PSY 9556B (March 5) Autoregressive Latent Trajectory (ALT) models

Overall thoughts:

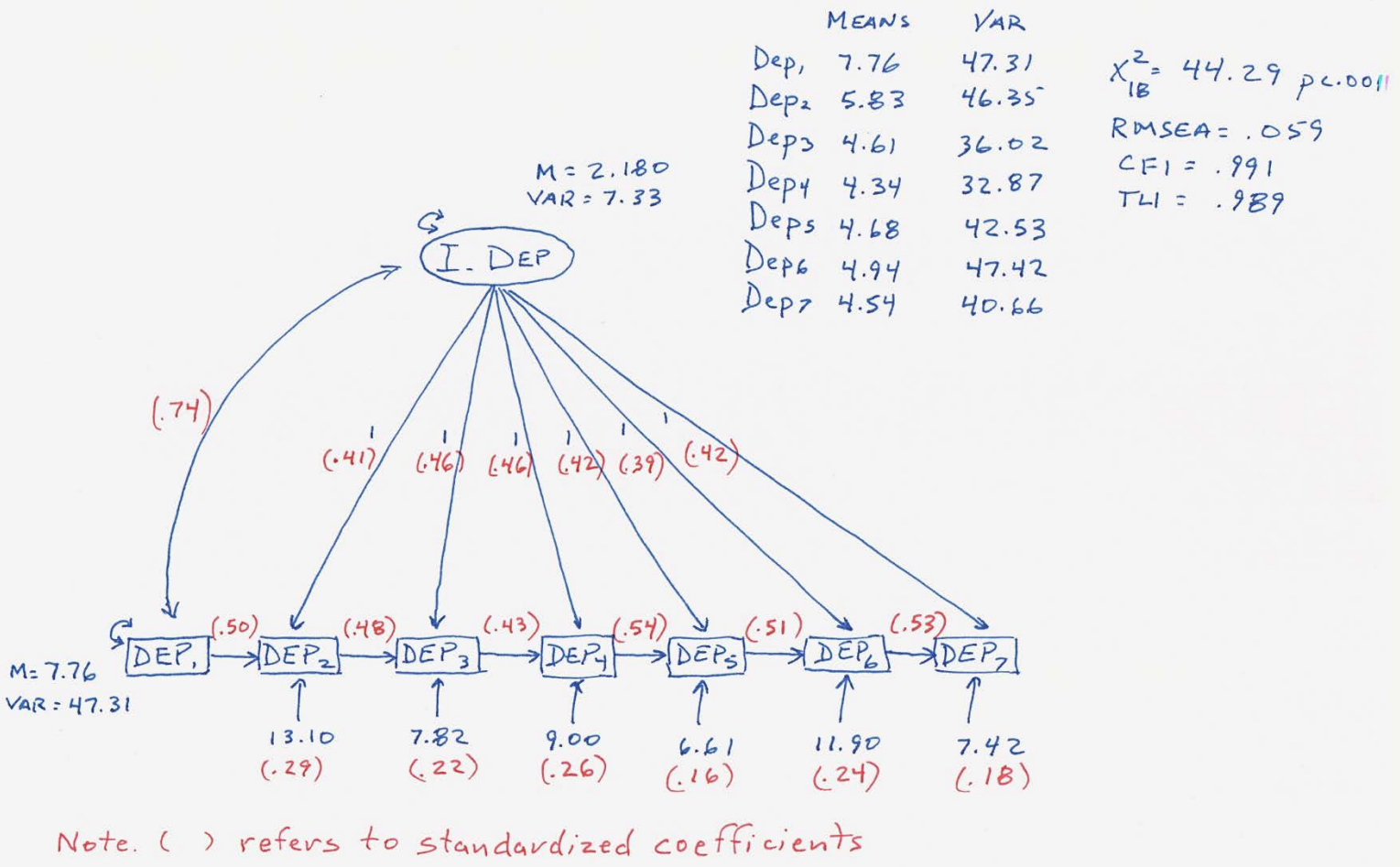
- Combines parts from latent growth models and cross-lagged panel models
- Best to construct these models in stages (i.e., model building rather than trimming)
- You may find that not all parts of LGM and cross-lagged panel models needed
    - Example: If there is no meaningful change (growth) you could just model a latent intercept representing stability across time
    - What is the meaning of a model that includes the latent intercept plus autoregressive paths?
        - Note that because these two are estimated simultaneously, they represent unique effects from one another
        - Little may have a point: "To me, the ALT model is conflating two very different kinds of questions that can't be answered in the same model" (p. 271)
        - I think we need to continue exploring these models with simulation studies in which we ask ourselves what the data would look like in a good fitting ALT

