PSY 9555A (Nov 13): Latent Growth Modeling
Description of Data Set

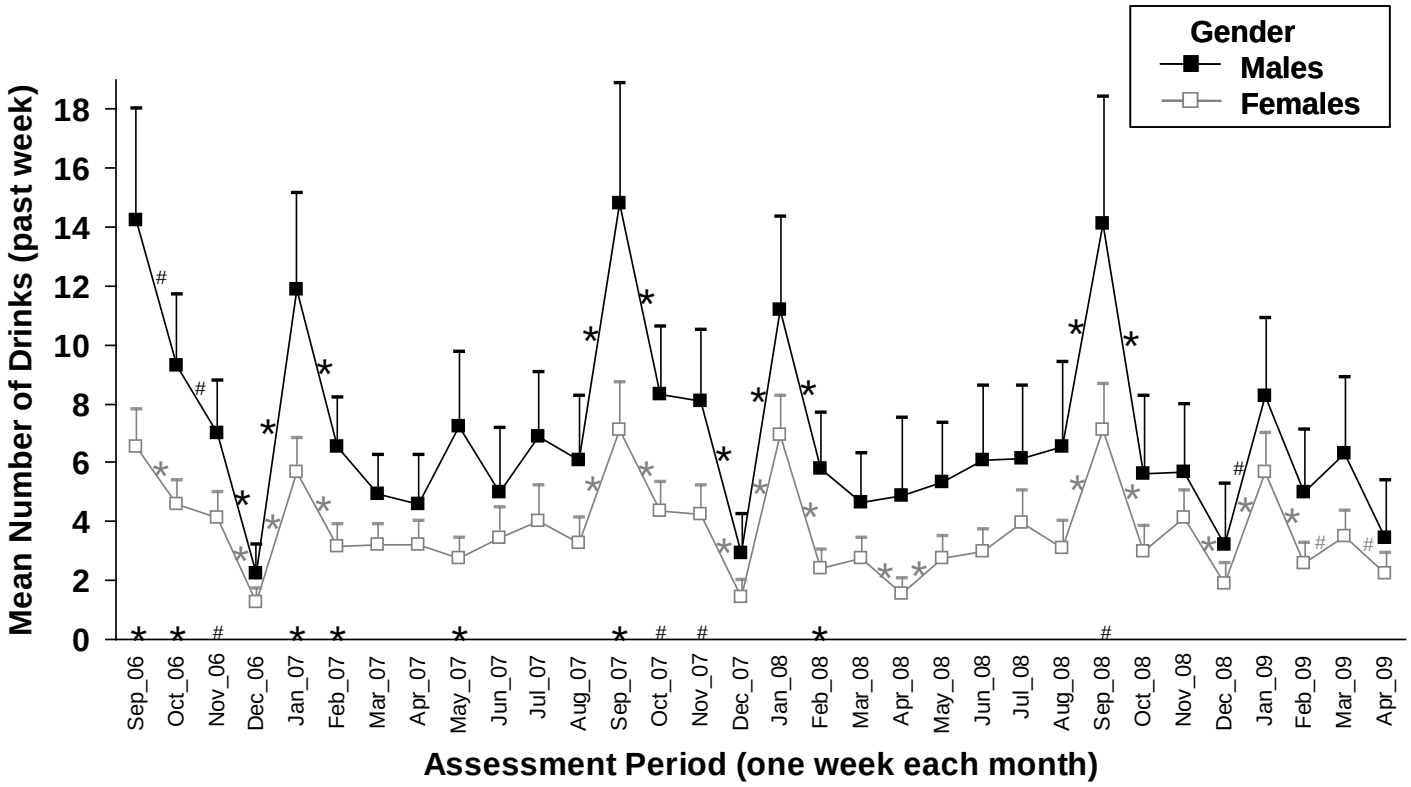


FIGURE 1. Alcohol consumption over three academic years by gender. Error bars (95% CI) shown above the mean only. Symbols, * $p < .002$ and # $p < .01$, refer to significant adjacent week differences and to significant gender differences in mean number of drinks during specific weeks (indicated above horizontal axis).

