Supplementary Information

Spatial Dependence in Regional Business Cycles: Evidence from Mexican States

This online appendix provides details on data and the estimation results.

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Online Appendix A. Data

Figure A1

Figure A1 shows the seasonally adjusted Quarterly Indicator of State Economic Activity (*Indicador Trimestral de la Actividad Económica Estatal*, ITAEE) from 2003:Q1 to 2015Q4.

Figure A2

Figure A2 shows the percentage changes of ITAEE, which are calculated by $[\log(y_{t,n}) - \log(y_{t-1,n})] \times 100$.

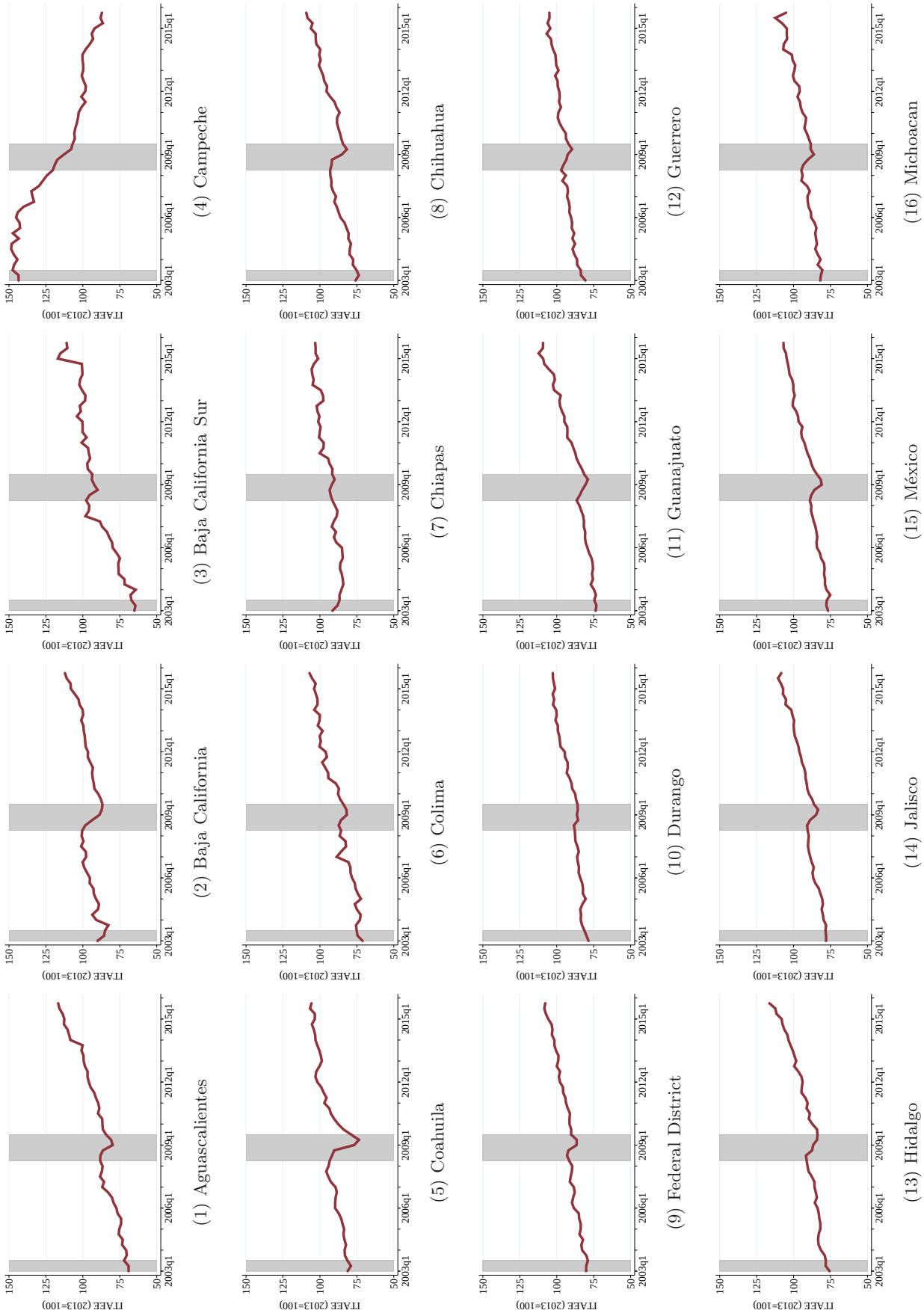


Figure A1: Quarterly Indicator of State Economic Activity (ITAEE)

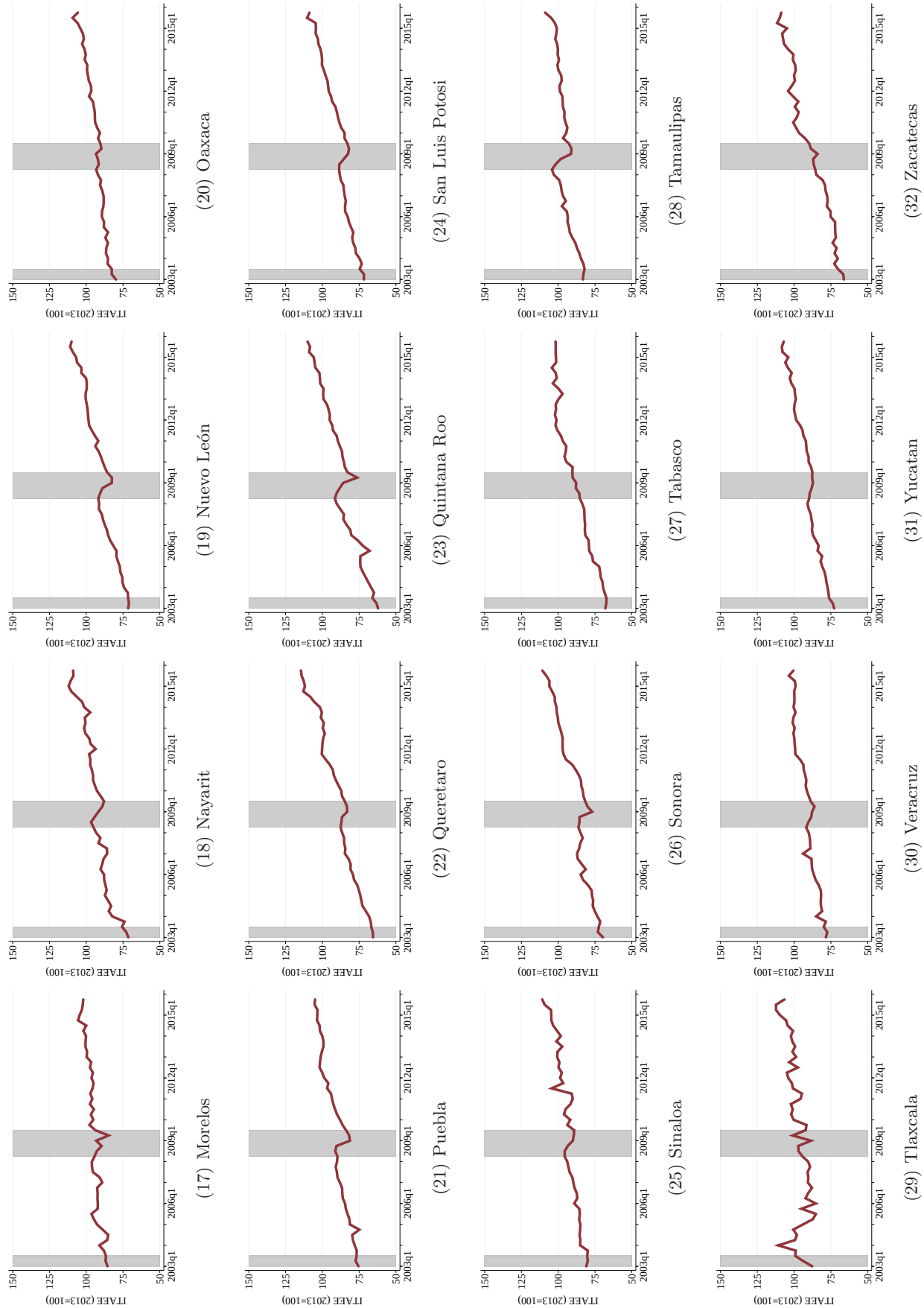


Figure A1: ITAEE (Continued)

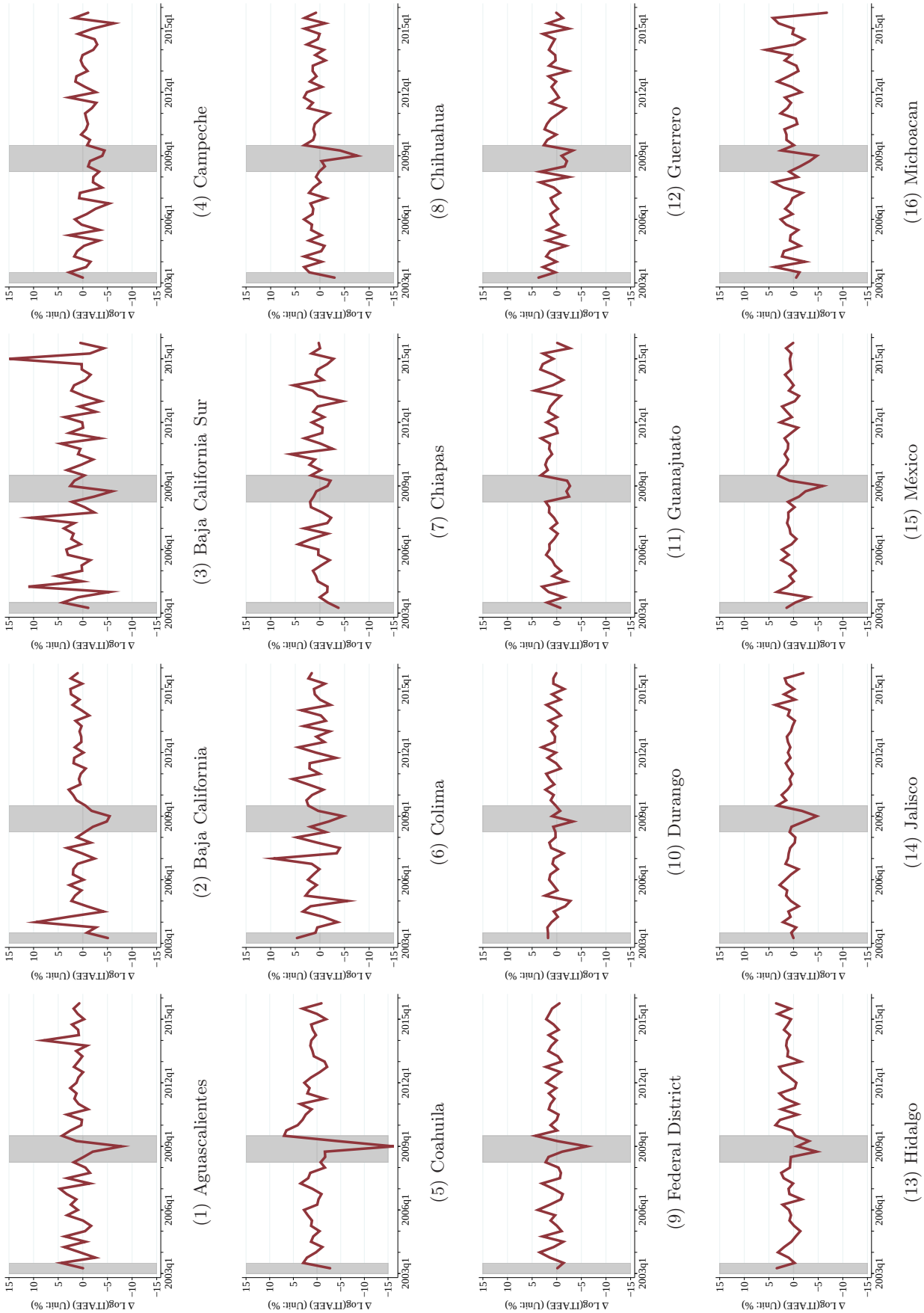


Figure A2: Growth Rate of Quarterly Indicator of State Economic Activity (ITAEE)

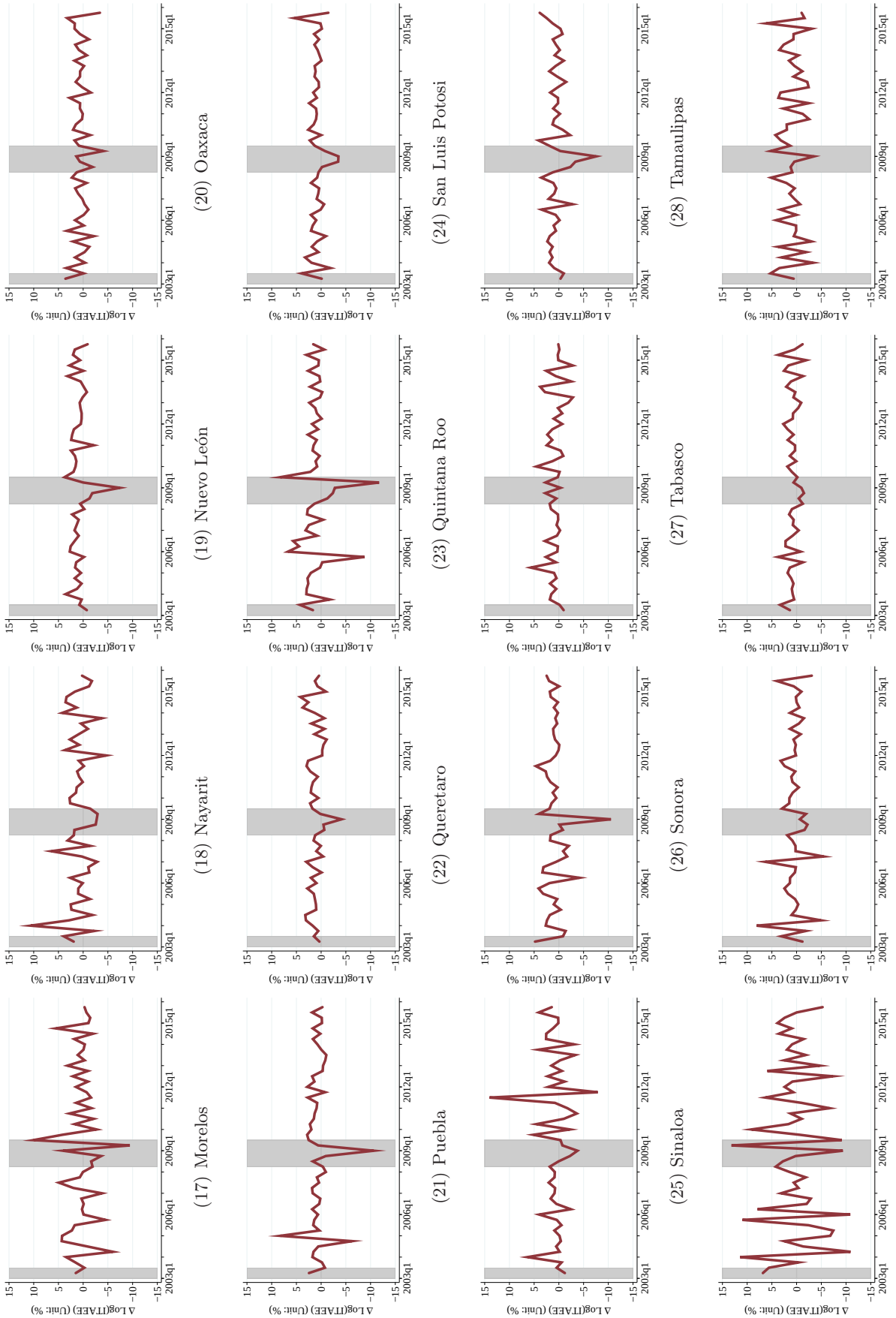


Figure A2: Percentage Change of ITAEE (Continued)

Online Appendix B. Estimation Results of Markov Switching Model

The estimation results here are obtained by estimating the standard Markov switching model:

$$\boldsymbol{y}_t = \boldsymbol{\mu}_0 \odot (\boldsymbol{\iota}_N - \boldsymbol{s}_t) + \boldsymbol{\mu}_1 \odot \boldsymbol{s}_t + \boldsymbol{\varepsilon}_t,$$

where $\boldsymbol{\varepsilon}_t \sim$ i.i.d. $\mathrm{N}(\mathbf{0}, \boldsymbol{\Omega})$ and $\boldsymbol{\Omega} = \mathrm{diag}(\sigma_1^2, \ldots, \sigma_N^2)$.

Table B1

Table B1 shows the point estimates and interval estimates of parameters.

Figure B1

Figure B1 shows the probabilities of recession, which are calculated by $1 - G^{-1} \sum_{g=1}^{G} s_{t,n}^{(g)}$, where G is the number of iterations and the superscript (g) is the gth iteration.

Figure B2

Figure B2 shows the histogram and density plots of parameters by state. The solid line indicates density estimates obtained by kernel density estimation.

Figure B3

Figure B3 shows the autocorrelation plots of parameters by state.

Figure B4

Figure B4 shows the trace plots of parameters by state.

Table B1: Estimated Parameters of Markov Swithcing Model

		μ_0			μ_1		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	−0.69	−0.61	[−2.78, 0.95]	1.18	1.18	[0.52, 1.90]
2	Baja California	−1.47	−1.53	[−3.15, 0.34]	0.90	0.91	[0.12, 1.64]
3	Baja California Sur	−0.34	−0.24	[−2.19, 1.00]	1.11	1.09	[0.14, 2.20]
4	Campeche	−1.42	−1.36	[−2.57, −0.59]	−0.16	−0.25	[−1.10, 1.23]
5	Coahuila	−1.45	−1.43	[−3.59, 0.49]	0.97	0.97	[0.08, 1.87]
6	Colima	−0.32	−0.20	[−2.13, 0.91]	0.96	0.93	[0.19, 1.92]
7	Chiapas	−0.63	−0.54	[−2.16, 0.40]	0.49	0.44	[−0.18, 1.46]
8	Chihuahua	−2.12	−2.21	[−3.95, 0.15]	1.02	1.02	[0.51, 1.51]
9	Federal District	−0.85	−0.70	[−3.09, 0.62]	0.74	0.72	[0.23, 1.30]
10	Durango	−0.69	−0.50	[−2.59, 0.59]	0.70	0.68	[0.29, 1.26]
11	Guanajuato	−1.13	−1.22	[−2.53, 0.58]	1.08	1.08	[0.55, 1.63]
12	Guerrero	−0.38	−0.21	[−2.14, 0.66]	0.73	0.69	[0.18, 1.51]
13	Hidalgo	−1.07	−1.13	[−2.65, 0.66]	1.12	1.11	[0.62, 1.66]
14	Jalisco	−1.93	−1.99	[−3.14, −0.26]	0.88	0.88	[0.52, 1.22]
15	México	−2.23	−2.28	[−3.61, −0.46]	0.93	0.93	[0.54, 1.28]
16	Michoacán	−0.81	−0.64	[−3.00, 0.60]	0.68	0.66	[0.03, 1.44]
17	Morelos	−0.49	−0.39	[−2.09, 0.62]	0.62	0.58	[−0.24, 1.75]
18	Nayarit	−0.31	−0.20	[−2.08, 0.90]	1.07	1.02	[0.24, 2.20]
19	Nuevo León	−1.97	−2.00	[−3.57, −0.11]	1.10	1.10	[0.68, 1.52]
20	Oaxaca	−0.34	−0.13	[−2.31, 0.70]	0.69	0.66	[0.18, 1.39]
21	Puebla	−1.16	−0.91	[−4.07, 0.68]	0.89	0.89	[0.19, 1.64]
22	Querétaro	−0.49	−0.43	[−2.17, 0.88]	1.36	1.35	[0.85, 1.94]
23	Quintana Roo	−1.60	−1.68	[−3.91, 0.83]	1.50	1.53	[0.58, 2.31]
24	San Luis Potosí	−1.36	−1.44	[−2.94, 0.53]	1.02	1.02	[0.59, 1.43]
25	Sinaloa	−0.38	−0.28	[−2.13, 0.79]	0.80	0.77	[−0.04, 1.82]
26	Sonora	−1.04	−0.93	[−3.56, 0.84]	1.16	1.15	[0.47, 1.88]
27	Tabasco	−0.27	−0.16	[−2.03, 0.82]	0.96	0.93	[0.42, 1.63]
28	Tamaulipas	−2.13	−2.24	[−3.77, 0.14]	0.85	0.85	[0.34, 1.34]
29	Tlaxcala	−0.61	−0.55	[−2.28, 0.74]	0.71	0.67	[−0.48, 2.04]
30	Veracruz	−0.40	−0.26	[−2.16, 0.68]	0.67	0.63	[0.00, 1.58]
31	Yucatán	−0.23	−0.09	[−1.97, 0.82]	0.90	0.88	[0.45, 1.48]
32	Zacatecas	−0.23	−0.10	[−2.06, 1.02]	1.11	1.08	[0.37, 2.09]

Notes: 95% CI indicates 95% credible interval.

Table B1: Estimated Parameters (Continued)

		σ^2			p_{11}			p_{00}		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	4.80	4.68	[3.15, 7.28]	0.93	0.95	[0.74, 1.00]	0.76	0.77	[0.47, 0.95]
2	Baja California	4.58	4.42	[2.71, 7.27]	0.93	0.95	[0.78, 1.00]	0.75	0.77	[0.50, 0.95]
3	Baja California Sur	13.22	12.88	[9.00, 19.38]	0.92	0.95	[0.70, 1.00]	0.78	0.80	[0.50, 0.97]
4	Campeche	3.84	3.77	[2.42, 5.73]	0.86	0.89	[0.62, 0.99]	0.84	0.87	[0.57, 0.98]
5	Coahuila	8.38	8.12	[5.36, 12.70]	0.93	0.95	[0.75, 1.00]	0.77	0.78	[0.51, 0.95]
6	Colima	7.17	7.01	[4.79, 10.54]	0.91	0.94	[0.68, 1.00]	0.77	0.79	[0.48, 0.96]
7	Chiapas	4.08	3.97	[2.72, 5.98]	0.92	0.95	[0.68, 1.00]	0.78	0.79	[0.49, 0.96]
8	Chihuahua	2.88	2.77	[1.81, 4.60]	0.95	0.96	[0.85, 1.00]	0.73	0.75	[0.46, 0.94]
9	Federal District	2.60	2.54	[1.68, 3.93]	0.93	0.96	[0.73, 1.00]	0.75	0.76	[0.46, 0.96]
10	Durango	1.47	1.44	[0.86, 2.27]	0.92	0.94	[0.71, 1.00]	0.75	0.77	[0.45, 0.96]
11	Guanajuato	2.17	2.09	[1.28, 3.50]	0.93	0.94	[0.77, 0.99]	0.75	0.76	[0.48, 0.94]
12	Guerrero	2.66	2.60	[1.68, 3.96]	0.91	0.93	[0.67, 1.00]	0.78	0.80	[0.49, 0.97]
13	Hidalgo	2.23	2.15	[1.44, 3.42]	0.93	0.95	[0.78, 0.99]	0.76	0.78	[0.50, 0.95]
14	Jalisco	1.34	1.29	[0.87, 2.11]	0.96	0.97	[0.88, 1.00]	0.76	0.78	[0.50, 0.95]
15	México	1.53	1.47	[0.97, 2.48]	0.95	0.95	[0.86, 0.99]	0.72	0.73	[0.46, 0.93]
16	Michoacán	4.50	4.41	[2.80, 6.77]	0.93	0.96	[0.74, 1.00]	0.77	0.79	[0.49, 0.96]
17	Morelos	9.21	9.00	[6.32, 13.37]	0.90	0.93	[0.65, 1.00]	0.79	0.81	[0.50, 0.97]
18	Nayarit	6.68	6.54	[4.42, 9.81]	0.90	0.93	[0.66, 1.00]	0.78	0.80	[0.49, 0.97]
19	Nuevo León	2.14	2.07	[1.40, 3.27]	0.96	0.96	[0.88, 1.00]	0.75	0.77	[0.49, 0.94]
20	Oaxaca	2.62	2.56	[1.75, 3.87]	0.92	0.95	[0.69, 1.00]	0.79	0.81	[0.50, 0.97]
21	Puebla	4.99	4.90	[2.78, 7.73]	0.93	0.95	[0.74, 1.00]	0.75	0.76	[0.46, 0.96]
22	Querétaro	1.83	1.77	[1.17, 2.81]	0.93	0.94	[0.77, 1.00]	0.76	0.78	[0.51, 0.95]
23	Quintana Roo	7.15	6.86	[4.09, 11.91]	0.93	0.94	[0.77, 0.99]	0.74	0.75	[0.47, 0.94]
24	San Luis Potosí	1.88	1.81	[1.22, 2.93]	0.95	0.96	[0.84, 1.00]	0.76	0.78	[0.49, 0.95]
25	Sinaloa	9.24	9.01	[6.35, 13.44]	0.91	0.94	[0.68, 1.00]	0.78	0.80	[0.50, 0.97]
26	Sonora	4.69	4.58	[2.85, 7.21]	0.93	0.95	[0.73, 1.00]	0.75	0.76	[0.46, 0.95]
27	Tabasco	2.74	2.67	[1.81, 4.00]	0.93	0.95	[0.73, 1.00]	0.78	0.80	[0.50, 0.97]
28	Tamaulipas	2.66	2.55	[1.68, 4.23]	0.95	0.96	[0.83, 0.99]	0.75	0.76	[0.48, 0.94]
29	Tlaxcala	27.69	27.09	[18.95, 39.97]	0.90	0.93	[0.66, 1.00]	0.79	0.81	[0.51, 0.97]
30	Veracruz	4.94	4.83	[3.35, 7.18]	0.92	0.95	[0.70, 1.00]	0.79	0.81	[0.49, 0.97]
31	Yucatán	1.76	1.71	[1.15, 2.59]	0.93	0.95	[0.71, 1.00]	0.78	0.80	[0.50, 0.97]
32	Zacatecas	5.84	5.73	[3.87, 8.57]	0.91	0.94	[0.67, 1.00]	0.77	0.79	[0.48, 0.97]

Notes: 95% CI indicates 95% credible interval.

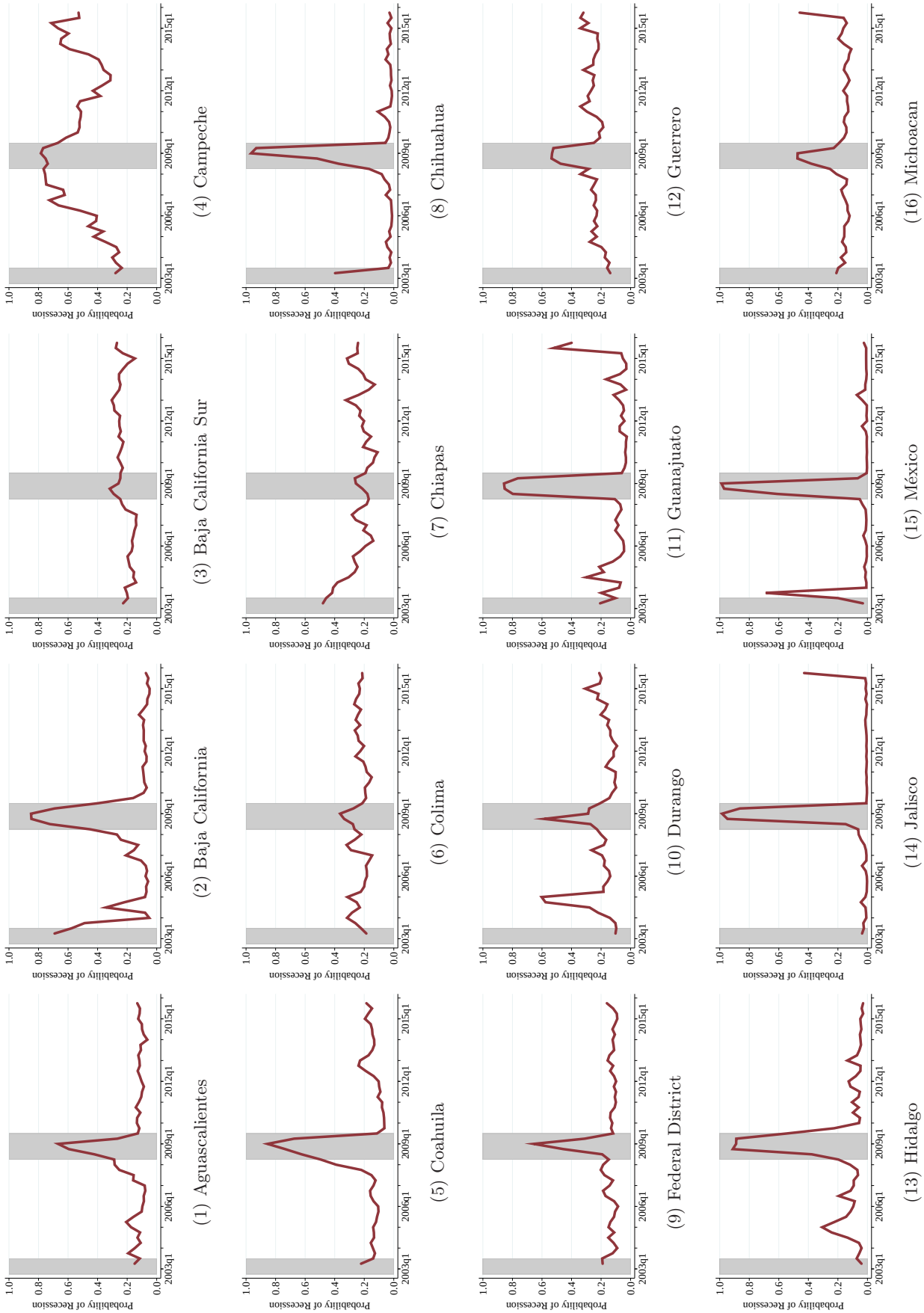


Figure B1: Recession Probabilities from Markov Switching Model

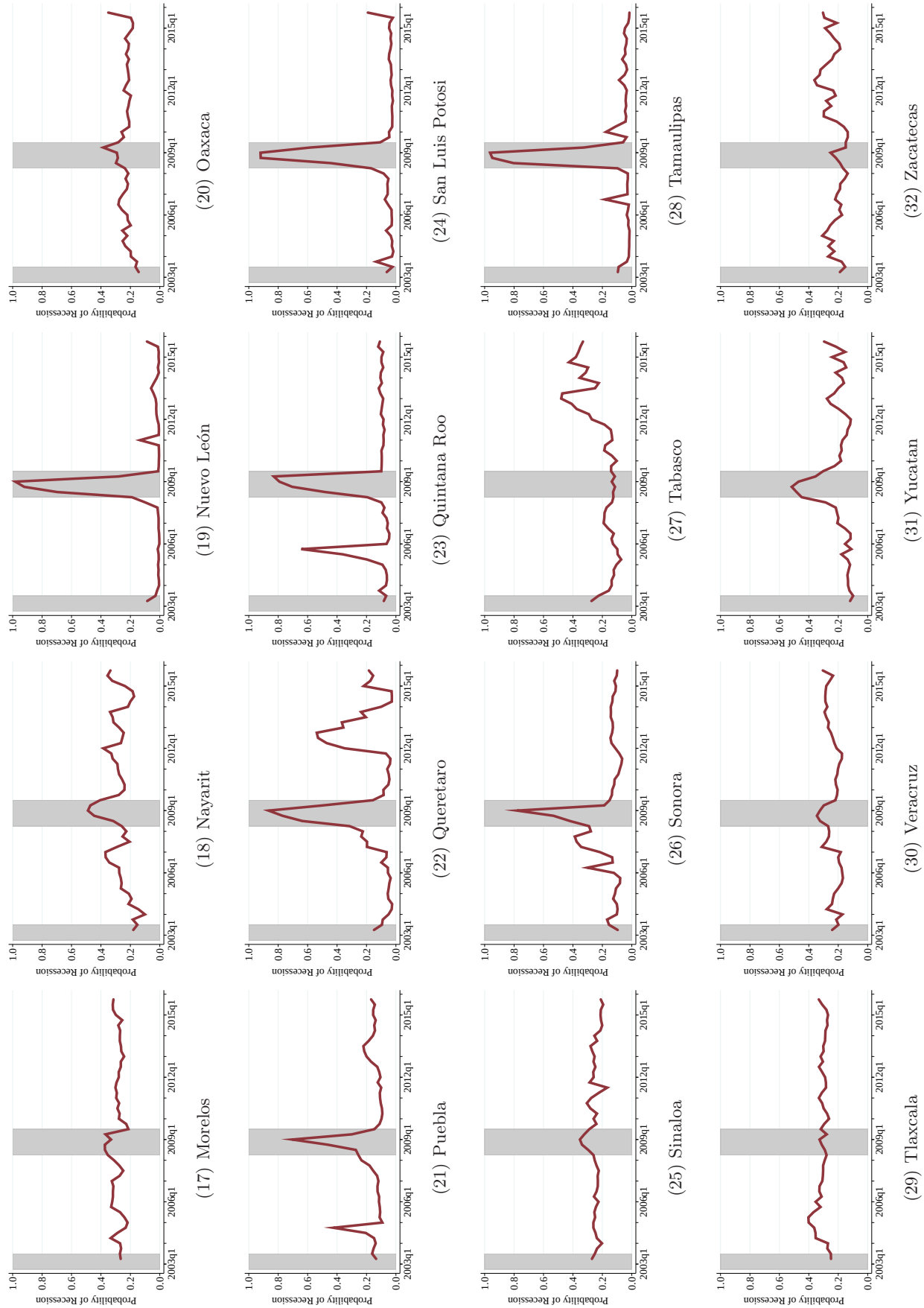


Figure B1: Recession Probabilities from Markov Switching Model (Continued)

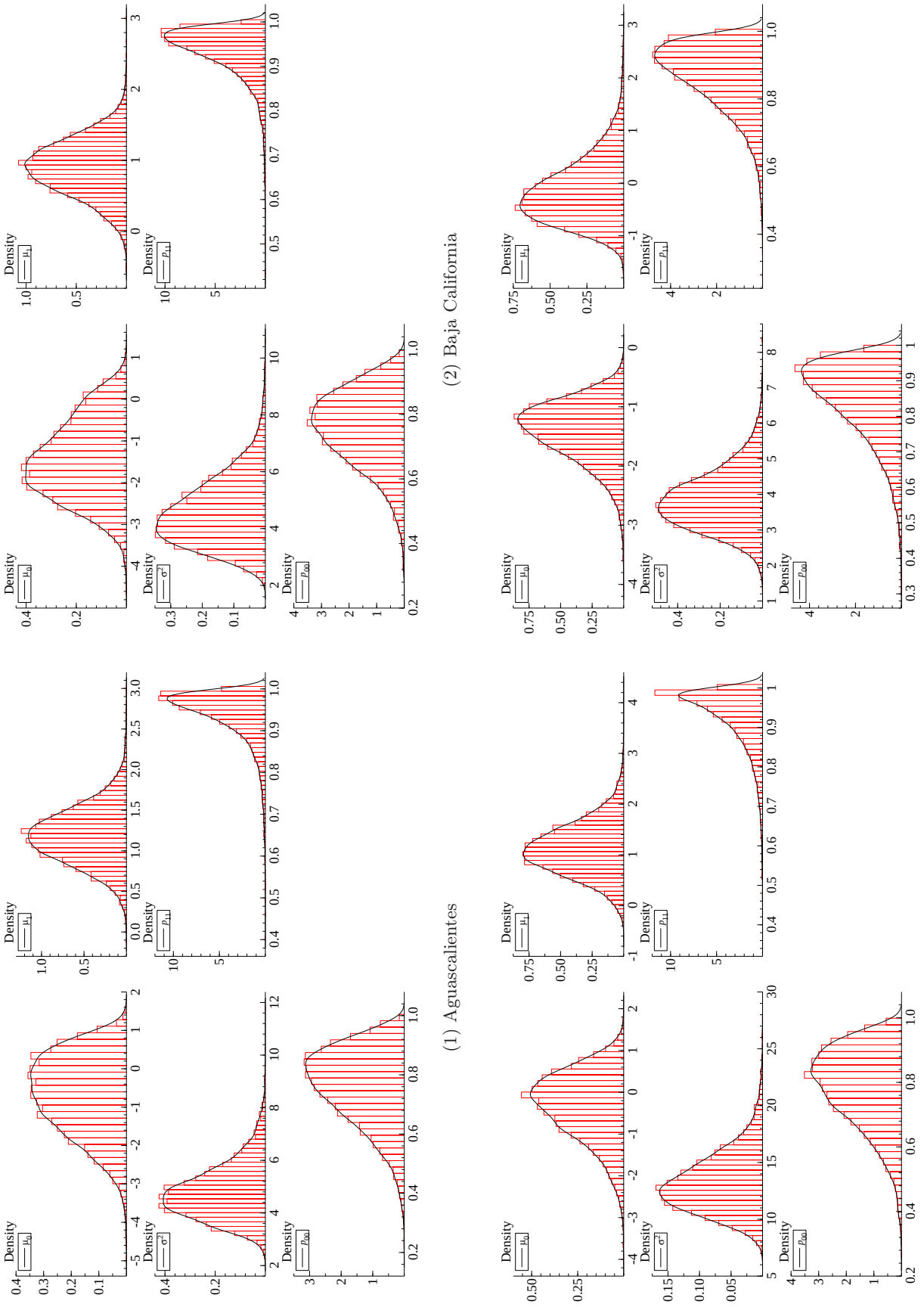
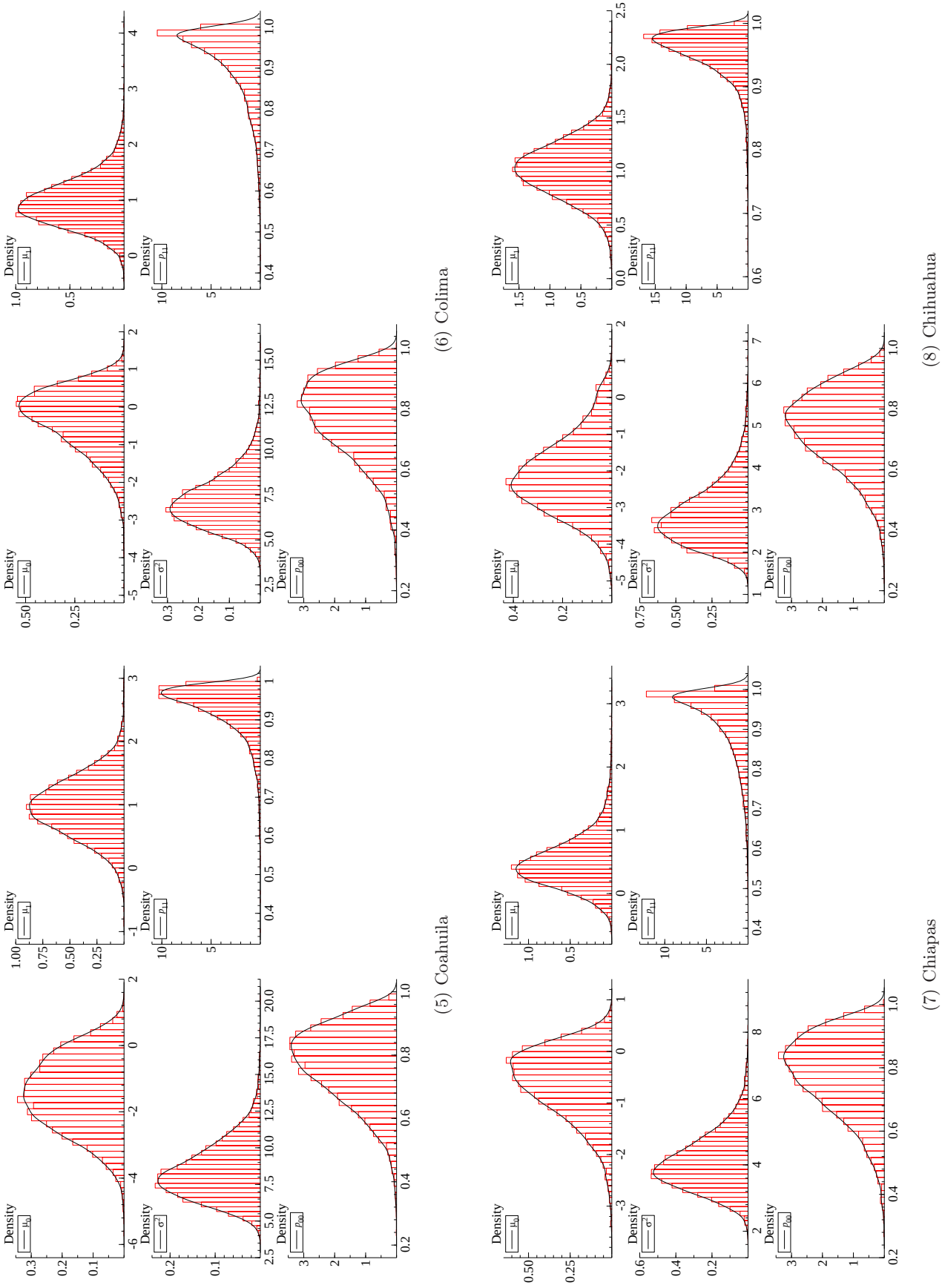


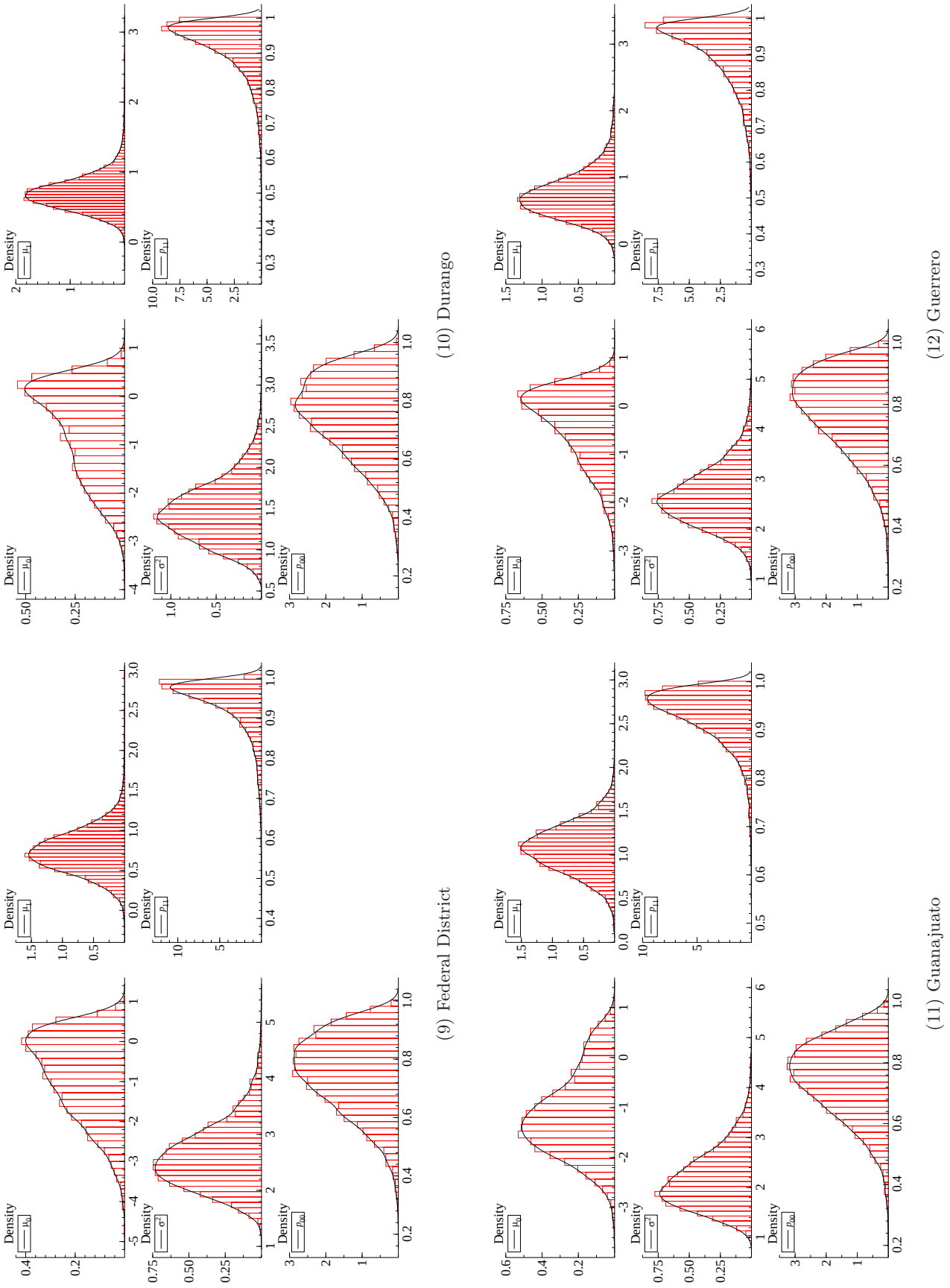
Figure B2: Posterior Distributions from Markov Swithcing Model



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

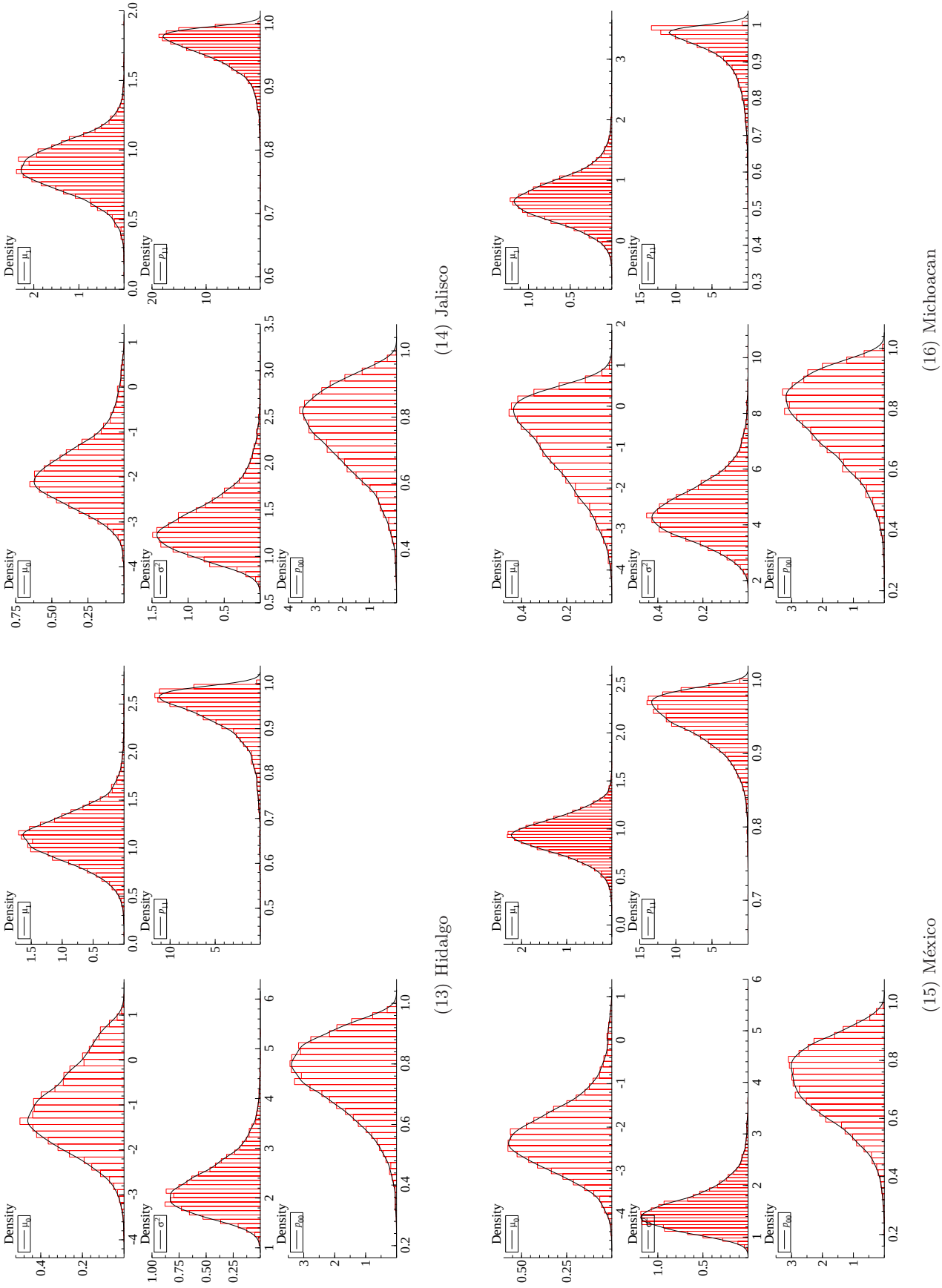
Figure B2: Posterior Distributions from Markov Swithcing Model (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

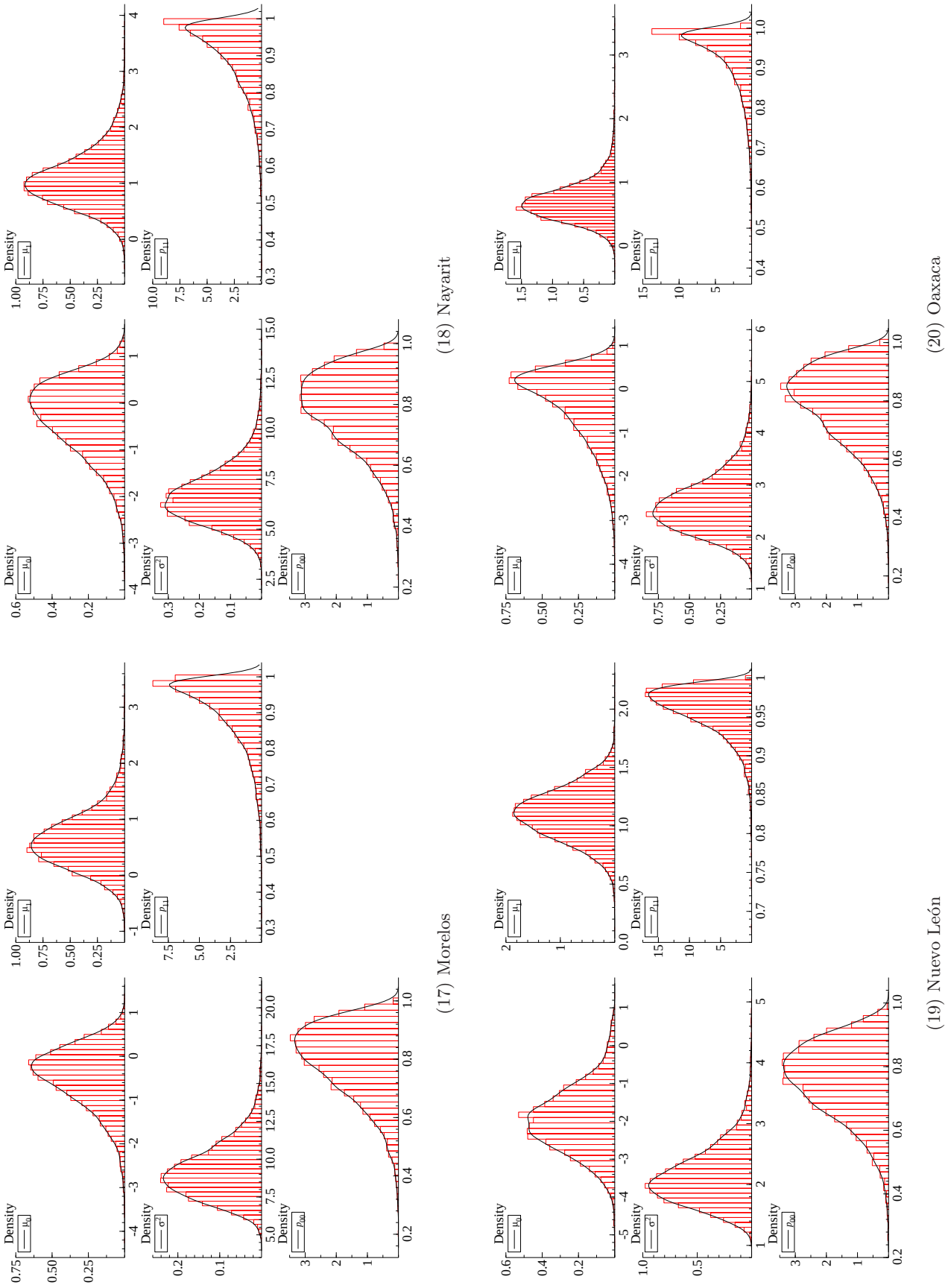
Figure B2: Posterior Distributions from Markov Swithcing Model (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

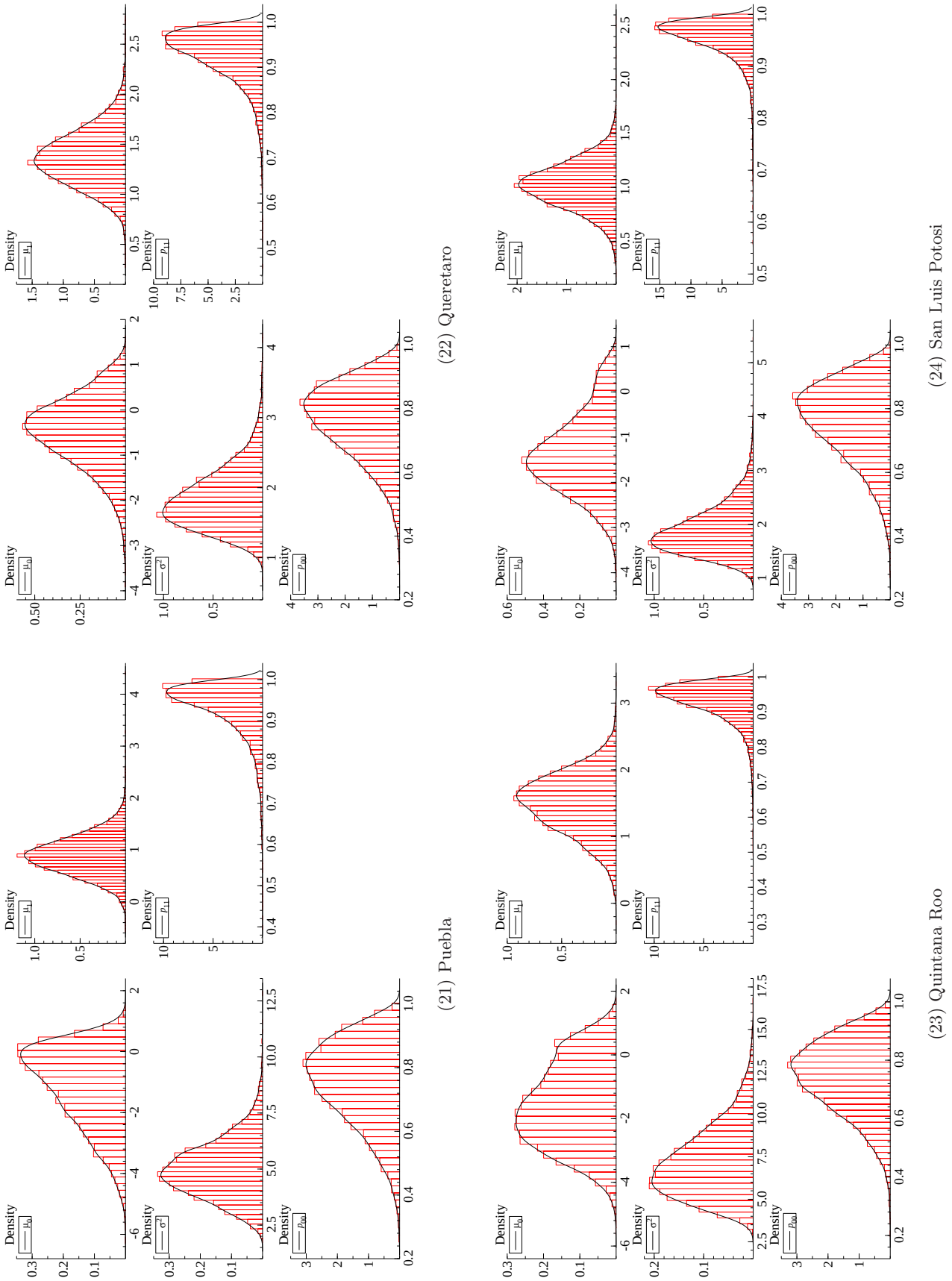
Figure B2: Posterior Distributions from Markov Switching Model (Continued)



(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

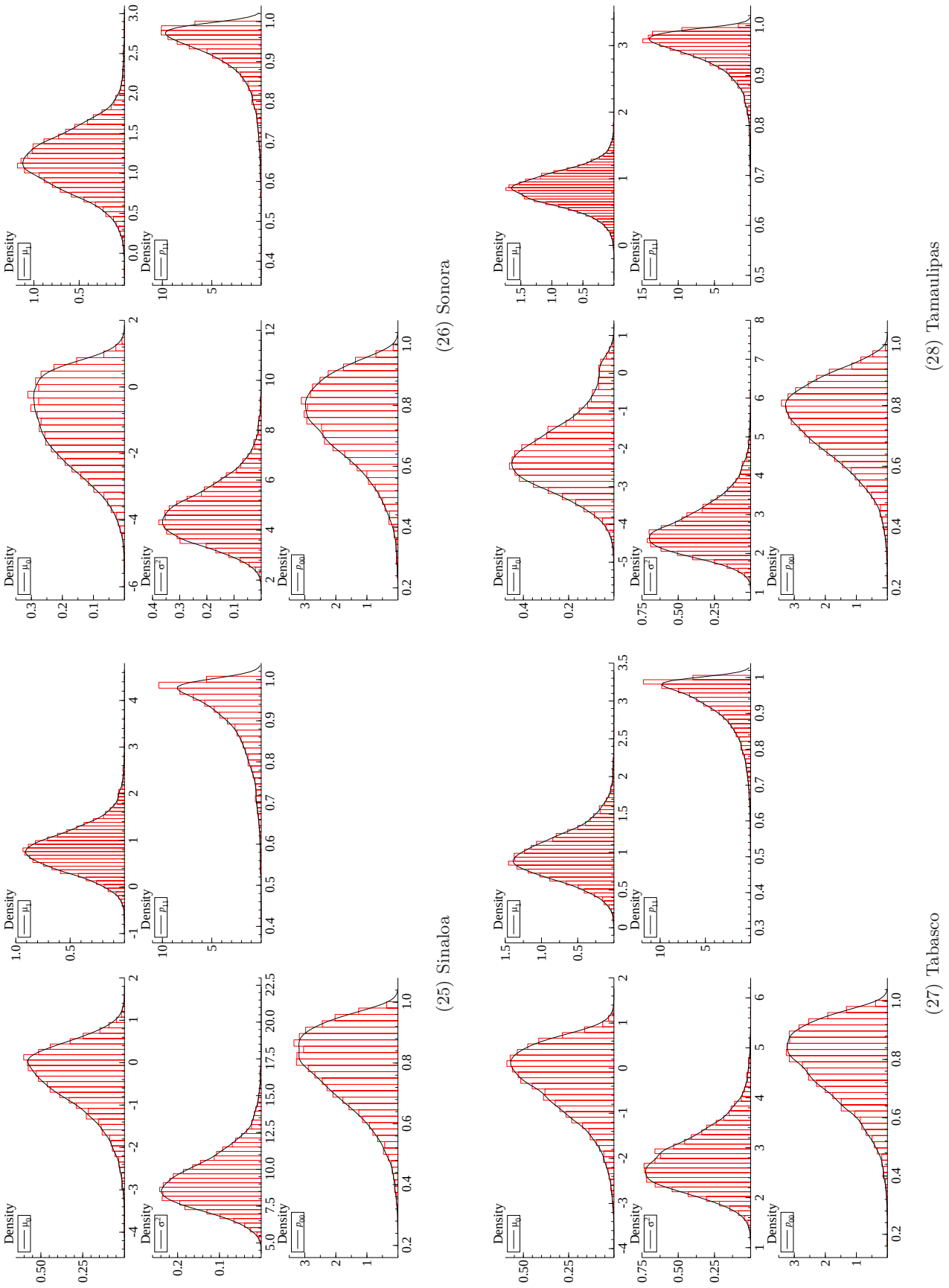
Figure B2: Posterior Distributions from Markov Swithcing Model (Continued)



