ONLINE APPENDIX

Online Appendix for Sterba, S.K. (2014). Handling missing covariates in conditional mixture models under missing at random assumptions. *Multivariate Behavioral Research, 49,* 614-632. Tables A.1-A.7

Online Appendix Table A.1. Comparison of the conventional multivariate, endogenous-constrained-*x*, and exogenous-*x* approaches using complete-case data and simulation parameters from Arminger et al. (1999): Results shown for a single sample of N=50,000

		Estimate (SE) for a single sample of N=50,000		
Parameter	Generating value	Conventional multivariate mixture	Conditional mixture: Endogenous-constrained-*x*	Conditional mixture: Exogenous-*x*
Class 1				
intercept ($\mu^{(1)}$)	-.5	-.045 *(.014)*	-.497 *(.006)*	-.497 *(.006)*
slope of y on x_1 ($\gamma_1^{(1)}$)	-1	-.064 *(.017)*	-1.002 *(.005)*	-1.002 *(.005)*
slope of y on x_2 ($\gamma_2^{(1)}$)	-1.5	-.097 *(.020)*	-1.497 *(.005)*	-1.497 *(.005)*
slope of y on x_3 ($\gamma_3^{(1)}$)	.5	.048 *(.017)*	.500 *(.005)*	.500 *(.005)*
residual variance ($\sigma^{2(1)}$)	.5	1.174 *(.011)*	.499 *(.006)*	.499 *(.006)*
Class 2				
Intercept ($\mu^{(2)}$)	.5	-.023 *(.032)*	.503 *(.008)*	.503 *(.008)*
slope of y on x_1 ($\gamma_1^{(2)}$)	1	.029 *(.018)*	.999 *(.007)*	.999 *(.007)*
slope of y on x_2 ($\gamma_2^{(2)}$)	1.5	.043 *(.019)*	1.505 *(.007)*	1.505 *(.007)*
slope of y on x_3 ($\gamma_3^{(2)}$)	-.5	.018 *(.018)*	-.502 *(.007)*	-.502 *(.007)*
residual variance ($\sigma^{2(2)}$)	1	9.757 *(.107)*	1.019 *(.011)*	1.019 *(.011)*
multinomial intercept ($\alpha^{(1)}$ *)	0	.467 *(.012)*	.006 *(.013)*	.006 *(.013)*

Notes. *= Generating multinomial intercept of 0 in class 1 implies class proportions of .50/.50. The estimated class 1 multinomial intercept of .467 implies class proportions of .61/.39. The estimated class 1 multinomial intercept of .006 implies proportions .50/.50.

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Online Appendix Table A.2

Exogenous *x*- approach with 35% missingness: Estimate, Analytic Standard Error, Empirical Standard Deviation
Percent Absolute Relative Bias, and Percent Standardized Bias for each individual parameter

