

Supplemental Materials

We conducted three additional sets of simulation analyses (S1, S2, & S3) to enhance the generalizability of the findings from our primary simulation study reported in the paper. The data generation procedure for all these additional simulations was identical to the one used in the primary simulation study; however, we purposely reduced the number of specific conditions to ease the loads of these additional analyses. In the following, we described the settings of each additional simulation that distinguished themselves from those used in the primary study.

In S1, we examined if the findings from the primary simulation study could be replicated using *a different set of the parameter values for the AR and CR coefficients*. The cluster-specific dynamic coefficients for the reference cluster were generated with the AR coefficients be 0.4 at lag 1 and 0.2 at lag 2, and the CR coefficients be 0 at both lag-1 and lag-2. For other clusters, the AR coefficients remained to be 0.4, and the CR coefficients were generated by adding or subtracting the predetermined distance values (0.1 & 0.2) from those in the reference cluster. The results were reported in Tables S1.1, S1.2, and S1.3.

In S2, we examined if the findings from the primary simulation study could be replicated *with the between-individual variations imposed on the AR and CR coefficients within clusters*. The parameter values for the cluster-specific coefficients were set identical to those used in S1. We sampled the person-specific coefficients of the AR and CR within each cluster from a normal distribution with a small variance of 0.01 for each element, instead of setting them to be identical across individuals as we did in the primary simulation study. The between-cluster distance values were still set be 0.1 and 0.2. The results were reported in Tables S2.1, S2.2, and S2.3.

In S3, we examined if the findings from the primary simulation study could be replicated *with the AR and CR coefficients drawn from normal distributions* instead of uniform distributions as we did in the primary simulation study. Specifically, for the reference cluster, the AR coefficients were drawn from a normal distribution $N(0.4, 0.01)$ at lag 1 and $N(0.2, 0.01)$ at lag 2, and the CR coefficients were drawn from a normal distribution $N(0, 0.01)$. For other clusters, the AR coefficients were generated using the same normal distributions as those used in the reference cluster; however, the CR coefficients were drawn from normal distributions $N(0.1, 0.01)$ or $N(0.2, 0.01)$ in a correspondence to the between-cluster distance values of 0.1 and 0.2. The results were reported in Tables S3.1, S3.2, and S3.3.

All these additional stimulations replicated the findings obtained from the primary simulation study. We summarized the replicated findings as follows:

1. Regarding the recovery on the number of clusters, the LO exhibited higher rates of recovery than the HO; in addition, the LO outperformed the HO even when all ILDs were generated by VAR (2) (See Tables S1.1, S2.1, and S3.1).
2. Regarding the recovery of the cluster membership, the LO consistently showed a superior performance over the HO (See Tables S1.2, S2.2, and S3.2).
3. Regarding the recovery of the cluster-specific dynamic coefficients, the HO performed better than the LO, except for the cases where all ILDs were generated by VAR (1). In addition, the performance of the LO decreased as the between-cluster distance increased and the proportion of effective coefficients increased (See Tables S1.3, S2.3, and S3.3).

4. Lastly, the strategy of using the LO for cluster identification and then fitting a higher-order VAR model to estimate cluster-specific coefficients was shown to be effective (See Tables S1.3, S2.3, and S3.3).

Table S1.1. The Percentage of Correctly Recovered Number of Clusters

Levels		Clustering Algorithms							
		GMM				K-means			
		Temporal Order Selection Methods							
		LO		HO		LO		HO	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.62	0.40	0.37	0.34	0.45	0.46	0.31	0.43
	10%	0.75	0.31	0.56	0.38	0.37	0.44	0.25	0.38
	60%	0.91	0.19	0.71	0.31	0.76	0.32	0.67	0.45
	100%	0.70	0.36	0.58	0.37	0.58	0.43	0.51	0.46
Number of True Clusters	2	0.75	0.32	0.62	0.30	0.52	0.43	0.44	0.45
	4	0.66	0.40	0.40	0.40	0.53	0.46	0.41	0.46
Sample Size	60	0.65	0.34	0.56	0.36	0.50	0.44	0.39	0.45
	240	0.76	0.38	0.46	0.37	0.55	0.44	0.45	0.46
Length of ILDs	50	0.49	0.36	0.32	0.29	0.18	0.25	0.08	0.20
	100	0.68	0.37	0.41	0.33	0.50	0.44	0.34	0.42
	500	0.94	0.17	0.80	0.30	0.89	0.28	0.84	0.33
Between-Cluster Distance	0.1	0.48	0.40	0.32	0.32	0.33	0.44	0.25	0.40
	0.2	0.84	0.26	0.63	0.35	0.64	0.40	0.52	0.46
Proportion of Effective Coefficients	25%	0.53	0.40	0.36	0.34	0.37	0.43	0.27	0.42
	50%	0.74	0.35	0.53	0.37	0.56	0.44	0.44	0.45
	62.5%	0.79	0.32	0.59	0.36	0.60	0.42	0.51	0.46