(21) Puebla (22) Queretaro

(23) Quintana Roo (24) San Luis Potosi

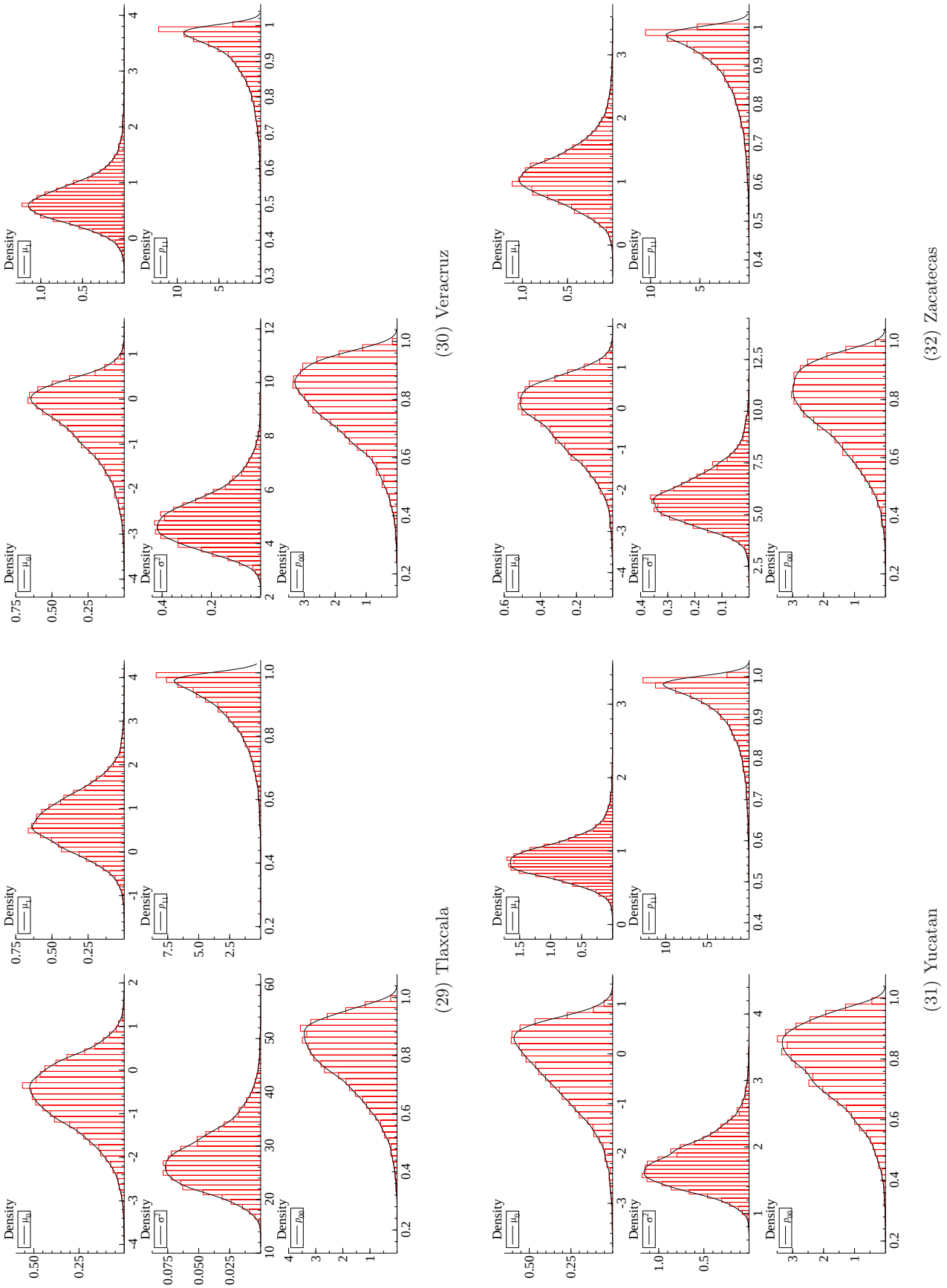
Figure B2: Posterior Distributions from Markov Swithcing Model (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

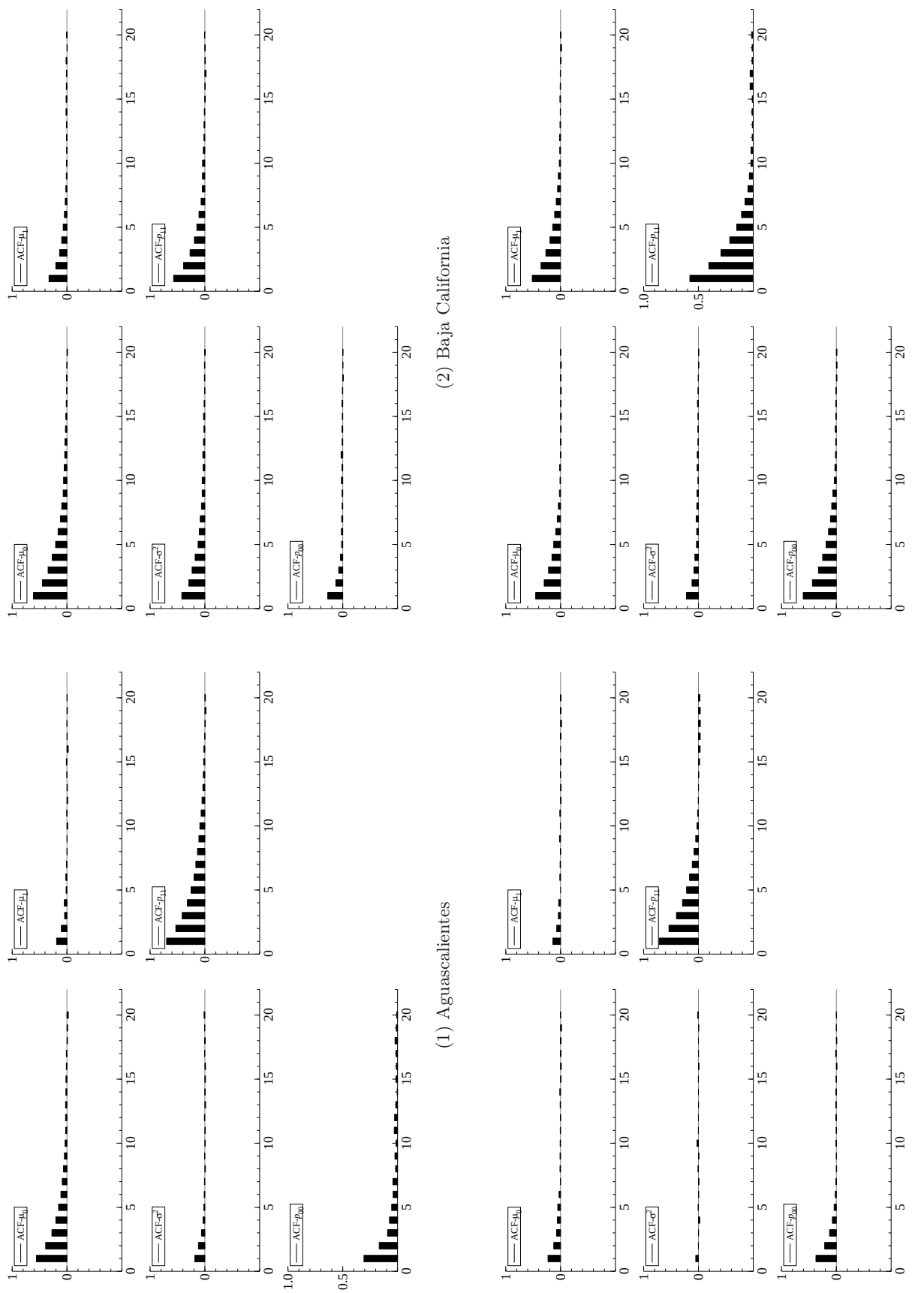
Figure B2: Posterior Distributions from Markov Swithcing Model (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

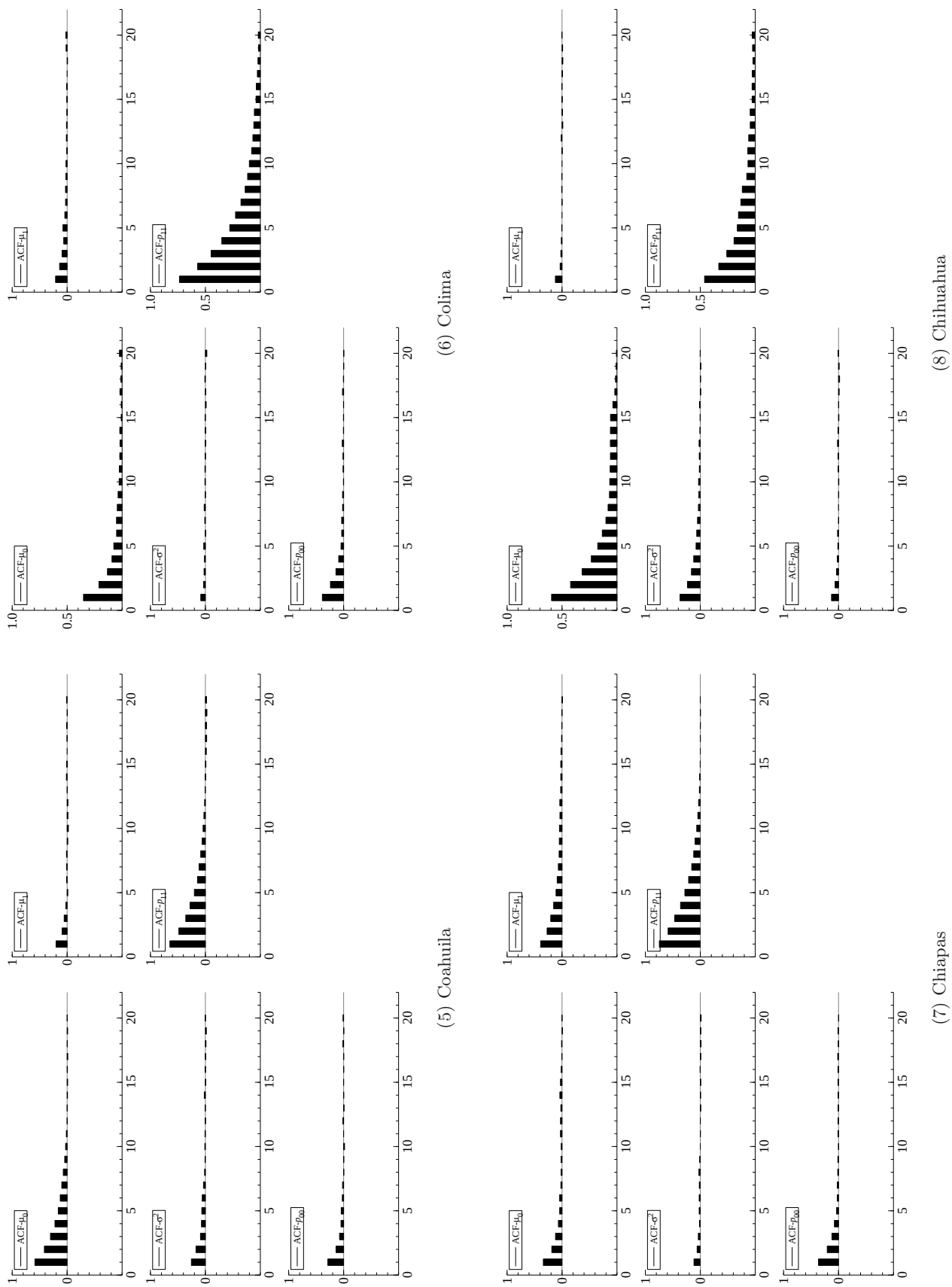
Figure B2: Posterior Distributions from Markov Swithcing Model (Continued)



(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

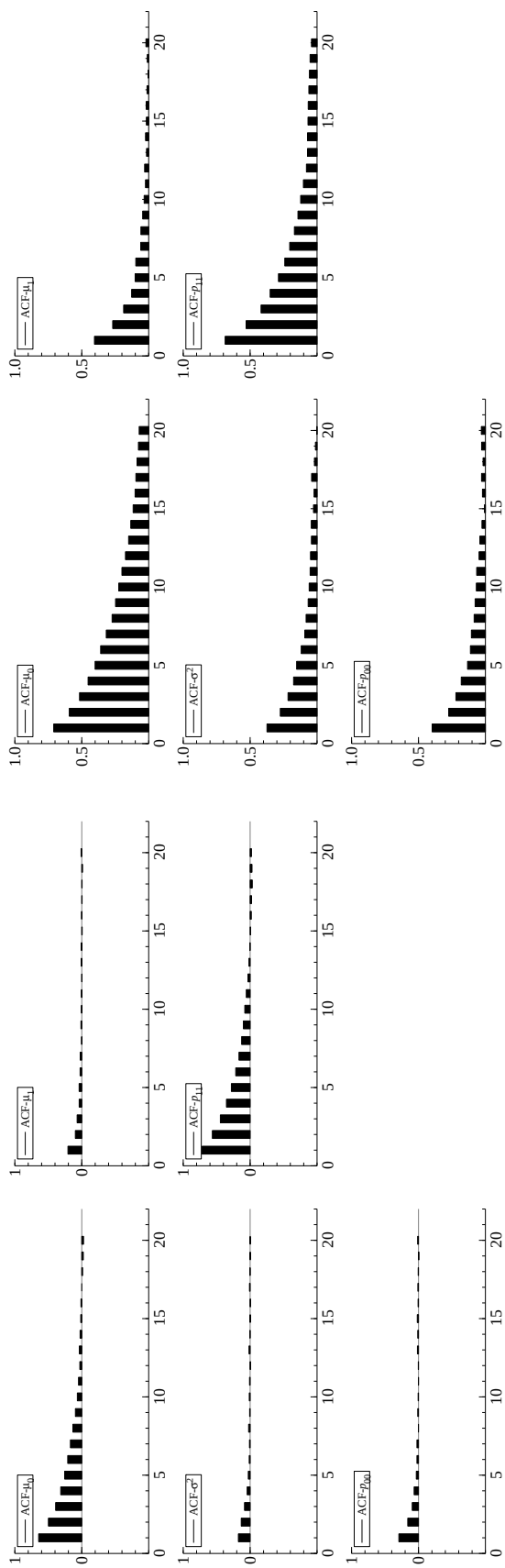
Figure B3: Autocorrelation Function from Markov Swithcing Model



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

Figure B3: Autocorrelation Function from Markov Swithcing Model (Continued)



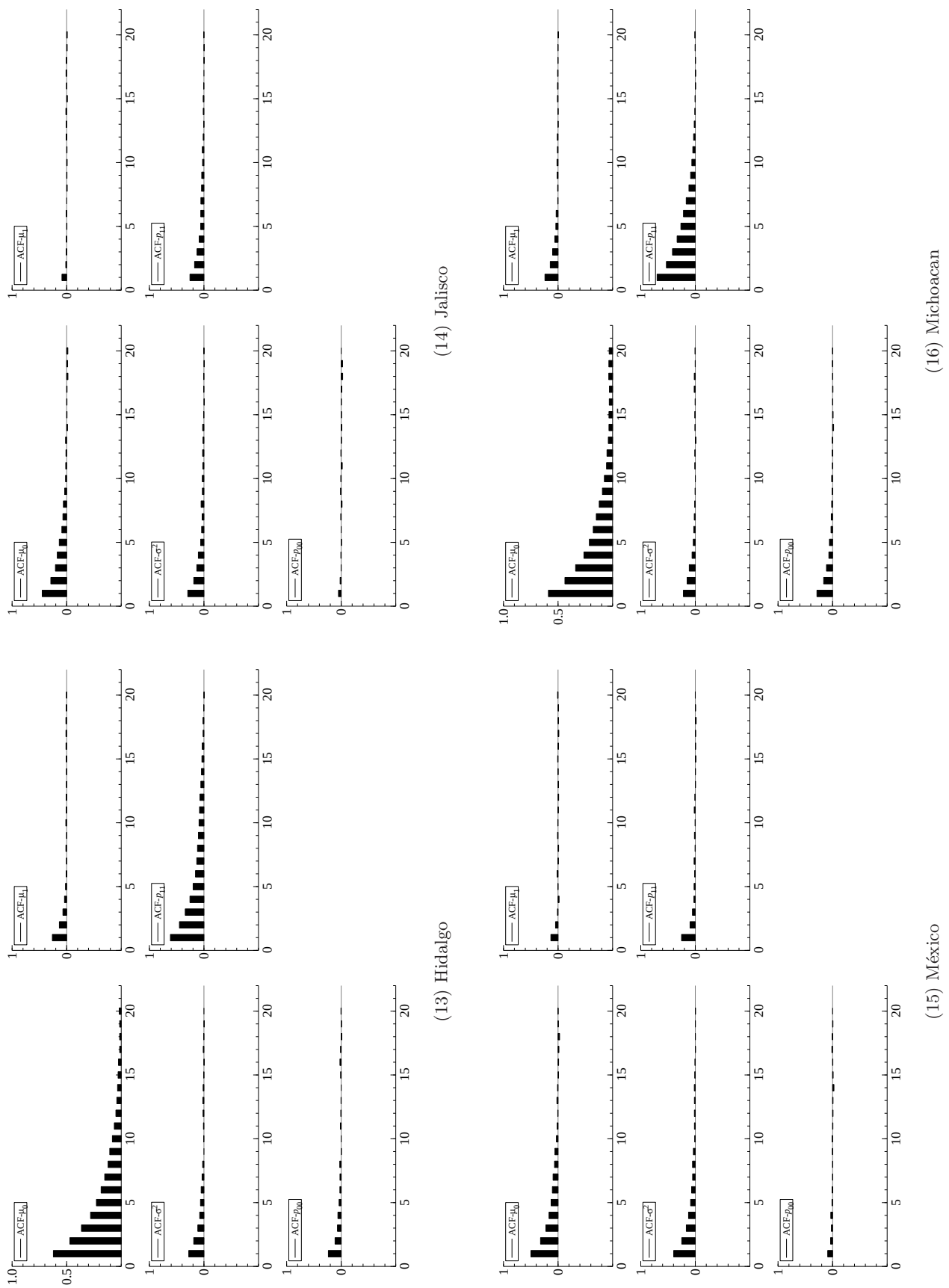
(9) Federal District

(10) Durango

(11) Guanajuato

(12) Guerrero

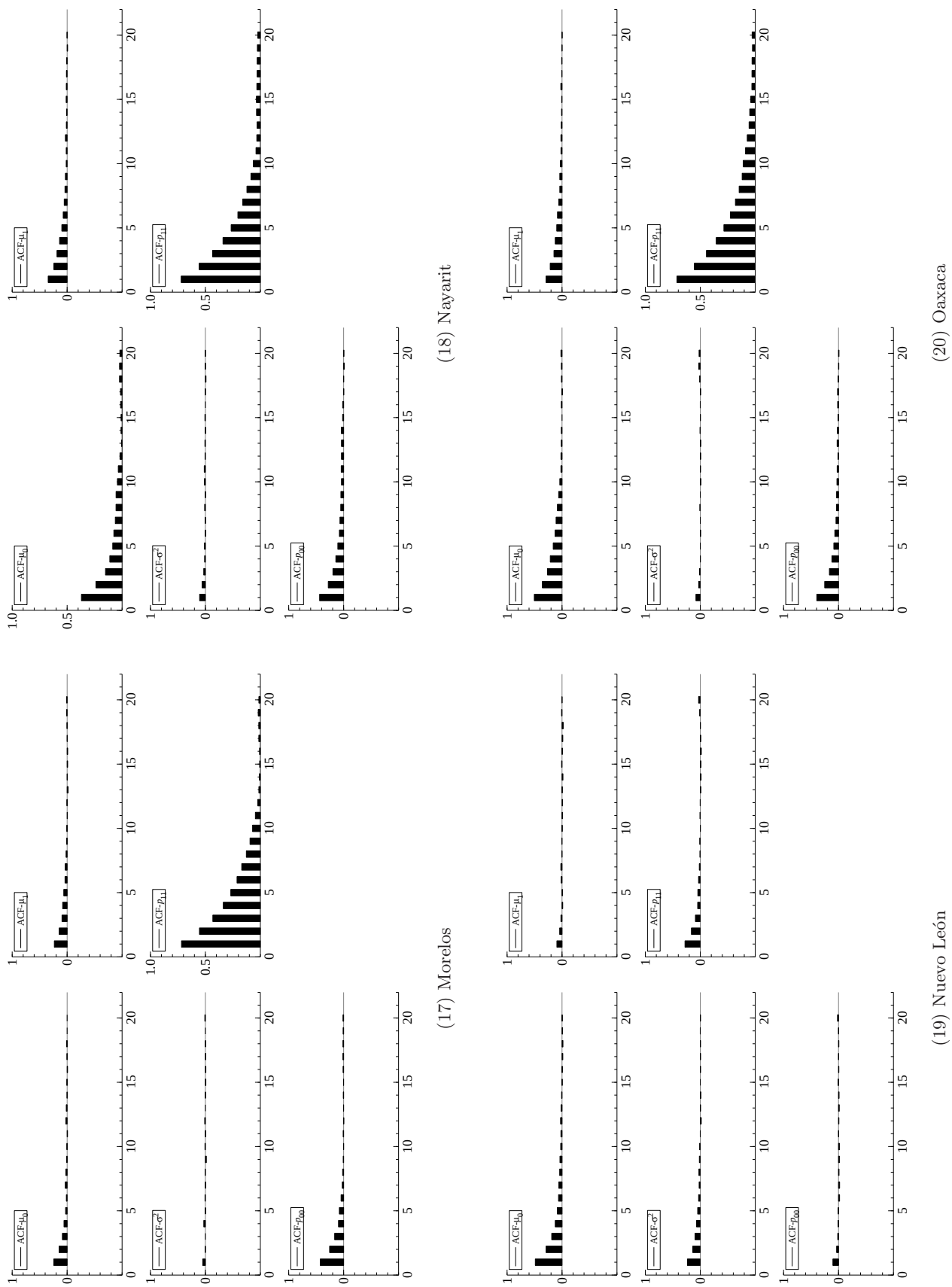
Figure B3: Autocorrelation Function from Markov Swithcing Model (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

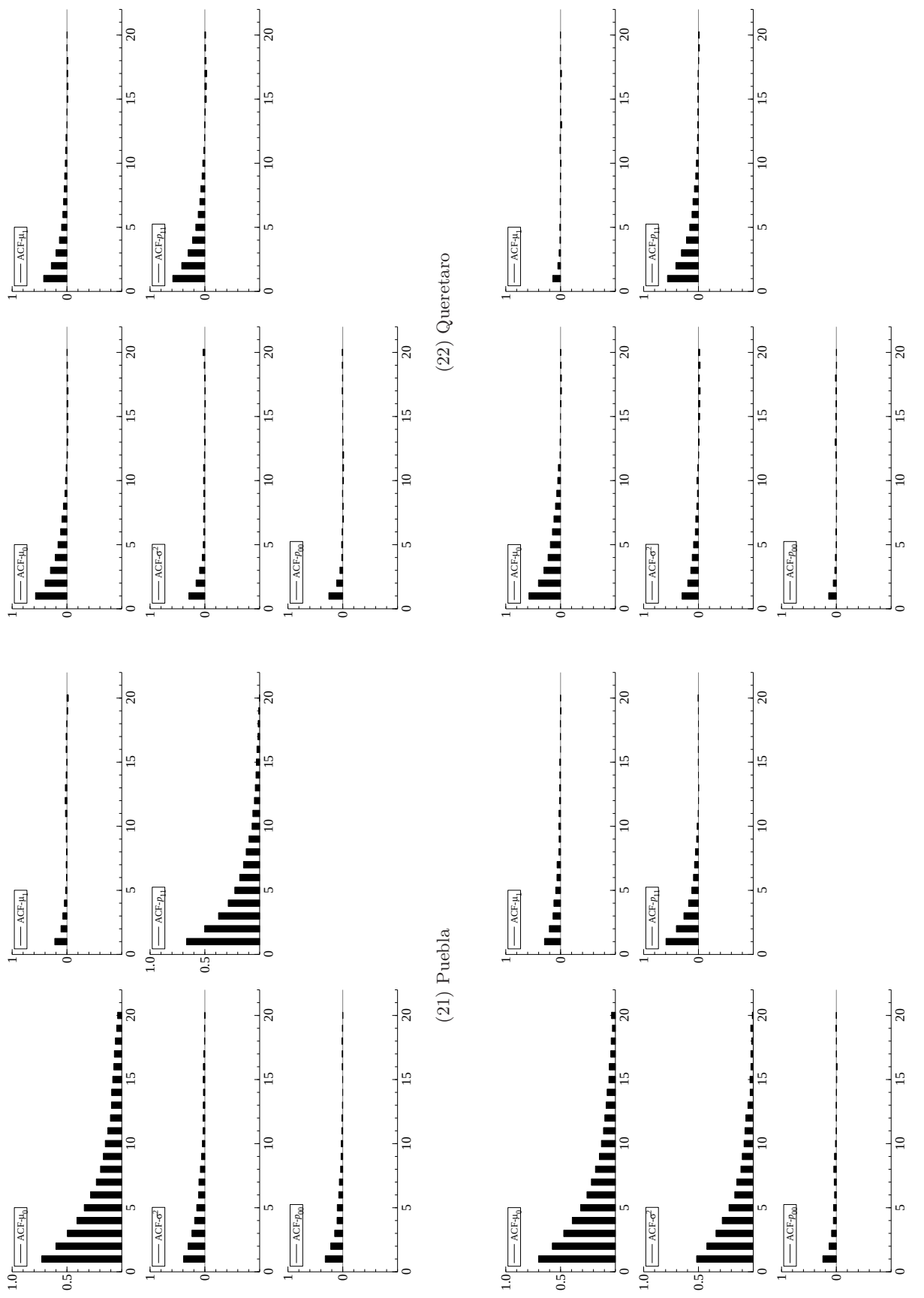
Figure B3: Autocorrelation Function (Continued)



(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

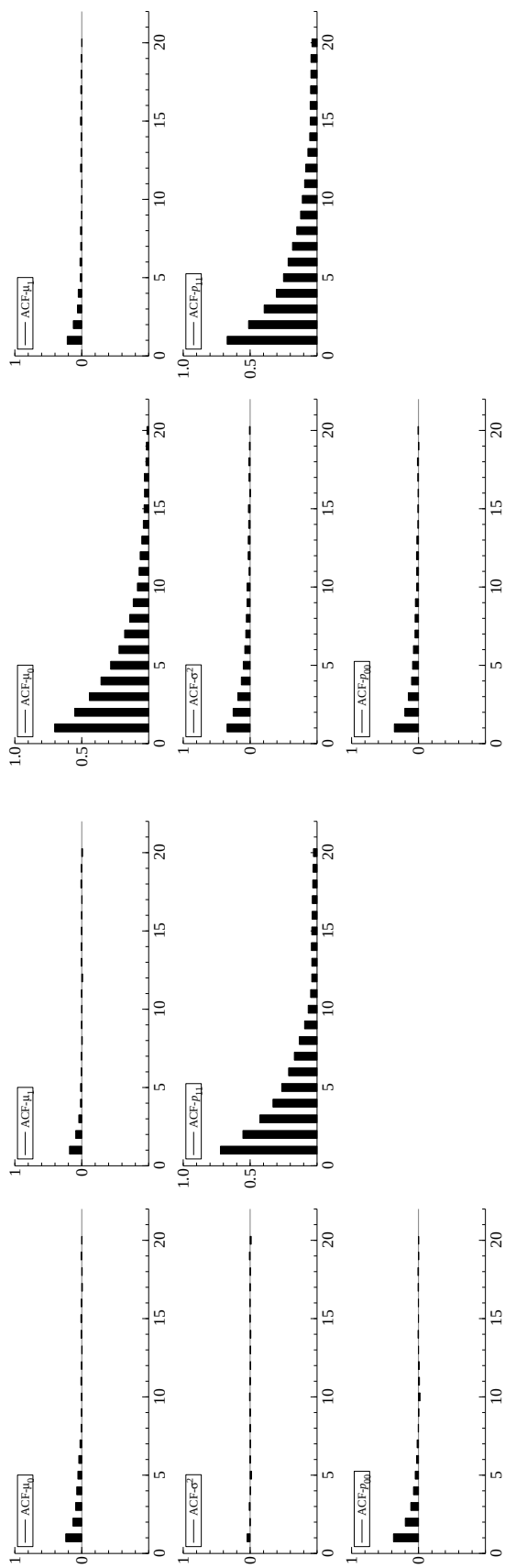
Figure B3: Autocorrelation Function from Markov Swithcing Model (Continued)



(21) Puebla (22) Queretaro

(23) Quintana Roo (24) San Luis Potosi

Figure B3: Autocorrelation Function from Markov Swithcing Model (Continued)



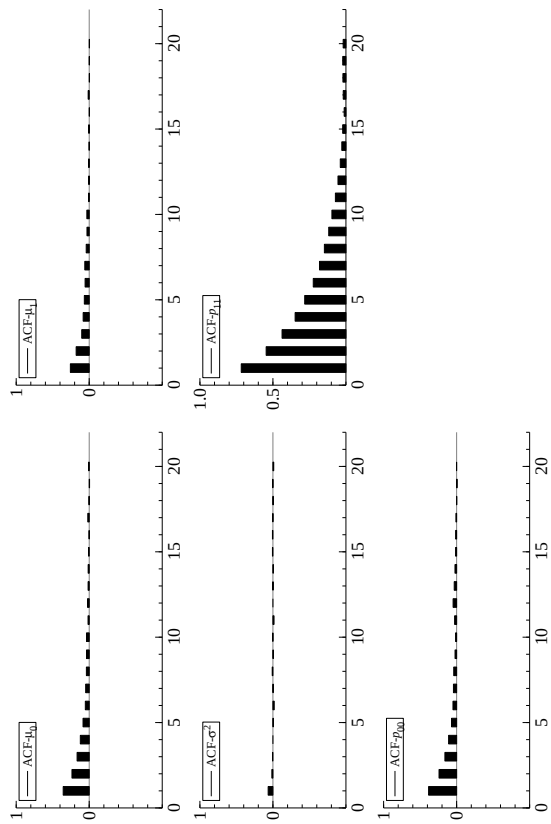
(25) Sinaloa

(26) Sonora

(27) Tabasco

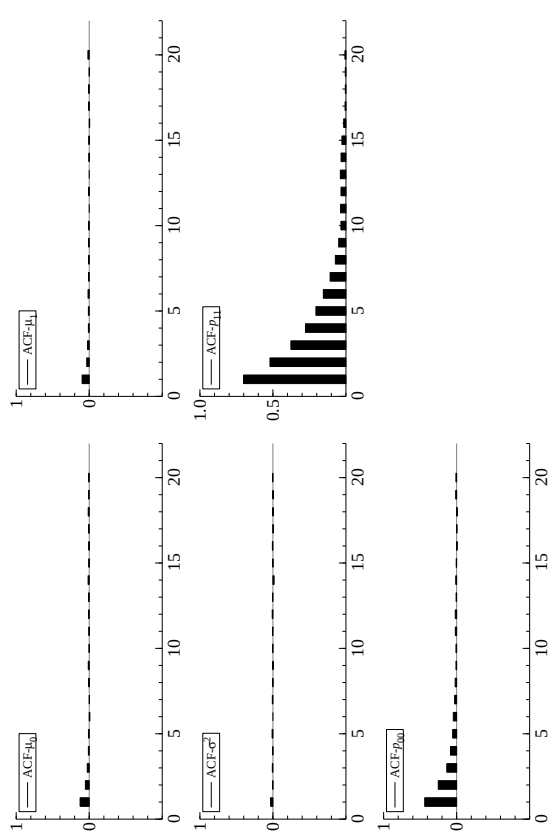
(28) Tamaulipas

Figure B3: Autocorrelation Function from Markov Swithcing Model (Continued)

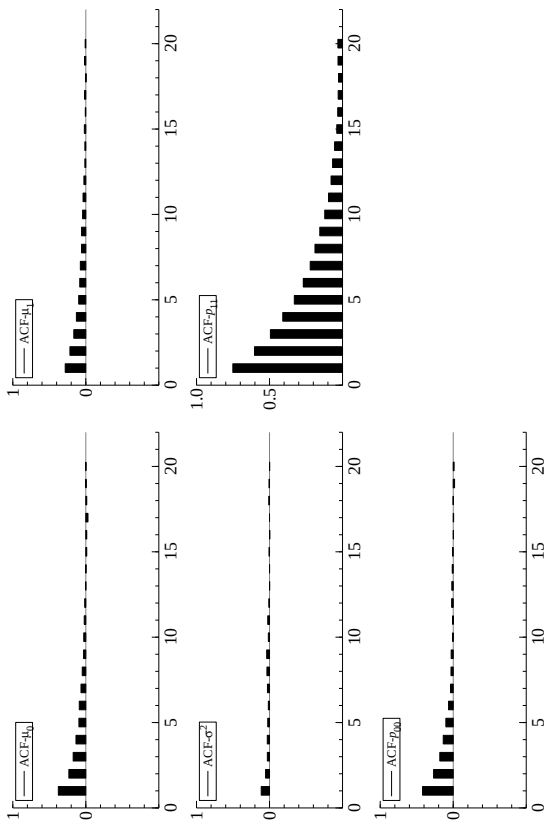


(29) Tlaxcala

(30) Veracruz



(31) Yucatan



(32) Zacatecas

Figure B3: Autocorrelation Function from Markov Swithcing Model (Continued)

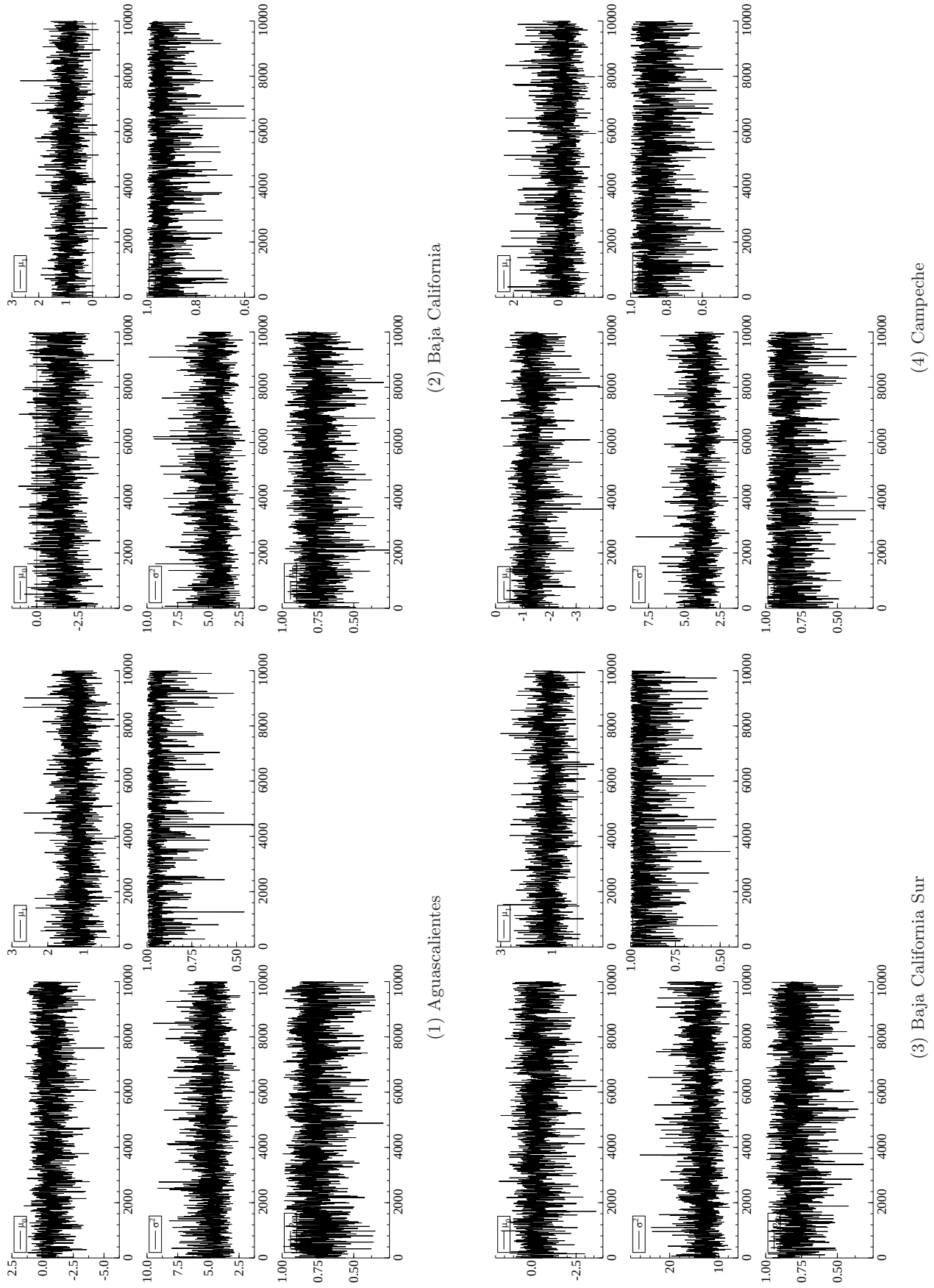
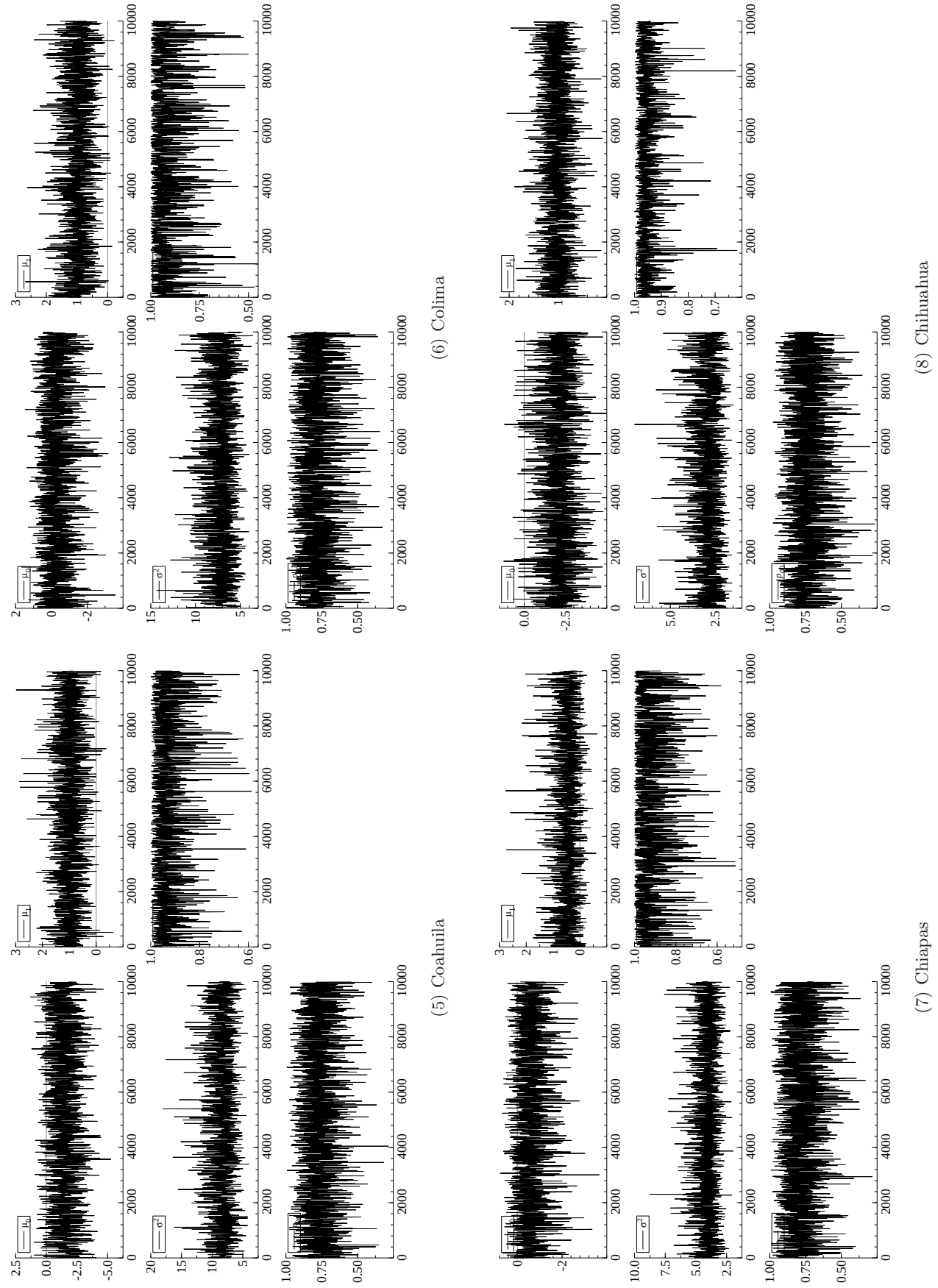


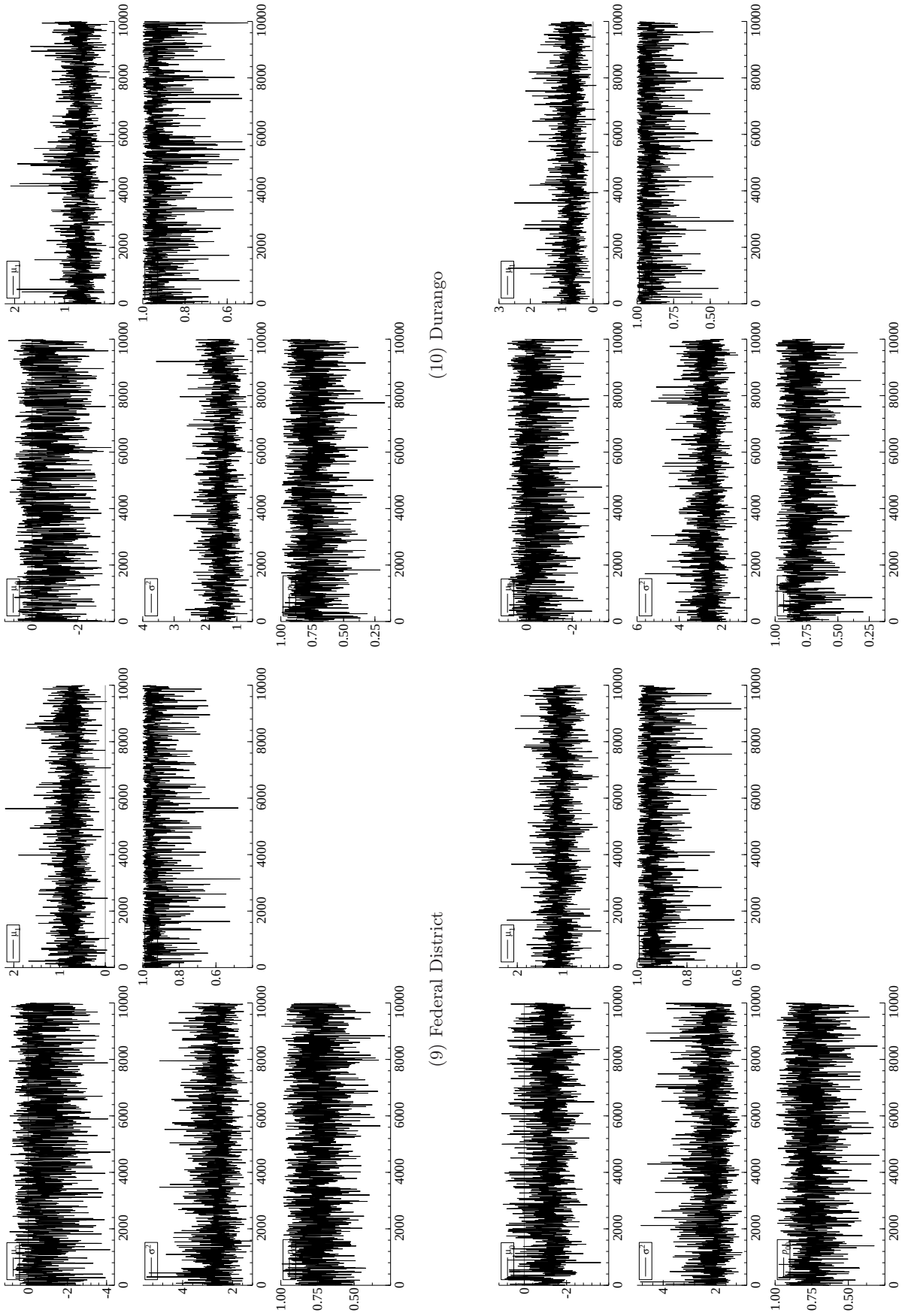
Figure B4: Trace Plots from Markov Swithcing Model



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

Figure B4: Trace Plots from Markov Swithcing Model (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

Figure B4: Trace Plots from Markov Swithcing Model (Continued)

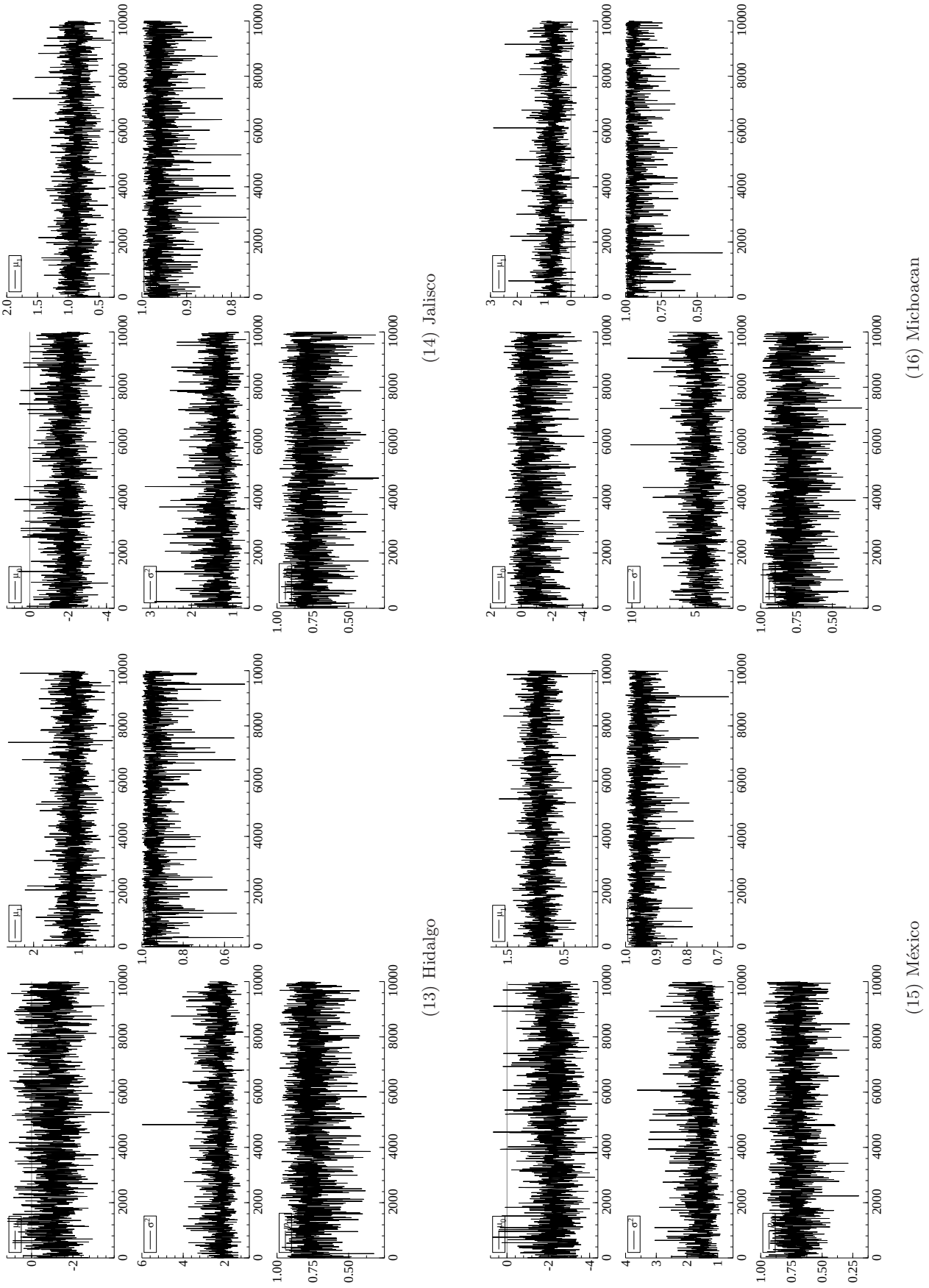
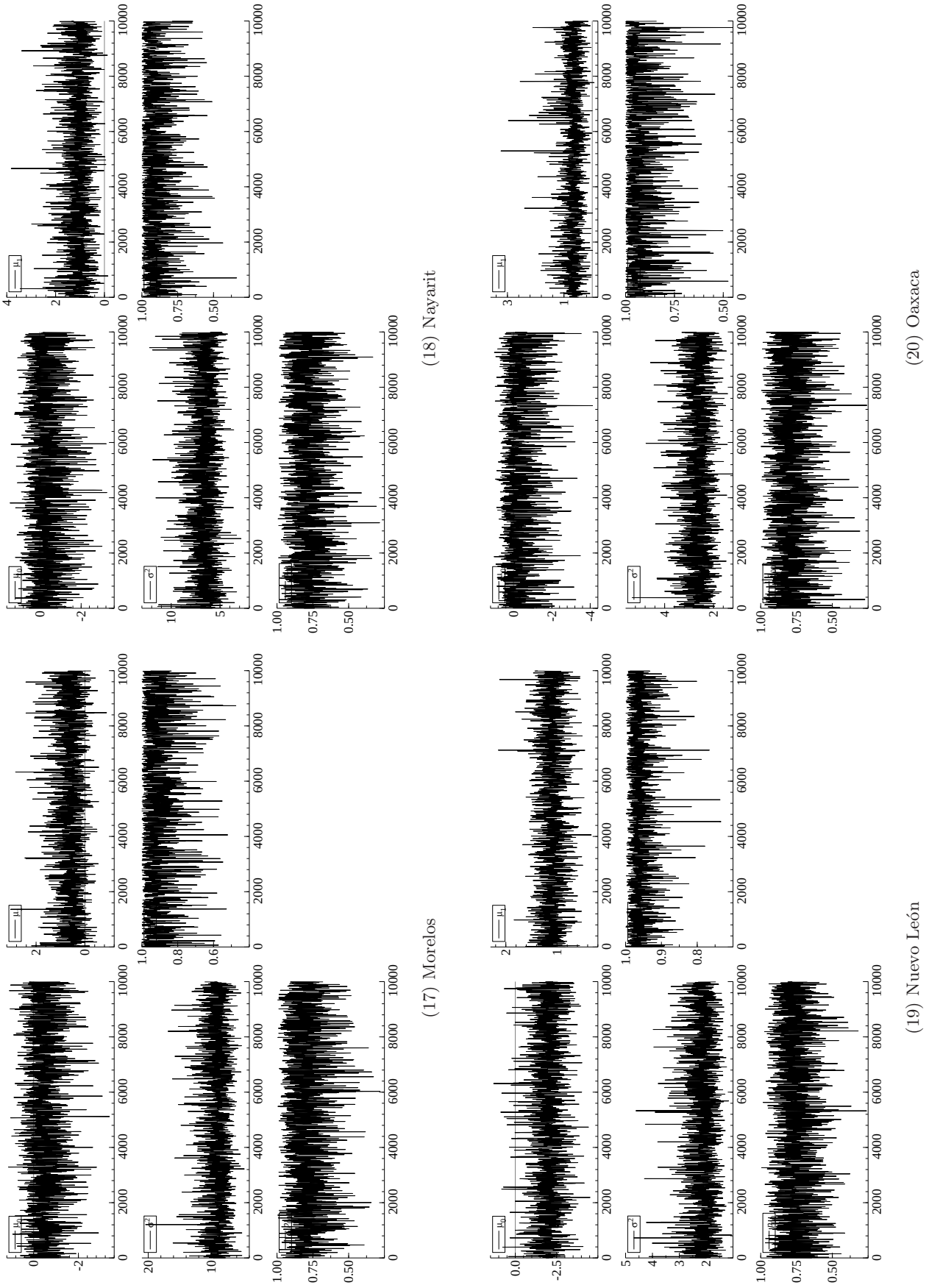
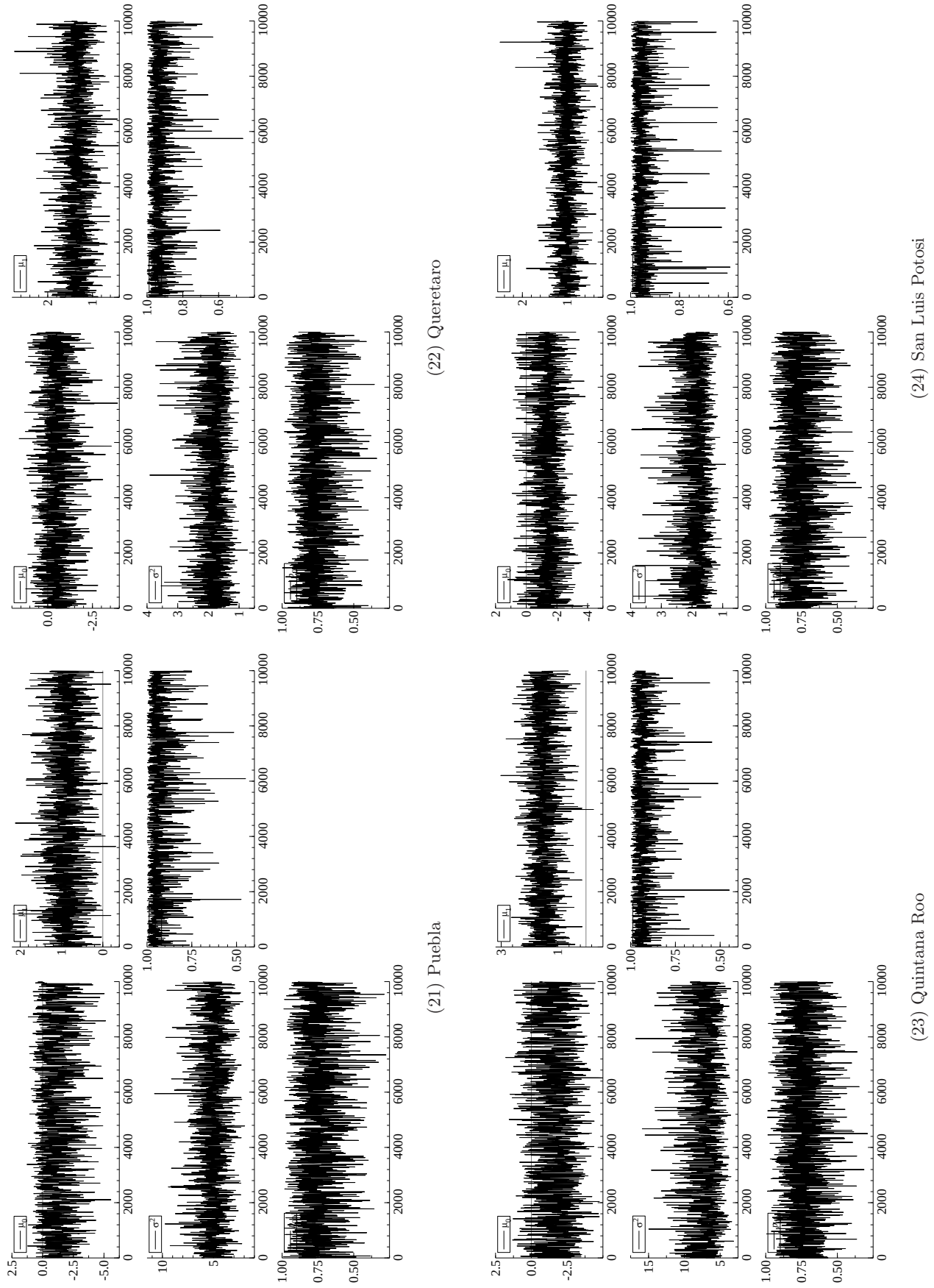


Figure B4: Trace Plots from Markov Switching Model (Continued)



(17) Morelos (18) Nayarit (19) Nuevo León (20) Oaxaca

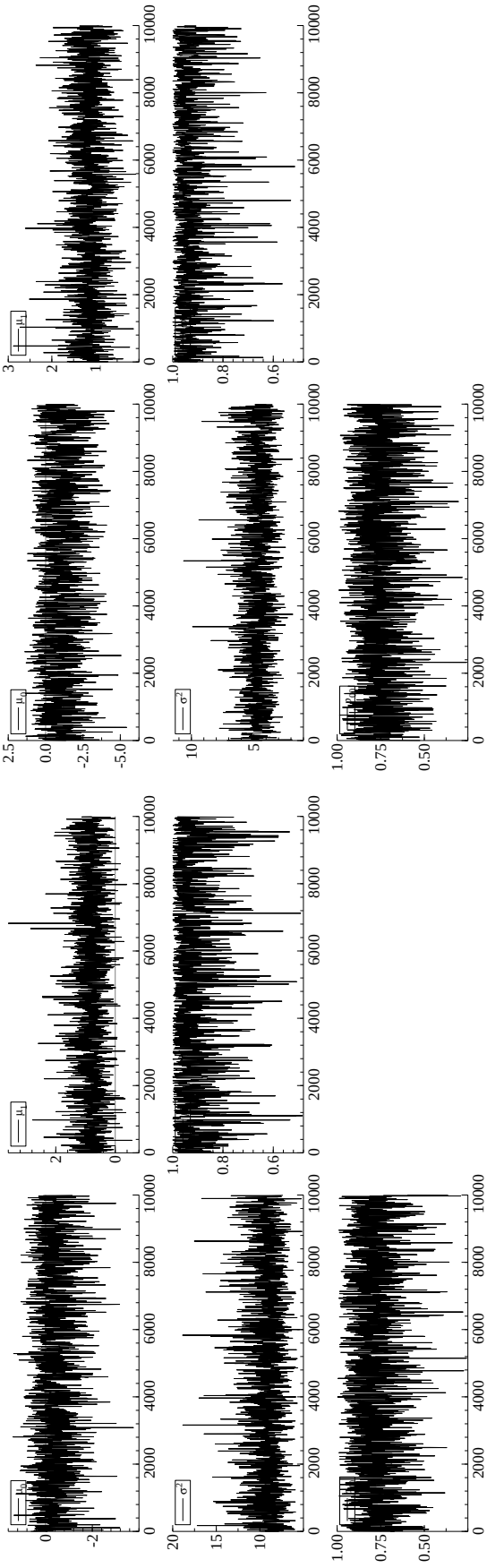
Figure B4: Trace Plots from Markov Switching Model (Continued)



(21) Puebla (22) Queretaro

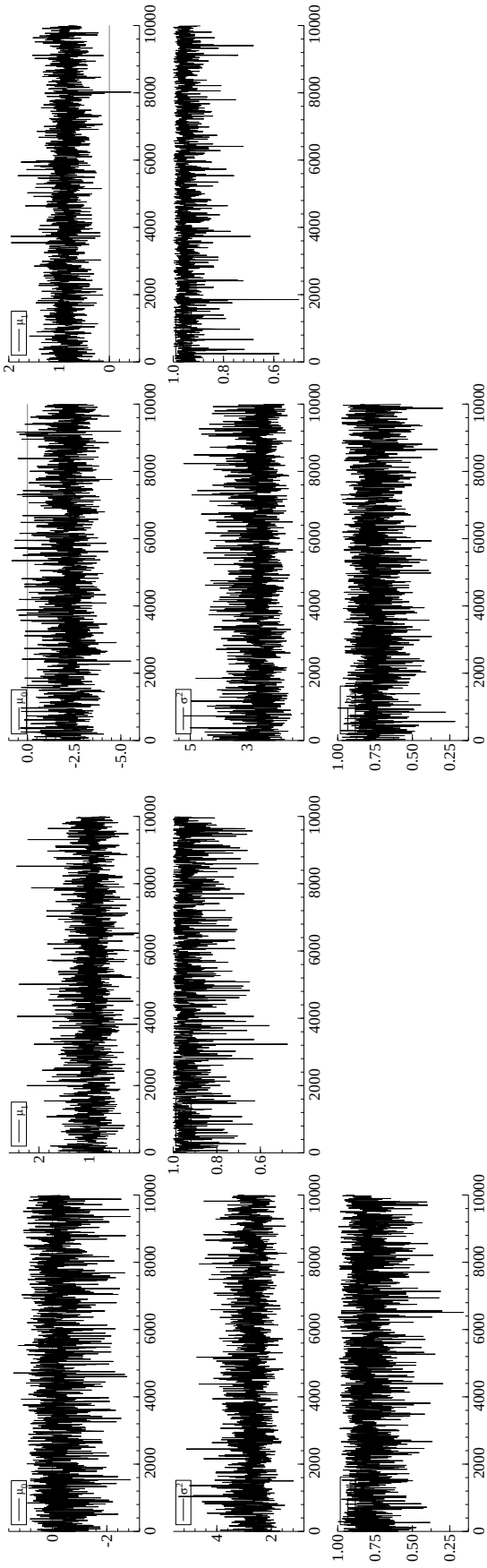
(23) Quintana Roo (24) San Luis Potosi

Figure B4: Trace Plots from Markov Swithcing Model (Continued)



(25) Sinaloa

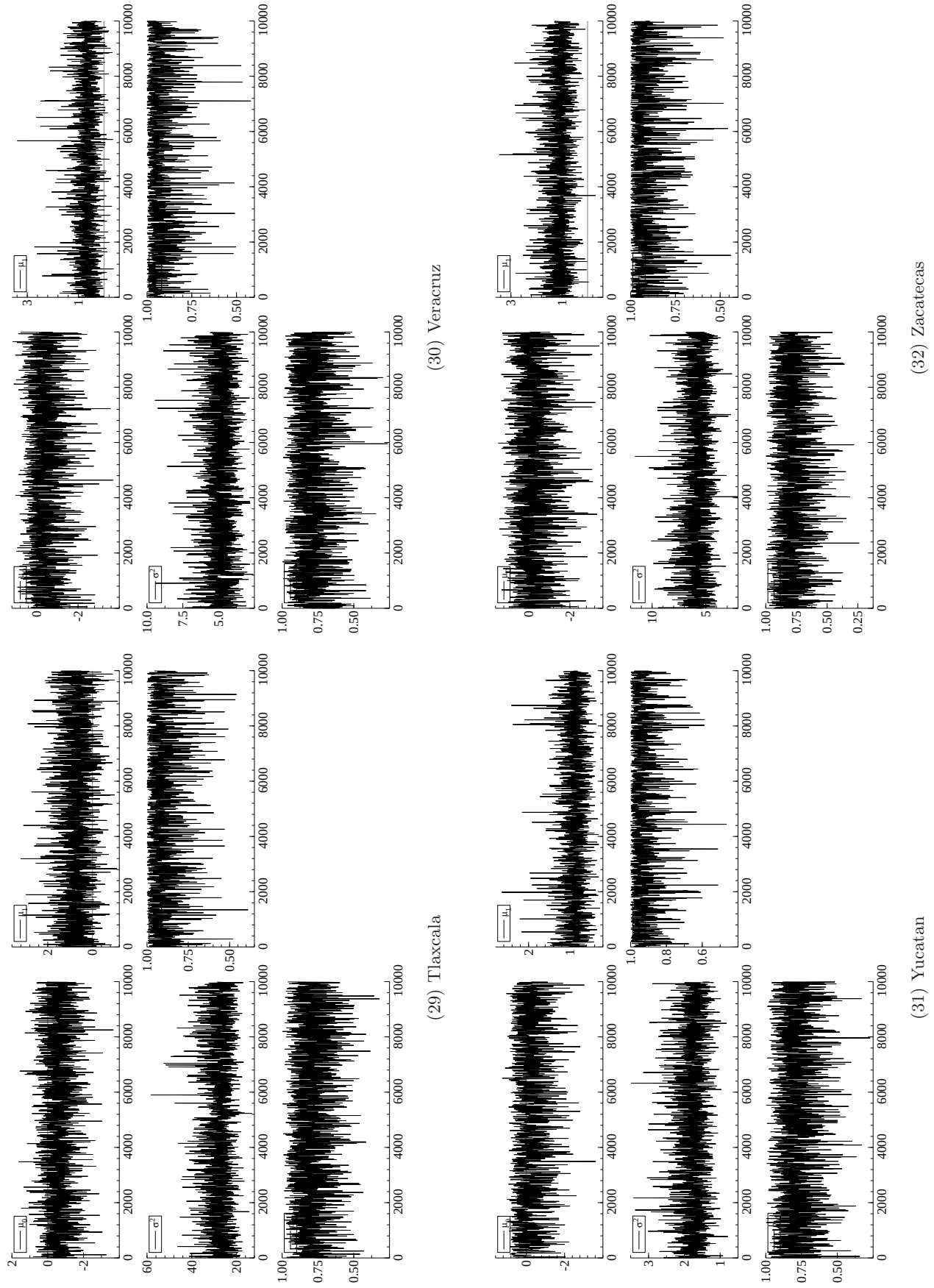
(26) Sonora



(27) Tabasco

(28) Tamaulipas

Figure B4: Trace Plots from Markov Switching Model (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

Figure B4: Trace Plots from Markov Swithcing Model (Continued)

Online Appendix C. Estimation Results of Markov Switching Model with First-Order Autoregressive Process

The estimation results here are obtained by estimating the Markov switching model with first-order autoregressive process:

$$\boldsymbol{y}_t = \boldsymbol{\Phi}\boldsymbol{y}_{t-1} + \boldsymbol{\mu}_0 \odot (\boldsymbol{\iota}_N - \boldsymbol{s}_t) + \boldsymbol{\mu}_1 \odot \boldsymbol{s}_t + \boldsymbol{\varepsilon}_t,$$

where $\boldsymbol{\Phi} = \text{diag}(\phi_1, \ldots, \phi_N)$, $\boldsymbol{\varepsilon}_t \sim$ i.i.d. $\text{N}(\boldsymbol{0}, \boldsymbol{\Omega})$, and $\boldsymbol{\Omega} = \text{diag}(\sigma_1^2, \ldots, \sigma_N^2)$.

