	4	4	4	3	4	4	4	5	4	5	5
10	5	4	4	4	2	4	4	4	4	3	4	4	5	3	5
11	3	3	3	3	2	3	3	5	3	4	3	2	3	3	2
12	2	3	2	2	2	2	2	3	2	3	2	2	2	2	2
13	4	4	4	4	4	5	4	4	4	3	4	4	4	4	5
14	3	4	5	3	4	5	2	4	4	3	2	3	3	3	5
15	4	4	4	5	5	4	4	4	4	4	4	4	4	4	4
16	2	3	4	2	2	2	2	3	2	2	3	2	2	2	2
17	4	4	2	5	2	2	5	5	4	4	4	3	4	5	5
18	4	2	2	4	2	2	3	3	4	4	3	4	3	3	3

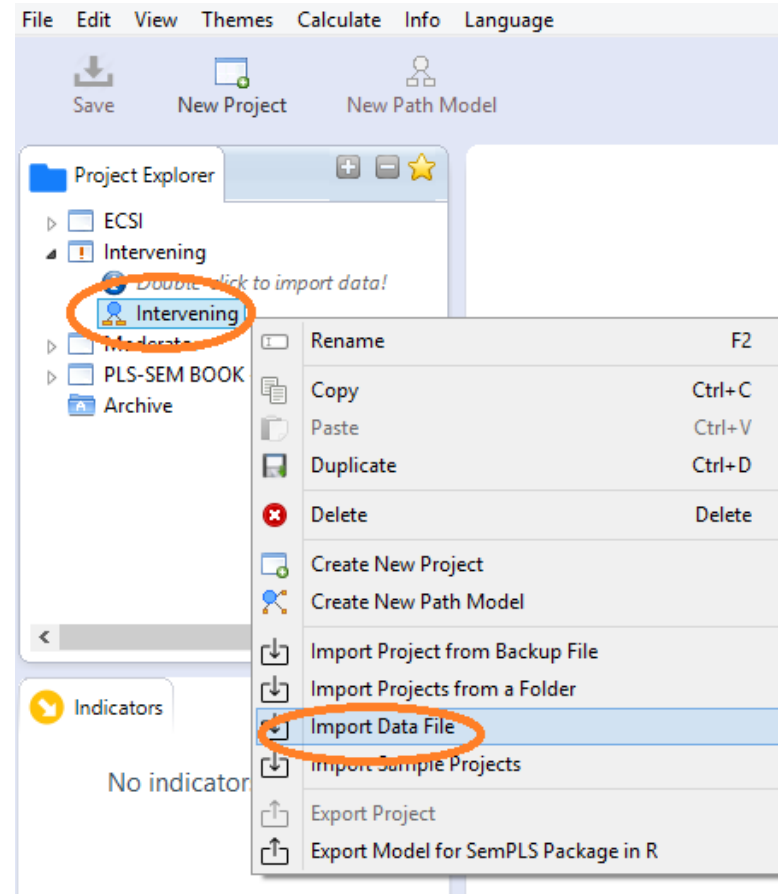
# New Project

- ❑ New Project
- ❑ Name: Intervening
- ❑ OK



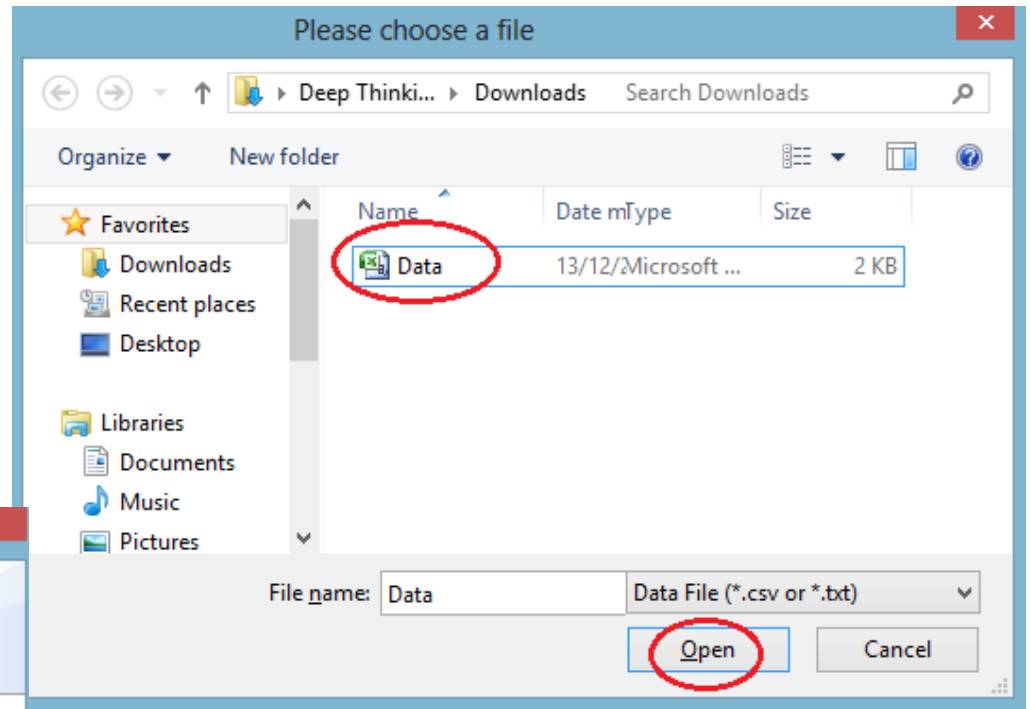
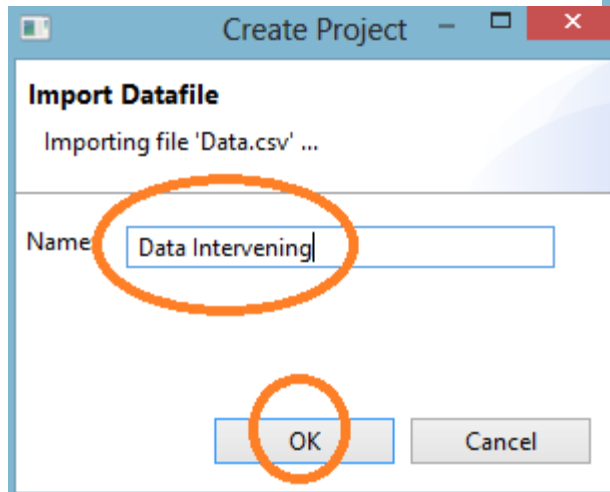
# Import Data File

- ❑ Klik “kanan” di Intervening
- ❑ Import Data File





- ❑ Klik “Data”
- ❑ Open
- ❑ Ketikkan “Data Intervening” di “Name”
- ❑ OK



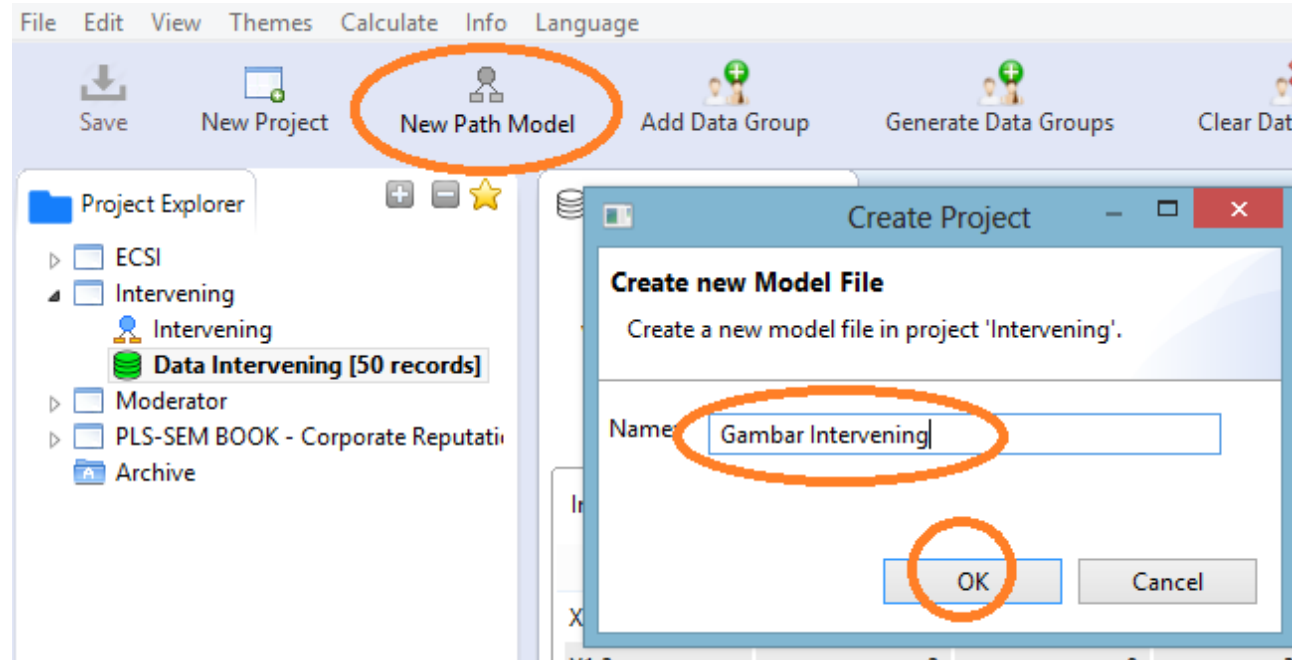
# Data akan ditampilkan

The screenshot displays the SmartPLS software interface. The top menu bar includes File, Edit, View, Themes, Calculate, Info, and Language. Below the menu is a toolbar with icons for Save, New Project, New Path Model, Add Data Group, Generate Data Groups, and Clear Data Groups. On the left, the Project Explorer shows a tree view with folders for ECSI, Intervening, and Moderators. The 'Intervening' folder is expanded, and 'Data Intervening [50 records]' is highlighted. The main workspace shows the 'Data Intervening.txt' file selected, with its import settings: Delimiter: Semicolon, Encoding: UTF-8, Value Quote Character: None, Sample size: 50, Number Format: US (e.g. 1,000.23), Indicators: 15, and Missing Value Marker: None. Below the settings is a table with columns for Indicators, Indicator Correlations, Raw File, No., Missing, Mean, Median, and M. The table contains 11 rows of data, with a large orange circle highlighting the 'No.', 'Missing', 'Mean', and 'Median' columns for all rows.

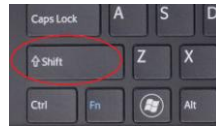
Indicators	Indicator Correlations	Raw File	No.	Missing	Mean	Median	M
X1.1			1	0	3.520	4.000	2.00
X1.2			2	0	3.540	4.000	2.00
X1.3			3	0	3.480	4.000	2.00
X2.1			4	0	3.860	4.000	2.00
X2.2			5	0	3.700	4.000	2.00
X2.3			6	0	3.860	4.000	2.00
X3.1			7	0	3.400	4.000	2.00
X3.2			8	0	3.560	4.000	2.00
X3.3			9	0	3.480	4.000	2.00
X4.1			10	0	3.540	4.000	2.00
X4.2			11	0	3.600	4.000	2.00

# New Path Model (Model Jalur Baru)

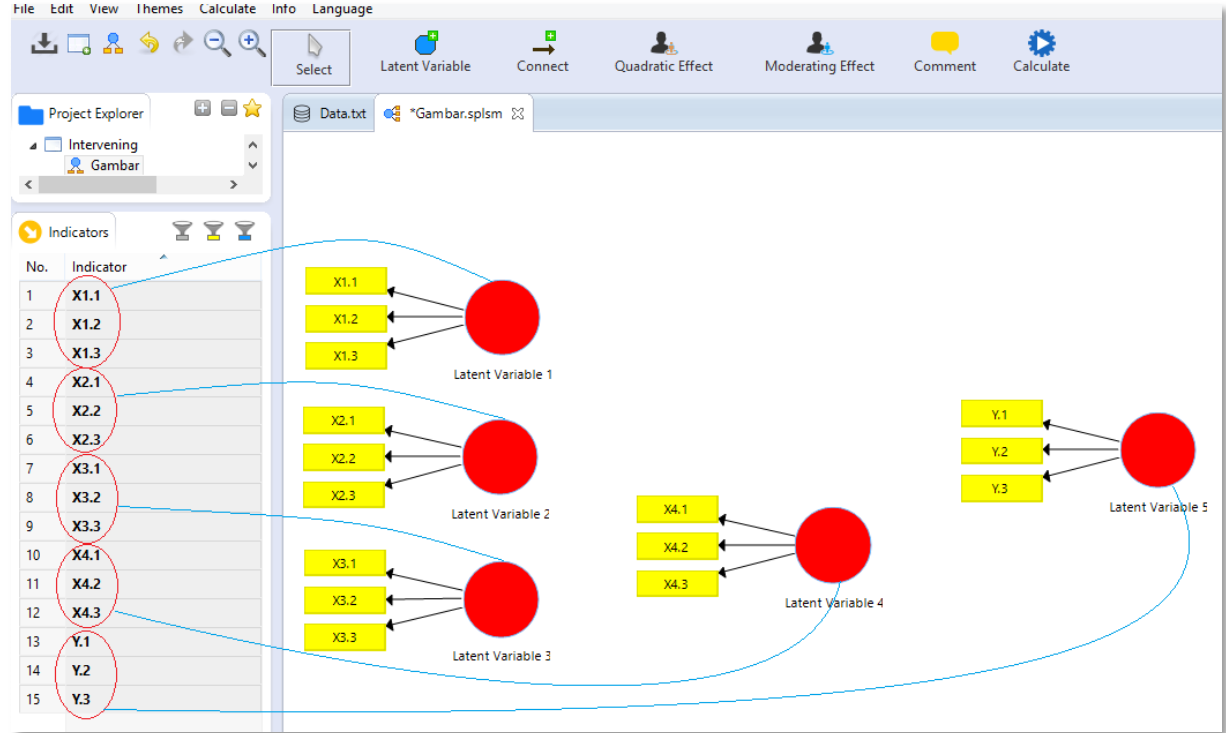
- ❑ Klik “New Path Model”
- ❑ Pada “Name”, ketikkan nama model, misalnya “Gambar Intervening”, atau “Gambar”, atau “Model”.
- ❑ OK



□ Pindahkan seluruh indikator masing-masing variabel, ke kanan halaman, dengan menekan “Shift” pada keyboard (jangan lepaskan), lalu klik pada seluruh indikator untuk setiap variabel, seperti berikut ini:

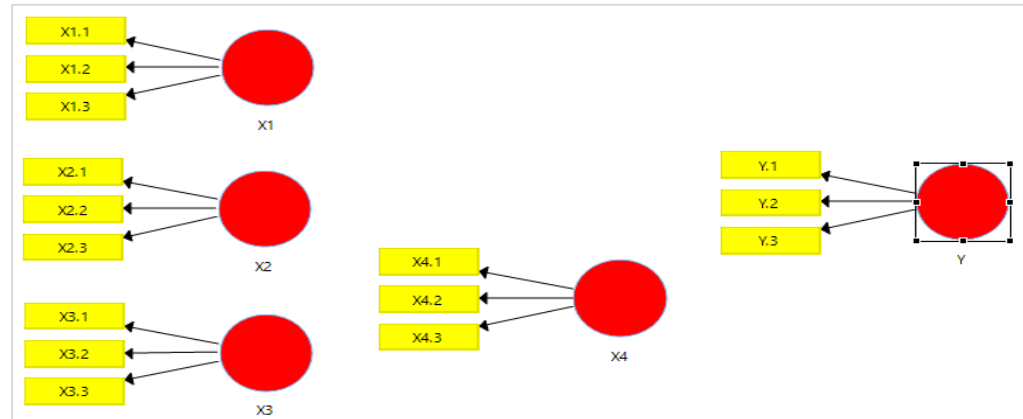
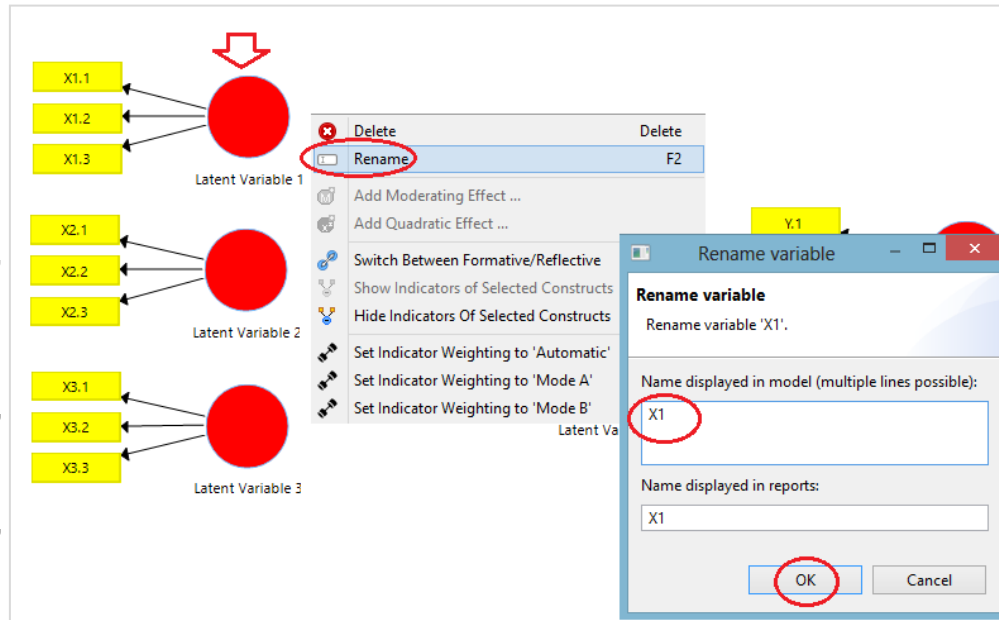


- Tekan “Shif” di keyboard, Klik X1.1, klik X1.2, klik X1.3, lalu pindahkan ke kanan.
- Tekan “Shif” di keyboard, Klik X2.1, klik X2.2, klik X2.3, lalu pindahkan ke kanan.
- Tekan “Shif” di keyboard, Klik X3.1, klik X3.2, klik X3.3, lalu pindahkan ke kanan.
- Tekan “Shif” di keyboard, Klik X4.1, klik X4.2, klik X4.3, lalu pindahkan ke kanan.
- Tekan “Shif” di keyboard, Klik Y.1, klik Y.2, klik Y.3, lalu pindahkan ke kanan.



Rubah nama latent variable menjadi X1, X2, X3, X4, dan Y, dengan cara berikut ini:

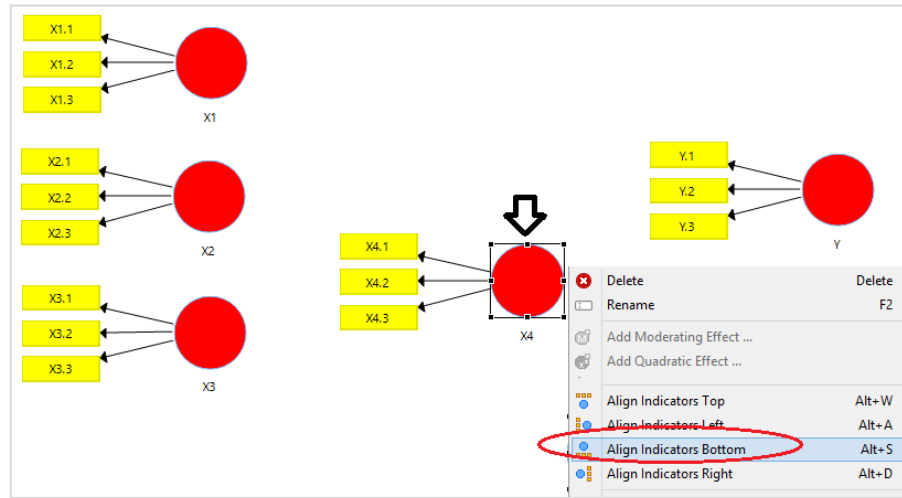
- ❑ Klik kanan “Latent Variable 1”, klik “Rename”. Ketikkan X1 pada “Name displayed in model”, klik OK
- ❑ Klik kanan “Latent Variable 2”, klik “Rename”. Ketikkan X2, klik OK
- ❑ Klik kanan “Latent Variable 3”, klik “Rename”. Ketikkan X3, klik OK
- ❑ Klik kanan “Latent Variable 4”, klik “Rename”. Ketikkan X4, klik OK
- ❑ Klik kanan “Latent Variable 5”, klik “Rename”. Ketikkan Y, klik OK



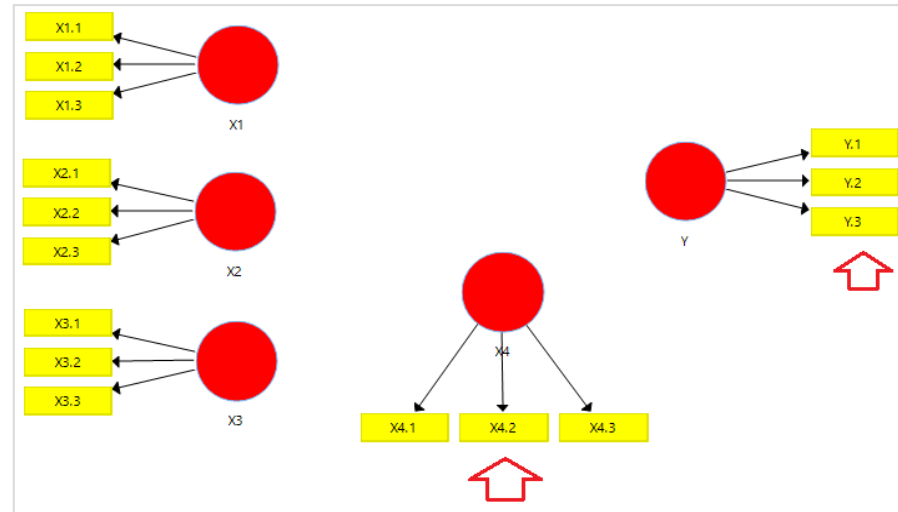
Jika telah selesai, hasilnya, akan terlihat seperti pada gambar

Atur posisi indikator jika diinginkan, misalnya:

- Untuk variabel X4: Klik kanan pada X4, pilih “Align Indicators Bottom”, maka indikator akan berada pada posisi bawah variabel X4
- Untuk variabel Y: Klik kanan pada Y, pilih “Align Indicators Right”, maka indikator akan berada pada posisi kanan variabel Y



Jika telah selesai, maka posisi indikator akan terlihat seperti di dalam contoh gambar

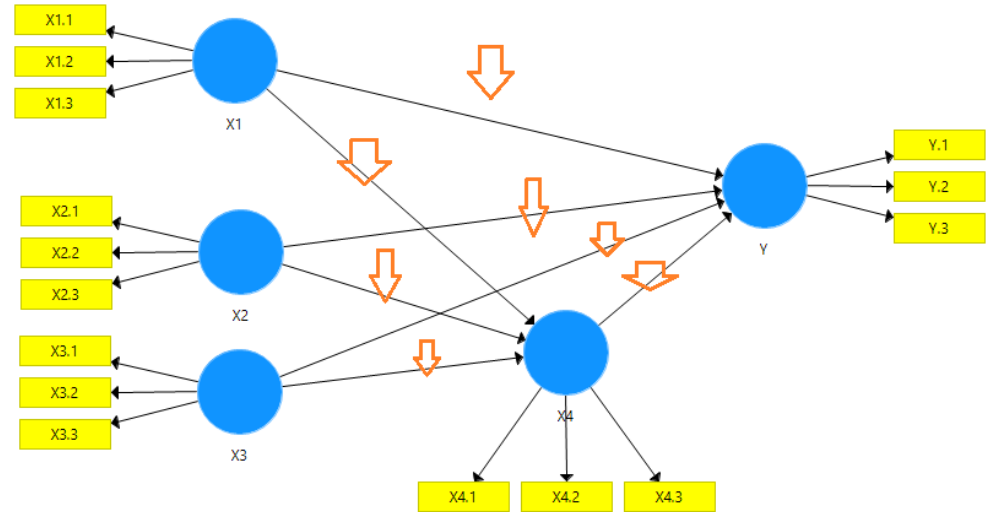
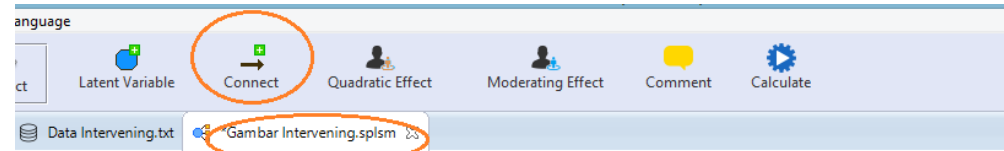


# Connect (Koneksi)

Untuk menghubungkan variabel-variabel, klik “Connect”, lalu:

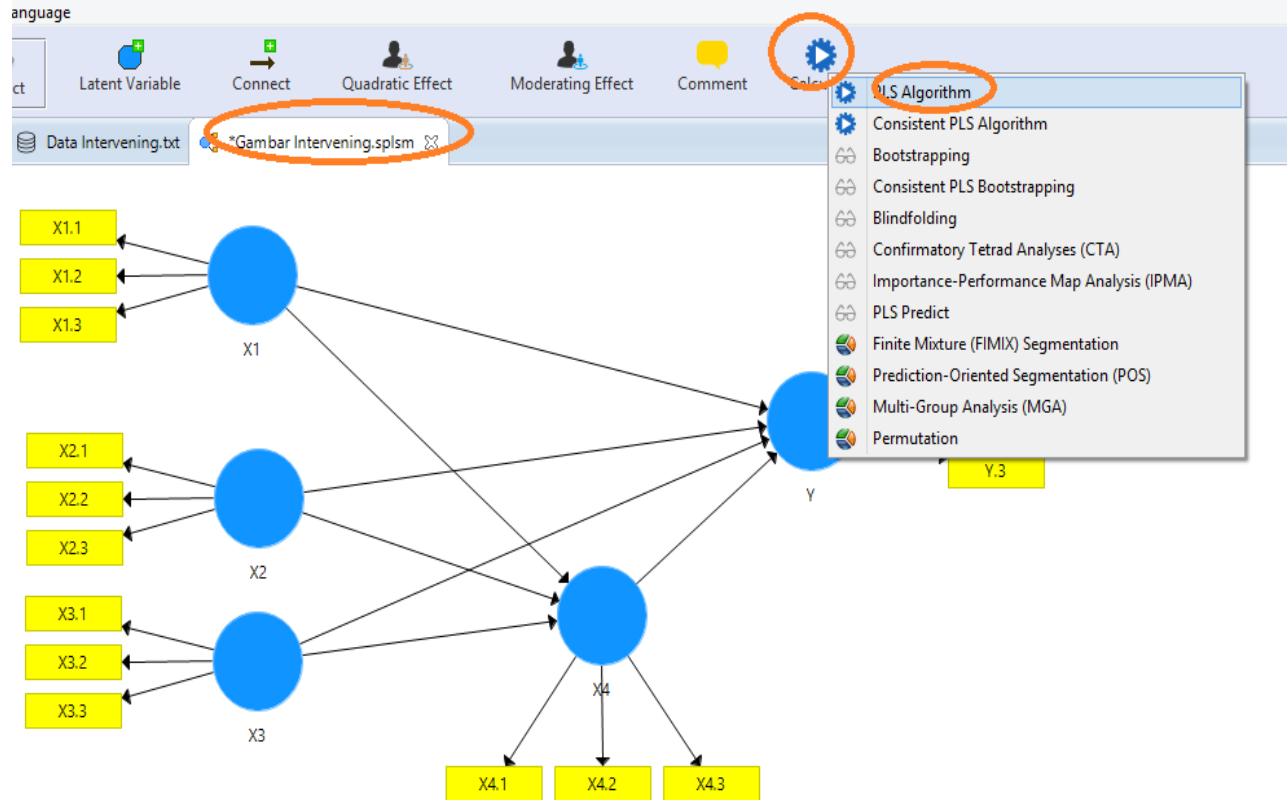
- ❑ Klik X1 dan klik X4
- ❑ Klik X2 dan klik X4
- ❑ Klik X3 dan klik X4
- ❑ Klik X1 dan klik Y
- ❑ Klik X2 dan klik Y
- ❑ Klik X3 dan klik Y
- ❑ Klik X4 dan klik Y

Jika telah selesai, klik “Esc” di keyboard atau klik kembali “Connect” untuk mengakhiri proses menghubungkan variabel



# Calculate-PLS Algorithm

- ❑ Klik tab “Gambar Intervening”
- ❑ Klik “Calculate”
- ❑ Klik “PLS Algorithm”





## ☐ Klik Start Calculation.

### Partial Least Squares Algorithm

The PLS path modeling method was developed by Wold (1982). In essence, the PLS algorithm is a sequence of regressions in terms of weight vectors. The weight vectors obtained at convergence satisfy fixed point equations (see Dijkstra, 2010, for a general analysis of these equations).