Description of Data Set

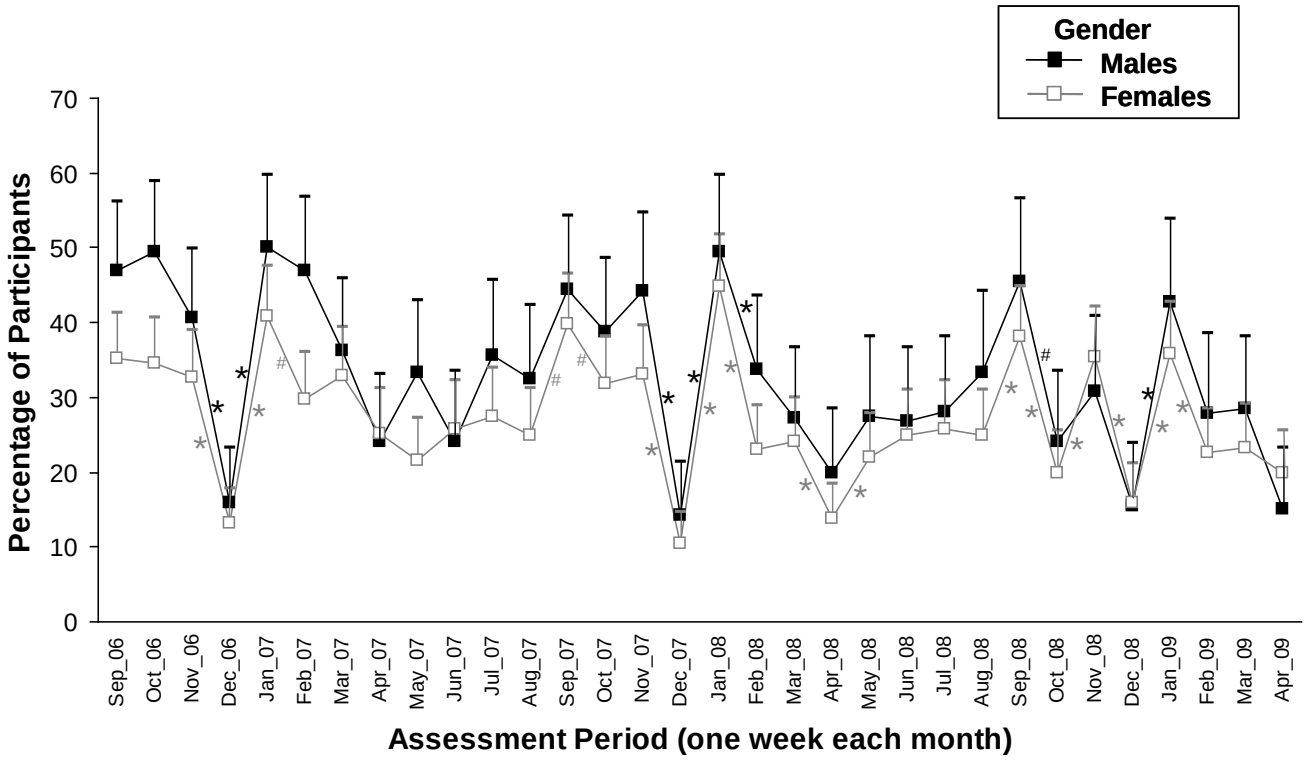


FIGURE 2. Percentage of males and females who drink heavily (4+ drinks for females and 5+ drinks for males) on at least one day of the week. Error bars (95% CI) shown above the mean only. Symbols, * $p < .002$ and # $p < .01$, refer to significant adjacent week differences.

Aggregating Data into 8 Time-Points

Four-month drinking aggregates. In order to investigate the overall three-year trend (from September 2006 to April 2009) in number of drinks per week, we created four-month drinking aggregates which consisted of the average number of drinks per week for that period. Each aggregate consisted of the mean of