Table C1

Table C1 shows the point estimates and interval estimates of parameters.

Figure C1

Figure C1 shows the probabilities of recession, which are calculated by $1 - G^{-1}\sum_{g=1}^{G} s_{t,n}^{(g)}$, where G is the number of iterations and the superscript (g) is the gth iteration.

Figure C2

Figure C2 shows the histogram and density plots of parameters by state. The solid line indicates density estimates obtained by kernel density estimation.

Figure C3

Figure C3 shows the autocorrelation plots of parameters by state.

Figure C4

Figure C4 shows the trace plots of parameters by state.

Table C1: Estimated Parameters

		μ_0			μ_1			ϕ		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	−1.29	−1.33	[−3.27, 0.62]	1.16	1.17	[0.29, 1.99]	0.20	0.20	[−0.11, 0.53]
2	Baja California	−2.14	−2.25	[−3.67, 0.11]	1.11	1.13	[0.40, 1.72]	−0.04	−0.05	[−0.32, 0.32]
3	Baja California Sur	−0.02	0.10	[−2.07, 1.44]	1.69	1.66	[0.84, 2.75]	−0.40	−0.40	[−0.69, −0.09]
4	Campeche	−1.43	−1.38	[−2.63, −0.50]	−0.16	−0.28	[−1.28, 1.59]	−0.22	−0.22	[−0.53, 0.09]
5	Coahuila	−0.69	−0.61	[−2.57, 0.76]	0.89	0.87	[−0.30, 2.20]	0.13	0.14	[−0.18, 0.45]
6	Colima	−0.56	−0.48	[−2.34, 0.78]	1.04	0.99	[0.02, 2.37]	0.16	0.16	[−0.15, 0.48]
7	Chiapas	−0.64	−0.57	[−2.33, 0.63]	0.75	0.69	[−0.27, 2.10]	−0.10	−0.10	[−0.42, 0.21]
8	Chihuahua	−1.53	−1.45	[−4.04, 0.48]	1.02	1.04	[0.04, 1.93]	−0.05	−0.06	[−0.37, 0.29]
9	Federal District	−1.89	−1.95	[−3.73, 0.25]	0.88	0.89	[0.28, 1.43]	−0.05	−0.05	[−0.45, 0.37]
10	Durango	−0.65	−0.55	[−2.20, 0.36]	0.51	0.46	[−0.10, 1.38]	0.32	0.32	[−0.05, 0.67]
11	Guanajuato	−0.82	−0.73	[−2.78, 0.72]	1.07	1.06	[0.12, 2.11]	−0.02	−0.02	[−0.36, 0.34]
12	Guerrero	−1.06	−1.09	[−2.44, 0.31]	0.76	0.77	[0.08, 1.42]	−0.02	−0.02	[−0.38, 0.39]
13	Hidalgo	−1.89	−1.99	[−3.99, 0.49]	1.32	1.34	[0.37, 2.14]	−0.18	−0.19	[−0.49, 0.18]
14	Jalisco	−1.42	−1.36	[−3.84, 0.51]	0.88	0.88	[0.11, 1.68]	0.03	0.03	[−0.32, 0.35]
15	México	−1.61	−1.75	[−3.31, 0.41]	1.02	1.02	[0.31, 1.67]	0.20	0.21	[−0.16, 0.56]
16	Michoacán	−1.39	−1.44	[−3.43, 0.53]	0.93	0.93	[0.19, 1.66]	−0.04	−0.04	[−0.36, 0.29]
17	Morelos	−0.77	−0.79	[−2.08, 0.53]	1.03	1.05	[0.27, 1.77]	−0.21	−0.22	[−0.58, 0.19]
18	Nayarit	−0.45	−0.38	[−2.20, 0.91]	1.03	0.99	[−0.08, 2.41]	−0.05	−0.05	[−0.37, 0.27]
19	Nuevo León	−1.88	−1.96	[−3.93, 0.43]	1.27	1.28	[0.40, 2.05]	0.10	0.10	[−0.25, 0.41]
20	Oaxaca	−0.53	−0.36	[−2.40, 0.67]	0.79	0.76	[0.11, 1.68]	−0.21	−0.21	[−0.53, 0.11]
21	Puebla	−0.85	−0.78	[−2.92, 0.76]	1.13	1.12	[0.12, 2.18]	0.06	0.05	[−0.29, 0.40]
22	Querétaro	−1.89	−1.98	[−3.65, 0.32]	1.44	1.44	[0.53, 2.29]	0.13	0.14	[−0.27, 0.49]
23	Quintana Roo	−0.98	−0.83	[−3.40, 0.88]	1.40	1.36	[0.10, 2.84]	−0.06	−0.06	[−0.37, 0.27]
24	San Luis Potosí	−1.37	−1.43	[−3.26, 0.62]	1.24	1.26	[0.27, 2.09]	−0.02	−0.02	[−0.37, 0.35]
25	Sinaloa	−0.47	−0.36	[−2.33, 0.84]	0.97	0.93	[0.05, 2.16]	−0.03	−0.03	[−0.36, 0.30]
26	Sonora	−0.65	−0.58	[−2.67, 0.98]	1.33	1.31	[0.29, 2.42]	−0.24	−0.24	[−0.56, 0.08]
27	Tabasco	−0.25	−0.24	[−2.22, 1.47]	1.85	1.84	[1.13, 2.65]	−0.55	−0.55	[−0.82, −0.28]
28	Tamaulipas	−1.25	−1.27	[−2.97, 0.42]	1.01	1.02	[0.09, 1.90]	−0.01	−0.02	[−0.37, 0.36]
29	Tlaxcala	−0.99	−1.00	[−2.60, 0.46]	0.99	1.00	[0.11, 1.83]	0.11	0.11	[−0.27, 0.50]
30	Veracruz	−0.27	−0.14	[−2.04, 0.86]	0.98	0.92	[0.20, 2.13]	−0.10	−0.10	[−0.44, 0.23]
31	Yucatán	−0.41	−0.40	[−1.88, 0.90]	1.38	1.38	[0.55, 2.27]	−0.14	−0.15	[−0.50, 0.22]
32	Zacatecas	−0.15	−0.05	[−2.12, 1.32]	1.52	1.48	[0.65, 2.61]	−0.40	−0.40	[−0.70, −0.10]

Notes: 95% CI indicates 95% credible interval.

Table C1: Estimated Parameters (Continued)

		σ^2			p_{11}			p_{00}		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	3.69	3.50	[1.95, 6.52]	0.92	0.94	[0.73, 1.00]	0.75	0.77	[0.48, 0.95]
2	Baja California	2.37	2.20	[1.34, 4.40]	0.94	0.95	[0.81, 0.99]	0.77	0.79	[0.52, 0.95]
3	Baja California Sur	3.97	3.83	[2.38, 6.35]	0.93	0.95	[0.73, 1.00]	0.78	0.80	[0.49, 0.97]
4	Campeche	4.52	4.37	[2.72, 7.20]	0.87	0.89	[0.62, 0.99]	0.84	0.87	[0.57, 0.98]
5	Coahuila	16.15	15.56	[10.04, 25.45]	0.90	0.93	[0.68, 1.00]	0.78	0.80	[0.50, 0.97]
6	Colima	7.21	6.99	[4.28, 11.40]	0.91	0.93	[0.69, 1.00]	0.78	0.80	[0.50, 0.97]
7	Chiapas	9.28	9.01	[5.53, 14.67]	0.90	0.93	[0.67, 1.00]	0.78	0.79	[0.50, 0.97]
8	Chihuahua	5.33	5.16	[2.32, 9.30]	0.91	0.93	[0.73, 0.99]	0.76	0.77	[0.48, 0.96]
9	Federal District	1.60	1.50	[0.93, 2.81]	0.94	0.95	[0.82, 0.99]	0.76	0.78	[0.49, 0.95]
10	Durango	1.68	1.63	[0.93, 2.74]	0.91	0.93	[0.69, 1.00]	0.78	0.79	[0.50, 0.97]
11	Guanajuato	5.03	4.84	[2.84, 8.40]	0.91	0.93	[0.71, 1.00]	0.78	0.79	[0.51, 0.96]
12	Guerrero	1.74	1.65	[0.98, 2.98]	0.92	0.93	[0.73, 0.99]	0.78	0.80	[0.53, 0.96]
13	Hidalgo	4.62	4.33	[2.52, 8.25]	0.94	0.95	[0.80, 0.99]	0.77	0.78	[0.50, 0.95]
14	Jalisco	3.65	3.50	[1.94, 6.31]	0.93	0.94	[0.75, 1.00]	0.75	0.77	[0.47, 0.95]
15	México	1.96	1.84	[1.02, 3.57]	0.93	0.94	[0.78, 0.99]	0.74	0.75	[0.46, 0.94]
16	Michoacán	3.13	2.99	[1.66, 5.37]	0.92	0.94	[0.73, 1.00]	0.75	0.76	[0.47, 0.95]
17	Morelos	2.25	2.16	[1.31, 3.78]	0.92	0.94	[0.75, 1.00]	0.79	0.81	[0.54, 0.96]
18	Nayarit	12.62	12.17	[7.88, 19.93]	0.91	0.93	[0.68, 1.00]	0.79	0.81	[0.51, 0.97]
19	Nuevo León	4.23	3.99	[2.39, 7.51]	0.94	0.95	[0.81, 0.99]	0.76	0.77	[0.49, 0.95]
20	Oaxaca	2.48	2.40	[1.44, 4.03]	0.91	0.93	[0.67, 1.00]	0.78	0.79	[0.49, 0.97]
21	Puebla	7.34	7.06	[4.33, 11.92]	0.92	0.94	[0.73, 1.00]	0.77	0.79	[0.49, 0.96]
22	Querétaro	3.34	3.12	[1.92, 5.93]	0.94	0.95	[0.83, 0.99]	0.77	0.79	[0.51, 0.95]
23	Quintana Roo	10.46	10.32	[4.18, 17.97]	0.91	0.92	[0.71, 1.00]	0.76	0.78	[0.48, 0.96]
24	San Luis Potosí	4.14	3.94	[2.07, 7.30]	0.92	0.94	[0.75, 0.99]	0.75	0.76	[0.48, 0.95]
25	Sinaloa	6.92	6.69	[4.18, 10.94]	0.90	0.93	[0.68, 1.00]	0.78	0.80	[0.49, 0.96]
26	Sonora	7.17	6.90	[4.22, 11.68]	0.92	0.94	[0.72, 1.00]	0.77	0.79	[0.50, 0.96]
27	Tabasco	2.99	2.90	[1.61, 4.88]	0.94	0.96	[0.77, 1.00]	0.75	0.77	[0.45, 0.96]
28	Tamaulipas	3.92	3.73	[2.18, 6.72]	0.91	0.93	[0.72, 0.99]	0.78	0.80	[0.52, 0.96]
29	Tlaxcala	2.61	2.48	[1.29, 4.70]	0.89	0.90	[0.68, 0.99]	0.76	0.77	[0.50, 0.96]
30	Veracruz	3.56	3.43	[2.21, 5.67]	0.91	0.94	[0.69, 1.00]	0.79	0.82	[0.50, 0.97]
31	Yucatán	2.44	2.33	[1.41, 4.07]	0.92	0.94	[0.73, 1.00]	0.79	0.81	[0.54, 0.96]
32	Zacatecas	5.00	4.83	[3.01, 7.97]	0.92	0.95	[0.69, 1.00]	0.77	0.79	[0.47, 0.96]

Notes: 95% CI indicates 95% credible interval.

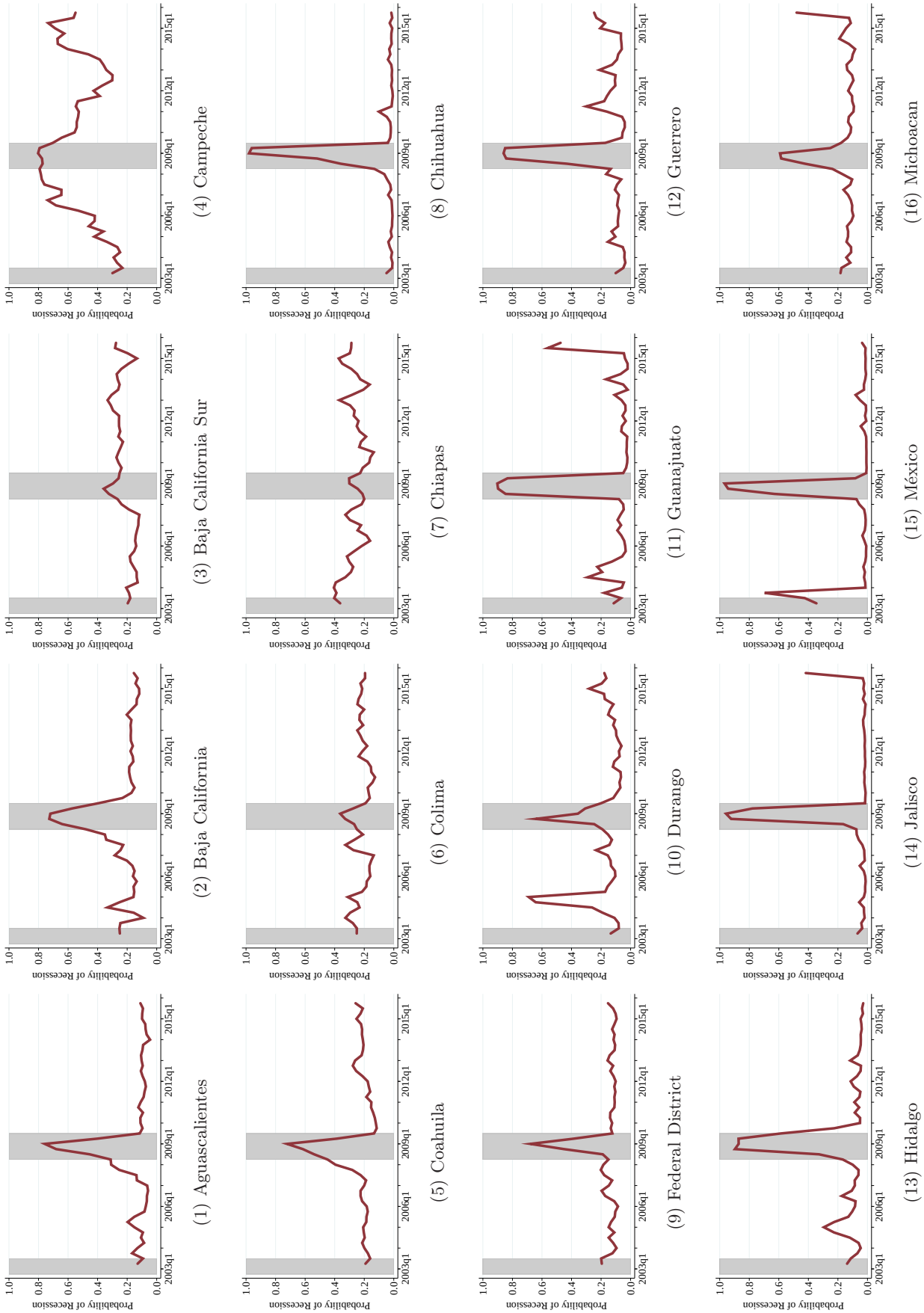


Figure C1: Recession Probabilities from Markov Switching Model with AR(1)

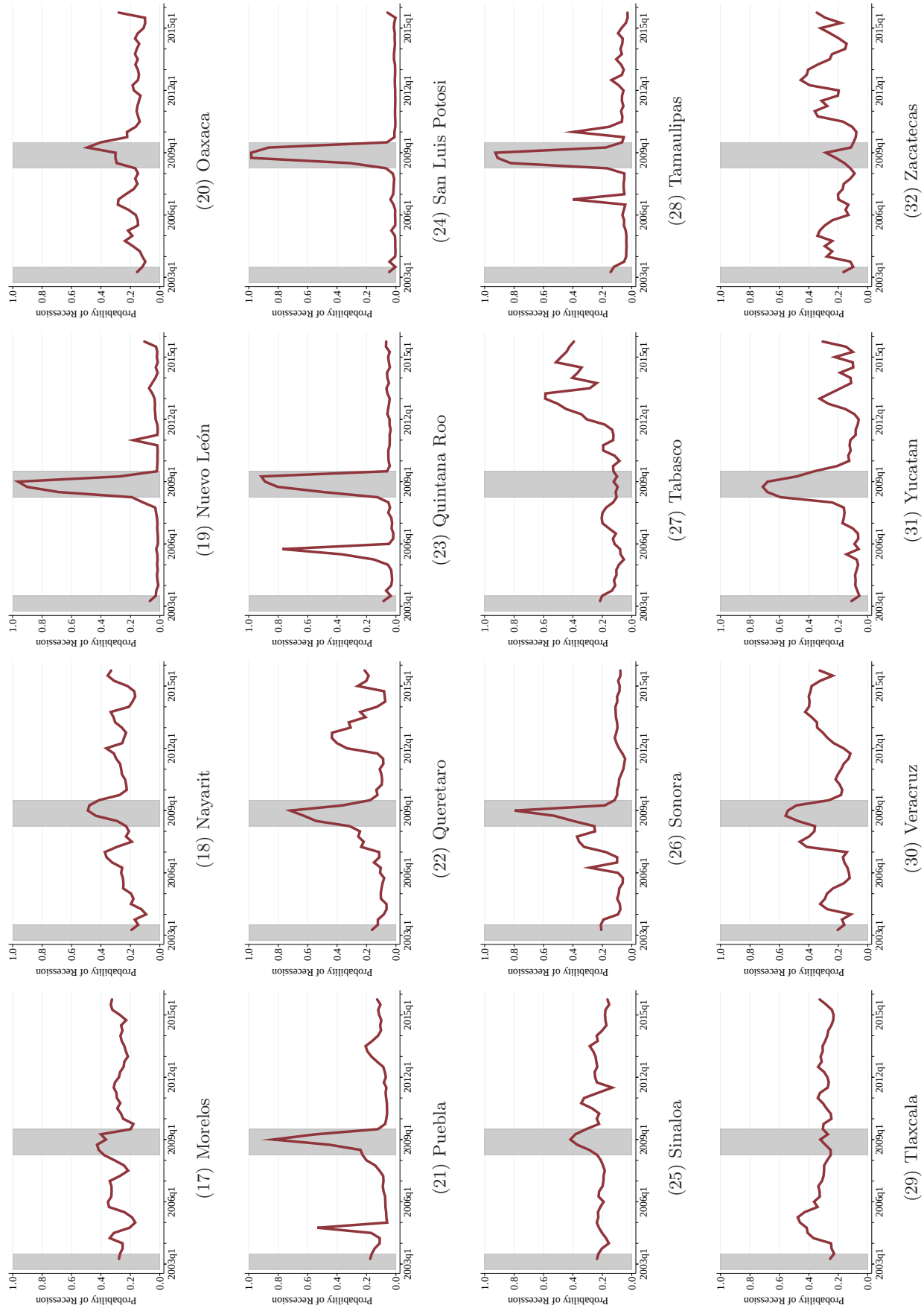
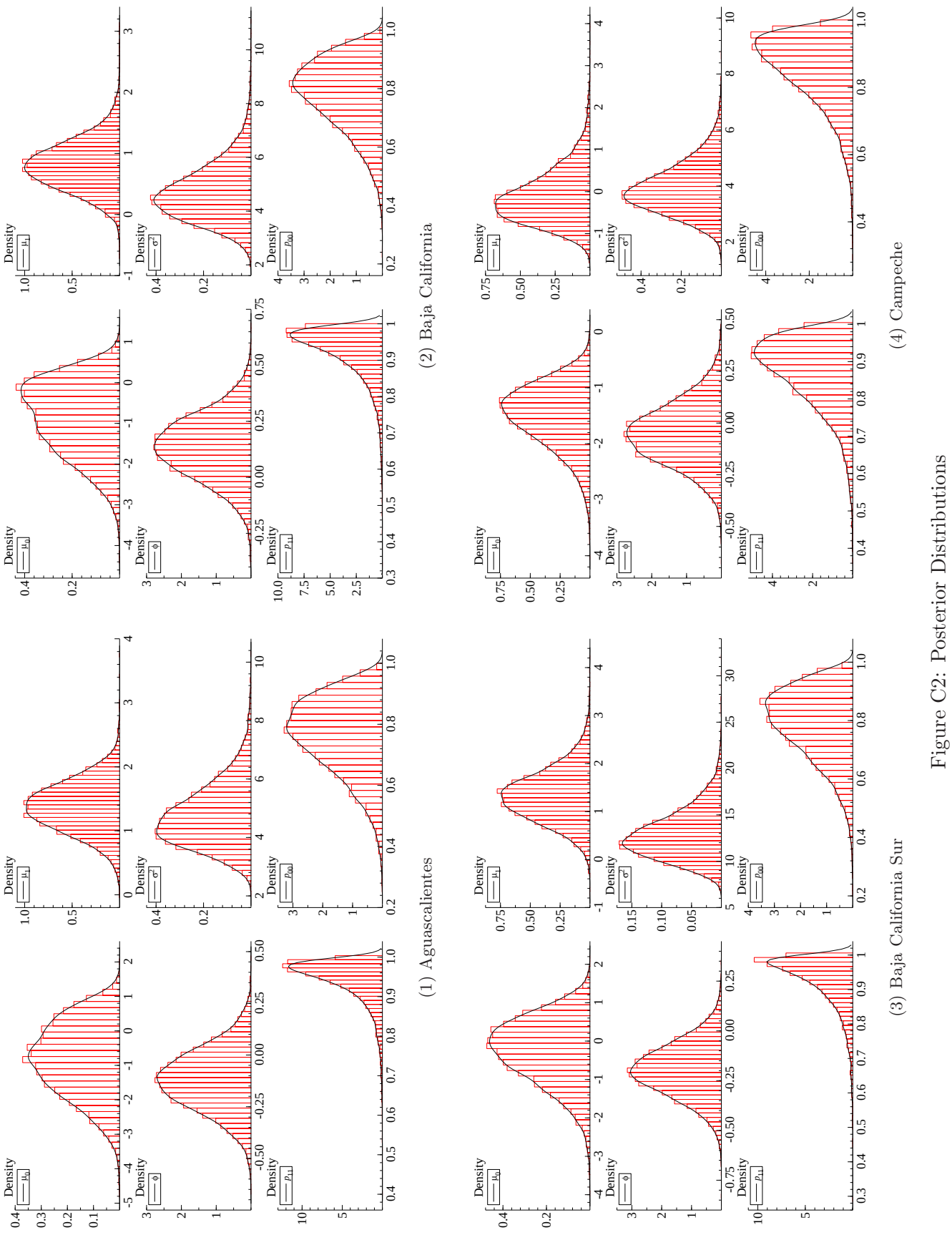


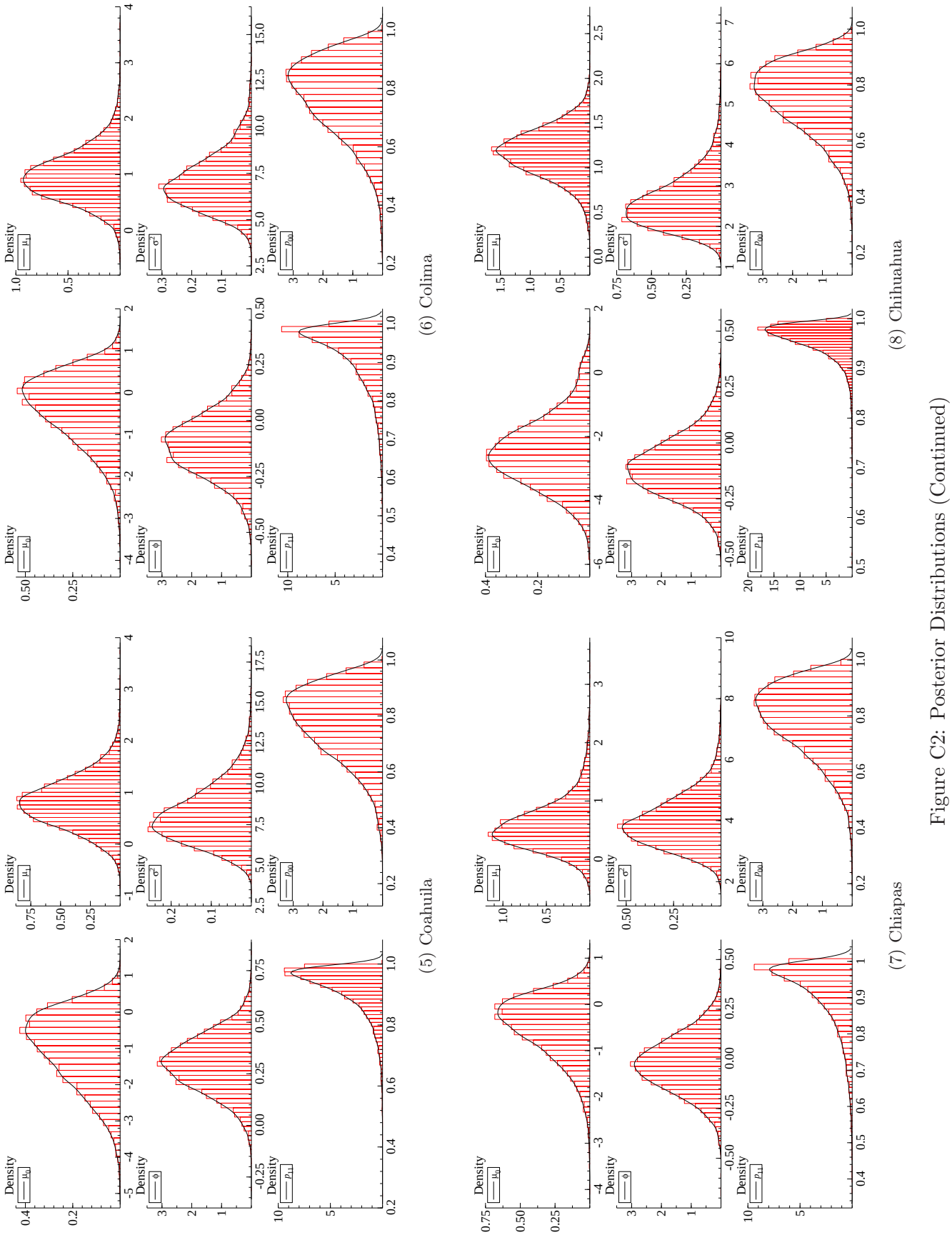
Figure C1: Recession Probabilities (Continued)



(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

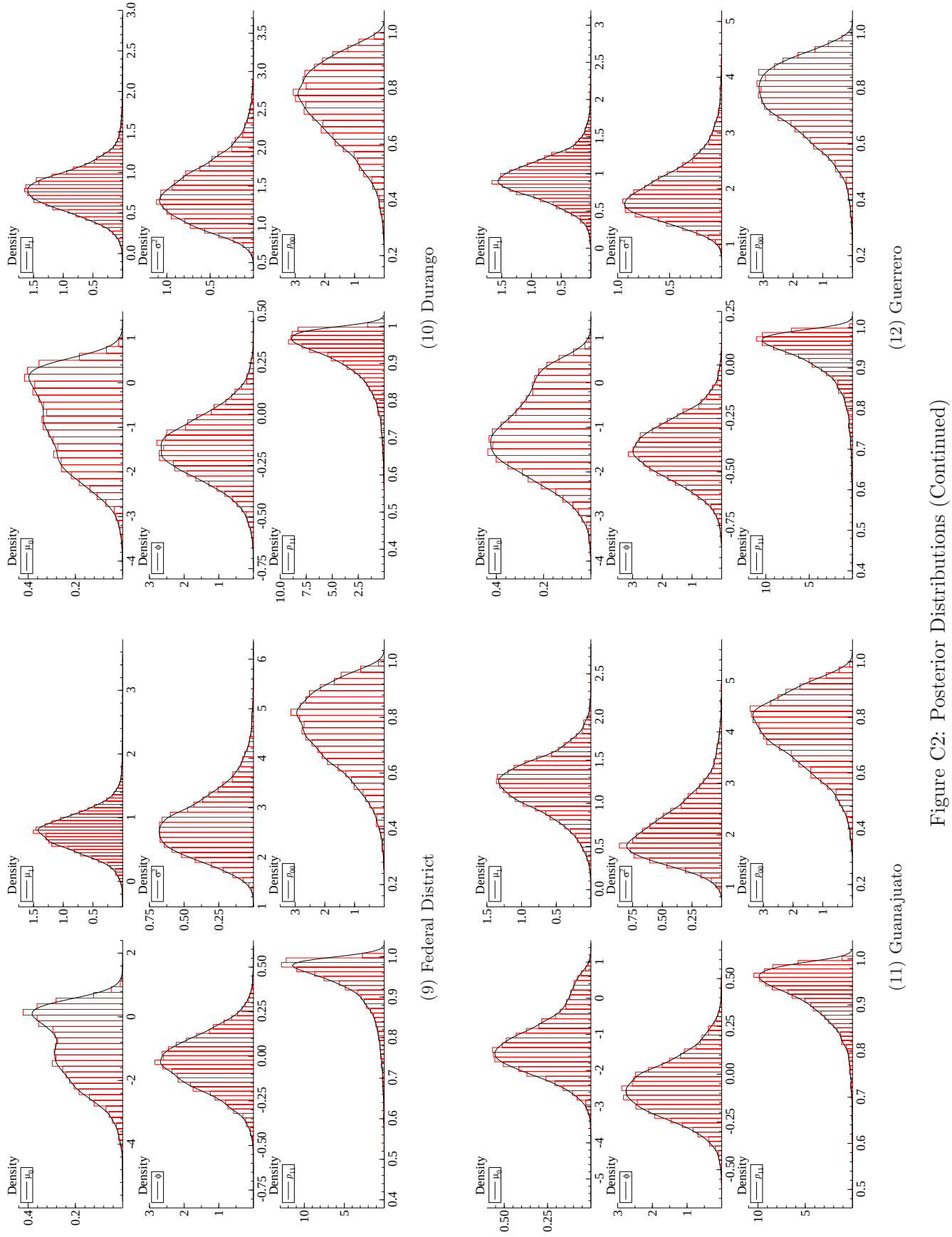
Figure C2: Posterior Distributions



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

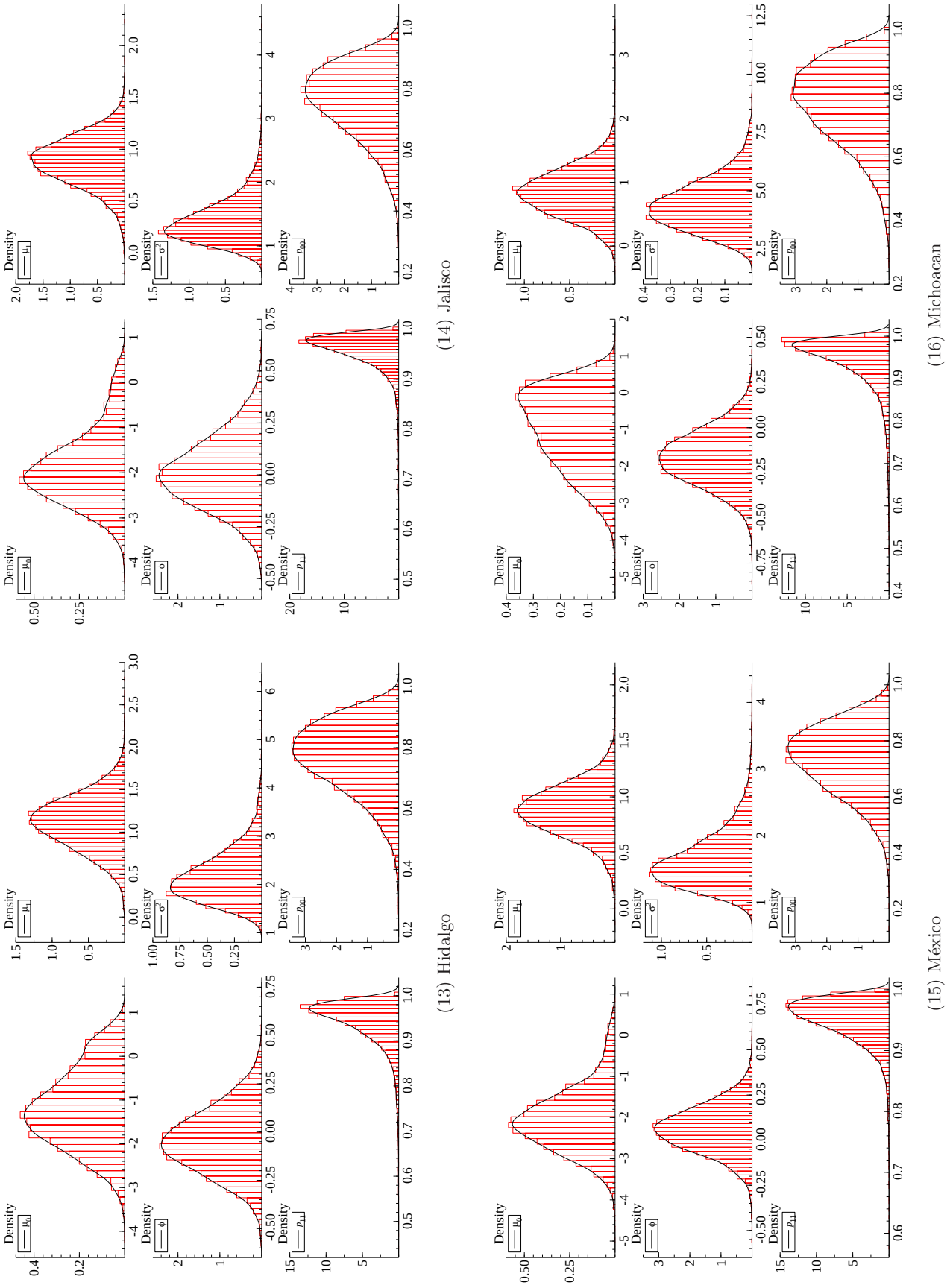
Figure C2: Posterior Distributions (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

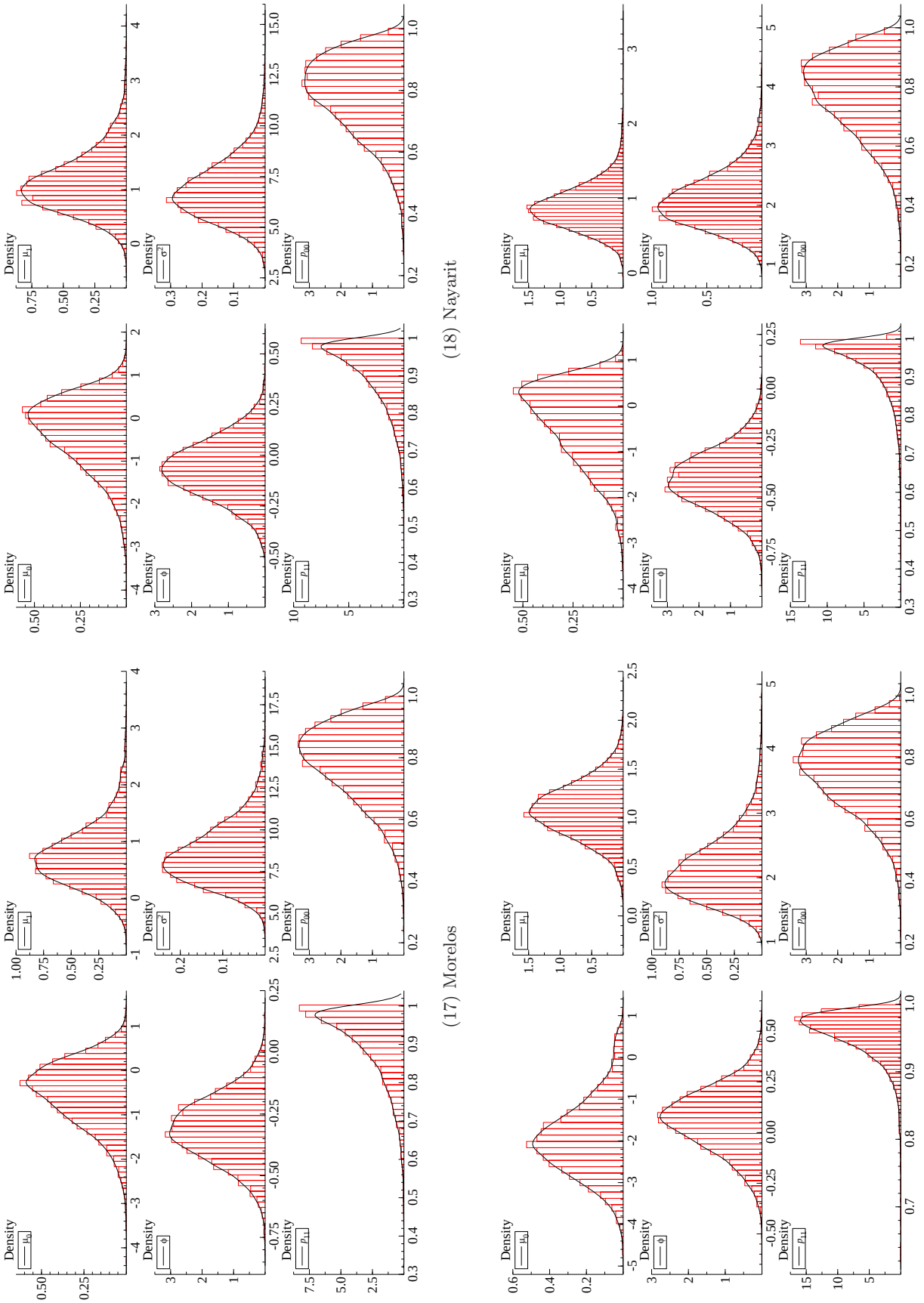
Figure C2: Posterior Distributions (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

Figure C2: Posterior Distributions (Continued)



(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

Figure C2: Posterior Distributions (Continued)

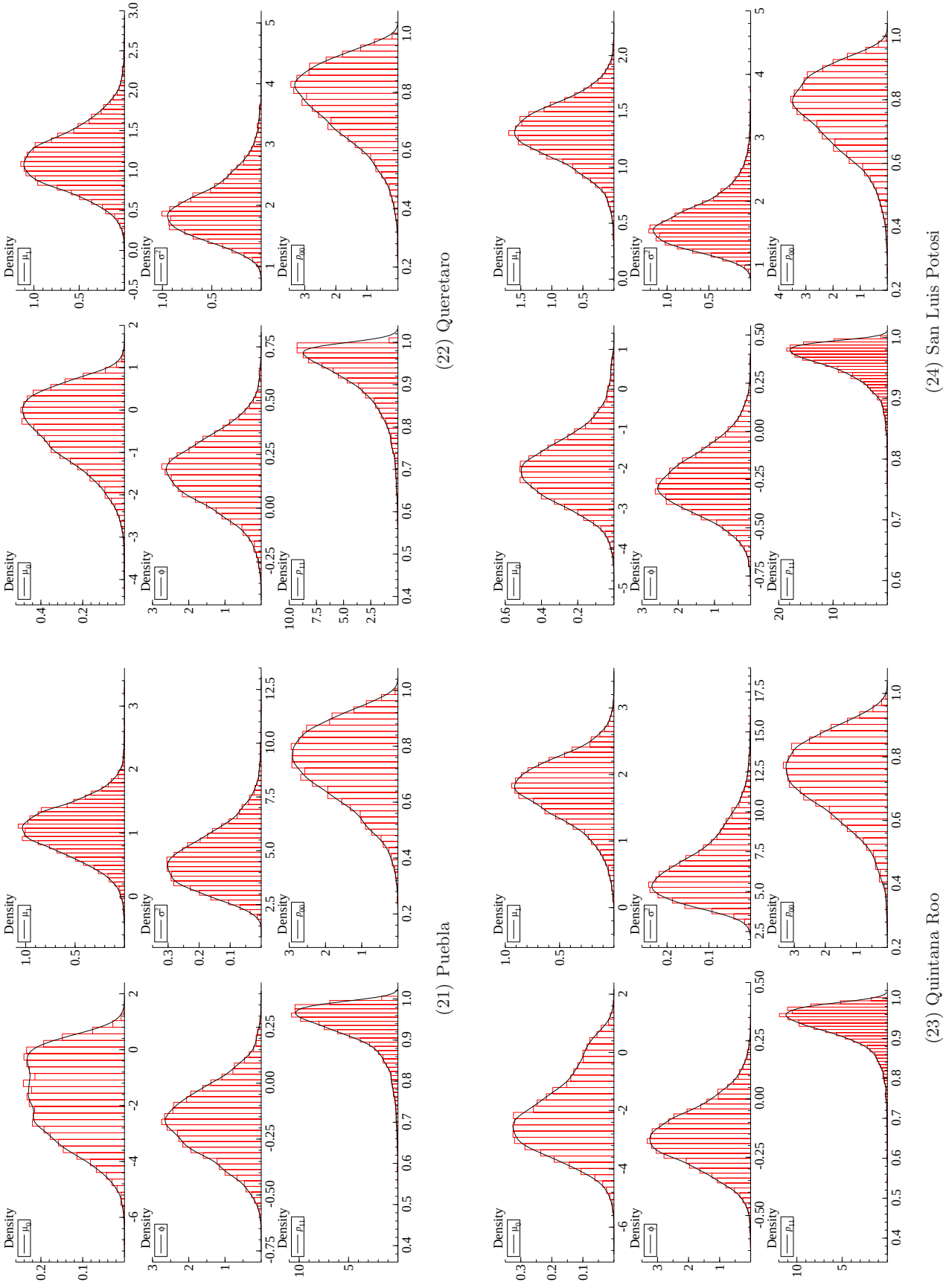
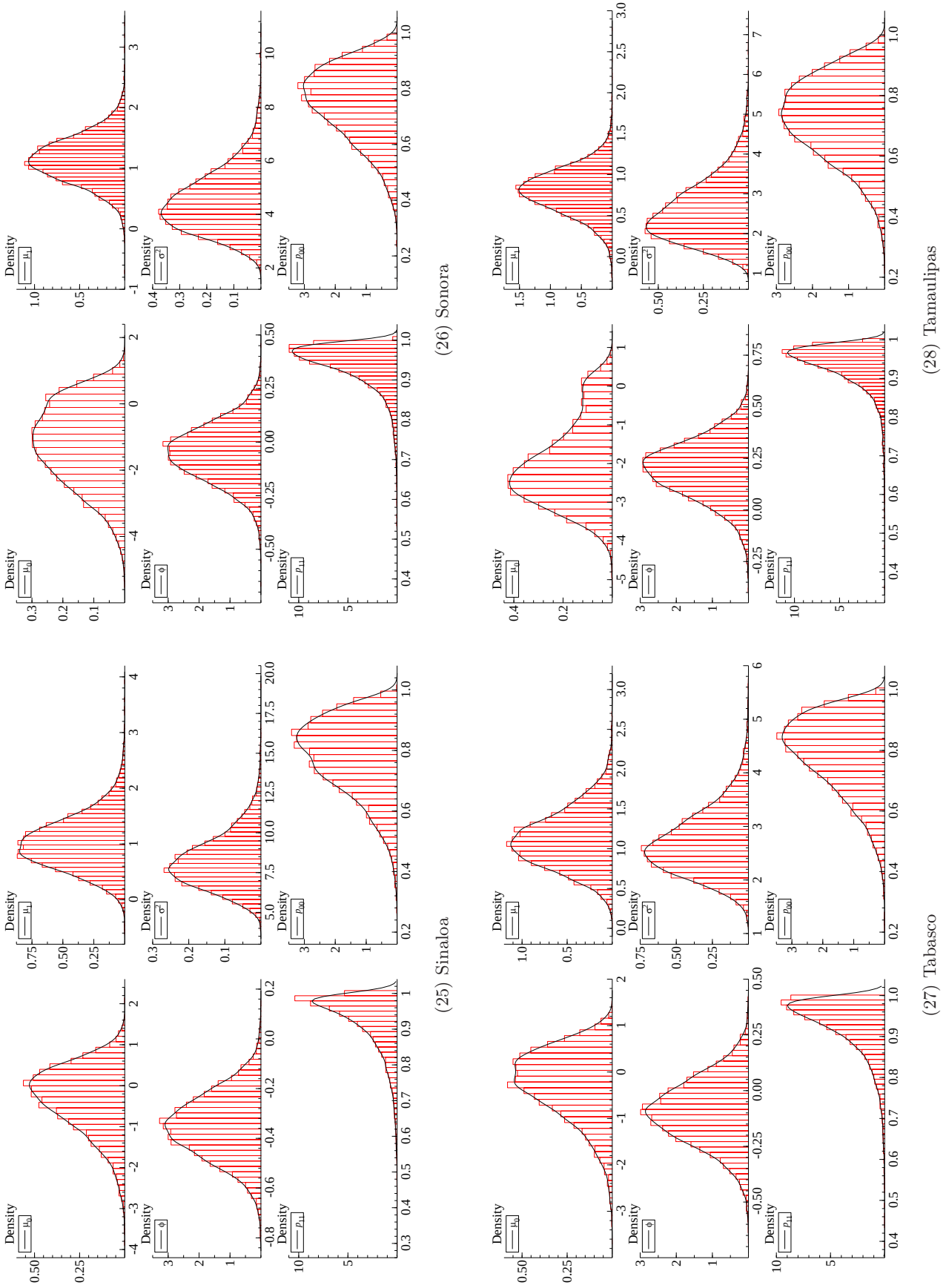


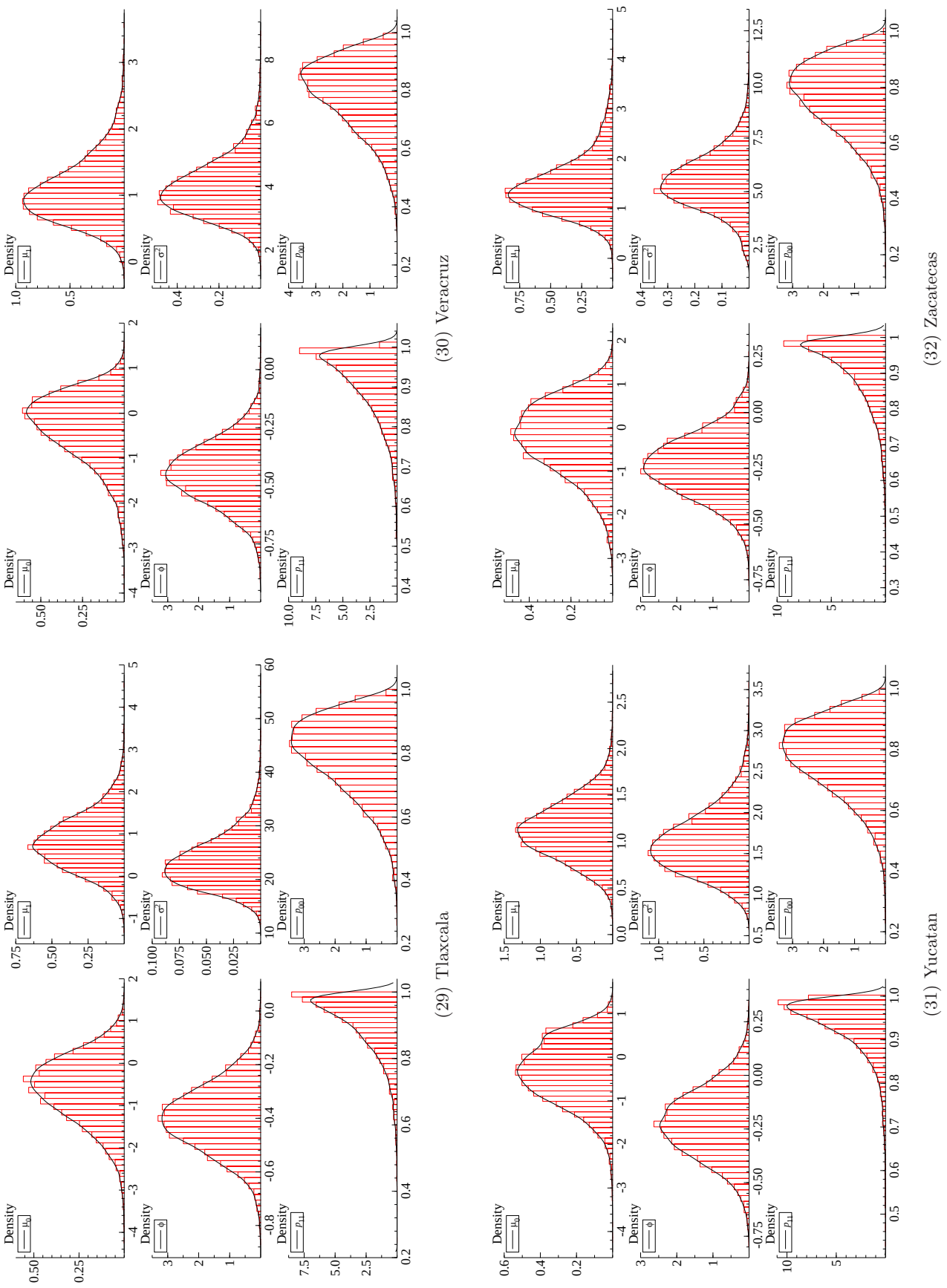
Figure C2: Posterior Distributions (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

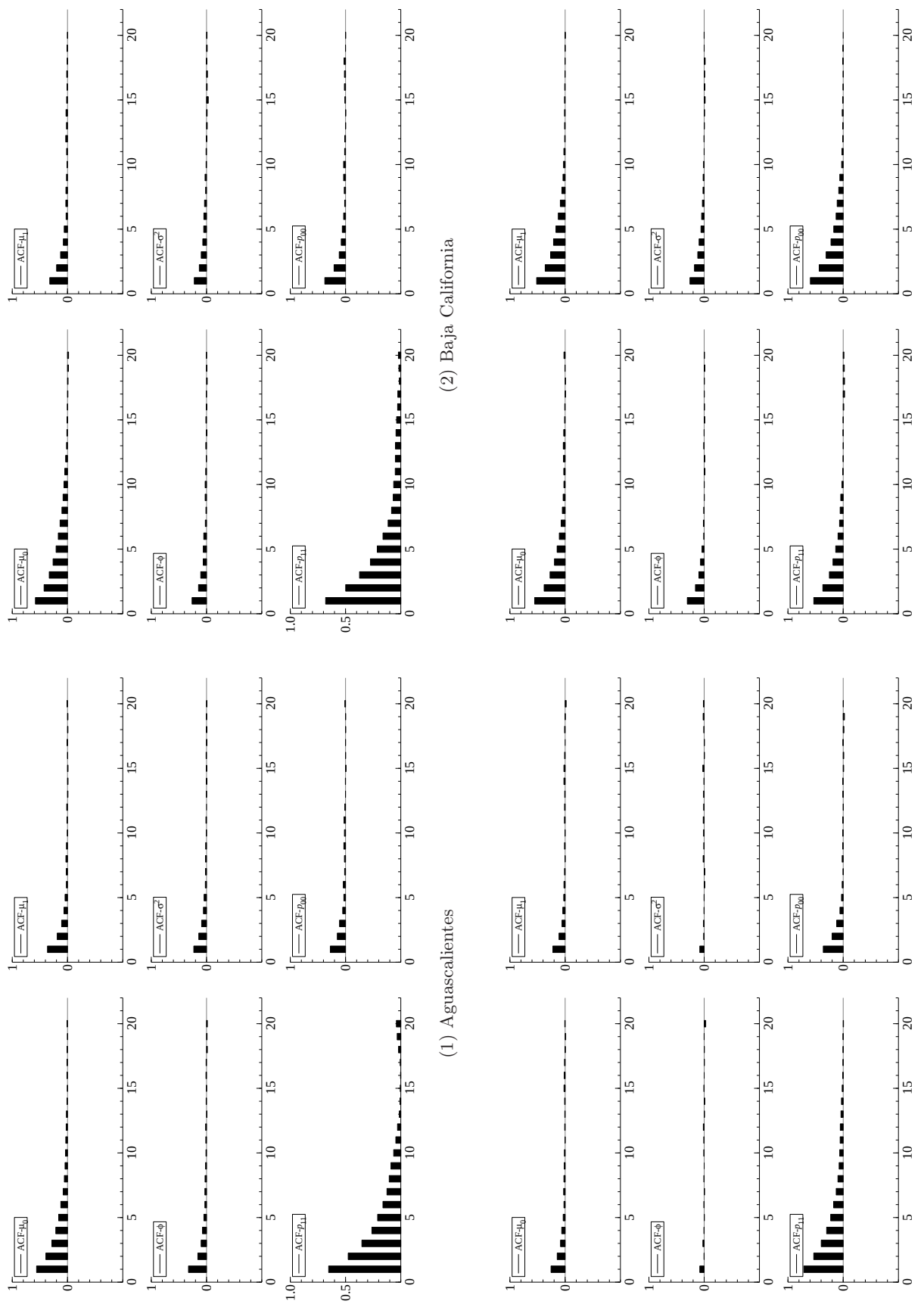
Figure C2: Posterior Distributions (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

