APPENDIX B

CRITICAL VALUES

This appendix contains the tabulated critical values for testing for seasonal unit roots in monthly and bimonthly time series. These values are based on 5000 Monte Carlo simulations and on the data generating process $y_t = y_{t-d} + \varepsilon_t$, where the ε_t are independently drawn from a standard normal distribution and where d is 12 or 6. In the tables below the legenda is as follows. The auxilary regressions can contain (no) constant terms (n)c, (no) seasonal dummy variables (n)d, and/or (no) trend (n)t. The T denotes the number of observations.

B.1 MONTHLY TIME SERIES

Tables for the values of the t-ratios for the individual π parameters

π_1 and π_2

		π_1				π_2			
Regression	T	.01	.025	.05	.10	.01	.025	.05	.10
nc,nd,nt	120	-2.49	-2.20	-1.85	-1.51	-2.37	-2.03	-1.78	-1.46
	240	-2.54	-2.20	-1.88	-1.56	-2.58	-2.22	-1.90	-1.58
c,nd,nt	120	-3.30	-2.99	-2.69	-2.40	-2.36	-2.02	-1.77	-1.46
	240	-3.35	-3.05	-2.80	-2.49	-2.55	-2.23	-1.89	-1.58
c,nd,t	120	-3.82	-3.54	-3.26	-2.96	-2.35	-2.01	-1.76	-1.46
	240	-3.85	-3.60	-3.35	-3.05	-2.54	-2.22	-1.89	-1.58
c,d,nt	120	-3.30	-2.93	-2.63	-2.35	-3.25	-2.93	-2.65	-2.40
	240	-3.24	-3.02	-2.75	-2.45	-3.27	-3.03	-2.79	-2.49
c,d,t	120	-3.73	-3.47	-3.24	-2.92	-3.23	-2.91	-2.65	-2.39
	240	-3.82	-3.53	-3.30	-3.02	-3.29	-3.03	-2.79	-2.49

π_3

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.35	-1.96	-1.66	-1.26	1.31	1.67	1.94	2.24
	240	-2.23	-1.93	-1.64	-1.25	1.24	1.61	1.93	2.22
c,nd,nt	120	-2.33	-1.95	-1.64	-1.25	1.29	1.65	1.92	2.22
	240	-2.25	-1.93	-1.64	-1.24	1.23	1.60	1.92	2.23
c,nd,t	120	-2.29	-1.93	-1.63	-1.24	1.27	1.63	1.92	2.20
	240	-2.25	-1.92	-1.63	-1.24	1.22	1.59	1.91	2.20
c,d,nt	120	-2.45	-2.11	-1.76	-1.39	1.37	1.74	2.11	2.54
	240	-2.55	-2.17	-1.83	-1.42	1.47	1.87	2.19	2.62
c,d,t	120	-2.41	-2.05	-1.71	-1.36	1.36	1.72	2.10	2.52
	240	-2.54	-2.15	-1.82	-1.41	1.47	1.87	2.18	2.61

π_4

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.49	-2.15	-1.80	-1.46	1.15	1.48	1.75	2.12
	240	-2.48	-2.17	-1.87	-1.54	1.06	1.40	1.68	1.99
c,nd,nt	120	-2.48	-2.14	-1.81	-1.45	1.12	1.46	1.72	2.12
	240	-2.47	-2.17	-1.87	-1.55	1.05	1.39	1.67	1.98
c,nd,t	120	-2.45	-2.12	-1.81	-1.45	1.11	1.44	1.71	2.09
	240	-2.46	-2.18	-1.87	-1.54	1.04	1.38	1.65	1.98
c,d,nt	120	-3.65	-3.34	-3.12	-2.83	-0.73	-0.44	-0.14	0.12
	240	-3.78	-3.51	-3.29	-2.97	-0.82	-0.49	-0.20	0.12
c,d,t	120	-3.64	-3.34	-3.12	-2.82	-0.74	-0.45	-0.15	0.11
	240	-3.79	-3.51	-3.29	-2.97	-0.82	-0.49	-0.22	0.11