Table S1.2. The Recovery of Cluster Membership (ARI)

Levels		Clustering Algorithms							
		GMM				K-means			
		Temporal Order Selection Methods							
		LO		HO		LO		HO	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.55	0.46	0.31	0.42	0.43	0.47	0.30	0.44
	10%	0.58	0.44	0.48	0.45	0.25	0.38	0.20	0.35
	60%	0.71	0.41	0.56	0.44	0.51	0.46	0.46	0.48
	100%	0.65	0.44	0.56	0.45	0.57	0.45	0.50	0.48
Number of True Clusters	2	0.61	0.45	0.48	0.46	0.41	0.45	0.36	0.45
	4	0.62	0.44	0.46	0.44	0.47	0.46	0.37	0.46
Sample Size	60	0.52	0.44	0.47	0.43	0.43	0.46	0.34	0.45
	240	0.72	0.43	0.47	0.47	0.45	0.46	0.39	0.46
Length of ILDs	50	0.32	0.40	0.16	0.29	0.12	0.27	0.05	0.18
	100	0.58	0.44	0.39	0.42	0.35	0.44	0.24	0.40
	500	0.95	0.19	0.86	0.30	0.85	0.31	0.81	0.35
Between-Cluster Distance	0.1	0.41	0.45	0.30	0.41	0.28	0.42	0.24	0.41
	0.2	0.82	0.32	0.64	0.42	0.60	0.44	0.49	0.47
Proportion of Effective Coefficients	25%	0.45	0.46	0.28	0.40	0.31	0.43	0.25	0.41
	50%	0.63	0.44	0.48	0.45	0.48	0.46	0.39	0.47
	62.5%	0.69	0.42	0.55	0.45	0.53	0.46	0.45	0.47

Table S1.3. The Difference between the Estimated and the True Cluster-Specific Coefficients

Levels		Clustering Algorithms											
		GMM						K-means					
		Temporal Order Selection Methods						Temporal Order Selection Methods					
		LO		HO		LO with VAR(2) ^a		LO		HO		LO with VAR(2) ^a	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.032	0.024	0.056	0.036	0.028	0.019	0.021	0.012	0.038	0.020	0.020	0.011
	10%	0.043	0.020	0.044	0.030	0.037	0.021	0.042	0.016	0.033	0.019	0.034	0.017
	60%	0.052	0.024	0.039	0.027	0.030	0.018	0.050	0.024	0.023	0.013	0.023	0.014
	100%	0.078	0.020	0.033	0.022	0.028	0.016	0.080	0.019	0.025	0.014	0.024	0.013
Number of True Clusters	2	0.043	0.025	0.043	0.031	0.028	0.018	0.046	0.028	0.029	0.016	0.024	0.013
	4	0.062	0.035	0.042	0.025	0.034	0.020	0.057	0.035	0.026	0.014	0.024	0.014
Sample Size	60	0.061	0.031	0.055	0.033	0.042	0.023	0.055	0.032	0.033	0.016	0.029	0.015
	240	0.040	0.029	0.029	0.021	0.017	0.010	0.047	0.033	0.024	0.014	0.018	0.011
Length of ILDs	50	0.070	0.030	0.075	0.029	0.056	0.021	0.075	0.029	0.071	0.024	0.052	0.016
	100	0.050	0.028	0.045	0.023	0.032	0.013	0.054	0.031	0.038	0.014	0.029	0.009
	500	0.039	0.030	0.013	0.006	0.010	0.004	0.040	0.031	0.010	0.004	0.010	0.004
Between-Cluster Distance	0.1	0.050	0.026	0.045	0.030	0.034	0.022	0.044	0.023	0.027	0.014	0.021	0.009
	0.2	0.052	0.033	0.042	0.029	0.028	0.017	0.055	0.035	0.029	0.016	0.026	0.014
Proportion of Effective Coefficients	25%	0.051	0.027	0.045	0.030	0.033	0.021	0.046	0.025	0.026	0.013	0.020	0.010
	50%	0.050	0.030	0.042	0.030	0.029	0.017	0.053	0.033	0.027	0.014	0.025	0.014
	62.5%	0.054	0.034	0.042	0.029	0.031	0.019	0.053	0.035	0.030	0.017	0.026	0.014