four monthly time points based on available data. Overall, there were eight aggregates with the first one consisting of the period Sep to Dec 2006 and the last one for the period Jan to Apr 2009. These aggregates correspond to academic semesters running from Sep to Dec and from Jan to Apr and to the spring-summer period from May to Aug. When data was missing on all four time points, no value for the aggregate was computed. As a result the total number of participants ranged from 348 in the first aggregate and 304 in the last aggregate.

Summary Trajectories from Multiple Group Latent Growth Modeling

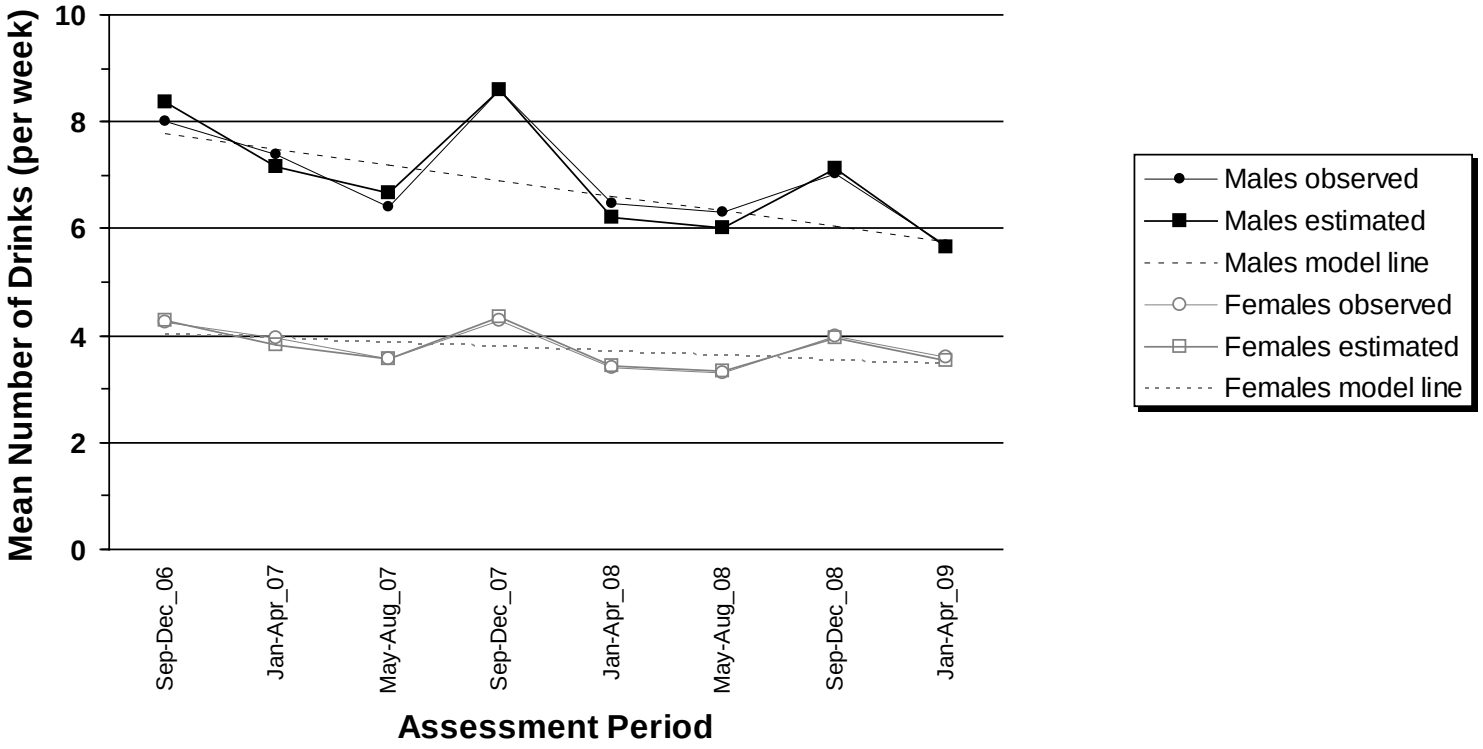
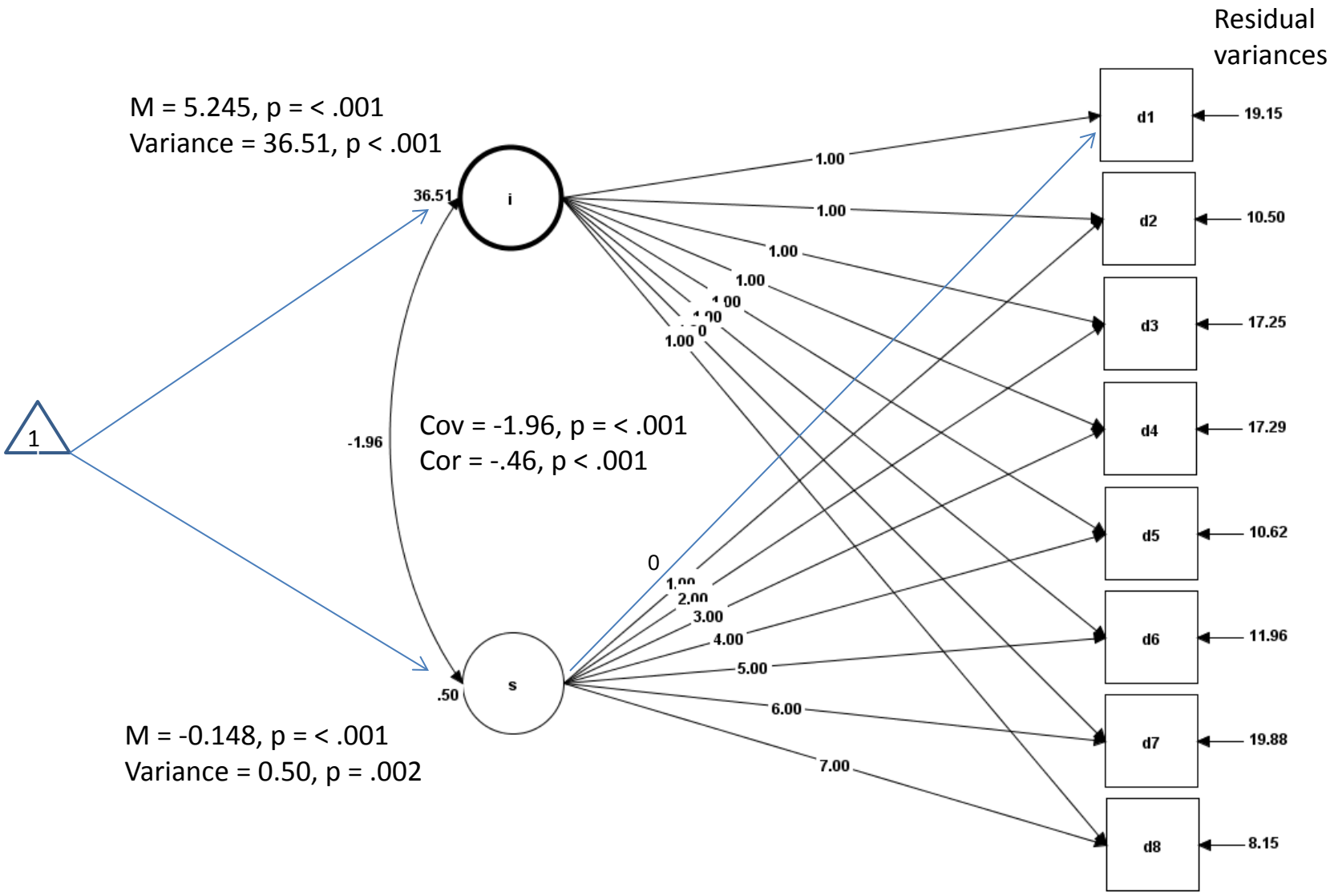


