Supplemental Material for Cross-Lagged Panel Modeling with Binary and Ordinal Outcomes

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1 Mplus input scripts

Mplus input for key analyses.

Table 1: Univariate analysis of abstinence using unrestricted model

```
                USEVARIABLES = z1-z8;
                CATEGORICAL = z1-z8;

DEFINE:         CUT z1-z8 (0.5);

ANALYSIS:       ESTIMATOR = BAYES;
                BITERATIONS = (5000);
                THIN = 10;
                PROCESSORS = 8;
MODEL:          z1-z8 WITH z1-z8;

OUTPUT:         STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:           TYPE = PLOT3;
```

Table 2: Univariate analysis of abstinence using RI-AR2

```
                USEVARIABLES = z1-z8;
                CATEGORICAL = z1-z8;

DEFINE:         CUT z1-z8 (0.5);

ANALYSIS:       ESTIMATOR = BAYES;
                BITERATIONS = (5000);
                THIN = 10;
                PROCESSORS = 8;

MODEL:          i BY z1-z8@1;
                z2^-z8^ PON z1^-z7^;
                z3^-z8^ PON z1^-z6^;

OUTPUT:         STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:           TYPE = PLOT3;
```

Table 3: Bivariate analysis of stress and abstinence using RI-CLPM2

```
                USEVARIABLES = y2-y9 z2-z9; ! y is stress, z is alcohol risk
                CATEGORICAL = z2-z9;

DEFINE:         CUT z2-z9(0.5);

ANALYSIS:       ESTIMATOR = BAYES;
                BITERATIONS = (5000);
                PROCESSORS = 8;
                THIN = 10;

MODEL:          iz BY z2-z9@1;
                z3^-z9^ PON on z2^-z8^;
                z4^-z9^ PON z2^-z7^;
                iy BY y2-y9@1;
                y3^-y9^ PON y2^-y8^;
                y4^-y9^ PON y2^-y7^;

                y3^-y9^ PON z2^-z8^;
                z3^-z9^ PON y2^-y8^;

                y2^-y9^ PWITH z2^-z9^;

OUTPUT:         STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:           TYPE = PLOT3;
```

Table 4: Bivariate analysis of stress and abstinence using RI-RCLPM

	USEVARIABLES = y2-y9 z2-z9; ! y is stress, z is alcohol risk CATEGORICAL = z2-z9;
DEFINE:	CUT z2-z9(0.5);
ANALYSIS:	ESTIMATOR = WLSMV; PARAMETERIZATION = THETA; STARTS = 20; BOOTSTRAP = 500;
MODEL:	iz BY z2-z9@1; z3^-z9^ PON z2^-z8^; z4^-z9^ PON z2^-z7^; iy by y2-y9@1; y3^-y9^ PON y2^-y8^; y4^-y9^ PON y2^-y7^; y3^-y9^ PON z2^-z8^; z3^-z9^ PON y2^-y8^; y3^-y9^ PON z3^-z9^ (ryz); z3^-z9^ PON y3^-y9^ (rzy); y2^ WITH z2^;
MODEL CONSTRAINT:	! Restriction (a): 0<ryz*rzy; 0<1-ryz*rzy;
OUTPUT:	STANDARDIZED RESIDUAL TECH1 TECH10; CINTERVAL(BOOTSTRAP);
PLOT:	TYPE = PLOT3;

Table 5: Bivariate analysis of stress and abstinence using RI-RLPM

```
                USEVARIABLES = y2-y9 z2-z9; ! y is stress, z is alcohol risk
                CATEGORICAL = z2-z9;

DEFINE:         CUT z2-z9(0.5);

ANALYSIS:       ESTIMATOR = WLSMV;
                PARAMETERIZATION = THETA;
                STARTS = 20;
                BOOTSTRAP = 500;

MODEL:          iz BY z2-z9@1;
                z3^-z9^ PON z2^-z8^;
                z4^-z9^ PON z2^-z7^;
                iy by y2-y9@1;
                y3^-y9^ PON y2^-y8^;
                y4^-y9^ PON y2^-y7^;

                ! y3^-y9^ PON z2^-z8^;
                ! z3^-z9^ PON y2^-y8^;

                y3^-y9^ PON z3^-z9^ (ryz);
                z3^-z9^ PON y3^-y9^ (rzy);

                y2^ WITH z2^;

                y3^-y9^ PWITH z3^-z9^;

OUTPUT:         STANDARDIZED RESIDUAL TECH1 TECH10;

                CINTERVAL(BOOTSTRAP);

PLOT:           TYPE = PLOT3;
```