		Normal *x's*										Nonnormal *x'* s									
		MAR					MCAR					MAR					MCAR				
Parameter	True	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB
Growth coeff.																					
Class 1-Intercept	4	3.77	0.18	0.17	5.63	-128.56	4.00	0.13	0.13	0.01	0.15	3.78	0.17	0.17	5.51	-131.64	4.01	0.16	0.13	0.15	3.86
Class 1-Linear	0.1	0.23	0.14	0.13	134.90	98.40	0.10	0.10	0.10	0.50	0.49	0.23	0.13	0.13	133.20	102.78	0.10	0.11	0.10	2.80	-2.56
Class 1-Quadratic	-0.02	-0.04	0.02	0.02	85.50	-77.03	-0.02	0.02	0.02	1.00	-1.23	-0.04	0.02	0.02	86.50	-83.98	-0.02	0.02	0.02	1.50	1.83
Class 2-Intercept	2.7	2.54	0.09	0.09	6.09	-187.56	2.70	0.08	0.09	0.07	2.55	2.53	0.10	0.09	6.24	-161.77	2.69	0.12	0.08	0.30	-6.84
Class 2-Linear	-0.3	-0.20	0.06	0.07	34.17	159.66	-0.30	0.06	0.07	0.03	0.17	-0.20	0.07	0.07	34.47	150.07	-0.30	0.08	0.06	1.27	4.73
Class 2-Quadratic	-0.03	-0.04	0.01	0.01	45.00	-132.35	-0.03	0.01	0.01	0.33	-1.10	-0.04	0.01	0.01	44.33	-126.67	-0.03	0.01	0.01	1.33	-3.42
Class 3-Intercept	1	0.90	0.12	0.12	10.46	-87.83	1.00	0.13	0.13	0.07	-0.53	0.90	0.13	0.12	9.54	-73.05	1.00	0.15	0.13	0.03	-0.21
Class 3-Linear	0.25	0.31	0.09	0.09	23.72	65.24	0.25	0.10	0.10	1.72	-4.25	0.31	0.09	0.09	22.80	64.92	0.25	0.10	0.10	0.44	1.13
Class 3-Quadratic	0.05	0.04	0.01	0.01	14.60	-50.00	0.05	0.02	0.02	1.80	5.56	0.04	0.01	0.01	14.40	-53.33	0.05	0.01	0.02	0.40	-1.36
Class 4-Intercept	0.03	-0.04	0.07	0.08	233.33	-102.34	0.02	0.08	0.09	31.33	-11.81	-0.03	0.09	0.07	191.00	-63.18	0.04	0.12	0.08	24.33	5.89
Class 4-Linear	0.01	0.05	0.05	0.06	431.00	85.52	0.02	0.06	0.07	51.00	8.99	0.05	0.06	0.06	362.00	65.58	0.00	0.08	0.06	52.00	-6.82
Class 4-Quadratic	0	-0.01	0.01	0.01	--	-70.89	0.00	0.01	0.01	--	-6.74	0.00	0.01	0.01	--	-55.29	0.00	0.01	0.01	--	6.31
Multinomial coeff.																					
Class 1-Intercept	-1	-1.87	0.72	0.29	87.38	-120.64	-1.15	0.79	0.24	15.42	-19.55	-1.80	0.26	0.27	79.82	-307.24	-1.04	0.21	0.22	4.20	-19.80
Class 1-Slope x1	1	1.13	0.43	0.26	13.40	31.30	1.14	0.47	0.23	13.73	29.19	1.04	0.24	0.24	4.07	16.78	1.04	0.23	0.23	4.07	17.62
Class 1-Slope x2	-0.75	-0.84	0.34	0.25	12.51	-27.56	-0.86	0.33	0.22	14.67	-33.24	-0.87	0.41	0.39	16.35	-30.21	-0.82	0.32	0.30	9.85	-22.88
Class 2-Intercept	0.1	-0.28	0.37	0.15	384.90	-103.69	0.12	0.38	0.15	15.90	4.15	-0.30	0.13	0.15	395.20	-292.96	0.11	0.12	0.15	7.20	6.14
Class 2-Slope x1	0.5	0.54	0.24	0.16	8.28	17.31	0.54	0.24	0.16	7.72	16.38	0.52	0.21	0.21	3.58	8.53	0.52	0.23	0.21	3.46	7.68
Class 2-Slope x2	-0.25	-0.27	0.18	0.15	6.60	-9.29	-0.27	0.18	0.15	6.76	-9.29	-0.26	0.15	0.15	5.92	-9.87	-0.26	0.14	0.14	5.68	-9.84
Class 3-Intercept	-0.8	-0.92	0.31	0.18	14.64	-37.36	-0.80	0.33	0.19	0.17	-0.43	-0.93	0.18	0.18	16.73	-74.92	-0.83	0.19	0.19	3.65	-15.48
Class 3-Slope x1	0.75	0.79	0.29	0.19	5.45	14.22	0.78	0.30	0.20	3.96	9.90	0.78	0.22	0.22	4.53	15.58	0.78	0.24	0.24	3.69	11.32
Class 3-Slope x2	-0.5	-0.52	0.20	0.18	3.92	-9.92	-0.51	0.22	0.19	2.50	-5.79	-0.55	0.23	0.23	9.24	-20.17	-0.55	0.25	0.24	10.42	-20.58
Residual variance	1	0.99	0.03	0.03	1.01	-33.67	1.00	0.03	0.03	0.39	-12.96	0.99	0.03	0.03	1.05	-36.33	1.00	0.03	0.03	0.48	-17.14