π_5

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.51	-2.14	-1.81	-1.43	1.11	1.48	1.79	2.18
	240	-2.47	-2.13	-1.83	-1.47	1.04	1.40	1.71	2.11
c,nd,nt	120	-2.50	-2.13	-1.81	-1.43	1.10	1.46	1.77	2.11
	240	-2.47	-2.13	-1.83	-1.47	1.03	1.39	1.70	2.10
c,nd,t	120	-2.47	-2.12	-1.80	-1.42	1.09	1.44	1.73	2.20
	240	-2.47	-2.12	-1.83	-1.47	1.02	1.37	1.69	2.08
c,d,nt	120	-3.66	-3.29	-3.00	-2.71	-0.42	-0.05	0.25	0.61
	240	-3.62	-3.33	-3.10	-2.77	-0.42	-0.09	0.21	0.54
c,d,t	120	-3.65	-3.29	-2.99	-2.70	-0.43	-0.06	0.24	0.61
	240	-3.61	-3.34	-3.09	-2.77	-0.43	-0.09	0.19	0.53

π_6

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.45	-2.08	-1.79	-1.42	1.10	1.47	1.79	2.18
	240	-2.40	-2.11	-1.82	-1.51	1.04	1.41	1.76	2.12
c,nd,nt	120	-2.45	-2.07	-1.77	-1.42	1.09	1.46	1.77	2.15
	240	-2.40	-2.10	-1.82	-1.51	1.04	1.41	1.75	2.10
c,nd,t	120	-2.43	-2.05	-1.76	-1.42	1.07	1.43	1.74	2.11
	240	-2.41	-2.10	-1.81	-1.51	1.03	1.40	1.73	2.09
c,d,nt	120	-3.76	-3.39	-3.12	-2.85	-0.73	-0.42	-0.09	0.31
	240	-3.76	-3.46	-3.21	-2.93	-0.79	-0.47	-0.18	0.19
c,d,t	120	-3.77	-3.38	-3.12	-2.84	-0.75	-0.44	-0.11	0.26
	240	-3.75	-3.46	-3.21	-2.93	-0.79	-0.47	-0.19	0.17

π_7

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.15	-1.82	-1.48	-1.11	1.45	1.78	2.08	2.44
	240	-2.14	-1.76	-1.42	-1.03	1.52	1.88	2.22	2.53
c,nd,nt	120	-2.13	-1.80	-1.48	-1.09	1.44	1.77	2.05	2.40
	240	-2.12	-1.76	-1.41	-1.02	1.50	1.87	2.21	2.53
c,nd,t	120	-2.16	-1.80	-1.46	-1.09	1.45	1.77	2.07	2.38
	240	-2.11	-1.75	-1.42	-1.02	1.50	1.85	2.20	2.49
c,d,nt	120	-0.57	-0.27	0.05	0.41	2.68	3.00	3.31	3.67
	240	-0.58	-0.22	0.07	0.44	2.81	3.14	3.41	3.72
c,d,t	120	-0.49	-0.18	0.12	0.47	2.66	2.98	3.28	3.59
	240	-0.54	-0.17	0.11	0.46	2.81	3.12	3.39	3.71

π_8

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.42	-2.10	-1.85	-1.52	1.08	1.46	1.76	2.15
	240	-2.52	-2.20	-1.89	-1.56	0.98	1.38	1.70	2.07
c,nd,nt	120	-2.44	-2.13	-1.84	-1.52	1.07	1.43	1.73	2.09
	240	-2.54	-2.18	-1.90	-1.56	0.98	1.37	1.71	2.05
c,nd,t	120	-2.51	-2.15	-1.84	-1.53	1.07	1.42	1.77	2.07
	240	-2.53	-2.17	-1.91	-1.56	0.98	1.37	1.71	2.04
c,d,nt	120	-3.73	-3.39	-3.14	-2.84	-0.72	-0.42	-0.18	0.20
	240	-3.78	-3.50	-3.22	-2.94	-0.81	-0.48	-0.16	0.11
c,d,t	120	-3.74	-3.40	-3.15	-2.85	-0.71	-0.43	-0.17	0.21
	240	-3.78	-3.50	-3.23	-2.95	-0.81	-0.48	-0.18	0.12