Example

- In this example I will investigate the relations between amount of exercise (hrs per week) and depressive symptoms (BDI-II)

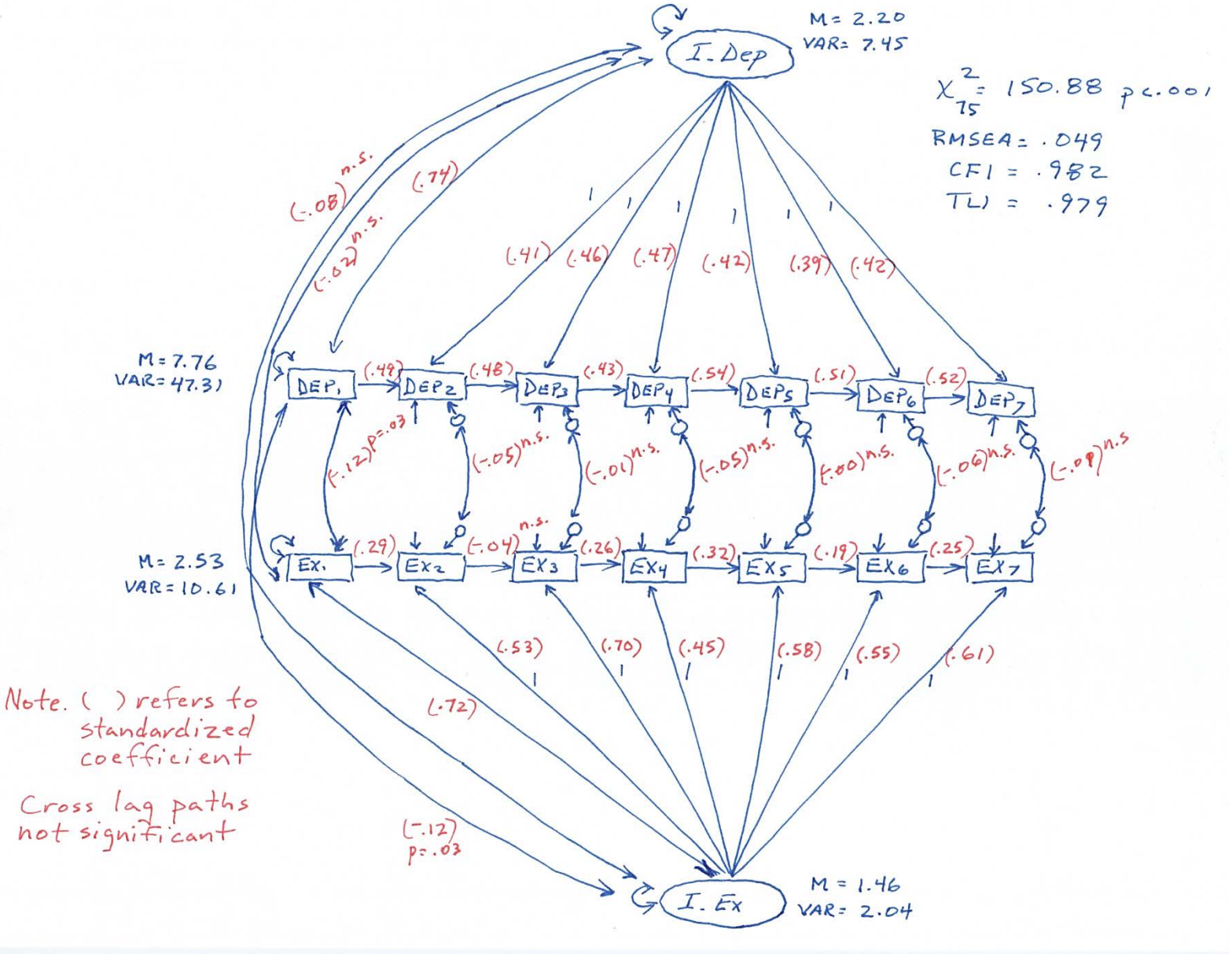
- Although the original data consists of 26 consecutive weeks from October to April, I have aggregated the data into 7 time-points for this example
- I will develop my model in the following order:
  - LGM of the Exercise trajectory
  - Addition of autoregressive paths AR1
  - See if any other autoregressive paths or correlated-residuals needed
  - Repeat the previous three steps for the Depression trajectory
  - Combine the two trajectories allowing correlations between all latent variables
  - Allow residuals same-time residuals to correlate (i.e., exercise1 with depression1)
  - Add cross-lagged paths beginning with $\text{exercise}_{(t)}$ predicting $\text{depression}_{(t+1)}$
  - Add cross-lagged paths of $\text{depression}_{(t)}$ predicting $\text{exercise}_{(t+1)}$
- Note. As in the Bollen and Curran approach I will leave the first time point as an exogenous variable (see diagrams in subsequent slides)