Notes. Multinomial coefficients (intercepts and slopes) are fixed in the last (reference) class for identification purposes. Multinomial coefficients are used to calculate class membership probabilities. Coeff.= Coefficient. Residual variance was held to be equal across-time and across-class. Est=across-samples average of the estimate. True =generating parameter. SD=Empirical repeated-sampling standard deviation of the estimate. SE=average analytic standard error of the estimate. MAR=Missing at random. MCAR= Missing completely at random. %SB=Percent Standardized Bias: ((Est-True)/SD)×100. %ARB=Percent Absolute Relative Bias: |((Est-True)/True)×100|.

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Online Appendix Table A.3

Endogenous-constrained *x*- approach with 35% missingness: Estimate, Analytic Standard Error, Empirical Standard Deviation
Percent Absolute Relative Bias, and Percent Standardized Bias for each individual parameter

		Normal *x's*										Nonnormal *x'* s									
		MAR					MCAR					MAR					MCAR				
Parameter	True	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB
Growth coeff.																					
Class 1-Intercept	4	4.00	0.10	0.11	0.06	-2.37	4.00	0.10	0.11	0.06	-2.37	4.00	0.11	0.11	0.04	1.49	4.00	0.11	0.11	0.03	0.96
Class 1-Linear	0.1	0.10	0.08	0.08	2.90	3.75	0.10	0.08	0.08	2.80	3.62	0.10	0.08	0.08	3.80	-4.69	0.10	0.08	0.08	3.70	-4.57
Class 1-Quadratic	-0.02	-0.02	0.01	0.01	2.00	-3.28	-0.02	0.01	0.01	2.00	-3.28	-0.02	0.01	0.01	3.50	5.60	-0.02	0.01	0.01	3.50	5.60
Class 2-Intercept	2.7	2.70	0.06	0.07	0.04	1.82	2.70	0.06	0.07	0.04	1.82	2.69	0.08	0.07	0.19	-6.10	2.69	0.08	0.07	0.20	-6.35
Class 2-Linear	-0.3	-0.30	0.04	0.05	0.47	3.22	-0.30	0.04	0.05	0.43	2.99	-0.30	0.05	0.05	0.83	4.93	-0.30	0.05	0.05	0.83	4.95
Class 2-Quadratic	-0.03	-0.03	0.01	0.01	1.00	-4.29	-0.03	0.01	0.01	1.00	-4.29	-0.03	0.01	0.01	0.67	-2.63	-0.03	0.01	0.01	0.67	-2.67
Class 3-Intercept	1	1.00	0.10	0.10	0.49	-4.76	1.00	0.10	0.10	0.49	-4.77	1.00	0.11	0.10	0.26	2.30	1.00	0.11	0.10	0.21	1.86
Class 3-Linear	0.25	0.25	0.08	0.08	0.44	-1.41	0.25	0.08	0.08	0.44	-1.41	0.25	0.07	0.08	0.60	-2.07	0.25	0.07	0.08	0.64	-2.21
Class 3-Quadratic	0.05	0.05	0.01	0.01	1.00	3.97	0.05	0.01	0.01	1.00	3.97	0.05	0.01	0.01	0.40	1.80	0.05	0.01	0.01	0.40	1.80