FIGURE 3. Latent Growth Trajectories of alcohol consumption over three academic years by gender.

Latent Growth Modeling: Which Parameter are Fixed and which are Estimated?



Latent Growth Modeling: Which Parameter are Fixed and which are Estimated?

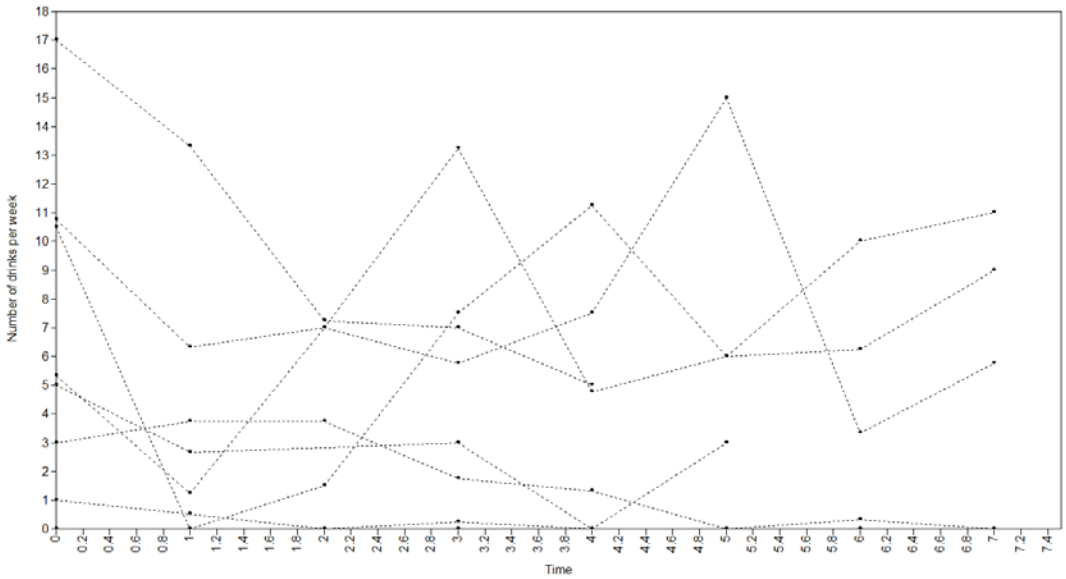
Parameters and dfs

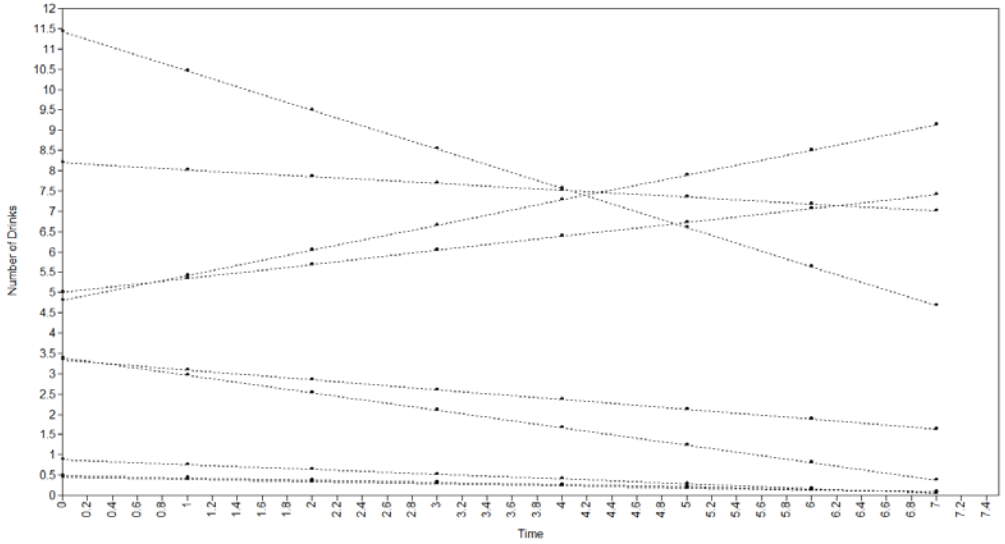
Elements:
(v (v+3))/2 = (8*11)/2 = 44

Parameters:
8 residuals (8 time points): left-over variance not explained by latent variables
1 mean intercept: the mean start-point of individual trajectories
1 mean slope: the mean slope (e.g., growth/learning/decrease) of individual trajectories
1 variance of the intercepts: variation in individual start-points
1 variance of the slopes: variation in individual slopes
1 correlation between intercept and slope: explain the meaning of this
(note, indicator intercepts fixed at 0)

Total parameters = 13
dfs = 44 -13 = 31

A Sub-Sample of Individual Observed and Estimated Trajectories





LGM Drinking Example (8 time points)

Mplus - [linear_semesterdrinking6b.inp]

File Edit View Mplus Graph Window Help

```
Title: Drinking three-month blocks Paul Tremblay;
data: File is c:\paul\mplus\may10\drinking_semesters_mpluspaper.dat;
    Format is 1F4, 1F1, 9F8.2;
variable: names are studid gender drinker d1 d2 d3 d4 d5 d6 d7 d8;
missing = blank;
usevariables are d1 d2 d3 d4 d5 d6 d7 d8;
!grouping is gender (1=male 2=female);
analysis:
estimator = mlr;
model: i s | d1@0 d2@1 d3@2 d4@3 d5@4 d6@5 d7@6 d8@7;
plot:
    type=plot3;
    series is d1 (0) d2 (1) d3 (2) d4 (3) d5 (4) d6 (5) d7 (6) d8 (7);
output: sampstat stdyx tech1 tech3 tech4 modindices;
```

Ready Ln 7, Col 2

Different ways of scaling slope

Mplus - [linear_semesterdrinking6.inp]

File Edit View Mplus Graph Window Help

```
Title: Drinking three-month blocks Paul Tremblay;
data: File is c:\paul\mplus\may10\drinking_semesters_mpluspaper.dat;
    Format is 1F4, 1F1, 9F8.2;
variable: names are studid gender drinker d1 d2 d3 d4 d5 d6 d7 d8;
missing = blank;
usevariables are d1 d2 d3 d4 d5 d6 d7 d8;
!grouping is gender (1=male 2=female);
analysis:
estimator = mlr;
model: i s | d1@0 d2@0.143 d3@0.286 d4@0.429 d5@0.572 d6@0.715 d7@0.858 d8@1;
plot:
    type=plot3;
    series is d1 (0) d2 (1) d3 (2) d4 (3) d5 (4) d6 (5) d7 (6) d8 (7);
output: sampstat stdyx tech1 tech3 tech4 modindices;
```

Ready Ln 13, Col 31

LGM Drinking Example (8 time points)

Information Criteria

Akaike (AIC)	15645.900
Bayesian (BIC)	15695.978
Sample-Size Adjusted BIC (n* = (n + 2) / 24)	15654.738

Chi-Square Test of Model Fit

Value	57.441*
Degrees of Freedom	31
P-Value	0.0027
Scaling Correction Factor for MLR	2.5634

* The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be used for chi-square difference testing in the regular way. MLM, MLR and WLSM chi-square difference testing is described on the Mplus website. MLMV, WLSMV, and ULSMV difference testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.050	
90 Percent C.I.	0.029	0.069
Probability RMSEA <= .05	0.489	

CFI/TLI

CFI	0.964
TLI	0.967

Chi-Square Test of Model Fit for the Baseline Model

Value	762.584
Degrees of Freedom	28
P-Value	0.0000

SRMR (Standardized Root Mean Square Residual)