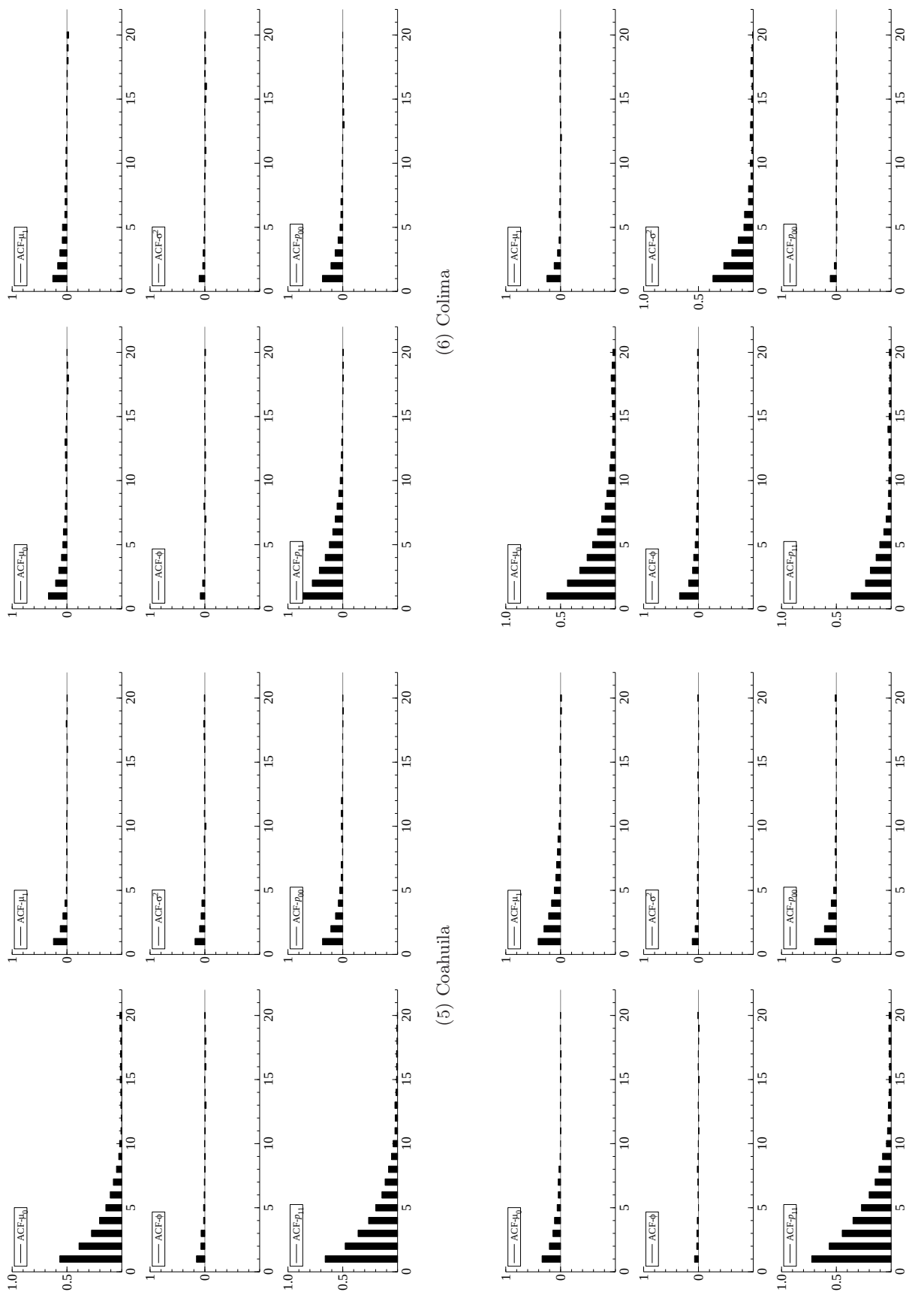
Figure C2: Posterior Distributions (Continued)



(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

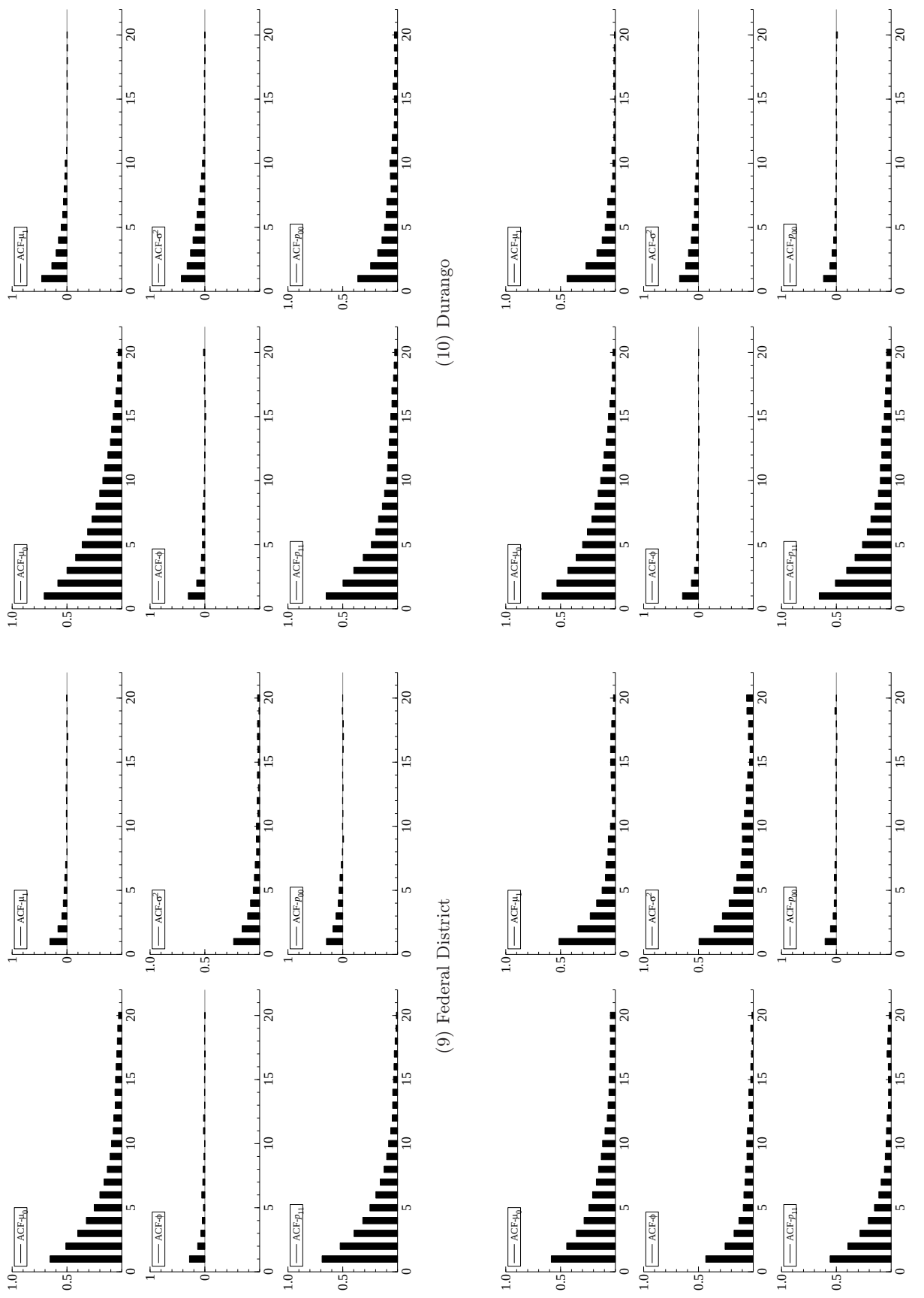
Figure C3: Autocorrelation Function



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

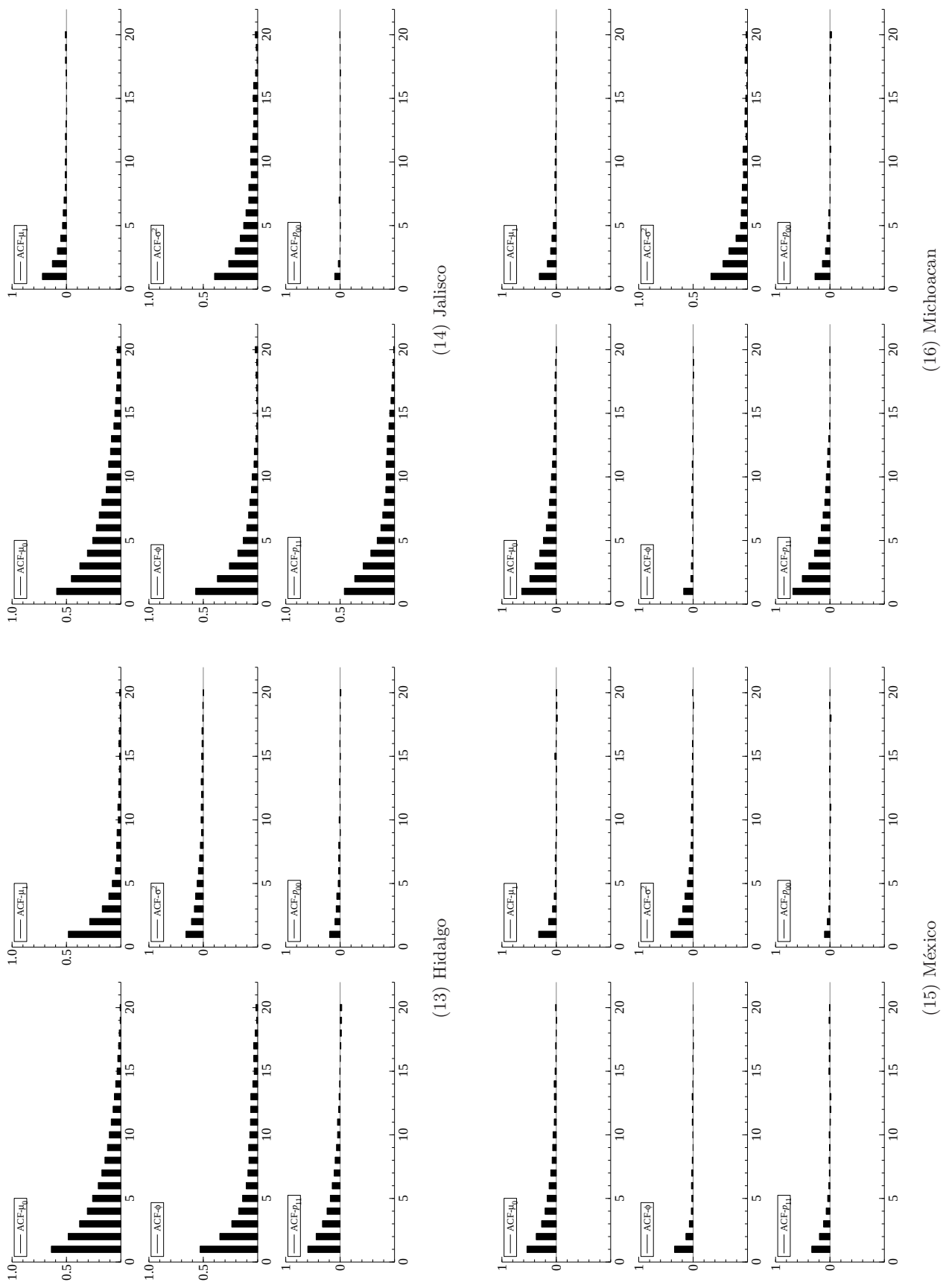
Figure C3: Autocorrelation Function (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

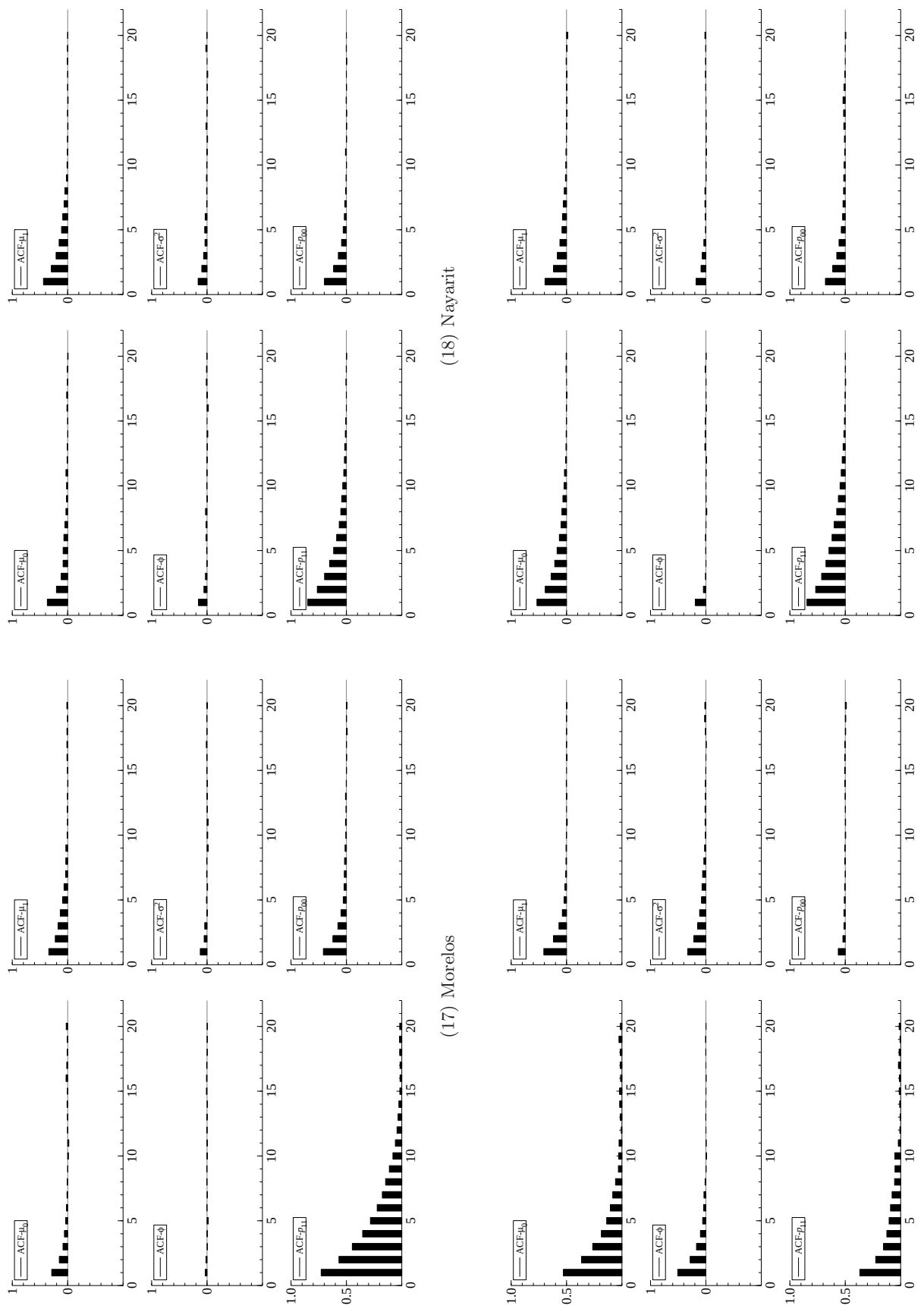
Figure C3: Autocorrelation Function (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

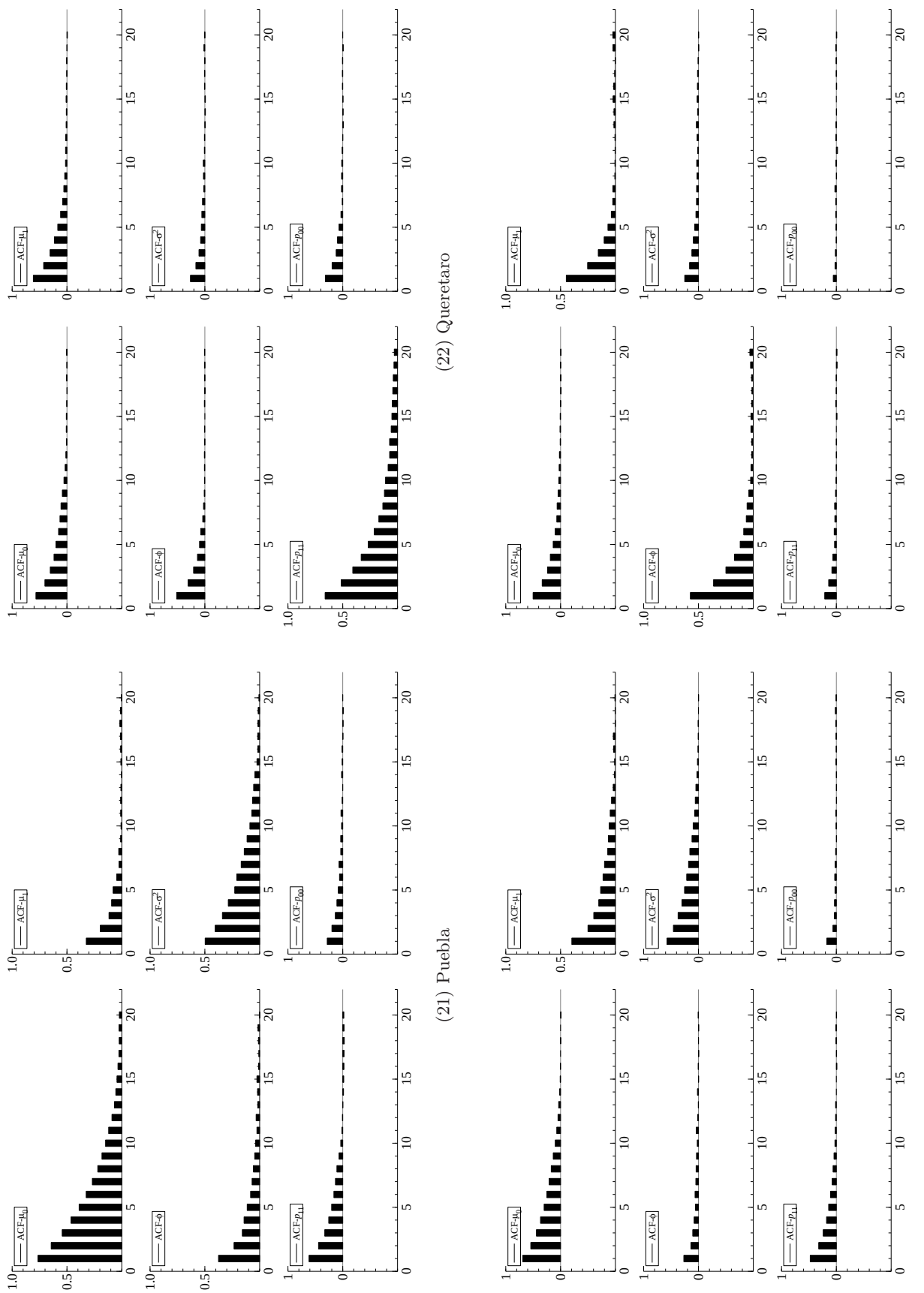
Figure C3: Autocorrelation Function (Continued)



(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

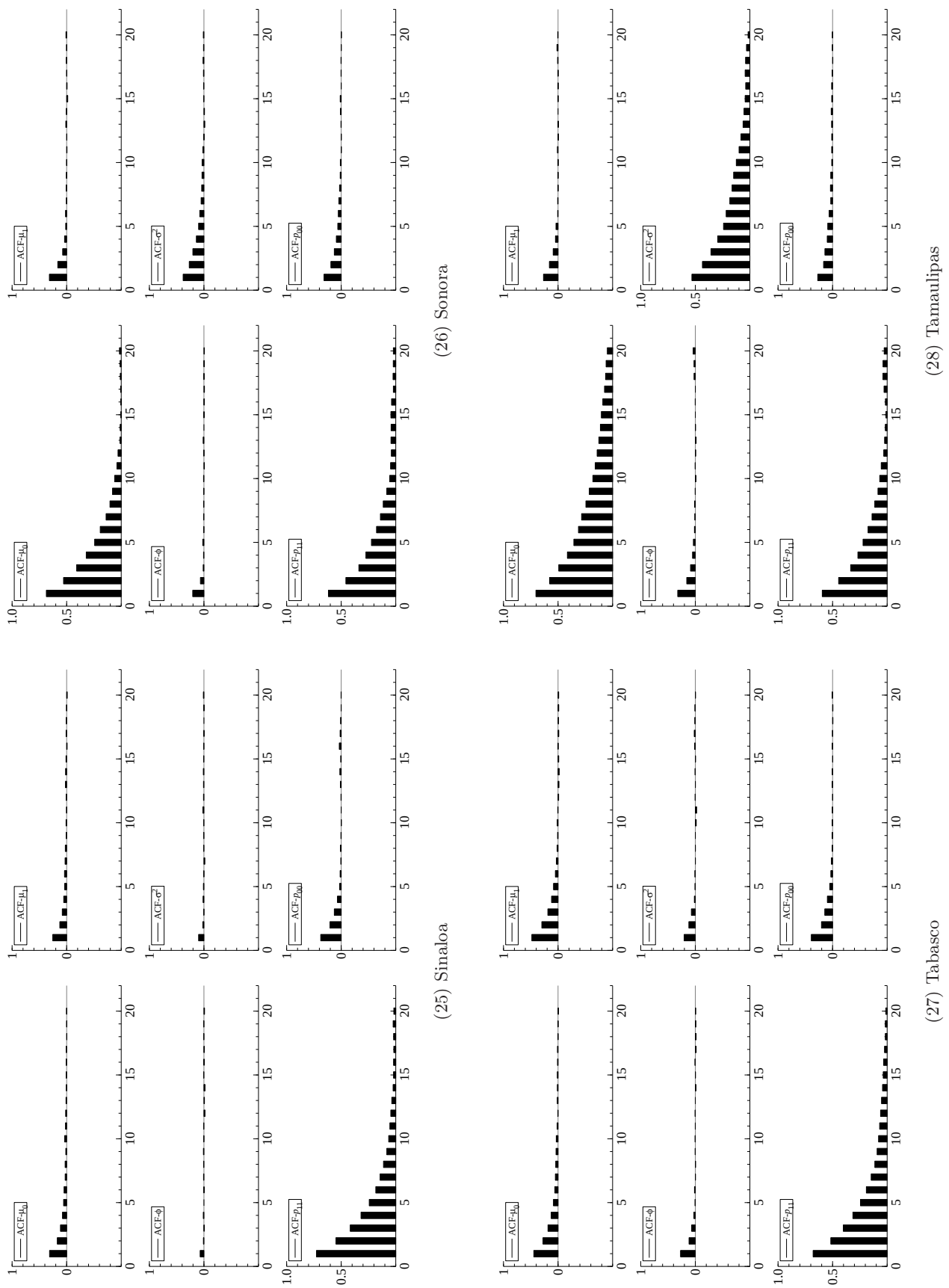
Figure C3: Autocorrelation Function (Continued)



(21) Puebla (22) Queretaro

(23) Quintana Roo (24) San Luis Potosi

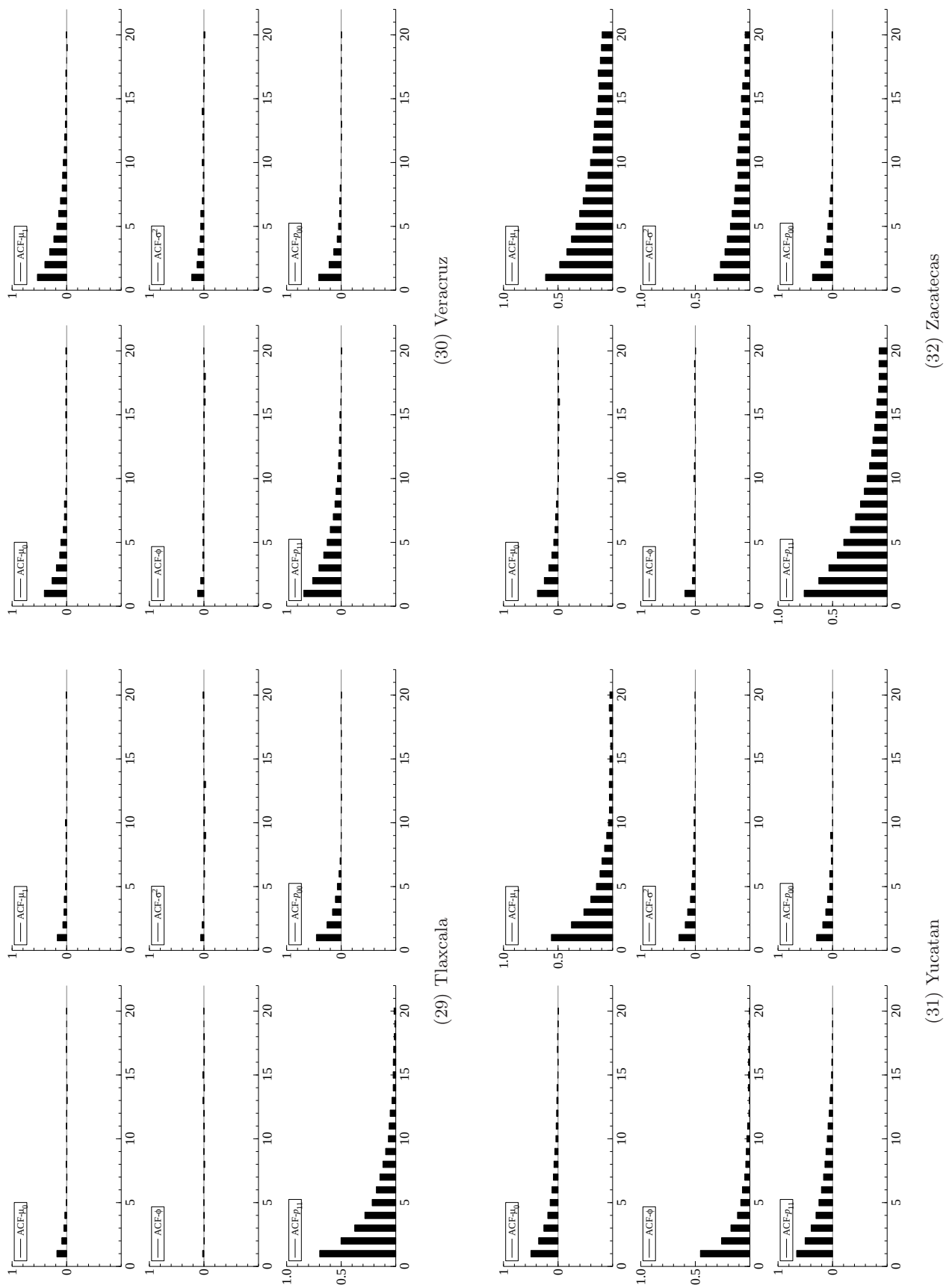
Figure C3: Autocorrelation Function (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

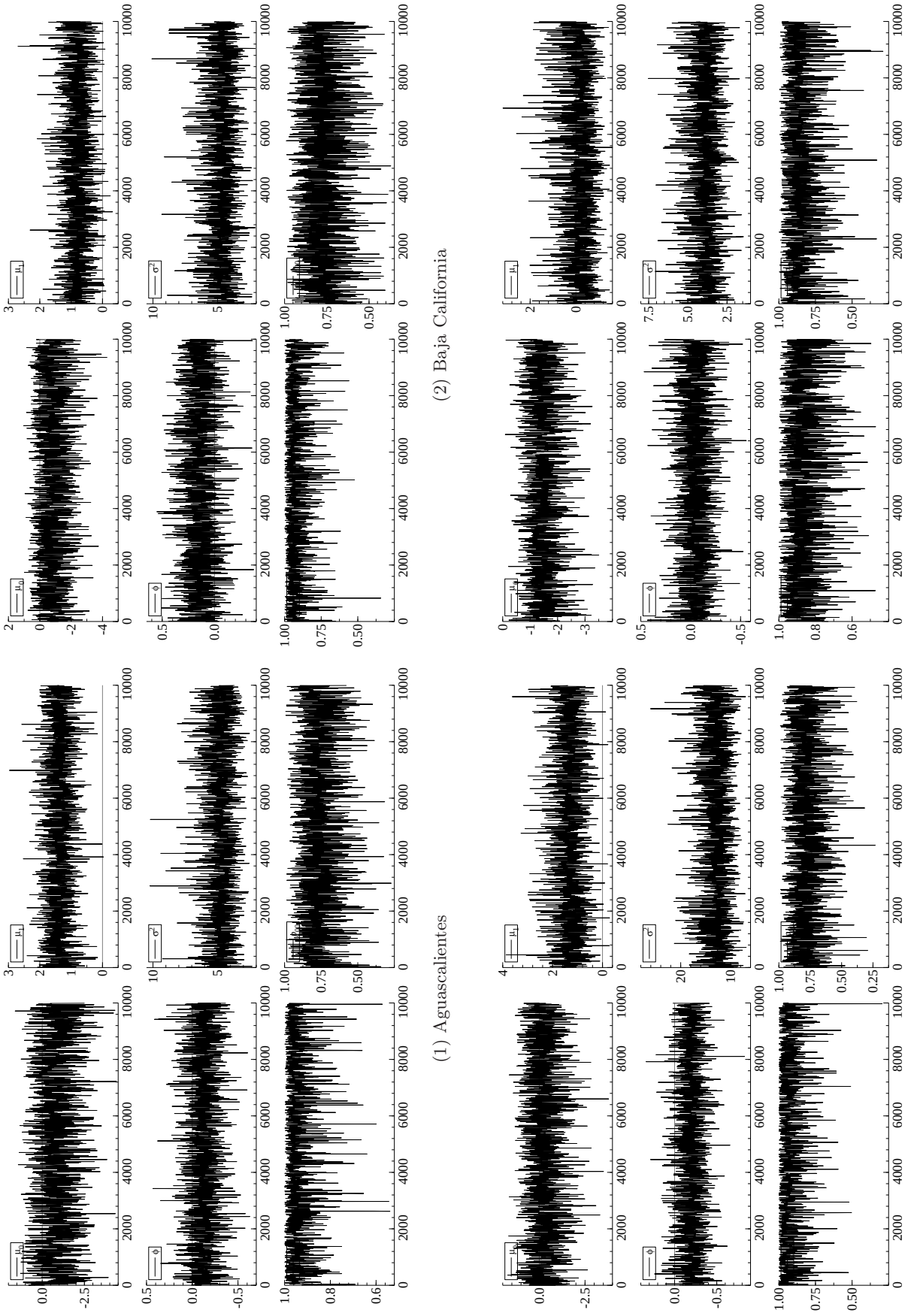
Figure C3: Autocorrelation Function (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

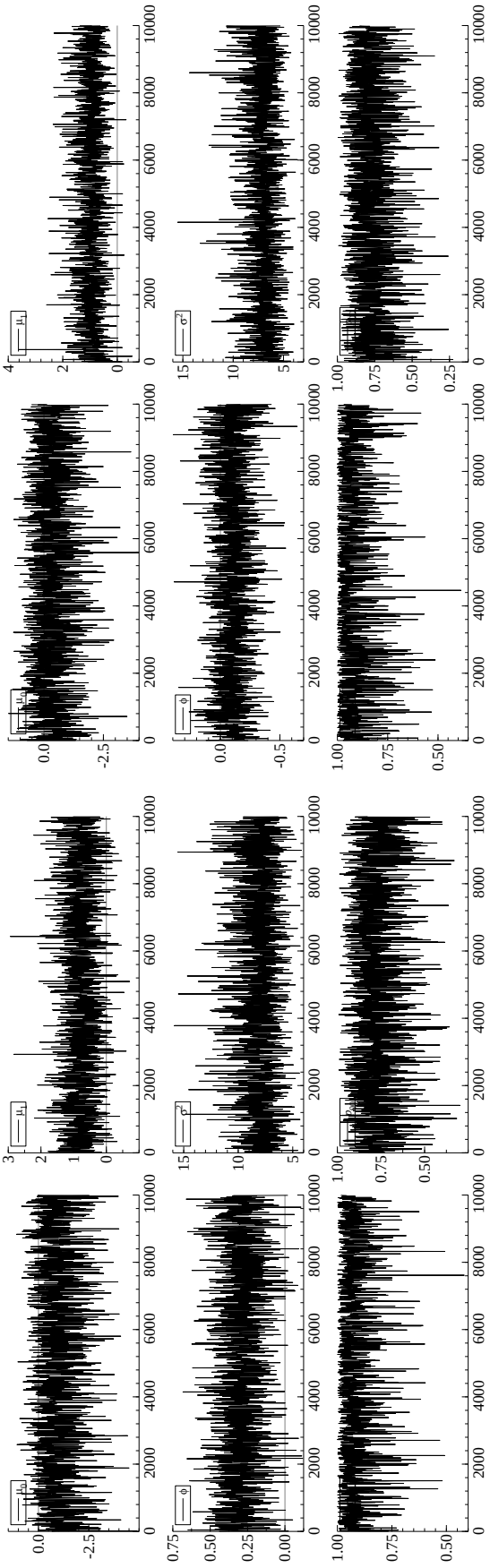
Figure C3: Autocorrelation Function (Continued)



(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

Figure C4: Trace Plots



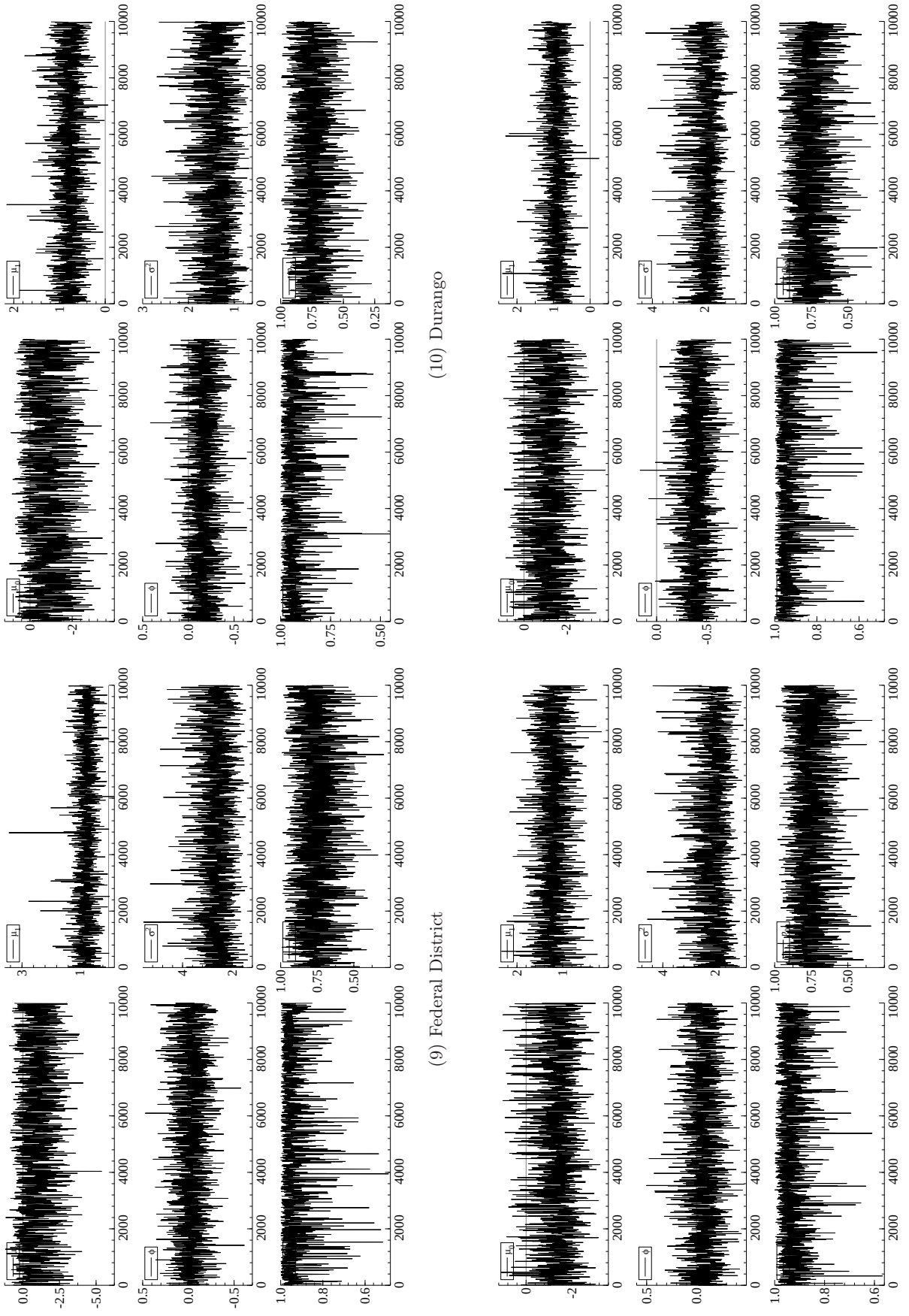
(5) Coahuila

(6) Colima

(7) Chiapas

(8) Chihuahua

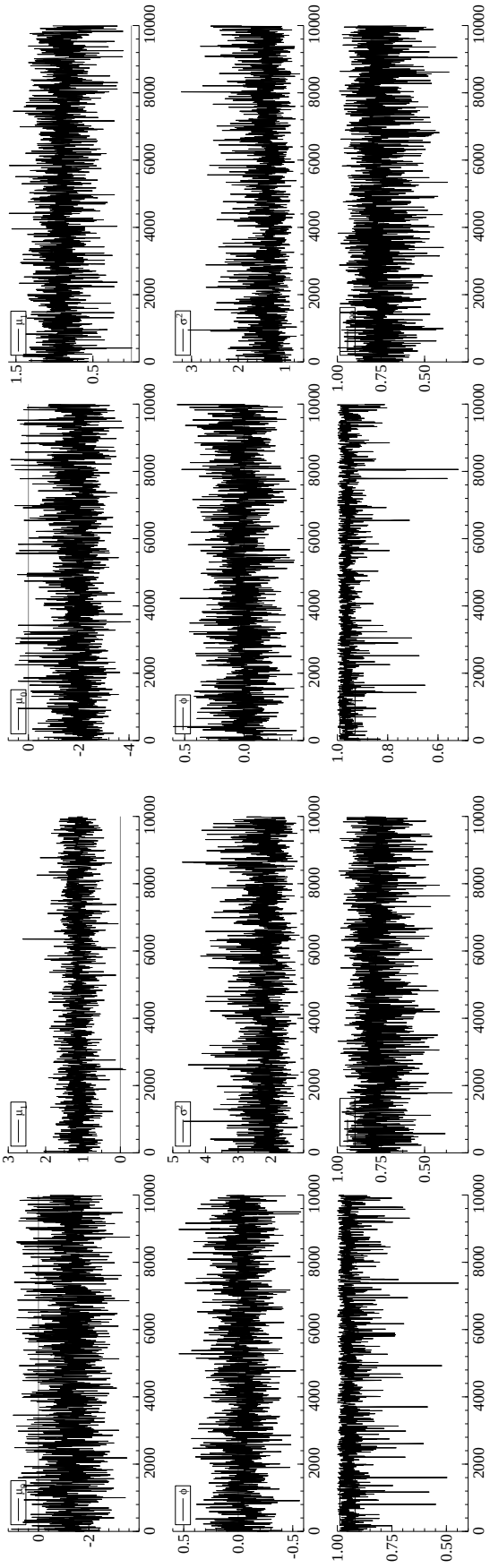
Figure C4: Trace Plots (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

Figure C4: Trace Plots (Continued)



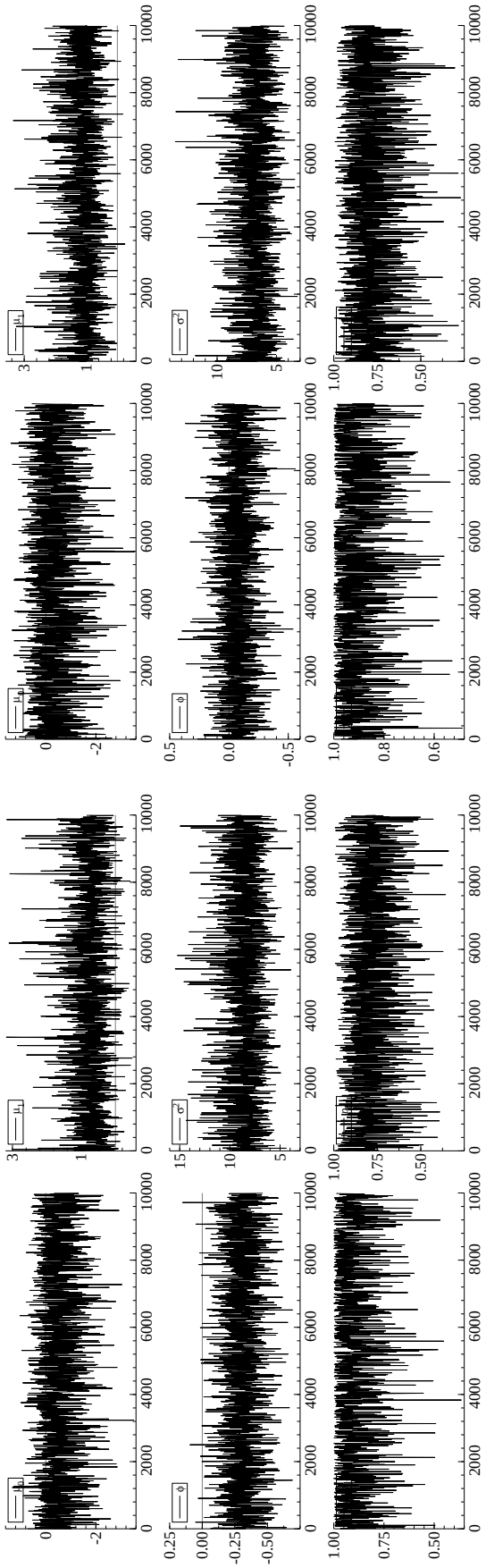
(13) Hidalgo

(14) Jalisco

(15) México

(16) Michoacan

Figure C4: Trace Plots (Continued)



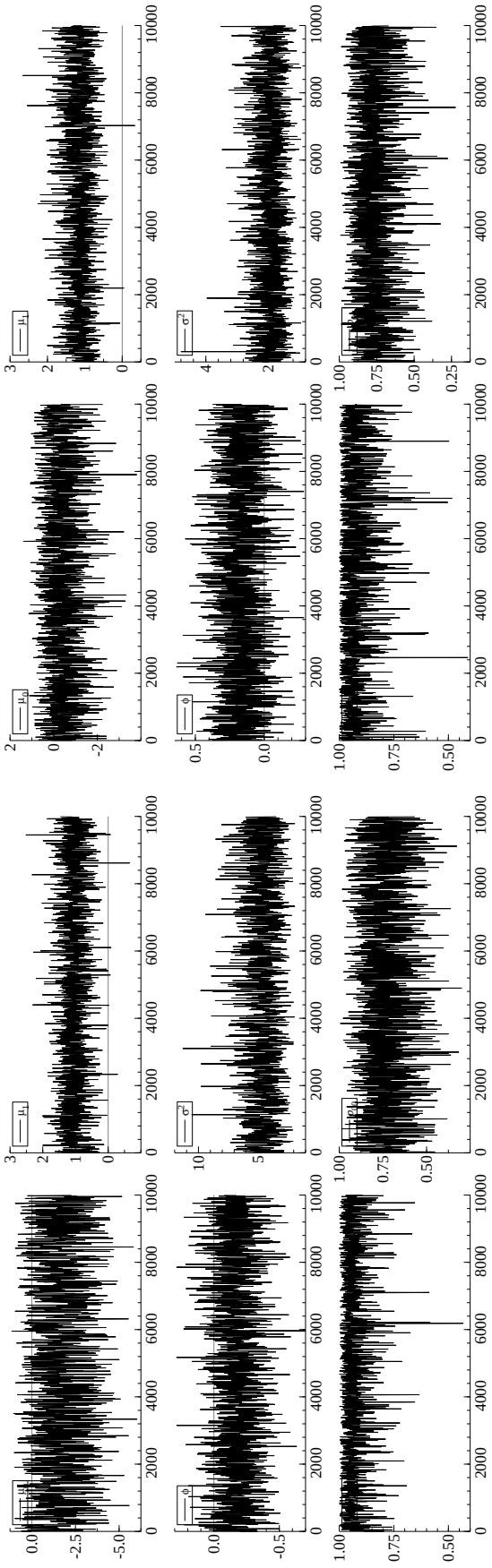
(17) Morelos

(18) Nayarit

(19) Nuevo León

(20) Oaxaca

Figure C4: Trace Plots (Continued)



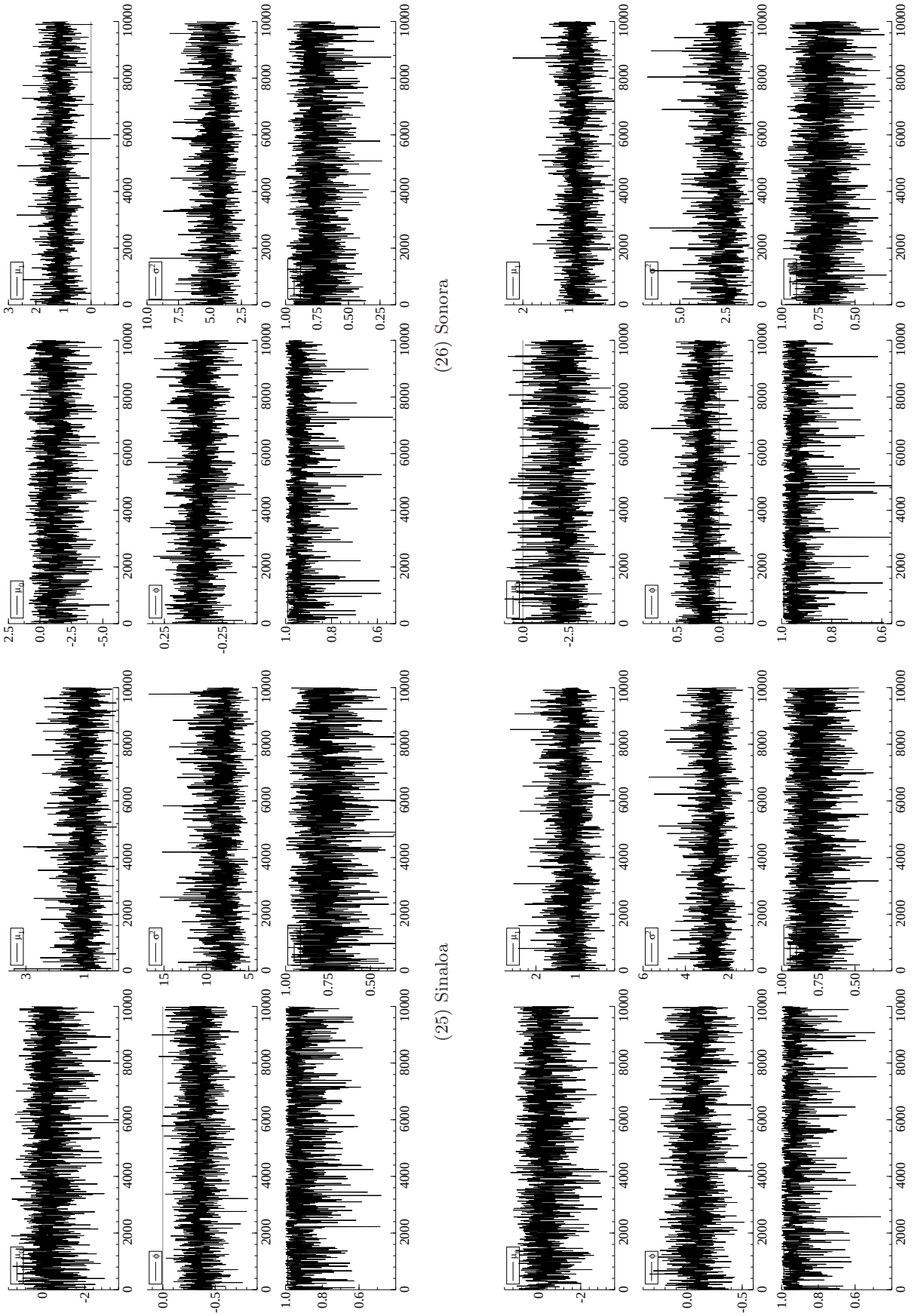
(21) Puebla

(22) Queretaro

(23) Quintana Roo

(24) San Luis Potosi

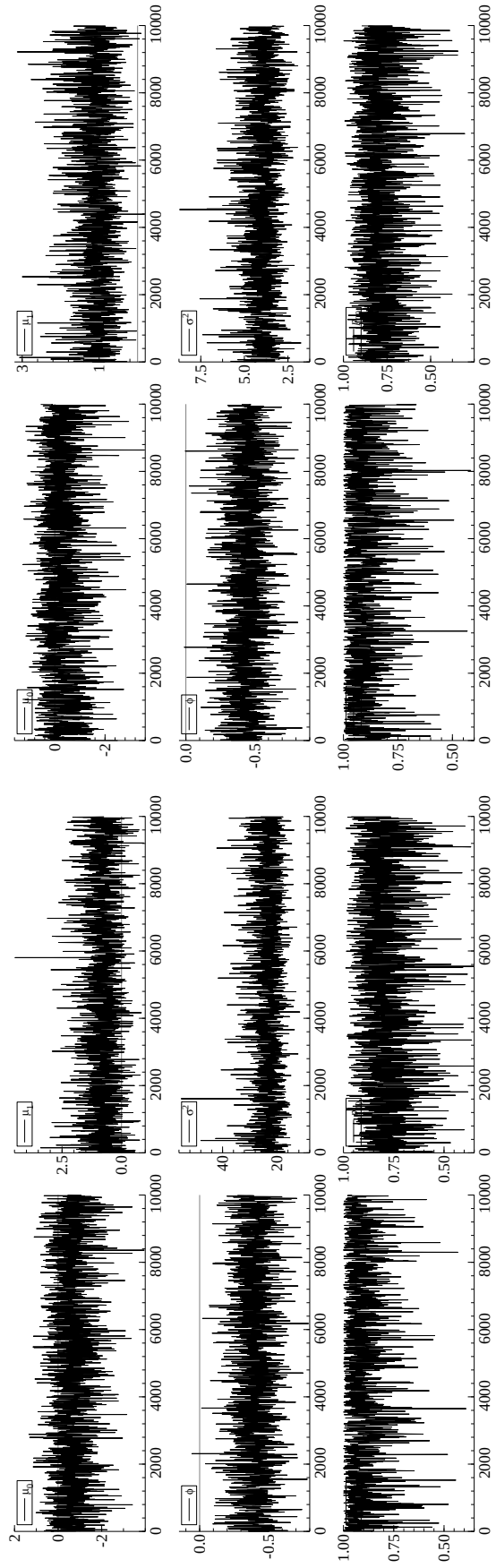
Figure C4: Trace Plots (Continued)



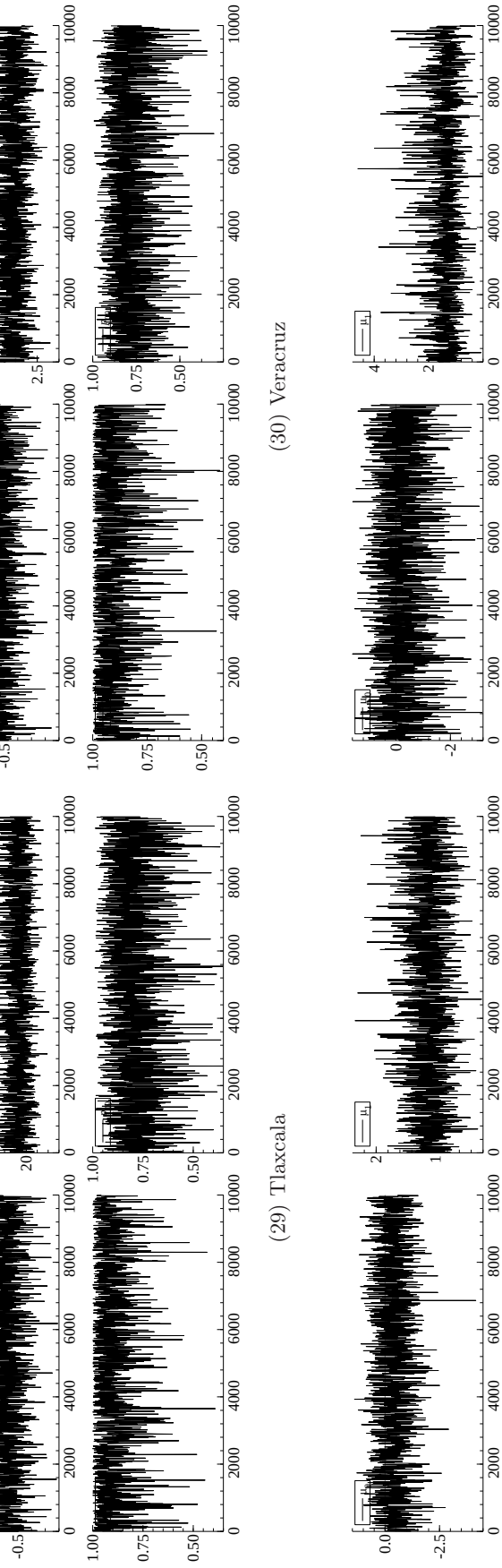
(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

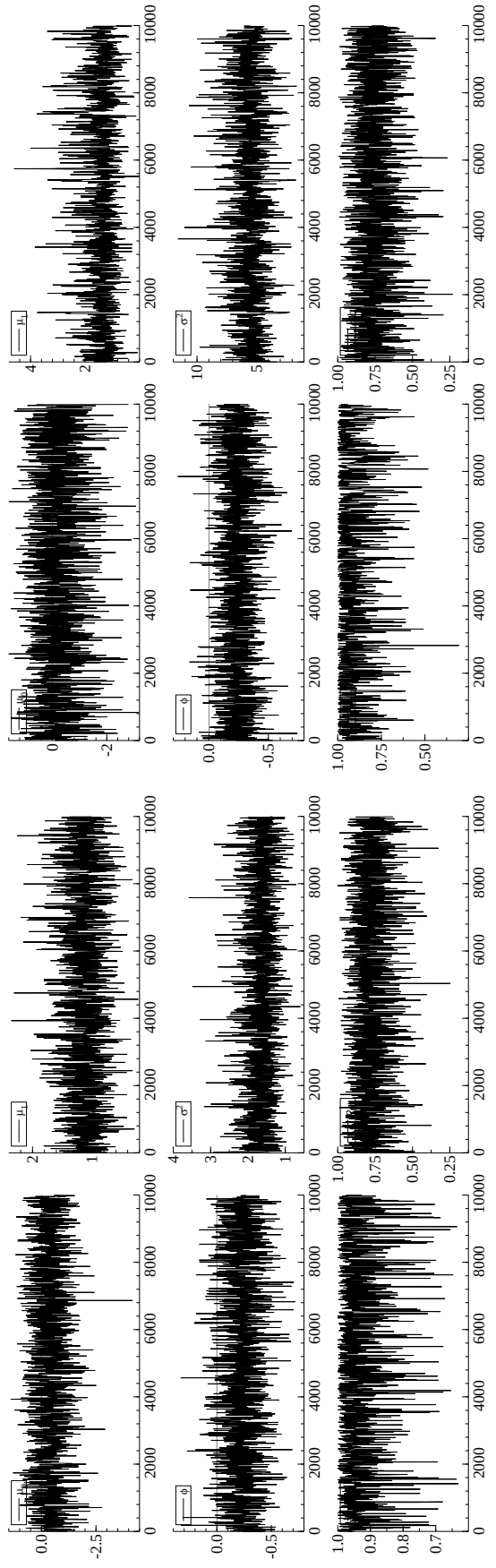
Figure C4: Trace Plots (Continued)



(29) Tlaxcala



(30) Veracruz



(31) Yucatan

(32) Zacatecas

Figure C4: Trace Plots (Continued)

Online Appendix D. Estimation Results of Markov Switching Model with Spatial Autoregressive Process

The estimation results here are obtained by estimating the Markov switching model with spatial autoregressive (SAR) process:

$$\boldsymbol{y}_t = \rho \boldsymbol{W} \boldsymbol{y}_t + \boldsymbol{\mu}_0 \odot (\boldsymbol{\iota}_N - \boldsymbol{s}_t) + \boldsymbol{\mu}_1 \odot \boldsymbol{s}_t + \boldsymbol{\varepsilon}_t,$$

where $\boldsymbol{\Phi} = \text{diag}(\phi_1, \ldots, \phi_N)$, $\boldsymbol{\varepsilon}_t \sim$ i.i.d. $\text{N}(\boldsymbol{0}, \boldsymbol{\Omega})$, and $\boldsymbol{\Omega} = \text{diag}(\sigma_1^2, \ldots, \sigma_N^2)$. (Distance-Based SWM, $\eta = 4$)

Table D1

Table D1 shows the point estimates and interval estimates of parameters.

Figure D1

Figure D1 shows the probabilities of recession, which are calculated by $1 - G^{-1} \sum_{g=1}^{G} s_{t,n}^{(g)}$, where G is the number of iterations and the superscript (g) is the gth iteration.

Figure D2

Figure D2 shows convergence diagnostics (kernel density, autocorrelation, and trace plots) for the posterior distribution of ρ.

Figure D3

Figure D3 shows the histogram and density plots of parameters by state. The solid line indicates density estimates obtained by kernel density estimation.

Figure D4

Figure D4 shows the autocorrelation plots of parameters by state.

Figure D5

Figure D5 shows the trace plots of parameters by state.