Class 4-Intercept	0.03	0.03	0.06	0.07	15.33	-7.67	0.03	0.06	0.07	16.00	-7.99	0.04	0.09	0.07	29.33	10.14	0.04	0.09	0.07	28.67	9.89
Class 4-Linear	0.01	0.01	0.05	0.05	38.00	8.43	0.01	0.05	0.05	39.00	8.63	0.01	0.05	0.05	49.00	-9.50	0.01	0.05	0.05	49.00	-9.48
Class 4-Quadratic	0	0.00	0.01	0.01	--	-7.04	0.00	0.01	0.01	--	-7.04	0.00	0.01	0.01	--	7.69	0.00	0.01	0.01	--	7.69
Multinomial coeff.																					
Class 1-Intercept	-1	-1.11	0.68	0.23	11.49	-16.90	-1.14	0.74	0.21	14.00	-18.99	-1.38	0.53	0.31	38.33	-72.47	-1.05	0.19	0.19	4.93	-26.03
Class 1-Slope x1	1	1.10	0.41	0.25	10.16	24.50	1.12	0.46	0.22	12.01	26.33	1.08	0.26	0.25	7.84	29.74	1.02	0.23	0.23	1.71	7.58
Class 1-Slope x2	-0.75	-0.82	0.33	0.24	8.85	-20.25	-0.85	0.33	0.21	13.09	-30.02	-1.33	0.88	0.49	77.73	-66.44	-0.80	0.31	0.29	6.72	-16.15
Class 2-Intercept	0.1	0.11	0.36	0.12	10.40	2.91	0.11	0.36	0.12	11.80	3.32	0.10	0.10	0.12	1.50	-1.54	0.10	0.10	0.12	2.00	-1.98
Class 2-Slope x1	0.5	0.54	0.24	0.16	7.66	16.17	0.53	0.23	0.16	6.34	13.68	0.57	0.23	0.22	13.96	30.11	0.50	0.22	0.21	0.20	0.46
Class 2-Slope x2	-0.25	-0.27	0.18	0.15	6.32	-8.97	-0.26	0.18	0.15	5.80	-8.02	-0.22	0.13	0.14	12.92	24.29	-0.26	0.14	0.14	4.56	-8.02
Class 3-Intercept	-0.8	-0.81	0.30	0.16	0.97	-2.57	-0.81	0.31	0.16	1.05	-2.75	-0.82	0.15	0.16	2.89	-15.15	-0.84	0.16	0.16	4.81	-23.99
Class 3-Slope x1	0.75	0.79	0.28	0.19	4.87	12.82	0.77	0.30	0.20	2.60	6.57	0.82	0.23	0.22	9.71	31.18	0.76	0.24	0.23	1.11	3.49
Class 3-Slope x2	-0.5	-0.52	0.20	0.18	3.44	-8.74	-0.51	0.21	0.19	1.48	-3.45	-0.50	0.20	0.21	0.10	0.26	-0.54	0.25	0.24	8.82	-17.77
Residual variance	1	1.00	0.02	0.02	0.27	-11.44	1.00	0.02	0.02	0.27	-11.44	1.00	0.02	0.02	0.27	-11.95	1.00	0.02	0.02	0.27	-11.95

Notes. Multinomial coefficients (intercepts and slopes) are fixed in the last (reference) class for identification purposes. Multinomial coefficients are used to calculate class membership probabilities. Coeff.= Coefficient. Residual variance was held to be equal across-time and across-class. %ARB, %SB, Est., SD, SE, MAR, and MCAR were defined in the Table A.2 notes.

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Online Appendix Table A.4

Exogenous *x*- approach with 15% missingness: Estimate, Analytic Standard Error, Empirical Standard Deviation

Percent Absolute Relative Bias, and Percent Standardized Bias for each individual parameter

