

Detection of misspecifications in Mplus

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Mini conference *Measurement invariance: Methods, problems and further directions*
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INTRODUCTION

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EXAMPLE 1

THE PROBLEM AND A SOLUTION

EXAMPLE 2

CONCLUSIONS

EXAMPLE 1: CORRELATIONS BETWEEN GENETIC POLYMORPHISMS

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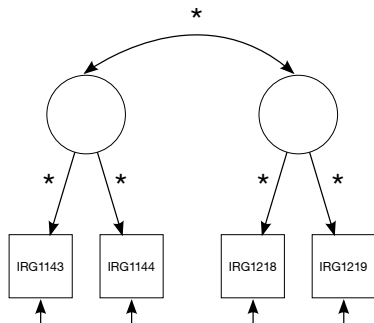
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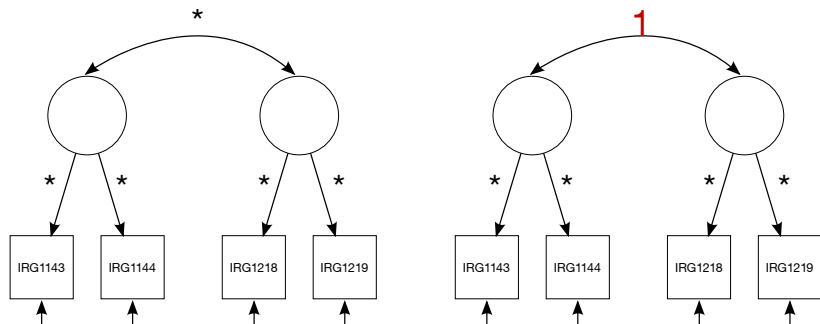
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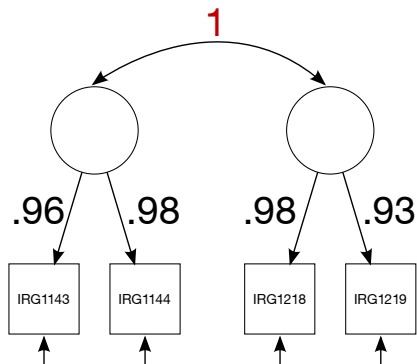


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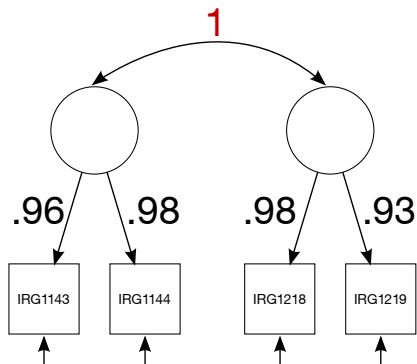


THE RESTRICTED MODEL ESTIMATED WITH MPLUS

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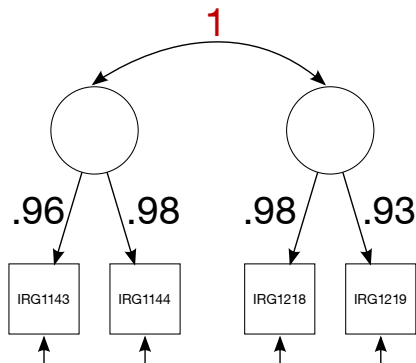


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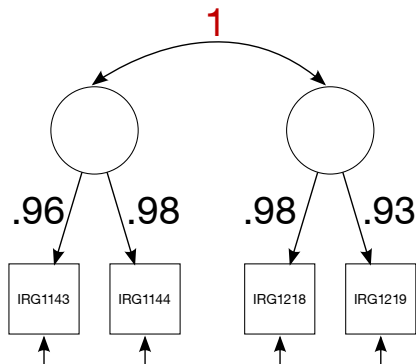
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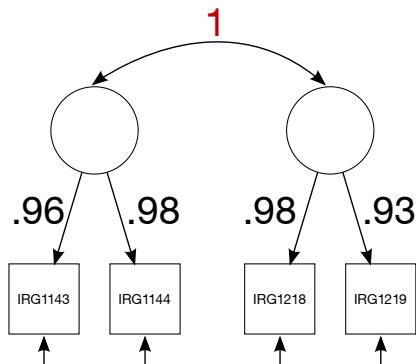
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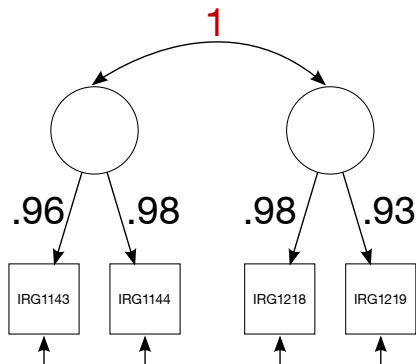