Table 6: Bivariate analysis of stress and abstinence using single-direction lag 0

```
                USEVARIABLES = y2-y9 z2-z9; ! y is stress, z is alcohol risk
                CATEGORICAL = z2-z9;

DEFINE:         CUT z2-z9(0.5);

ANALYSIS:       ESTIMATOR = WLSMV;
                PARAMETERIZATION = THETA;
                STARTS = 20;

MODEL:          iz BY z2-z9@1;
                z3^-z9^ PON z2^-z8^;
                z4^-z9^ PON z2^-z7^;
                iy by y2-y9@1;
                y3^-y9^ PON y2^-y8^;
                y4^-y9^ PON y2^-y7^;

                y3^-y9^ PON z2^-z8^;
                z3^-z9^ PON y2^-y8^;

                ! y2^-y9^ PWITH z2^-z9^;

                y2^ WITH z2^;
                y3^-y9^ PON z3^-z9^ (lag0);

OUTPUT:         STANDARDIZED RESIDUAL TECH1 TECH10;

PLOT:           TYPE = PLOT3;
```

Table 7: Univariate analysis of alcohol risk using unrestricted regular ordinal probit

```
                USEVARIABLES = z1-z8;
                CATEGORICAL = z1-z8;

ANALYSIS:       ESTIMATOR = BAYES;
                BITERATIONS = (5000);
                THIN = 10;
                PROCESSORS = 8;

MODEL:          z1-z8 WITH z1-z8;

OUTPUT:         STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:           TYPE = PLOT3;
```

Table 8: Univariate analysis of alcohol risk using regular ordinal probit RI-AR2

```
                USEVARIABLES = z1-z8;
                CATEGORICAL = z1-z8;

ANALYSIS:       ESTIMATOR = BAYES;
                BITERATIONS = (5000);
                THIN = 10;
                PROCESSORS = 8;

MODEL:          i BY z1-z8@1;
                z2^-z8^ PON z1^-z7^;
                z3^-z8^ PON z1^-z6^;

OUTPUT:         STANDARDIZED RESIDUAL TECH8 TECH10;
PLOT:           TYPE = PLOT3;
```

Table 9: Univariate analysis of alcohol risk using unrestricted two-part ordinal

```
                USEVARIABLES = u1-u8 p1-p8;
                CATEGORICAL = u1-u8 p1-p8;

DATA TWOPART:   NAMES = z1-z8;
                BINARY = u1-u8;
                CONTINUOUS = p1-p8;
                CUTPOINT = 0;
                TRANSFORM = NONE;

ANALYSIS:       ESTIMATOR = BAYES;
                BITERATIONS = (10000);
                THIN = 10;
                PROCESSORS = 8;

MODEL:          u1-u8 WITH u1-u8;
                p1-p8 WITH p1-p8;
                p1^-p8^ ON u1^-u8^;
                p1^-p8^ PON u1^-u8^@0;

OUTPUT:         STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:           TYPE = PLOT3;
```

Table 10: Univariate analysis of alcohol risk using two-part ordinal RI-AR2

```
                    USEVARIABLES = u1-u8 p1-p8;
                    CATEGORICAL = u1-u8 p1-p8;

DATA TWOPART:       NAMES = z1-z8;
                    BINARY = u1-u8;
                    CONTINUOUS = p1-p8;
                    CUTPOINT = 0;
                    TRANSFORM = NONE;

ANALYSIS:           ESTIMATOR = BAYES;
                    BITERATIONS = (10000);
                    THIN = 10;
                    PROCESSORS = 8;

MODEL:              ib BY u1-u8@1;
                    ip BY p1-p8@1;
                    u2^-u8^ PON u1^-u7^;
                    u3^-u8^ PON u1^-u6^;
                    p2^-p8^ PON p1^-p7^;
                    p3^-p8^ PON p1^-p6^;
                    ! u1-u5 PWITH p1-p5;

OUTPUT:             STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:               TYPE = PLOT3;
```