[Read more!](#)

Setup **Weighting**

---

**Basic Settings**

Weighting Scheme  Centroid  Factor  Path

Maximum Iterations:

Stop Criterion ( $10^{-X}$ ):

---

**Advanced Settings**

Initial Weights  Use Lohmoeller Settings  
or configure [individual initial weights](#)

---

**Basic Settings**

**Weighting Scheme**

PLS-SEM allows the user to apply three structural model weighting schemes:

- (1) centroid weighting scheme,
- (2) factor weighting scheme, and
- (3) path weighting scheme (default).

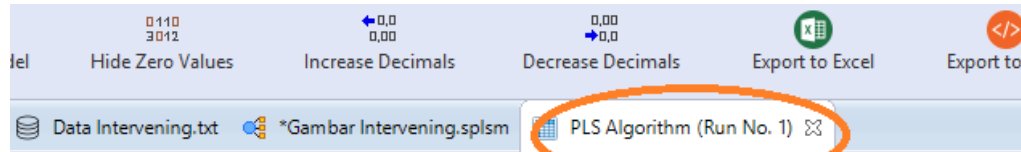
While the results differ little for the alternative weighting schemes, path weighting is the recommended approach. This weighting scheme provides the highest  $R^2$  value for endogenous latent variables and is generally applicable for all kinds of PLS path model specifications and estimations. Moreover, when the path model includes higher-order constructs (often called second-order models), researchers should usually not use the centroid weighting scheme.

**Maximum Iterations**

This parameter represents the maximum number of iterations that will be used for calculating the PLS results. This number should be sufficiently large (e.g., 300 iterations). When checking the PLS-SEM result, one must make sure that the algorithm did not stop because the maximum number of iterations was reached but due to the stop criterion. Note: The selection of 0 for the maximum number of iterations allows you to obtain results of the sum scores approach.

After Calculation:

# Hasil PLS Algorithm akan diperlihatkan pada tab "PLS Algorithm"



## Path Coefficients

	X1	X2	X3	X4	Y
X1				0.345	0.344
X2				0.302	0.350
X3				0.352	0.270
X4					0.056
Y					

Final Results	Quality Criteria	Interim Results	Base Data
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>	<a href="#">Stop Criterion Changes</a>	<a href="#">Setting</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>		<a href="#">Inner Model</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>		<a href="#">Outer Model</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>		<a href="#">Indicator Data (Original)</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>		<a href="#">Indicator Data (Standardized)</a>
<a href="#">Latent Variable</a>	<a href="#">Model Fit</a>		<a href="#">Indicator Data (Correlations)</a>
<a href="#">Residuals</a>			

Hasil PLS Algorithm akan menampilkan:

### Final result:

- Path Coefficients
- Indirect Effects
- Total Effects
- Outer Loadings
- Outer Weights
- Latent Variable
- Residuals

### Quality Criteria:

- R-Square
- f-Square
- Construct Reliability and Validity
- Discriminant Validity
- Colinearity Statistic (VIF)
- dan Model Fit

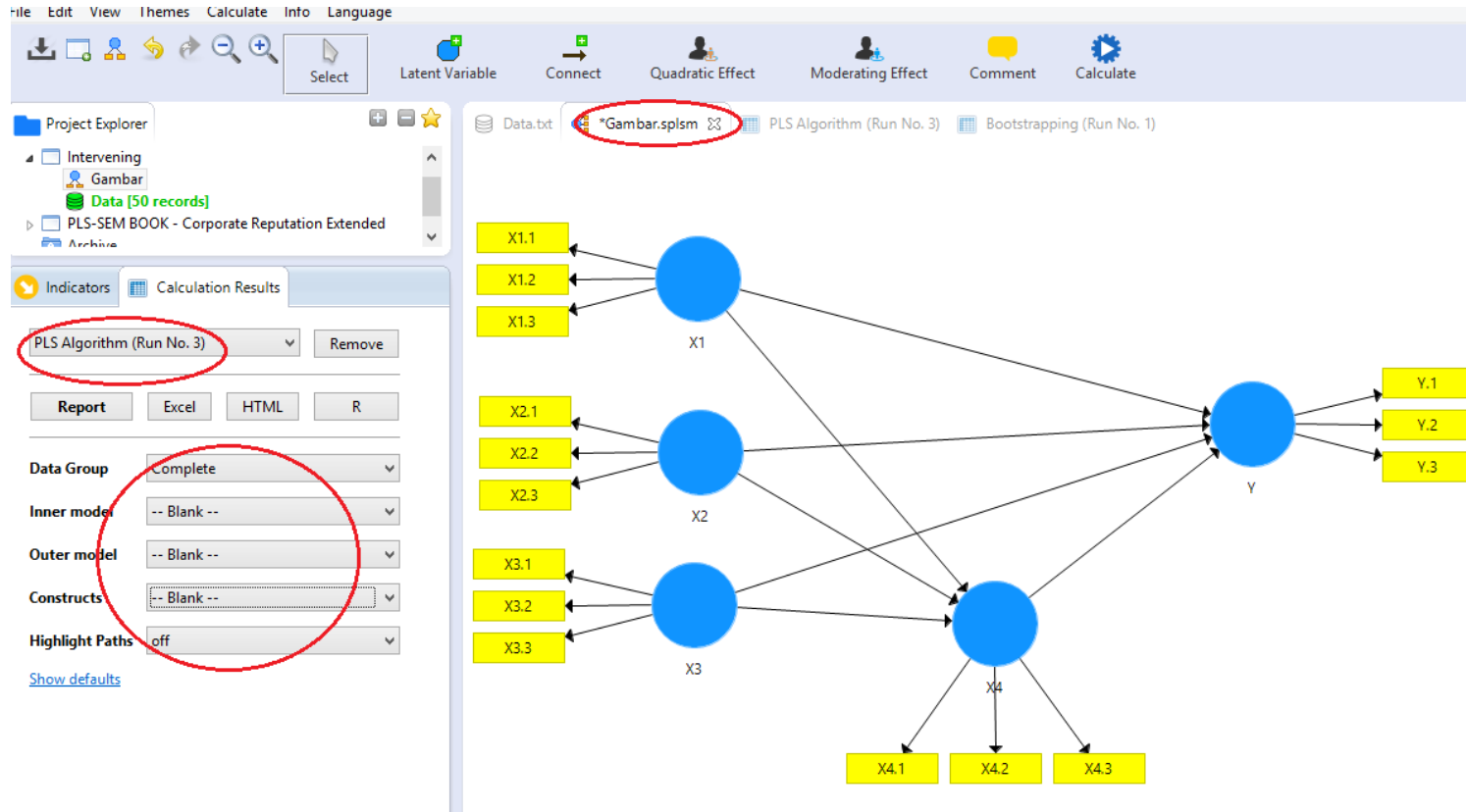
### Interim Results

Base Data

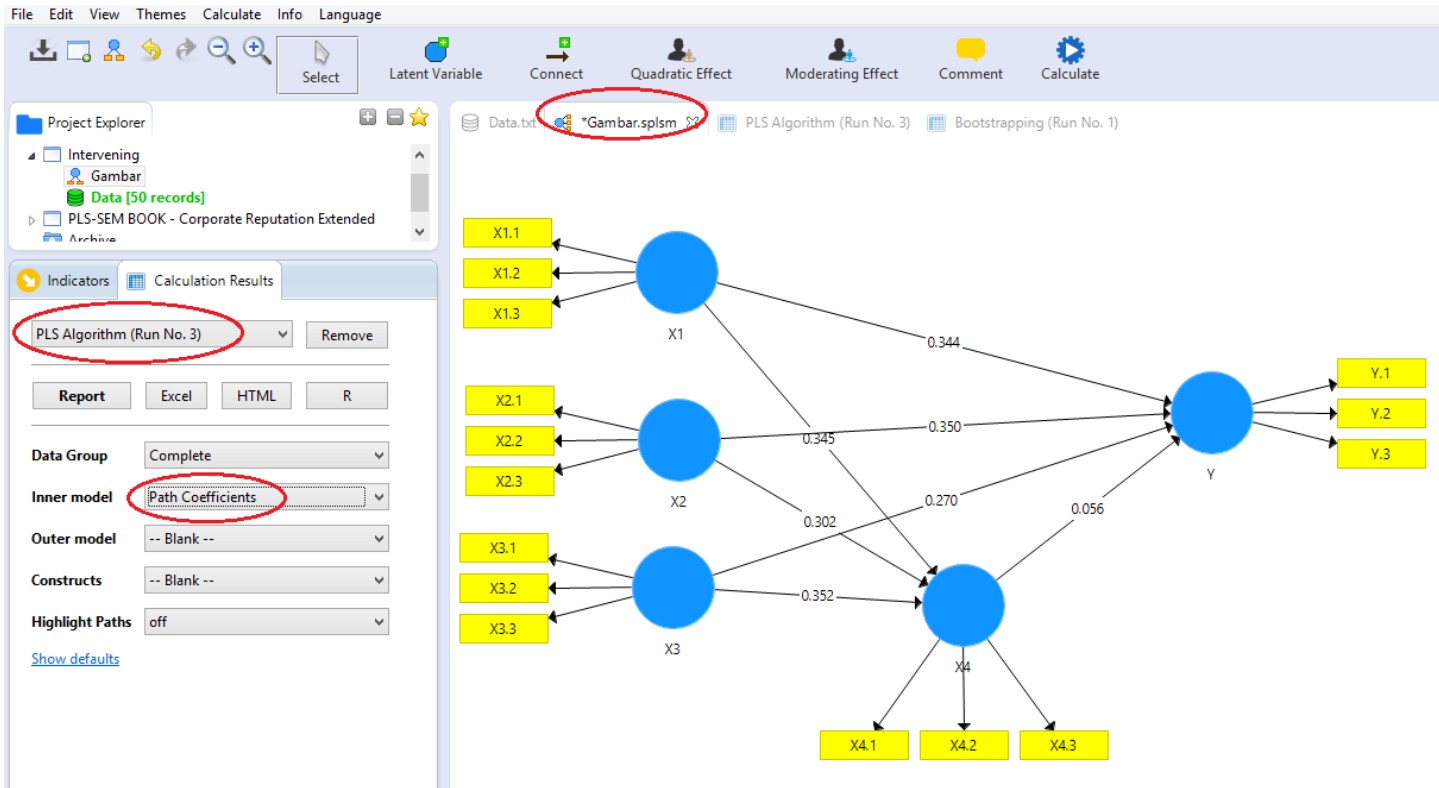
Catatan:

Interpretasi/analisis dari nilai-nilai hasil di atas akan diperlihatkan pada bagian akhir di dalam slide ini.

Hasil PLS Algorithm juga akan diperlihatkan pada tab model/gambar  
Jika dipilih “Blank”, baik pada Inner model, Outer model, dan Construct, maka pada gambar tidak ditampilkan nilai-nilainya



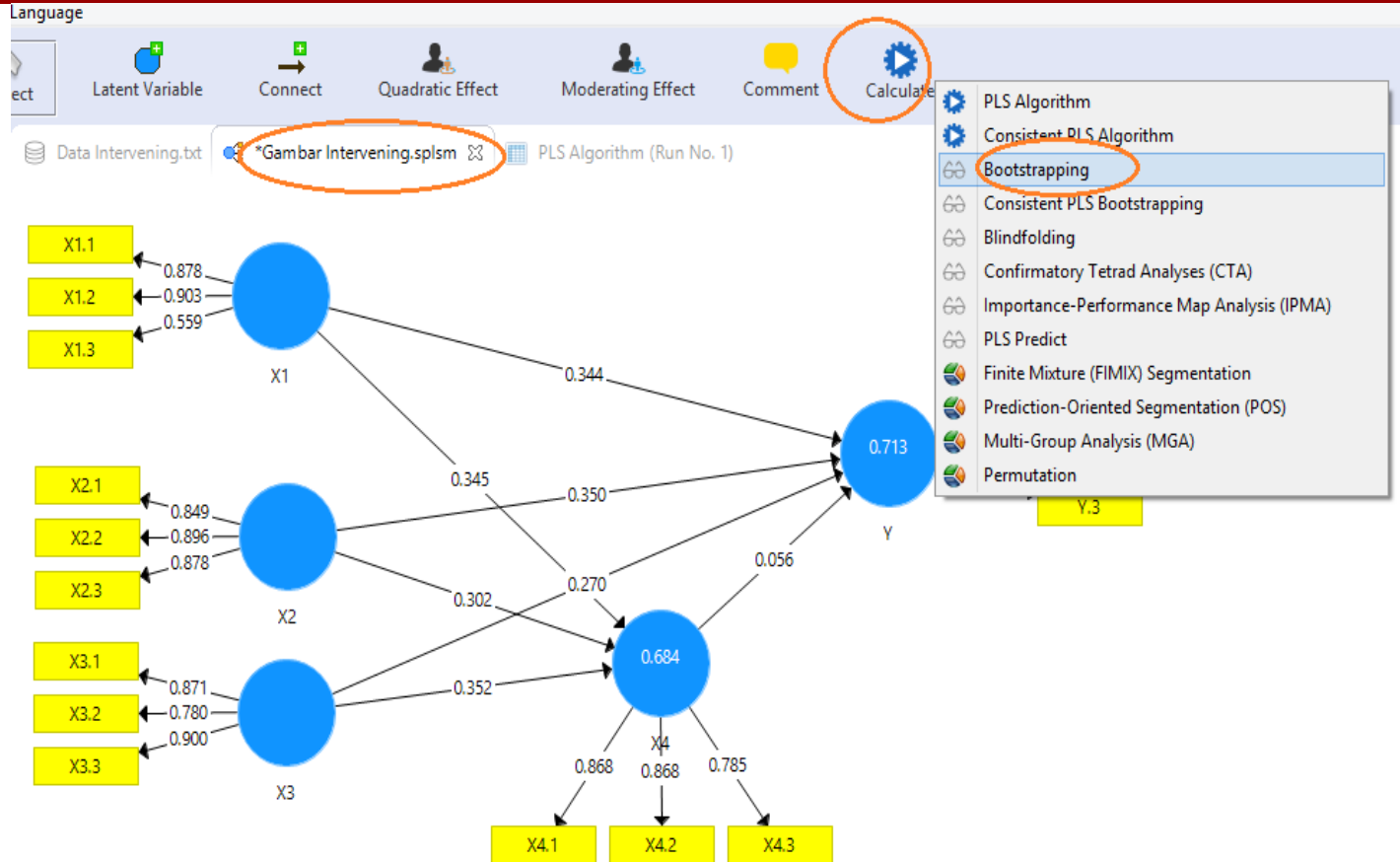
Jika pada “Inner model”, dipilih misalnya “Path Coefficients”, maka koefisien-koefisien jalur akan diperlihatkan. Demikian juga jika ingin memperlihatkan nilai-nilai hasil yang lain.



Catatan:  
Interpretasi/analisis dari nilai-nilai hasil di atas akan diperlihatkan pada bagian akhir di dalam slide ini.

# Calculate-Bootstrapping

- ❑ Pada tab “Gambar Intervening”
- ❑ Klik Calculate
- ❑ Bootstrapping



- ❑ Ketikkan 5000 pada “Subsamples”
- ❑ Klik “Complete Bootstrapping”
- ❑ Start Calculation

**Bootstrapping**  
Bootstrapping is a nonparametric procedure that allows testing the statistical significance of various PLS-SEM results such path coefficients, Cronbach's alpha, HTMT, and R<sup>2</sup> values. [Read more!](#)

**Setup** Partial Least Squares Weighting

**Basic Settings**

Subsamples: 5000

Do Parallel Processing

Sign Changes:  No Sign Changes,  Construct Level Changes,  Individual Changes

Amount of Results:  Basic Bootstrapping,  Complete Bootstrapping

**Advanced Settings**

Confidence Interval Method:  Percentile Bootstrap,  Studentized Bootstrap,  Bias-Corrected and Accelerated (BCa) Bootstrap,  Davison Hinkley's Double Bootstrap,  Shi's Double Bootstrap

Test Type:  One Tailed,  Two Tailed

**Basic Settings**

**Subsamples**

In bootstrapping, subsamples are created with observations randomly drawn (with replacement) from the original set of data. To ensure stability of results, the number of subsamples should be large. For an initial assessment, one may use a smaller number of bootstrap subsamples (e.g., 500). For the final results preparation, however, one should use a large number of bootstrap subsamples (e.g., 5,000).  
Note: Larger numbers of bootstrap subsamples increase the computation time.

**Do Parallel Processing**

This option runs the bootstrapping routine on multiple processors (if your computer device offers more than one core). Using parallel computing will reduce computation time.

**Sign Changes**

Sets the method for dealing with sign changes during the bootstrap iterations. The following options are available:

(1) No Sign Changes (default)  
Sign changes in the resamples will be ignored and the results are taken as they are. This is the most conservative estimation option and the recommended choice when running the bootstrapping routine.

After Calculation:

# Hasil Bootstraping akan diperlihatkan

The screenshot shows the SmartPLS software interface. The top menu bar includes File, Edit, View, Themes, Calculate, Info, and Language. Below the menu are various toolbars with icons for Save, New Project, New Path Model, Hide Zero Values, Increase Decimals, Decrease Decimals, Export to Excel, Export to Web, and Export to R. The Project Explorer on the left shows a project named 'Intervening' with a sub-project 'Gambar Intervening'. The Indicators and Calculation Results panels are also visible. The main window displays the 'Path Coefficients' table, which is the focus of the image. The 'Bootstrapping (Run No. 1)' tab is highlighted with an orange circle. Below the table, there are four sections: Final Results, Quality Criteria, Histograms, and Base Data, each with a list of links to various statistical outputs.

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> X4	0.345	0.338	0.120	2.871	0.004
X1 -> Y	0.344	0.347	0.157	2.194	0.028
X2 -> X4	0.302	0.311	0.090	3.352	0.001
X2 -> Y	0.350	0.351	0.153	2.297	0.022
X3 -> X4	0.352	0.352	0.087	4.048	0.000
X3 -> Y	0.270	0.289	0.141	1.918	0.055
X4 -> Y	0.056	0.040	0.136	0.412	0.680

**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](#)
- [Average Variance Extracted \(AVE\)](#)
- [Composite Reliability](#)
- [rho\\_A](#)
- [Cronbach's Alpha](#)

**Histograms**

- [Path Coefficients Histogram](#)
- [Indirect Effects Histogram](#)
- [Total Effects Histogram](#)

**Base Data**

- [Setting](#)
- [Inner Model](#)
- [Outer Model](#)
- [Indicator Data \(Original\)](#)
- [Indicator Data \(Standardized\)](#)

# ANALISIS DATA



Setelah melakukan kalkulasi PLS Algorithm dan Bootstrapping, maka dapat dilakukan analisis, khususnya:

1. Analisis Model Pengukuran/Measurement Model Analysis(Outer Model)  
Menganalisis hubungan konstruk (variabel laten) dan indikator
  - 1.1. Construct Reliability and Validity
  - 1.2. Discriminant Validity
2. Analisis Model Struktural/Structural Model Analysis (Inner Model)  
Menganalisis hubungan antar konstruk (antar variabel laten) yakni eksogen dan endogen serta hubungan diantaranya
  - 2.1. R-Square
  - 2.2. F-Square
  - 2.1. Direct Effect
  - 2.2. Indirect Effect
  - 2.3. Total Effect

<b>Evaluation of the Measurement Models</b>	
<b>Reflective Measurement Models</b>	<b>Formative Measurement Models</b>
Composite reliability (consistency reliability)	AVE/Convergent validity
AVE/Average Variance Extracted (Convergent validity)	Collinearity among indicators
Discriminant validity	Significance and relevance of outer weights
<b>Evaluation of the Structural Model</b>	
Coefficients of determination ( $R^2$ )	Collinearity
$f^2$ effect sizes	Coefficients of determination ( $R^2$ )
Size and significance of path coefficients	$f^2$ effect sizes
	Size and significance of path coefficients

Sumber: Diadaptasi dari Hair, Hult, Ringle, Sarstedt (2014)

# 1. Analisis Model Pengukuran/Measurement Model

## 1.1. Construct Reliability and Validity

Construct reliability and validity (validitas dan reliabilitas konstruk) adalah pengujian untuk mengukur kehandalan suatu konstruk. Kehandalan skor konstruk harus cukup tinggi.