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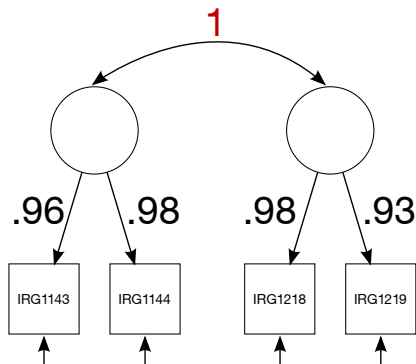


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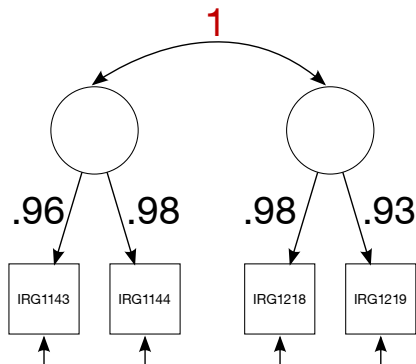
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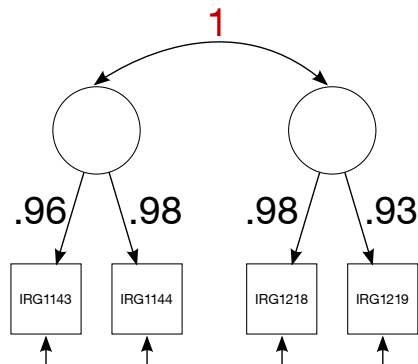
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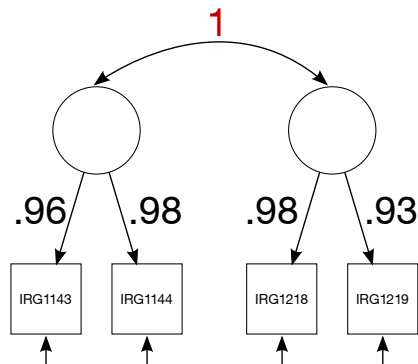
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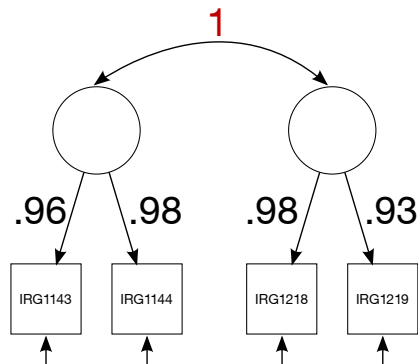
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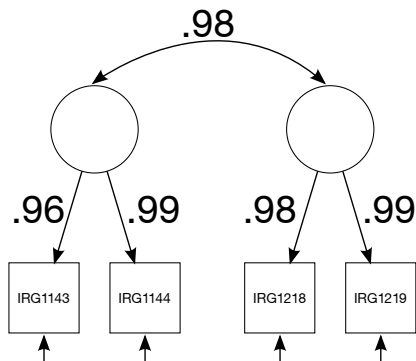
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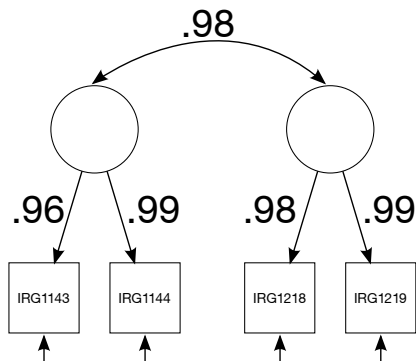
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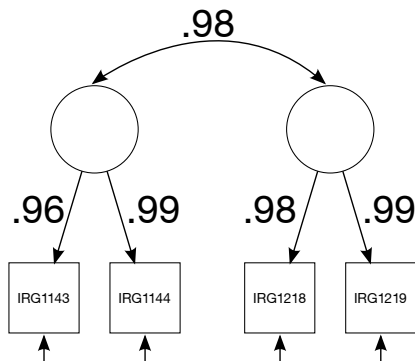
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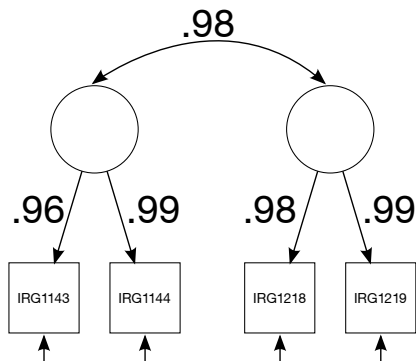