		Normal *x's*										Nonnormal *x'* s									
		MAR					MCAR					MAR					MCAR				
Parameter	True	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB
Growth coeff.																					
Class 1-Intercept	4	3.89	0.12	0.13	2.84	-91.98	4.00	0.11	0.12	0.09	-3.18	3.88	0.13	0.13	2.90	-88.41	4.00	0.13	0.11	0.03	0.87
Class 1-Linear	0.1	0.17	0.10	0.10	72.20	74.36	0.10	0.09	0.09	2.20	2.57	0.17	0.10	0.10	68.20	67.79	0.10	0.09	0.09	1.00	-1.11
Class 1-Quadratic	-0.02	-0.03	0.02	0.02	47.00	-61.04	-0.02	0.01	0.01	1.00	-1.47	-0.03	0.02	0.02	43.00	-54.09	-0.02	0.01	0.01	1.00	1.44
Class 2-Intercept	2.7	2.63	0.07	0.08	2.70	-105.50	2.70	0.07	0.08	0.02	-0.76	2.62	0.09	0.08	2.90	-86.15	2.69	0.10	0.07	0.23	-6.52
Class 2-Linear	-0.3	-0.25	0.05	0.06	15.70	94.77	-0.30	0.05	0.06	0.47	2.88	-0.25	0.06	0.06	15.53	79.52	-0.30	0.06	0.06	0.83	4.08
Class 2-Quadratic	-0.03	-0.04	0.01	0.01	20.67	-78.48	-0.03	0.01	0.01	0.67	-2.56	-0.04	0.01	0.01	19.33	-65.91	-0.03	0.01	0.01	0.67	-2.20
Class 3-Intercept	1	0.96	0.11	0.11	4.38	-39.64	1.00	0.11	0.11	0.47	-4.14	0.96	0.11	0.11	3.83	-33.74	1.00	0.12	0.11	0.01	-0.08
Class 3-Linear	0.25	0.27	0.08	0.08	8.60	25.81	0.25	0.09	0.09	0.72	-2.11	0.27	0.08	0.08	9.40	31.04	0.25	0.08	0.09	0.24	0.75
Class 3-Quadratic	0.05	0.05	0.01	0.01	4.60	-17.29	0.05	0.01	0.01	1.20	4.38	0.05	0.01	0.01	6.00	-25.42	0.05	0.01	0.01	0.20	-0.82
Class 4-Intercept	0.03	0.00	0.06	0.07	95.00	-45.75	0.02	0.07	0.07	19.00	-8.65	0.01	0.09	0.07	53.33	-18.16	0.04	0.10	0.07	24.33	7.34
Class 4-Linear	0.01	0.03	0.05	0.05	177.00	37.58	0.01	0.05	0.06	42.00	8.64	0.02	0.05	0.05	94.00	17.60	0.01	0.06	0.06	49.00	-8.13
Class 4-Quadratic	0	0.00	0.01	0.01	--	-31.08	0.00	0.01	0.01	--	-6.49	0.00	0.01	0.01	--	-14.81	0.00	0.01	0.01	--	6.67
Multinomial coeff.																					
Class 1-Intercept	-1	-1.43	0.68	0.22	42.93	-63.45	-1.13	0.71	0.21	12.77	-18.02	-1.37	0.20	0.20	36.65	-180.19	-1.04	0.18	0.19	3.63	-19.86
Class 1-Slope x1	1	1.11	0.40	0.21	10.64	26.78	1.13	0.42	0.20	12.56	30.13	1.03	0.21	0.20	3.08	14.79	1.03	0.20	0.20	3.14	15.55
Class 1-Slope x2	-0.75	-0.83	0.28	0.20	10.72	-28.87	-0.84	0.29	0.19	12.23	-32.18	-0.83	0.31	0.29	10.67	-25.69	-0.81	0.28	0.26	8.44	-22.91
Class 2-Intercept	0.1	-0.04	0.35	0.13	141.70	-39.95	0.11	0.36	0.13	13.90	3.81	-0.06	0.11	0.13	159.20	-150.90	0.10	0.10	0.13	2.60	2.56
Class 2-Slope x1	0.5	0.54	0.22	0.14	8.12	18.29	0.54	0.22	0.14	8.58	19.14	0.51	0.19	0.18	2.30	6.15	0.51	0.19	0.19	2.90	7.60
Class 2-Slope x2	-0.25	-0.27	0.16	0.13	9.04	-14.43	-0.27	0.16	0.13	7.72	-11.92	-0.26	0.13	0.12	4.72	-9.21	-0.26	0.13	0.12	3.16	-6.25
Class 3-Intercept	-0.8	-0.85	0.31	0.16	5.68	-14.68	-0.80	0.31	0.17	0.46	-1.18	-0.86	0.16	0.16	7.76	-38.19	-0.82	0.16	0.17	2.80	-14.01
Class 3-Slope x1	0.75	0.78	0.28	0.17	4.55	12.24	0.78	0.28	0.18	4.32	11.52	0.77	0.20	0.20	2.55	9.58	0.77	0.21	0.20	3.03	11.02
Class 3-Slope x2	-0.5	-0.52	0.19	0.16	3.82	-10.29	-0.52	0.20	0.17	3.78	-9.65	-0.53	0.20	0.20	5.92	-14.51	-0.53	0.21	0.21	6.44	-15.27
Residual variance	1	0.99	0.03	0.03	0.71	-27.41	1.00	0.03	0.03	0.32	-12.70	0.99	0.03	0.03	0.74	-29.37	1.00	0.02	0.03	0.33	-13.41