Value	0.059

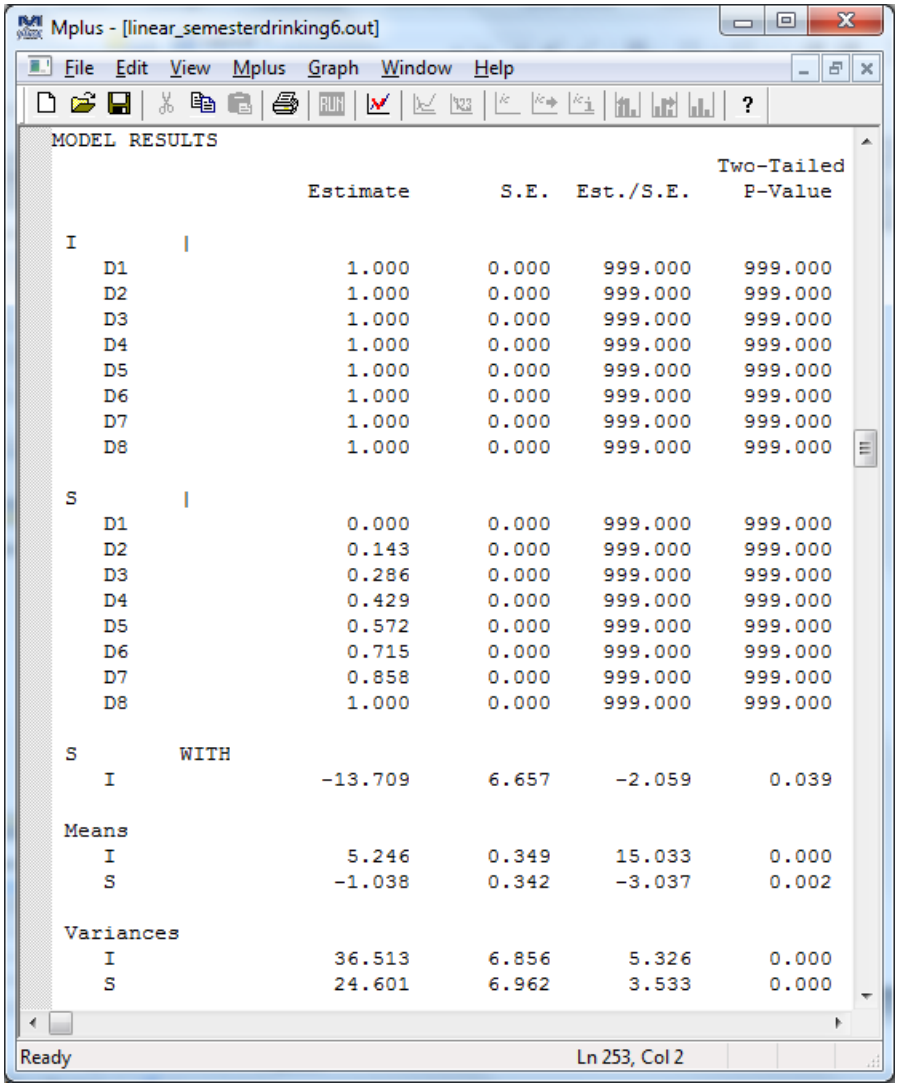
LGM Drinking Example (8 time points)

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
I |				
D1	1.000	0.000	999.000	999.000
D2	1.000	0.000	999.000	999.000
D3	1.000	0.000	999.000	999.000
D4	1.000	0.000	999.000	999.000
D5	1.000	0.000	999.000	999.000
D6	1.000	0.000	999.000	999.000
D7	1.000	0.000	999.000	999.000
D8	1.000	0.000	999.000	999.000
S |				
D1	0.000	0.000	999.000	999.000
D2	1.000	0.000	999.000	999.000
D3	2.000	0.000	999.000	999.000
D4	3.000	0.000	999.000	999.000
D5	4.000	0.000	999.000	999.000
D6	5.000	0.000	999.000	999.000
D7	6.000	0.000	999.000	999.000
D8	7.000	0.000	999.000	999.000
S WITH				
I	-1.959	0.951	-2.059	0.039
Means				
I	5.245	0.349	15.033	0.000
S	-0.148	0.049	-3.037	0.002
Intercepts				
D1	0.000	0.000	999.000	999.000
D2	0.000	0.000	999.000	999.000
D3	0.000	0.000	999.000	999.000
D4	0.000	0.000	999.000	999.000
D5	0.000	0.000	999.000	999.000
D6	0.000	0.000	999.000	999.000
D7	0.000	0.000	999.000	999.000
D8	0.000	0.000	999.000	999.000
Variances				
I	36.511	6.855	5.326	0.000
S	0.502	0.142	3.533	0.000
Residual Variances				
D1	19.154	4.282	4.473	0.000
D2	10.505	1.432	7.335	0.000
D3	17.249	3.626	4.757	0.000
D4	17.287	2.714	6.369	0.000
D5	10.620	1.744	6.091	0.000
D6	11.956	1.780	6.718	0.000
D7	19.875	5.619	3.537	0.000
D8	8.153	2.628	3.102	0.002

LGM Drinking Example

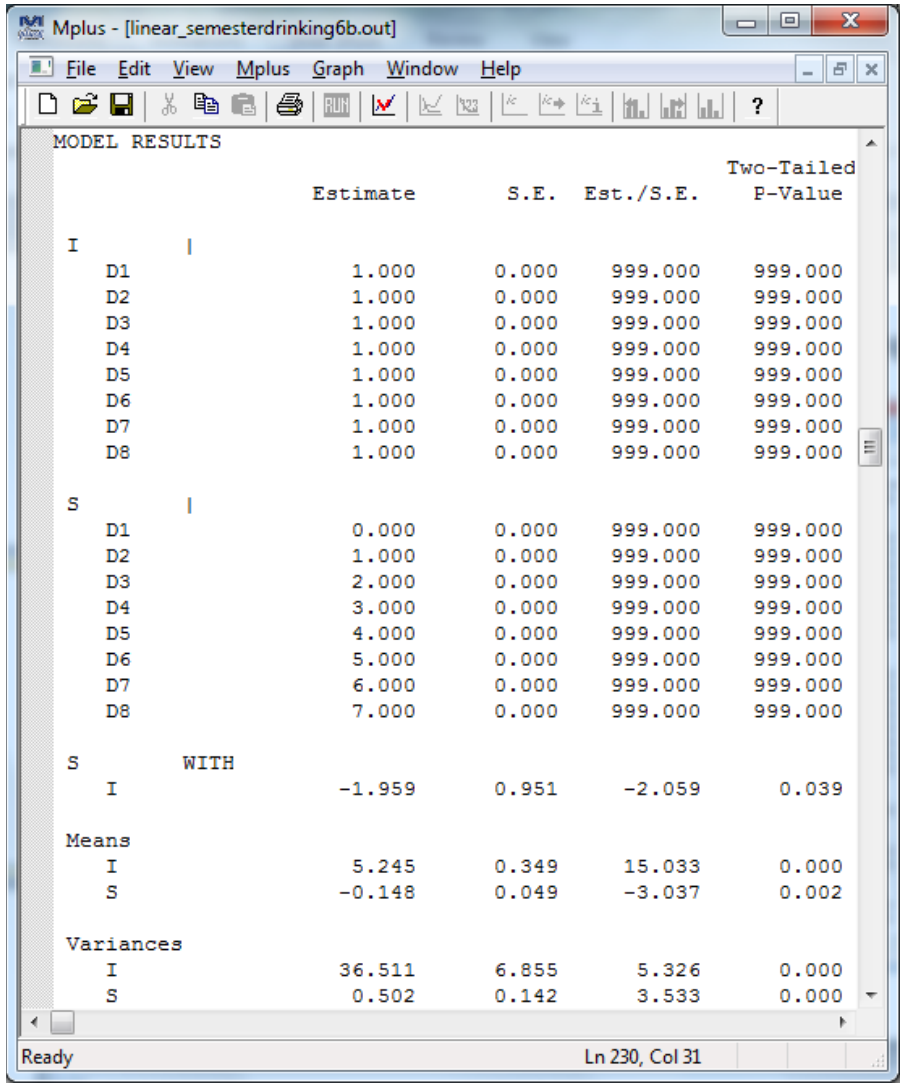
model: i s | d1@0 d2@0.143 d3@0.286 d4@0.429 d5@0.572 d6@0.715 d7@0.858 d8@1;



MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
I |				
D1	1.000	0.000	999.000	999.000
D2	1.000	0.000	999.000	999.000
D3	1.000	0.000	999.000	999.000
D4	1.000	0.000	999.000	999.000
D5	1.000	0.000	999.000	999.000
D6	1.000	0.000	999.000	999.000
D7	1.000	0.000	999.000	999.000
D8	1.000	0.000	999.000	999.000
S |				
D1	0.000	0.000	999.000	999.000
D2	0.143	0.000	999.000	999.000
D3	0.286	0.000	999.000	999.000
D4	0.429	0.000	999.000	999.000
D5	0.572	0.000	999.000	999.000
D6	0.715	0.000	999.000	999.000
D7	0.858	0.000	999.000	999.000
D8	1.000	0.000	999.000	999.000
S WITH				
I	-13.709	6.657	-2.059	0.039
Means				
I	5.246	0.349	15.033	0.000
S	-1.038	0.342	-3.037	0.002
Variances				
I	36.513	6.856	5.326	0.000
S	24.601	6.962	3.533	0.000

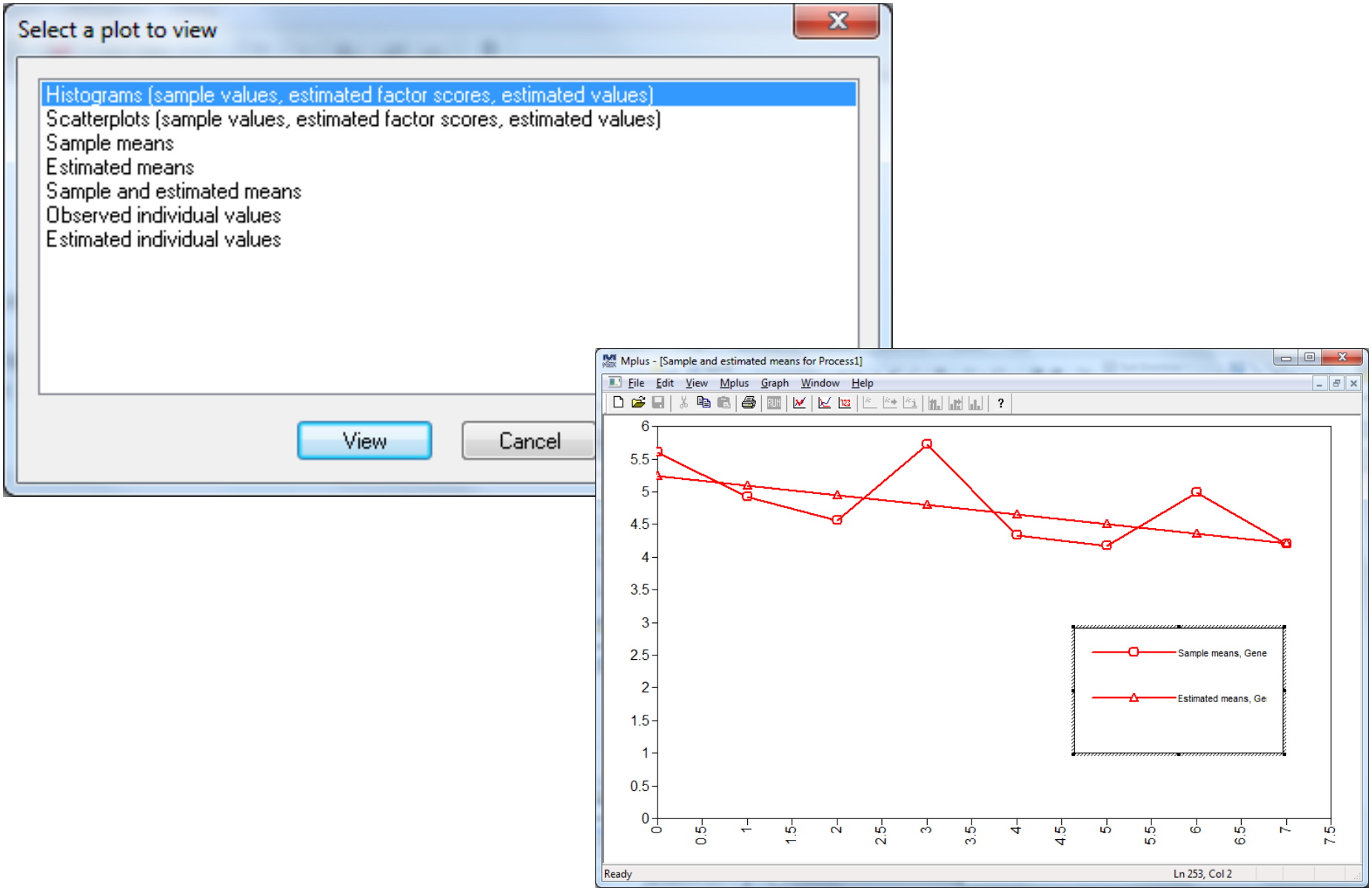
model: i s | d1@0 d2@1 d3@2 d4@3 d5@4 d6@5 d7@6 d8@7;