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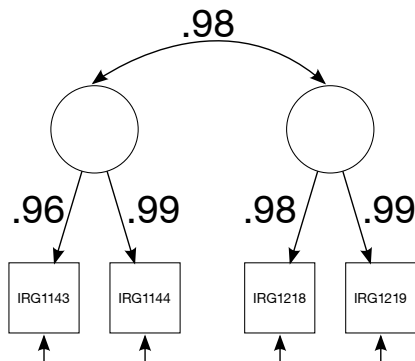
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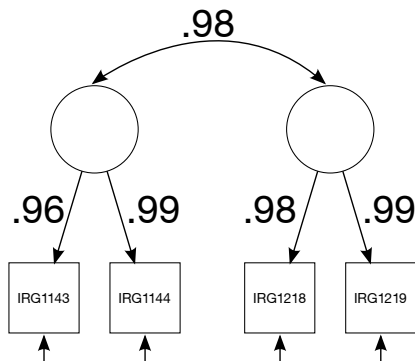
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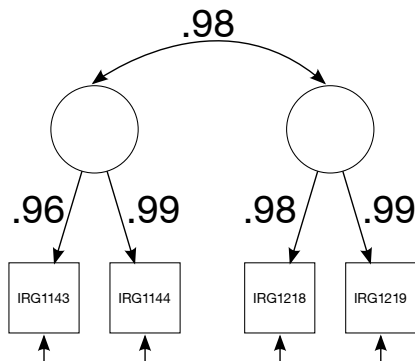
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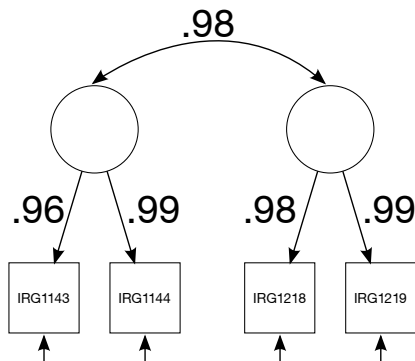
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- ▶ Whether we used χ^2 , $\Delta\chi^2$, or *any of the fit measures*, we would make a **wrong decision**.

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- ▶ If the misspecification (EPC) does not exceed some threshold of acceptability, the model is **not misspecified**
- ▶ On the other hand, if the EPC *does* exceed the threshold, the model **is misspecified**

DECISION RULES

	High power	Low power
Significant MI	Inspect EPC	Misspecification
Nonsignificant MI	No misspecification	Inconclusive

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How do we obtain the power?