Kriteria construct reliability and validity yang baik dapat dilihat dari:

1. Cronbach Alpha:  $> 0,7$  (Nunnally dan Bernstein, 1994; Vinzi, Trinchera, & Amato, 2010)
2. Rho\_A:  $>0,7$  (Vinzi, Trinchera, & Amato, 2010)
3. Composite Reliability:  $>0,6$  (Bagozzi dan Yi, 1988; Chin & Dibbern, 2010)
4. Average Variance Extracted (AVE):  $> 0,5$  (Fornell dan Larcker, 1981; Bagozzi dan Yi, 1988; Chin & Dibbern, 2010)

Kesimpulan:

- ❑ Cronbach Alpha: Seluruh konstruk variabel  $> 0,7$
- ❑ rho\_A: Seluruh variabel  $> 0,7$
- ❑ Composite Reliability: Seluruh variabel  $> 0,6$
- ❑ Average Variance Extracted (AVE) Seluruh variabel  $> 0,5$

Dengan demikian, dilihat dari hasil pengujian construct reliability and validity terlihat

Catatan:

- SmartPLS memberi indikasi dari warna: nilai berwarna hijau (mengindikasikan konstruk baik), merah (konstruk buruk)

Data Intervening.txt \*Gambar Intervening.splsm PLS Algorithm (Run No. 1) Bootstrapping (Run No. 1)

### Construct Reliability and Validity

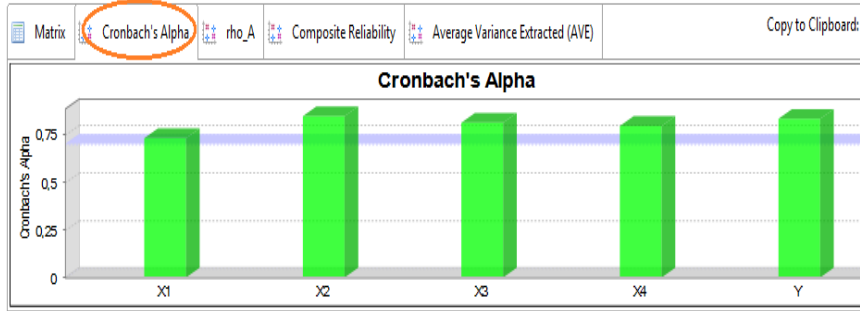
	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
X1	0.731	0.839	0.832	0.633
X2	0.846	0.846	0.907	0.765
X3	0.812	0.845	0.887	0.725
X4	0.795	0.812	0.879	0.708
Y	0.832	0.834	0.899	0.749

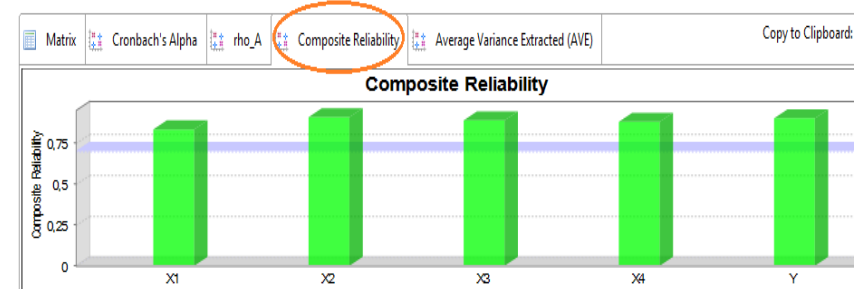
Final Results	Quality Criteria	Interim Results	Base Data
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>	<a href="#">Stop Criterion Changes</a>	<a href="#">Setting</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>		<a href="#">Inner Model</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>		<a href="#">Outer Model</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>		<a href="#">Indicator Data (Original)</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>		<a href="#">Indicator Data (Standardized)</a>
<a href="#">Latent Variable</a>	<a href="#">Model Fit</a>		<a href="#">Indicator Data (Correlations)</a>
<a href="#">Residuals</a>			

Catatan: Jika diperlukan, analisis juga dapat menyertakan grafik SmartPLS. SmartPLS memberi indikasi dari warna grafik: nilai berwarna hijau (dapat ditolerir), merah (tidak dapat ditolerir)

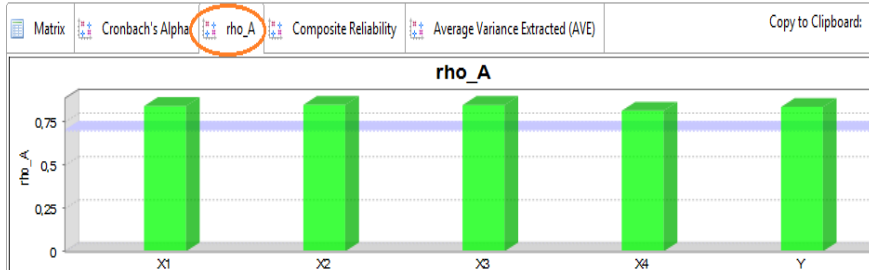
### Construct Reliability and Validity



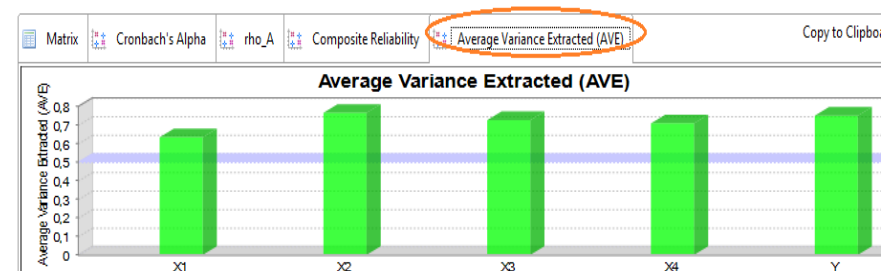
### Construct Reliability and Validity



### Construct Reliability and Validity



### Construct Reliability and Validity



## 1.2. Discriminant Validity

Discriminant validity (validitas diskriminan) adalah sejauh mana suatu konstruk benar-benar berbeda dari konstruksi lain (konstruk adalah unik).

Untuk mengukur validitas diskriminan dapat dilihat dari:

- ❑ Fornell-Larcker Cirteiron
- ❑ Cross Loadings
- ❑ Heretroit-Monotrait Ratio (HTMT)

Namun demikian, dalam website SmartPLS, pengukuran terbaru yang terbaik adalah melihat nilai Heretroit-Monotrait Ratio (HTM). Jika nilai HTMT  $< 0,90$  maka suatu konstruk memiliki validitas diskriminan yang baik (Jörg Henseler Christian; M. Ringle; Marko Sarsted; 2015).

### Discriminant Validity



Kesimpulan:

X2 -> X1	0.571	<0,90 (Valid)
X3 -> X1	0.693	<0,90 (Valid)
X3 -> X2	0.568	<0,90 (Valid)
X4 -> X1	0.812	<0,90 (Valid)
X4 -> X2	0.780	<0,90 (Valid)
X4 -> X3	0.834	<0,90 (Valid)
Y -> X1	0.800	<0,90 (Valid)
Y -> X2	0.822	<0,90 (Valid)
Y -> X3	0.808	<0,90 (Valid)
Y -> X4	0.864	<0,90 (Valid)

### Discriminant Validity

	X1	X2	X3	X4	Y
X1					
X2	0.571				
X3	0.693	0.568			
X4	0.812	0.780	0.834		
Y	0.800	0.822	0.808	0.864	

#### Final Results

[Path Coefficients](#)

[Indirect Effects](#)

[Total Effects](#)

[Outer Loadings](#)

[Outer Weights](#)

[Latent Variable](#)

[Residuals](#)

#### Quality Criteria

[R Square](#)

[f Square](#)

[Construct Reliability and Validity](#)

[Discriminant Validity](#)

[Collinearity Statistics \(VIF\)](#)

[Model Fit](#)

#### Interim Results

[Stop Criterion Changes](#)

#### Base Data

[Setting](#)

[Inner Model](#)

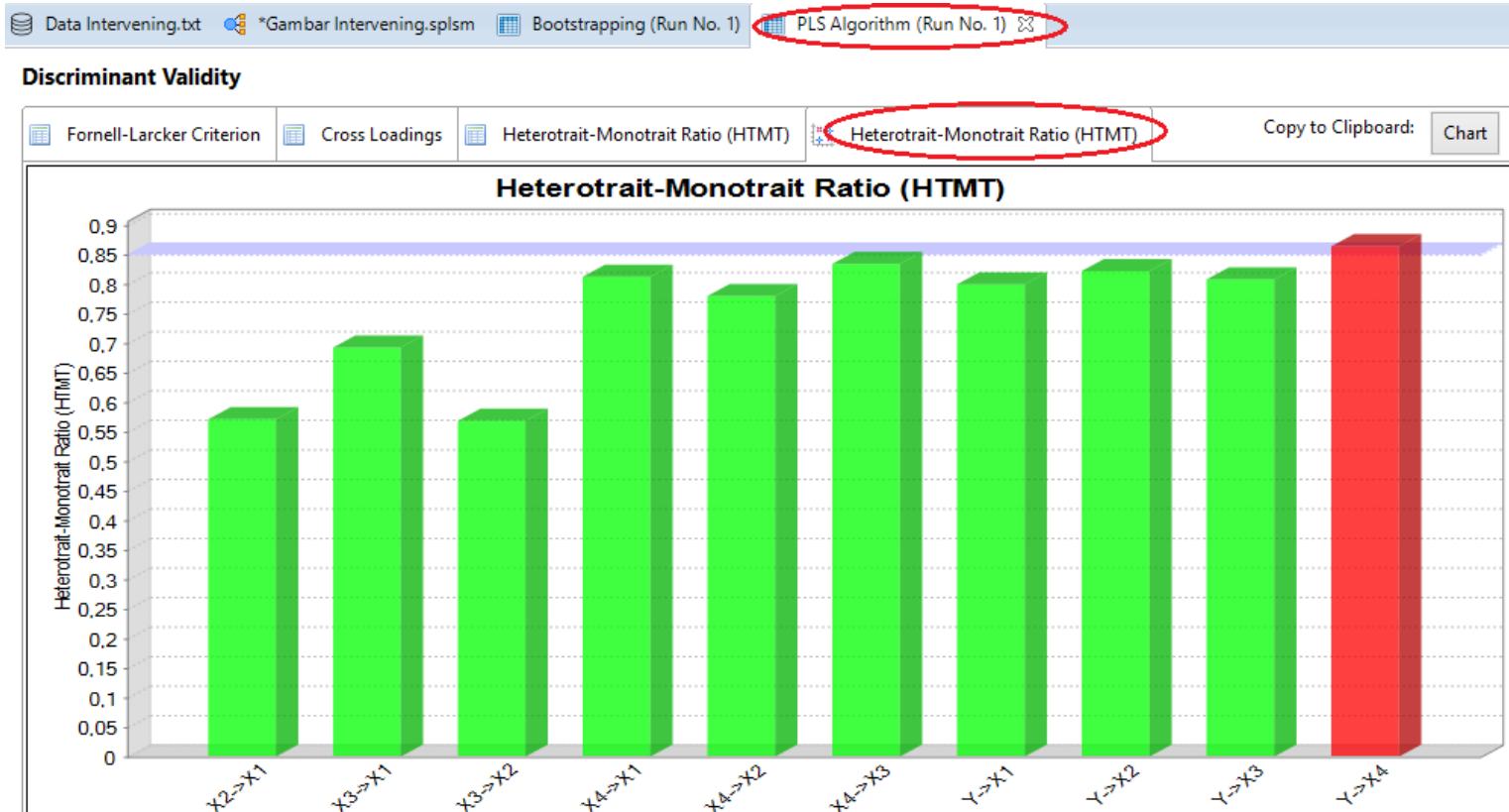
[Outer Model](#)

[Indicator Data \(Original\)](#)

[Indicator Data \(Standardized\)](#)

[Indicator Data \(Correlations\)](#)

Dari warna grafik juga dapat mengindikasikan discriminant validity. Warna hijau menunjukkan validitas masih dapat ditolerir, dan merah menunjukkan validitas yang tidak ditolerir.





# 2. Analisis Model Struktural (Inner Model)

## 2.1. R-Square

R-Square adalah ukuran proporsi variasi nilai variabel yang dipengaruhi (endogen) yang dapat dijelaskan oleh variabel yang mempengaruhinya (eksogen). Ini berguna untuk memprediksi apakah model adalah baik/buruk.

Kriterianya:

- Jika nilai  $R^2 = 0,75$  → Model adalah substansial (kuat)
- Jika nilai  $R^2 = 0,50$  → Model adalah moderate (sedang)
- Jika nilai  $R^2 = 0,25$  → Model adalah lemah (buruk)

Kesimpulan:

- R-Square Adjusted Model Jalur I = 0,664. Artinya kemampuan variabel X1, X2, X3 dalam menjelaskan X4 adalah sebesar 66,4% , dengan demikian model tergolong moderat.
- R-Square Model Adjusted Jalur II = 0,687. Artinya kemampuan X1, X2, X3, X4 dalam menjelaskan Y sebesar 68,7% , dengan demikian model tergolong moderat.

Catatan:

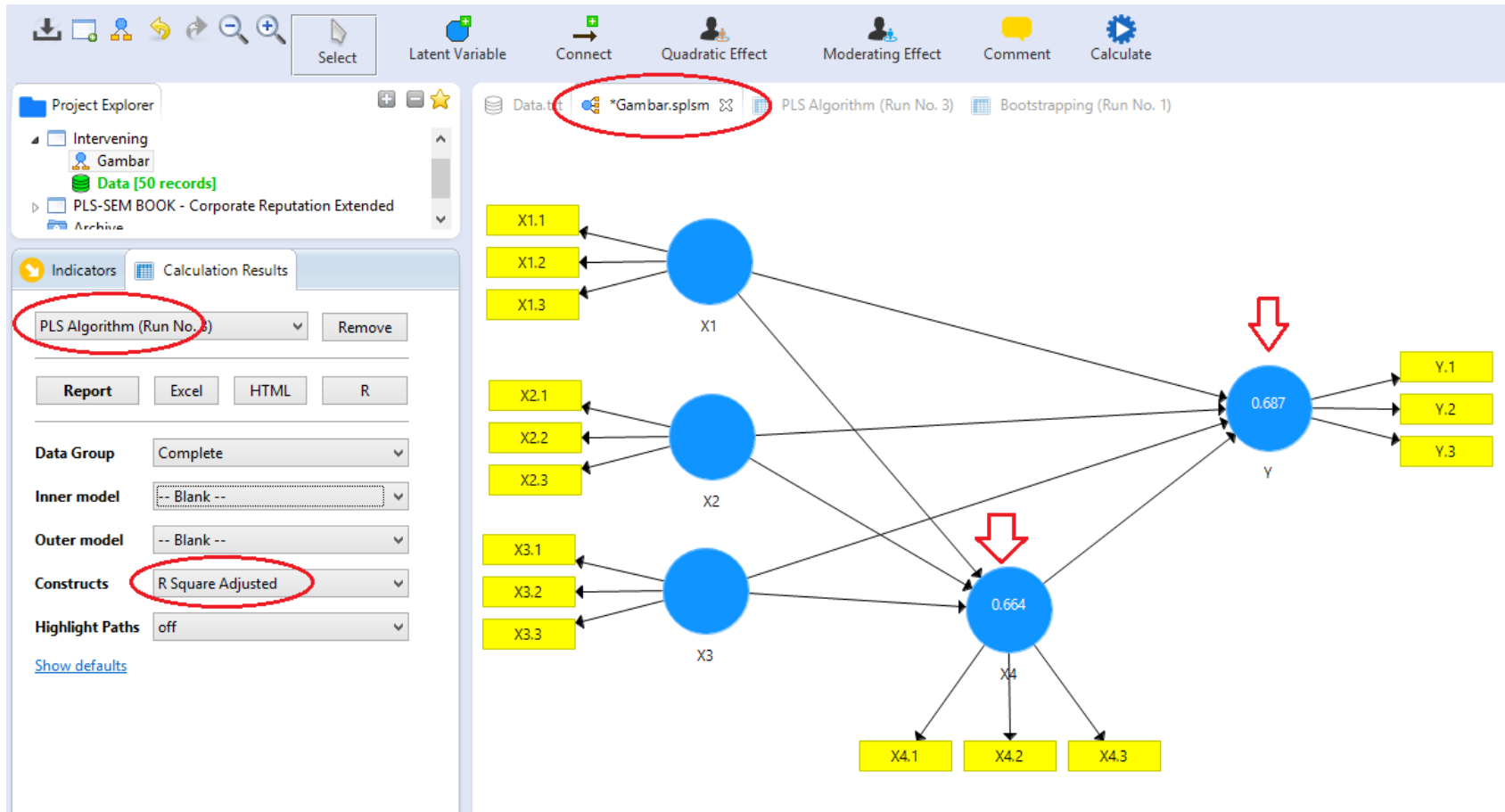
- SmartPLS memberi indikasi dari warna: nilai berwarna hijau (mengindikasikan efek)
- Jika variabel eksogen lebih dari 1, maka gunakan R Square Adjusted.
- Jika variabel eksogen hanya 1, maka gunakan R Square

The screenshot shows the SmartPLS software interface. At the top, there are buttons for 'Values', 'Increase Decimals', 'Decrease Decimals', and 'Export to Excel'. Below these are file names: 'Data.txt', '\*Gambar.spism', and 'PLS Algorithm (Run No. 3)'. The 'PLS Algorithm (Run No. 3)' button is circled in red. Below the file names is a table titled 'R Square'.

Matrix	R Square	R Square Adjusted
X4	0.684	0.664
Y	0.713	0.687

The 'R Square Adjusted' values for X4 (0.664) and Y (0.687) are circled in red. Below the table is a navigation menu with four columns: 'Final Results', 'Quality Criteria', 'Interim Results', and 'Bas'. Under 'Quality Criteria', 'R Square' is circled in red. Other items in the menu include 'Path Coefficients', 'Indirect Effects', 'Total Effects', 'Outer Loadings', 'Outer Weights', 'Latent Variable', 'Residuals', 'Stop Criterion Changes', and 'Sett'.

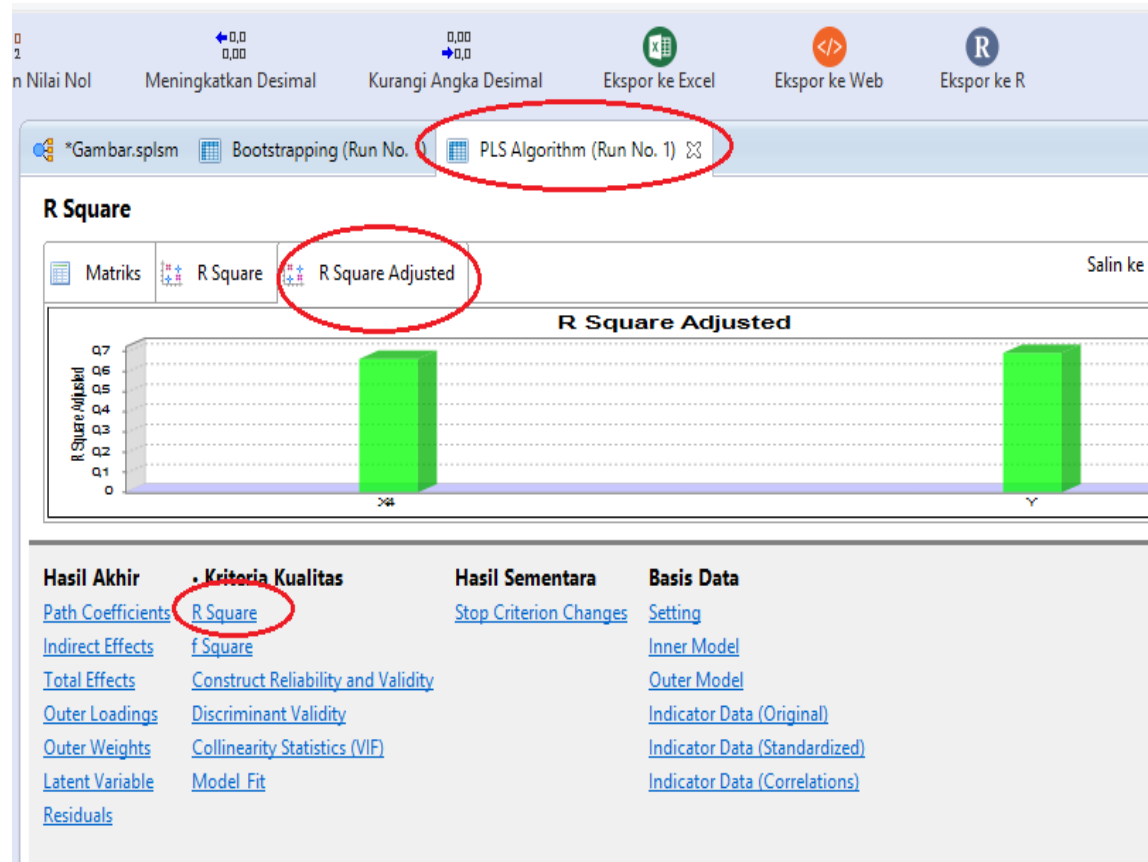
Dalam gambar model, juga dapat dilihat nilai R Square adjusted tersebut



Catatan:  
 SmartPLS memberi indikasi R-Square dari warna grafik: berwarna hijau, mengindikasikan model yang berada dalam nilai toleransi, namun jika berwarna merah mengindikasikan model berada dalam nilai toleransi

Dengan demikian,

- R-Square Model Jalur I = 0,684, berwarna hijau (berada dalam nilai toleransi)
- R-Square Model Jalur II = 0,687 berwarna hijau (berada dalam nilai toleransi)



## 2.2. $f^2$ (f-Square)

$$f^2 = \frac{R^2_{\text{included}} - R^2_{\text{excluded}}}{1 - R^2_{\text{included}}}$$

$f^2$  effect size (F-Square): adalah ukuran yang digunakan untuk menilai dampak relatif dari suatu variabel yang mempengaruhi (eksogen) terhadap variabel yang dipengaruhi (endogen).

Perubahan nilai  $R^2$  saat variabel eksogen tertentu dihilangkan dari model, dapat digunakan untuk mengevaluasi apakah variabel yang dihilangkan memiliki dampak substantif pada konstruk endogen.

Kriterianya (Cohen, 1988):

- ❑ Jika nilai  $f^2 = 0,02 \rightarrow$  Efek yang kecil dari variabel eksogen terhadap endogen
- ❑ Jika nilai  $f^2 = 0,15 \rightarrow$  Efek yang sedang/moderat dari variabel eksogen terhadap endogen
- ❑ Jika nilai  $f^2 = 0,35 \rightarrow$  Efek yang besar dari variabel eksogen terhadap endogen

Kesimpulan:

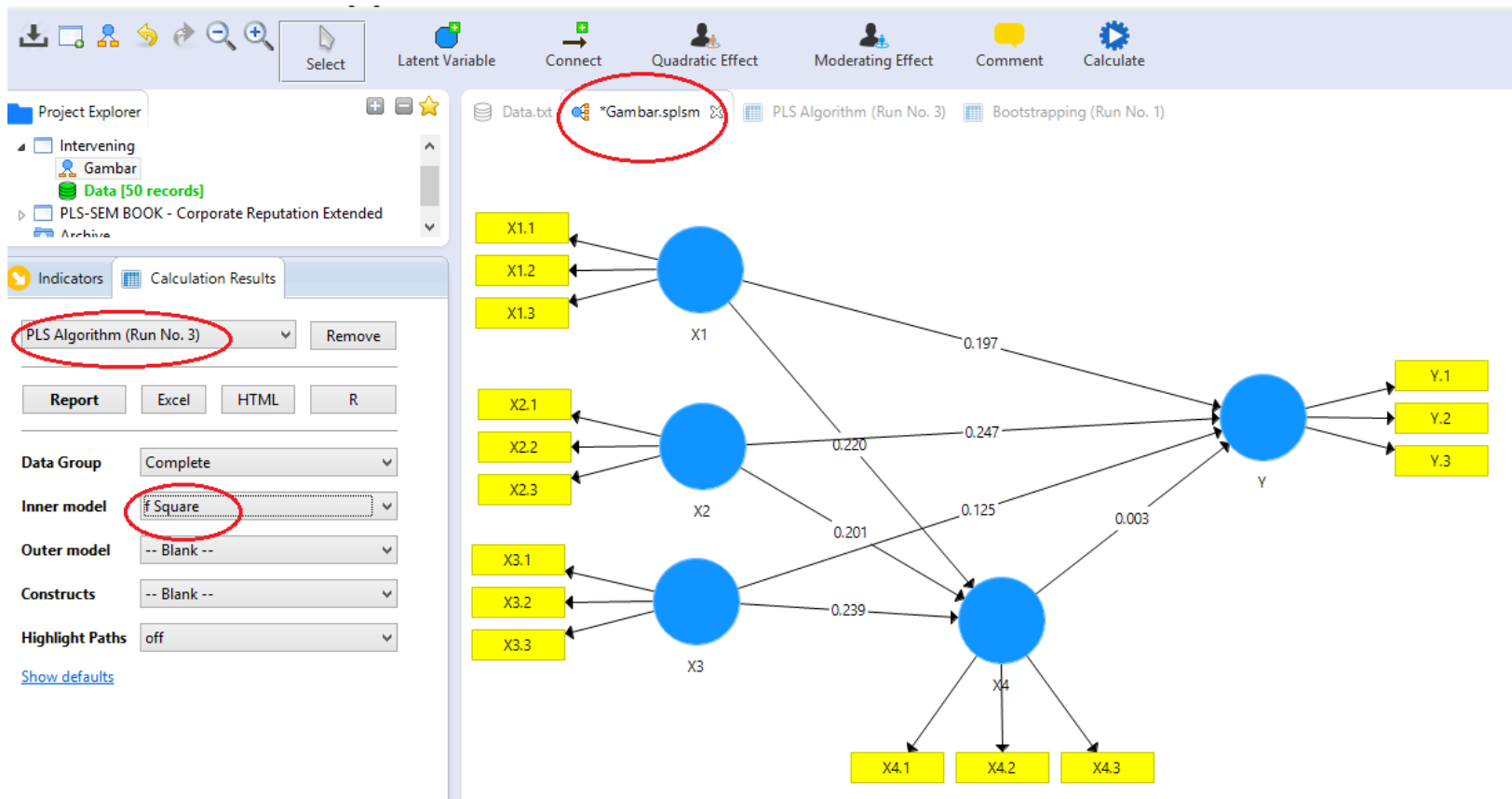
- ❑  $X1 \rightarrow X4 = 0,220$  (sedang)
- ❑  $X2 \rightarrow X4 = 0,201$  (sedang)
- ❑  $X3 \rightarrow X4 = 0,239$  (sedang)
- ❑  $X1 \rightarrow Y = 0,197$  (sedang)
- ❑  $X2 \rightarrow Y = 0,247$  (sedang)
- ❑  $X3 \rightarrow Y = 0,125$  (rendah)
- ❑  $X4 \rightarrow Y = 0,003$  (rendah)

The screenshot shows the SmartPLS software interface. At the top, there are navigation buttons: Values, Increase Decimals, Decrease Decimals, Export to Excel, Export to Web, and Export to R. Below these are file tabs: Data.txt, \*Gambar.splsm, PLS Algorithm (Run No. 3), and Bootstrapping (Run No. 1). The main window displays the 'f Square' matrix, which is a table of effect sizes. The matrix is circled in red, and the values are color-coded: green for significant effects (0.220, 0.201, 0.239, 0.197, 0.247) and red for non-significant effects (0.125, 0.003). Below the matrix, there are four columns of results: Final Results, Quality Criteria, Interim Results, and Base Data. The 'Quality Criteria' column contains a link to 'f Square', which is also circled in red.