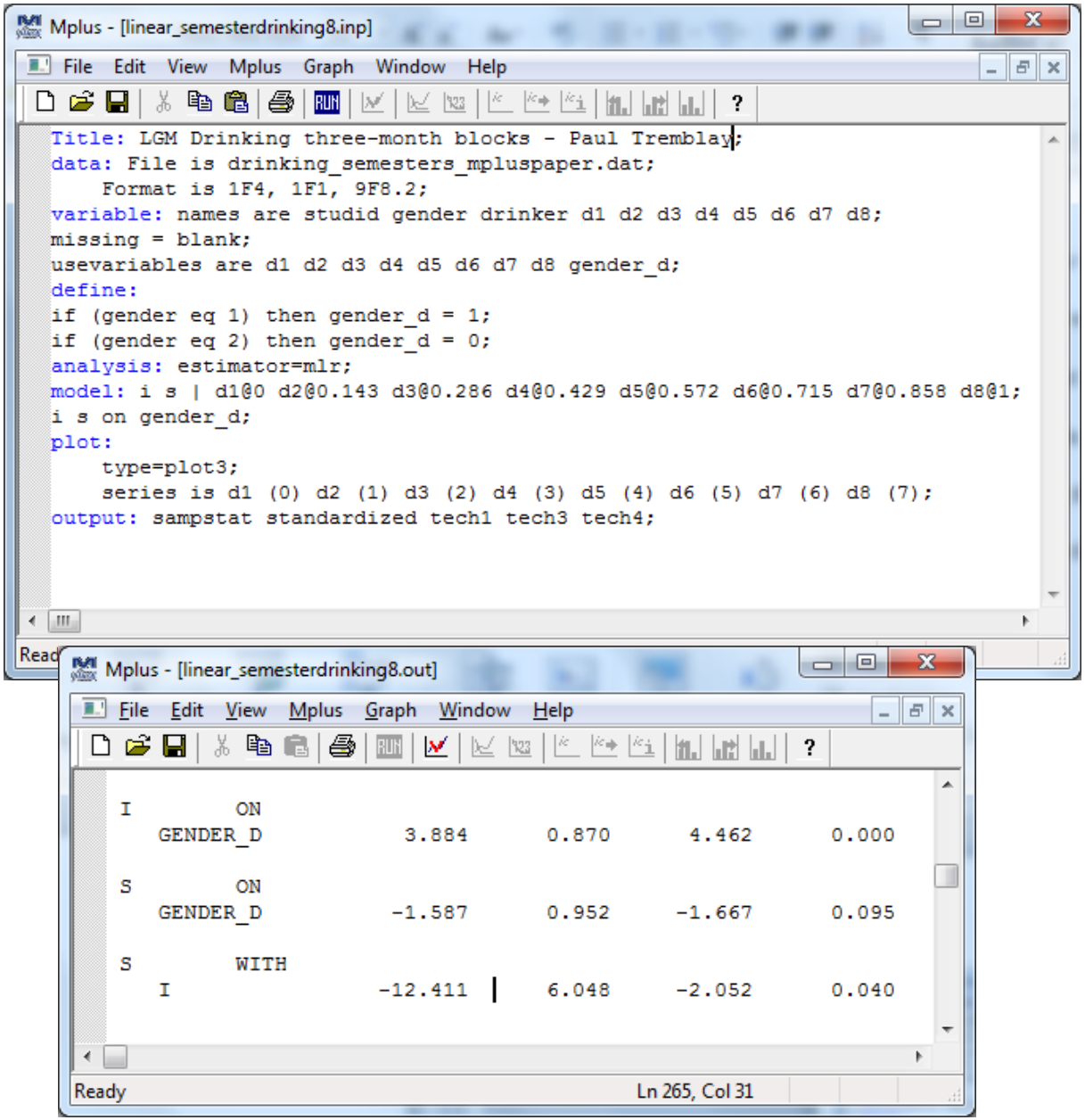
MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
I |				
D1	1.000	0.000	999.000	999.000
D2	1.000	0.000	999.000	999.000
D3	1.000	0.000	999.000	999.000
D4	1.000	0.000	999.000	999.000
D5	1.000	0.000	999.000	999.000
D6	1.000	0.000	999.000	999.000
D7	1.000	0.000	999.000	999.000
D8	1.000	0.000	999.000	999.000
S |				
D1	0.000	0.000	999.000	999.000
D2	1.000	0.000	999.000	999.000
D3	2.000	0.000	999.000	999.000
D4	3.000	0.000	999.000	999.000
D5	4.000	0.000	999.000	999.000
D6	5.000	0.000	999.000	999.000
D7	6.000	0.000	999.000	999.000
D8	7.000	0.000	999.000	999.000
S WITH				
I	-1.959	0.951	-2.059	0.039
Means				
I	5.245	0.349	15.033	0.000
S	-0.148	0.049	-3.037	0.002
Variances				
I	36.511	6.855	5.326	0.000
S	0.502	0.142	3.533	0.000