Notes. Multinomial coefficients (intercepts and slopes) are fixed in the last (reference) class for identification purposes. Multinomial coefficients are used to calculate class membership probabilities. Coeff.= Coefficient. Residual variance was held to be equal across-time and across-class. %ARB, %SB, Est., SD, SE, MAR, and MCAR were defined in the Table A.2 notes.

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Online Appendix Table A.5

Endogenous-constrained-*x* approach with 15% x-missingness: Estimate, Analytic Standard Error, Empirical Standard Deviation
Percent Absolute Relative Bias, and Percent Standardized Bias for each individual parameter

		Normal *x's*										Nonnormal *x*'s									
		MAR					MCAR					MAR					MCAR				
Parameter	True	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB	Est	SD	SE	%ARB	%SB
Growth coeff.																					
Class 1-Intercept	4	4.00	0.10	0.11	0.06	-2.47	4.00	0.10	0.11	0.06	-2.27	4.00	0.11	0.11	0.03	0.87	4.00	0.11	0.11	0.04	1.22
Class 1-Linear	0.1	0.10	0.08	0.08	2.80	3.62	0.10	0.08	0.08	2.80	3.63	0.10	0.08	0.08	3.70	-4.57	0.10	0.08	0.08	3.80	-4.69
Class 1-Quadratic	-0.02	-0.02	0.01	0.01	2.00	-3.28	-0.02	0.01	0.01	2.00	-3.28	-0.02	0.01	0.01	3.50	5.60	-0.02	0.01	0.01	3.50	5.60
Class 2-Intercept	2.7	2.70	0.06	0.07	0.04	1.82	2.70	0.06	0.07	0.05	2.16	2.69	0.08	0.07	0.19	-6.12	2.69	0.08	0.07	0.20	-6.47
Class 2-Linear	-0.3	-0.30	0.04	0.05	0.43	2.99	-0.30	0.04	0.05	0.43	2.99	-0.30	0.05	0.05	0.83	4.93	-0.30	0.05	0.05	0.83	4.93
Class 2-Quadratic	-0.03	-0.03	0.01	0.01	1.00	-4.29	-0.03	0.01	0.01	1.00	-4.29	-0.03	0.01	0.01	1.00	-3.95	-0.03	0.01	0.01	1.00	-3.95
Class 3-Intercept	1	1.00	0.10	0.10	0.50	-4.86	1.00	0.10	0.10	0.49	-4.76	1.00	0.11	0.10	0.19	1.68	1.00	0.11	0.10	0.18	1.60
Class 3-Linear	0.25	0.25	0.08	0.08	0.44	-1.41	0.25	0.08	0.08	0.40	-1.28	0.25	0.07	0.08	0.60	-2.07	0.25	0.07	0.08	0.56	-1.94
Class 3-Quadratic	0.05	0.05	0.01	0.01	1.00	3.97	0.05	0.01	0.01	1.00	3.97	0.05	0.01	0.01	0.40	1.80	0.05	0.01	0.01	0.40	1.80
Class 4-Intercept	0.03	0.03	0.06	0.07	15.00	-7.49	0.03	0.06	0.07	15.00	-7.50	0.04	0.09	0.07	29.67	10.24	0.04	0.09	0.07	29.33	10.10