	X1	X2	X3	X4	Y
X1				0.220	0.197
X2				0.201	0.247
X3				0.239	0.125
X4					0.003
Y					

Final Results	Quality Criteria	Interim Results	Base Data
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>	<a href="#">Stop Criterion Changes</a>	<a href="#">Setting</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>		<a href="#">Inner Model</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>		<a href="#">Outer Model</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>		<a href="#">Indicator Data (Original)</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>		<a href="#">Indicator Data (Standardized)</a>
<a href="#">Latent Variable</a>	<a href="#">Model Fit</a>		<a href="#">Indicator Data (Correlations)</a>
<a href="#">Residuals</a>			

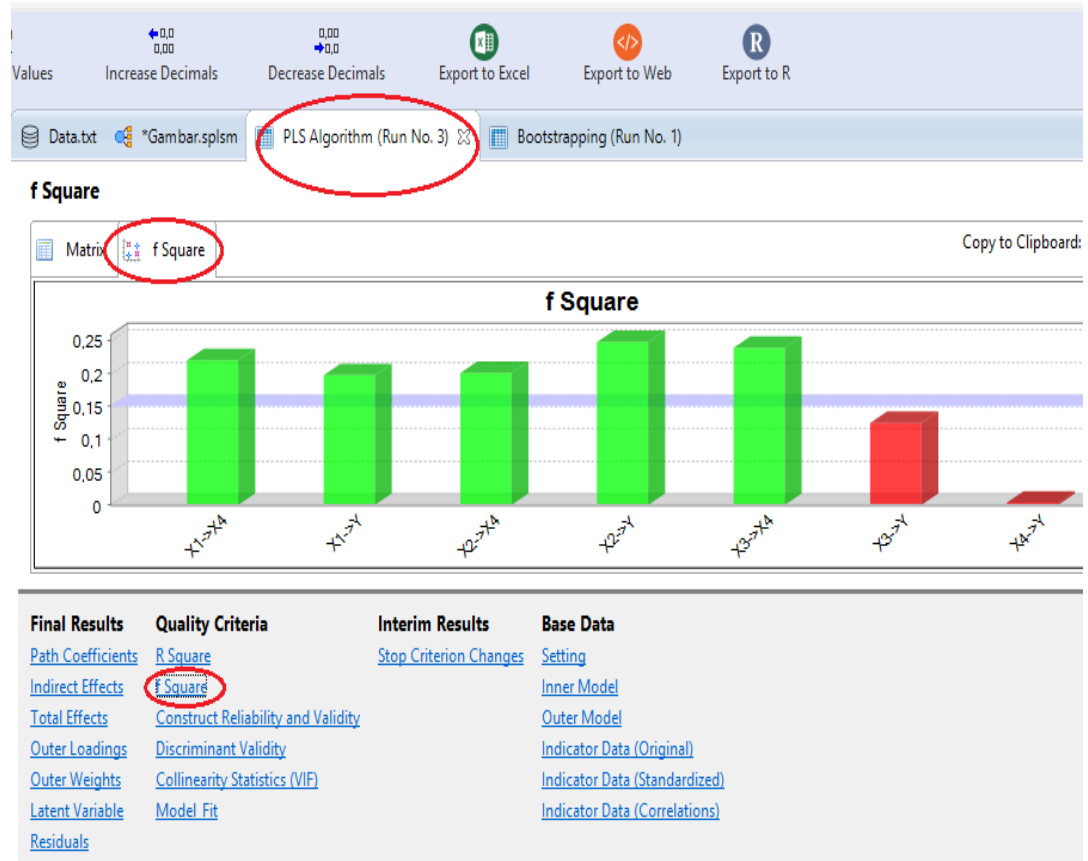
Catatan: SmartPLS memberi indikasi dari warna: nilai berwarna hijau (mengindikasikan efek yang baik), hitam (sedang), merah (buruk)



Catatan: SmartPLS memberi indikasi f-Square dari warna grafik: berwarna hijau (mengindikasikan efek yang masih berada dalam toleransi), merah (di luar toleransi)

Dengan demikian, f-Square untuk:

- $X1 \rightarrow X4$  (hijau)= dapat ditolerir
- $X2 \rightarrow X4$  (hijau)= dapat ditolerir
- $X3 \rightarrow X4$  (hijau)= dapat ditolerir
- $X1 \rightarrow Y$  (hijau)= dapat ditolerir
- $X2 \rightarrow Y$  (hijau)= dapat ditolerir
- $X3 \rightarrow Y$  (merah)= tidak dapat ditolerir
- $X4 \rightarrow Y$  (merah)= tidak dapat ditolerir



## 2.3. Direct Effect (Pengaruh Langsung)

Analisis direct effect berguna untuk menguji hipotesis pengaruh langsung suatu variabel yang mempengaruhi (eksogen) terhadap variabel yang dipengaruhi (endogen).

Kriterianya:

- ❑ Koefisien jalur (Path Coefficient):
  - ❑ Jika nilai koefisien jalur (path coefficient) adalah positif, maka pengaruh suatu variabel terhadap adalah searah, jika nilai suatu variabel eksogen meningkat/naik, maka nilai variabel endogen juga meningkat/naik
  - ❑ Jika nilai koefisien jalur (path coefficient) adalah negatif, maka pengaruh suatu variabel terhadap adalah berlawanan arah, jika nilai suatu variabel eksogen meningkat/naik, maka nilai variabel endogen menurun.
- ❑ Nilai Probabilitas/Signifikansi (P-Value):
  - ❑ Jika nilai P-Values < 0,05, maka signifikan
  - ❑ Jika nilai P-Values > 0,05, maka tidak signifikan

### Kesimpulan:

Koefisien jalur (Path Coefficient): Seluruh nilai koefisien jalur adalah positif (catatan: lihat pada original sample):

- $X1 \rightarrow X4$ : Koefisien jalur=0,345 dan P-Values=0,004 ( $<0,05$ ), artinya, pengaruh  $X1$  terhadap  $X4$  adalah positif dan signifikan
- $X1 \rightarrow Y$ : Koefisien jalur=0,344 dan P-Values=0,027 ( $<0,05$ ), artinya, pengaruh  $X1$  terhadap  $Y$  adalah positif dan signifikan
- $X2 \rightarrow X4$ : Koefisien jalur=0,350 dan P-Values=0,001 ( $<0,05$ ), artinya, pengaruh  $X2$  terhadap  $X4$  adalah positif dan signifikan
- $X2 \rightarrow Y$ : Koefisien jalur=0,350 dan P-Values=0,024 ( $<0,05$ ), artinya, pengaruh  $X2$  terhadap  $Y$  adalah positif dan signifikan
- $X3 \rightarrow X4$ : Koefisien jalur=0,352 dan P-Values=0,000 ( $<0,05$ ), artinya, pengaruh  $X3$  terhadap  $X4$  adalah positif dan signifikan
- $X3 \rightarrow Y$ : Koefisien jalur=0,270 dan P-Values=0,058 ( $>0,05$ ), artinya, pengaruh  $X3$  terhadap  $Y$  adalah positif namun tidak signifikan
- $X4 \rightarrow Y$ : Koefisien jalur=0,056 dan P-Values=0,682 ( $>0,05$ ), artinya, pengaruh  $X4$  terhadap  $Y$  adalah positif namun tidak signifikan

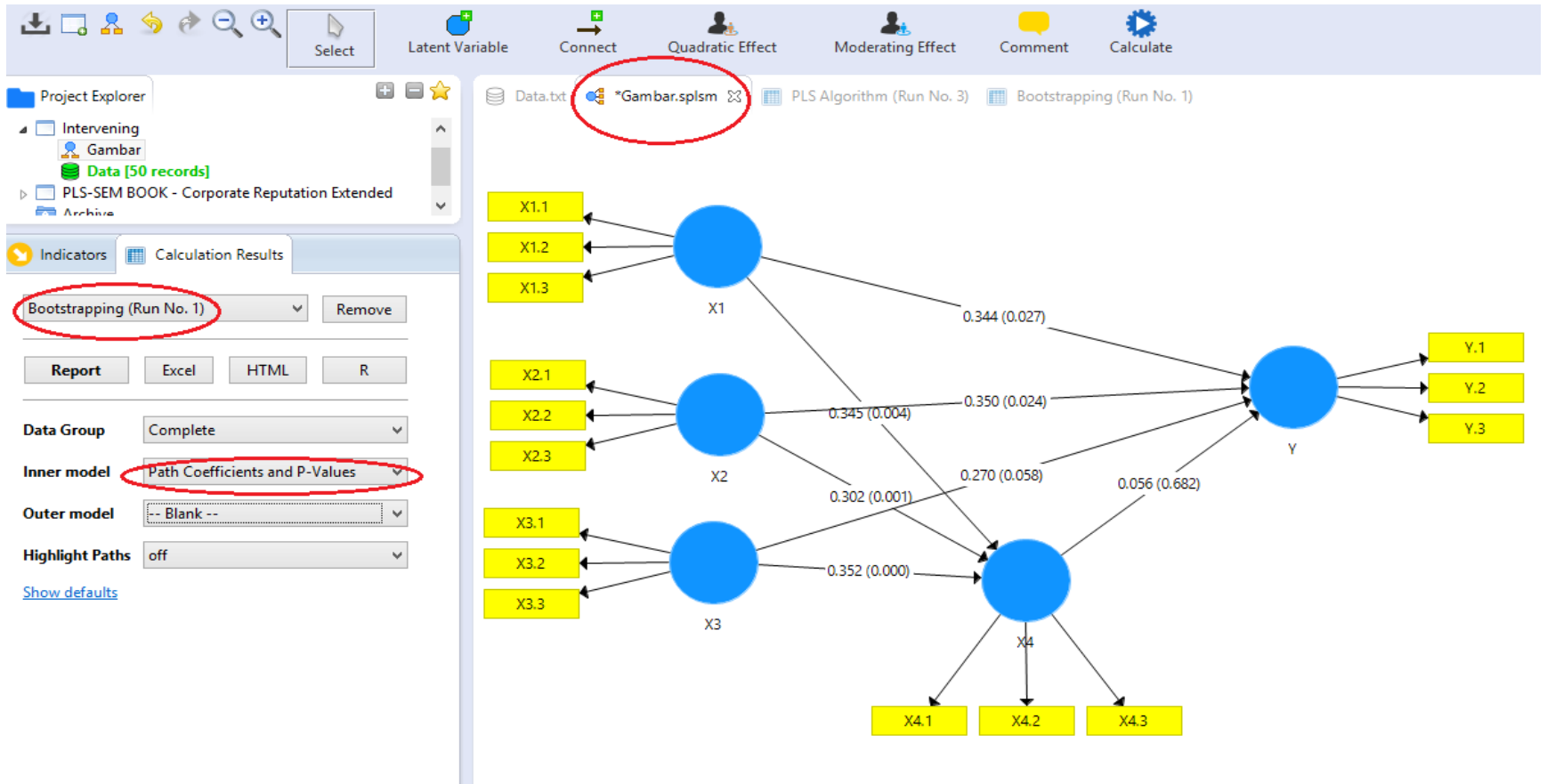
The screenshot displays the SmartPLS software interface. At the top, there are navigation buttons for 'Increase Decimals', 'Decrease Decimals', 'Export to Excel', 'Export to Web', and 'Export to R'. Below these are tabs for 'Data.txt', '\*Gambar.splsm', 'PLS Algorithm (Run No. 3)', and 'Bootstrapping (Run No. 1)'. The main window shows the 'Path Coefficients' table with columns for 'Original Sample Mean', 'Sample Mean', 'Standard Deviation', 'T Statistics', and 'P Values'. The 'Path Coefficients' tab is selected, and the 'Mean, STDEV, T-Values, P-Values' sub-tab is active. The table contains the following data:

	Original Sample Mean	Sample Mean	Standard Deviation	T Statistics	P Values
$X1 \rightarrow X4$	0.345	0.340	0.121	2.862	0.004
$X1 \rightarrow Y$	0.344	0.344	0.156	2.211	0.027
$X2 \rightarrow X4$	0.302	0.311	0.090	3.361	0.001
$X2 \rightarrow Y$	0.350	0.353	0.155	2.257	0.024
$X3 \rightarrow X4$	0.352	0.352	0.086	4.109	0.000
$X3 \rightarrow Y$	0.270	0.290	0.142	1.894	0.058
$X4 \rightarrow Y$	0.056	0.041	0.137	0.410	0.682

Below the table, there are three sections: 'Final Results' (with 'Path Coefficients' highlighted), 'Histograms' (with 'Path Coefficients Histogram' highlighted), and 'Base Data' (with 'Setting' highlighted). Other links include 'Total Indirect Effects', 'Indirect Effects Histogram', 'Inner Model', 'Specific Indirect Effects', 'Total Effects Histogram', 'Outer Model', 'Total Effects', 'Indicator Data (Original)', 'Outer Loadings', 'Indicator Data (Standardized)', and 'Outer Weights'.



Dari gambar jalur juga akan sangat mudah menentukan nilai positif/negatif dari suatu jalur, dan signifikan/tidak signifikan dari suatu jalur.



## 2.4. Indirect Effect (Pengaruh Tidak Langsung)

Analisis indirect effect berguna untuk menguji hipotesis pengaruh tidak langsung suatu variabel yang mempengaruhi (eksogen) terhadap variabel yang dipengaruhi (endogen) yang diantarai/dimediasi oleh suatu variabel intervening (variabel mediator).

Kriterianya:

- ❑ Jika nilai  $P\text{-Values} < 0,05$ , maka signifikan, artinya variabel mediator, memediasi pengaruh suatu variabel eksogen terhadap suatu variabel endogen. Dengan kata lain, pengaruhnya adalah tidak langsung.
- ❑ Jika nilai  $P\text{-Values} > 0,05$ , maka tidak signifikan, artinya variabel mediator tidak memediasi pengaruh suatu variabel eksogen terhadap suatu variabel endogen. Dengan kata lain, pengaruhnya adalah langsung

## Kesimpulan:

- ❑ Pengaruh tidak langsung  $X1 \rightarrow X4 \rightarrow Y$  adalah 0,019, dengan P-Values  $0,692 > 0,05$  (tidak signifikan), maka  $X4$  tidak memediasi pengaruh  $X1$  terhadap  $Y$
- ❑ Pengaruh tidak langsung  $X2 \rightarrow X4 \rightarrow Y$  adalah 0,017, dengan P-Values  $0,715 > 0,05$  (tidak signifikan), maka  $X4$  tidak memediasi pengaruh  $X2$  terhadap  $Y$
- ❑ Pengaruh tidak langsung  $X3 \rightarrow X4 \rightarrow Y$  adalah 0,020, dengan P-Values  $0,693 > 0,05$  (tidak signifikan), maka  $X4$  tidak memediasi pengaruh  $X3$  terhadap  $Y$

The screenshot shows the SmartPLS software interface. At the top, there are buttons for 'Increase Decimals', 'Decrease Decimals', 'Export to Excel', 'Export to Web', and 'Export to R'. Below these are file tabs for 'Data.txt', '\*Gambar.splsm', 'PLS Algorithm (Run No. 3)', and 'Bootstrapping (Run No. 1)'. The 'Bootstrapping (Run No. 1)' tab is circled in red. Below the tabs is the 'Specific Indirect Effects' section, which contains a table with the following data:

	Original Sample (O)	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> X4 -> Y	0.019	0.014	0.049	0.395	0.692
X2 -> X4 -> Y	0.017	0.014	0.046	0.366	0.715
X3 -> X4 -> Y	0.020	0.013	0.050	0.395	0.693

Below the table are three sections: 'Final Results', 'Histograms', and 'Base Data'. The 'Specific Indirect Effects' link under 'Final Results' is circled in red.

Catatan:

Jika Anda membandingkan cara klasik analisis jalur, hasilnya akan sama dengan cara membandingkan nilai P-Value seperti di atas.

Contohnya:

Pengaruh langsung (PL)  $X1 \rightarrow Y$  (0,344) dengan pengaruh tidak langsung (PTL)  $X1 \rightarrow X4 \rightarrow Y$  (0,019): Maka  $PL > PTL$  ( $X4$  tidak memediasi pengaruh  $X1$  terhadap  $Y$ )

Pengaruh langsung (PL)  $X2 \rightarrow Y$  (0,350) dengan pengaruh tidak langsung (PTL)  $X2 \rightarrow X4 \rightarrow Y$  (0,017): : Maka  $PL > PTL$  ( $X4$  tidak memediasi pengaruh  $X2$  terhadap  $Y$ )

Pengaruh langsung (PL)  $X3 \rightarrow Y$  (0,270) dengan pengaruh tidak langsung (PTL)  $X3 \rightarrow X4 \rightarrow Y$  (0,020): : Maka  $PL > PTL$  ( $X4$  tidak memediasi pengaruh  $X3$  terhadap  $Y$ )

SmartPLS software interface showing the Path Coefficients table. The table lists path coefficients for various paths, with red circles highlighting the Mean, STDEV, T-Values, and P-Values columns. The 'Bootstrapping (Run No. 1)' tab is also highlighted.

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
$X1 \rightarrow X4$	0.345	0.340	0.121	2.862	0.004
$X1 \rightarrow Y$	0.344	0.344	0.156	2.211	0.027
$X2 \rightarrow X4$	0.302	0.311	0.090	3.361	0.001
$X2 \rightarrow Y$	0.350	0.353	0.155	2.257	0.024
$X3 \rightarrow X4$	0.352	0.352	0.086	4.109	0.000
$X3 \rightarrow Y$	0.270	0.290	0.142	1.894	0.058
$X4 \rightarrow Y$	0.056	0.041	0.137	0.410	0.682

Navigation menu: Final Results (highlighted), Histograms, Base Data. Sub-menu: Path Coefficients (highlighted), Total Indirect Effects, Specific Indirect Effects, Total Effects, Outer Loadings, Outer Weights.

SmartPLS software interface showing the Specific Indirect Effects table. The table lists specific indirect effects for various paths, with red circles highlighting the Mean, STDEV, T-Values, and P-Values columns. The 'Bootstrapping (Run No. 1)' tab is also highlighted.

	Original Sample (O)	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
$X1 \rightarrow X4 \rightarrow Y$	0.019	0.014	0.049	0.395	0.692
$X2 \rightarrow X4 \rightarrow Y$	0.017	0.014	0.046	0.366	0.715
$X3 \rightarrow X4 \rightarrow Y$	0.020	0.013	0.050	0.395	0.693

Navigation menu: Final Results, Histograms, Base Data. Sub-menu: Specific Indirect Effects (highlighted), Total Effects Histogram, Outer Model, Indicator Data (Original), Indicator Data (Standardized).

# 2.5. Total Effect (Pengaruh Total)

Total Efek merupakan total dari direct effect dan indirect effect.

- Direct effect ( $X1 \rightarrow Y$ ) = 0,344
- Indirect effect  $X1 \rightarrow X4 \rightarrow Y$  = 0,019+
- Total effect = 0,363  
(pada output smart PLS tertera 0,364)

Total efek untuk hubungan  $X1$ ,  $X4$ , dan  $Y$  adalah sebesar 0,364

- Direct effect ( $X2 \rightarrow Y$ ) = 0,350
- Indirect effect ( $X2 \rightarrow X4 \rightarrow Y$ ) = 0,017+
- Total effect = 0,367

Total efek untuk hubungan  $X2$ ,  $X4$ , dan  $Y$  adalah sebesar 0,367.

- Direct effect ( $X3 \rightarrow Y$ ) = 0,270
- Indirect effect ( $X3 \rightarrow X4 \rightarrow Y$ ) = 0,020+
- Total effect = 0,290  
(pada output smart PLS tertera 0,289)

Total efek untuk hubungan  $X3$ ,  $X4$ , dan  $Y$  adalah sebesar 0,289.

Catatan: Untuk nilai-nilai indirect effect di atas, lihat pada output

The screenshot shows the SmartPLS software interface. At the top, the 'Bootstrapping (Run No. 1)' tab is highlighted with a red circle. Below it, the 'Total Effects' table is displayed, with the 'Mean, STDEV, T-Values, P-Values' column header and several data rows circled in red. The table includes columns for Original Sample Mean, Sample Mean, Standard Deviation, T Statistics, and P Values. Below the table, a navigation menu is visible with links for Final Results, Histograms, and Base Data. The 'Total Effects' link in the Final Results section is circled in red.

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> X4	0.345	0.340	0.121	2.862	0.004
X1 -> Y	0.364	0.358	0.160	2.270	0.023
X2 -> X4	0.302	0.311	0.090	3.361	0.001
X2 -> Y	0.367	0.367	0.133	2.771	0.006
X3 -> X4	0.352	0.352	0.086	4.109	0.000
X3 -> Y	0.289	0.303	0.134	2.164	0.031
X4 -> Y	0.056	0.041	0.137	0.410	0.682

**Final Results**  
[Path Coefficients](#)  
[Total Indirect Effects](#)  
[Specific Indirect Effects](#)  
[Total Effects](#)  
[Outer Loadings](#)  
[Outer Weights](#)

**Histograms**  
[Path Coefficients Histogram](#)  
[Indirect Effects Histogram](#)  
[Total Effects Histogram](#)

**Base Data**  
[Setting](#)  
[Inner Model](#)  
[Outer Model](#)  
[Indicator Data \(Original\)](#)  
[Indicator Data \(Standardized\)](#)

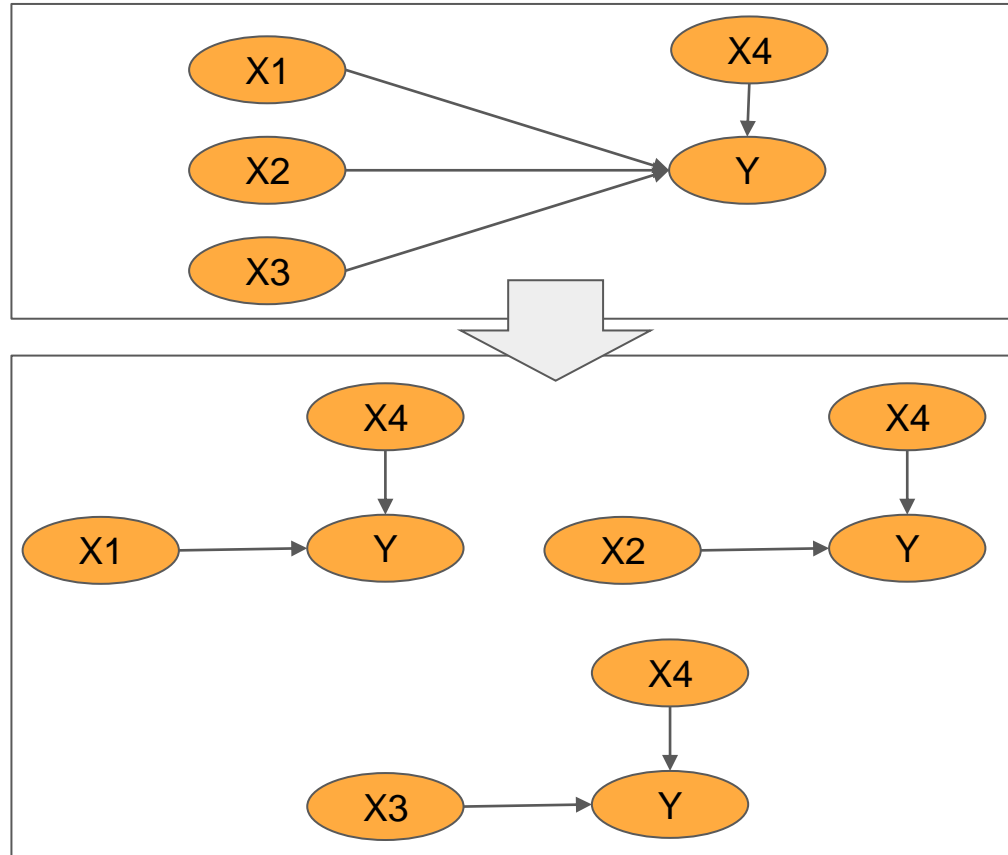
# Analisis PLS ber-Variabel Moderator

Azuar Juliandi

# SEM Bervariabel Moderator

- ❑ Variabel moderator adalah variabel yang mempengaruhi hubungan variabel eksogen (bebas) dengan variabel endogen (terikat)
- ❑ Jika variabel eksogen (bebas) lebih dari satu, maka analisis harus dipisah masing-masing.
- ❑ Contoh: Variabel eksogen/bebas ada 3 (X1, X2, X3), variabel moderator ada 1 (X4), variabel endogen/terikat ada 1 (Y), maka analisisnya adalah masing-masing:
  - ❑  $X1 \rightarrow Y$  dimoderasi X4
  - ❑  $X2 \rightarrow Y$  dimoderasi X4
  - ❑  $X3 \rightarrow Y$  dimoderasi X4

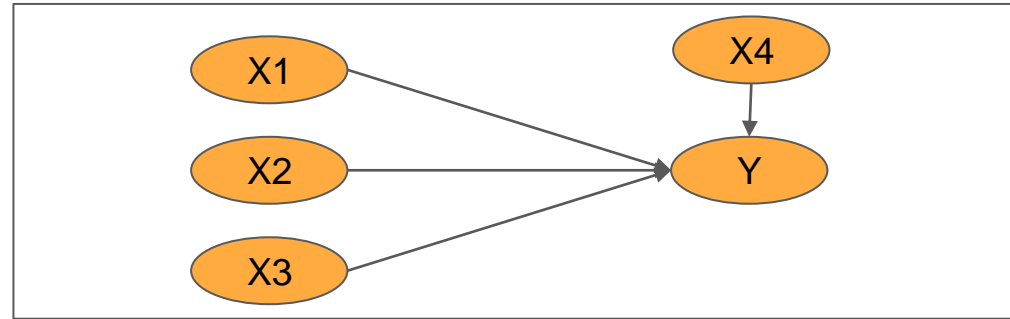
Dengan demikian, running untuk SmartPLS ada 3 kali



# Rumusan Masalah/Tujuan Penelitian/Hipotesis

Rumusan Masalah/Tujuan  
Penelitian/Hipotesis:

- 1)  $X1 \rightarrow Y$  yang dimoderasi  $X4$
- 2)  $X2 \rightarrow Y$  yang dimoderasi  $X4$
- 3)  $X3 \rightarrow Y$  yang dimoderasi  $X4$





