SEM_Mediation_models_Power_Analysis: 记录
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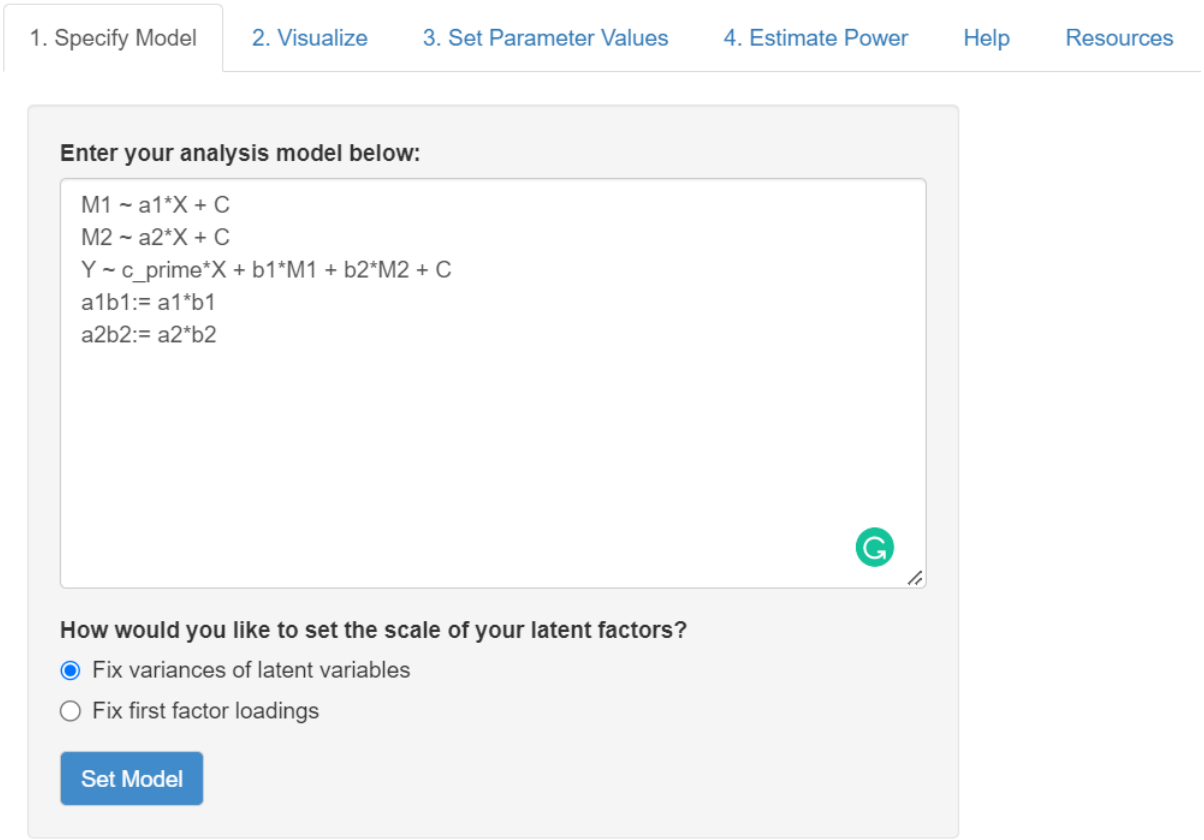
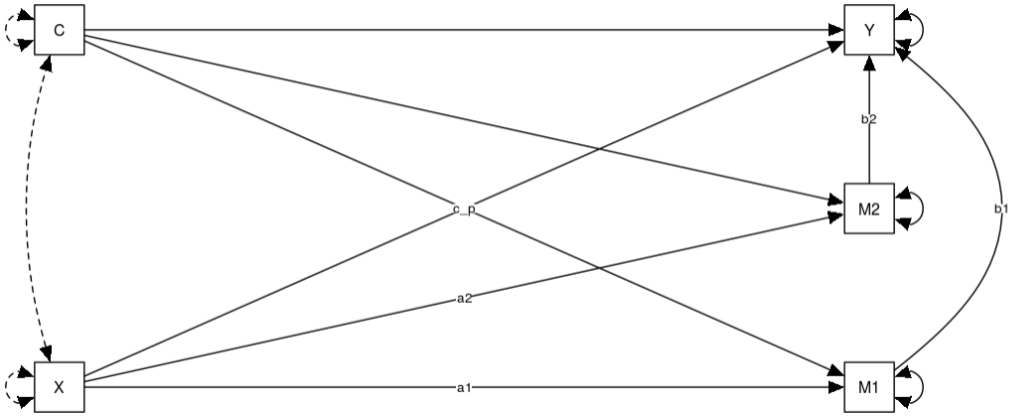
问题一：
结构方程模型中介模型功效分析，以有控制变量的显变量并行中介为例。

解决方案一（可截图）
本组主要通过Andrew Wang的shinyapp网站进行中介模型功效分析，该工具仅需简单的模型设定，易于上手。

https://yilinandrewang.shinyapps.io/pwrSEM/



1. Specify Model | 2. Visualize | 3. Set Parameter Values | 4. Estimate Power | Help | Resources



Dotted edges represent fixed parameters; solid edges represent free parameters.