Note. ^a. After the LO was used to identify clusters and assign membership, a VAR (2) model was fitted to the data within clusters to estimate the cluster-specific coefficients.

Table S2.1. The Percentage of Correctly Recovered Number of Clusters

Levels		Clustering Algorithms							
		GMM				K-means			
		Temporal Order Selection Methods							
		LO		HO		LO		HO	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.59	0.42	0.35	0.33	0.44	0.46	0.32	0.43
	10%	0.59	0.36	0.44	0.37	0.22	0.39	0.17	0.34
	60%	0.66	0.38	0.52	0.38	0.47	0.45	0.44	0.47
	100%	0.93	0.15	0.84	0.26	0.89	0.18	0.78	0.36
Number of True Clusters	2	0.69	0.34	0.60	0.29	0.38	0.44	0.34	0.44
	4	0.60	0.42	0.36	0.40	0.48	0.47	0.37	0.45
Sample Size	60	0.58	0.34	0.51	0.37	0.41	0.45	0.34	0.44
	240	0.71	0.41	0.44	0.37	0.45	0.46	0.37	0.45
Length of ILDs	50	0.42	0.37	0.27	0.28	0.14	0.26	0.05	0.15
	100	0.60	0.37	0.38	0.33	0.36	0.45	0.25	0.39
	500	0.92	0.20	0.79	0.28	0.79	0.37	0.77	0.38
Between-Cluster Distance	0.1	0.45	0.39	0.34	0.33	0.25	0.41	0.22	0.38
	0.2	0.81	0.29	0.59	0.37	0.58	0.44	0.47	0.46
Proportion of Effective Coefficients	25%	0.50	0.39	0.36	0.34	0.25	0.39	0.21	0.38
	50%	0.71	0.37	0.52	0.37	0.49	0.46	0.40	0.46
	62.5%	0.72	0.36	0.54	0.38	0.53	0.46	0.44	0.45

Table S2.2. The Recovery of Cluster Membership (ARI)

Levels		Clustering Algorithms							
		GMM				K-means			
		Temporal Order Selection Methods							
		LO		HO		LO		HO	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.55	0.46	0.30	0.41	0.43	0.47	0.31	0.44
	10%	0.59	0.44	0.47	0.45	0.25	0.39	0.21	0.36
	60%	0.70	0.41	0.56	0.44	0.50	0.46	0.46	0.48
	100%	0.64	0.44	0.57	0.45	0.56	0.46	0.48	0.48
Number of True Clusters	2	0.61	0.45	0.47	0.46	0.40	0.46	0.36	0.45
	4	0.62	0.44	0.46	0.44	0.47	0.46	0.37	0.46
Sample Size	60	0.51	0.43	0.47	0.43	0.42	0.46	0.34	0.45
	240	0.71	0.43	0.45	0.47	0.45	0.46	0.38	0.46
Length of ILDs	50	0.32	0.40	0.16	0.30	0.12	0.27	0.04	0.17
	100	0.57	0.44	0.38	0.42	0.34	0.44	0.24	0.40
	500	0.95	0.19	0.85	0.31	0.85	0.31	0.81	0.34
Between-Cluster Distance	0.1	0.41	0.45	0.29	0.41	0.27	0.42	0.24	0.40
	0.2	0.81	0.33	0.64	0.42	0.60	0.44	0.49	0.47
Proportion of Effective Coefficients	25%	0.44	0.45	0.29	0.41	0.31	0.42	0.25	0.41
	50%	0.63	0.44	0.49	0.45	0.48	0.47	0.40	0.47
	62.5%	0.68	0.42	0.53	0.45	0.52	0.47	0.44	0.47

Table S2.3. The Difference between the Estimated and the True Cluster-Specific Coefficients