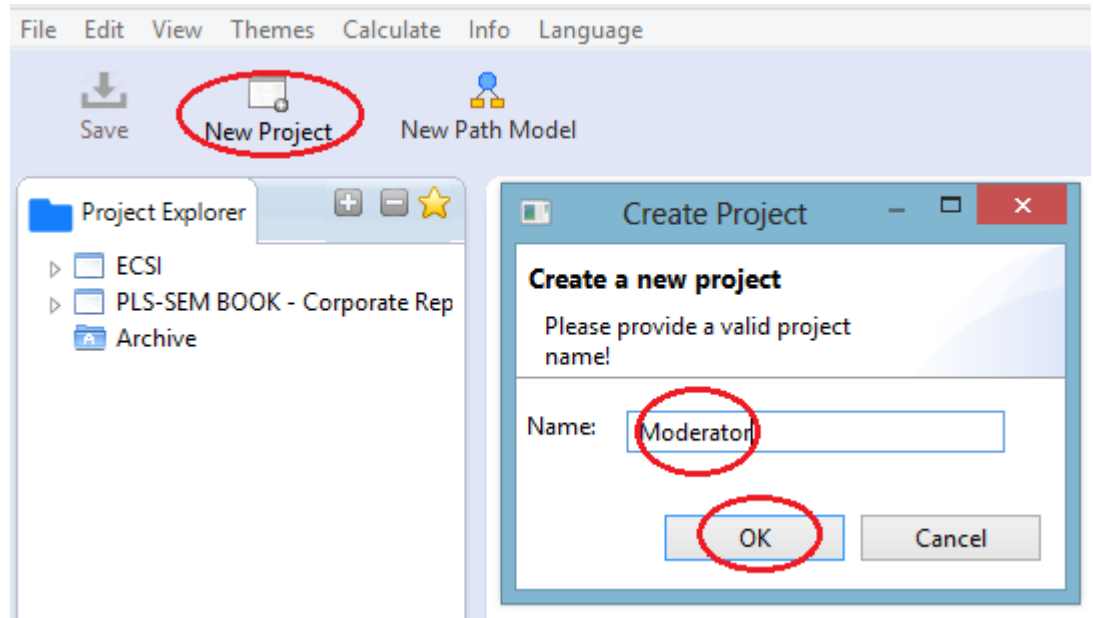
# Data

- ❑ [Download Contoh Data](#) (Data dikemas dalam di Excel dengan save as type: CSV-MS DOS)
- ❑ Sampel: 50
- ❑ Variabel terdiri dari 4:
  - ❑ Variabel eksogen/bebas (X1, X2, X3), indikatornya:
    - ❑ X1.1; X1.2; X1.3
    - ❑ X2.1; X2.2; X2.3
    - ❑ X3.1; X3.2; X3.3
  - ❑ Variabel moderator (X4), indikatornya:
    - ❑ X4.1; X4.2; X4.3
  - ❑ Variabel endogen/Terikat (Y), indikatornya:
    - ❑ Y.1; Y.2; Y.3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	X1.1	X1.2	X1.3	X2.1	X2.2	X2.3	X3.1	X3.2	X3.3	X4.1	X4.2	X4.3	Y.1	Y.2	Y.3
2	2	3	3	2	2	2	2	2	3	2	2	2	3	3	3
3	4	4	4	5	4	5	4	5	5	4	5	4	5	4	4
4	3	3	3	5	5	4	2	2	2	3	4	3	3	3	4
5	4	3	4	5	4	5	5	4	5	4	4	4	3	5	4
6	3	4	3	5	4	5	4	4	4	3	3	3	4	4	5
7	3	4	3	4	4	5	5	3	3	3	4	3	3	3	5
8	4	4	4	4	5	5	4	5	4	4	4	3	5	4	4
9	4	4	3	4	4	4	4	3	4	4	4	5	4	5	5
10	5	4	4	4	2	4	4	4	4	3	4	4	5	3	5
11	3	3	3	3	2	3	3	5	3	4	3	2	3	3	2
12	2	3	2	2	2	2	2	3	2	3	2	2	2	2	2
13	4	4	4	4	4	5	4	4	4	3	4	4	4	4	5
14	3	4	5	3	4	5	2	4	4	3	2	3	3	3	5
15	4	4	4	5	5	4	4	4	4	4	4	4	4	4	4
16	2	3	4	2	2	2	2	3	2	2	3	2	2	2	2
17	4	4	2	5	2	2	5	5	4	4	4	3	4	5	5
18	4	2	2	4	2	2	3	3	4	4	3	4	3	3	3

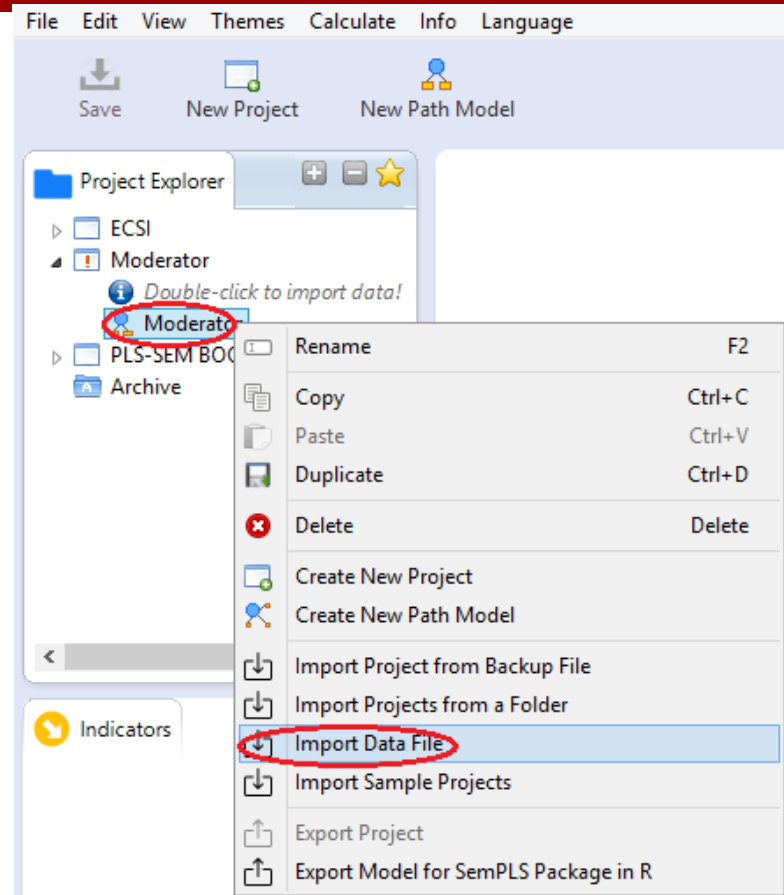
# New Project

- ❑ New Project
- ❑ Name: Moderator
- ❑ OK

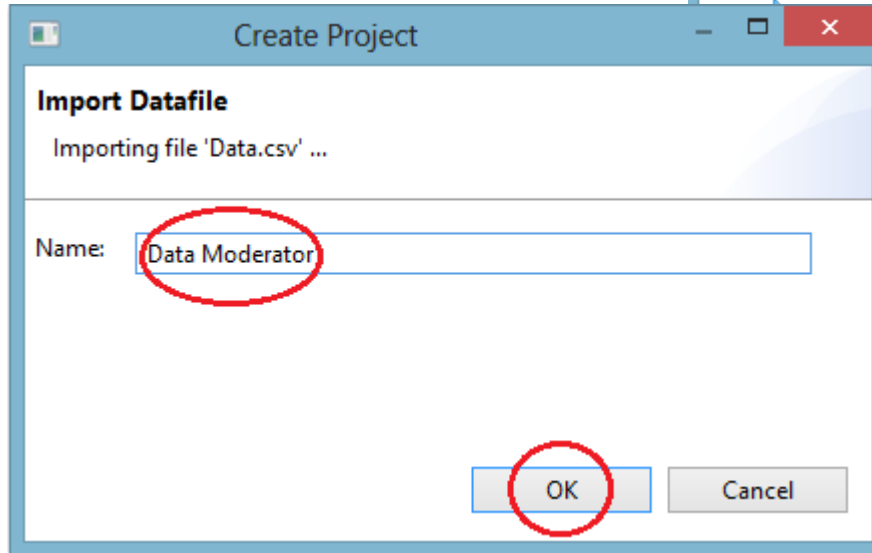
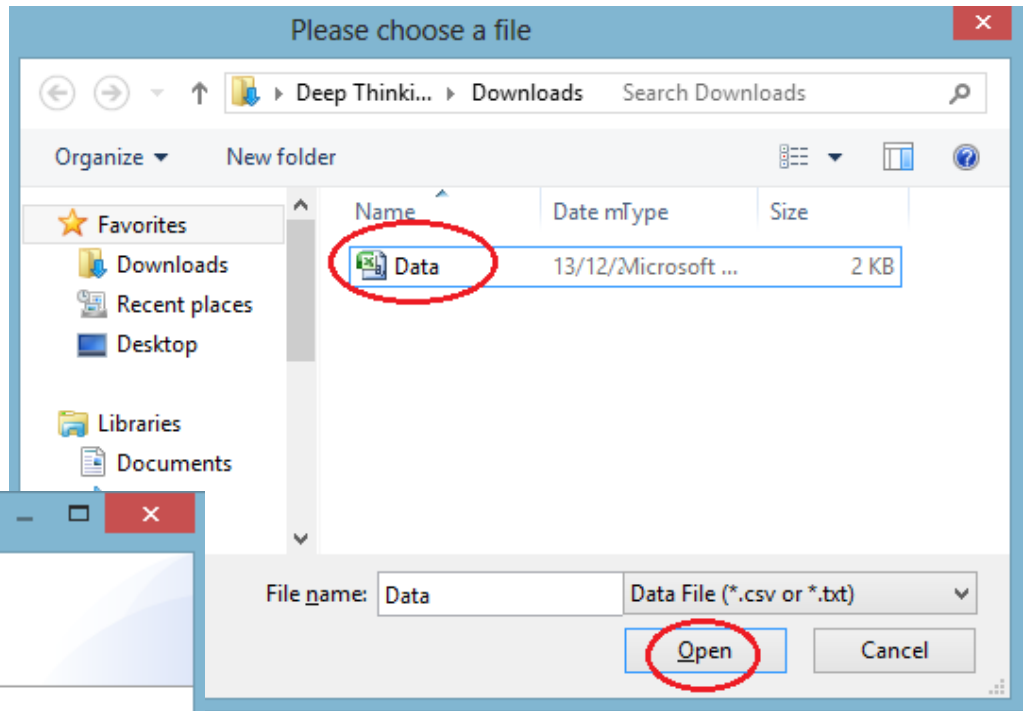


# Import Data File

- ❑ Klik “kanan” di Moderator
- ❑ Import Data File



- ❑ Klik “Data”
- ❑ Open
- ❑ Ketikkan “Data Moderator” di “Name”
- ❑ OK

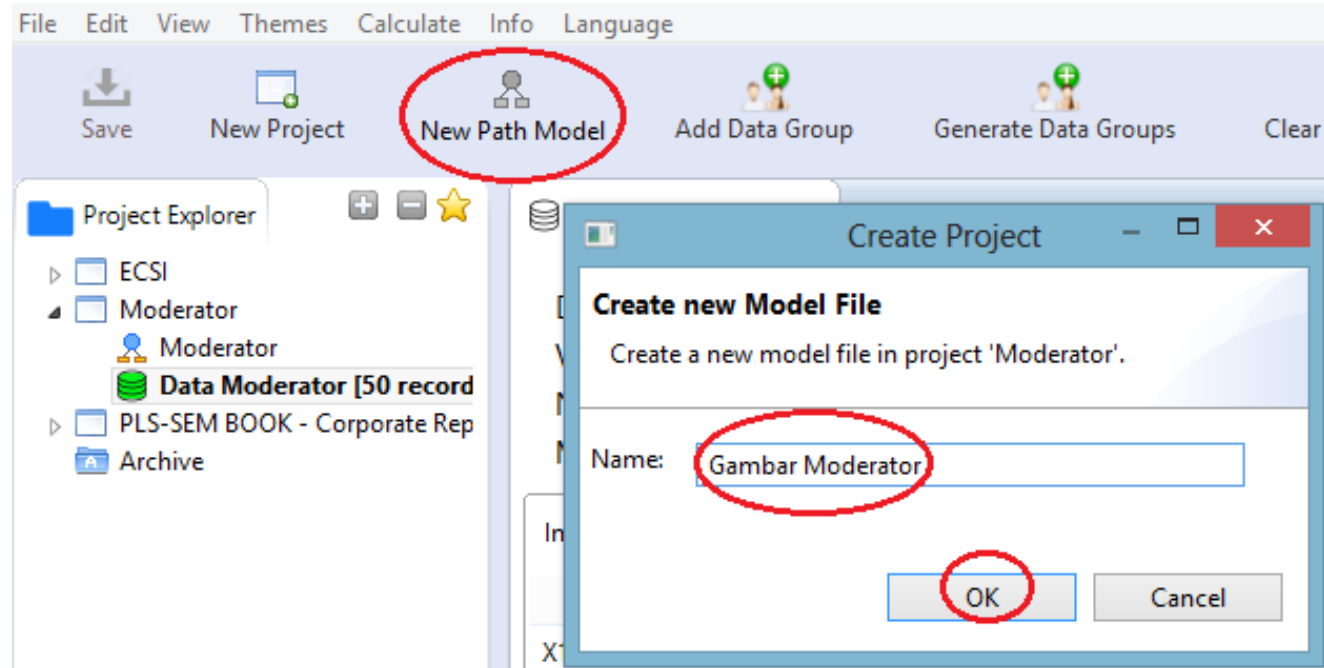


# Data akan ditampilkan

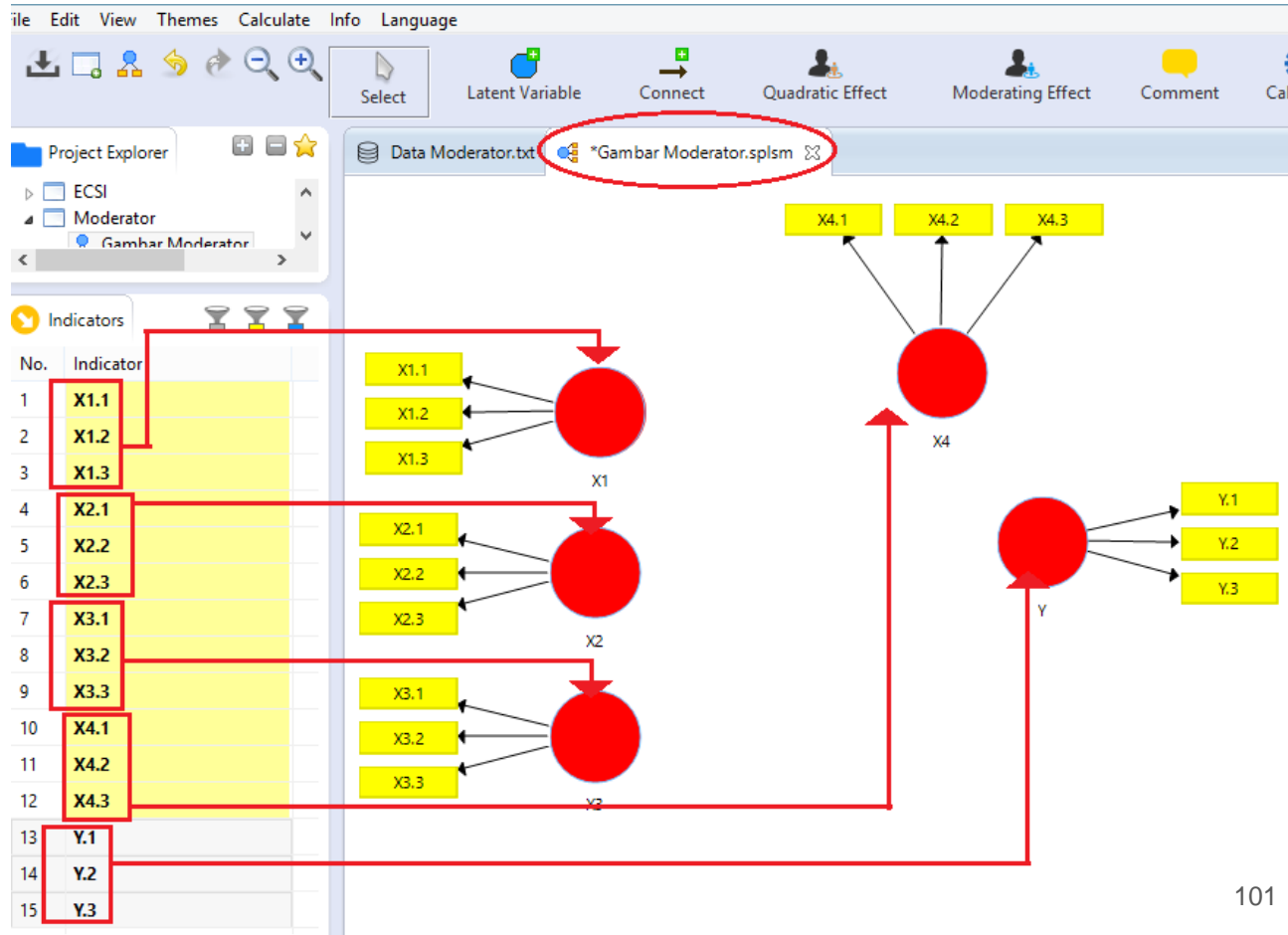
The screenshot shows the SmartPLS software interface. The menu bar includes File, Edit, View, Themes, Calculate, Info, and Language. The toolbar contains icons for Save, New Project, New Path Model, Add Data Group, Generate Data Groups, and Clear Data Groups. The Project Explorer on the left shows a tree structure with folders for ECSI, Moderator, PLS-SEM BOOK - Corporate Rep, and Archive. The main workspace displays the 'Data Moderator.txt' file, which is circled in red. The file settings are: Delimiter: Semicolon, Encoding: UTF-8, Value Quote Character: None, Sample size: 50, Number Format: US (e.g. 1,000.23), Indicators: 15, and Missing Value Marker: None. Below the settings is a table with columns for Indicators, Indicator Correlations, and Raw File. The table contains data for indicators X1.1 through X3.2, with columns for No., Missing, Mean, Median, Min, Max, and Standard Devia... The table is also circled in red.

Indicators:	Indicator Correlations	Raw File	No.	Missing	Mean	Median	Min	Max	Standard Devia...
X1.1			1	0	3.520	4.000	2.000	5.000	0.854
X1.2			2	0	3.540	4.000	2.000	4.000	0.727
X1.3			3	0	3.480	4.000	2.000	5.000	0.830
X2.1			4	0	3.860	4.000	2.000	5.000	1.096
X2.2			5	0	3.700	4.000	2.000	5.000	1.100
X2.3			6	0	3.860	4.000	2.000	5.000	1.166
X3.1			7	0	3.400	4.000	2.000	5.000	1.000
X3.2			8	0	3.560	4.000	2.000	5.000	0.920
v2.3			9	0	3.400	4.000	2.000	5.000	0.877

- ❑ Klik “New Path Project”
- ❑ Ketikkan “Gambar Moderator” pada Name
- ❑ OK



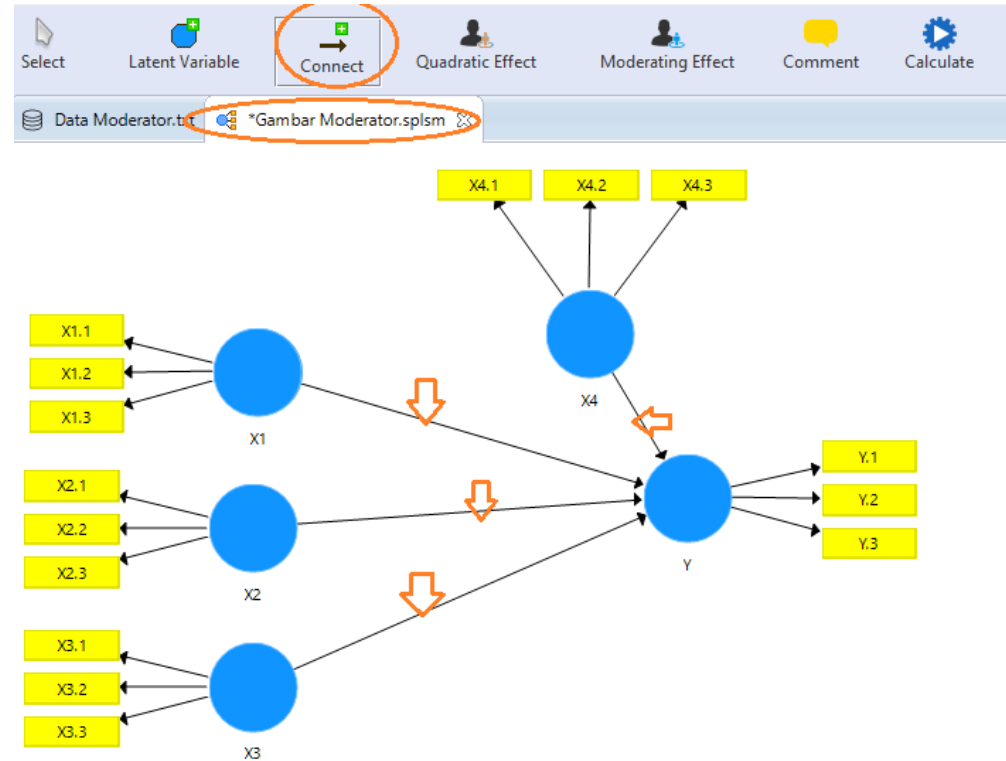
- Untuk masing-masing variabel, pindahkan seluruh indikator ke kanan (ikuti bentuk seperti contoh)
- Ganti nama untuk masing-masing variabel (rename), menjadi X1, X2, X3, X4, Y
- Atur posisi indikator (seperti contoh di gambar)



# Connect

Klik “Connect” untuk menghubungkan variabel-variabel:

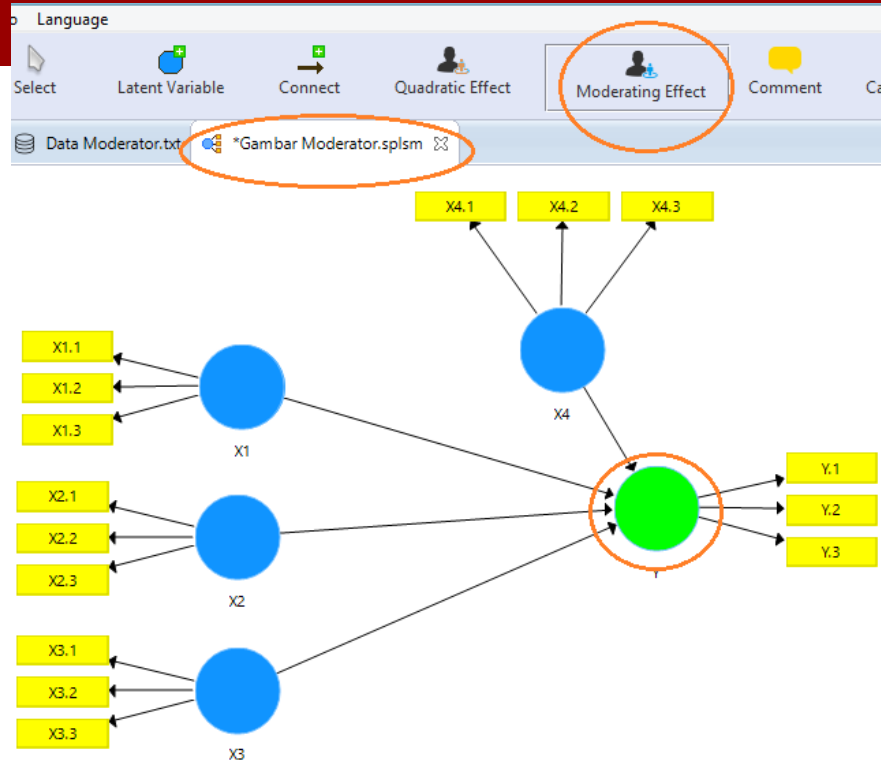
- ❑ X1 ke Y
- ❑ X2 ke Y
- ❑ X3 ke Y
- ❑ X4 ke Y





# Moderating Effect

- ❑ Klik “Moderating Effect”
- ❑ Klik pada variabel Y (warna hijau)



Sesuaikan seperti berikut ini:

- ❑ Dependent variabel: Y
- ❑ Moderator variable: X4
- ❑ Independent variable: X1
- ❑ Calculation Method: Pilih Product Indicator
- ❑ OK