Class 4-Linear	0.01	0.01	0.05	0.05	38.00	8.43	0.01	0.05	0.05	38.00	8.43	0.01	0.05	0.05	50.00	-9.69	0.01	0.05	0.05	49.00	-9.48
Class 4-Quadratic	0	0.00	0.01	0.01	--	-7.04	0.00	0.01	0.01	--	-7.04	0.00	0.01	0.01	--	7.69	0.00	0.01	0.01	--	7.69
Multinomial coeff.																					
Class 1-Intercept	-1	-1.11	0.66	0.20	10.50	-15.82	-1.12	0.69	0.20	12.05	-17.46	-1.10	0.24	0.21	10.15	-42.29	-1.04	0.17	0.18	4.02	-23.14
Class 1-Slope x1	1	1.10	0.39	0.20	9.74	24.70	1.12	0.41	0.19	12.06	29.12	1.05	0.21	0.20	5.24	24.44	1.02	0.20	0.20	2.49	12.49
Class 1-Slope x2	-0.75	-0.82	0.27	0.20	9.79	-26.81	-0.84	0.28	0.19	11.65	-30.86	-0.92	0.42	0.33	23.05	-40.75	-0.81	0.27	0.26	7.44	-20.58
Class 2-Intercept	0.1	0.11	0.35	0.12	12.20	3.46	0.11	0.36	0.12	13.40	3.76	0.10	0.10	0.12	0.90	-0.94	0.10	0.10	0.12	0.50	-0.52
Class 2-Slope x1	0.5	0.54	0.22	0.14	7.92	17.88	0.54	0.22	0.14	8.22	18.42	0.53	0.19	0.19	6.22	15.99	0.51	0.19	0.19	2.06	5.45
Class 2-Slope x2	-0.25	-0.27	0.16	0.13	8.88	-14.20	-0.27	0.16	0.13	7.24	-11.19	-0.25	0.12	0.12	1.84	3.80	-0.26	0.13	0.12	3.04	-6.00
Class 3-Intercept	-0.8	-0.81	0.30	0.16	1.06	-2.81	-0.81	0.30	0.16	0.86	-2.27	-0.82	0.15	0.15	2.64	-13.92	-0.83	0.15	0.16	3.46	-18.05
Class 3-Slope x1	0.75	0.78	0.28	0.17	4.45	12.00	0.78	0.28	0.18	3.93	10.53	0.79	0.20	0.20	4.91	18.08	0.77	0.20	0.20	2.39	8.81
Class 3-Slope x2	-0.5	-0.52	0.18	0.16	3.66	-9.92	-0.52	0.19	0.17	3.40	-8.73	-0.50	0.18	0.19	0.74	-2.01	-0.53	0.21	0.21	6.28	-14.95
Residual variance	1	1.00	0.02	0.02	0.27	-11.44	1.00	0.02	0.02	0.27	-11.44	1.00	0.02	0.02	0.27	-11.95	1.00	0.02	0.02	0.27	-11.89

Notes. Multinomial coefficients (intercepts and slopes) are fixed in the last (reference) class for identification purposes. Multinomial coefficients are used to calculate class membership probabilities. Coeff.= Coefficient. Residual variance was held to be equal across-time and across-class. %ARB, %SB, Est., SD, SE, MAR, and MCAR were defined in the Table A.2 notes.

ONLINE APPENDIX

Online Appendix Table A.6. Comparison of the conventional multivariate, endogenous-constrained-*x*, and exogenous-*x* approaches using complete-case data and parameters from Arminger et al. (1999) *with x's correlated at .60*: Results averaged across 500 repeated samples of N=500.