Example



Note. ( ) refers to standardized coefficients

Example


I. Dep
M = 2.20
VAR = 7.45
X^2_{75} = 150.88 p<.001
RMSEA = .049
CFI = .982
TLI = .979
DEP1
DEP2
DEP3
DEP4
DEP5
DEP6
DEP7
M = 7.76
VAR = 47.31
EX1
EX2
EX3
EX4
EX5
EX6
EX7
M = 2.53
VAR = 10.61
I. Ex
M = 1.46
VAR = 2.04
Note. ( ) refers to standardized coefficient
Cross lag paths not significant

Example

```
model:
Iex | ex2@0 ex3@1 ex4@2 ex5@3 ex6@4 ex7@5;
Iex with ex1;
ex2 on ex1;
ex3 on ex2;
ex4 on ex3;
ex5 on ex4;
ex6 on ex5;
ex7 on ex6;
Id | dp2@0 dp3@1 dp4@2 dp5@3 dp6@4 dp7@5;
Id  with dp1;
dp2 on dp1;
dp3 on dp2;
dp4 on dp3;
dp5 on dp4;
dp6 on dp5;
dp7 on dp6;
ex1 with dp1;
ex2 with dp2;
ex3 with dp3;
ex4 with dp4;
ex5 with dp5;
ex6 with dp6;
ex7 with dp7;
output: sampstat stdyx tech4 modindices;
```

```
Chi-Square Test of Model Fit

          Value                             150.879
          Degrees of Freedom                    75
          P-Value                           0.0000

RMSEA (Root Mean Square Error Of Approximation)

          Estimate                           0.049
          90 Percent C.I.                    0.038  0.061
          Probability RMSEA <= .05           0.516

CFI/TLI

          CFI                                0.982
          TLI                                0.979

Chi-Square Test of Model Fit for the Baseline Model

          Value                          4338.535
          Degrees of Freedom                    90
          P-Value                           0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                              0.042
```