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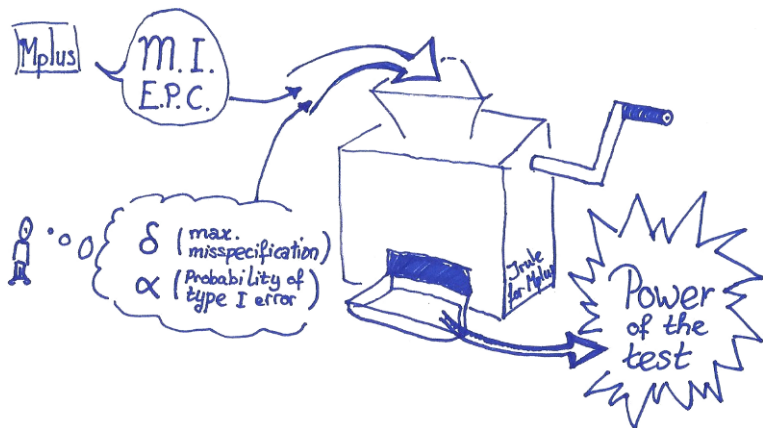
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- ▶ The high power is due to the very large loadings
- ▶ So power does not *just* depend on sample size. Things are not so simple.

POWER

The power of the modification index test to detect a certain misspecification (say, δ) can be determined just from the value of the MI and the EPC.

Saris, W.E., A. Satorra, & W. van der Veld (2009). *Testing Structural Equation Models or Detection of Misspecifications?*, Structural Equation Modeling, 16 pp. 561-582.



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- ▶ It can be downloaded for free from <http://wiki.github.com/daob/JruleMplus/>

Jrule for Mplus beta

File Edit Tools Help

Output file to read:
vote.out

Parameters and misspecifications | Misspecification plots | Change decision rules

Filter by parameter Filter by decision Filter by group

Parameter	Decision	Group	MI	EPC	Power	NCP
GENE1	Not misspecified (EPC < delta)	1	4.589	0.029	1.000	54.566
GENE2	Not misspecified (EPC < delta)	1	4.589	0.029	1.000	54.566
GENE2 WITH GENE1	Not misspecified (EPC < delta)	1	4.589	-0.014	1.000	234.133
IRG1144 WITH IRG1143	Not misspecified (EPC < delta)	1	4.589	0.026	1.000	67.885
IRG1218 WITH IRG1143	Not misspecified (EPC < delta)	1	4.589	0.026	1.000	67.885
IRG1218 WITH IRG1144	Not misspecified (EPC < delta)	1	17.802	-0.052	1.000	65.836
IRG1219 WITH IRG1143	Not misspecified (EPC < delta)	1	17.802	-0.051	1.000	68.443
IRG1219 WITH IRG1144	Not misspecified (EPC < delta)	1	4.589	0.027	1.000	62.949
IRG1219 WITH IRG1218	Not misspecified (EPC < delta)	1	4.589	0.027	1.000	62.949

The current output file is 'Z:\home\daob\work\Presentations\Jrule\ld-1fac.out'.

EXAMPLE 2: PERSONALITY TRAITS AND VOTING

- ▶ “Big Five” personality traits: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism

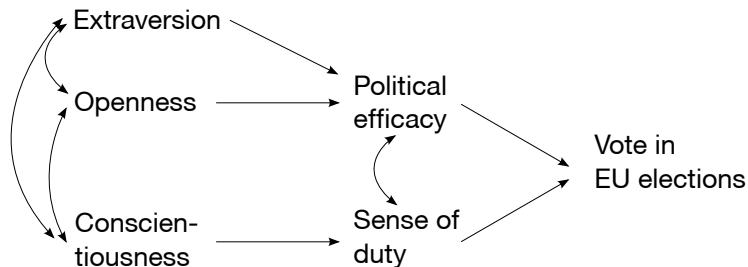
EXAMPLE 2: PERSONALITY TRAITS AND VOTING

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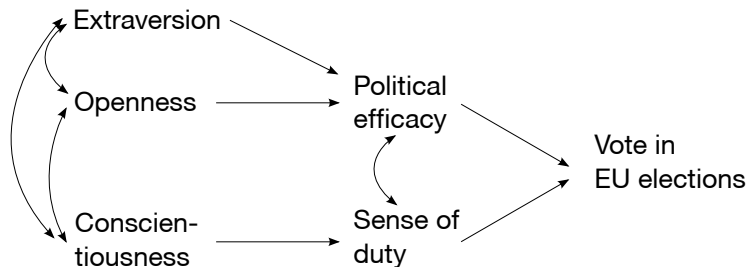
- ▶ “Big Five” personality traits: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism
- ▶ Correlated with voting
- ▶ Hypothesized to affect voting only *indirectly*, through things like “a sense that voting is a duty”, “political efficacy” (Gallego & Oberski, frth)