**Moderating Effect**

**Basic Settings**

Dependent Variable: Y

Moderator Variable: X4

Independent Variable: X1

Calculation Method:  Product Indicator  
 Two Stage  
 Orthogonalization

**Advanced Settings**

Product Term Generation:  Unstandardized  
 Mean Centered  
 Standardized

Weighing Mode:  Automatic  
 Mode A  
 Mode B  
 Sumscores  
 Pre Defined

**Basic Settings**

**Dependent Variable**  
The selected dependent variable is:

**Predictor Variable**  
Field to define the predictor variable:

**Moderator Variable**  
Field to define the moderator variable:

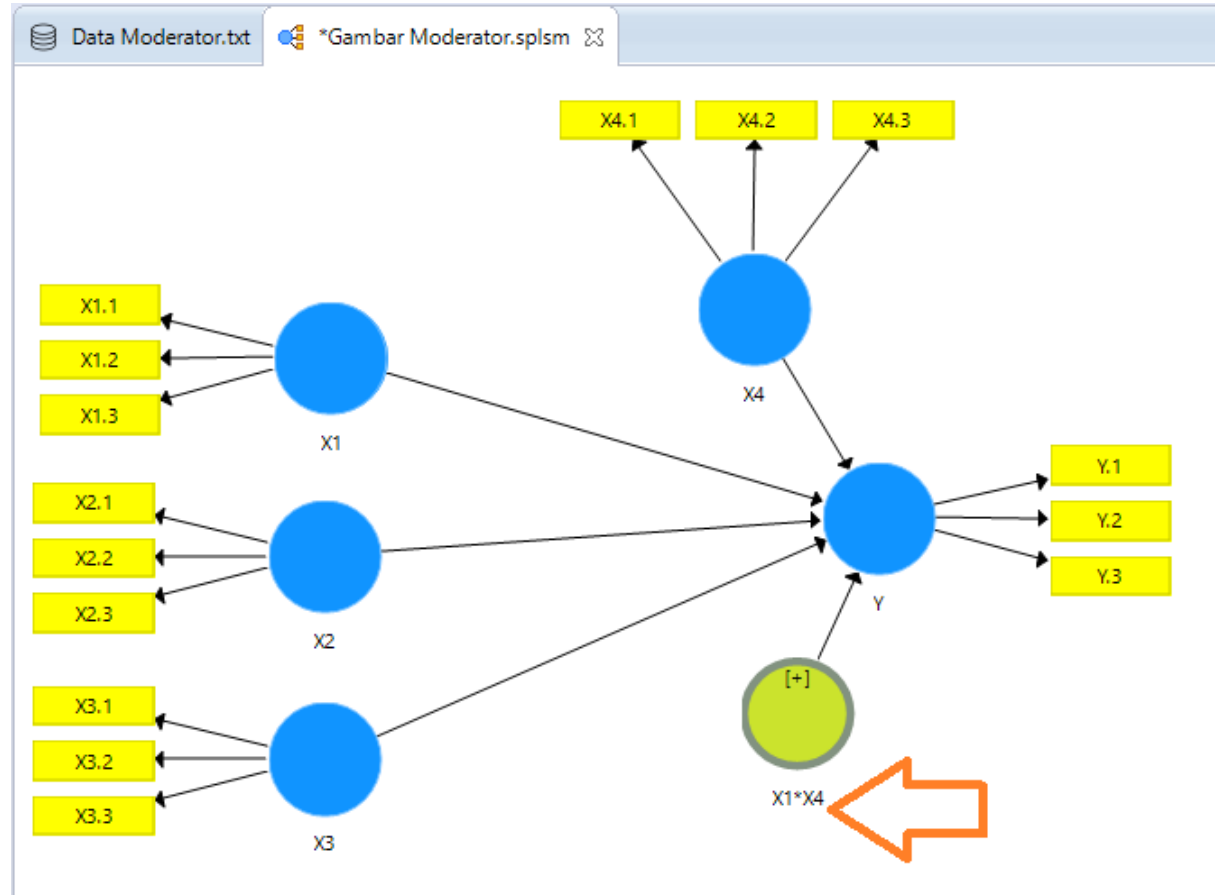
**Calculation Method**  
Selects the method of interaction options:  
(1) Product Indicator  
This approach uses all predictor and the latent indicators ("product indicator")  
(2) Two-stage (default)  
This approach uses the moderator variable from the predictor variable:

OK Cancel

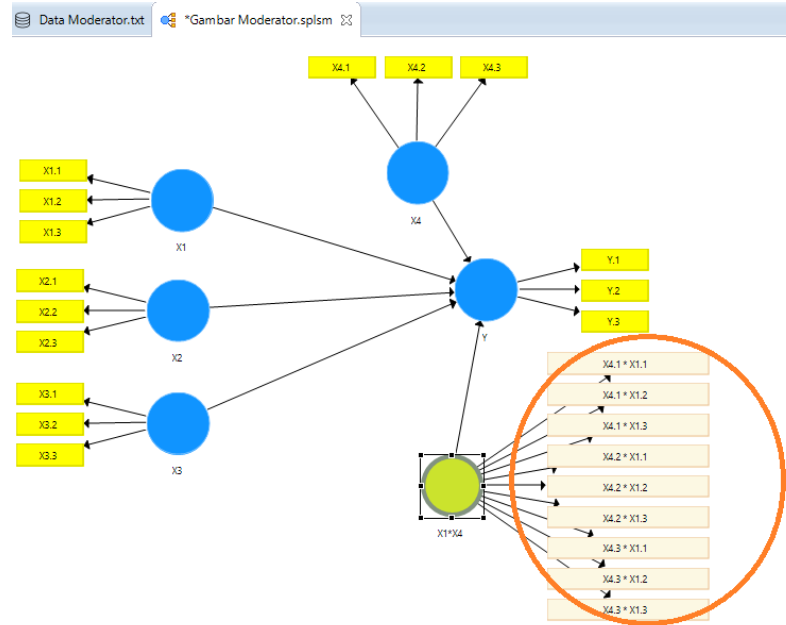
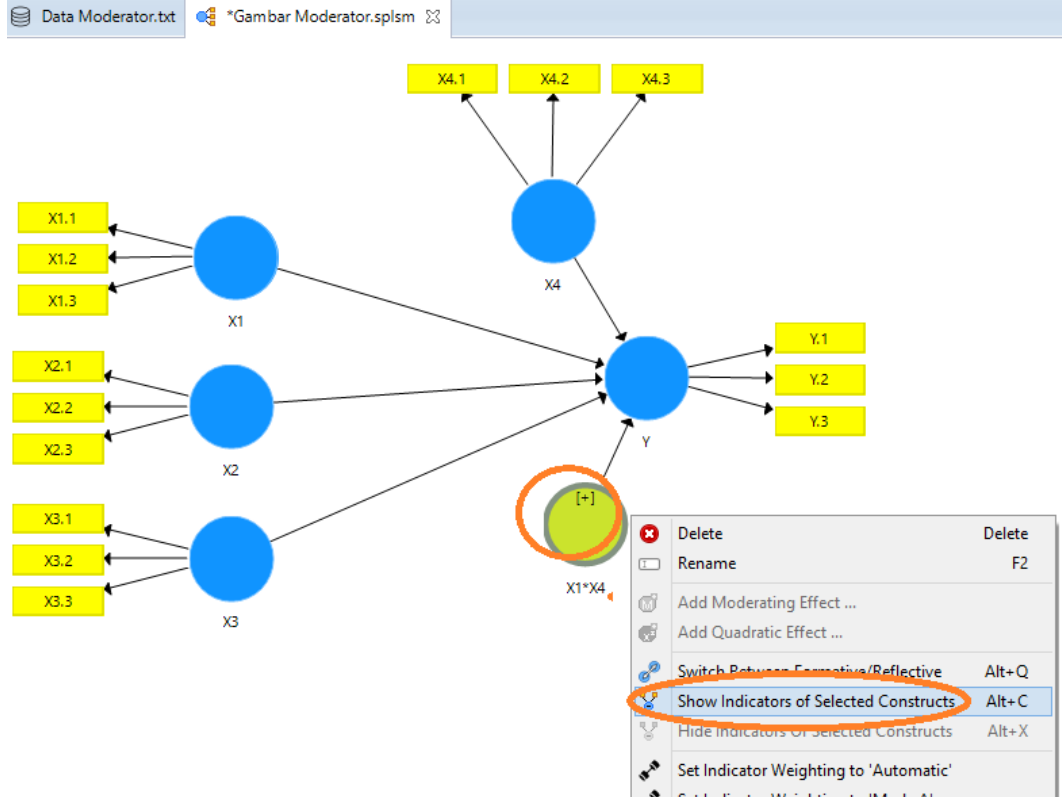
- ❑ Variabel baru akan ditampilkan (Moderating Effect)
- ❑ Klik kanan pada variabel baru (warna hijau), Rename, Ganti menjadi X1\*X4
- ❑ OK

The screenshot displays the SmartPLS software interface. At the top, the file explorer shows 'Data Moderator.txt' and '\*Gambar Moderator.splsm'. The main area contains a path model with latent variables X1, X2, X3, X4, and Y. X1, X2, and X3 are measured by indicators X1.1-X1.3, X2.1-X2.3, and X3.1-X3.3 respectively. X4 is measured by indicators X4.1, X4.2, and X4.3. Y is measured by indicators Y.1, Y.2, and Y.3. A moderating effect is shown as a green circle with a '+' sign, labeled 'Moderating Effect 1', with an arrow pointing to the path between X1 and X4. A right-click context menu is open over this moderating effect, with the 'Rename' option highlighted. A 'Rename variable' dialog box is open, showing the current name 'Moderating Effect 1' and the new name 'X1\*X4' entered in both the 'Name displayed in model' and 'Name displayed in reports' fields. The 'OK' button is also highlighted.

Nama variabel telah berubah menjadi  $X1*X4$

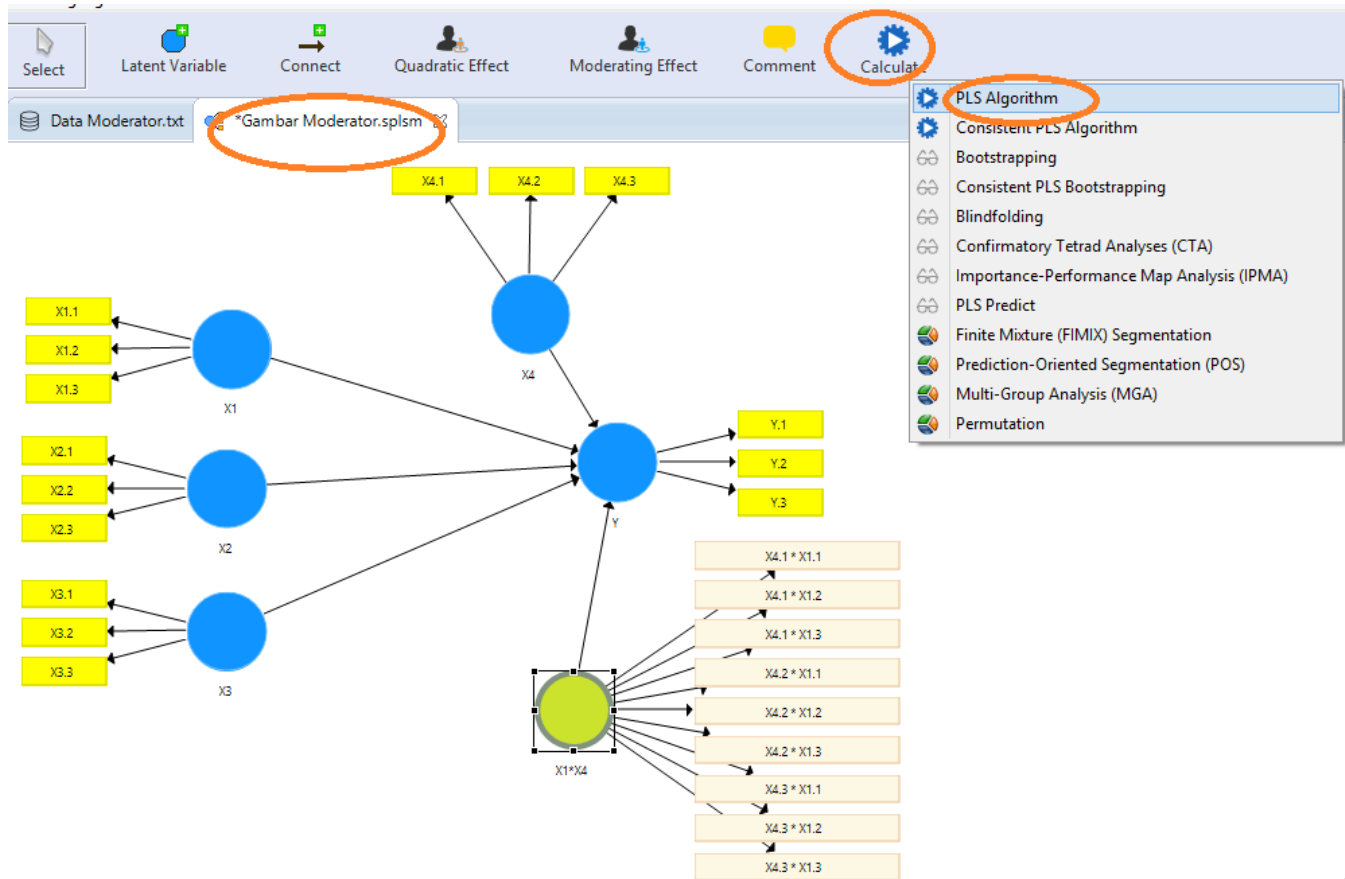


- ❑ Klik “kanan” pada variabel interaksi ( $X1 \cdot X4$ ) yang berwarna hijau
- ❑ Klik “Show indicators of selected construct”
- ❑ Indikator akan ditampilkan



# Calculate-PLS Algorithm (X1 terhadap Y yang Dimoderasi X4)

- Calculate
- PLS Algorithm



# Klik Start Calculation

## Partial Least Squares Algorithm

The PLS path modeling method was developed by Wold (1982). In essence, the PLS algorithm is a sequence of regressions in terms of weight vectors. The weight vectors obtained at convergence satisfy fixed point equations (see Dijkstra, 2010, for a general analysis of these equations).

[Read more!](#)

Setup **Weighting**

---

**Basic Settings**

Weighting Scheme  Centroid  Factor  Path

Maximum Iterations:

Stop Criterion ( $10^{-X}$ ):

---

**Advanced Settings**

Initial Weights  Use Lohmoeller Settings  
or configure [individual initial weights](#)

---

**Basic Settings**

**Weighting Scheme**

PLS-SEM allows the user to apply three structural model weighting schemes:

- (1) centroid weighting scheme,
- (2) factor weighting scheme, and
- (3) path weighting scheme (default).




While the results differ little for the alternative weighting schemes, path weighting is the recommended approach. This weighting scheme provides the highest  $R^2$  value for endogenous latent variables and is generally applicable for all kinds of PLS path model specifications and estimations. Moreover, when the path model includes higher-order constructs (often called second-order models), researchers should usually not use the centroid weighting scheme.





**Maximum Iterations**

This parameter represents the maximum number of iterations that will be used for calculating the PLS results. This number should be sufficiently large (e.g., 300 iterations). When checking the PLS-SEM result, one must make sure that the algorithm did not stop because the maximum number of iterations was reached but due to the stop criterion. Note: The selection of 0 for the maximum number of iterations allows you to obtain results of the sum scores approach.


After Calculation:

# Hasil PLS Algorithm akan diperlihatkan

←0,0  
0,00 Increase Decimals    0,00  
0,00 Decrease Decimals     Export to Excel     Export to Web     Export to R

 Moderator.splsm     \*Gambar Moderator.splsm     **PLS Algorithm (Run No. 1)** 

## Path Coefficients

Matrix  Path Coefficients Copy to Clipbo

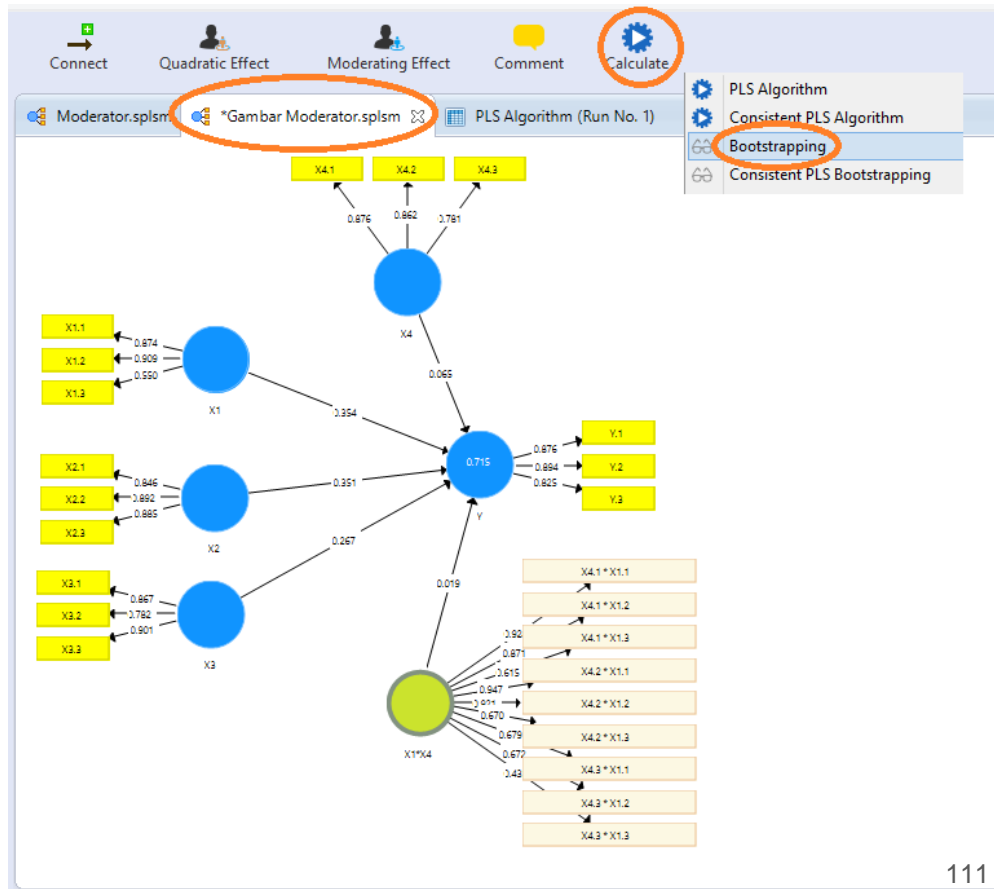
	X1	X1*X4	X2	X3	X4	Y
X1						0.354
X1*X4						0.019
X2						0.351
X3						0.267
X4						0.065
Y						

Final Results	Quality Criteria	Interim Results	Base Data
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>	<a href="#">Stop Criterion Changes</a>	<a href="#">Setting</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>		<a href="#">Inner Model</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>		<a href="#">Outer Model</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>		<a href="#">Indicator Data (Original)</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>		<a href="#">Indicator Data (Standardized)</a>
<a href="#">Latent Variable</a>	<a href="#">Model Fit</a>		<a href="#">Indicator Data (Correlations)</a>
<a href="#">Residuals</a>			



# Calculate-Bootstrapping (X1 terhadap Y yang Dimoderasi X4)

- ❑ Pada tab “Gambar Moderator”
- ❑ Klik Calculate
- ❑ Bootstrapping



- ❑ Ketikkan 5000 pada “Subsamples”
- ❑ Klik “Complete Bootstrapping”
- ❑ Start Calculation

**Bootstrapping**  
Bootstrapping is a nonparametric procedure that allows testing the statistical significance of various PLS-SEM results such path coefficients, Cronbac HTMT, and R<sup>2</sup> values.

Setup Partial Least Squares Weighting

**Basic Settings**

Subsamples

Do Parallel Processing

Sign Changes  No Sign Changes  
 Construct Level Changes  
 Individual Changes

Amount of Results  Basic Bootstrapping  
 Complete Bootstrapping

**Advanced Settings**

Confidence Interval Method  Percentile Bootstrap  
 Studentized Bootstrap  
 Bias-Corrected and Accelerated (BCa) Bootstrap  
 Davision Hinkley's Double Bootstrap  
 Shi's Double Bootstrap

Test Type  One Tailed  Two Tailed

**Basic Settings**

**Subsamples**

In bootstrapping, subsamples are created with observ. from the original set of data. To ensure stability of rest large. For an initial assessment, one may use a small 500). For the final results preparation, however, one sl subsamples (e.g., 5,000).

**Note:** Larger numbers of bootstrap subsamples incre

**Do Parallel Processing**

This option runs the bootstrapping routine on multiple more than one core). Using parallel computing will red

**Sign Changes**

Sets the method for dealing with sign changes during are available:

(1) No Sign Changes (default)

Sign changes in the resamples will be ignored and This is the most conservative estimation option an running the bootstrapping routine.

After Calculation:

Hasil Bootstrapping akan diperlihatkan

## Kesimpulan:

Nilai interaksi  $X1 * X4$  terhadap Y adalah tidak signifikan ( $0,868 > 0,05$ ).

Dengan demikian, variabel X4 tidak memoderasi pengaruh X1 terhadap Y

SmartPLS software interface showing the results of a bootstrapping analysis. The 'Path Coefficients' table is displayed, with the p-value for the interaction term  $X1 * X4 \rightarrow Y$  highlighted in orange. The 'Final Results' section is also visible, with 'Path Coefficients' circled in orange.

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> Y	0.354	0.361	0.169	2.097	0.036
<b>X1*X4 -&gt; Y</b>	0.019	-0.003	0.114	0.167	<b>0.868</b>
X2 -> Y	0.351	0.346	0.162	2.175	0.030
X3 -> Y	0.267	0.278	0.140	1.908	0.056
X4 -> Y	0.065	0.041	0.133	0.490	0.624

**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](#)
- [Average Variance Extracted \(AVE\)](#)
- [Composite Reliability](#)
- [rho A](#)
- [Cronbach's Alpha](#)
- [Heterotrait-Monotrait Ratio \(HTMT\)](#)
- [SRMR](#)
- [d ULS](#)
- [d G1](#)
- [d G2](#)

**Histograms**

- [Path Coefficients Histogram](#)
- [Indirect Effects Histogram](#)
- [Total Effects Histogram](#)

**Base Data**

- [Setting](#)
- [Inner Model](#)
- [Outer Model](#)
- [Indicator Data \(Original\)](#)
- [Indicator Data \(Standardized\)](#)

# Lakukan Calculate untuk hubungan X2→ Y yang Dimoderasi X4

Lakukan cara yang sama seperti di atas, untuk menganalisis hubungan-hubungan X2→ Y yang dimoderasi X4

- ❑ Klik “kanan” pada variabel interaksi (X1\*X4)
- ❑ Rename
- ❑ Ganti menjadi X2\*X4
- ❑ OK

The screenshot displays the SmartPLS interface with a path diagram. The diagram shows latent variables X1, X2, X3, X4, and Y. X1, X2, and X3 are measured by indicators X1.1-X1.3, X2.1-X2.3, and X3.1-X3.3 respectively. X4 is measured by indicators X4.1, X4.2, and X4.3. Y is measured by indicators Y.1, Y.2, and Y.3. Path coefficients are shown: X1 to X4 (0.490), X2 to X4 (1.097), X3 to X4 (1.908), and X4 to Y (0.167). A context menu is open over the X1\*X4 interaction variable, with the 'Rename' option selected. A 'Rename variable' dialog box is open, showing the variable name 'X2\*X4' in both the 'Name displayed in model' and 'Name displayed in reports' fields. The 'OK' button is also highlighted.

Moderator.splsm \*Gambar Moderator.splsm Bootstrapping (Run No. 3)

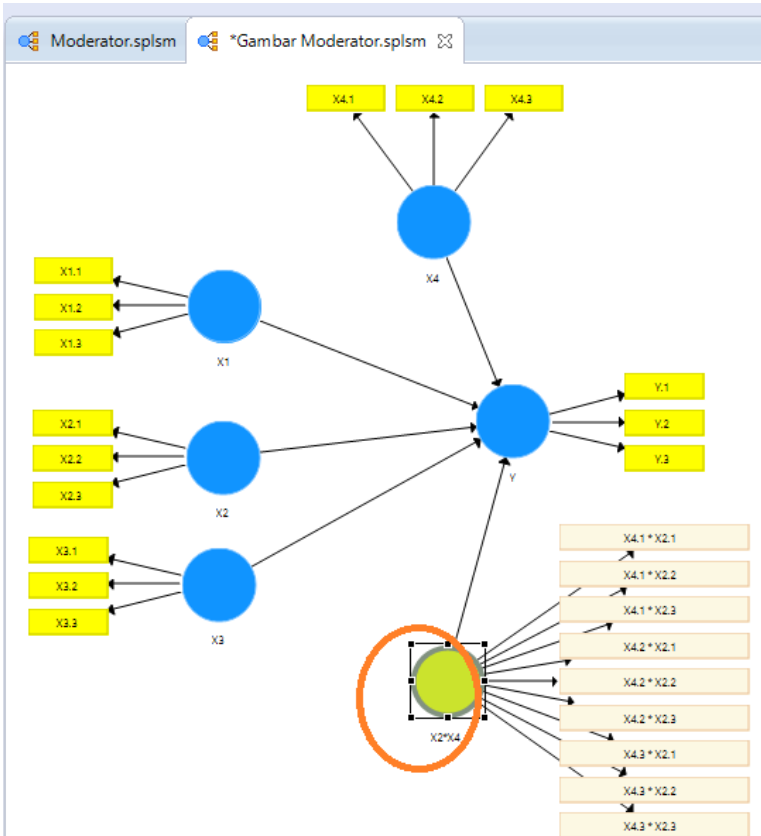
**Rename variable**  
Rename variable 'X1\*X4'.  
Name displayed in model (multiple lines possible):  
X2\*X4  
Name displayed in reports:  
X2\*X4  
OK Cancel

Path	Coefficient
X1 → X4	0.490
X2 → X4	1.097
X3 → X4	1.908
X4 → Y	0.167

Indicator	Value
X1.1	18.353
X1.2	39.990
X1.3	3.112
X2.1	16.619
X2.2	28.079
X2.3	21.361
X3.1	17.962
X3.2	9.557
X3.3	35.396
X4.1	24.443
X4.2	25.520
X4.3	10.075
Y.1	30.185
Y.2	18.962
Y.3	13.200

Interaction	Value
X4.1 * X1.1	7.24
X4.1 * X1.2	5.187
X4.1 * X1.3	1.484
X4.2 * X1.1	1.484

Klik 2 kali pada variabel interaksi ( $X2 * X4$ ), pada independent variable pilih X2, Calculation Method, pilih “Production Indicator”, dan OK



**Moderating Effect**

**Basic Settings**

- Dependent Variable: Y
- Moderator Variable: X4
- Independent Variable: X2
- Calculation Method:
  - Product Indicator
  - Two-stage
  - Orthogonalization

**Advanced Settings**

- Product Term Generation:
  - Unstandardized
  - Mean Centered
  - Standardized
- Weighing Mode:
  - Automatic
  - Mode A
  - Mode B
  - Sumscores
  - Pre Defined

**Basic Settings**

**Dependent Variable**

The selected dependent variable for which a moderating effect will be estimated.