Table D1: Estimated Parameters

		ρ					
		Mean		Median		95% CI	
Spatial Dependence		0.26		0.22		[0.21, 0.30]	
		μ_0			μ_1		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	−0.53	−0.42	[−2.53, 0.84]	1.00	0.99	[0.35, 1.74]
2	Baja California	−1.20	−1.16	[−2.89, 0.29]	0.62	0.61	[−0.13, 1.44]
3	Baja California Sur	−0.33	−0.23	[−2.11, 0.97]	1.02	0.99	[0.07, 2.15]
4	Campeche	−1.50	−1.45	[−2.59, −0.72]	−0.28	−0.40	[−1.29, 1.41]
5	Coahuila	−1.27	−1.16	[−3.50, 0.38]	0.76	0.74	[−0.09, 1.76]
6	Colima	−0.33	−0.21	[−2.12, 0.79]	0.84	0.79	[0.05, 1.88]
7	Chiapas	−0.71	−0.61	[−2.18, 0.26]	0.33	0.28	[−0.32, 1.28]
8	Chihuahua	−1.57	−1.64	[−3.58, 0.43]	0.79	0.79	[0.27, 1.32]
9	Federal District	−0.57	−0.36	[−2.58, 0.54]	0.55	0.53	[0.10, 1.13]
10	Durango	−0.45	−0.23	[−2.26, 0.45]	0.50	0.46	[0.05, 1.18]
11	Guanajuato	−0.66	−0.61	[−2.24, 0.61]	0.80	0.78	[0.26, 1.43]
12	Guerrero	−0.34	−0.18	[−2.04, 0.54]	0.58	0.53	[0.04, 1.50]
13	Hidalgo	−0.62	−0.59	[−2.28, 0.68]	0.97	0.95	[0.42, 1.62]
14	Jalisco	−1.19	−1.26	[−2.66, 0.38]	0.62	0.62	[0.25, 1.01]
15	México	−2.30	−2.33	[−3.30, −1.11]	0.78	0.78	[0.48, 1.07]
16	Michoacán	−0.64	−0.48	[−2.51, 0.50]	0.50	0.47	[−0.14, 1.34]
17	Morelos	−0.56	−0.46	[−2.13, 0.55]	0.52	0.47	[−0.35, 1.66]
18	Nayarit	−0.30	−0.19	[−1.98, 0.82]	0.93	0.88	[0.11, 2.07]
19	Nuevo León	−0.81	−0.80	[−2.49, 0.67]	0.89	0.88	[0.46, 1.35]
20	Oaxaca	−0.37	−0.18	[−2.22, 0.57]	0.55	0.52	[0.04, 1.35]
21	Puebla	−0.62	−0.47	[−2.61, 0.66]	0.80	0.77	[0.05, 1.70]
22	Querétaro	−0.19	−0.12	[−1.72, 0.88]	1.20	1.17	[0.65, 1.87]
23	Quintana Roo	−1.44	−1.52	[−3.77, 0.91]	1.60	1.62	[0.68, 2.43]
24	San Luis Potosí	−0.64	−0.57	[−2.38, 0.65]	0.77	0.76	[0.33, 1.27]
25	Sinaloa	−0.42	−0.31	[−2.06, 0.70]	0.65	0.62	[−0.17, 1.64]
26	Sonora	−0.88	−0.65	[−3.49, 0.79]	1.00	0.99	[0.34, 1.77]
27	Tabasco	−0.25	−0.14	[−2.04, 0.86]	1.00	0.97	[0.46, 1.71]
28	Tamaulipas	−1.32	−1.33	[−3.13, 0.31]	0.62	0.61	[0.08, 1.26]
29	Tlaxcala	−0.65	−0.60	[−2.29, 0.67]	0.64	0.61	[−0.57, 2.02]
30	Veracruz	−0.45	−0.31	[−2.18, 0.56]	0.53	0.49	[−0.12, 1.40]
31	Yucatán	−0.10	0.05	[−2.00, 1.04]	1.08	1.06	[0.63, 1.66]
32	Zacatecas	−0.30	−0.18	[−2.05, 0.86]	0.92	0.88	[0.19, 1.86]

Notes: 95% CI indicates 95% credible interval.

Table D1: Estimated Parameters (Continued)

		σ^2			p_{11}			p_{00}		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	4.26	4.15	[2.79, 6.34]	0.92	0.95	[0.71, 1.00]	0.77	0.79	[0.48, 0.96]
2	Baja California	4.45	4.34	[2.66, 6.96]	0.93	0.95	[0.74, 1.00]	0.76	0.77	[0.51, 0.95]
3	Baja California Sur	13.14	12.84	[9.00, 19.12]	0.91	0.94	[0.68, 1.00]	0.79	0.81	[0.51, 0.97]
4	Campeche	3.91	3.82	[2.52, 5.79]	0.86	0.88	[0.60, 0.99]	0.85	0.87	[0.57, 0.99]
5	Coahuila	7.23	7.03	[4.65, 10.96]	0.92	0.94	[0.70, 1.00]	0.78	0.79	[0.51, 0.96]
6	Colima	7.00	6.83	[4.72, 10.23]	0.90	0.93	[0.66, 1.00]	0.78	0.80	[0.49, 0.97]
7	Chiapas	3.84	3.75	[2.58, 5.62]	0.92	0.95	[0.68, 1.00]	0.78	0.80	[0.50, 0.96]
8	Chihuahua	2.56	2.47	[1.55, 4.10]	0.94	0.96	[0.79, 1.00]	0.73	0.75	[0.45, 0.94]
9	Federal District	2.11	2.06	[1.40, 3.15]	0.93	0.95	[0.70, 1.00]	0.77	0.78	[0.47, 0.97]
10	Durango	1.58	1.54	[1.02, 2.34]	0.91	0.94	[0.66, 1.00]	0.78	0.80	[0.48, 0.97]
11	Guanajuato	2.21	2.17	[1.23, 3.42]	0.92	0.94	[0.72, 1.00]	0.75	0.77	[0.48, 0.95]
12	Guerrero	2.54	2.48	[1.69, 3.70]	0.91	0.94	[0.66, 1.00]	0.79	0.81	[0.50, 0.98]
13	Hidalgo	2.31	2.25	[1.47, 3.51]	0.92	0.94	[0.70, 1.00]	0.77	0.79	[0.49, 0.96]
14	Jalisco	1.29	1.25	[0.81, 2.00]	0.95	0.96	[0.83, 1.00]	0.76	0.78	[0.49, 0.95]
15	México	0.99	0.95	[0.64, 1.56]	0.94	0.95	[0.87, 0.99]	0.71	0.72	[0.45, 0.91]
16	Michoacán	4.48	4.39	[2.98, 6.59]	0.93	0.95	[0.71, 1.00]	0.78	0.80	[0.48, 0.97]
17	Morelos	9.14	8.91	[6.18, 13.47]	0.90	0.93	[0.65, 1.00]	0.79	0.81	[0.51, 0.97]
18	Nayarit	6.45	6.32	[4.34, 9.40]	0.90	0.93	[0.67, 1.00]	0.79	0.81	[0.51, 0.97]
19	Nuevo León	1.60	1.56	[0.96, 2.49]	0.93	0.95	[0.77, 1.00]	0.74	0.76	[0.46, 0.95]
20	Oaxaca	2.68	2.62	[1.82, 3.92]	0.92	0.95	[0.68, 1.00]	0.79	0.81	[0.49, 0.97]
21	Puebla	6.04	5.89	[3.93, 8.97]	0.92	0.94	[0.71, 1.00]	0.77	0.79	[0.49, 0.96]
22	Querétaro	1.65	1.61	[1.01, 2.55]	0.91	0.93	[0.71, 1.00]	0.77	0.79	[0.51, 0.96]
23	Quintana Roo	7.08	6.79	[4.07, 11.62]	0.93	0.94	[0.78, 1.00]	0.74	0.75	[0.47, 0.95]
24	San Luis Potosí	1.82	1.77	[1.19, 2.72]	0.94	0.96	[0.76, 1.00]	0.77	0.79	[0.49, 0.96]
25	Sinaloa	8.76	8.55	[6.00, 12.75]	0.92	0.94	[0.67, 1.00]	0.79	0.81	[0.51, 0.97]
26	Sonora	4.20	4.12	[2.48, 6.48]	0.92	0.94	[0.71, 1.00]	0.75	0.77	[0.46, 0.96]
27	Tabasco	2.63	2.57	[1.72, 3.90]	0.93	0.95	[0.73, 1.00]	0.78	0.80	[0.49, 0.97]
28	Tamaulipas	2.51	2.44	[1.54, 3.92]	0.92	0.94	[0.74, 1.00]	0.75	0.76	[0.47, 0.95]
29	Tlaxcala	27.53	26.82	[18.78, 40.16]	0.90	0.92	[0.65, 1.00]	0.80	0.82	[0.52, 0.97]
30	Veracruz	4.71	4.60	[3.19, 6.95]	0.91	0.94	[0.68, 1.00]	0.79	0.81	[0.50, 0.97]
31	Yucatán	1.97	1.92	[1.32, 2.86]	0.93	0.96	[0.72, 1.00]	0.78	0.80	[0.49, 0.97]
32	Zacatecas	5.36	5.23	[3.60, 7.84]	0.91	0.94	[0.68, 1.00]	0.78	0.80	[0.48, 0.97]

Notes: 95% CI indicates 95% credible interval.

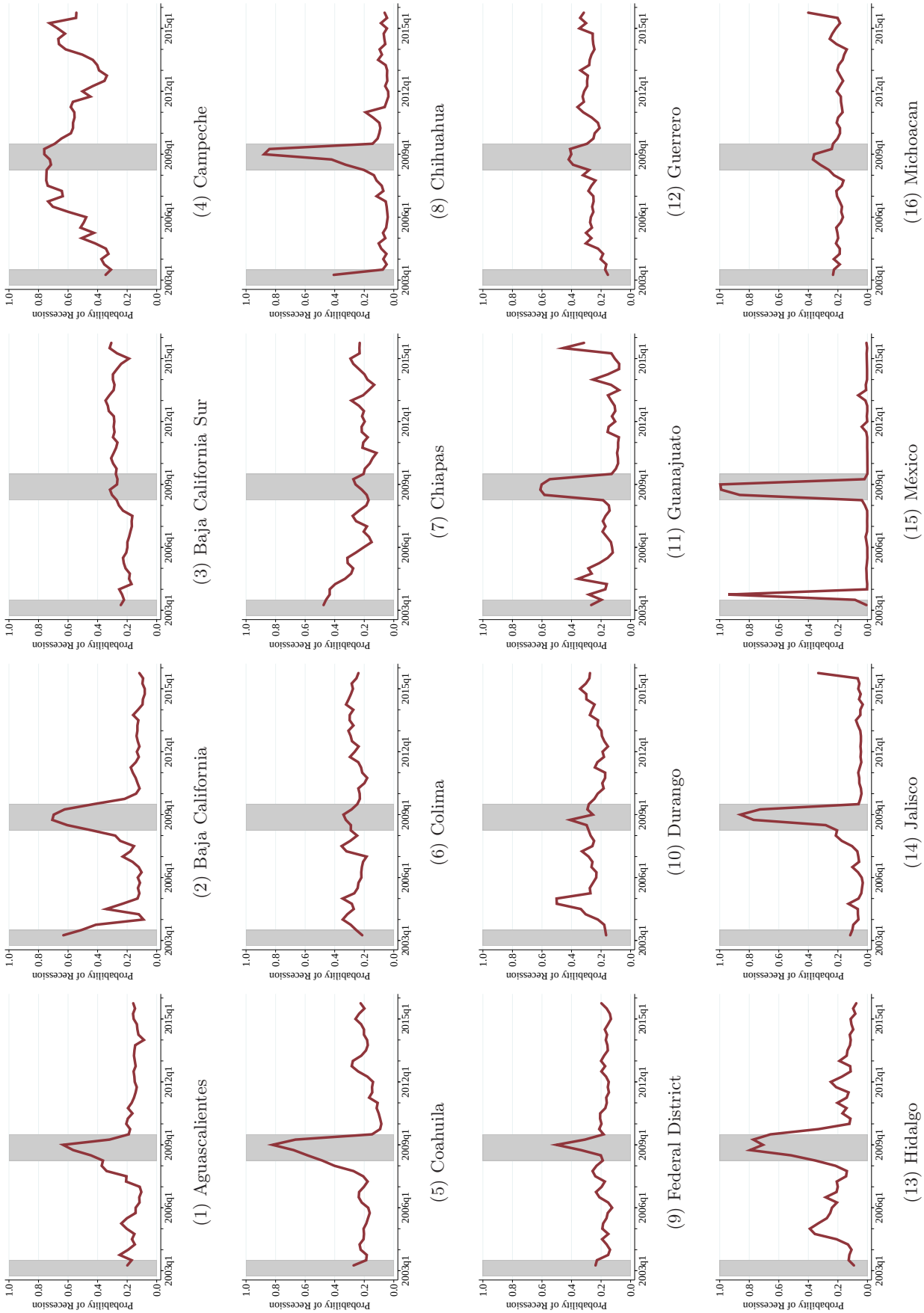


Figure D1: Recession Probabilities

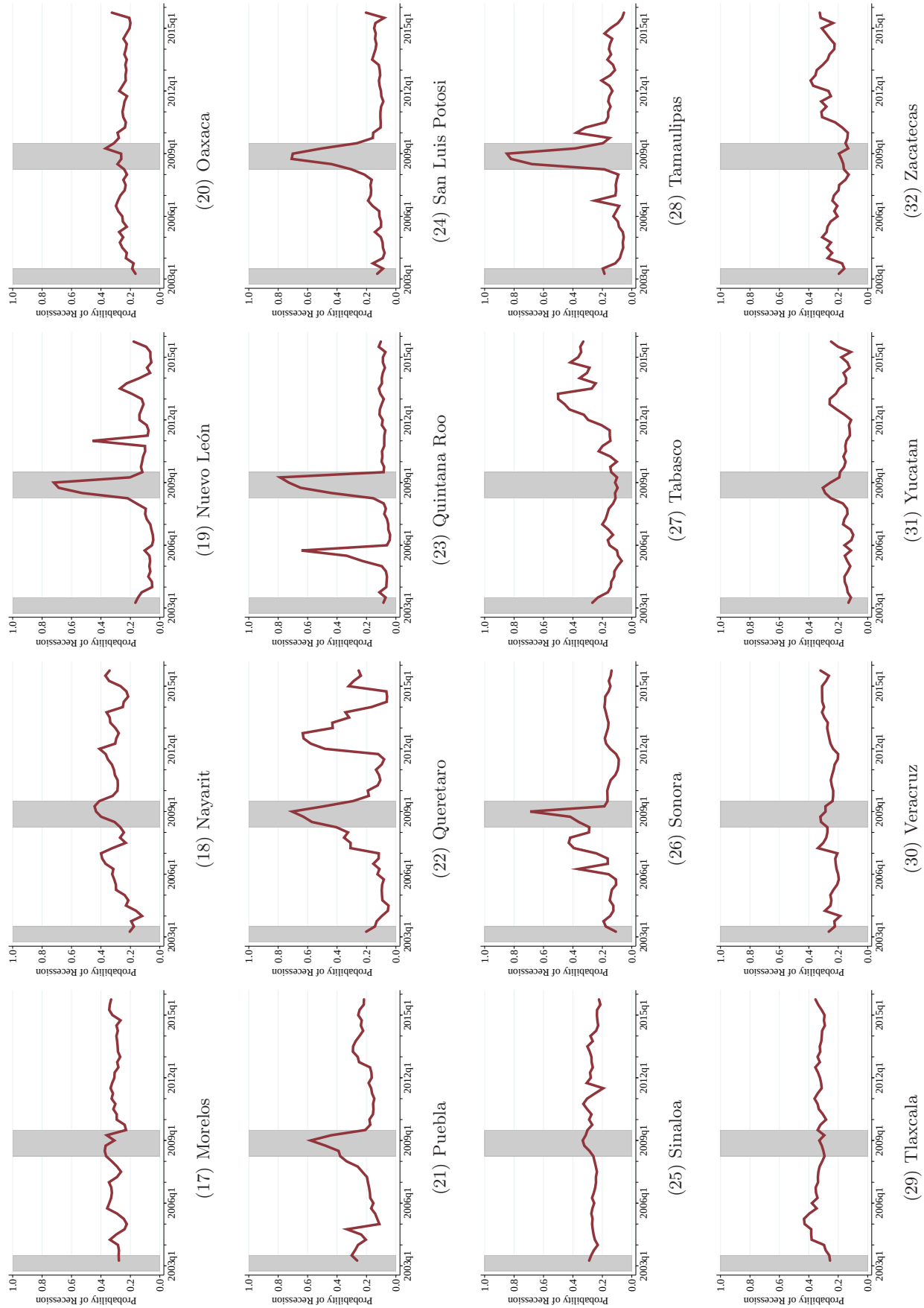


Figure D1: Recession Probabilities (Continued)

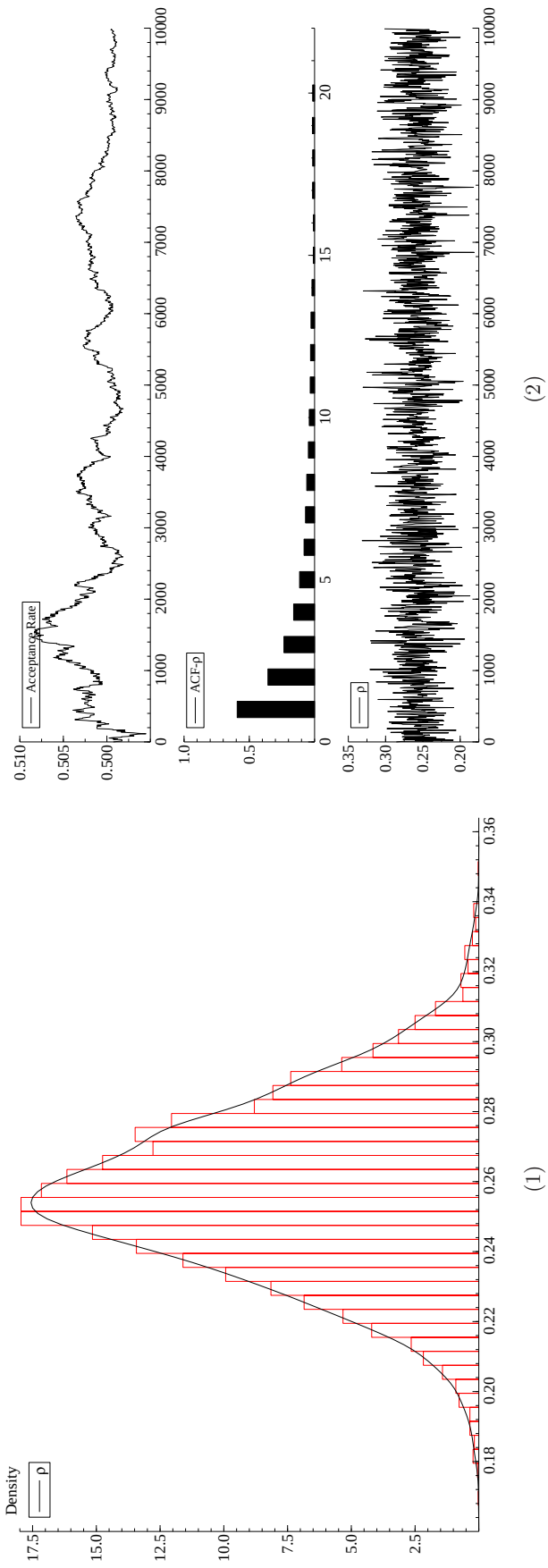


Figure D2: Posterior Distribution of ρ

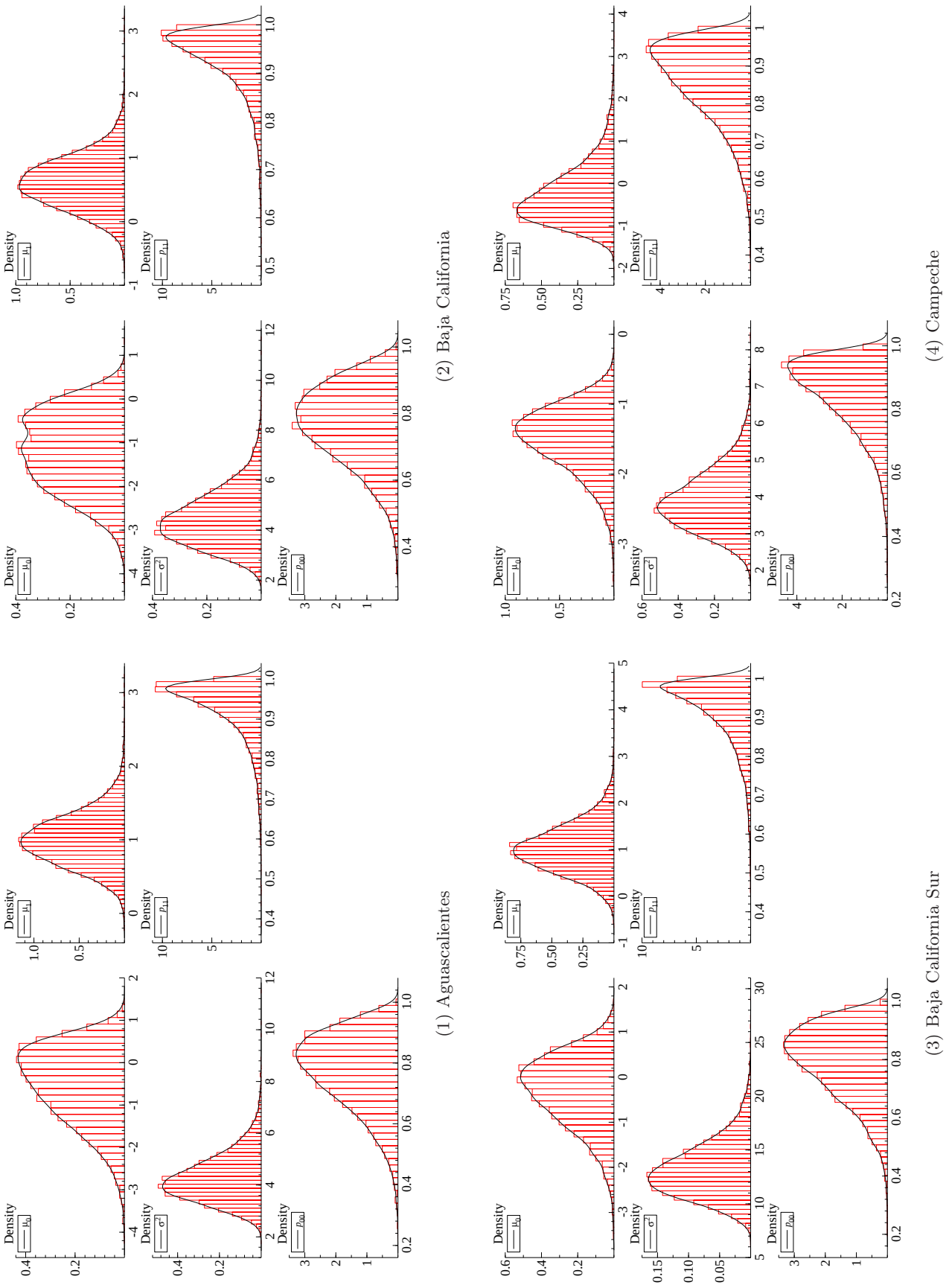


Figure D3: Posterior Distributions

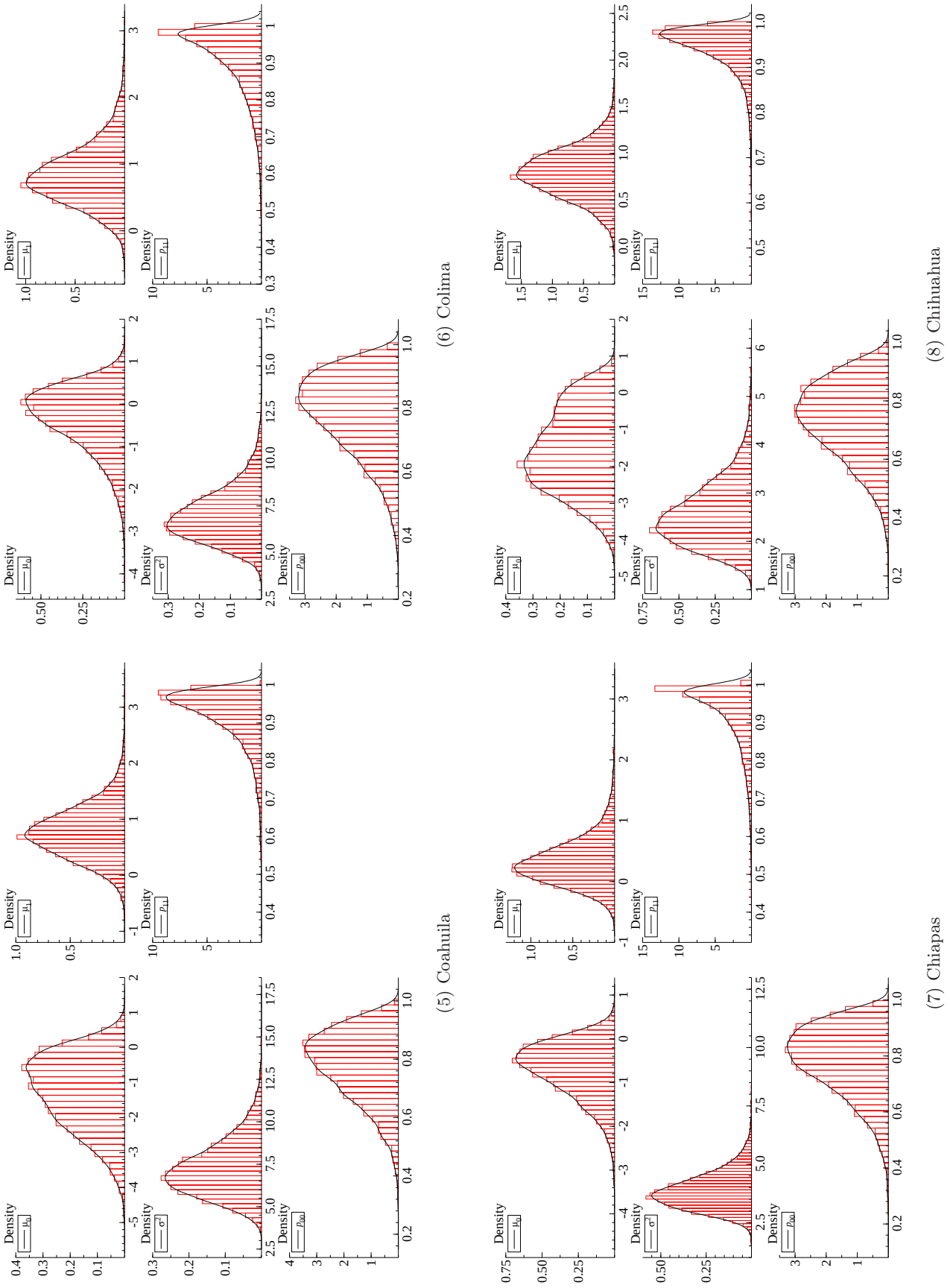


Figure D3: Posterior Distributions (Continued)

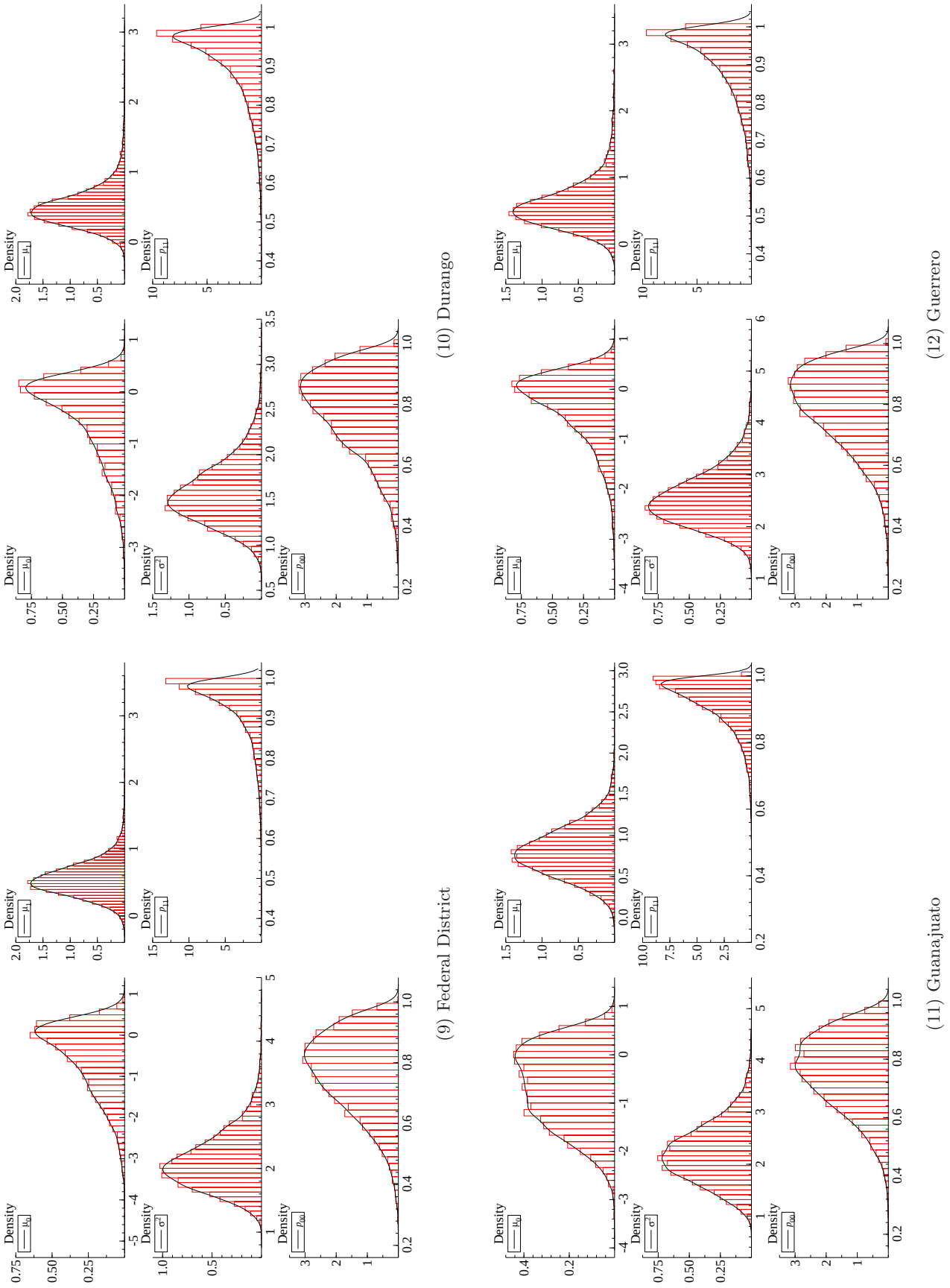
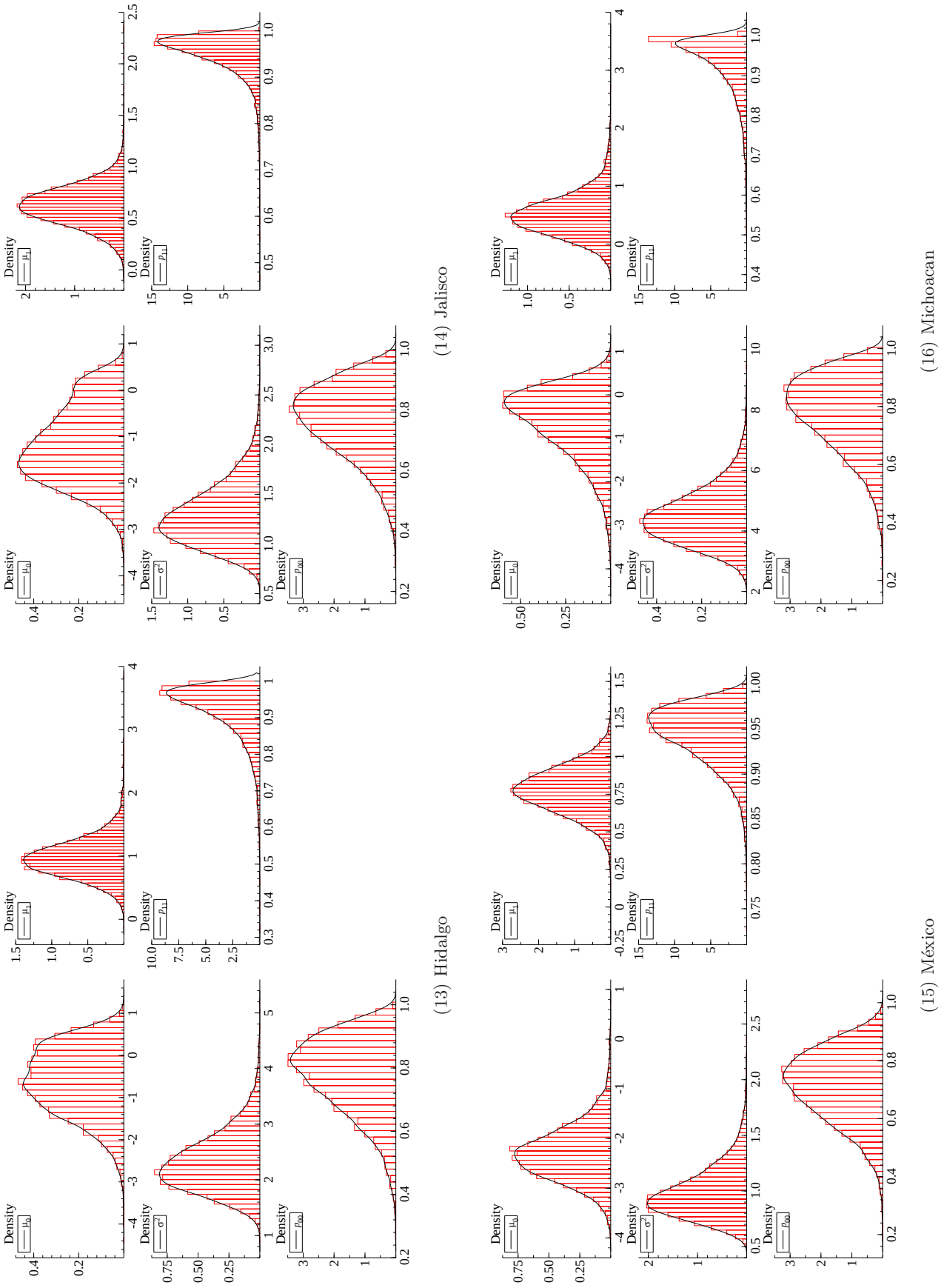


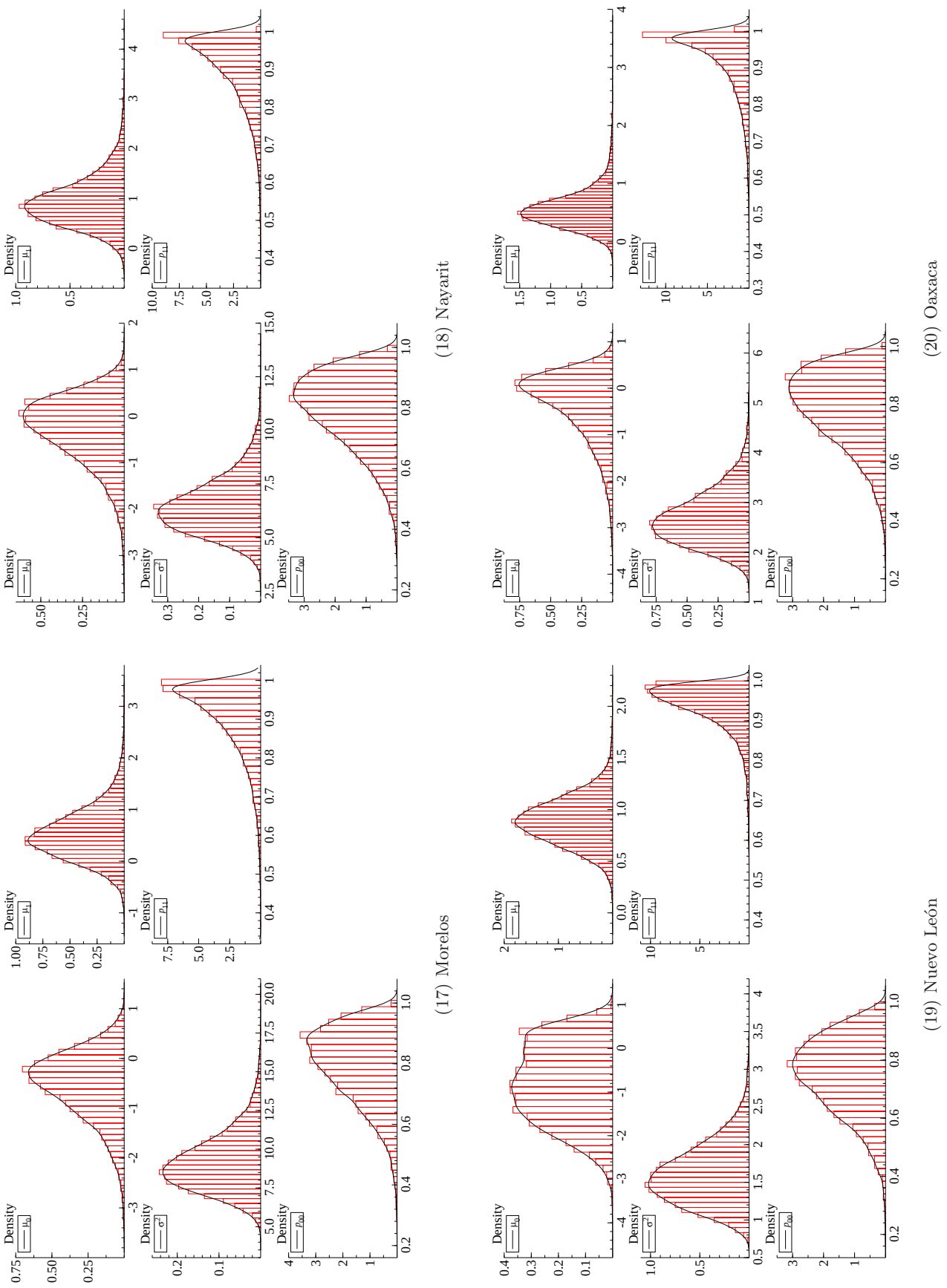
Figure D3: Posterior Distributions (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

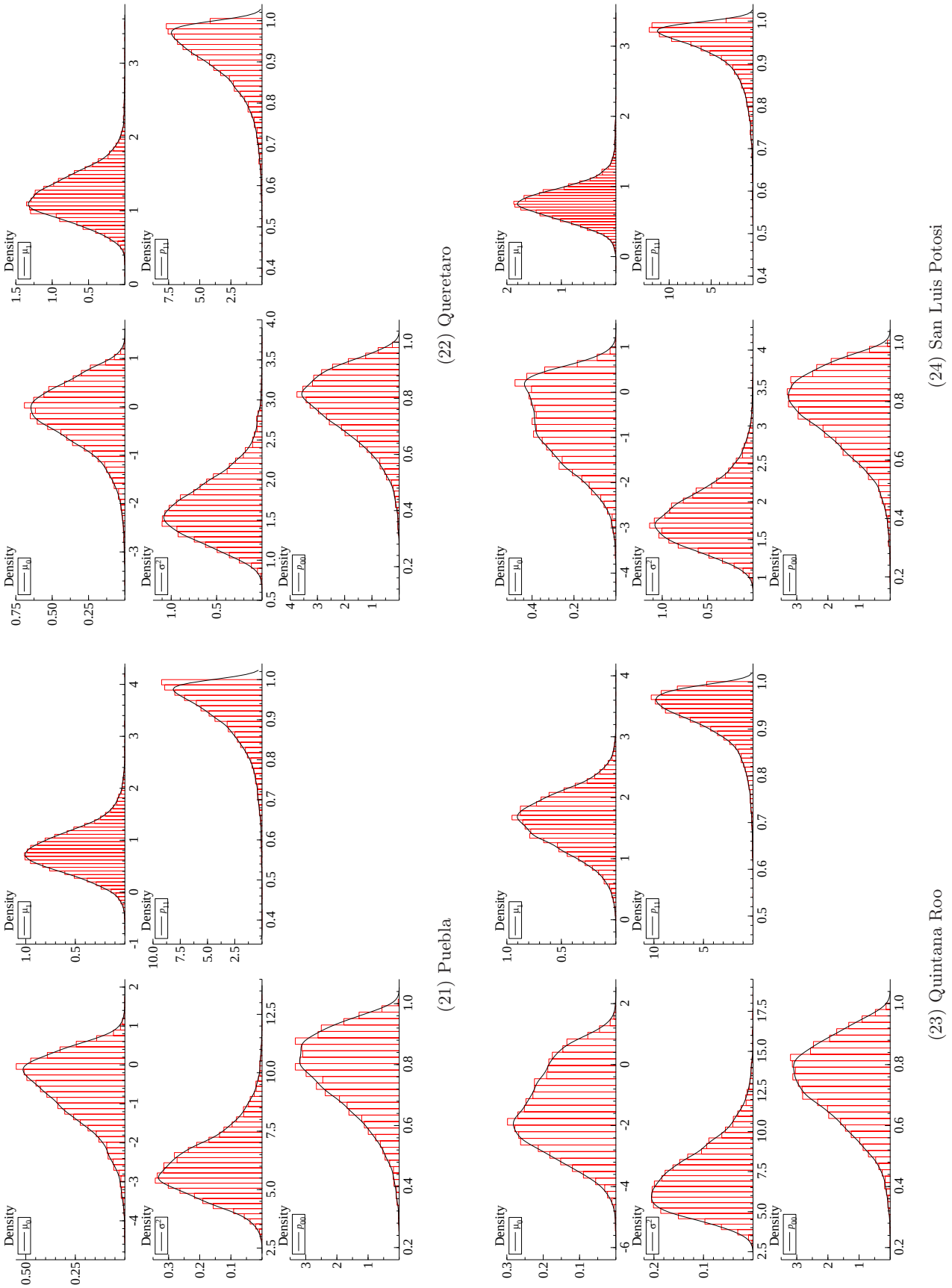
Figure D3: Posterior Distributions (Continued)



(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

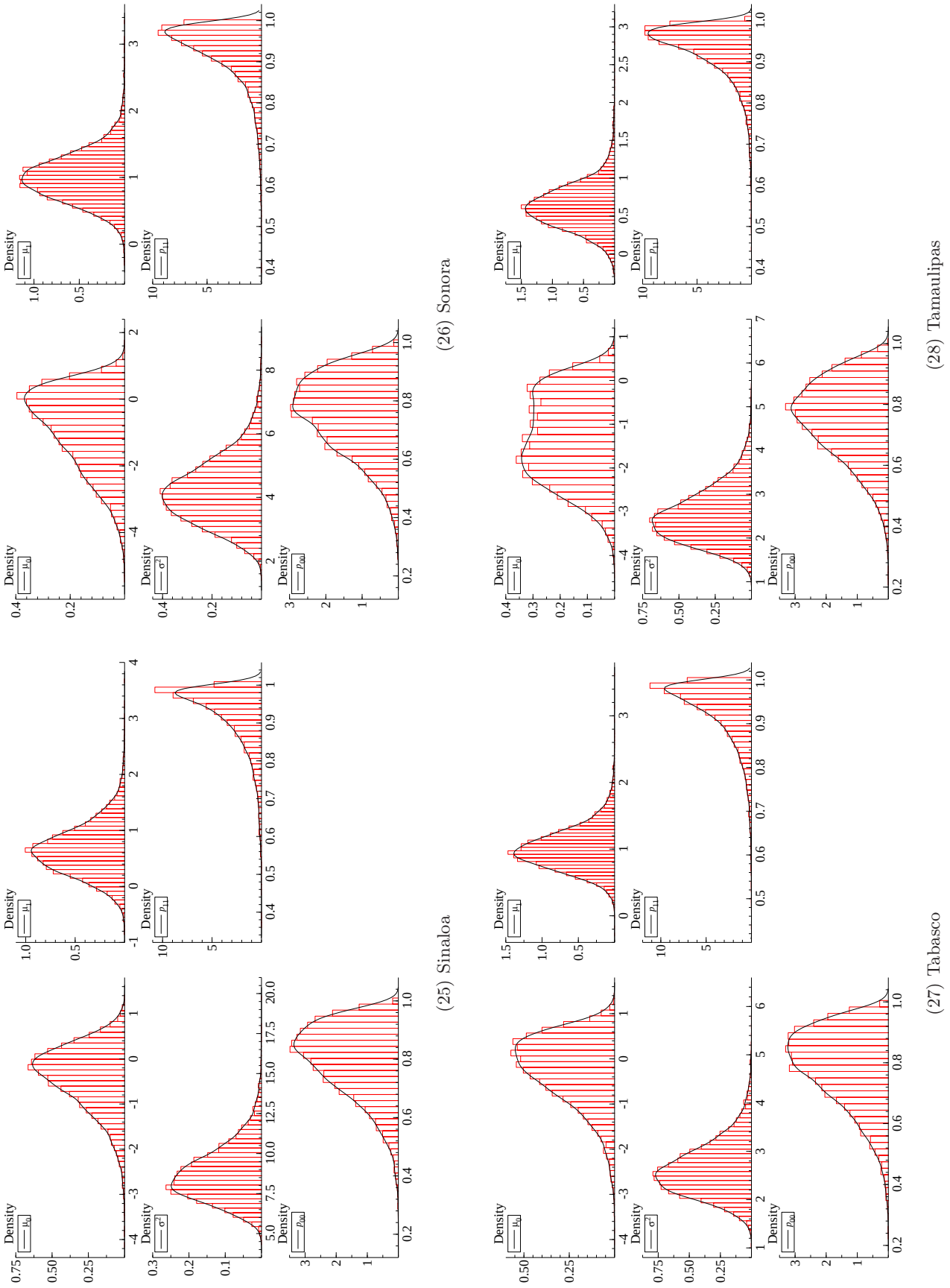
Figure D3: Posterior Distributions (Continued)



(21) Puebla (22) Queretaro

(23) Quintana Roo (24) San Luis Potosi

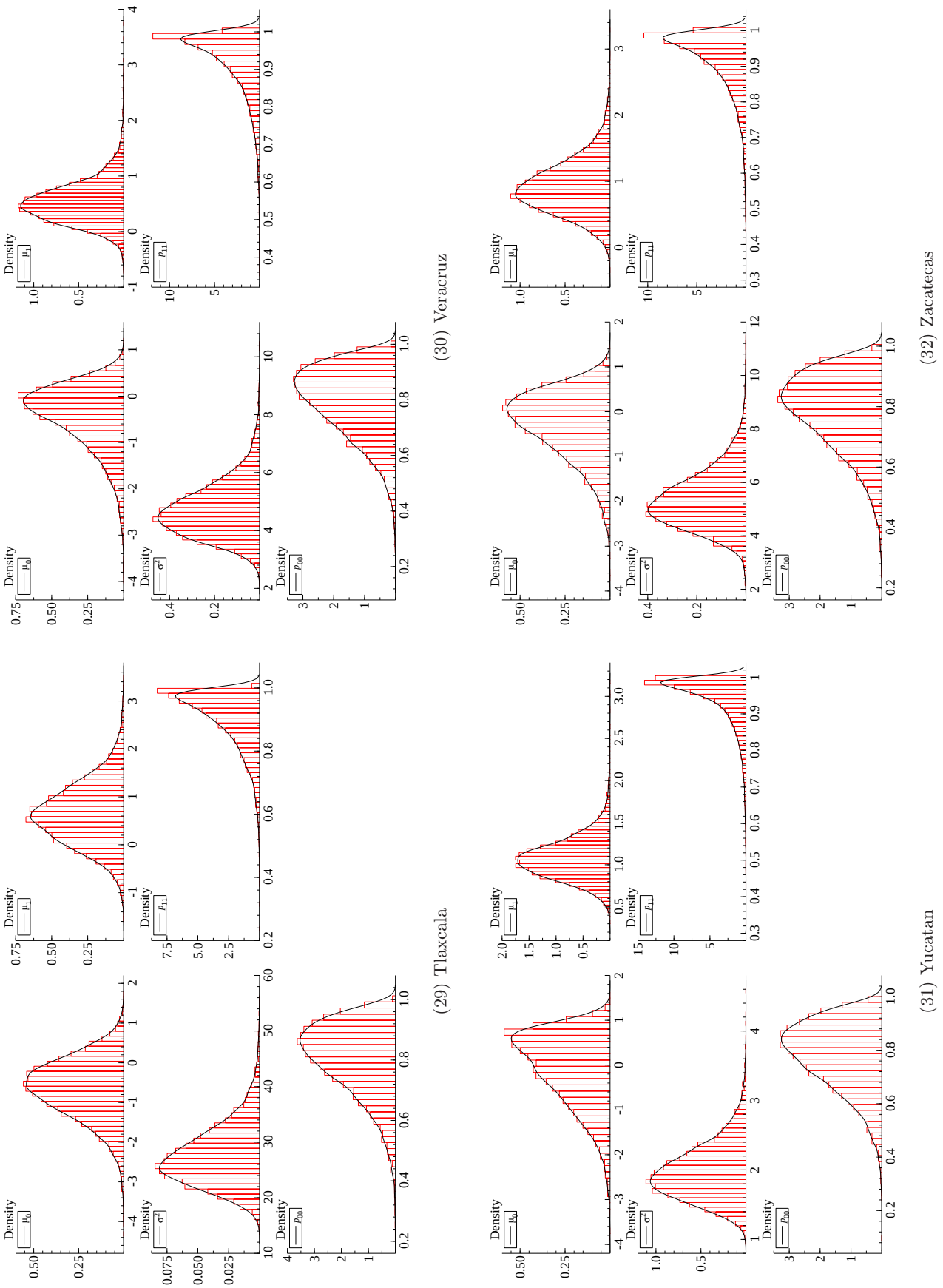
Figure D3: Posterior Distributions (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

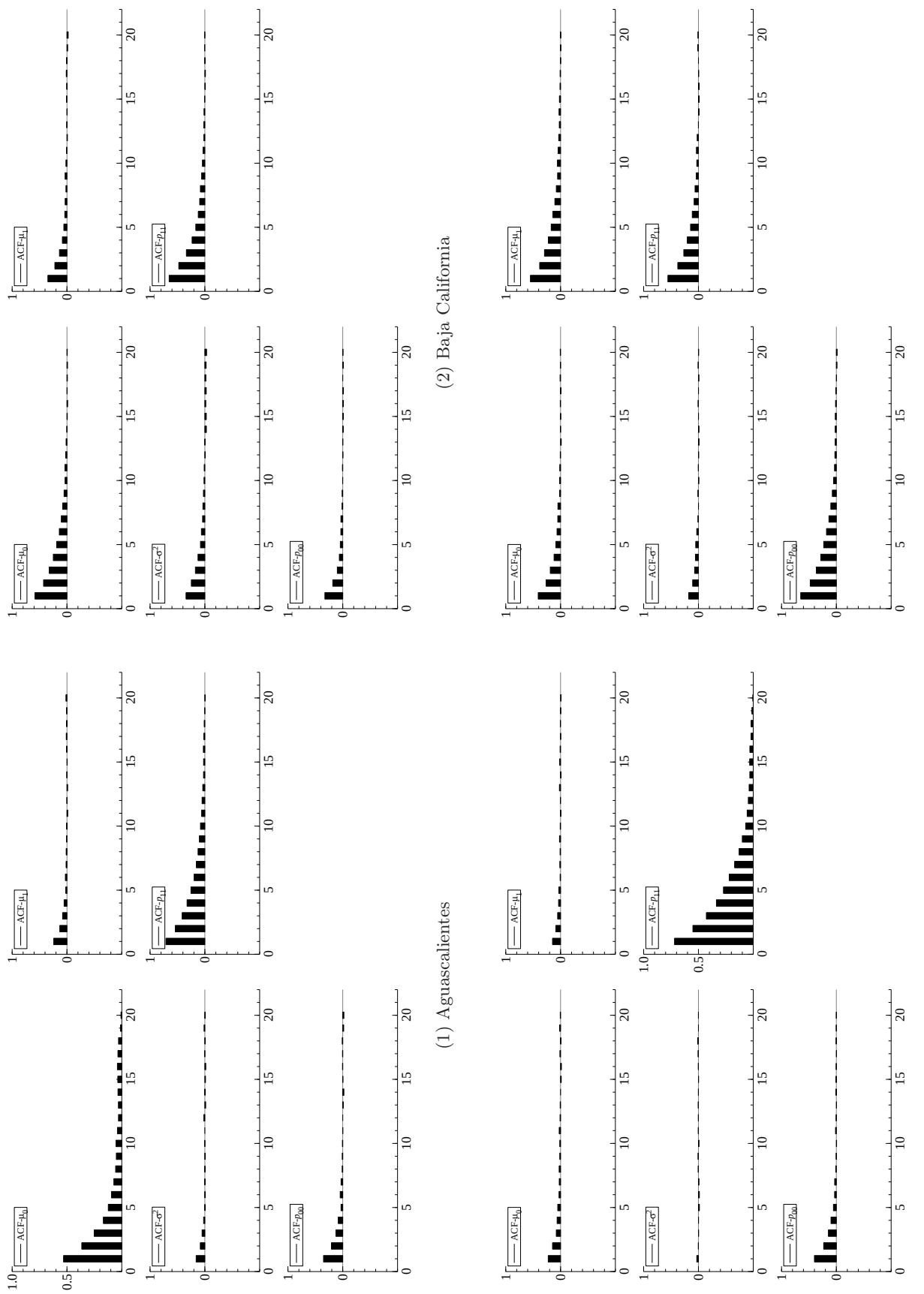
Figure D3: Posterior Distributions (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

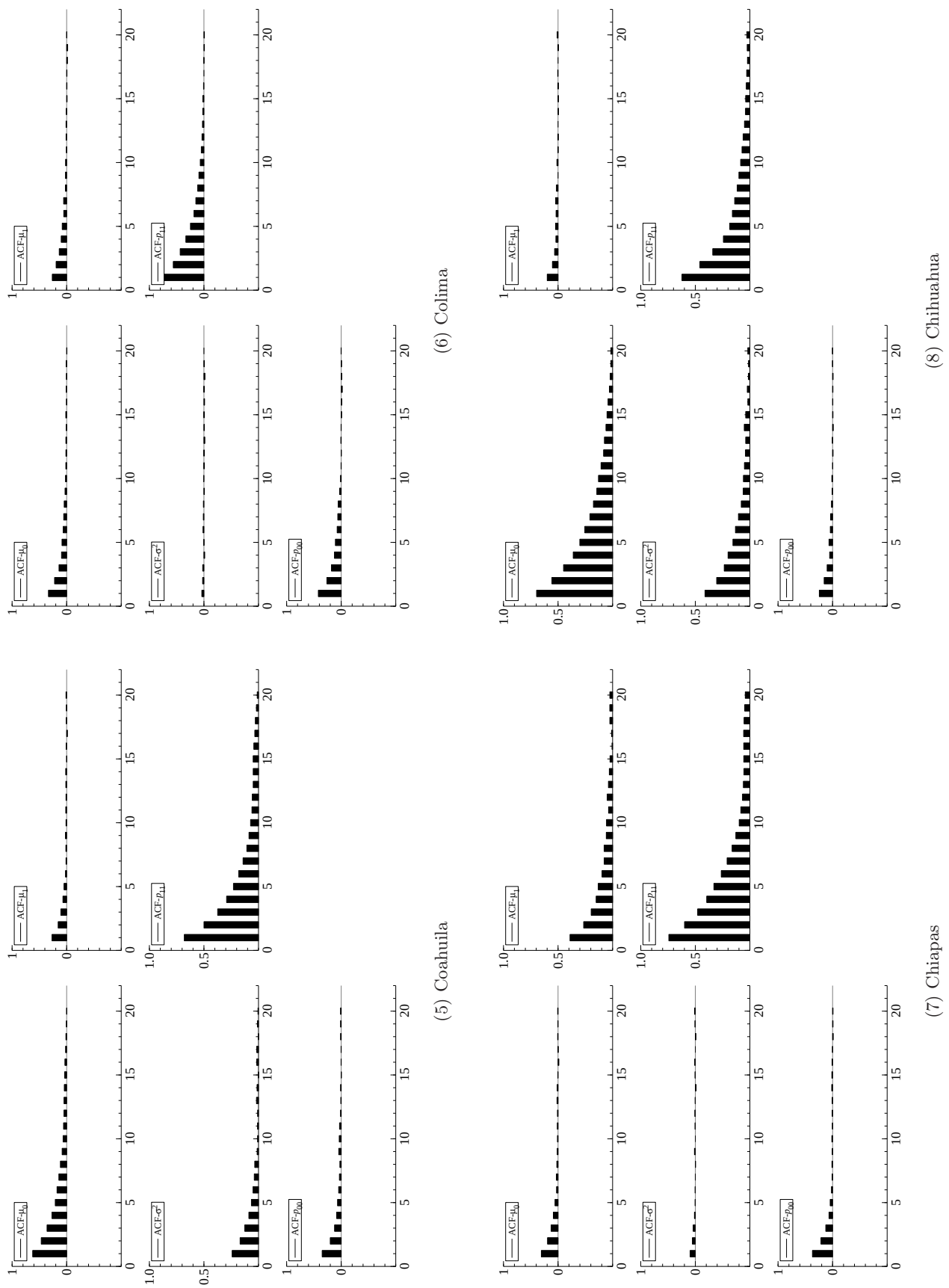
Figure D3: Posterior Distributions (Continued)



(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

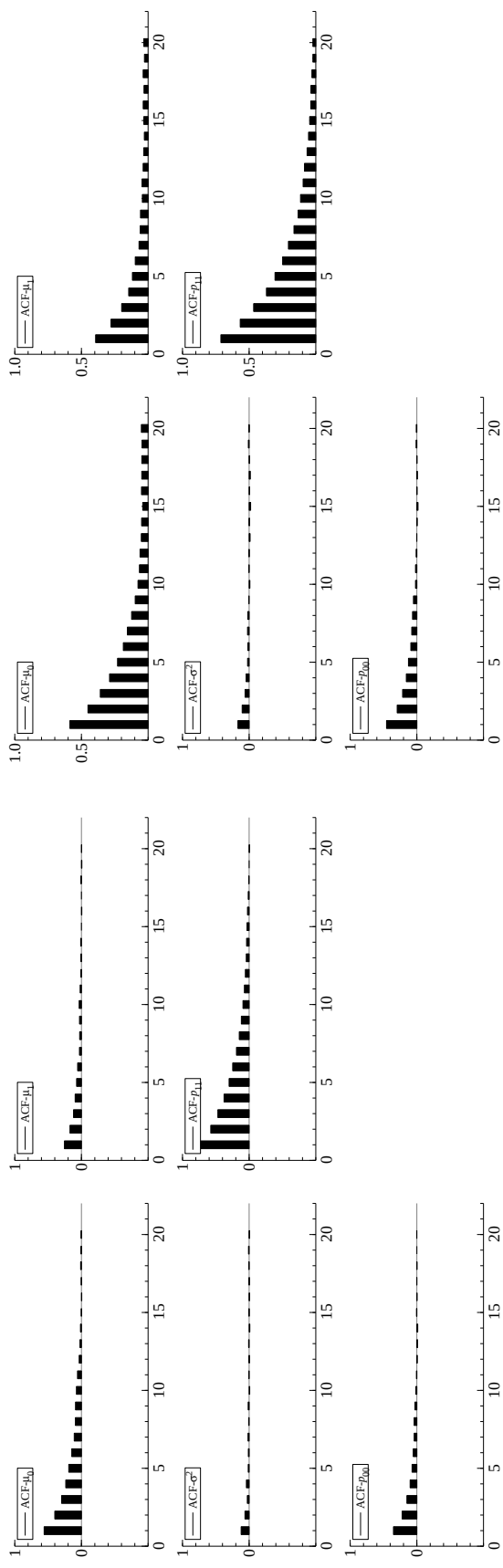
Figure D4: Posterior Distributions



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

Figure D4: Autocorrelation Function (Continued)