HIGHLY SIMPLIFIED PATH MODEL



(all regression equations are also controlled for age, sex, and education -- not shown)

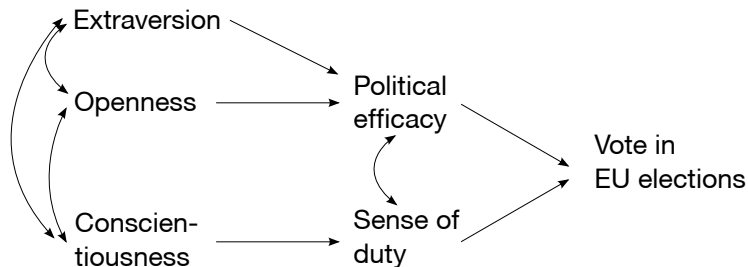
HIGHLY SIMPLIFIED PATH MODEL



(all regression equations are also controlled for age, sex, and education -- not shown)

**Should we introduce a path from
Openness/Conscientiousness/Extraversion directly to Voting?**

HIGHLY SIMPLIFIED PATH MODEL



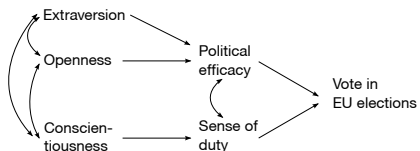
(all regression equations are also controlled for age, sex, and education -- not shown)

**Should we introduce a path from
Openness/Conscientiousness/Extraversion directly to Voting?**

I will conclude we should **if the effect is bigger than 0.05.**

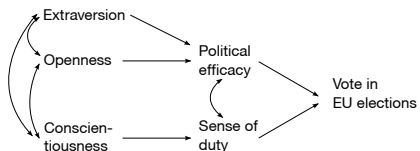
THE MEDIATION MODEL ESTIMATED WITH MPLUS

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(all regression equations are also controlled for age, sex, and education -- not shown)

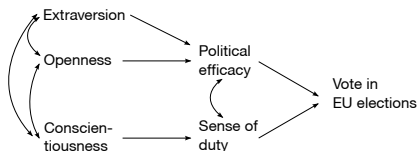
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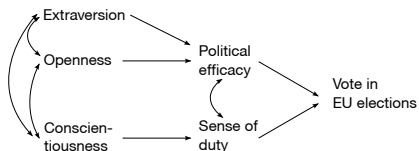
- ▶ Chisquare: 12.3, $df = 4^*$,
 $p = 0.0152$



(all regression equations are also controlled for age, sex, and education -- not shown)

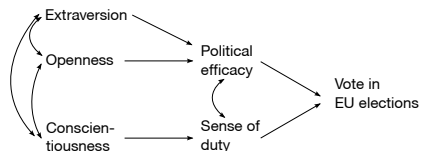
THE MEDIATION MODEL ESTIMATED WITH MPLUS

- ▶ Chisquare: 12.3, $df = 4^*$, $p = 0.0152$
- ▶ CFI: 0.965



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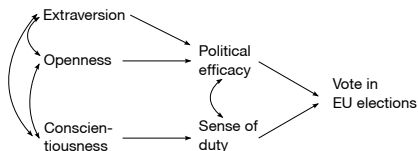
THE MEDIATION MODEL ESTIMATED WITH MPLUS



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- ▶ Chisquare: 12.3, $df = 4^*$, $p = 0.0152$
- ▶ CFI: 0.965
- ▶ TLI: 0.948

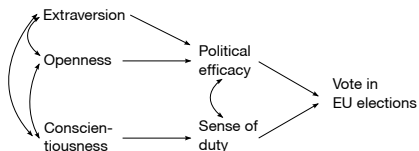
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- ▶ Chisquare: 12.3, $df = 4^*$, $p = 0.0152$
- ▶ CFI: 0.965
- ▶ TLI: 0.948
- ▶ RMSEA: 0.026