**Predictor Variable**

Field to define the predictor variable for which a moderating effect will be estimated.

**Moderator Variable**

Field to define the moderator variable for which a moderating effect will be estimated.

**Calculation Method**

Selects the method of interaction term construct in PLS path modeling. There are three options:

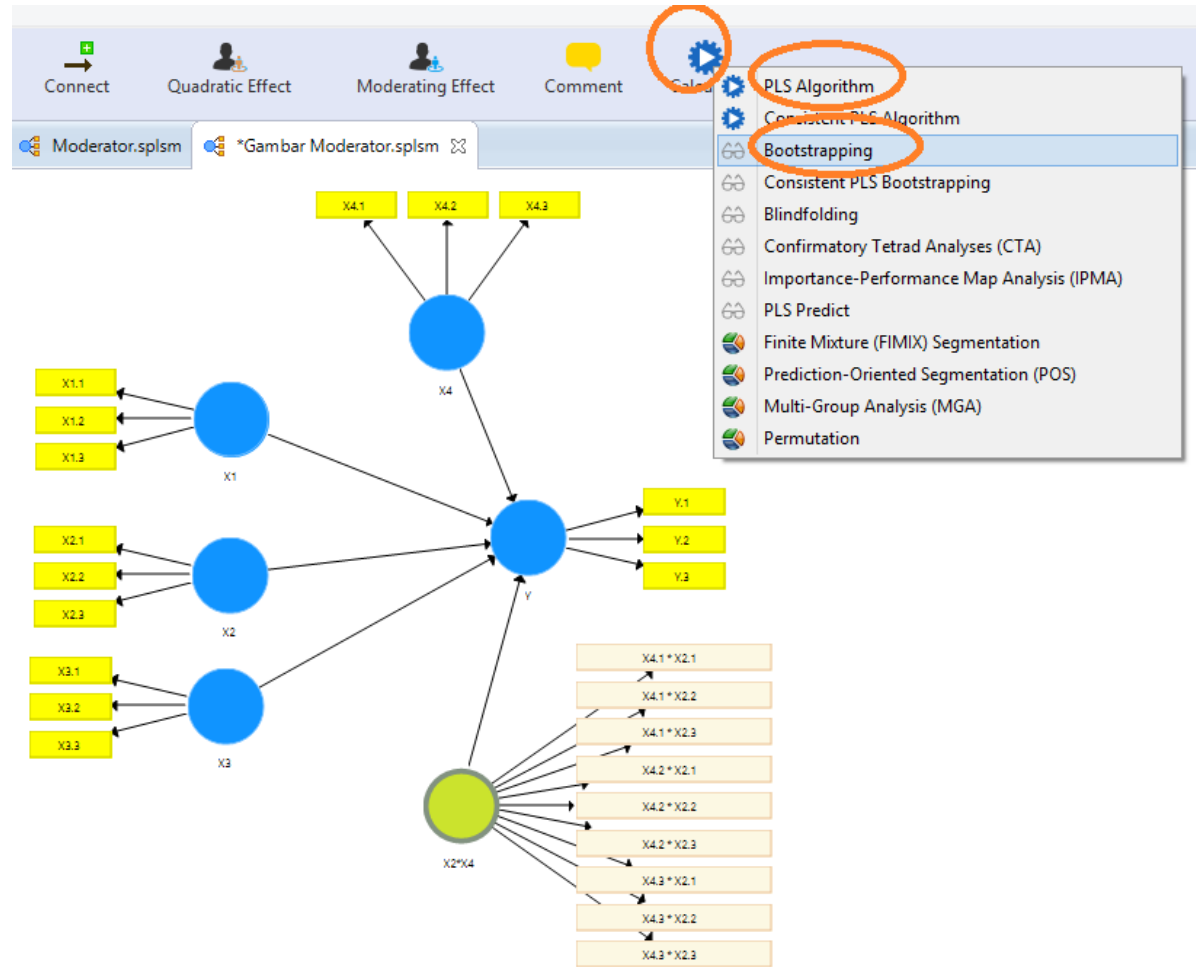
- Product Indicator**  
This approach uses all possible pair combinations of the indicators of the latent predictor and the latent moderator variable. These product terms serve as indicators ("product indicators") of the interaction term in the structural model.
- Two-stage (default)**  
This approach uses the latent variable scores of the latent predictor and latent moderator variable from the main effects model (without the interaction term). These latent variable scores are saved and used to calculate the product indicator for the second stage analysis that involves the interaction term in addition to the predictor and moderator variable.
- Orthogonalization**  
This approach uses residuals that are calculated by regressing all possible pairwise product terms of the indicators of the latent predictor and the latent moderator variable (i.e., product indicators) on all indicators of the latent predictor and the latent moderator variable. These residuals serve as indicators of the interaction term in the structural model.

**OK** **Cancel**

Lalu lakukanlah kalkulasi (Calculation):

- ☐ PLS Algorithm
- ☐ Bootstrapping

Lakukan satu persatu/bertahap



Hasil akan diperlihatkan

## PLS Algorithm

Moderator.splsm \*Gambar Moderator.splsm PLS Algorithm (Run No. 2)

### Path Coefficients

Matrix Path Coefficients Copy to Clipboard:

	X1	X2	X2*X4	X3	X4	Y
X1						0.289
X2						0.287
X2*X4						-0.167
X3						0.278
X4						0.043
Y						

**Final Results**  
[Path Coefficients](#)  
[Indirect Effects](#)  
[Total Effects](#)  
[Outer Loadings](#)  
[Outer Weights](#)  
[Latent Variable](#)  
[Residuals](#)  
[Simple Slope Analysis](#)

**Quality Criteria**  
[R Square](#)  
[f Square](#)  
[Construct Reliability and Validity](#)  
[Discriminant Validity](#)  
[Collinearity Statistics \(VIF\)](#)  
[Model Fit](#)

**Interim Results**  
[Stop Criterion Changes](#)

**Base Data**  
[Setting](#)  
[Inner Model](#)  
[Outer Model](#)  
[Indicator Data \(Original\)](#)  
[Indicator Data \(Standardized\)](#)  
[Indicator Data \(Correlations\)](#)

# Bootstrapping

Path Coefficients

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> Y	0.289	0.304	0.159	1.818	0.069
X2 -> Y	0.287	0.279	0.139	2.059	0.040
X2*X4 -> Y	-0.167	-0.148	0.131	1.276	0.202
X3 -> Y	0.278	0.293	0.125	2.219	0.027
X4 -> Y	0.043	0.045	0.131	0.316	0.752

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](#)
- [Average Variance Extracted \(AVE\)](#)
- [Composite Reliability](#)
- [rho A](#)
- [Cronbach's Alpha](#)
- [Heterotrait-Monotrait Ratio \(HTMT\)](#)
- [SRMR](#)
- [d ULS](#)
- [d G1](#)
- [d G2](#)

Histograms

- [Path Coefficients Histogram](#)
- [Indirect Effects Histogram](#)
- [Total Effects Histogram](#)

Base Data

- [Setting](#)
- [Inner Model](#)
- [Outer Model](#)
- [Indicator Data \(Original\)](#)
- [Indicator Data \(Standardized\)](#)

Hasil Bootstrapping akan diperlihatkan

## Kesimpulan:

Nilai interaksi X2\*X4 terhadap Y adalah tidak signifikan ( $0,202 > 0,05$ ).

Dengan demikian, variabel X4 tidak memoderasi pengaruh X2 terhadap Y



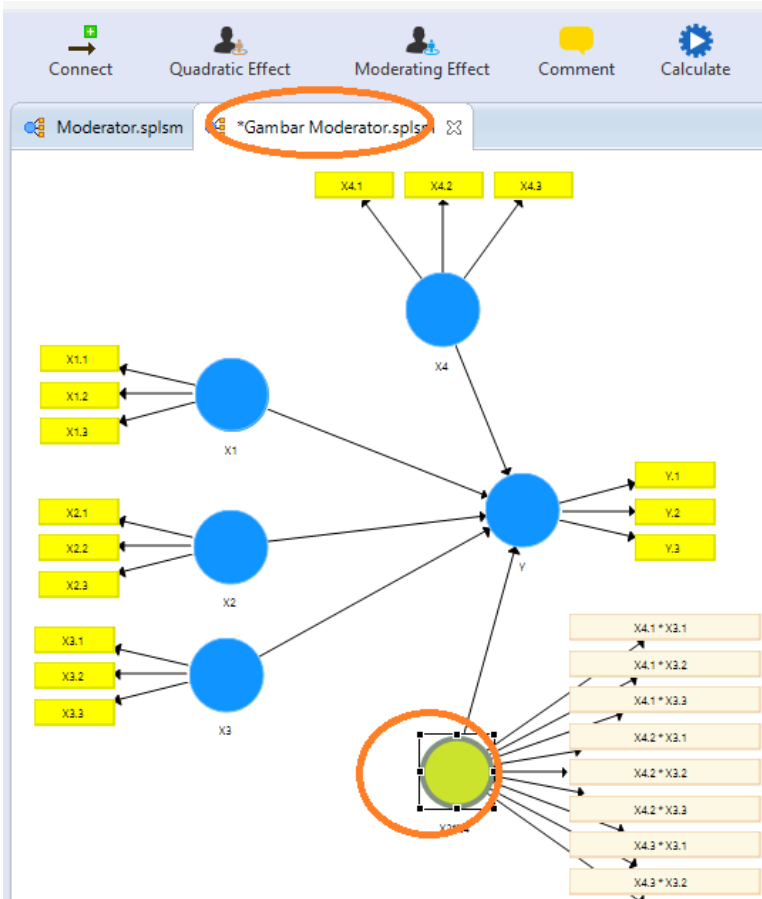
# Lakukan Calculate untuk hubungan $X3 \rightarrow Y$ yang Dimoderasi $X4$

Lakukan cara yang sama seperti di atas, untuk menganalisis hubungan-hubungan  $X3 \rightarrow Y$  yang dimoderasi  $X4$

- ❑ Klik “kanan” pada variabel interaksi ( $X2 * X4$ )
- ❑ Rename
- ❑ Ganti menjadi  $X3 * X4$
- ❑ OK

The screenshot displays the SmartPLS interface with a path diagram. The diagram shows three latent variables (X1, X2, X3) and one (X4) influencing a latent variable Y. X1 is measured by indicators X1.1, X1.2, and X1.3. X2 is measured by X2.1, X2.2, and X2.3. X3 is measured by X3.1, X3.2, and X3.3. X4 is measured by X4.1, X4.2, and X4.3. A path is shown from X3 to Y, moderated by X4. The interaction variable  $X2 * X4$  is highlighted with an orange circle. A context menu is open over it, with the 'Rename' option also circled in orange. To the right, the 'Rename variable' dialog box is open, showing the current name 'X2\*X4' and the new name 'X3\*X4' entered in both the 'Name displayed in model' and 'Name displayed in reports' fields. The 'OK' button in the dialog is also circled in orange.

Klik 2 kali pada variabel interaksi ( $X3 * X4$ ), pada independent variable pilih X3, Calculation Method, pilih “Production Indicator”, dan OK

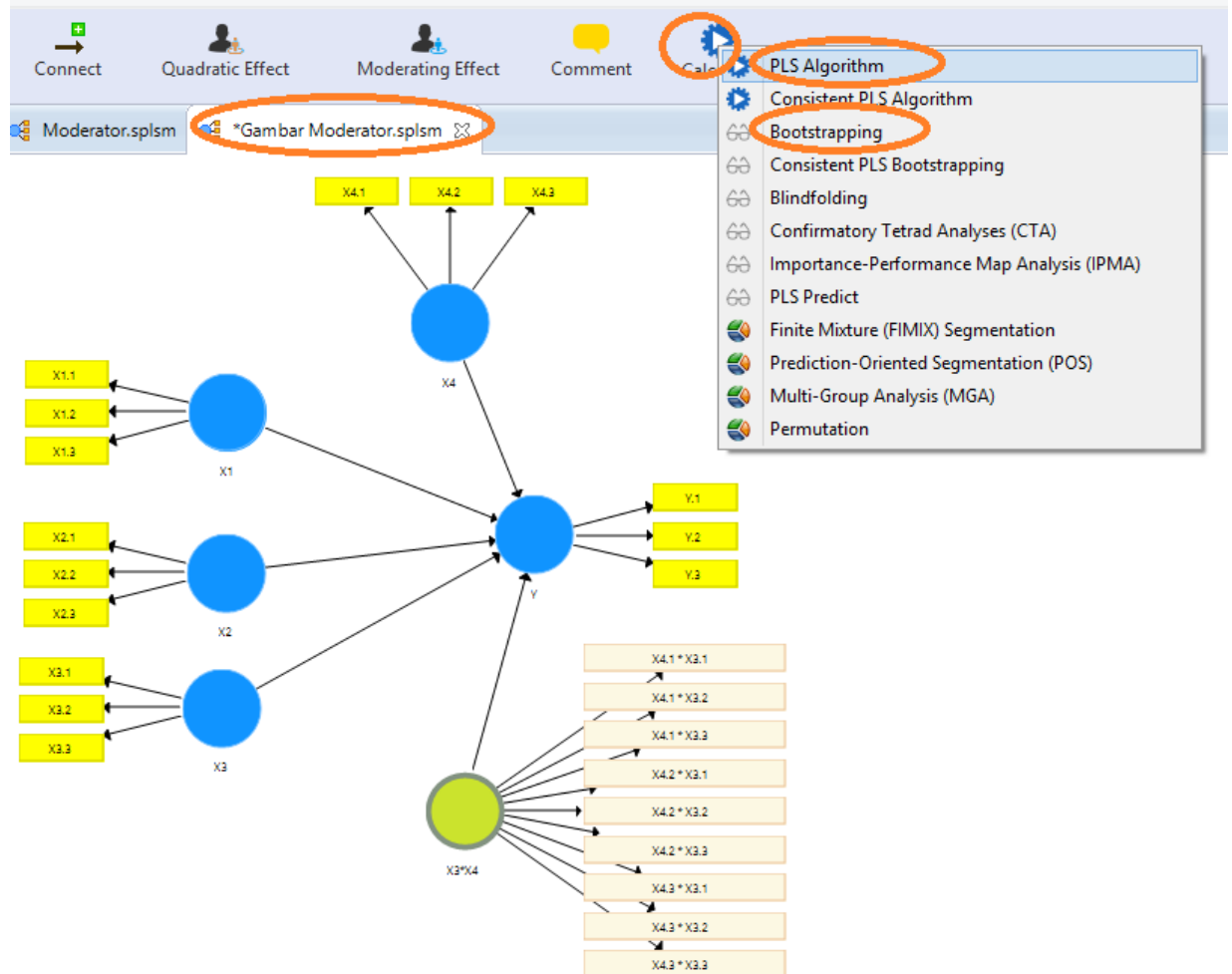


The screenshot shows the "Moderating Effect" dialog box. The "Basic Settings" section includes: Dependent Variable: Y; Moderator Variable: X4; Independent Variable: X3; Calculation Method: Product Indicator (selected). The "Advanced Settings" section includes: Product Term Generation: Standardized; Weighing Mode: Automatic. The "Basic Settings" section also includes: Dependent Variable: The selected dependent will be estimated. Predictor Variable: Field to define the predictor will be estimated. Moderator Variable: Field to define the moderator will be estimated. Calculation Method: Selects the method of centering. There are three options: (1) Product Indicator: This approach uses indicators of the latent predictor and the latent moderator serve as indicators ("product structural model"). (2) Two-stage (default): This approach uses indicator and latent moderator variable interaction term. The "OK" button is highlighted with an orange circle.

Lalu lakukanlah kalkulasi (Calculation):

- ☐ PLS Algorithm
- ☐ Bootstrapping

Lakukan satu persatu/bertahap



Hasil akan diperlihatkan

## PLS Algorithm

SmartPLS software interface showing the results of a PLS Algorithm run. The 'Path Coefficients' table is highlighted with an orange circle. The 'PLS Algorithm (Run No. 3)' tab is also circled in orange.

	X1	X2	X3	X3*X4	X4	Y
X1						0.393
X2						0.355
X3						0.259
X3*X4						0.079
X4						0.067
Y						

**Final Results**

- [Path Coefficients](#)
- [Indirect Effects](#)
- [Total Effects](#)
- [Outer Loadings](#)
- [Outer Weights](#)
- [Latent Variable](#)
- [Residuals](#)
- [Simple Slope Analysis](#)

**Quality Criteria**

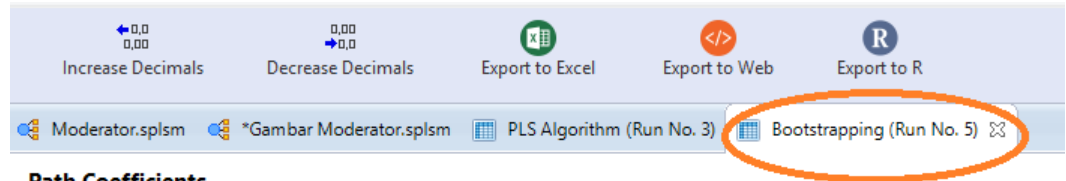
- [R Square](#)
- [f Square](#)
- [Construct Reliability and Validity](#)
- [Discriminant Validity](#)
- [Collinearity Statistics \(VIF\)](#)
- [Model Fit](#)

**Interim Results**

- [Stop Criterion Changes](#)

**Base Data**

- [Setting](#)
- [Inner Model](#)
- [Outer Model](#)
- [Indicator Data \(Original\)](#)
- [Indicator Data \(Standardized\)](#)
- [Indicator Data \(Correlations\)](#)



### Path Coefficients

	Mean, STDEV, T-Values, P-Value...	Confidence Intervals	Confidence Intervals Bias C...	Samples	Copy to Clip
	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> Y	0.393	0.387	0.184	2.133	0.033
X2 -> Y	0.355	0.350	0.163	2.174	0.030
X3 -> Y	0.259	0.276	0.141	1.843	0.065
X3*X4 -> Y	0.079	0.048	0.141	0.560	0.575
X4 -> Y	0.067	0.048	0.142	0.470	0.639

### 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](#)
- [Average Variance Extracted \(AVE\)](#)
- [Composite Reliability](#)
- [rho\\_A](#)
- [Cronbach's Alpha](#)
- [Heterotrait-Monotrait Ratio \(HTMT\)](#)
- [SRMR](#)
- [d\\_ULS](#)
- [d\\_G1](#)
- [d\\_G2](#)

### Histograms

- [Path Coefficients Histogram](#)
- [Indirect Effects Histogram](#)
- [Total Effects Histogram](#)

### Base Data

- [Setting](#)
- [Inner Model](#)
- [Outer Model](#)
- [Indicator Data \(Original\)](#)
- [Indicator Data \(Standardized\)](#)

Hasil Bootstrapping akan diperlihatkan

## Kesimpulan:

Nilai interaksi X3\*X4 terhadap Y adalah tidak signifikan ( $0,575 > 0,05$ ).

Dengan demikian, variabel X4 tidak memoderasi pengaruh X3 terhadap Y

Setelah melakukan kalkulasi PLS Algorithm dan Bootstrapping, maka dapat dilakukan analisis, khususnya:

1. Analisis Model Pengukuran/Measurement Model Analysis(Outer Model)  
Menganalisis hubungan konstruk (variabel laten) dan indikator
  - 1.1. Construct Reliability and Validity
  - 1.2. Discriminant Validity
2. Analisis Model Struktural/Structural Model Analysis (Inner Model)  
Menganalisis hubungan antar konstruk (antar variabel laten) yakni eksogen dan endogen serta hubungan diantaranya
  - 2.1. R-Square
  - 2.2. F-Square
  - 2.3. Pengujian hipotesis (hanya direct effect)
    - $X1 \rightarrow Y$  yang dimoderasi  $X4$
    - $X2 \rightarrow Y$  yang dimoderasi  $X4$
    - $X3 \rightarrow Y$  yang dimoderasi  $X4$

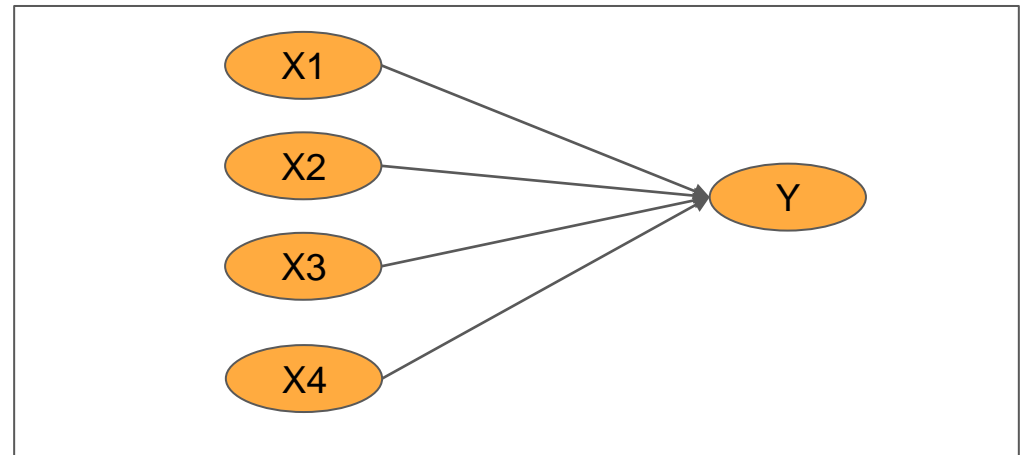
# Analisis Regresi Biasa

(Ber-Variabel Eksogen/Bebas dan Endogen/Terikat)

Azuar Juliandi

# SEM Bervariabel Eksogen dan Endogen Saja

- ❑ Variabel eksogen adalah variabel yang mempengaruhi (identik dengan variabel terikat dalam regresi biasa), sedangkan variabel endogen adalah variabel yang dipengaruhi (identik dengan variabel terikat dalam regresi biasa)
- ❑ Jika suatu model penelitian hanya menggunakan variabel eksogen dan endogen saja, maka analisis juga dapat menggunakan SmartPLS
- ❑ Contoh: Variabel eksogen/bebas ada 4 (X1, X2, X3, X4), variabel endogen/terikat ada 1 (Y), maka analisisnya adalah masing-masing:
  - ❑  $X1 \rightarrow Y$
  - ❑  $X2 \rightarrow Y$
  - ❑  $X3 \rightarrow Y$
  - ❑  $X4 \rightarrow Y$





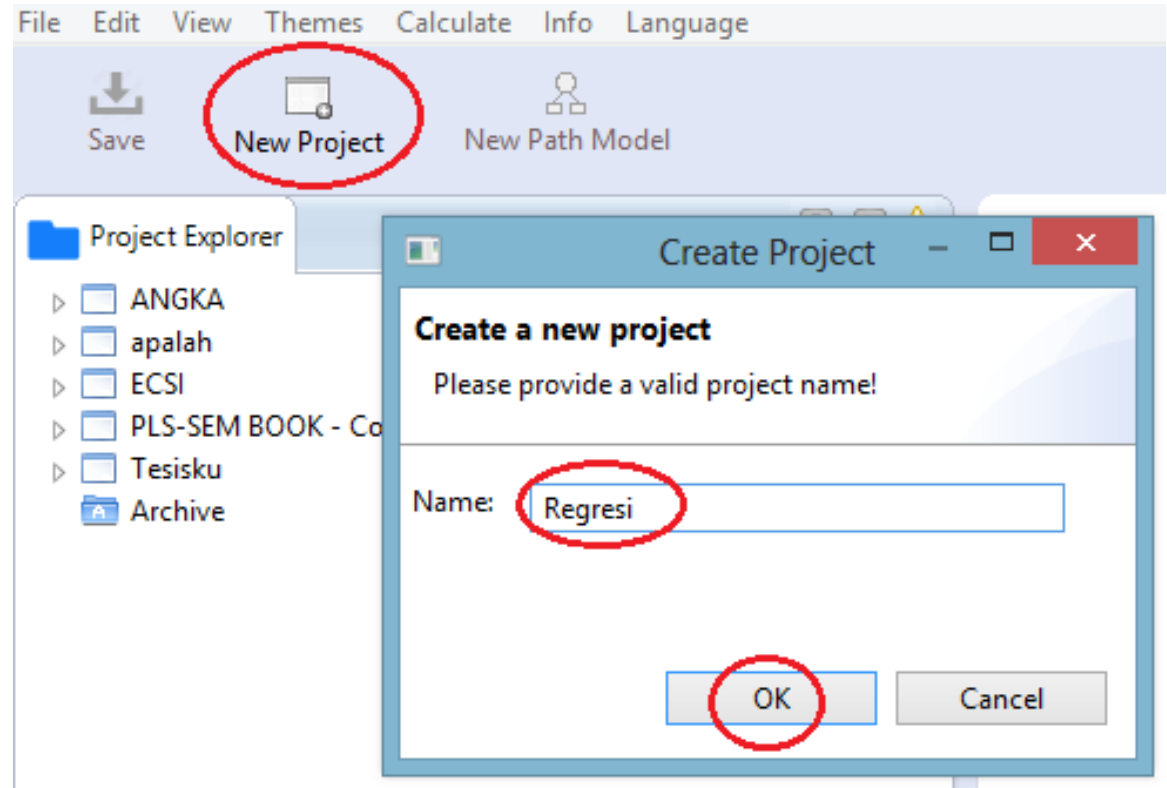
# Data

- ❑ [Download Contoh Data](#) (Data dikemas dalam di Excel dengan save as type: CSV-MS DOS)
- ❑ Sampel: 50
- ❑ Variabel terdiri dari 5:
  - ❑ Variabel eksogen/bebas (X1, X2, X3, X4), indikatornya:
    - ❑ X1.1; X1.2; X1.3
    - ❑ X2.1; X2.2; X2.3
    - ❑ X3.1; X3.2; X3.3
    - ❑ X4.1; X4.2; X4.3
  - ❑ Variabel endogen/Terikat (Y), indikatornya:
    - ❑ Y.1; Y.2; Y.3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	X1.1	X1.2	X1.3	X2.1	X2.2	X2.3	X3.1	X3.2	X3.3	X4.1	X4.2	X4.3	Y.1	Y.2	Y.3
2	2	3	3	2	2	2	2	2	3	2	2	2	3	3	3
3	4	4	4	5	4	5	4	5	5	4	5	4	5	4	4
4	3	3	3	5	5	4	2	2	2	3	4	3	3	3	4
5	4	3	4	5	4	5	5	4	5	4	4	4	3	5	4
6	3	4	3	5	4	5	4	4	4	3	3	3	4	4	5
7	3	4	3	4	4	5	5	3	3	3	4	3	3	3	5
8	4	4	4	4	5	5	4	5	4	4	4	3	5	4	4
9	4	4	3	4	4	4	4	3	4	4	4	5	4	5	5
10	5	4	4	4	2	4	4	4	4	3	4	4	5	3	5
11	3	3	3	3	2	3	3	5	3	4	3	2	3	3	2
12	2	3	2	2	2	2	2	3	2	3	2	2	2	2	2
13	4	4	4	4	4	5	4	4	4	3	4	4	4	4	5
14	3	4	5	3	4	5	2	4	4	3	2	3	3	3	5
15	4	4	4	5	5	4	4	4	4	4	4	4	4	4	4
16	2	3	4	2	2	2	2	3	2	2	3	2	2	2	2
17	4	4	2	5	2	2	5	5	4	4	4	3	4	5	5
18	4	2	2	4	2	2	3	3	4	4	3	4	3	3	3