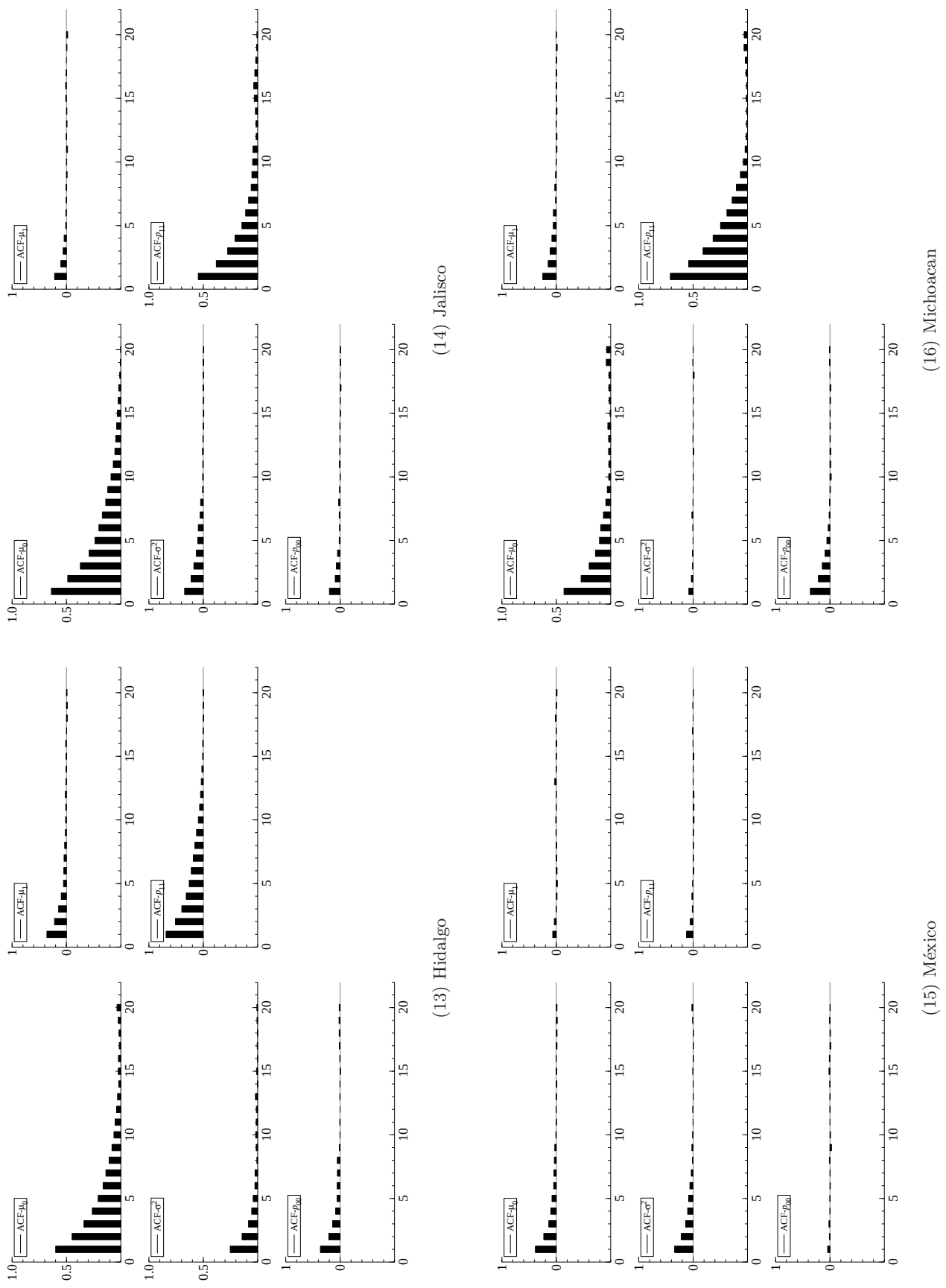
(9) Federal District

(10) Durango

(11) Guanajuato

(12) Guerrero

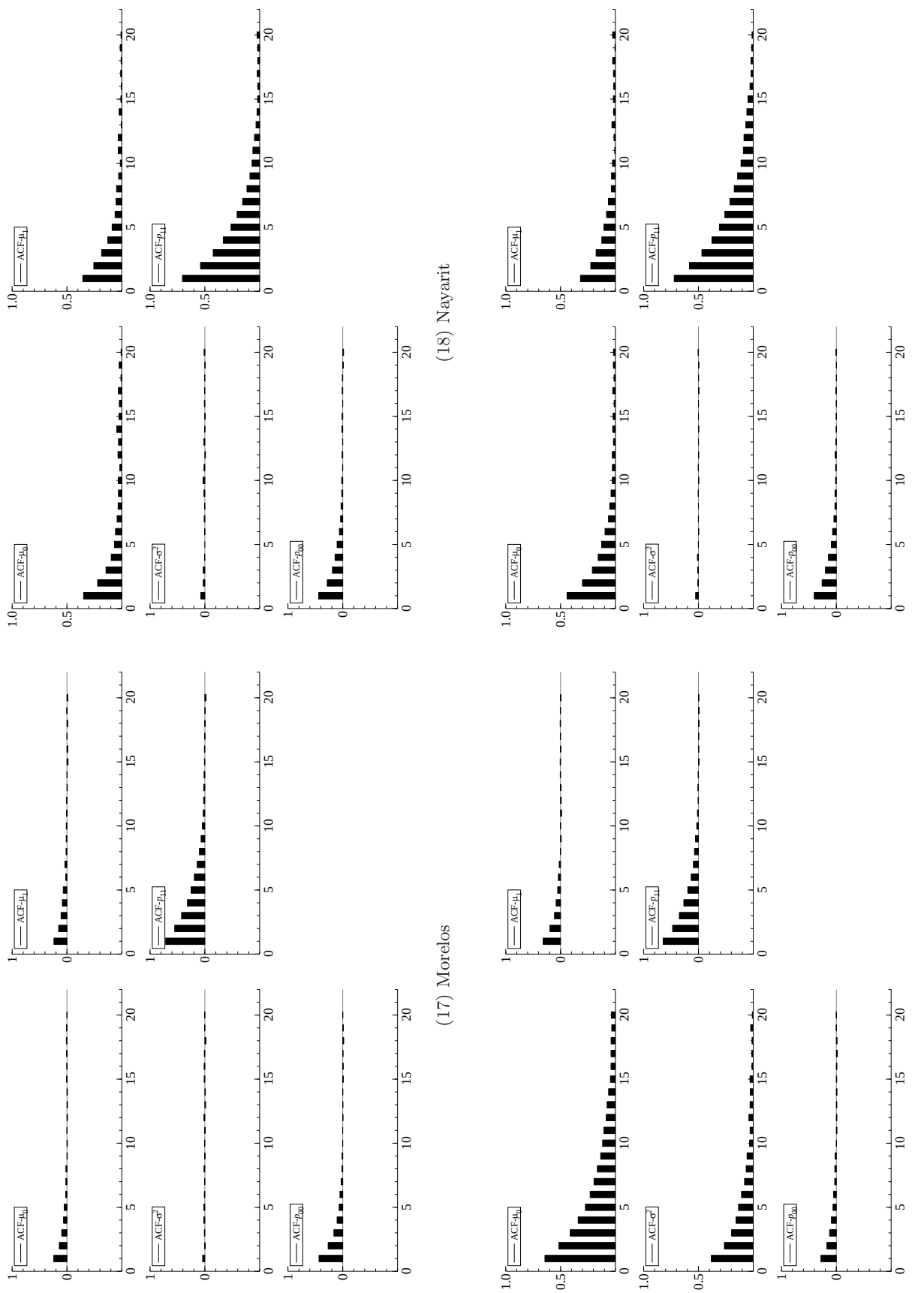
Figure D4: Autocorrelation Function (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

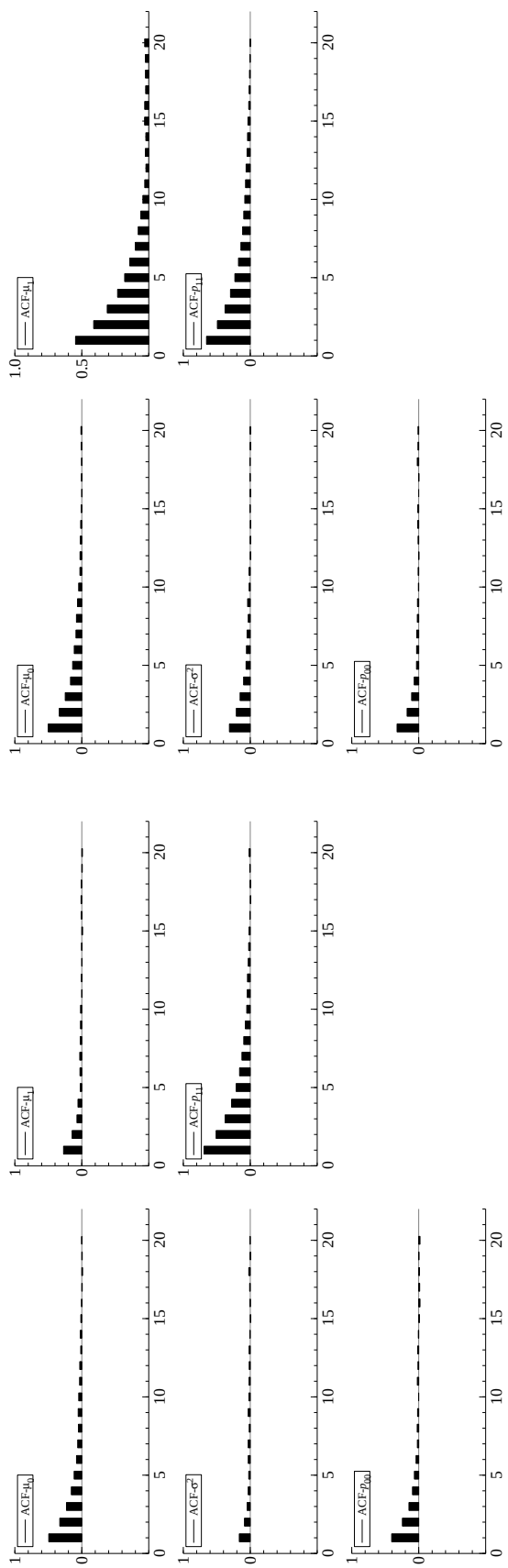
Figure D4: Autocorrelation Function (Continued)



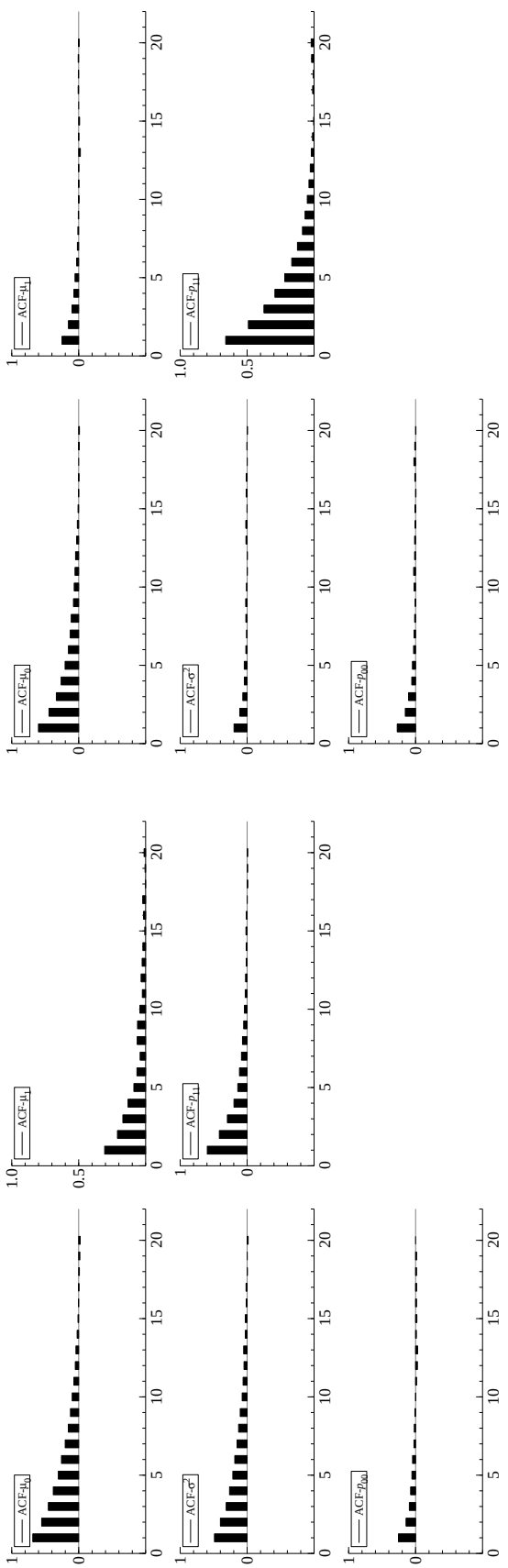
(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

Figure D4: Autocorrelation Function (Continued)

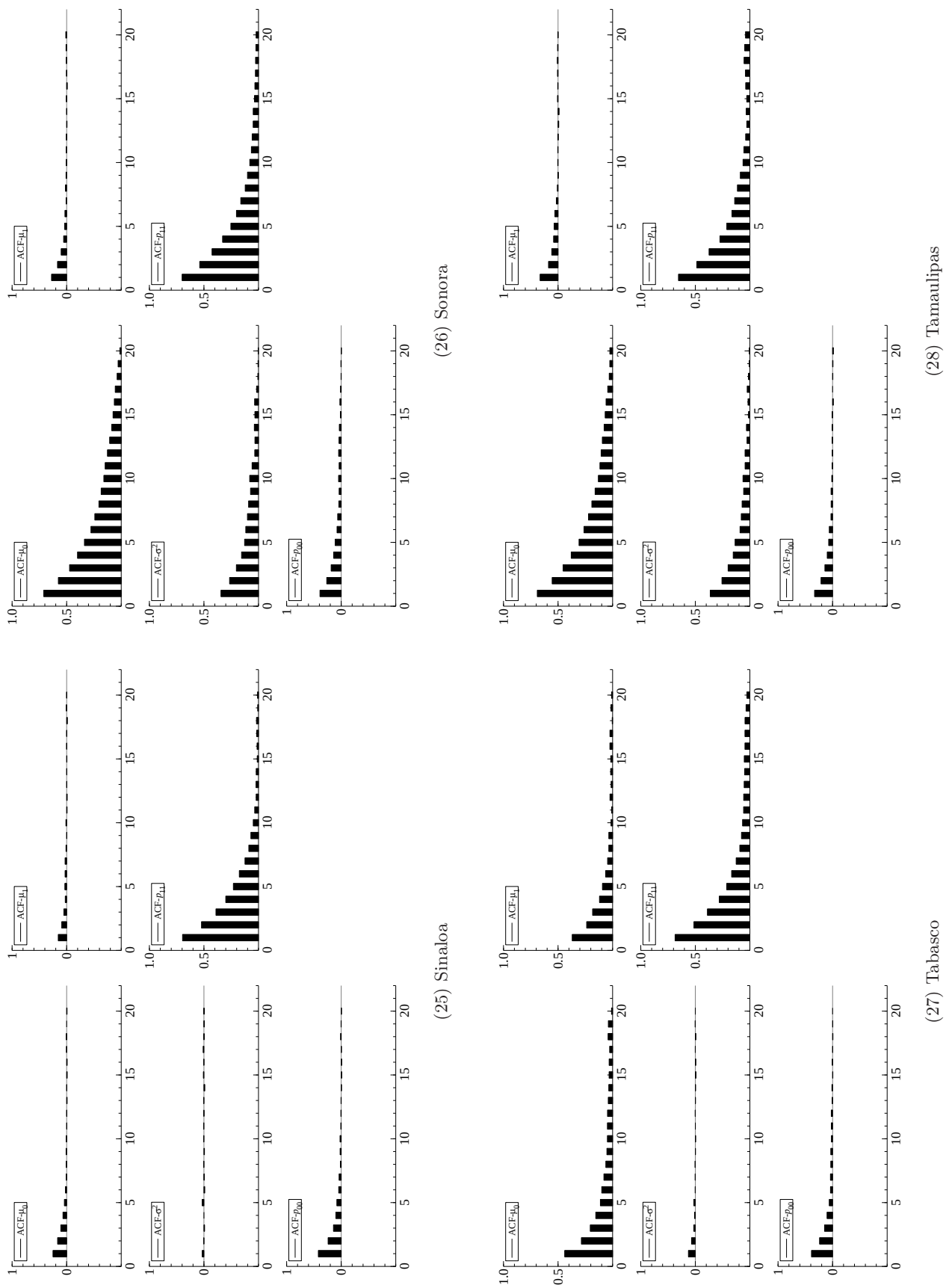


(21) Puebla (22) Queretaro



(23) Quintana Roo (24) San Luis Potosi

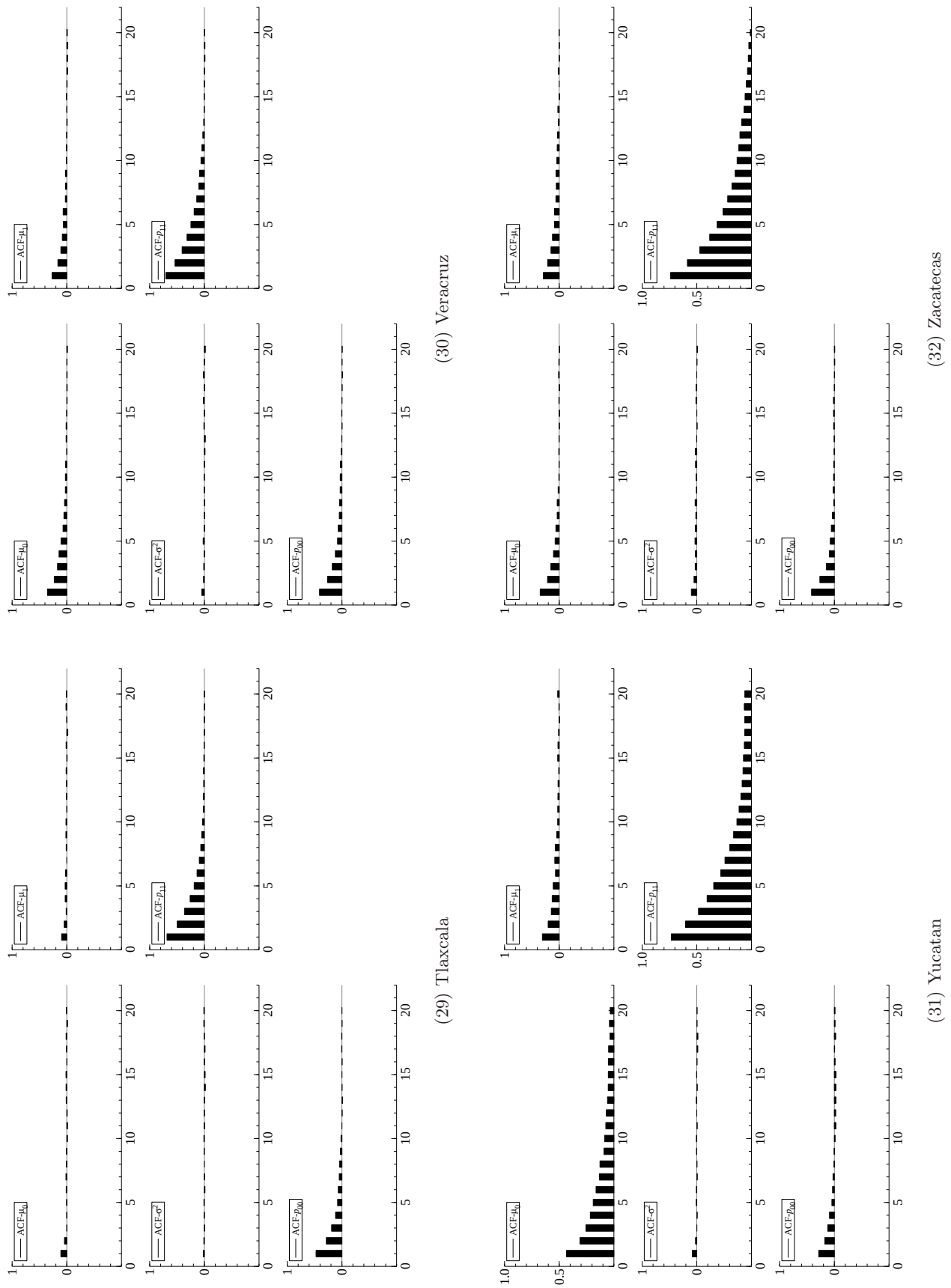
Figure D4: Autocorrelation Function (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

Figure D4: Autocorrelation Function (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

Figure D4: Autocorrelation Function (Continued)

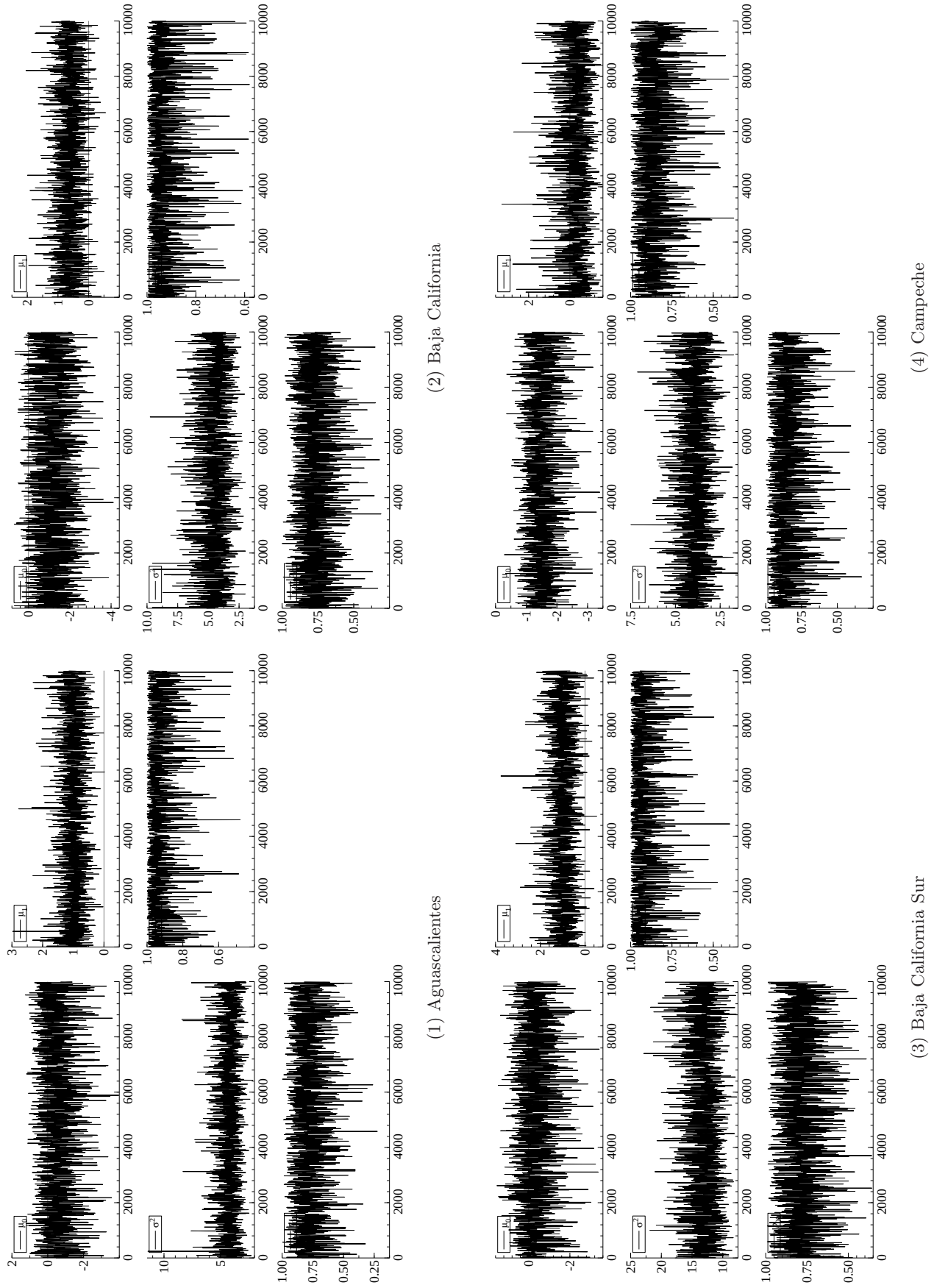
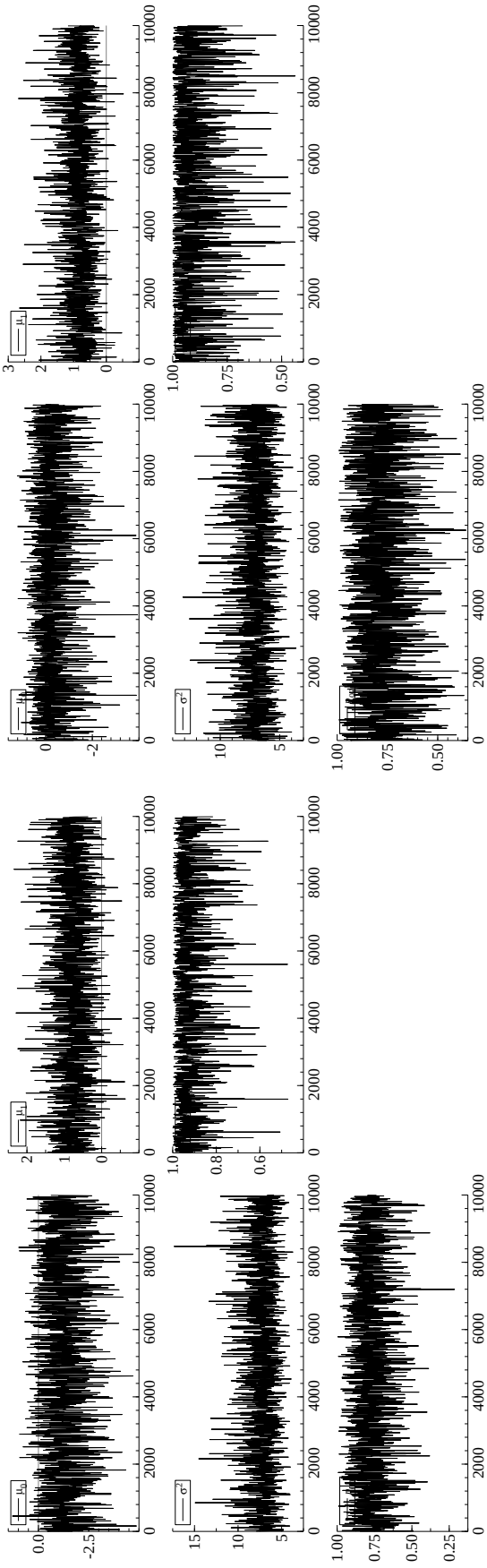


Figure D5: Trace Plots



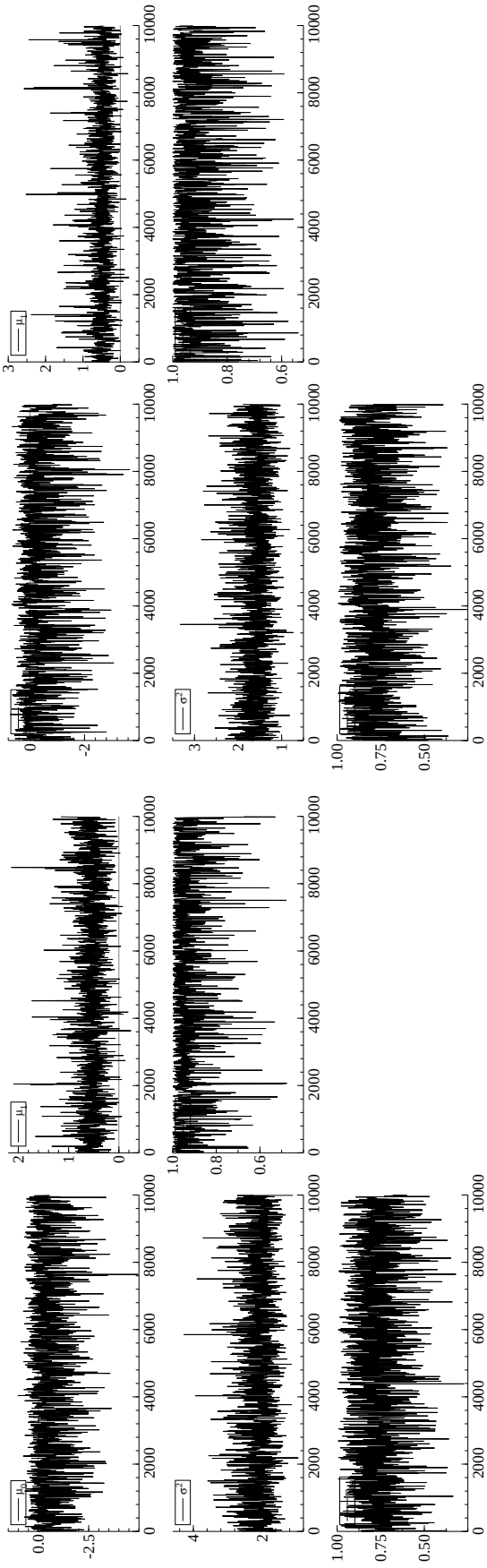
(5) Coahuila

(6) Colima

(7) Chiapas

(8) Chihuahua

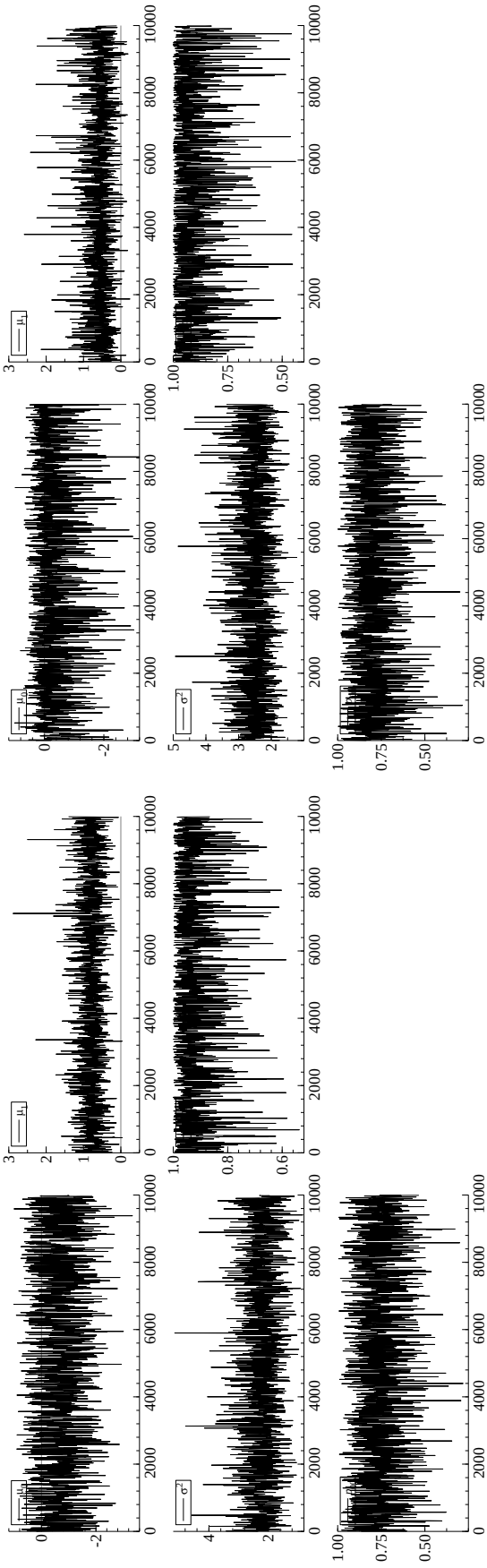
Figure D5: Trace Plots (Continued)



(9) Federal District

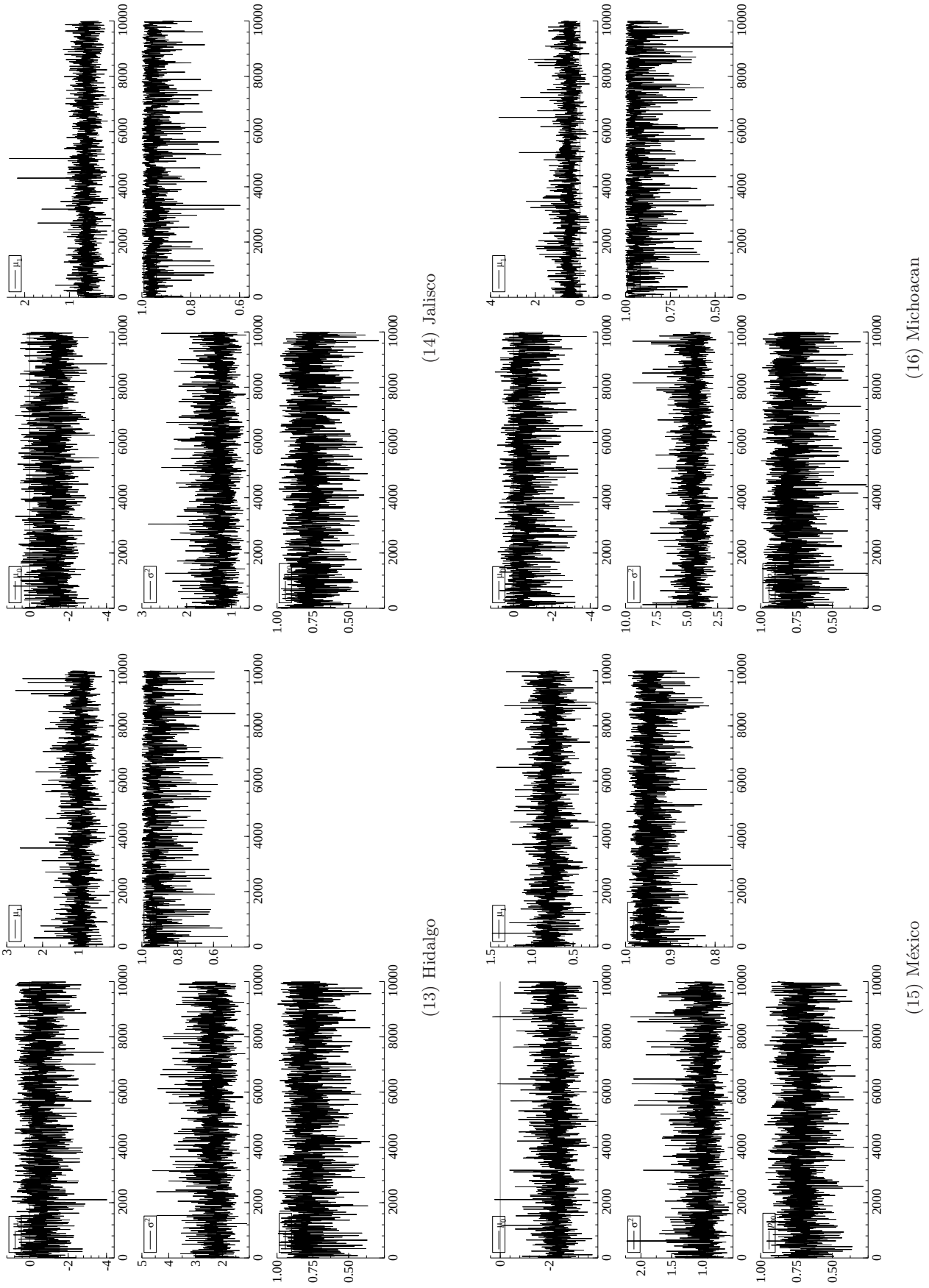
(10) Durango

(11) Guanajuato



(12) Guerrero

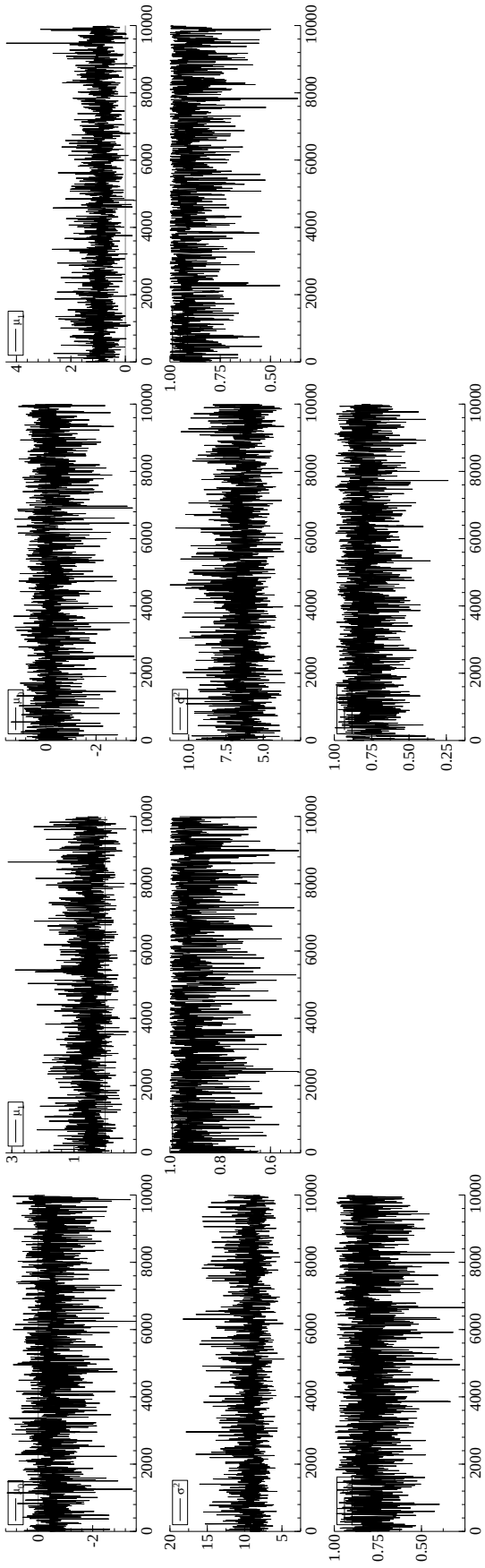
Figure D5: Trace Plots (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

Figure D5: Trace Plots (Continued)



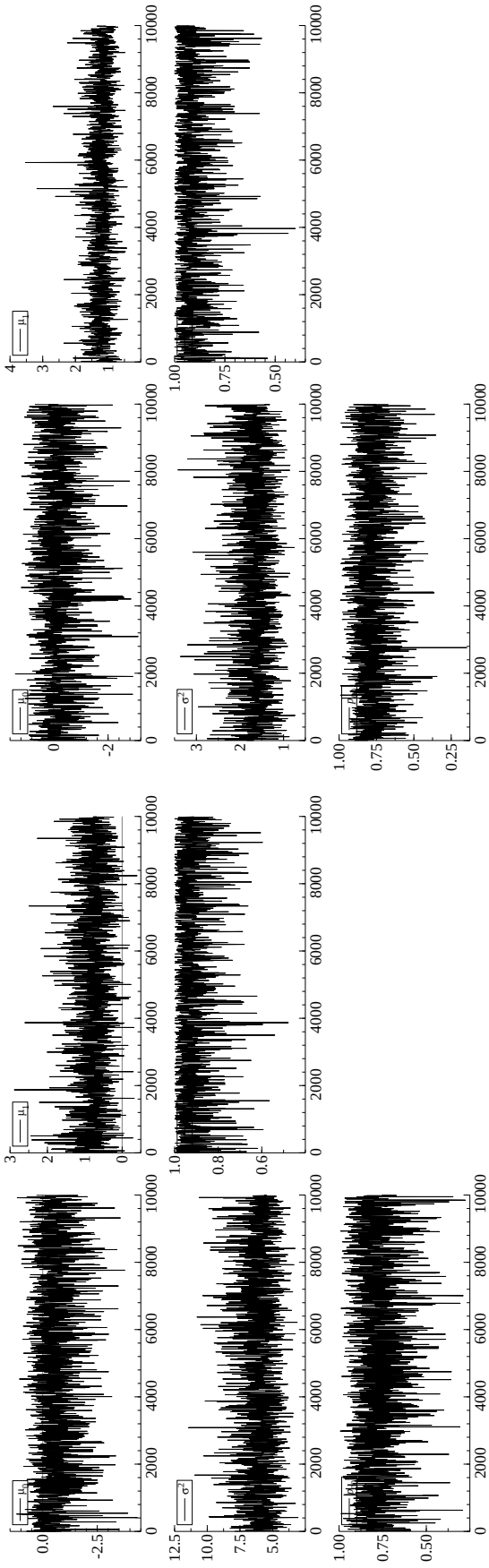
(17) Morelos

(18) Nayarit

(19) Nuevo León

(20) Oaxaca

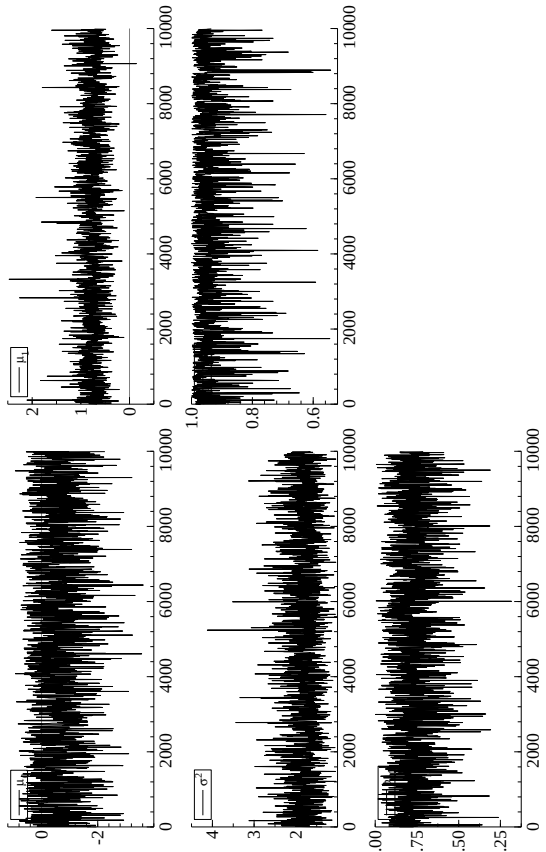
Figure D5: Trace Plots (Continued)



(21) Puebla

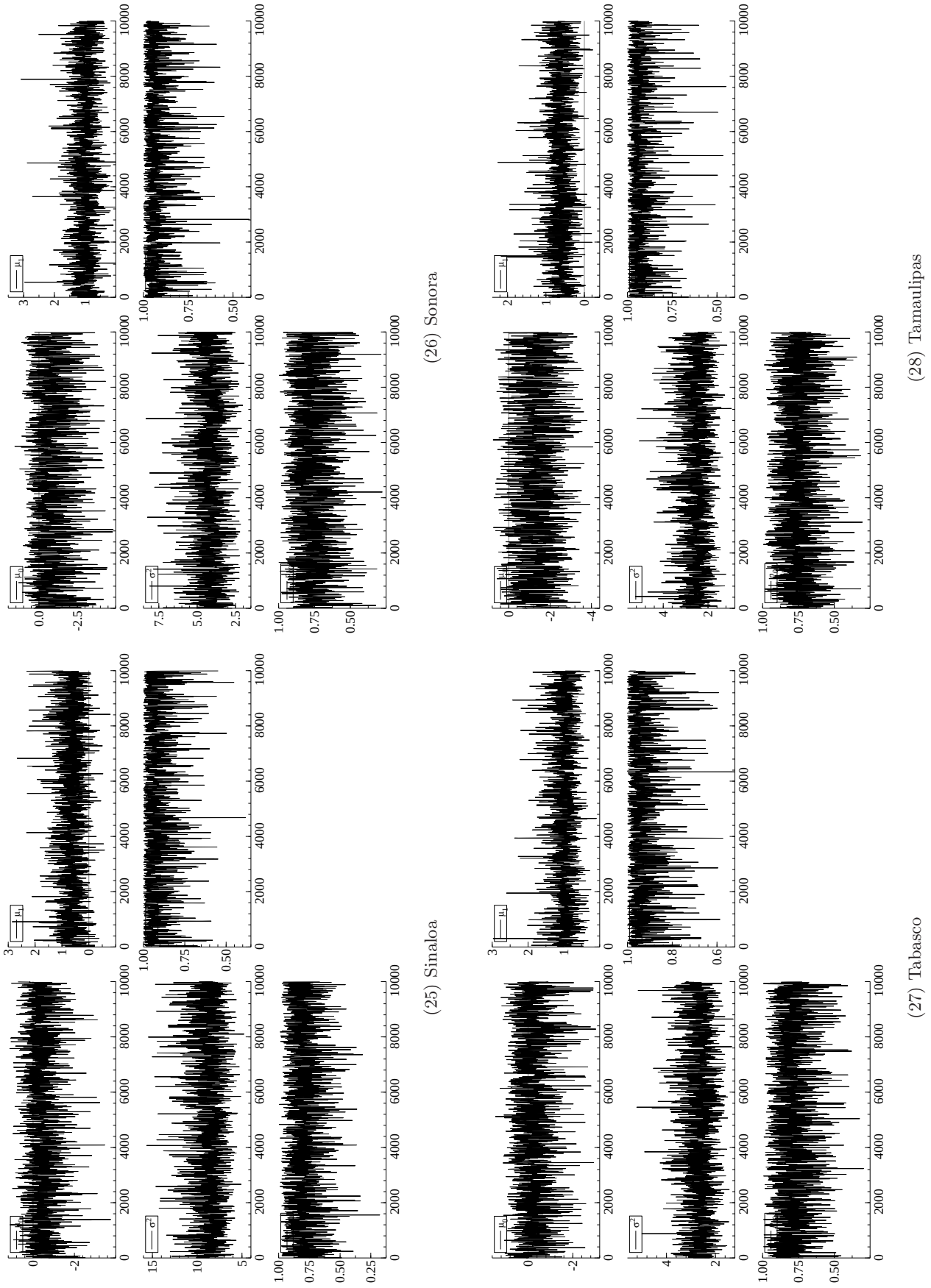
(22) Queretaro

(23) Quintana Roo



(24) San Luis Potosi

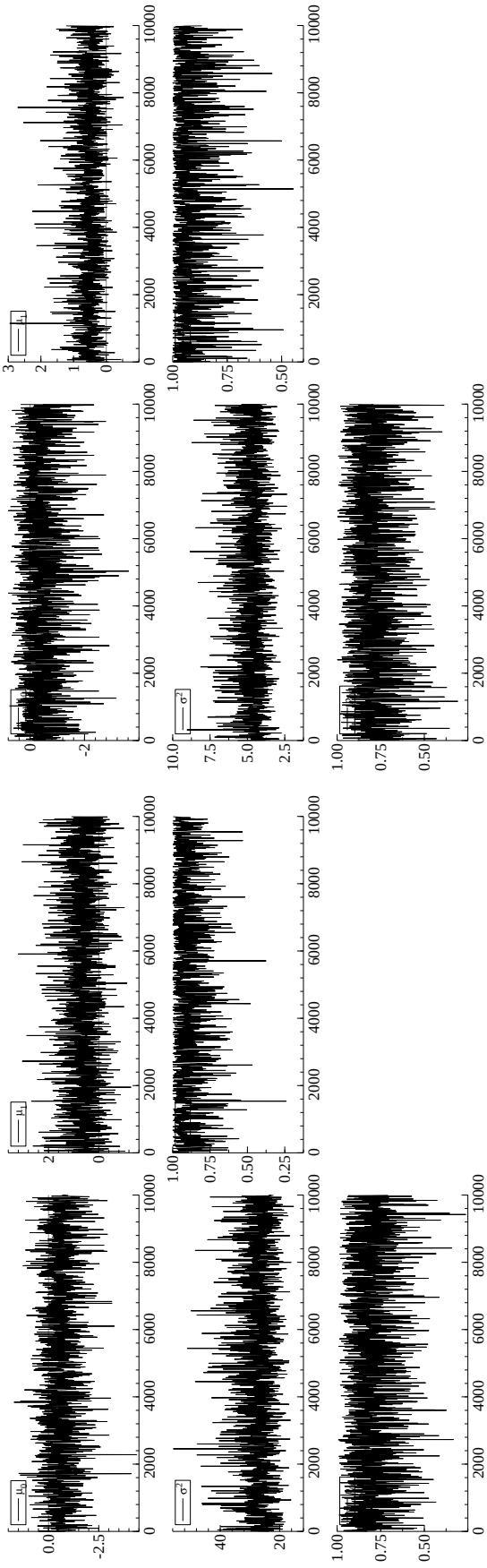
Figure D5: Trace Plots (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

Figure D5: Trace Plots (Continued)



(29) Tlaxcala

(30) Veracruz

(31) Yucatan

(32) Zacatecas

Figure D5: Trace Plots (Continued)

Online Appendix E. Estimation Results of Markov Switching Model with Spatial Autoregressive and First-Order Autoregressive Processes

The estimation results here are obtained by estimating the Markov switching model with SAR and AR(1) processes:

$$\boldsymbol{y}_t = \rho \boldsymbol{W} \boldsymbol{y}_t + \boldsymbol{\Phi} \boldsymbol{y}_{t-1} + \boldsymbol{\mu}_0 \odot (\boldsymbol{\iota}_N - \boldsymbol{s}_t) + \boldsymbol{\mu}_1 \odot \boldsymbol{s}_t + \boldsymbol{\varepsilon}_t,$$

where $\boldsymbol{\Phi} = \text{diag}(\phi_1, \ldots, \phi_N)$, $\boldsymbol{\varepsilon}_t \sim$ i.i.d. $\text{N}(\boldsymbol{0}, \boldsymbol{\Omega})$, and $\boldsymbol{\Omega} = \text{diag}(\sigma_1^2, \ldots, \sigma_N^2)$. (Distance-Based SWM, $\eta = 4$)

Table E1

Table E1 shows the point estimates and interval estimates of parameters.

Figure E1

Figure E1 shows the probabilities of recession, which are calculated by $1 - G^{-1} \sum_{g=1}^{G} s_{t,n}^{(g)}$, where G is the number of iterations and the superscript (g) is the gth iteration.

Figure E2

Figure E2 shows convergence diagnostics (kernel density, autocorrelation, and trace plots) for the posterior distribution of ρ.

Figure E3

Figure E3 shows the histogram and density plots of parameters by state. The solid line indicates density estimates obtained by kernel density estimation.

Figure E4

Figure E4 shows the autocorrelation plots of parameters by state.

Figure E5

Figure E5 shows the trace plots of parameters by state.

Table E1: Estimated Parameters

		ρ		
		Mean	Median	95% CI
	Spatial Dependence	0.26	0.26	[0.22, 0.31]

		μ_0			μ_1			ϕ		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	−0.71	−0.67	[−2.64, 0.86]	1.18	1.17	[0.43, 1.95]	−0.13	−0.13	[−0.40, 0.14]
2	Baja California	−0.82	−0.70	[−2.58, 0.42]	0.63	0.60	[−0.09, 1.52]	0.08	0.08	[−0.19, 0.33]
3	Baja California Sur	−0.30	−0.23	[−2.13, 1.06]	1.21	1.18	[0.20, 2.40]	−0.20	−0.20	[−0.46, 0.07]
4	Campeche	−1.55	−1.48	[−2.71, −0.71]	−0.27	−0.38	[−1.30, 1.42]	−0.02	−0.02	[−0.31, 0.26]
5	Coahuila	−0.90	−0.73	[−3.00, 0.40]	0.58	0.55	[−0.26, 1.65]	0.28	0.29	[0.04, 0.52]
6	Colima	−0.36	−0.25	[−2.08, 0.80]	0.85	0.81	[0.04, 1.87]	−0.13	−0.13	[−0.39, 0.13]
7	Chiapas	−0.59	−0.48	[−2.10, 0.34]	0.41	0.35	[−0.25, 1.46]	−0.03	−0.03	[−0.30, 0.24]
8	Chihuahua	−1.99	−2.08	[−4.10, 0.37]	0.93	0.93	[0.38, 1.45]	−0.09	−0.10	[−0.33, 0.18]
9	Federal District	−0.64	−0.44	[−2.68, 0.57]	0.60	0.58	[0.11, 1.25]	−0.04	−0.04	[−0.31, 0.21]
10	Durango	−0.68	−0.47	[−2.55, 0.49]	0.60	0.57	[0.13, 1.27]	−0.23	−0.23	[−0.51, 0.06]
11	Guanajuato	−0.88	−0.94	[−2.34, 0.57]	0.98	0.97	[0.30, 1.67]	−0.10	−0.10	[−0.37, 0.20]
12	Guerrero	−0.45	−0.32	[−2.07, 0.57]	0.77	0.72	[0.17, 1.68]	−0.36	−0.36	[−0.61, −0.10]
13	Hidalgo	−0.81	−0.79	[−2.46, 0.57]	0.93	0.93	[0.28, 1.62]	−0.03	−0.03	[−0.36, 0.29]
14	Jalisco	−1.20	−1.28	[−2.78, 0.36]	0.63	0.63	[0.14, 1.09]	0.01	0.01	[−0.30, 0.33]
15	México	−2.09	−2.17	[−3.23, −0.38]	0.73	0.73	[0.37, 1.08]	0.04	0.04	[−0.16, 0.25]
16	Michoacán	−0.65	−0.50	[−2.61, 0.59]	0.66	0.64	[−0.03, 1.46]	−0.22	−0.22	[−0.52, 0.09]
17	Morelos	−0.55	−0.47	[−2.12, 0.55]	0.62	0.56	[−0.26, 1.87]	−0.29	−0.30	[−0.55, −0.04]
18	Nayarit	−0.38	−0.28	[−2.08, 0.81]	0.99	0.93	[0.11, 2.24]	−0.08	−0.08	[−0.36, 0.19]
19	Nuevo León	−0.87	−0.91	[−2.50, 0.65]	0.99	0.99	[0.45, 1.56]	−0.07	−0.07	[−0.34, 0.18]
20	Oaxaca	−0.39	−0.20	[−2.27, 0.72]	0.75	0.72	[0.24, 1.48]	−0.42	−0.42	[−0.70, −0.15]
21	Puebla	−0.73	−0.57	[−2.87, 0.64]	0.82	0.80	[0.00, 1.78]	−0.03	−0.03	[−0.33, 0.28]
22	Querétaro	−0.26	−0.15	[−1.96, 0.78]	1.00	0.96	[0.37, 1.82]	0.14	0.14	[−0.14, 0.41]
23	Quintana Roo	−1.95	−2.13	[−4.15, 0.80]	1.85	1.89	[0.82, 2.69]	−0.15	−0.16	[−0.39, 0.12]
24	San Luis Potosí	−1.23	−1.32	[−2.90, 0.58]	0.98	0.99	[0.40, 1.51]	−0.19	−0.20	[−0.50, 0.14]
25	Sinaloa	−0.34	−0.23	[−2.09, 0.83]	0.89	0.86	[0.08, 1.94]	−0.37	−0.37	[−0.61, −0.12]
26	Sonora	−1.31	−1.21	[−3.82, 0.64]	0.99	0.99	[0.31, 1.68]	−0.07	−0.07	[−0.30, 0.17]
27	Tabasco	−0.22	−0.13	[−1.88, 0.91]	1.15	1.13	[0.50, 1.91]	−0.10	−0.10	[−0.38, 0.19]
28	Tamaulipas	−1.06	−0.91	[−3.05, 0.36]	0.57	0.55	[−0.02, 1.31]	0.15	0.15	[−0.12, 0.41]
29	Tlaxcala	−0.71	−0.65	[−2.43, 0.66]	0.71	0.68	[−0.46, 2.06]	−0.41	−0.41	[−0.65, −0.16]
30	Veracruz	−0.31	−0.20	[−1.95, 0.74]	0.90	0.84	[0.20, 1.97]	−0.48	−0.48	[−0.72, −0.24]
31	Yucatán	−0.14	−0.05	[−2.04, 1.15]	1.35	1.32	[0.79, 2.00]	−0.29	−0.29	[−0.60, 0.02]
32	Zacatecas	−0.26	−0.19	[−1.94, 0.96]	1.28	1.20	[0.40, 2.69]	−0.24	−0.24	[−0.49, 0.03]

Notes: 95% CI indicates 95% credible interval.

Table E1: Estimated Parameters (Continued)

		σ^2			p_{11}			p_{00}		
Code	State	Mean	Median	95% CI	Mean	Median	95% CI	Mean	Median	95% CI
1	Aguascalientes	4.18	4.06	[2.71, 6.25]	0.93	0.95	[0.74, 1.00]	0.77	0.79	[0.49, 0.96]
2	Baja California	4.12	4.02	[2.62, 6.21]	0.91	0.94	[0.70, 1.00]	0.78	0.79	[0.50, 0.96]
3	Baja California Sur	12.95	12.64	[8.71, 18.88]	0.92	0.94	[0.69, 1.00]	0.78	0.80	[0.50, 0.97]
4	Campeche	4.00	3.92	[2.54, 5.94]	0.86	0.88	[0.61, 0.99]	0.85	0.88	[0.57, 0.99]
5	Coahuila	6.89	6.73	[4.49, 10.32]	0.91	0.93	[0.69, 1.00]	0.78	0.80	[0.51, 0.97]
6	Colima	6.78	6.64	[4.48, 10.03]	0.91	0.94	[0.68, 1.00]	0.78	0.79	[0.48, 0.97]
7	Chiapas	3.73	3.65	[2.46, 5.53]	0.91	0.94	[0.67, 1.00]	0.79	0.80	[0.50, 0.97]
8	Chihuahua	2.30	2.21	[1.42, 3.75]	0.95	0.96	[0.82, 1.00]	0.75	0.76	[0.47, 0.95]
9	Federal District	2.13	2.07	[1.38, 3.20]	0.93	0.95	[0.71, 1.00]	0.76	0.78	[0.46, 0.97]
10	Durango	1.46	1.43	[0.88, 2.23]	0.92	0.94	[0.69, 1.00]	0.76	0.78	[0.47, 0.97]
11	Guanajuato	2.05	1.98	[1.08, 3.40]	0.91	0.93	[0.73, 1.00]	0.75	0.76	[0.47, 0.95]
12	Guerrero	2.03	1.97	[1.27, 3.09]	0.90	0.93	[0.67, 1.00]	0.78	0.79	[0.49, 0.97]
13	Hidalgo	2.21	2.14	[1.38, 3.42]	0.92	0.95	[0.72, 1.00]	0.77	0.78	[0.50, 0.96]
14	Jalisco	1.32	1.27	[0.82, 2.07]	0.94	0.96	[0.79, 1.00]	0.76	0.78	[0.49, 0.95]
15	México	1.07	1.02	[0.67, 1.81]	0.95	0.95	[0.86, 0.99]	0.72	0.73	[0.46, 0.92]
16	Michoacán	4.41	4.30	[2.79, 6.61]	0.93	0.95	[0.71, 1.00]	0.78	0.79	[0.48, 0.97]
17	Morelos	8.58	8.39	[5.75, 12.58]	0.90	0.92	[0.65, 1.00]	0.79	0.80	[0.50, 0.97]
18	Nayarit	6.58	6.42	[4.27, 9.79]	0.90	0.93	[0.66, 1.00]	0.78	0.80	[0.50, 0.97]
19	Nuevo León	1.58	1.54	[0.93, 2.51]	0.93	0.95	[0.78, 1.00]	0.74	0.75	[0.47, 0.95]
20	Oaxaca	2.16	2.11	[1.41, 3.21]	0.92	0.95	[0.70, 1.00]	0.77	0.79	[0.49, 0.97]
21	Puebla	6.21	6.07	[3.88, 9.41]	0.91	0.94	[0.71, 1.00]	0.77	0.78	[0.48, 0.96]
22	Querétaro	1.74	1.70	[1.06, 2.65]	0.92	0.94	[0.72, 1.00]	0.77	0.79	[0.49, 0.96]
23	Quintana Roo	6.48	6.06	[3.66, 11.33]	0.93	0.95	[0.81, 0.99]	0.73	0.74	[0.46, 0.93]
24	San Luis Potosí	1.67	1.61	[1.06, 2.63]	0.95	0.96	[0.81, 1.00]	0.77	0.79	[0.51, 0.96]
25	Sinaloa	7.68	7.49	[5.15, 11.37]	0.91	0.94	[0.68, 1.00]	0.78	0.80	[0.49, 0.96]
26	Sonora	3.67	3.60	[2.02, 5.86]	0.93	0.95	[0.77, 1.00]	0.73	0.75	[0.44, 0.95]
27	Tabasco	2.60	2.53	[1.66, 3.92]	0.92	0.94	[0.74, 1.00]	0.79	0.81	[0.51, 0.97]
28	Tamaulipas	2.60	2.55	[1.46, 4.07]	0.91	0.93	[0.69, 1.00]	0.75	0.77	[0.47, 0.96]
29	Tlaxcala	22.89	22.32	[15.52, 33.66]	0.90	0.93	[0.67, 1.00]	0.79	0.81	[0.51, 0.97]
30	Veracruz	3.62	3.54	[2.33, 5.40]	0.91	0.93	[0.68, 1.00]	0.79	0.81	[0.50, 0.97]
31	Yucatán	1.84	1.80	[1.15, 2.78]	0.94	0.96	[0.76, 1.00]	0.77	0.78	[0.49, 0.96]
32	Zacatecas	4.94	4.87	[2.64, 7.56]	0.90	0.93	[0.66, 1.00]	0.77	0.79	[0.50, 0.96]

Notes: 95% CI indicates 95% credible interval.