Levels		Clustering Algorithms											
		GMM						K-means					
		Temporal Order Selection Methods						Temporal Order Selection Methods					
		LO		HO		LO with VAR(2) ^a		LO		HO		LO with VAR(2) ^a	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR(2)	0%	0.031	0.019	0.045	0.027	0.028	0.016	0.021	0.011	0.019	0.011	0.019	0.010
	10%	0.043	0.021	0.038	0.028	0.037	0.023	0.036	0.013	0.019	0.009	0.030	0.015
	60%	0.053	0.024	0.038	0.026	0.029	0.019	0.050	0.023	0.025	0.013	0.021	0.012
	100%	0.078	0.020	0.030	0.020	0.028	0.017	0.081	0.020	0.019	0.011	0.023	0.015
Number of True Clusters	2	0.043	0.025	0.040	0.027	0.028	0.019	0.043	0.028	0.019	0.011	0.021	0.012
	4	0.061	0.035	0.032	0.020	0.033	0.019	0.057	0.036	0.023	0.011	0.024	0.014
Sample Size	60	0.061	0.031	0.049	0.030	0.042	0.023	0.052	0.032	0.024	0.012	0.026	0.014
	240	0.041	0.029	0.026	0.017	0.018	0.010	0.049	0.033	0.018	0.010	0.019	0.011
Length of ILDs	50	0.069	0.030	0.066	0.026	0.055	0.021	0.075	0.031	0.067	0.022	0.050	0.016
	100	0.051	0.028	0.041	0.019	0.032	0.013	0.054	0.031	0.027	0.009	0.028	0.009
	500	0.039	0.030	0.013	0.006	0.010	0.004	0.040	0.031	0.011	0.004	0.010	0.004
Between-Cluster Distance	0.1	0.050	0.025	0.040	0.028	0.033	0.022	0.041	0.024	0.019	0.010	0.017	0.008
	0.2	0.053	0.033	0.036	0.024	0.028	0.017	0.055	0.036	0.022	0.012	0.025	0.014
Proportion of Effective Coefficients	25%	0.050	0.027	0.040	0.027	0.033	0.021	0.044	0.026	0.018	0.009	0.018	0.009
	50%	0.051	0.031	0.037	0.026	0.029	0.019	0.052	0.034	0.019	0.011	0.023	0.014
	62.5%	0.053	0.033	0.036	0.024	0.030	0.018	0.053	0.035	0.024	0.013	0.025	0.014

Note. ^a. After the LO was used to identify clusters and assign membership, a VAR (2) model was fitted to the data within clusters to estimate the cluster-specific coefficients.

Table S3.1. The Percentage of Correctly Recovered Number of Clusters

Levels		Clustering Algorithms							
		GMM				K-means			
		Temporal Order Selection Methods							
		LO		HO		LO		HO	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.61	0.39	0.38	0.35	0.47	0.46	0.32	0.43
	10%	0.53	0.39	0.49	0.39	0.20	0.36	0.20	0.35
	60%	0.61	0.40	0.55	0.38	0.45	0.46	0.48	0.47
	100%	0.72	0.35	0.59	0.36	0.60	0.42	0.50	0.46
Number of True Clusters	2	0.66	0.35	0.63	0.29	0.41	0.44	0.37	0.44
	4	0.58	0.42	0.37	0.41	0.45	0.46	0.38	0.46
Sample Size	60	0.56	0.35	0.53	0.38	0.42	0.44	0.35	0.44
	240	0.68	0.41	0.47	0.37	0.44	0.46	0.39	0.46
Length of ILDs	50	0.36	0.34	0.30	0.30	0.12	0.24	0.05	0.15
	100	0.57	0.37	0.38	0.32	0.35	0.42	0.26	0.39
	500	0.92	0.20	0.82	0.28	0.82	0.35	0.81	0.34
Between-Cluster Distance	0.1	0.46	0.38	0.40	0.36	0.28	0.41	0.26	0.41
	0.2	0.78	0.32	0.60	0.36	0.58	0.43	0.49	0.46
Proportion of Effective Coefficients	25%	0.49	0.39	0.40	0.35	0.30	0.40	0.27	0.41
	50%	0.66	0.38	0.54	0.37	0.47	0.46	0.39	0.46
	62.5%	0.70	0.36	0.57	0.38	0.52	0.46	0.45	0.46

Table S3.2. The Recovery of Cluster Membership (ARI)