Table 11: Bivariate analysis of stress and alcohol risk using two-part ordinal RI-CLPM

```
                    USEVARIABLES = y1-y8 u1-u8 p1-p8;
                    CATEGORICAL = u1-u8 p1-p8;

DATA TWOPART:       NAMES = z1-z8;
                    BINARY = u1-u8;
                    CONTINUOUS = p1-p8;
                    CUTPOINT = 0;
                    TRANSFORM = none;

ANALYSIS:           ESTIMATOR = BAYES;
                    BITERATIONS = (10000);
                    ! FBITERATIONS = 200;
                    THIN = 10;
                    PROCESSORS = 8;
                    ALGORITHM = GIBBS(RW);

MODEL:              iy BY y1-y8@1;
                    ib BY u1-u8@1;
                    ip BY p1-p8@1;

                    ! univariates:
                    y2^-y8^ PON y1^-y7^;
                    y3^-y8^ PON y1^-y6^;

                    u2^-u8^ PON u1^-u7^;
                    u3^-u8^ PON u1^-u6^;

                    p2^-p8^ PON p1^-p7^;
                    p3^-p8^ PON p1^-p6^;

                    ! bivariates:
                    y2^-y8^ PON u1^-u7^;
                    y2^-y8^ PON p1^-p7^;

                    u2^-u8^ PON y1^-y7^;
                    p2^-p8^ PON y1^-y7^;

                    ! covariances:
                    y1^-y8^ PWITH u1^-u8^;
                    y1^-y8^ PWITH p1^-p8^;

OUTPUT:             STANDARDIZED RESIDUAL TECH8 TECH10;
PLOT:               TYPE = PLOT3;
```

Table 12: Bivariate analysis of stress and alcohol risk treatment effects using two-part ordinal RI-CLPM

```
                    USEVARIABLES = y1-y8 u1-u8 p1-p8;
                    CATEGORICAL = u1-u8 p1-p8;
                    CLASSES = c(9);
                    KNOWNCLASS = c(cCell = 1-9);

DATA TWOPART:       NAMES = z1-z8;
                    BINARY = u1-u8;
                    CONTINUOUS = p1-p8;
                    CUTPOINT = 0;
                    TRANSFORM = NONE;

ANALYSIS:           TYPE = MIXTURE;
                    ESTIMATOR = BAYES;
                    BITERATIONS = (5000);
                    THIN = 10;
                    PROCESSORS = 8;
                    ALGORITHM = GIBBS(RW);

MODEL:              %OVERALL%
                    iy BY y1-y8@1;
                    ib BY u1-u8@1;
                    ip BY p1-p8@1;

                    ! univariates:
                    y2^-y8^ PON y1^-y7^;
                    y3^-y8^ PON y1^-y6^;
                    u2^-u8^ PON u1^-u7^;
                    u3^-u8^ PON u1^-u6^;
                    p2^-p8^ PON p1^-p7^;
                    p3^-p8^ PON p1^-p6^;

                    ! bivariates:
                    y2^-y8^ PON u1^-u7^;
                    y2^-y8^ PON p1^-p7^;
                    u2^-u8^ PON y1^-y7^;
                    p2^-p8^ PON y1^-y7^;

                    ! covariances:
                    y1^-y8^ PWITH u1^-u8^;
                    y1^-y8^ PWITH p1^-p8^;

                    %c#1%
                    [iy@0 ib@0 ip@0];
                    %c#9%
                    [iy ib ip];

OUTPUT:             STANDARDIZED RESIDUAL TECH8 TECH10;

PLOT:               TYPE = PLOT3;
```