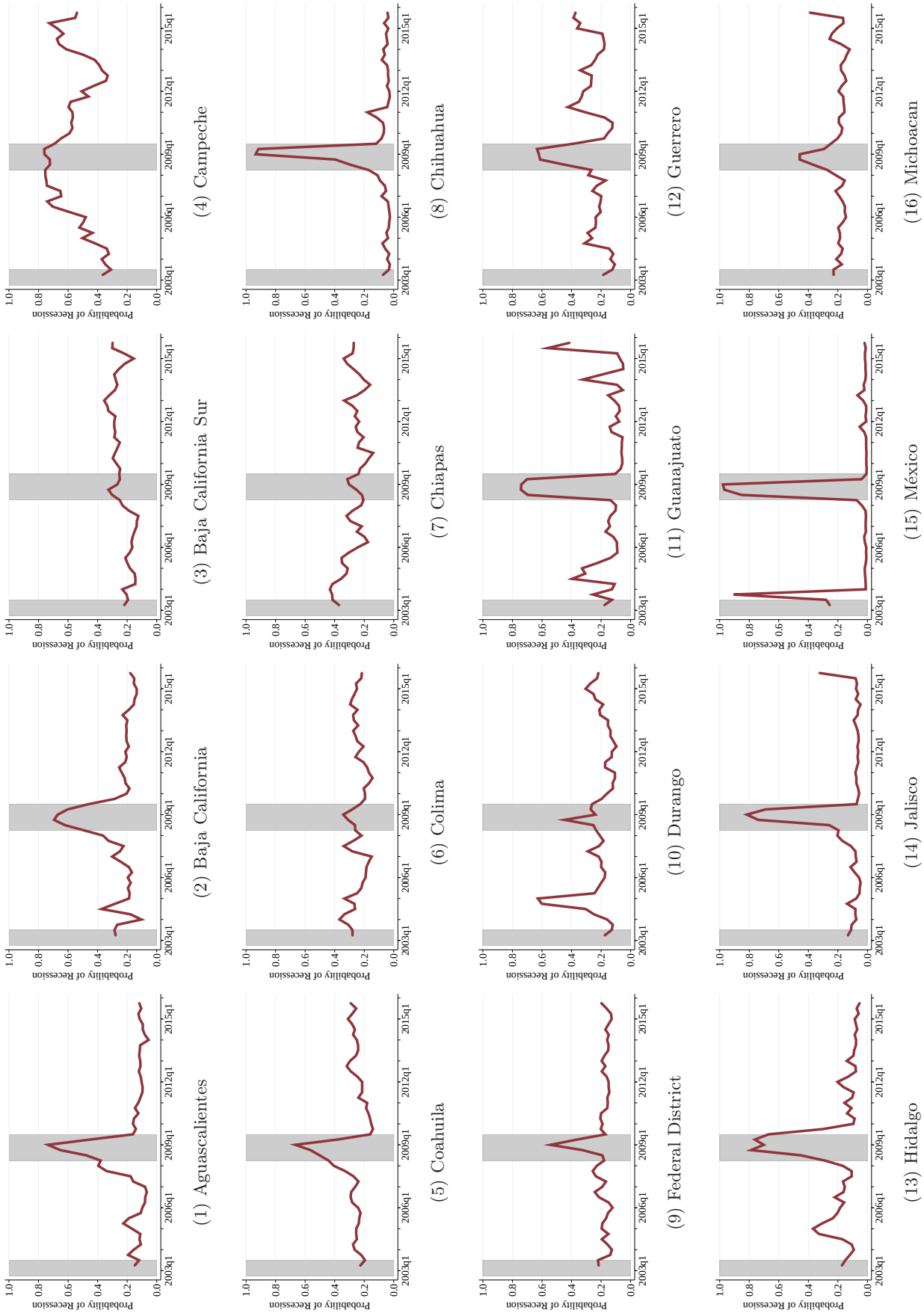


Figure E1: Recession Probabilities

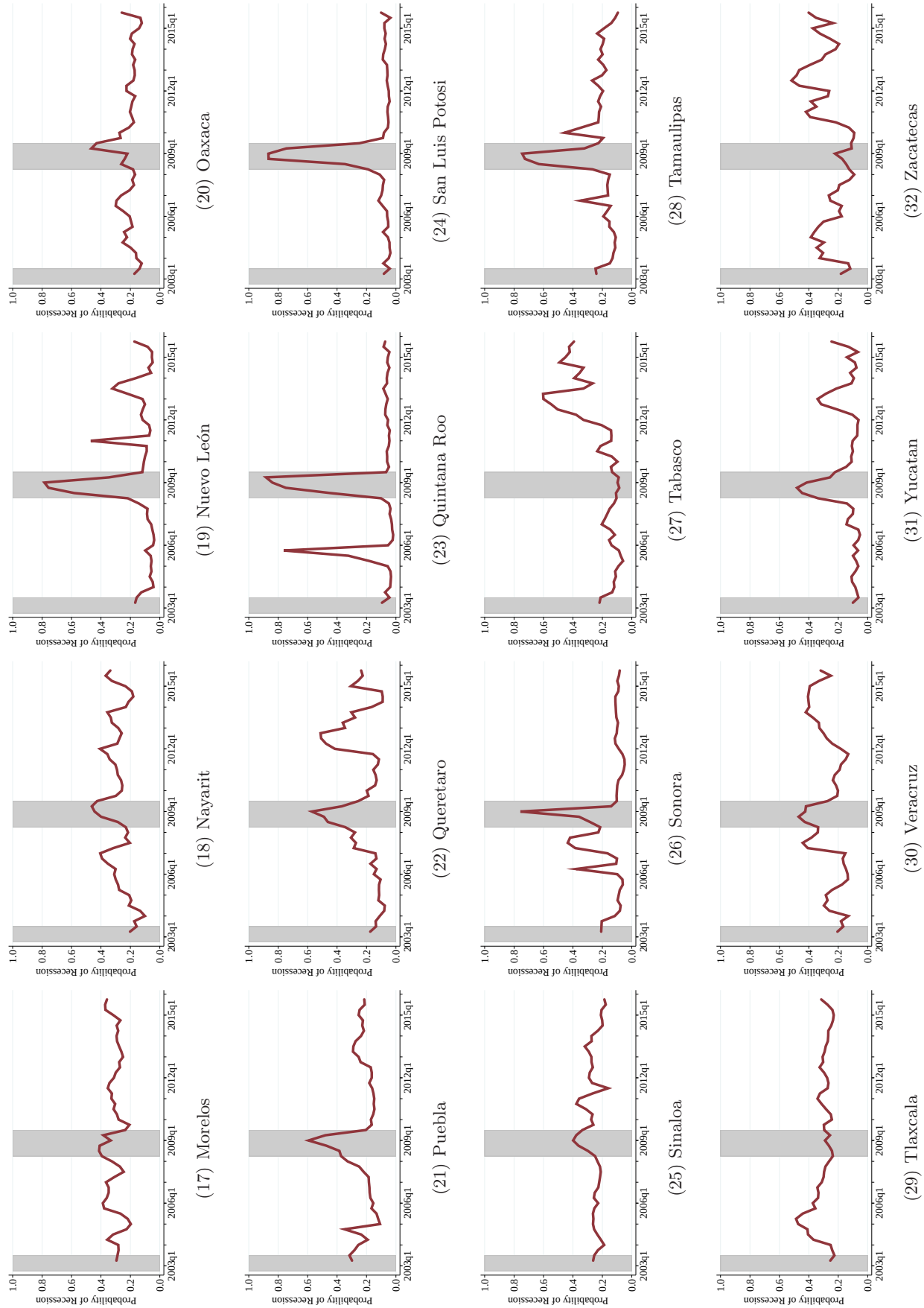


Figure E1: Recession Probabilities (Continued)

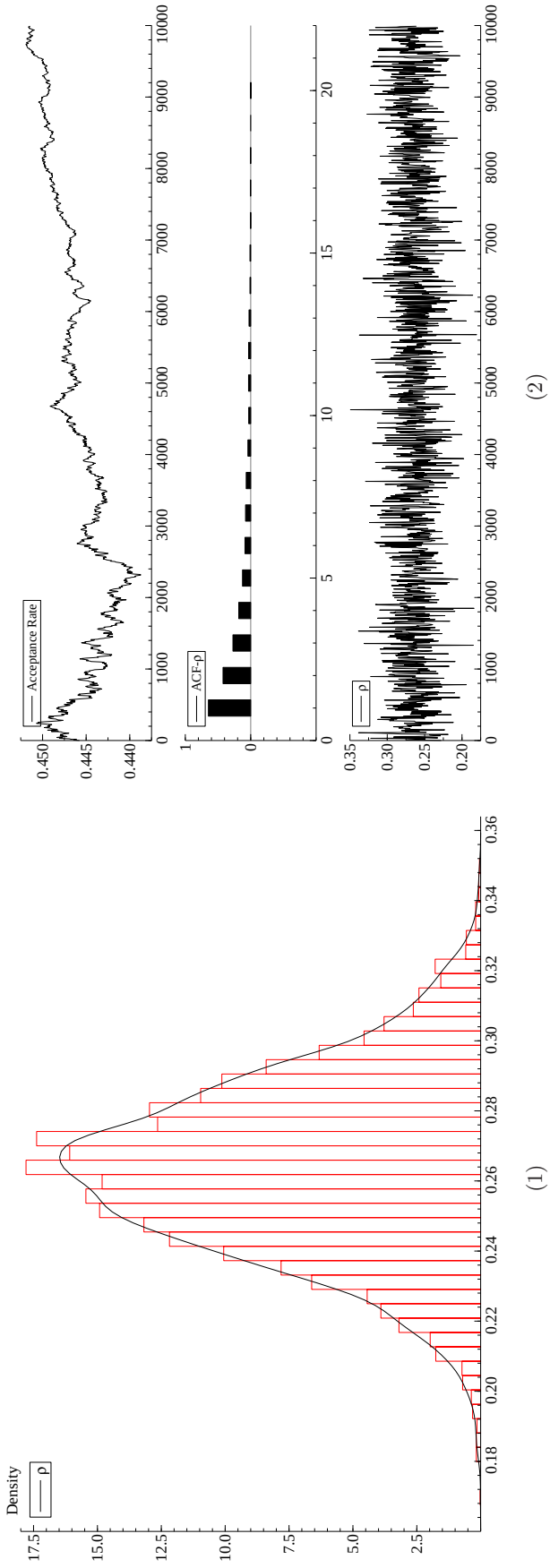


Figure E2: Posterior Distribution of ρ

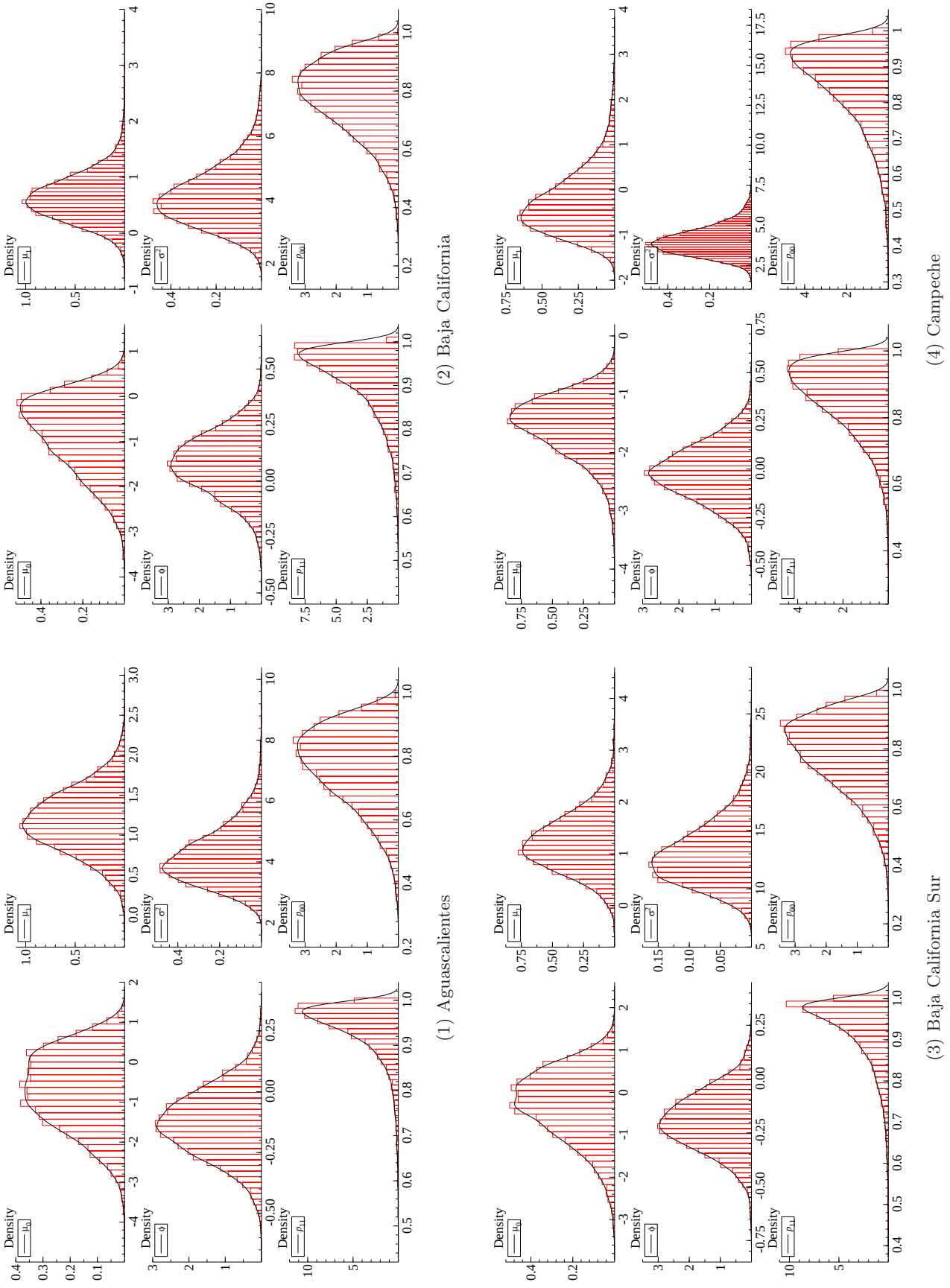
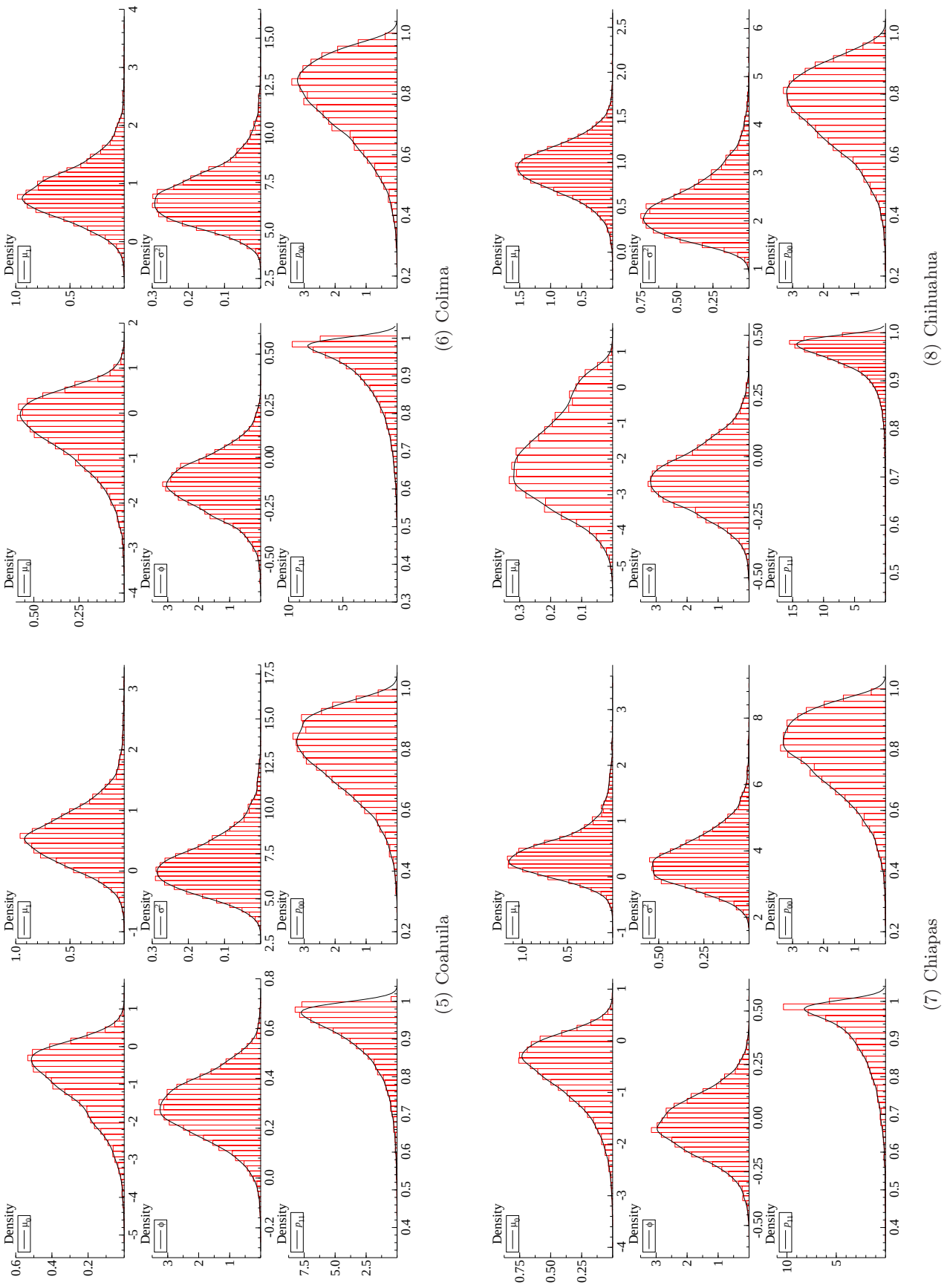


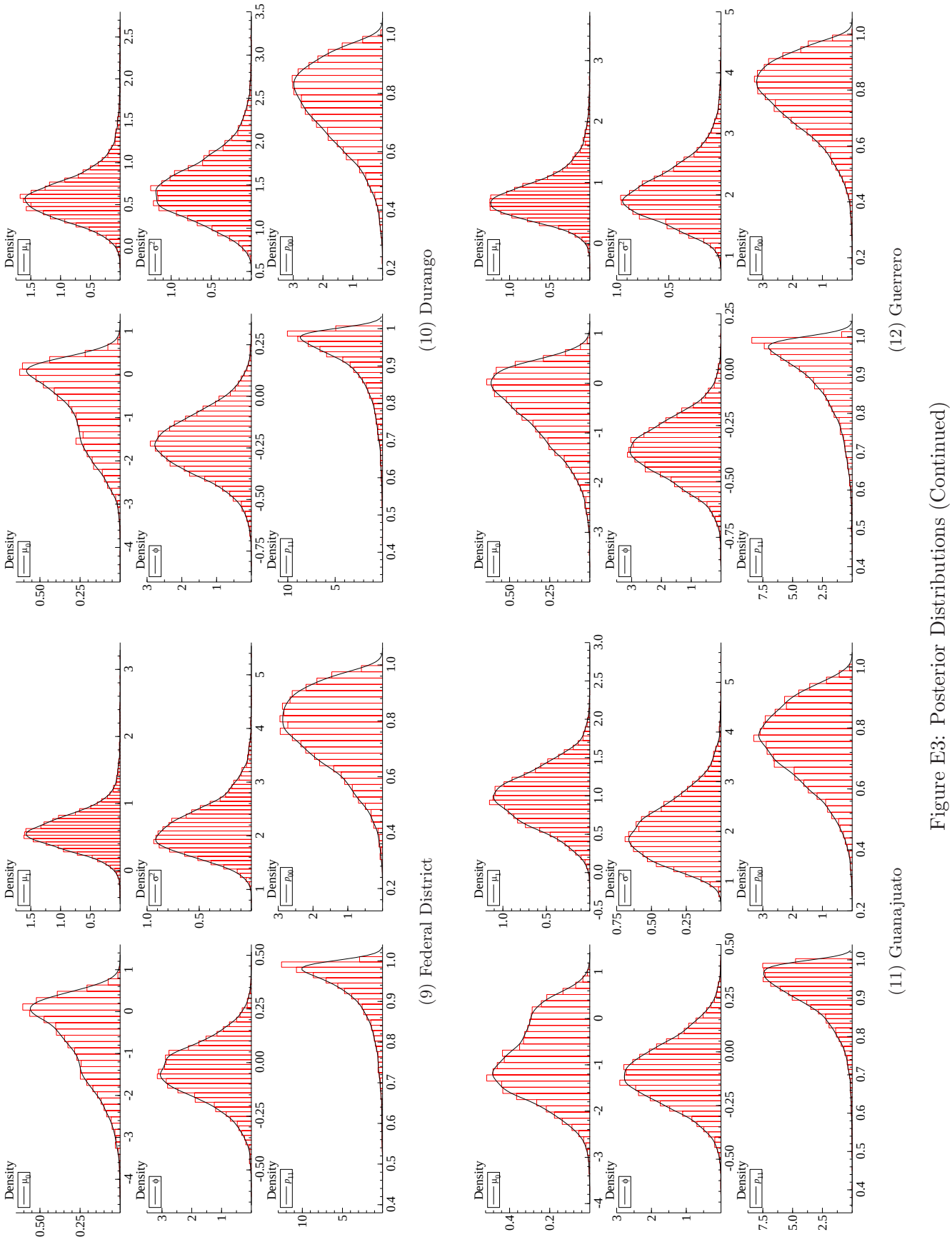
Figure E3: Posterior Distributions



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

Figure E3: Posterior Distributions (Continued)



(9) Federal District (10) Durango (11) Guanajuato (12) Guerrero

Figure E3: Posterior Distributions (Continued)

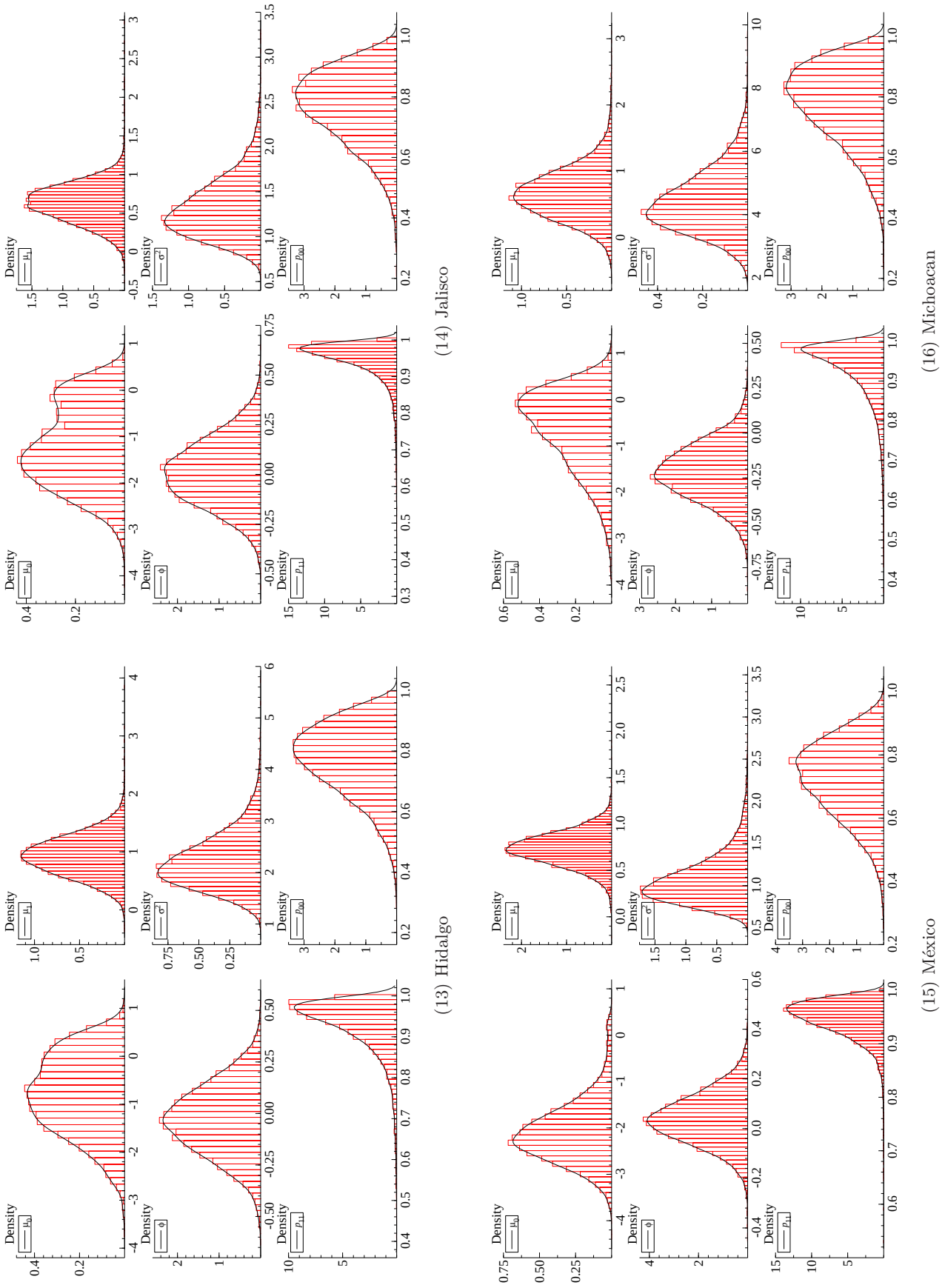
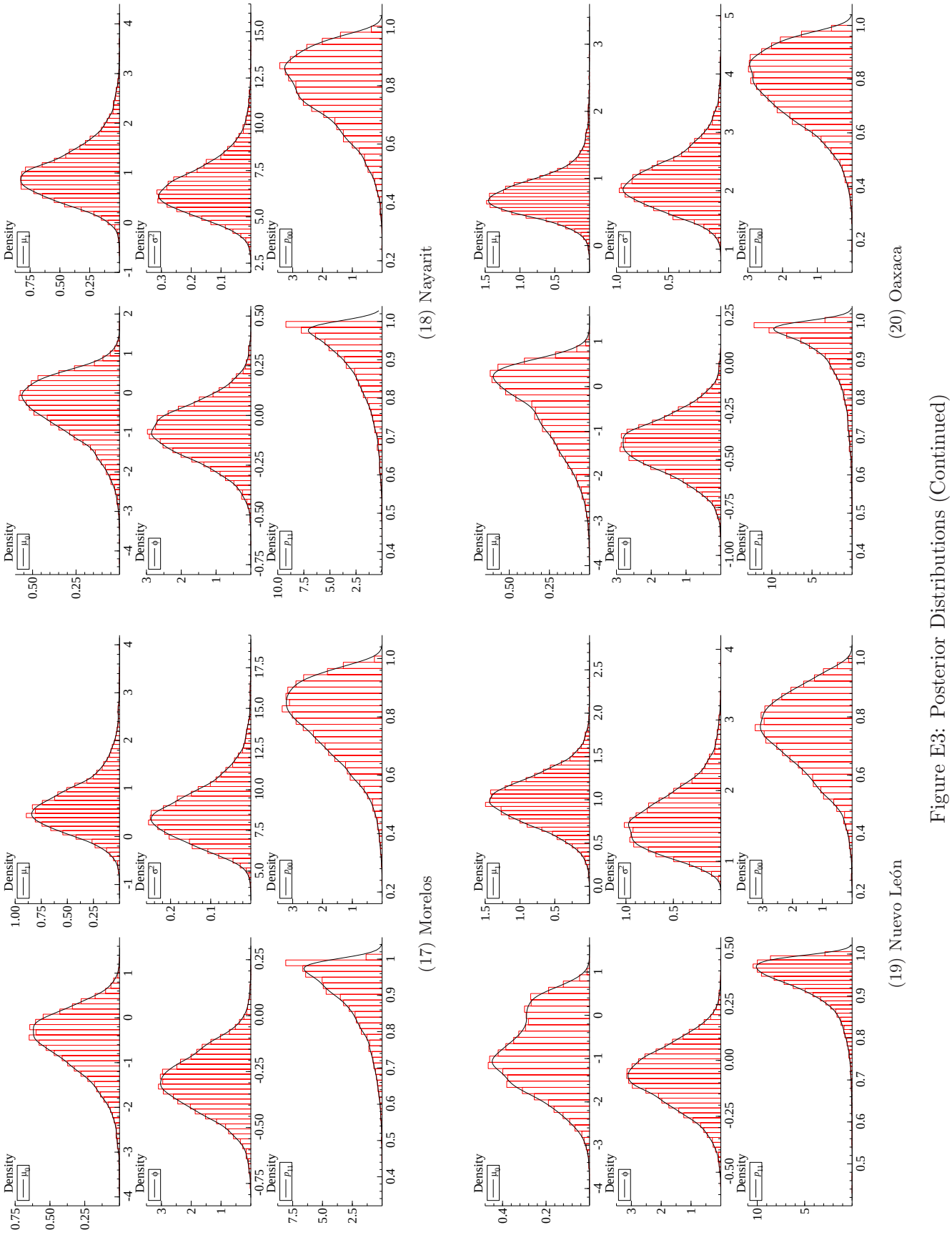


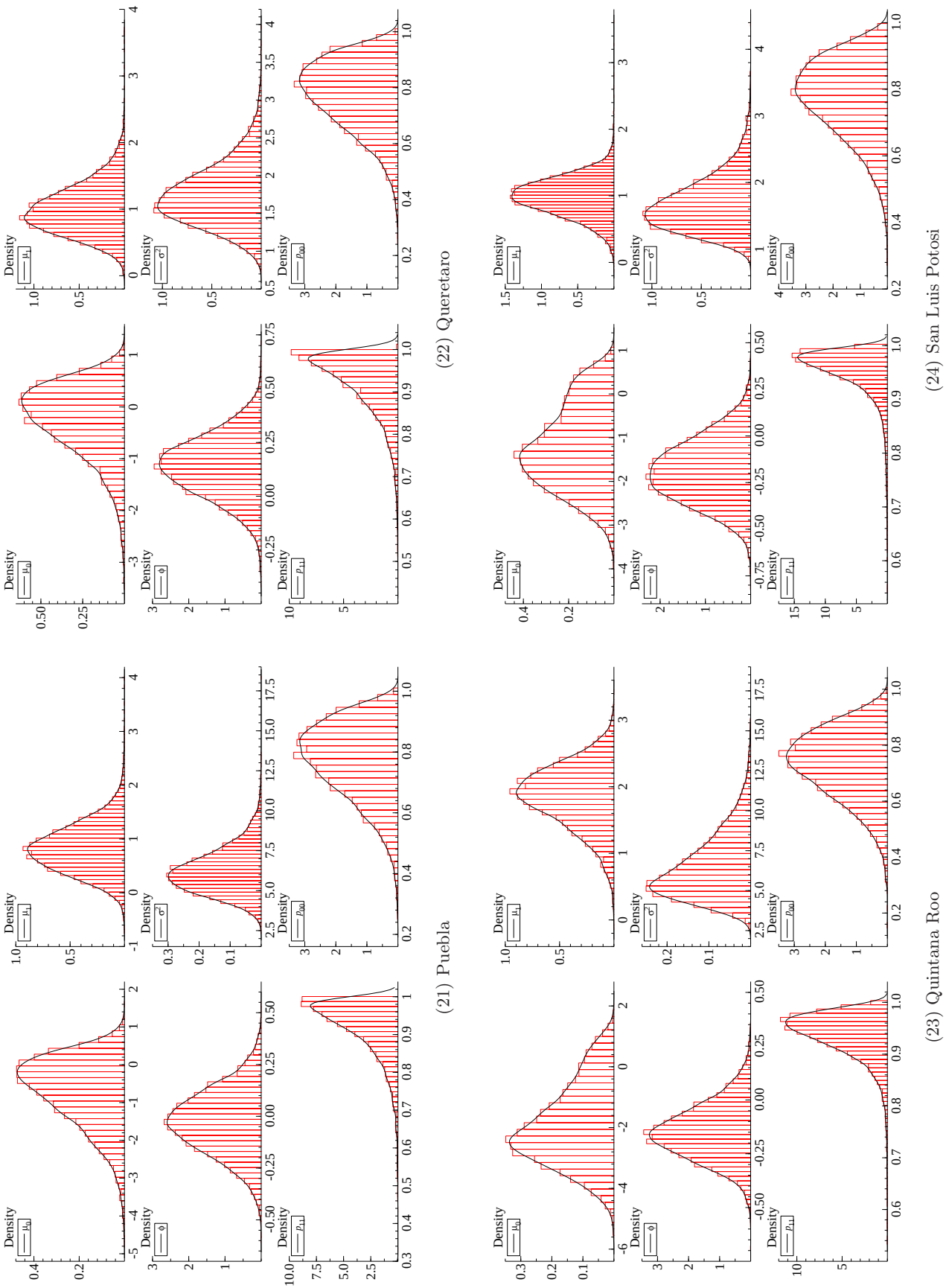
Figure E3: Posterior Distributions (Continued)



(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

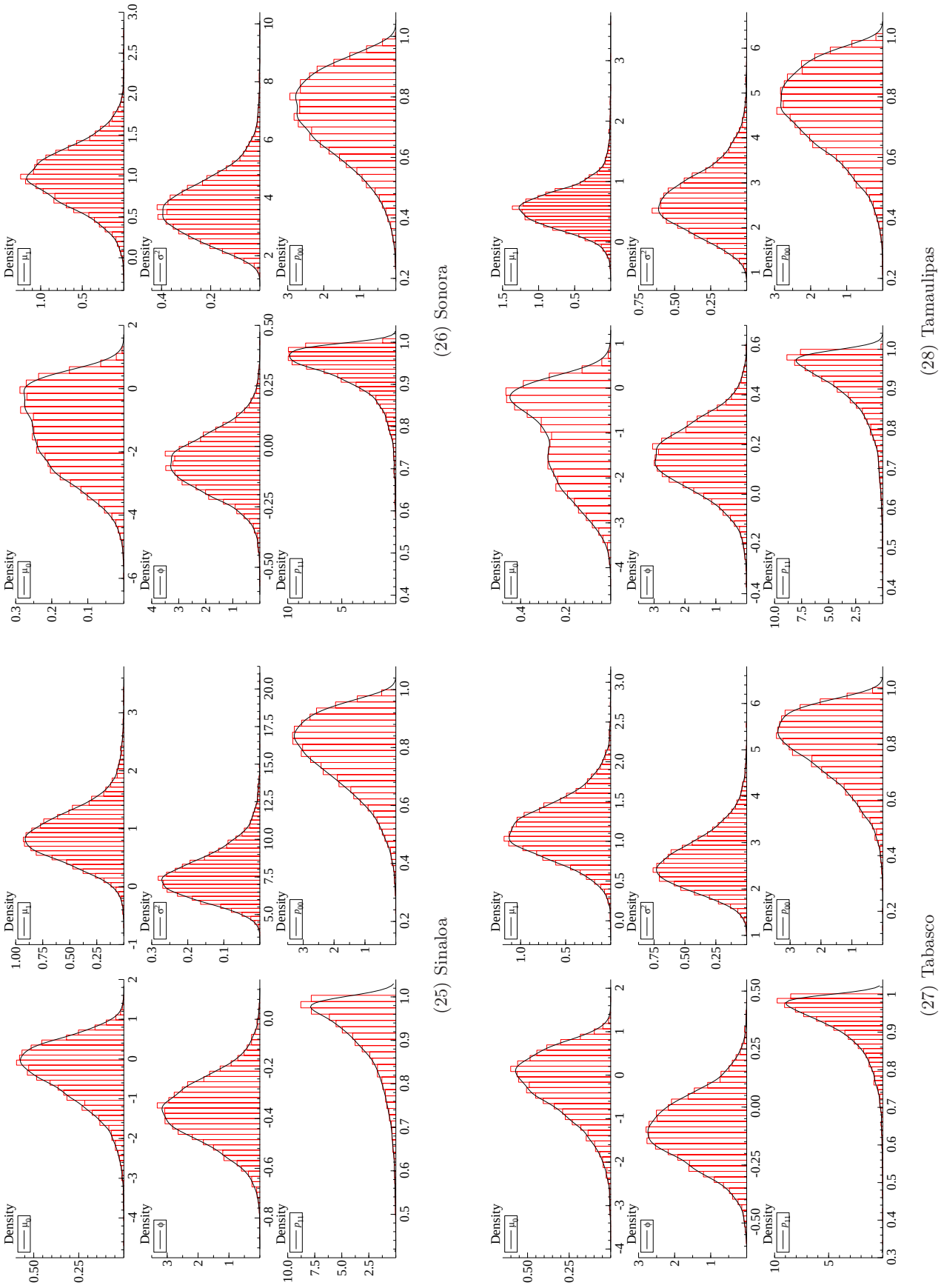
Figure E3: Posterior Distributions (Continued)



(21) Puebla (22) Queretaro

(23) Quintana Roo (24) San Luis Potosi

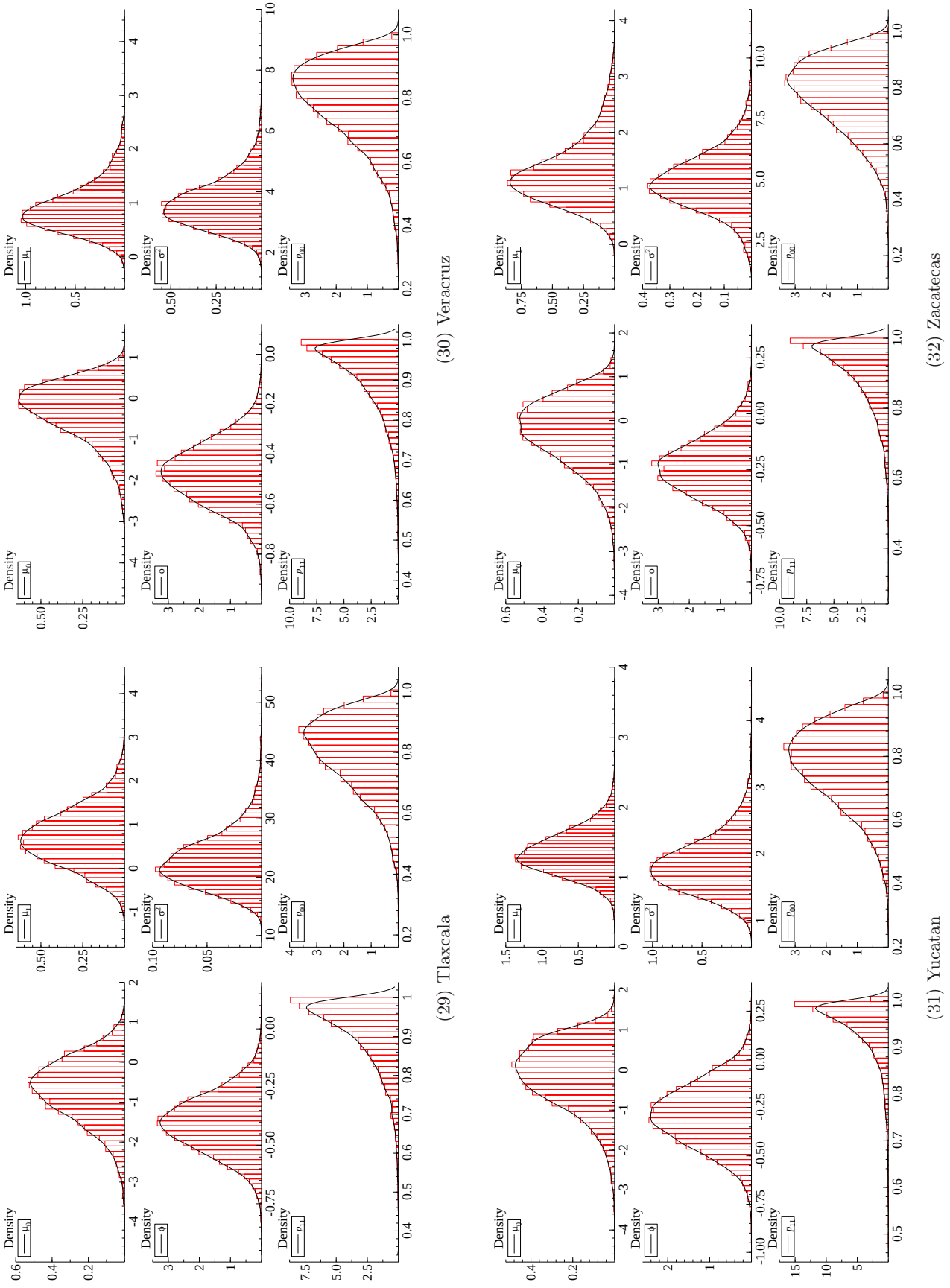
Figure E3: Posterior Distributions (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

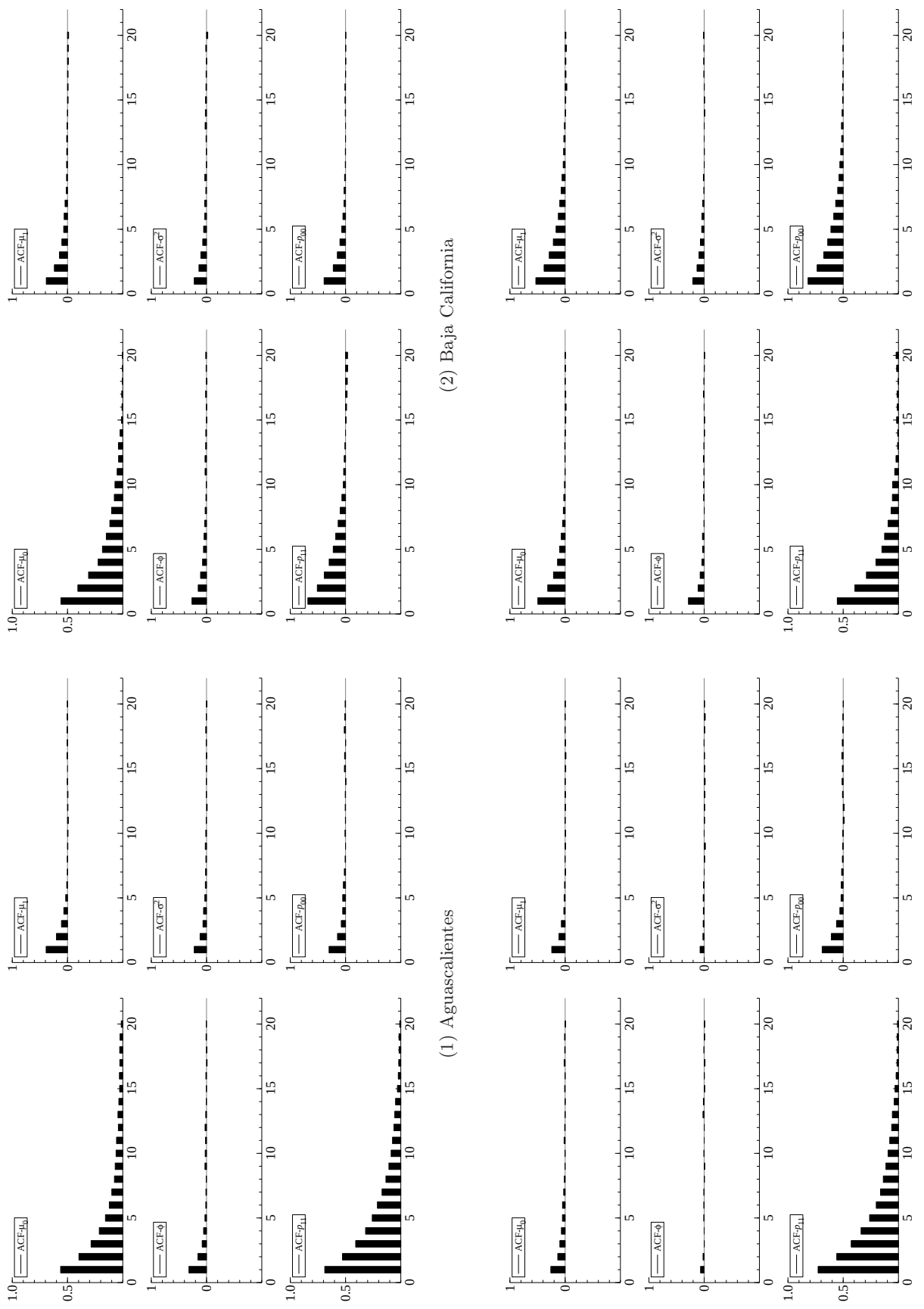
Figure E3: Posterior Distributions (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

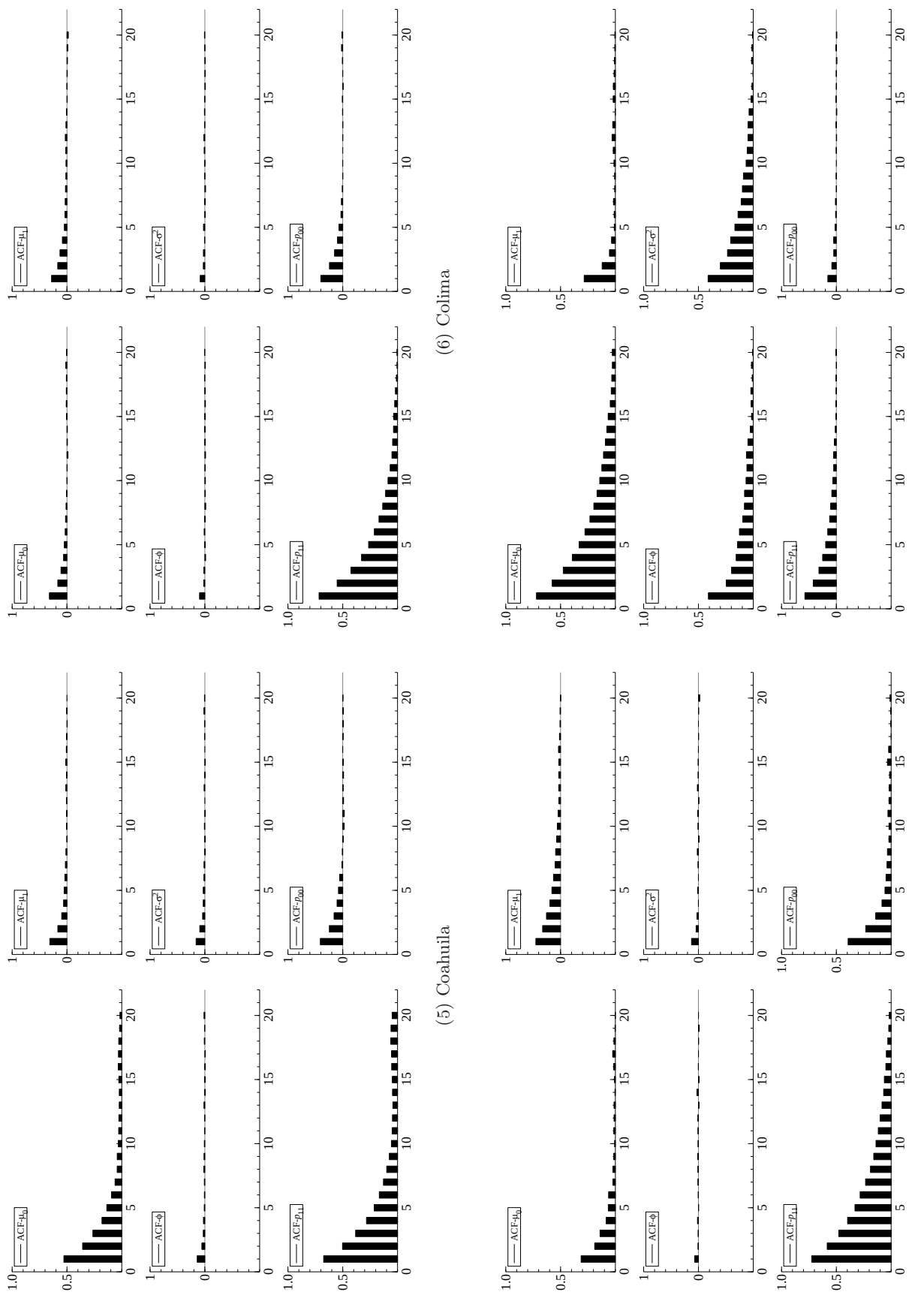
Figure E3: Posterior Distributions (Continued)



(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

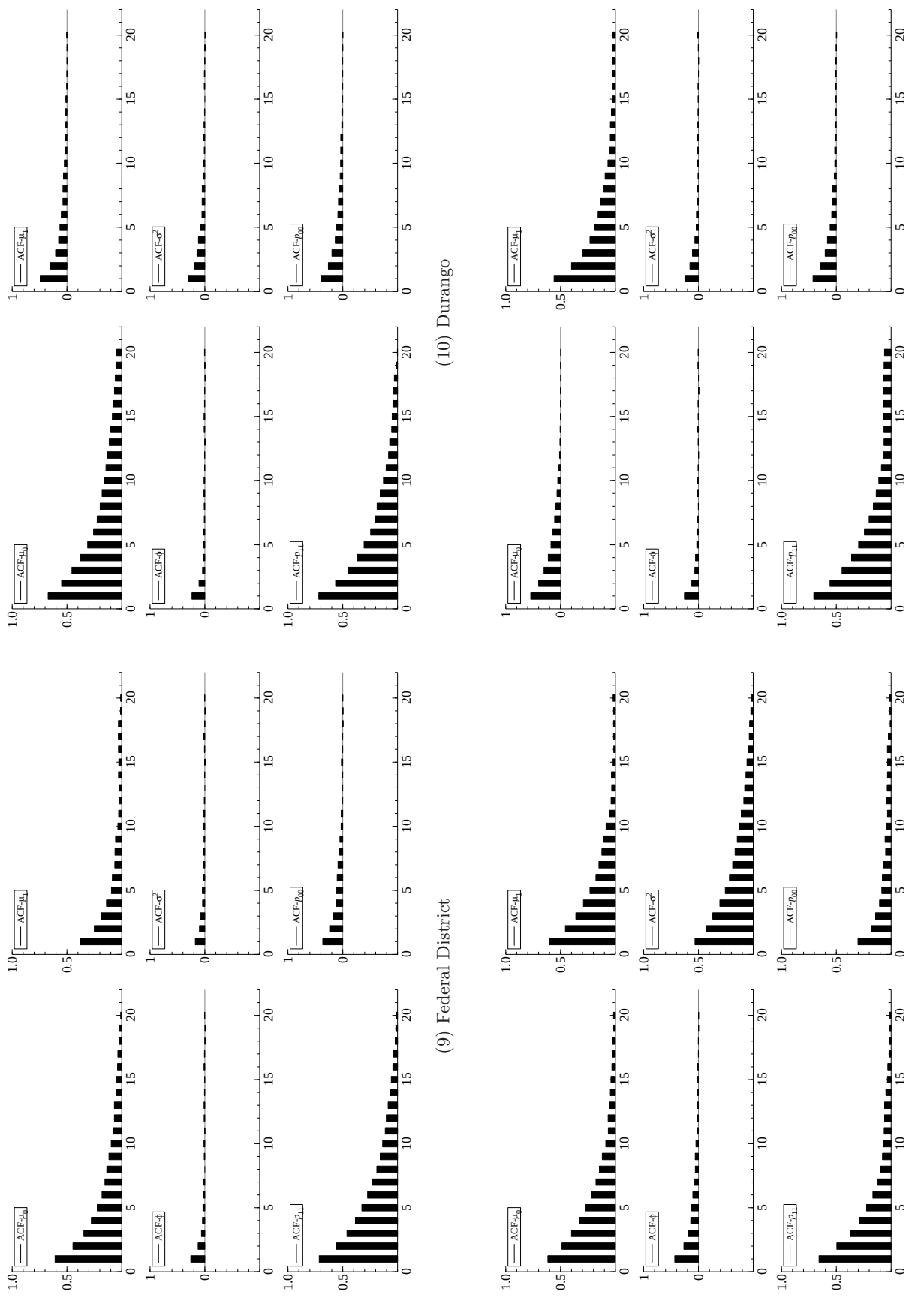
Figure E4: Autocorrelation Function



(5) Coahuila (6) Colima

(7) Chiapas (8) Chihuahua

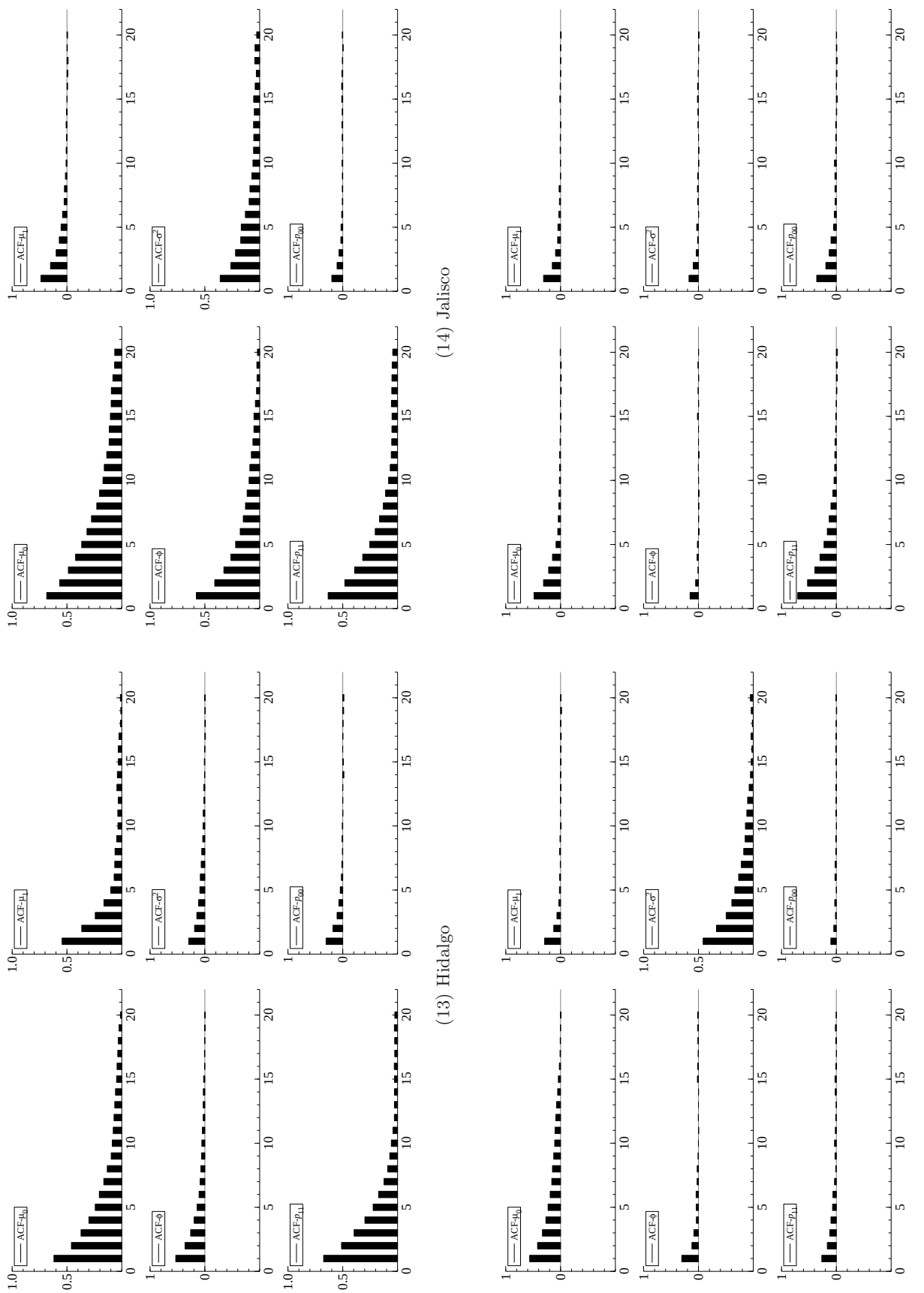
Figure E4: Autocorrelation Function (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

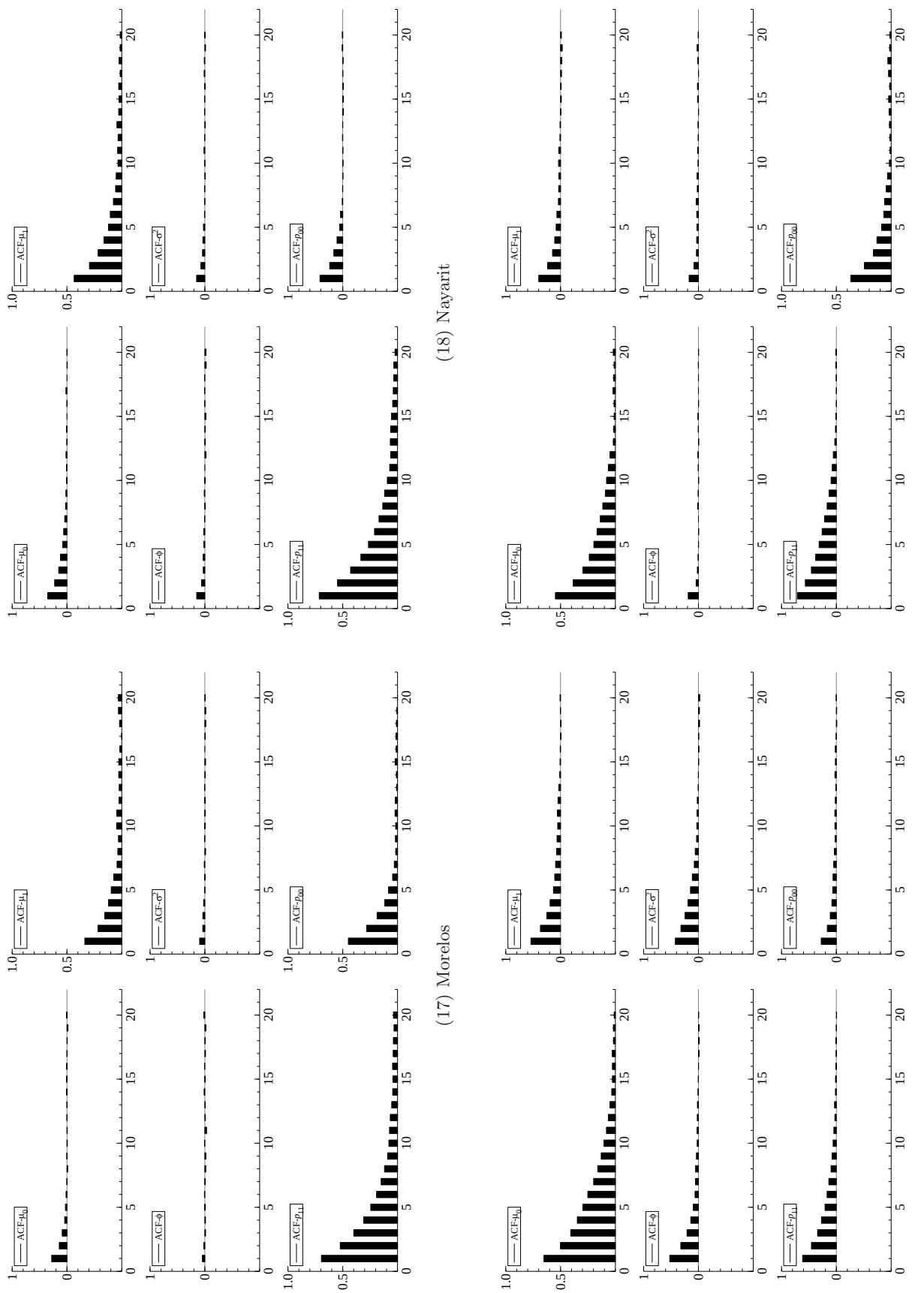
Figure E4: Autocorrelation Function (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