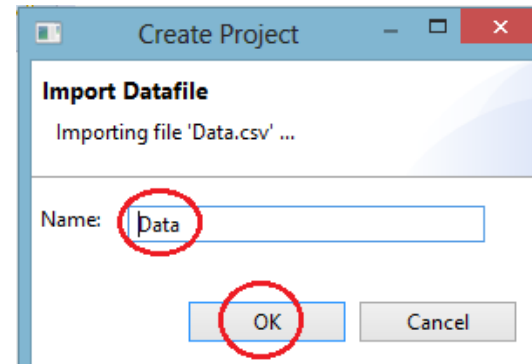
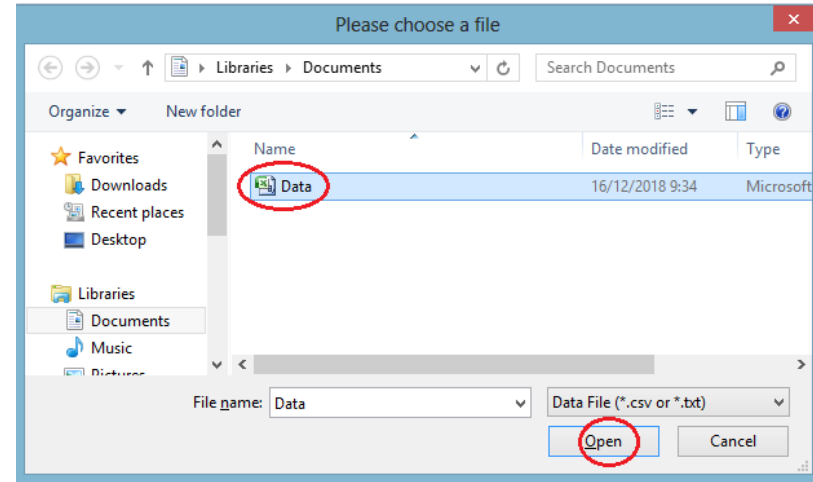
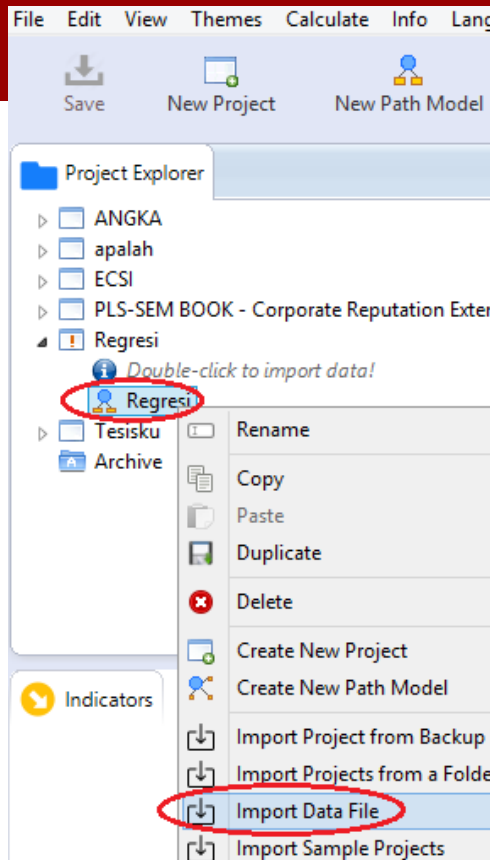
# New Project

- New project
- Name: Ketikkan nama project, misalnya “Regresi”
- OK



# Import Data File

- Klik “kanan” pada nama project yang telah dibuat, misalnya “Regresi”
- Import Data File
- Klik file data
- Open
- Ketikkan nama, misalnya “Data”
- OK



- Hasil akan ditampilkan

Data.txt

Delimiter: Semicolon Encoding: UTF-8 Re-Analyze Open External

Value Quote Character: None Sample size: 50

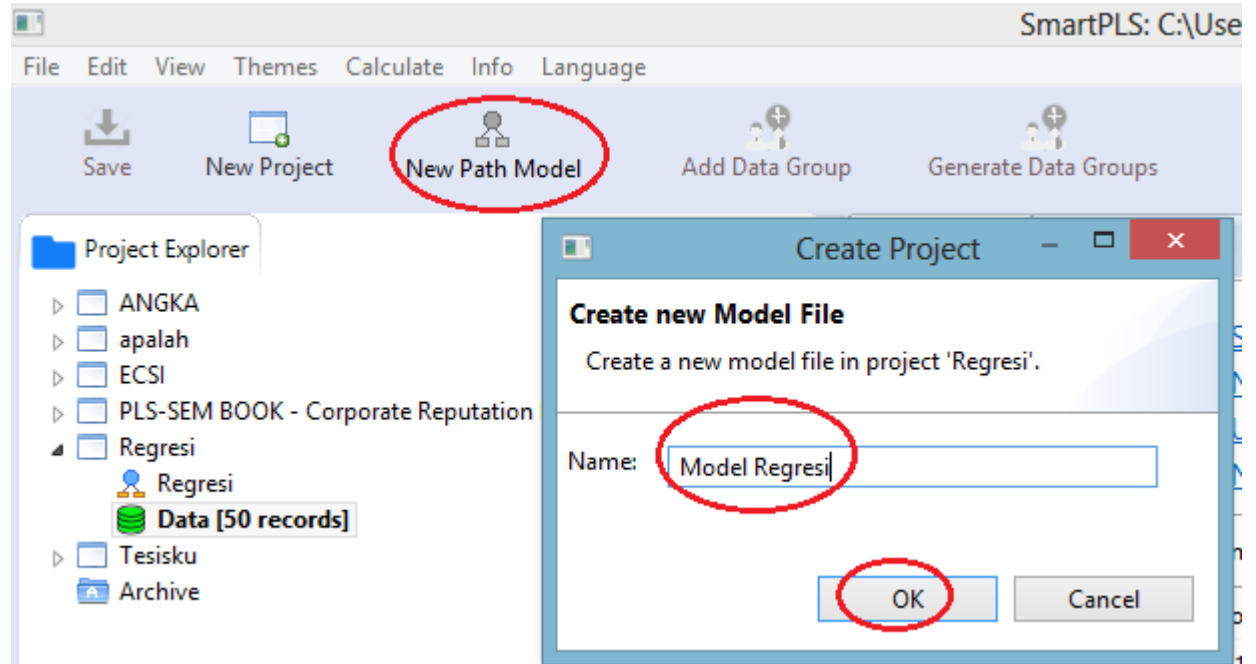
Number Format: US (e.g. 1,000.23) Indicators: 15

Missing Value Marker: None Missing Values: 0

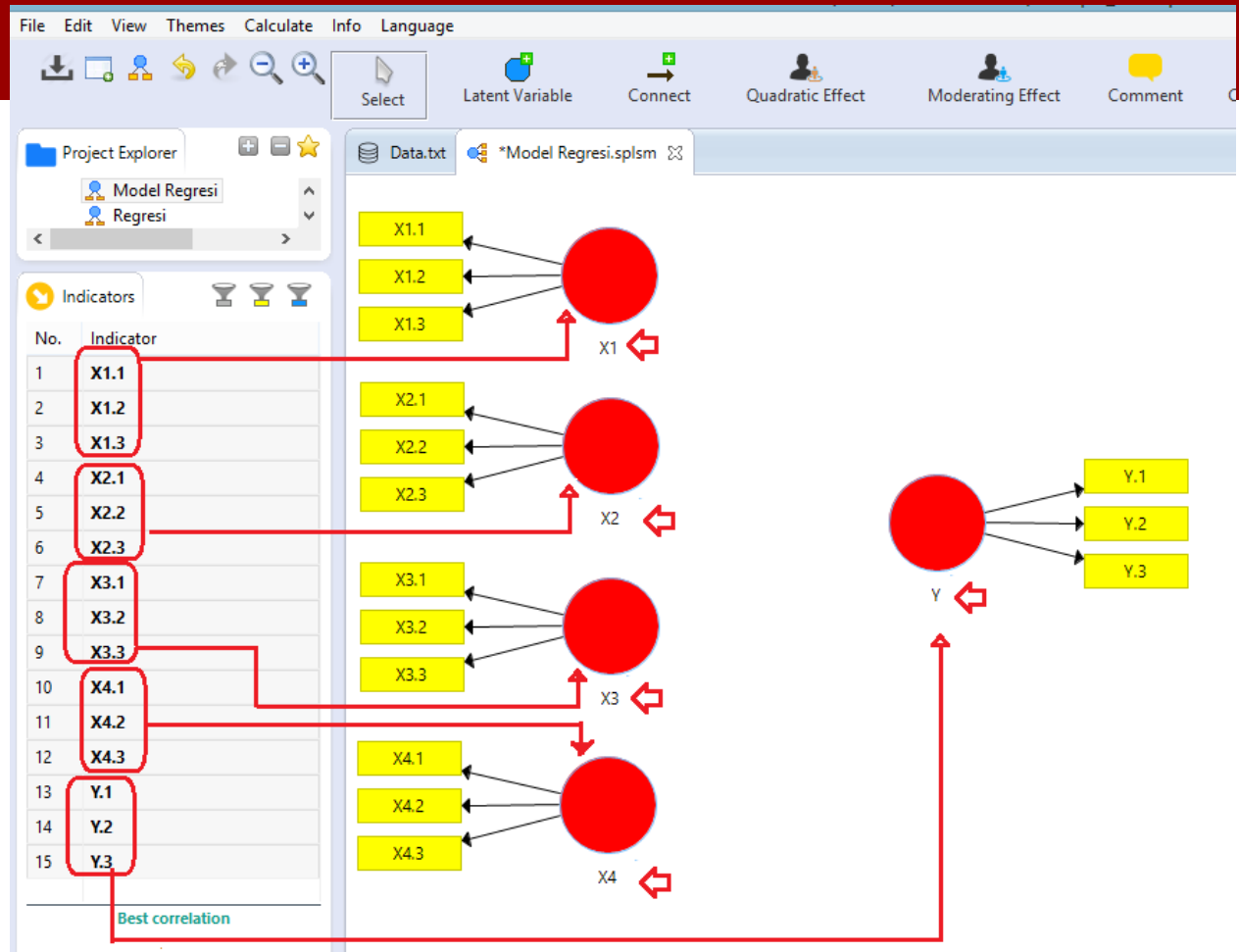
Indicators:	Indicator Correlations	Raw File								Copy to Clipboard
	No.	Missing	Mean	Median	Min	Max	Standard Devia...	Excess Kurtosis		
X1.1	1	0	3.520	4.000	2.000	5.000	0.854	-0.523		
X1.2	2	0	3.540	4.000	2.000	4.000	0.727	0.113		
X1.3	3	0	3.480	4.000	2.000	5.000	0.830	-0.516		
X2.1	4	0	3.860	4.000	2.000	5.000	1.096	-0.877		
X2.2	5	0	3.700	4.000	2.000	5.000	1.100	-1.097		
X2.3	6	0	3.860	4.000	2.000	5.000	1.166	-1.180		
X3.1	7	0	3.400	4.000	2.000	5.000	1.000	-1.149		
X3.2	8	0	3.560	4.000	2.000	5.000	0.920	-0.687		
X3.3	9	0	3.480	4.000	2.000	5.000	0.877	-0.705		
X4.1	10	0	3.540	4.000	2.000	5.000	0.830	-0.396		
X4.2	11	0	3.600	4.000	2.000	5.000	0.775	0.071		

# New Path Model

- New Path Model
- Pada “Name” ketikkan nama model gambar, misalnya “Model Regresi”
- OK



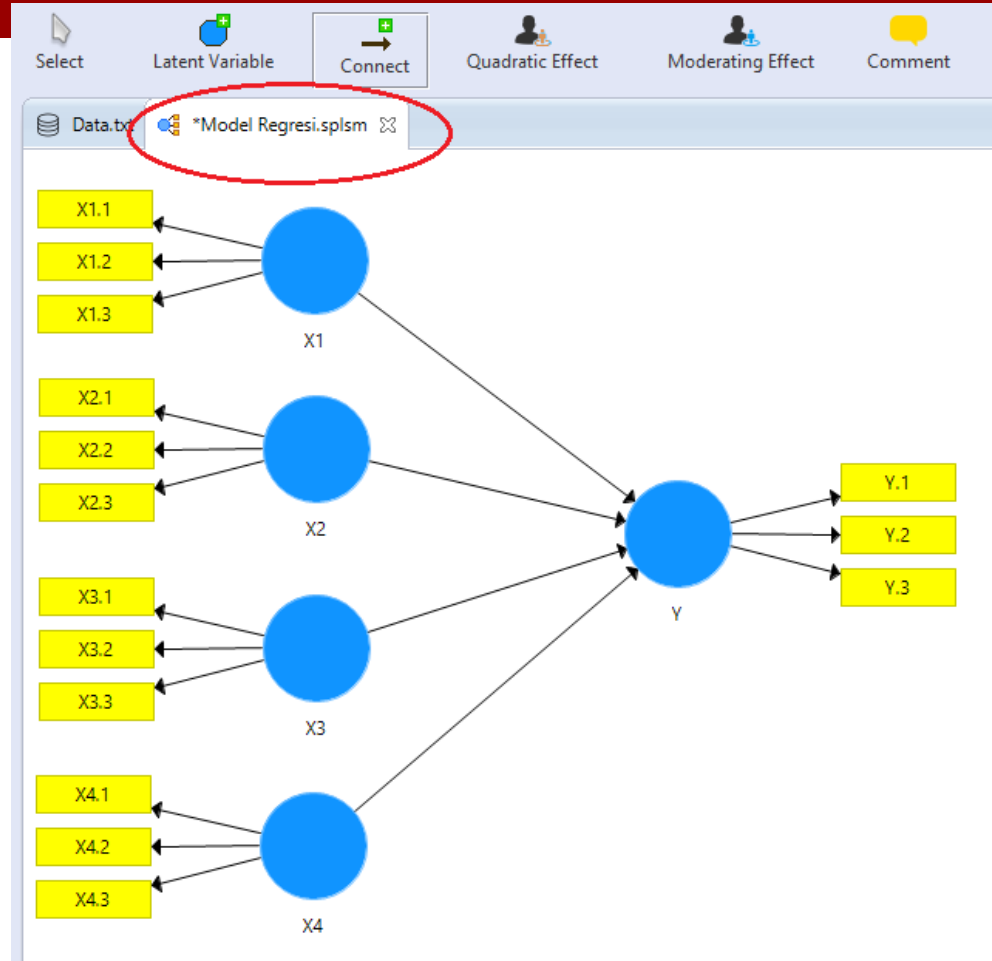
- Pindahkan seluruh indikator ke ruang kanan halaman
- Rubah nama variabel menjadi X1, X2, X3 X4 dan Y
- Atur posisi indikator jika dibutuhkan



# Connect

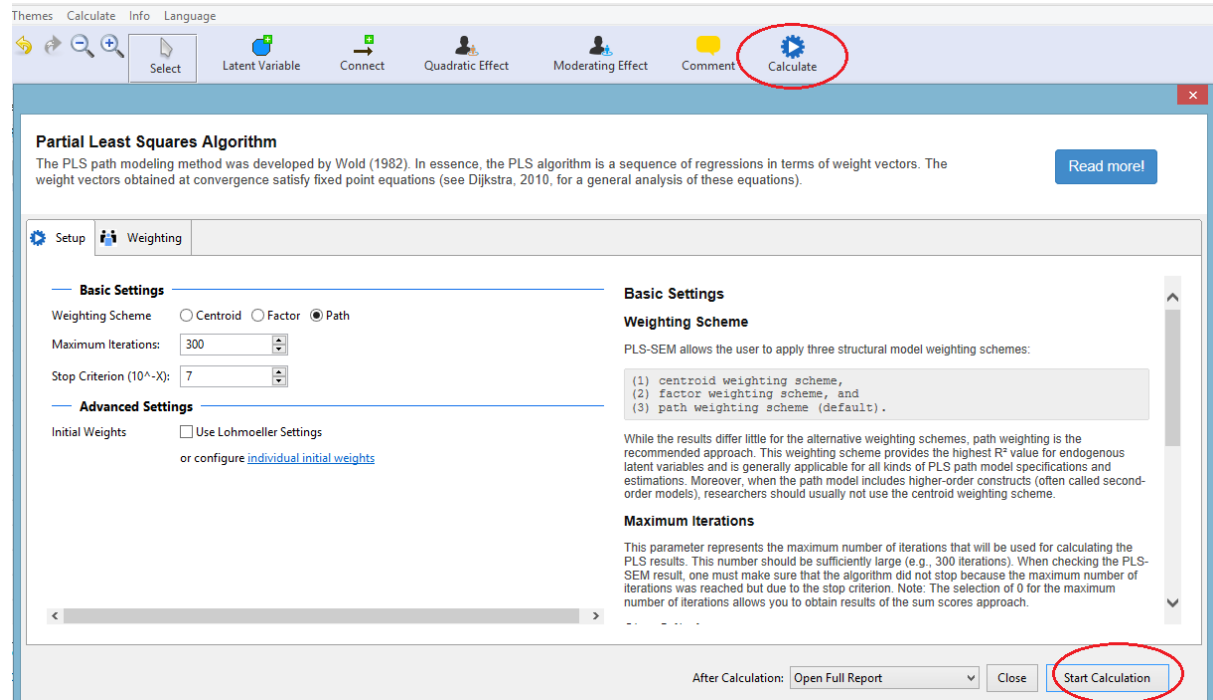
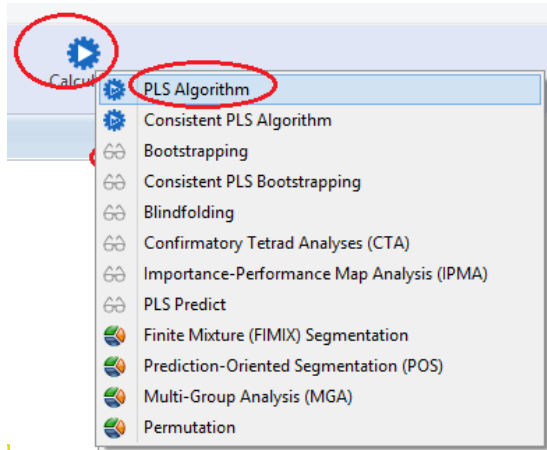
- Koneksikan jalur:

- X1 ke Y
- X2 ke Y
- X3 ke Y
- X4 ke Y



# Kalkulasi PLS Algorithm

- Calculate >> PLS Algorithm >> Start Calculation





- Hasil kalkulasi PLS Algorithm akan diperlihatkan

SmartPLS: C:\Users\Buluh Perindu\smartpls\_workspace

File Edit View Themes Calculate Info Language

Save New Project New Path Model Hide Zero Values Increase Decimals Decrease Decimals Export to Excel Export to Web Export to R

Project Explorer

- Model Regresi
- Regresi

Indicators Calculation Re...

PLS Algorithm (Run No. 1) R

Report Excel HTML

Data Group Complete

Inner model Path Coefficients

Outer model Outer Weights / Lo

Constructs R Square

Highlight Paths off

[Show defaults](#)

### Path Coefficients

Matrix	X1	X2	X3	X4	Y
X1					0.348
X2					0.347
X3					0.264
X4					0.061
Y					

### Final Results

Final Results	Quality Criteria	Interim Results	Base Data
<a href="#">Path Coefficients</a>	<a href="#">R Square</a>	<a href="#">Stop Criterion Changes</a>	<a href="#">Setting</a>
<a href="#">Indirect Effects</a>	<a href="#">f Square</a>		<a href="#">Inner Model</a>
<a href="#">Total Effects</a>	<a href="#">Construct Reliability and Validity</a>		<a href="#">Outer Model</a>
<a href="#">Outer Loadings</a>	<a href="#">Discriminant Validity</a>		<a href="#">Indicator Data (Original)</a>
<a href="#">Outer Weights</a>	<a href="#">Collinearity Statistics (VIF)</a>		<a href="#">Indicator Data (Standardized)</a>
<a href="#">Latent Variable Residuals</a>	<a href="#">Model Fit</a>		<a href="#">Indicator Data (Correlations)</a>

# Kalkulasi Bootstrap

- Calculate >> Bootstrap >> Ketikkan 5000 pada Subsample >> Complete Bootstrap >> Start Calculation

The screenshot displays the SmartPLS software interface. The 'Calculate' menu is open, and 'Bootstrapping' is selected. The 'Bootstrapping' dialog box is shown, with the following settings:

- Subsamples:** 5000
- Do Parallel Processing:**
- Sign Changes:**  No Sign Changes,  Construct Level Changes,  Individual Changes
- Amount of Results:**  Basic Bootstrapping,  Complete Bootstrapping
- Confidence Interval Method:**  Percentile Bootstrap,  Studentized Bootstrap,  Bias-Corrected and Accelerated (BCa) Bootstrap,  Davision Hinkley's Double Bootstrap,  Shi's Double Bootstrap
- Test Type:**  One Tailed,  Two Tailed

The 'Start Calculation' button is highlighted. The background shows the 'PLS Algorithm (Run No. 1)' window with the 'Bootstrapping' option selected in the 'Calculate' menu.

- Hasil akan diperlihatkan

Language

th Model    0.110    0.00    0.00    0.00    Export to Excel    Export to Web    Export to R

0.00    0.00

Data.txt    \*Model Regresi.splsm    PLS Algorithm (Run No. 1)    **Bootstrapping (Run No. 1)**

### Path Coefficients

Mean, STDEV, T-Values, P-Values    Confidence Intervals    Confidence Intervals Bias Corrected    Samples    Copy to Clipboard

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
X1 -> Y	0.348	0.352	0.155	2.246	0.025
X2 -> Y	0.347	0.347	0.150	2.319	0.020
X3 -> Y	0.264	0.280	0.137	1.922	0.055
X4 -> Y	0.061	0.052	0.136	0.451	0.652

### Final Results

- [Path Coefficients](#)
- [Total Indirect Effects](#)
- [Specific Indirect Effects](#)
- [Total Effects](#)
- [Outer Loadings](#)
- [Outer Weights](#)

### Quality Criteria

- [R Square](#)
- [R Square Adjusted](#)
- [Q Square](#)
- [Average Variance Extracted \(AVE\)](#)
- [Composite Reliability](#)
- [rho\\_A](#)
- [Cronbach's Alpha](#)
- [Heterotrait-Monotrait Ratio \(HTMT\)](#)
- [SRMR](#)
- [d\\_ULS](#)
- [d\\_G1](#)
- [d\\_G2](#)

### Histograms

- [Path Coefficients Histogram](#)
- [Indirect Effects Histogram](#)
- [Total Effects Histogram](#)

### Base Data

- [Setting](#)
- [Inner Model](#)
- [Outer Model](#)
- [Indicator Data \(Original\)](#)
- [Indicator Data \(Standardized\)](#)

# Analisis Data

Setelah melakukan kalkulasi PLS Algorithm dan Bootstraping, maka dapat dilakukan analisis, khususnya:

1. Analisis Model Pengukuran/Measurement Model Analysis(Outer Model)  
Menganalisis hubungan konstruk (variabel laten) dan indikator
  - 1.1. Construct Reliability and Validity
  - 1.2. Discriminant Validity
2. Analisis Model Struktural/Structural Model Analysis (Inner Model)  
Menganalisis hubungan antar konstruk (antar variabel laten) yakni eksogen dan endogen serta hubungan diantaranya
  - 2.1. R-Square
  - 2.2. F-Square
  - 2.3. Pengujian hipotesis (hanya direct effect)
    - Pengaruh X1 terhadap Y
    - Pengaruh X2 terhadap Y
    - Pengaruh X3 terhadap Y
    - Pengaruh X4 terhadap Y