Show measurement model? (●) Yes ( ) No

Size of manifest nodes 5

Size of latent nodes 8

Rotation 2

Back to Step 1 | Proceed

Press “Proceed”

1. Specify Model | 2. Visualize | 3. Set Parameter Values | 4. Estimate Power | Help | Resources

Your model parameter table is shown below. You can use it like an Excel spreadsheet. (e.g., double-click on a "Value" cell to edit).
Not sure what values to set the parameters at?

- If you need help with setting factor loadings or latent regression coefficients, click the "Help" tab for suggestions.
- If you need help with setting residual variances, enter factor loadings and regression coefficients in the standardized metric, *leave blank all other parameters*, then click "Set Residual Variances for Me" below. (Note that covariance parameters, if any, still need to be set by users afterwards.)

Row	Parameter	Label	Description	Value	Type	Effect	Free
1	M1 ~ X	a1	M1 is regressed on X	-0.20	regression coefficient	☑	1
2	M1 ~ C		M1 is regressed on C	0.20	regression coefficient	☐	2
3	M2 ~ X	a2	M2 is regressed on X	-0.25	regression coefficient	☑	3
4	M2 ~ C		M2 is regressed on C	0.20	regression coefficient	☐	4
5	Y ~ X	c_prime	Y is regressed on X	-0.25	regression coefficient	☑	5
6	Y ~ M1	b1	Y is regressed on M1	0.20	regression coefficient	☑	6
7	Y ~ M2	b2	Y is regressed on M2	0.30	regression coefficient	☑	7
8	Y ~ C		Y is regressed on C	0.20	regression coefficient	☐	8
9	M1 ~~ M1		Residual variance of M1		residual variance	☐	9
10	M2 ~~ M2		Residual variance of M2		residual variance	☐	10
11	Y ~~ Y		Residual variance of Y		residual variance	☐	11
12	X ~~ X		Residual variance of X		residual variance	☐	0

Back to Step 2 (Values are Saved) | Set Residual Variances for Me | Confirm Parameter Values

11	Y ~~ Y		Residual variance of Y		residual variance	☐	11
12	X ~~ X		Residual variance of X		residual variance	☐	0
13	X ~~ C		Residual of X covaries with residual of C	0.15	residual covariance	☐	0
14	C ~~ C		Residual variance of C		residual variance	☐	0
15	a1b1 := a1*b1	a1b1	Labelled parameter	-0.04	labelled parameter	☑	0
16	a2b2 := a2*b2	a2b2	Labelled parameter	-0.07	labelled parameter	☑	0

Back to Step 2 (Values are Saved) | Set Residual Variances for Me | Confirm Parameter Values

Press “Set Residual Variances for Me”

9	M1 ~~ M1		Residual variance of M1	0.92	residual variance	☐	9
10	M2 ~~ M2		Residual variance of M2	0.90	residual variance	☐	10
11	Y ~~ Y		Residual variance of Y	0.66	residual variance	☐	11
12	X ~~ X		Residual variance of X	1.00	residual variance	☐	0
13	X ~~ C		Residual of X covaries with residual of C	0.15	residual covariance	☐	0
14	C ~~ C		Residual variance of C	1.00	residual variance	☐	0
15	a1b1 := a1*b1	a1b1	Labelled parameter	-0.04	labelled parameter	☑	0
16	a2b2 := a2*b2	a2b2	Labelled parameter	-0.07	labelled parameter	☑	0

Back to Step 2 (Values are Saved) | Set Residual Variances for Me | Confirm Parameter Values

Press “Confirm Parameter Values”

1. Specify Model | 2. Visualize | 3. Set Parameter Values | 4. Estimate Power | Help | Resources

Set your sample size: 300

Set your alpha level: 0.05

Set seed for simulations: 42

Set number of simulations

100 | 1,000 | 10,000

100 | 1,100 | 2,100 | 3,100 | 4,100 | 5,100 | 6,100 | 7,100 | 8,100 | 9,100 | 10,000

We recommend starting with a low number of simulations (e.g., 100) to get a rough estimate of power before confirming it with a higher number of simulations (e.g., 1000). The larger the number, the longer simulations will take.