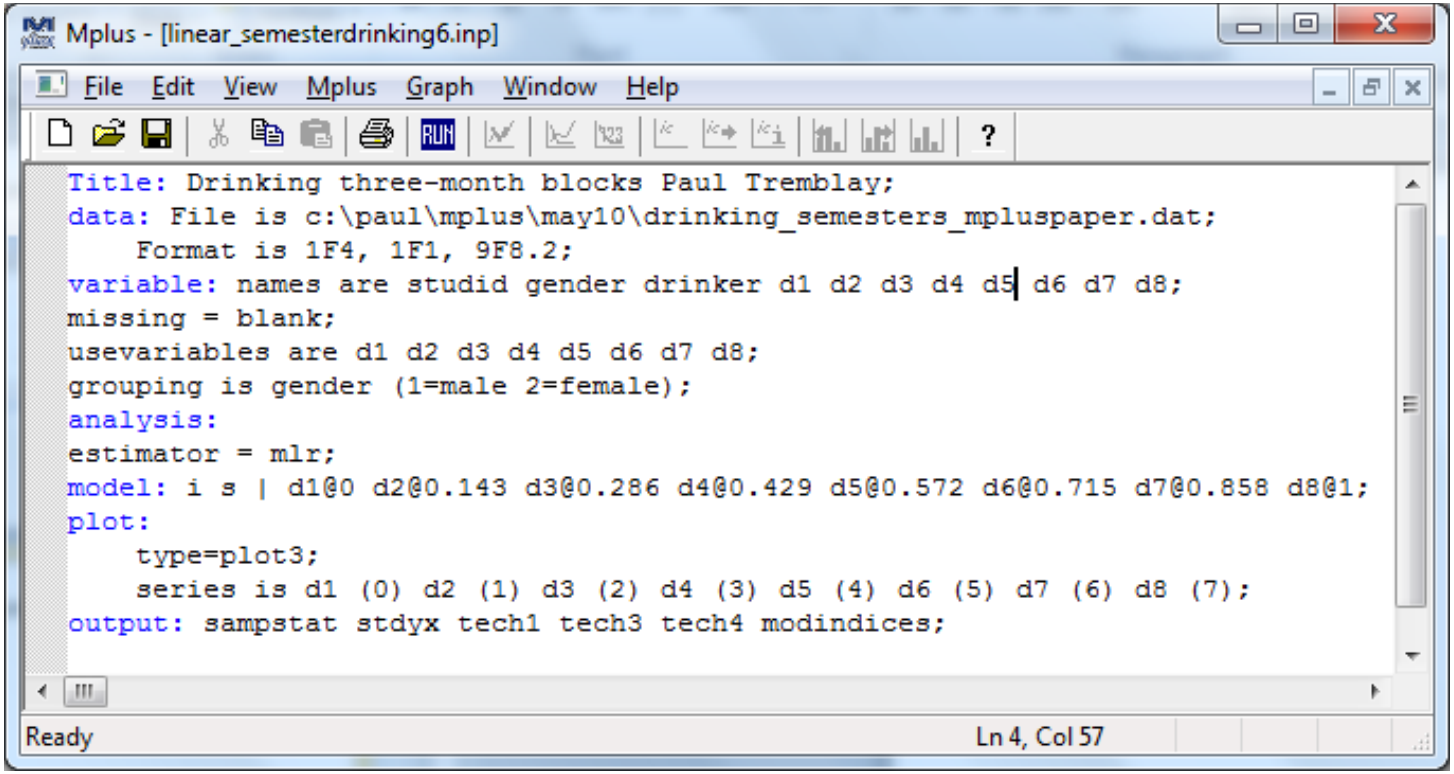
LGM Drinking Example



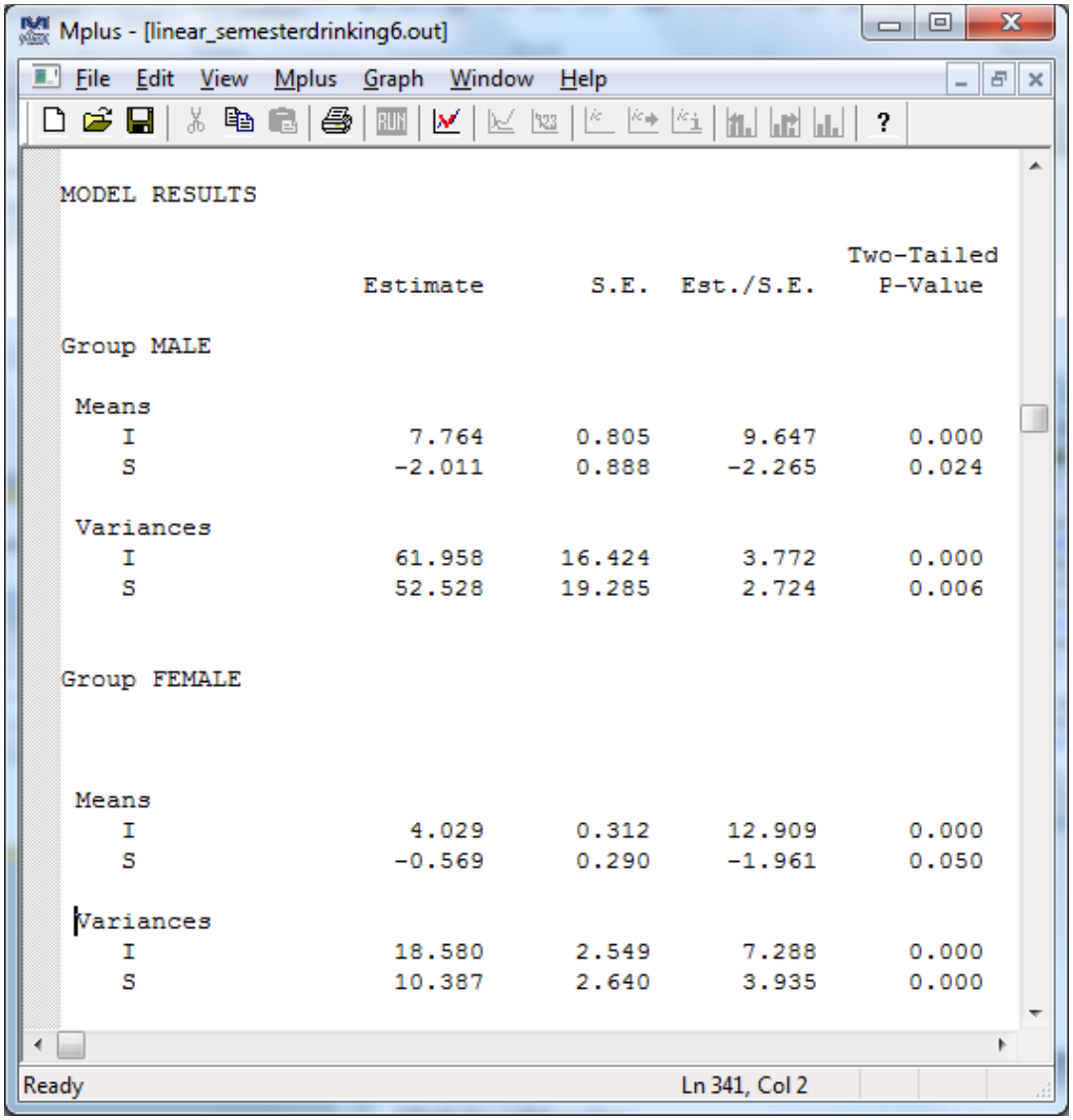
LGM with Intercept and Slope Regressed on Gender



LGM Multiple groups (Gender)



LGM Multiple groups (Gender)



LGM Multiple groups (Gender)