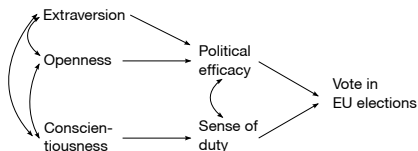
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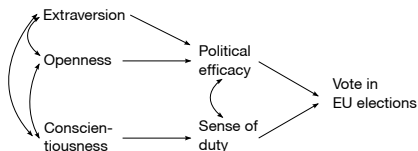
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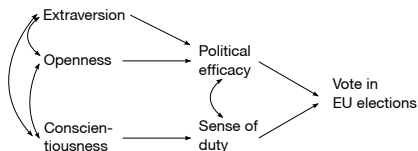
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VOTE ON CONS MI: 1.349 , EPC: 0.062

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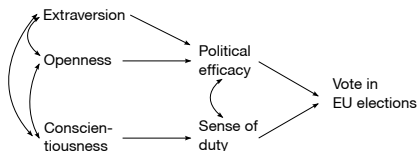
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- ▶ MI's and EPC's:

VOTE ON CONS MI: 1.349 , EPC: 0.062

VOTE ON EXTR MI: 7.259**, EPC: 0.072

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- ▶ RMSEA: 0.026
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- ▶ MI's and EPC's:

VOTE ON CONS MI: 1.349 , EPC: 0.062

VOTE ON EXTR MI: 7.259**, EPC: 0.072

VOTE ON OPEN MI: 1.349 , EPC: -0.041

* df calculated for model with categorical variables (WLSMV estimator)

CONCLUSIONS

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- ▶ So it seems our hypothesis that personality traits affect voting only indirectly is not rejected.
- ▶ Hooray?

Jrule for Mplus beta

File Edit Tools Help

Output file to read:
vote.out

Parameters and misspecifications | Misspecification plots | Change decision rules

Filter by parameter Filter by decision Filter by group

VOTEEU09 0

Parameter	Decision	Group	MI	EPC	Power	NCP
VOTEEU09 ON OPEN	Inconclusive	1	1.419	-0.025	0.479	3.633
VOTEEU09 ON EXTR	Misspecified (EPC >= delta)	1	7.259	0.040	0.769	7.259
VOTEEU09 ON CONS	Inconclusive	1	1.349	0.043	0.191	1.167

The screenshot shows a software window titled "Jrule for Mplus beta" with a menu bar (File, Edit, Tools, Help) and a file selection field containing "vote.out". Below the menu is a tabbed interface with three tabs: "Parameters and misspecifications" (selected), "Misspecification plots", and "Change decision rules". Under the selected tab, there are three filter sections: "Filter by parameter" (set to "VOTEEU09 0"), "Filter by decision", and "Filter by group". A table displays the results of the analysis, with columns for Parameter, Decision, Group, MI, EPC, Power, and NCP. The row for "VOTEEU09 ON EXTR" is highlighted in red, indicating a misspecification with the decision "Misspecified (EPC >= delta)". A mouse cursor is visible over the table.

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- ▶ The results on the possible presence of direct effects on voting from Openness and Conscientiousness can only be called **inconclusive**

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- ▶ The power to detect a misspecification for Openness and Conscientiousness is **very low** (0.479 and 0.191 respectively)
- ▶ Guess the sample size...
- ▶ $n = 3121$ (you probably saw that coming)
- ▶ The low power is due to small effects and the sampling design

- ▶ The results on the possible presence of direct effects on voting from Openness and Conscientiousness can only be called **inconclusive**
- ▶ This means we need better measures or a better model or a bigger sample or a combination

OVERALL CONCLUSIONS

- ▶ Chi square, fit measures, and MI are *all* affected by the power of the test

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- ▶ Chi square, fit measures, and MI are *all* affected by the power of the test
- ▶ The power is not only a function of the sample size but can surprise you
- ▶ To make a correct decision, one must take into account the power of the test
- ▶ Saris & a. (2009) suggest one method for doing this
- ▶ That method is implemented in the free software Jrule for Mplus (Oberski 2010)