Levels		Clustering Algorithms							
		GMM				K-means			
		Temporal Order Selection Methods							
		LO		HO		LO		HO	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.56	0.46	0.31	0.41	0.45	0.47	0.32	0.45
	10%	0.56	0.44	0.50	0.45	0.22	0.38	0.23	0.38
	60%	0.65	0.43	0.54	0.45	0.45	0.47	0.49	0.48
	100%	0.66	0.43	0.56	0.45	0.58	0.45	0.50	0.48
Number of True Clusters	2	0.60	0.45	0.46	0.46	0.39	0.45	0.38	0.46
	4	0.61	0.44	0.47	0.44	0.46	0.46	0.39	0.47
Sample Size	60	0.51	0.44	0.49	0.44	0.41	0.46	0.36	0.46
	240	0.71	0.43	0.45	0.47	0.44	0.46	0.40	0.46
Length of ILDs	50	0.32	0.40	0.16	0.29	0.11	0.27	0.05	0.19
	100	0.56	0.44	0.38	0.42	0.33	0.43	0.27	0.41
	500	0.95	0.18	0.87	0.30	0.83	0.33	0.83	0.33
Between-Cluster Distance	0.1	0.41	0.45	0.31	0.42	0.26	0.42	0.26	0.42
	0.2	0.81	0.33	0.63	0.43	0.59	0.44	0.51	0.47
Proportion of Effective Coefficients	25%	0.45	0.45	0.29	0.41	0.29	0.42	0.28	0.42
	50%	0.62	0.44	0.49	0.45	0.47	0.46	0.41	0.47
	62.5%	0.67	0.42	0.54	0.45	0.52	0.46	0.47	0.47

Table S3.3. The Difference between the Estimated and the True Cluster-Specific Coefficients

Levels		Clustering Algorithms											
		GMM						K-means					
		Temporal Order Selection Methods						Temporal Order Selection Methods					
		LO		HO		LO with VAR(2) ^a		LO		HO		LO with VAR(2) ^a	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Proportion of VAR (2)	0%	0.032	0.022	0.028	0.024	0.021	0.018	0.021	0.012	0.018	0.009	0.020	0.011
	10%	0.044	0.023	0.032	0.027	0.025	0.022	0.044	0.019	0.025	0.016	0.036	0.018
	60%	0.045	0.024	0.033	0.026	0.021	0.018	0.041	0.023	0.017	0.009	0.022	0.013
	100%	0.079	0.020	0.026	0.027	0.022	0.018	0.080	0.019	0.024	0.014	0.023	0.014
Number of True Clusters	2	0.041	0.028	0.031	0.026	0.022	0.018	0.044	0.030	0.019	0.011	0.023	0.013
	4	0.061	0.035	0.024	0.028	0.022	0.020	0.055	0.035	0.025	0.013	0.025	0.014
Sample Size	60	0.062	0.033	0.035	0.030	0.031	0.023	0.053	0.033	0.024	0.012	0.030	0.015
	240	0.037	0.029	0.025	0.019	0.014	0.009	0.046	0.034	0.016	0.010	0.018	0.010
Length of ILDs	50	0.071	0.032	0.062	0.025	0.044	0.022	0.076	0.028	0.053	0.020	0.052	0.017
	100	0.050	0.029	0.036	0.016	0.027	0.013	0.054	0.032	0.029	0.010	0.029	0.010
	500	0.035	0.030	0.011	0.005	0.010	0.004	0.036	0.031	0.010	0.004	0.010	0.004
Between-Cluster Distance	0.1	0.050	0.027	0.034	0.028	0.022	0.022	0.044	0.024	0.018	0.010	0.021	0.010
	0.2	0.051	0.034	0.027	0.024	0.022	0.017	0.052	0.036	0.021	0.012	0.026	0.014
Proportion of Effective Coefficients	25%	0.050	0.029	0.032	0.025	0.022	0.021	0.044	0.027	0.018	0.009	0.024	0.012
	50%	0.050	0.032	0.031	0.028	0.022	0.018	0.050	0.033	0.021	0.012	0.024	0.014
	62.5%	0.051	0.034	0.029	0.026	0.022	0.018	0.052	0.036	0.022	0.012	0.024	0.014

Note. ^a. After the LO was used to identify clusters and assign membership, a VAR (2) model was fitted to the data within clusters to estimate the cluster-specific coefficients.