Example

STDYX Standardization

		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
IEX	BY				
EX2		0.526	0.029	17.878	0.000
EX3		0.695	0.037	19.025	0.000
EX4		0.451	0.028	16.392	0.000
EX5		0.581	0.032	18.282	0.000
EX6		0.547	0.031	17.607	0.000
EX7		0.605	0.032	18.867	0.000
ID	BY				
DP2		0.408	0.032	12.666	0.000
DP3		0.459	0.035	13.305	0.000
DP4		0.467	0.037	12.713	0.000
DP5		0.423	0.033	12.706	0.000
DP6		0.389	0.031	12.363	0.000
DP7		0.422	0.033	12.753	0.000
EX2	ON				
EX1		0.289	0.031	9.235	0.000
EX3	ON				
EX2		-0.037	0.043	-0.869	0.385
EX4	ON				
EX3		0.256	0.035	7.394	0.000
EX5	ON				
EX4		0.323	0.038	8.407	0.000
EX6	ON				
EX5		0.194	0.038	5.173	0.000
EX7	ON				
EX6		0.247	0.040	6.203	0.000
DP2	ON				
DP1		0.494	0.028	17.551	0.000
DP3	ON				
DP2		0.478	0.035	13.532	0.000
DP4	ON				
DP3		0.431	0.037	11.770	0.000
DP5	ON				
DP4		0.537	0.035	15.520	0.000
DP6	ON				
DP5		0.512	0.034	15.098	0.000
DP7	ON				
DP6		0.524	0.036	14.621	0.000
IEX	WITH				
EX1		0.715	0.032	22.221	0.000
ID	WITH				
DP1		0.742	0.028	26.683	0.000
IEX		-0.079	0.061	-1.295	0.195
EX1	WITH				
ID		-0.015	0.055	-0.268	0.788
DP1	WITH				
IEX		-0.121	0.055	-2.205	0.027
EX1	WITH				
DP1		-0.107	0.049	-2.208	0.027

Example

EX2 WITH				
DP2	-0.045	0.055	-0.815	0.415
EX3 WITH				
DP3	-0.014	0.059	-0.241	0.810
EX4 WITH				
DP4	-0.052	0.057	-0.913	0.361
EX5 WITH				
DP5	-0.003	0.062	-0.044	0.965
EX6 WITH				
DP6	-0.062	0.057	-1.088	0.276
EX7 WITH				
DP7	-0.007	0.063	-0.110	0.912
Means				
EX1	0.778	0.056	13.866	0.000
DP1	1.128	0.063	17.944	0.000
IEX	1.026	0.071	14.351	0.000
ID	0.806	0.064	12.544	0.000
Intercepts				
EX2	0.000	0.000	999.000	999.000
EX3	0.000	0.000	999.000	999.000
EX4	0.000	0.000	999.000	999.000
EX5	0.000	0.000	999.000	999.000
EX6	0.000	0.000	999.000	999.000
EX7	0.000	0.000	999.000	999.000
DP2	0.000	0.000	999.000	999.000
DP3	0.000	0.000	999.000	999.000
DP4	0.000	0.000	999.000	999.000
DP5	0.000	0.000	999.000	999.000
DP6	0.000	0.000	999.000	999.000
DP7	0.000	0.000	999.000	999.000

Variances				
EX1	1.000	0.000	999.000	999.000
DP1	1.000	0.000	999.000	999.000
IEX	1.000	0.000	999.000	999.000
ID	1.000	0.000	999.000	999.000
Residual Variances				
EX2	0.423	0.031	13.619	0.000
EX3	0.554	0.033	16.693	0.000
EX4	0.576	0.035	16.336	0.000
EX5	0.324	0.030	10.905	0.000
EX6	0.496	0.034	14.541	0.000
EX7	0.364	0.032	11.500	0.000
DP2	0.291	0.025	11.673	0.000
DP3	0.220	0.021	10.669	0.000
DP4	0.263	0.025	10.519	0.000
DP5	0.159	0.017	9.389	0.000
DP6	0.242	0.022	10.933	0.000
DP7	0.179	0.018	9.900	0.000