		Estimate (SE) averaged across repeated samples		
Parameter	Generating value	Conventional multivariate mixture	Conditional mixture: Endogenous-constrained-*x*	Conditional mixture: Exogenous-*x*
Class 1				
intercept ($\mu^{(1)}$)	-.5	-.009 *(.244)*	-.500 *(.057)*	-.500 *(.057)*
slope of y on x_1 ($\gamma_1^{(1)}$)	-1	-.255 *(.359)*	-.996 *(.067)*	-.996 *(.067)*
slope of y on x_2 ($\gamma_2^{(1)}$)	-1.5	-.042 *(.368)*	-1.501 *(.067)*	-1.501 *(.067)*
slope of y on x_3 ($\gamma_3^{(1)}$)	.5	.040 *(.375)*	.500 *(.071)*	.500 *(.071)*
residual variance ($\sigma^{2(1)}$)	.5	1.153 *(.101)*	.486 *(.060)*	.486 *(.060)*
Class 2				
Intercept ($\mu^{(2)}$)	.5	-.007 *(.267)*	.497 *(.079)*	.497 *(.079)*
slope of y on x_1 ($\gamma_1^{(2)}$)	1	.043 *(.198)*	1.001 *(.093)*	1.001 *(.093)*
slope of y on x_2 ($\gamma_2^{(2)}$)	1.5	-.003 *(.198)*	1.498 *(.094)*	1.498 *(.094)*
slope of y on x_3 ($\gamma_3^{(2)}$)	-.5	-.020 *(.199)*	-.496 *(.098)*	-.496 *(.098)*
residual variance ($\sigma^{2(2)}$)	1	9.298 *(.964)*	.982 *(.110)*	.982 *(.110)*
multinomial intercept ($\alpha^{(1)}$)	0	.291 *(.109)*	.002 *(.137)*	.002 *(.137)*

ONLINE APPENDIX

Online Appendix Table A.7. Comparison of the conventional multivariate, endogenous-constrained-*x*, and exogenous-*x* approaches using complete-case data and parameters from Arminger et al. (1999) *with x's correlated at .60*: Results shown for a single sample of N=500

		Estimate (SE) for a single sample		
Parameter	Generating value	Conventional multivariate mixture	Conditional mixture: Endogenous-constrained-*x*	Conditional mixture: Exogenous-*x*
Class 1				
intercept ($\mu^{(1)}$)	-.5	-.013 (*.178*)	-.566 (*.055*)	-.566 (*.055*)
slope of *y* on x_1 ($\gamma_1^{(1)}$)	-1	-.112 (*.238*)	-.927 (*.067*)	-.927 (*.067*)
slope of *y* on x_2 ($\gamma_2^{(1)}$)	-1.5	.296 (*.336*)	-1.503 (*.057*)	-1.503 (*.057*)
slope of *y* on x_3 ($\gamma_3^{(1)}$)	.5	.026 (*.333*)	.483 (*.064*)	.483 (*.064*)
residual variance ($\sigma^{2(1)}$)	.5	1.143 (*.100*)	.459 (*.053*)	.459 (*.053*)
Class 2				
Intercept ($\mu^{(2)}$)	.5	.041 (*.312*)	.399 (*.077*)	.399 (*.077*)
slope of *y* on x_1 ($\gamma_1^{(2)}$)	1	-.198 (*.227*)	.972 (*.086*)	.972 (*.086*)
slope of *y* on x_2 ($\gamma_2^{(2)}$)	1.5	-.057 (*.208*)	1.668 (*.087*)	1.668 (*.087*)
slope of *y* on x_3 ($\gamma_3^{(2)}$)	-.5	.059 (*.236*)	-.557 (*.102*)	-.557 (*.102*)
residual variance ($\sigma^{2(2)}$)	1	12.299 (*1.321*)	.998 (*.106*)	.998 (*.106*)
multinomial intercept ($\alpha^{(1)}$)	0	.470 *(.111)*	-.016 (*.133*)	-.016 (*.133*)