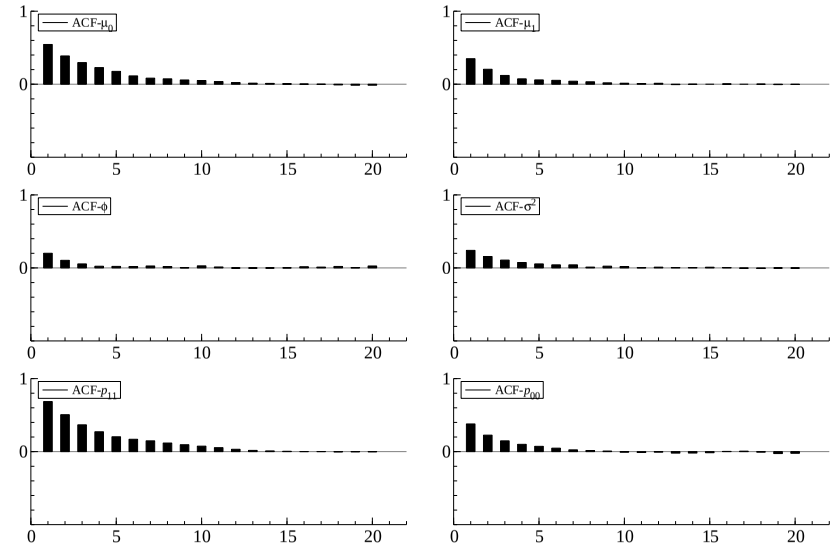
Figure E4: Autocorrelation Function (Continued)



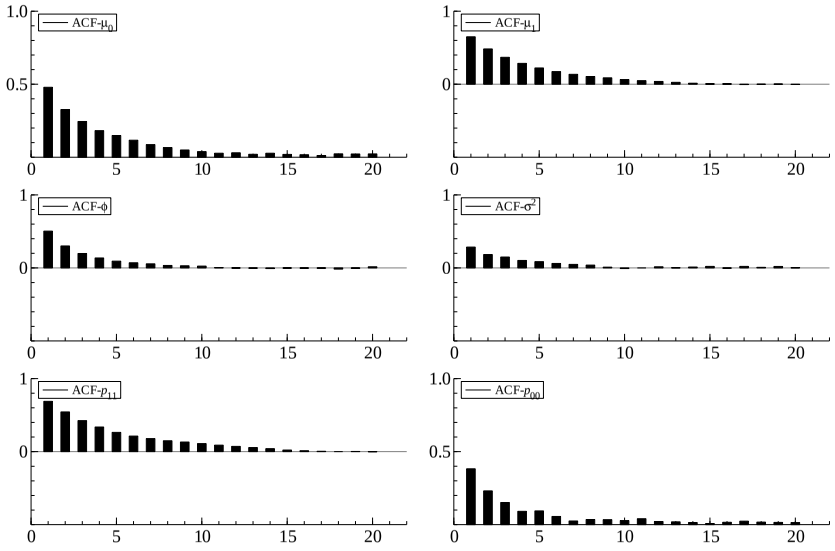
(17) Morelos (18) Nayarit

(19) Nuevo León (20) Oaxaca

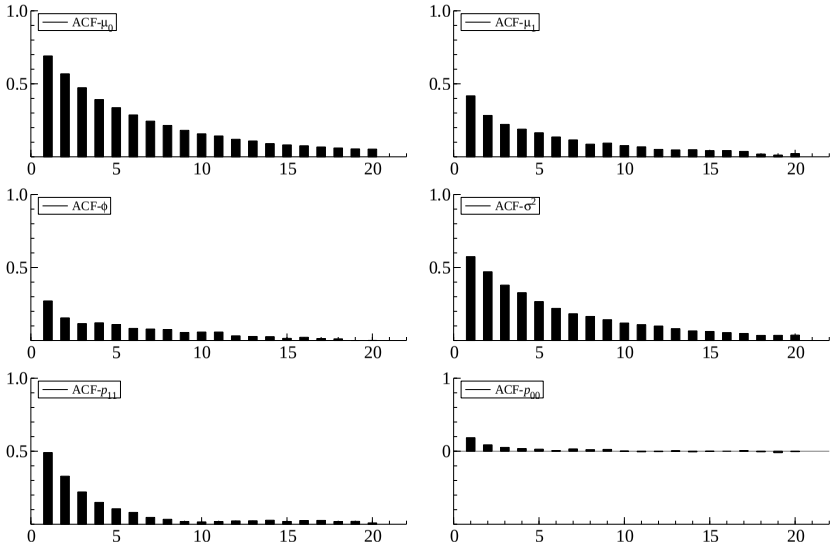
Figure E4: Autocorrelation Function (Continued)



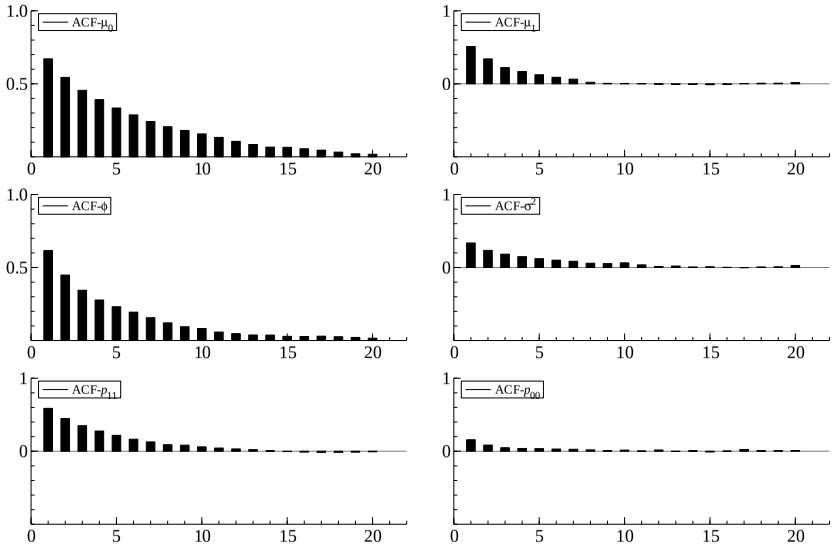
(21) Puebla



(22) Queretaro

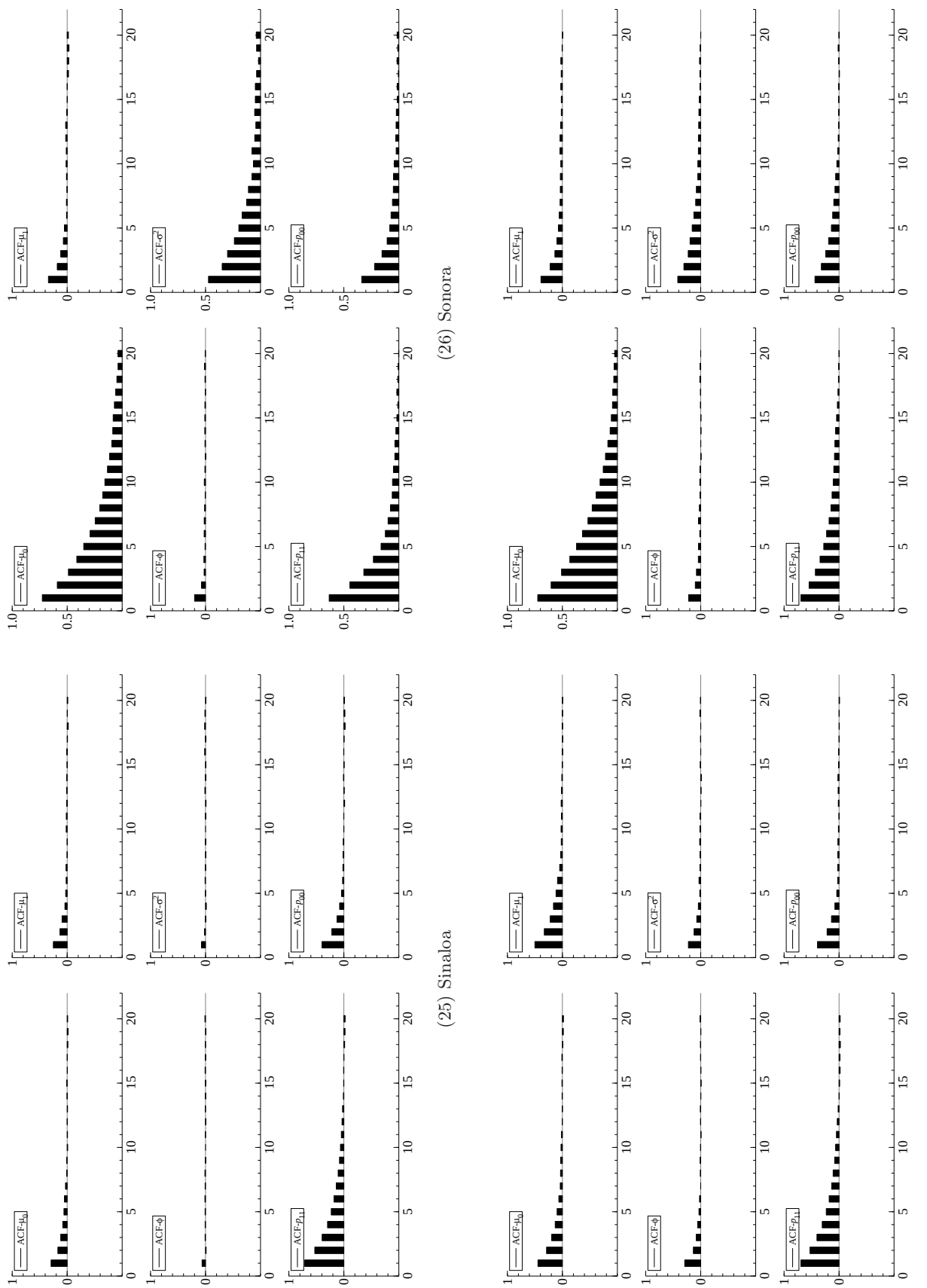


(23) Quintana Roo



(24) San Luis Potosi

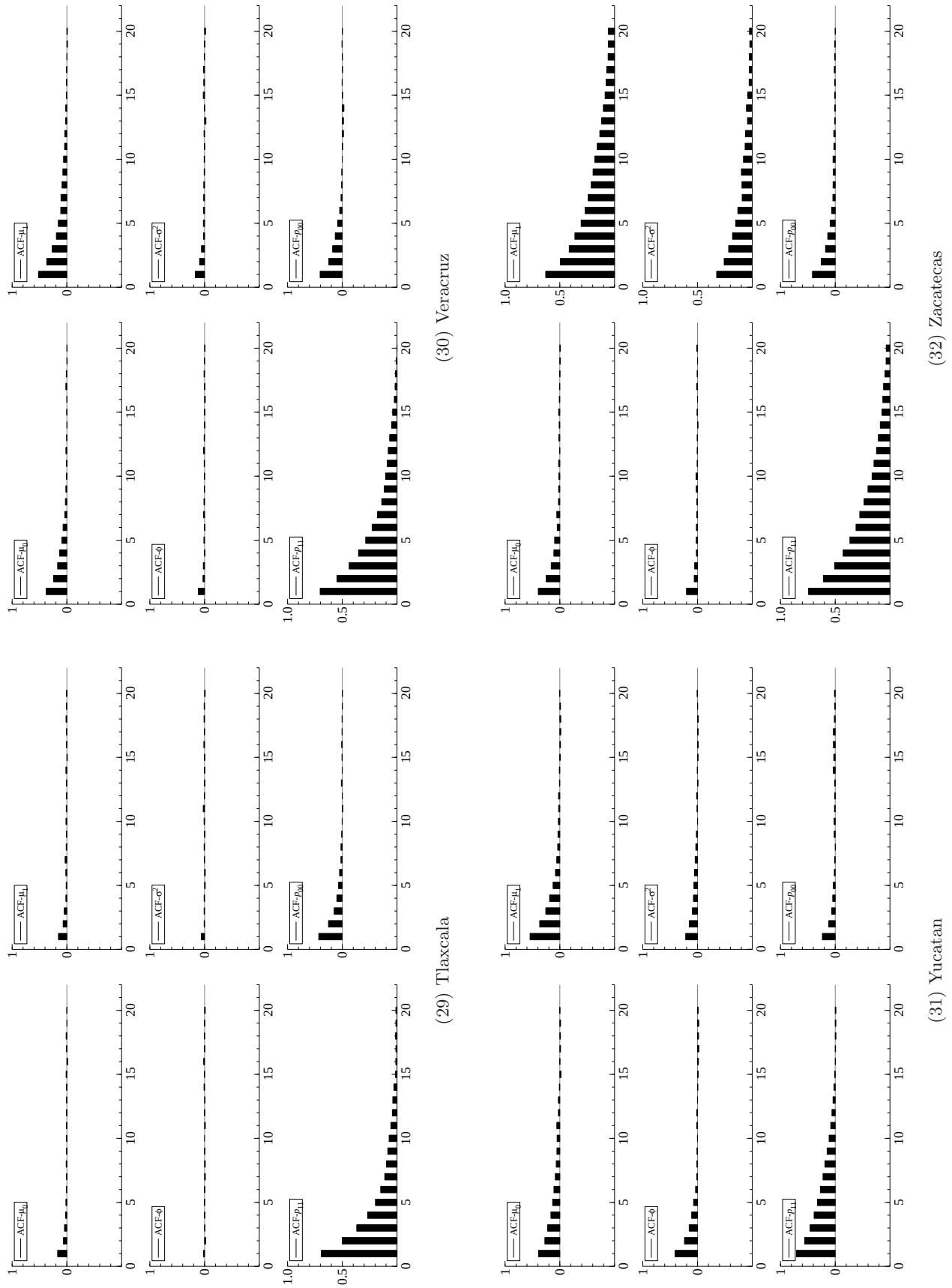
Figure E4: Autocorrelation Function (Continued)



(25) Sinaloa (26) Sonora

(27) Tabasco (28) Tamaulipas

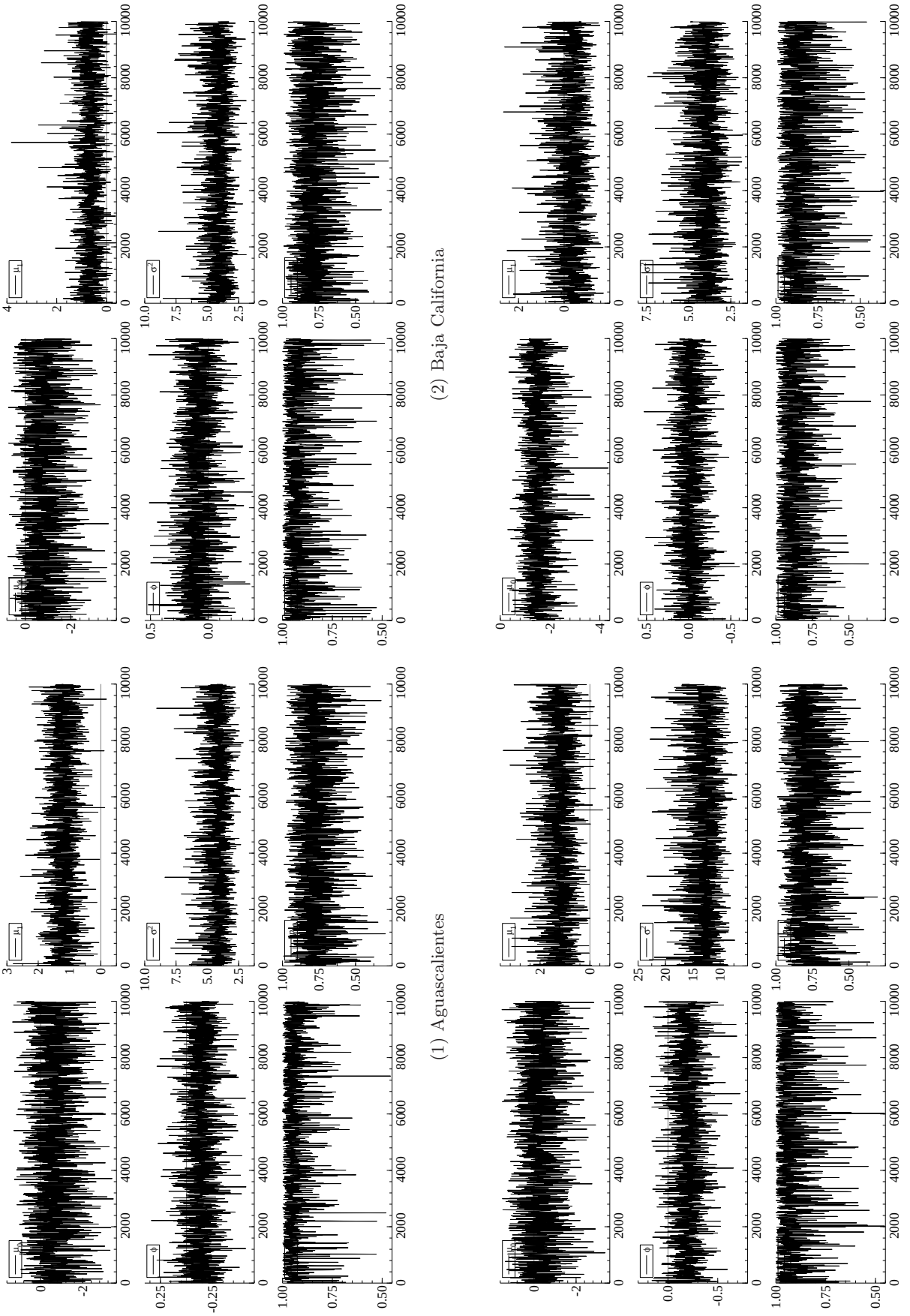
Figure E4: Autocorrelation Function (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

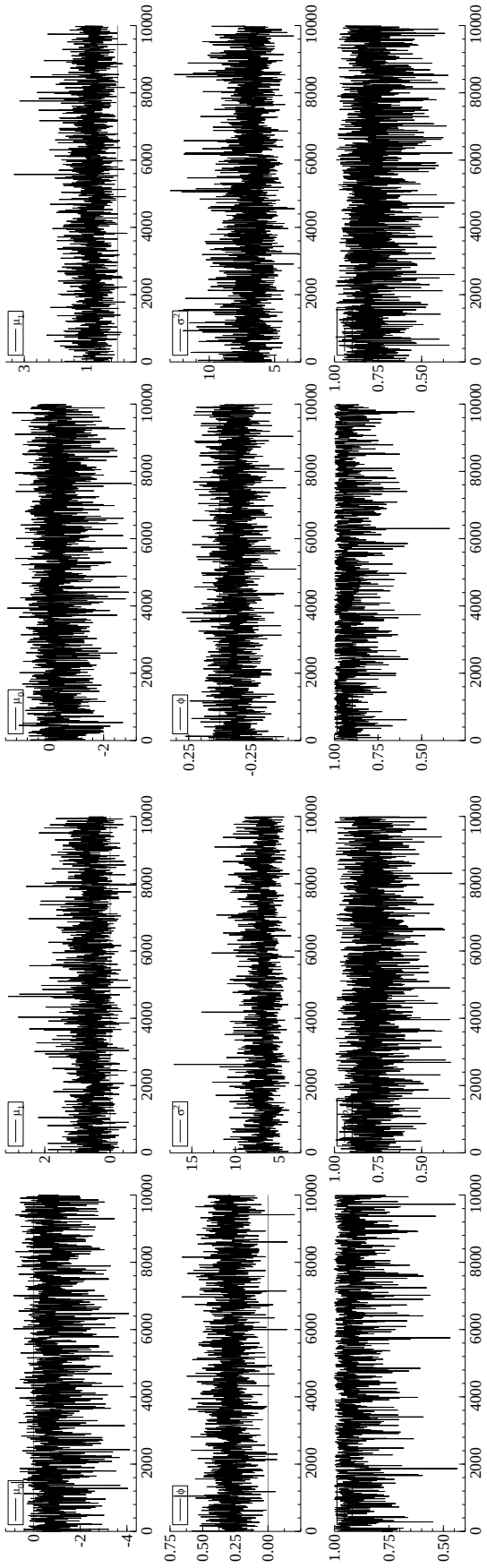
Figure E4: Autocorrelation Function (Continued)



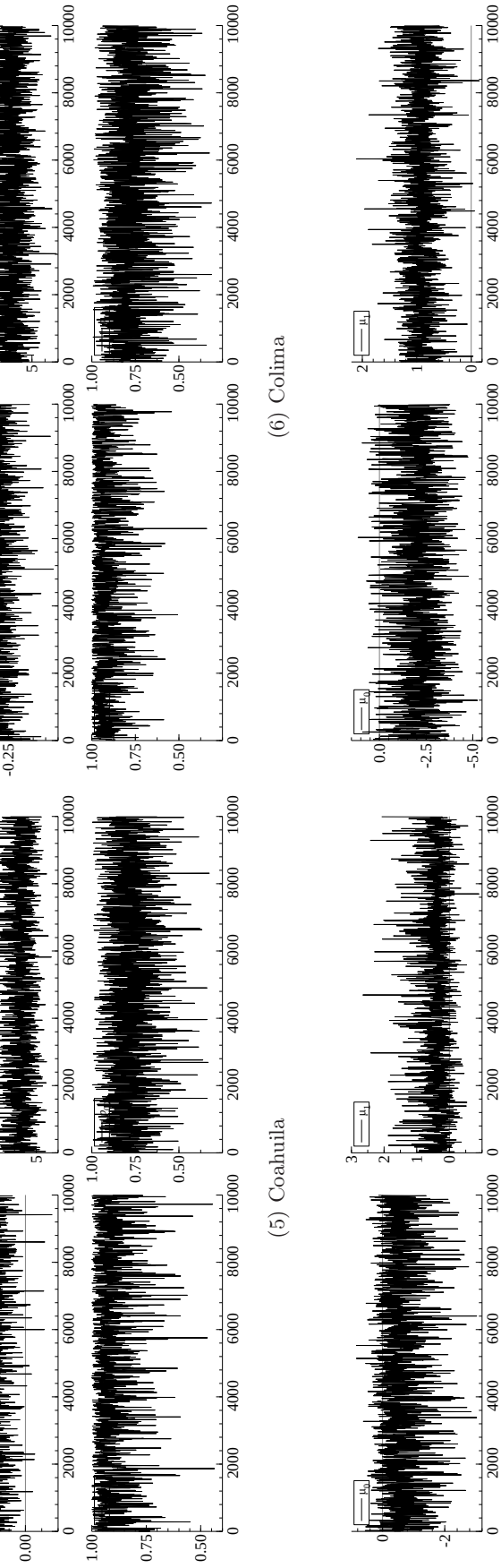
(1) Aguascalientes (2) Baja California

(3) Baja California Sur (4) Campeche

Figure E5: Trace Plots



(5) Coahuila

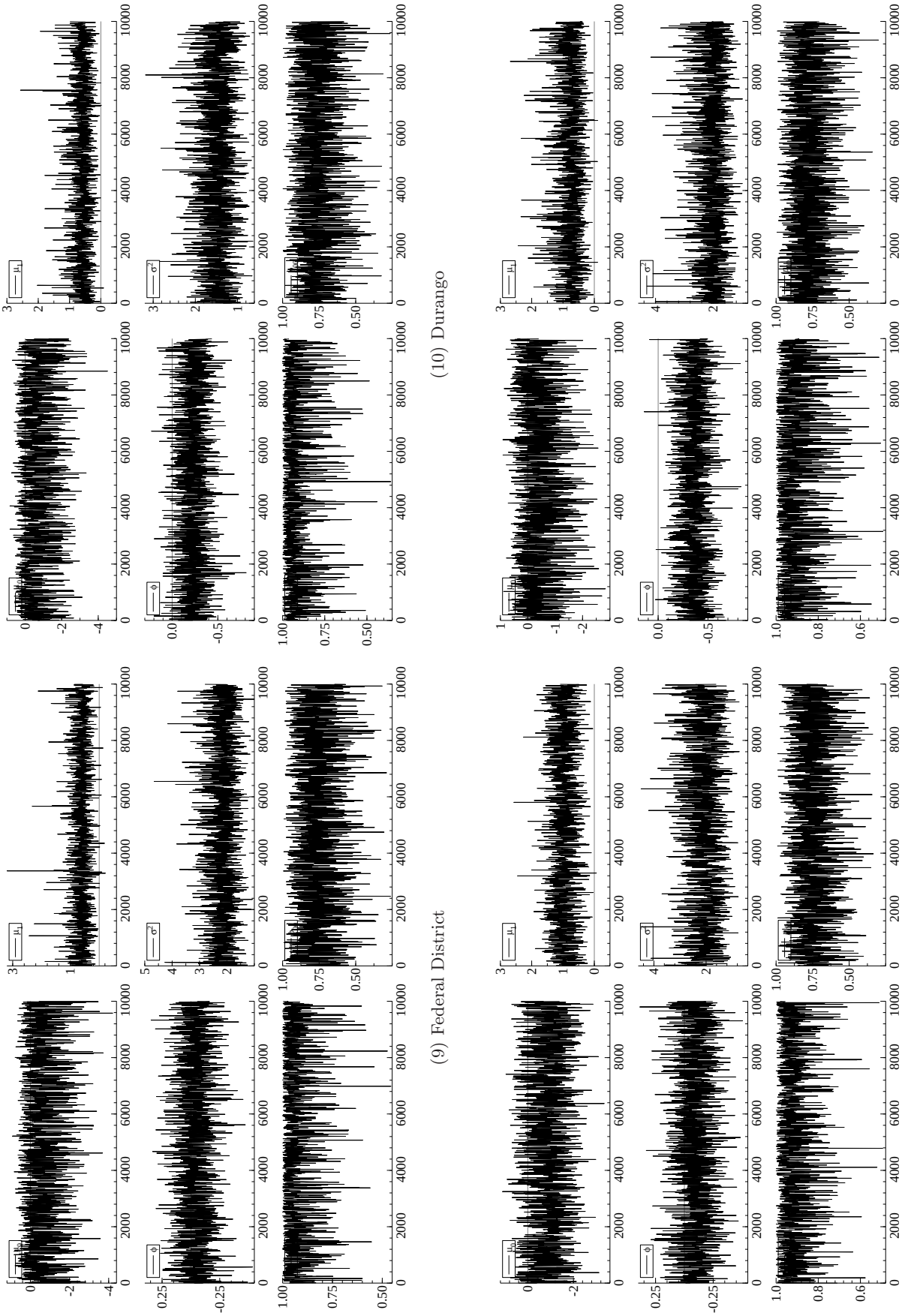


(6) Colima

(7) Chiapas

(8) Chihuahua

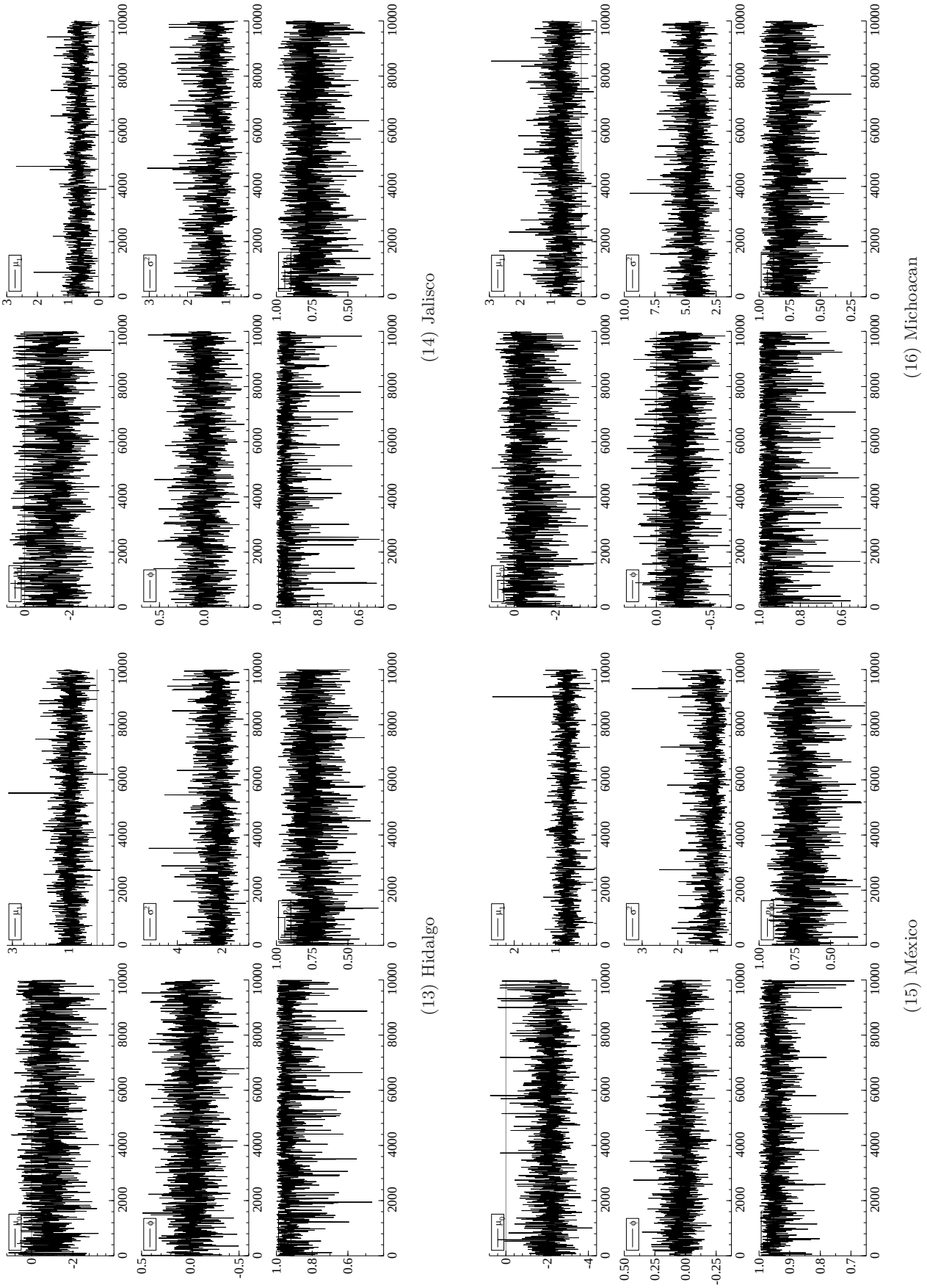
Figure E5: Trace Plots (Continued)



(9) Federal District (10) Durango

(11) Guanajuato (12) Guerrero

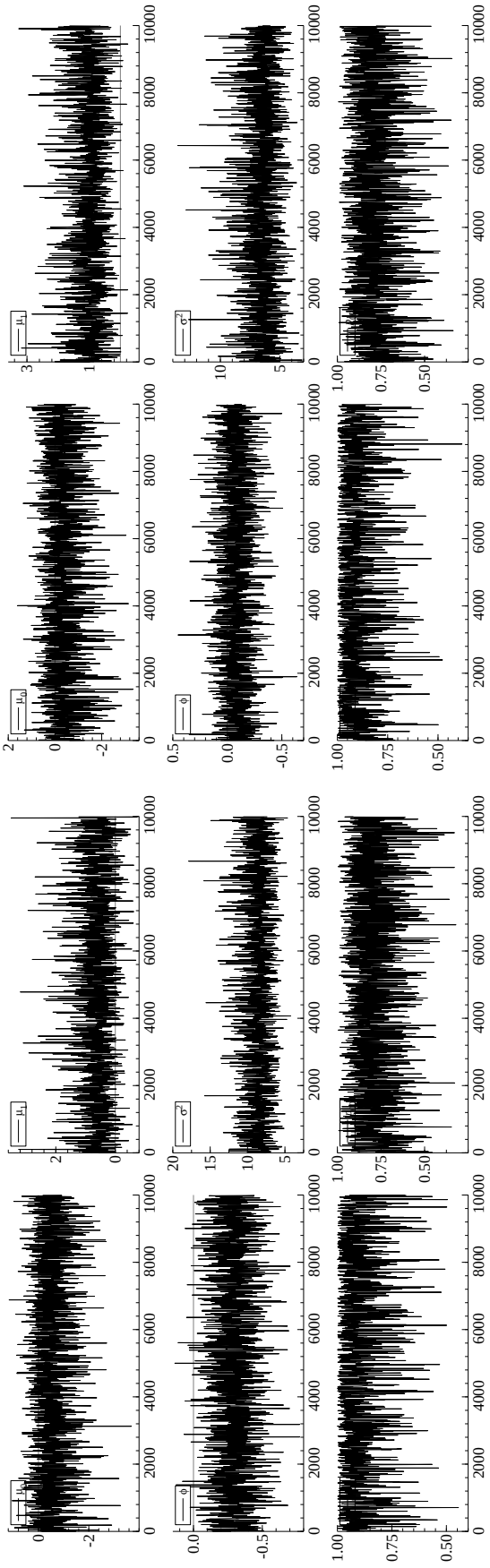
Figure E5: Trace Plots (Continued)



(13) Hidalgo (14) Jalisco

(15) México (16) Michoacan

Figure E5: Trace Plots (Continued)



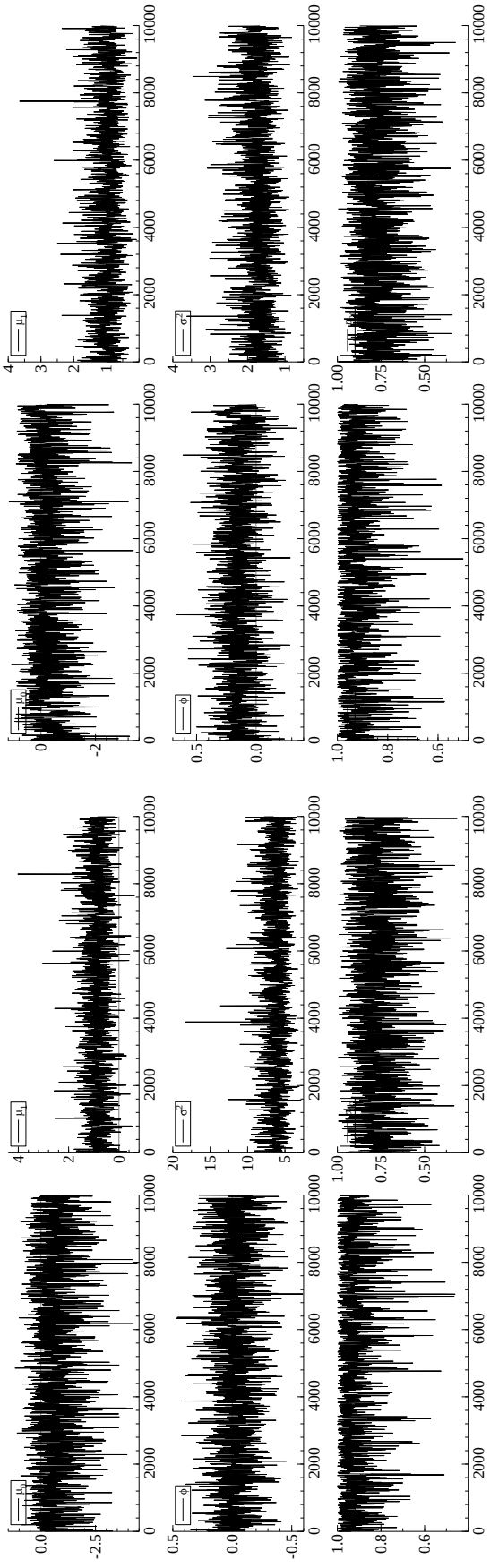
(17) Morelos

(18) Nayarit

(19) Nuevo León

(20) Oaxaca

Figure E5: Trace Plots (Continued)



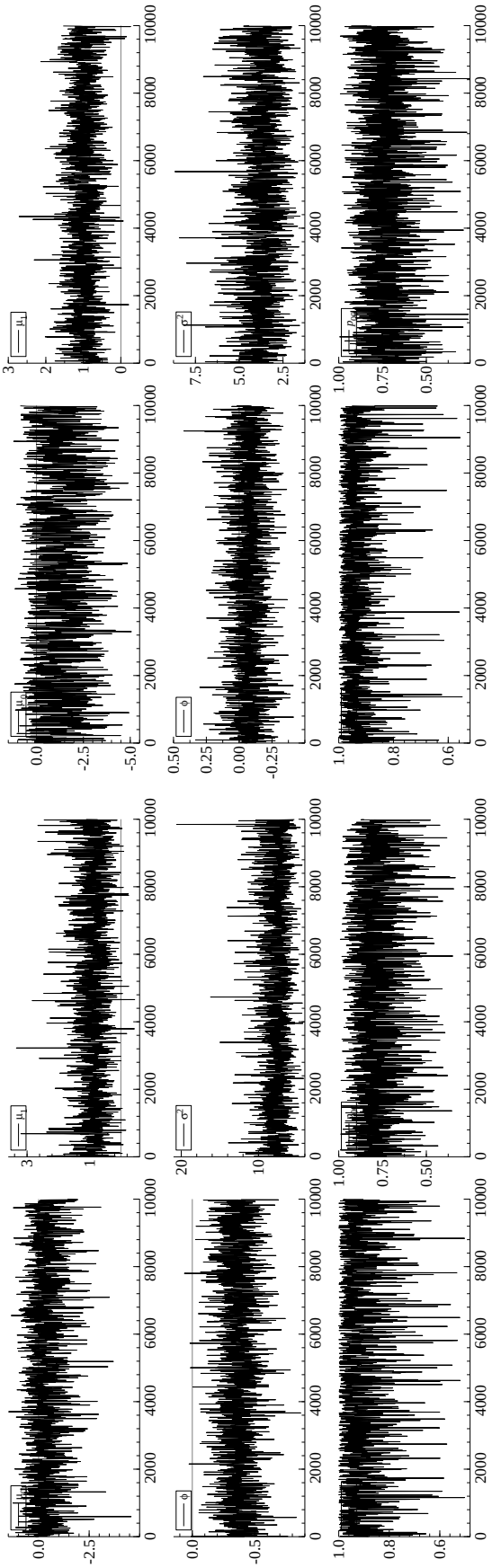
(21) Puebla

(22) Queretaro

(23) Quintana Roo

(24) San Luis Potosi

Figure E5: Trace Plots (Continued)



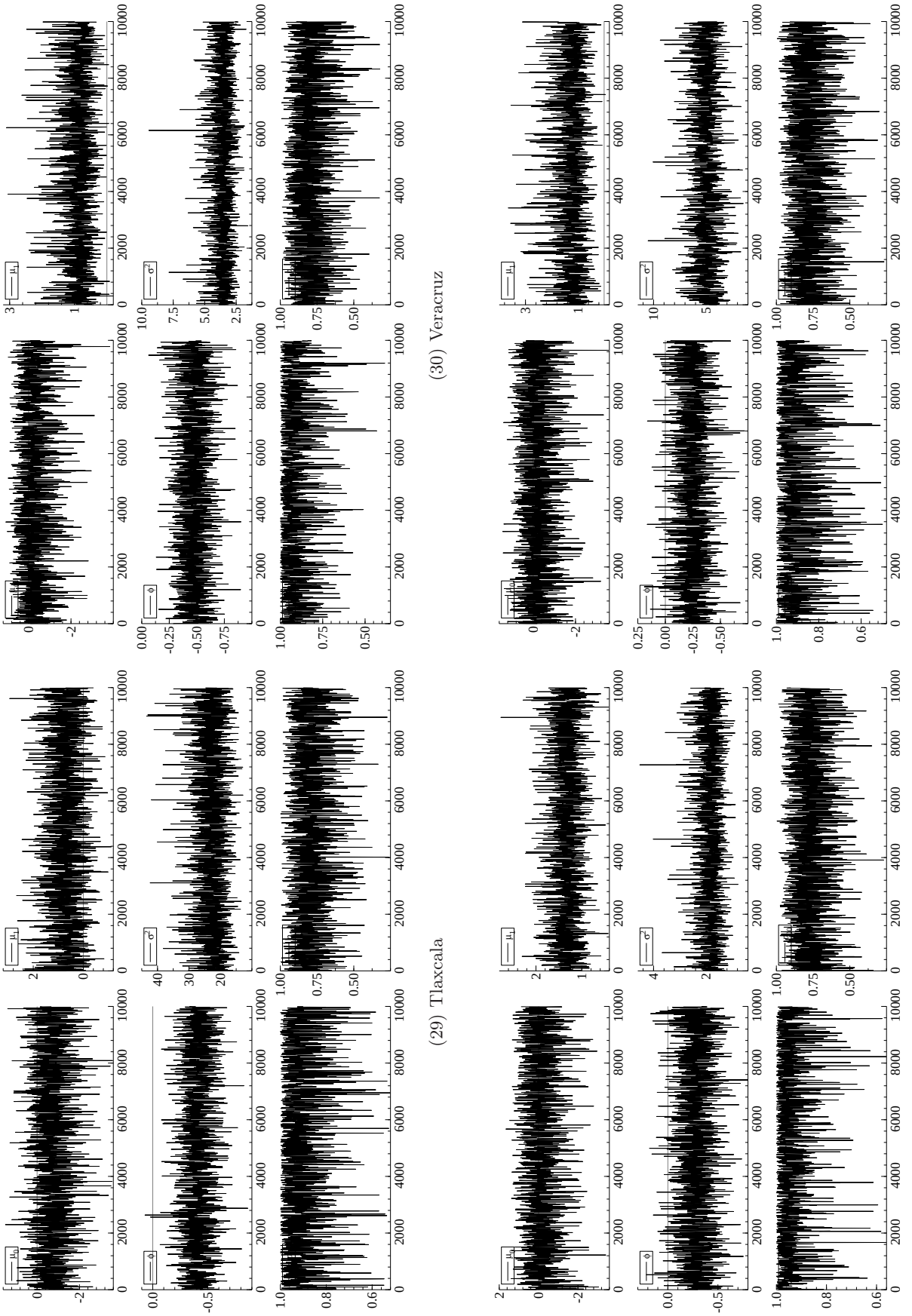
(25) Sinaloa

(26) Sonora

(27) Tabasco

(28) Tamaulipas

Figure E5: Trace Plots (Continued)



(29) Tlaxcala (30) Veracruz

(31) Yucatan (32) Zacatecas

Figure E5: Trace Plots (Continued)

Online Appendix F. Simulation Results of Spatial Spillover Effects

Figure F1

Figure F1 visualizes the spatial spillover effects of a transition from expansion to recession for all states, which are calculated based on equations (21) and (22).

Figure F2

Figure F2 visualizes the impulse responses of the spatial spillover effects of a transition from expansion to recession, which are calculated based on equation (21).

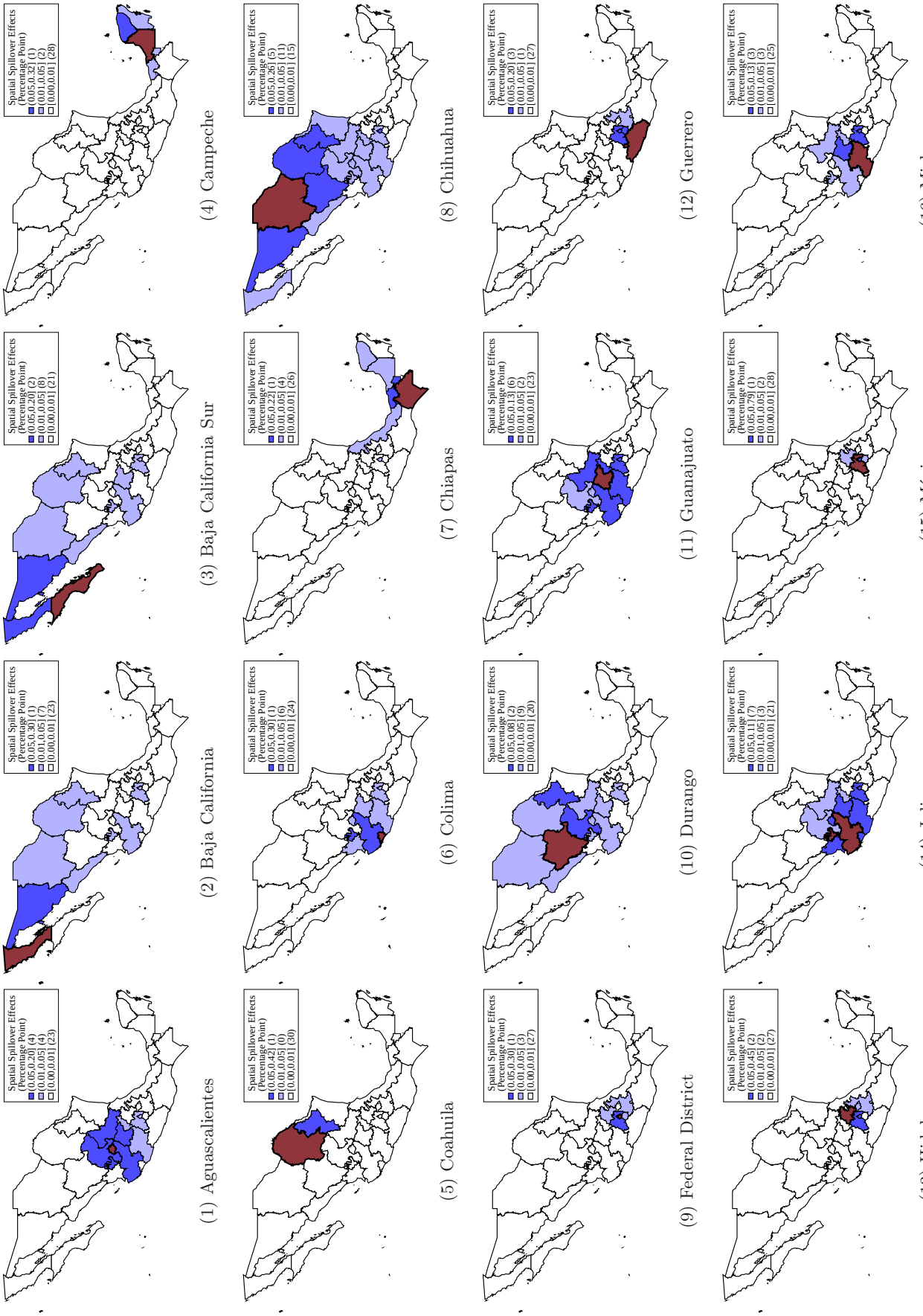


Figure F1: Numerical Simulation of Spatial Spillover Effects

Notes: The origin state of regime switch ($\mu_0 \leftarrow \mu_1$) is red-colored. Author's calculation based on equations (21) and (22). The values indicate the negative spatial spillover impact of a switch to a recessionary regime. The values indicate the negative spatial spillover impact of a switch to a recessionary regime.

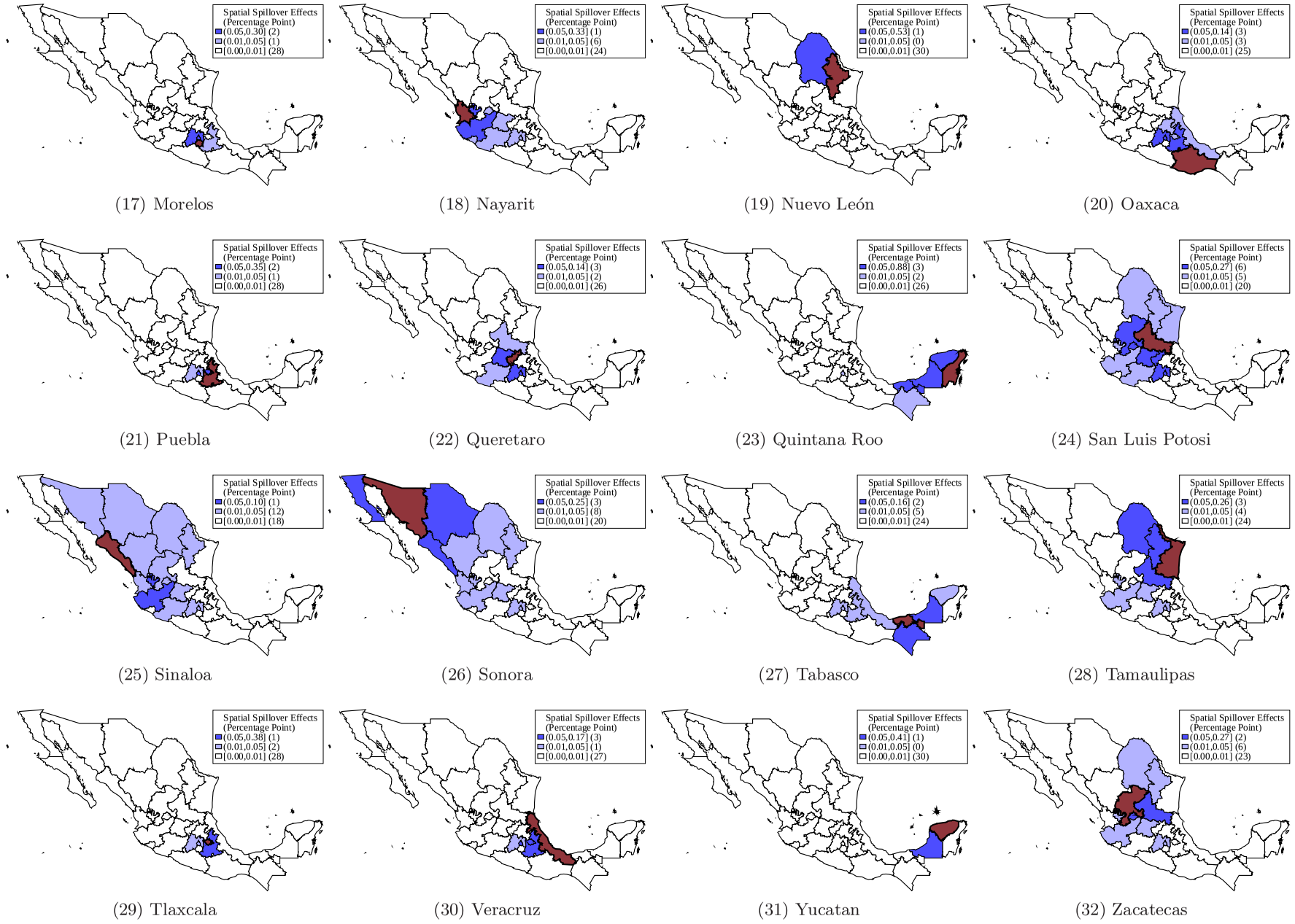
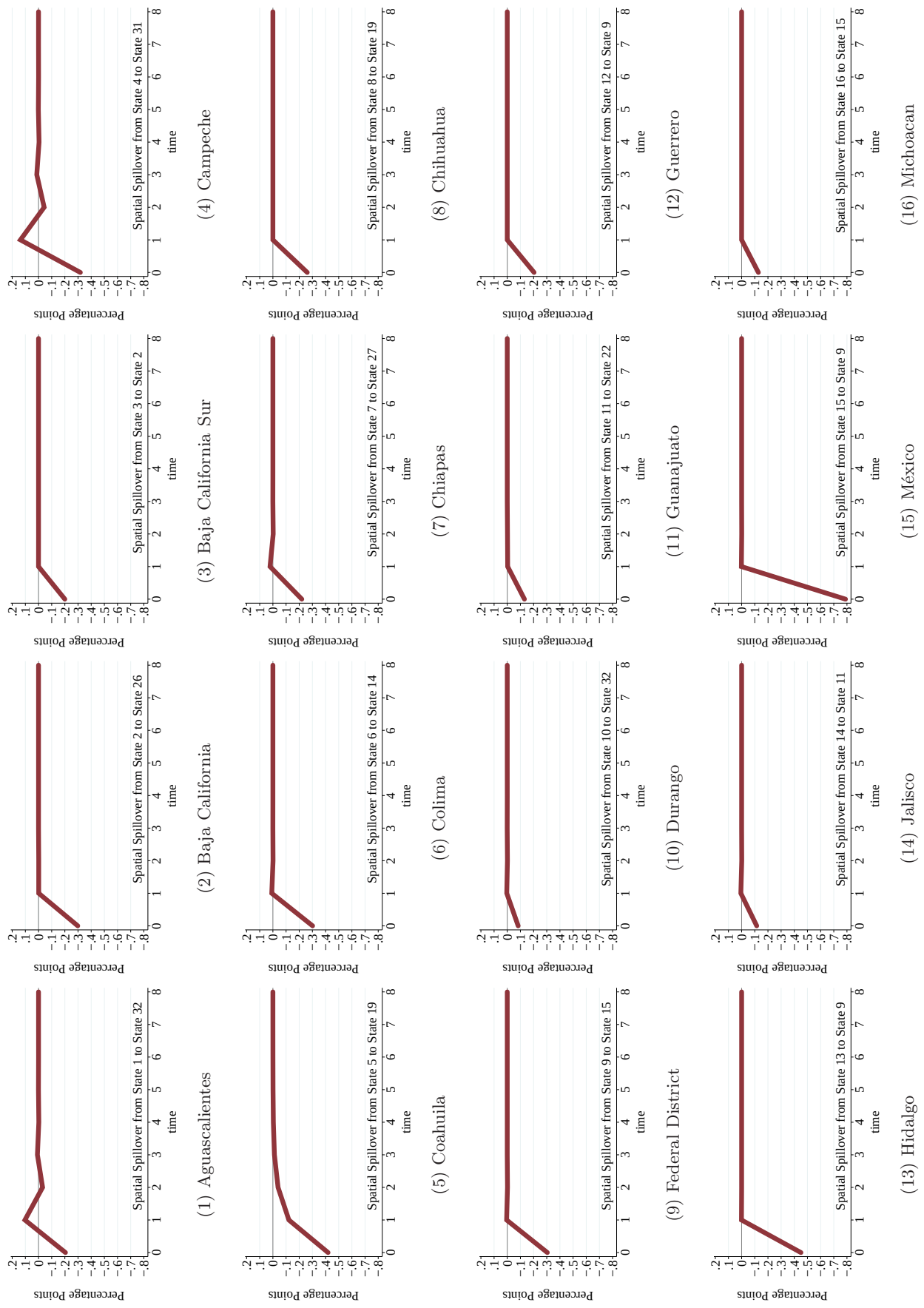


Figure F1: Numerical Simulation of Spatial Spillover Effects (Continued)

Notes: The origin state of regime switch ($\mu_0 \leftarrow \mu_1$) is red-colored. Author's calculation based on equations (21) and (22). The values indicate the negative spatial spillover impact of a switch to a recessionary regime. The values indicate the negative spatial spillover impact of a switch to a recessionary regime.



(1) Aguascalientes (2) Baja California (3) Baja California Sur (4) Campeche

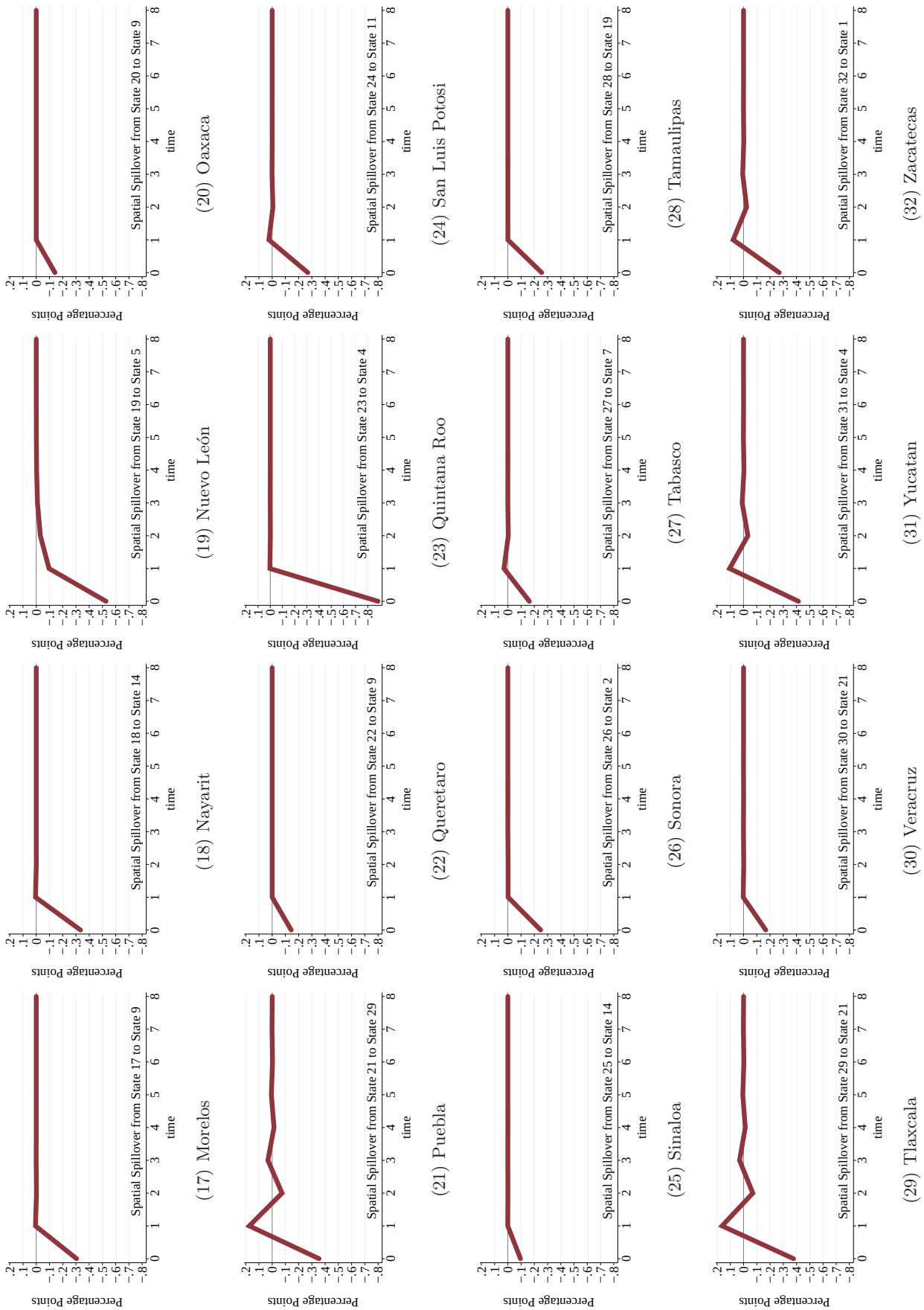
(5) Coahuila (6) Colima (7) Chiapas (8) Chihuahua

(9) Federal District (10) Durango (11) Guanajuato (12) Guerrero

(13) Hidalgo (14) Jalisco (15) México (16) Michoacan

Figure F2: Impulse Response of Spatial Spillover Effects

Notes: Author's calculation based on equations (21) and (22). This figure focuses only on the destination states that receive the largest spatial spillover impacts of the negative shock arising from of a switch to a recessionary regime in Figure F1.



(17) Morelos (18) Nayarit (19) Nuevo León (20) Oaxaca

(21) Puebla (22) Queretaro (23) Quintana Roo (24) San Luis Potosi

(25) Sinaloa (26) Sonora (27) Tabasco (28) Tamaulipas

(29) Tlaxcala (30) Veracruz (31) Yucatan (32) Zacatecas

Figure F2: Impulse Response of Spatial Spillover Effects (Continued)

Notes: Author's calculation based on equations (21) and (22). See Supplemental Information for the other states.