Estimate Power via Simulations

Set sample size, number of simulations, press “ Estimate Power via Simulations”

结果（可截图）：

Parameter	Value	Median	Power	Power (All Cases)
M1 ~ X	-0.20	-0.20	0.94	0.94
M2 ~ X	-0.25	-0.25	0.99	0.99
Y ~ X	-0.25	-0.25	1.00	1.00
Y ~ M1	0.20	0.20	0.99	0.99
Y ~ M2	0.30	0.30	1.00	1.00
a1b1 := a1*b1	-0.04	-0.04	0.86	0.86
a2b2 := a2*b2	-0.07	-0.07	0.99	0.99

Convergence rate is 1. Value is the population parameter value as set in Step 3. Median is the median of simulated estimates of a parameter. Power is estimated from all simulations with converged models. Power (All Cases) is estimated from all simulations, including those with non-converged models (which had no parameter estimates and were counted as failure to reject the null).

参考资料：

Wang, Y. A., & Rhemtulla, M. (2021). Power analysis for parameter estimation in structural equation modeling: A discussion and tutorial. *Advances in Methods and Practices in Psychological Science*, *4*(1), 2515245920918253.
https://journals.sagepub.com/doi/pdf/10.1177/2515245920918253
Supplementary material
https://journals.sagepub.com/doi/suppl/10.1177/2515245920918253/suppl_file/sj-pdf-1-amp-10.1177_2515245920918253.pdf

使用的文章：

Paleari, F. G., Pivetti, M., Galati, D., & Fincham, F. D. (2021). Hedonic and eudaimonic well-being during the COVID-19 lockdown in Italy: The role of stigma and appraisals. *British Journal of Health Psychology*, *26*(2), 657-678.

Young, G. R., Karnilowicz, H. R., Mauss, I. B., Hastings, P. D., Guyer, A. E., & Robins, R. W. (2022). Prospective associations between emotion regulation and depressive symptoms among Mexican-origin adolescents. *Emotion*. *22*(1), 129–141.

解决方案二：

翟宏堃同学MCPowerSEM函数

参考资料：

https://github.com/lingxuanxiao/SummerHackathon2022/tree/main/Project_MCPowerSEM#mcpowersem-structural-equation-modeling-power-analysis-use-monte-carlo-method

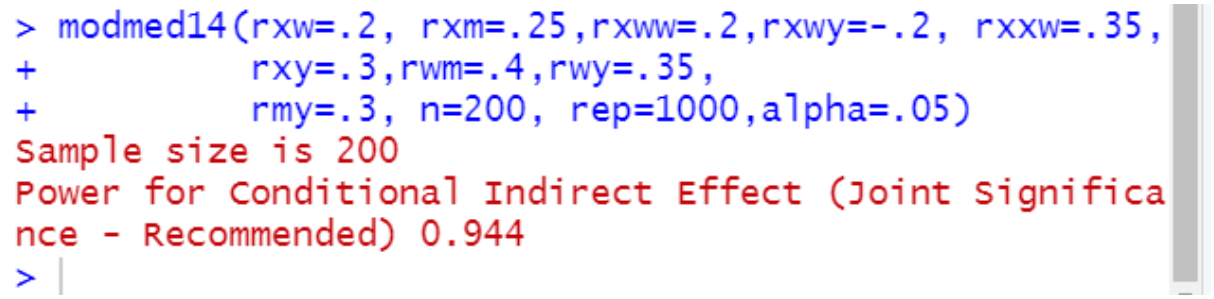
问题二：
有调节的中介（条件过程分析）的功效分析

解决步骤（可截图）
使用Chris Aberson的pwr2ppl包进行条件过程分析的功效分析，pwr2ppl包能够处理简单中介、链式中介、条件过程分析（process model 7, 8, 14, and 15）的功效分析，间接效应检验方法为联合显著性检验（joint significance test）

- I will likely update the notation on these beta functions
- rxy – corr between x and y
- rxm – corr between x and m
- rxw - corr between x and w
- rxxw – corr between x and xw (interaction)
- rxmw – corr between x and mw (interaction)
- Etc. with all the different combinations

```
#安装devtools包，方便通过github安装pwr2ppl
install.packages("devtools")
#通过github安装pwr2ppl
devtools::install_github("chrisaberson/pwr2ppl")
#导入library
library(pwr2ppl)
#以process model14为例
modmed14(rxw=.2, rxm=.25,rxww=.2,rxwy=-.2, rxxw=.35,
        rxy=.3,rwm=.4,rwy=.35,
        rmy=.3, n=200, rep=1000,alpha=.05)
```

结果（可截图）：



参考资料：

github.com/chrisaberson/pwr2ppl

使用过的文章：

Erickson, T. M., Jacobson, S. V., Banning, R. L., Quach, C. M., & Reas, H. E. (2021). Big five traits and interpersonal goals during stressors as predictors of hair cortisol. *Comprehensive Psychoneuroendocrinology*, *8*, 100084.

Zdunek, R. R., Czarna, A. Z., & Sedikides, C. (2022). Grandiose (communal and agentic) narcissism and predicted (dis) obedience in the Milgram paradigm. *Personality and Individual Differences*, *189*, 111514.