π_9

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.38	-1.99	-1.68	-1.32	1.18	1.53	1.84	2.21
	240	-2.46	-2.04	-1.75	-1.40	1.15	1.49	1.80	2.16
c,nd,nt	120	-2.35	-1.98	-1.68	-1.31	1.16	1.51	1.80	2.18
	240	-2.45	-2.03	-1.75	-1.40	1.14	1.47	1.79	2.14
c,nd,t	120	-2.35	-1.97	-1.66	-1.30	1.15	1.49	1.79	2.16
	240	-2.44	-2.03	-1.74	-1.40	1.14	1.46	1.77	2.12
c,d,nt	120	-3.19	-2.87	-2.54	-2.20	0.44	0.82	1.13	1.51
	240	-3.31	-2.92	-2.62	-2.28	0.38	0.78	1.13	1.57
c,d,t	120	-3.21	-2.86	-2.54	-2.19	0.43	0.81	1.12	1.46
	240	-3.30	-2.91	-2.61	-2.27	0.38	0.77	1.13	1.54

π_{10}

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.41	-2.02	-1.77	-1.46	1.13	1.56	1.87	2.24
	240	-2.46	-2.20	-1.88	-1.55	1.03	1.44	1.80	2.20
c,nd,nt	120	-2.41	-2.01	-1.77	-1.46	1.12	1.53	1.84	2.23
	240	-2.47	-2.20	-1.87	-1.55	1.02	1.43	1.79	2.19
c,nd,t	120	-2.39	-2.01	-1.76	-1.45	1.09	1.51	1.83	2.17
	240	-2.46	-2.20	-1.87	-1.55	1.01	1.42	1.78	2.18
c,d,nt	120	-3.71	-3.37	-3.07	-2.79	-0.71	-0.39	-0.07	0.30
	240	-3.87	-3.50	-3.25	-2.94	-0.78	-0.41	-0.10	0.17
c,d,t	120	-3.70	-3.36	-3.07	-2.79	-0.72	-0.40	-0.09	0.28
	240	-3.87	-3.52	-3.25	-2.94	-0.78	-0.42	-0.10	0.17

π_{11}

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.30	-1.85	-1.56	-1.21	1.38	1.75	2.03	2.41
	240	-2.21	-1.79	-1.47	-1.16	1.42	1.76	2.06	2.38
c,nd,nt	120	-2.28	-1.82	-1.56	-1.19	1.36	1.72	2.00	2.40
	240	-2.17	-1.79	-1.46	-1.15	1.42	1.75	2.06	2.37
c,nd,t	120	-2.27	-1.84	-1.55	-1.17	1.34	1.71	1.98	2.38
	240	-2.15	-1.77	-1.46	-1.14	1.40	1.74	2.04	2.35
c,d,nt	120	-1.48	-1.11	-0.78	-0.43	2.19	2.56	2.83	3.22
	240	-1.67	-1.21	-0.87	-0.44	2.28	2.62	2.92	3.29
c,d,t	120	-1.43	-1.08	-0.73	-0.39	2.19	2.55	2.80	3.18
	240	-1.61	-1.19	-0.84	-0.42	2.29	2.61	2.91	3.26

π_{12}

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	120	-2.49	-2.16	-1.85	-1.49	1.09	1.42	1.75	2.18
	240	-2.48	-2.14	-1.85	-1.51	1.02	1.40	1.71	2.05
c,nd,nt	120	-2.47	-2.15	-1.83	-1.49	1.07	1.41	1.74	2.16
	240	-2.47	-2.15	-1.84	-1.51	1.01	1.39	1.71	2.06
c,nd,t	120	-2.47	-2.15	-1.83	-1.50	1.04	1.39	1.72	2.11
	240	-2.47	-2.14	-1.84	-1.50	0.99	1.39	1.69	2.05
c,d,nt	120	-3.71	-3.43	-3.16	-2.85	-0.73	-0.42	-0.14	0.25
	240	-3.66	-3.44	-3.20	-2.90	-0.79	-0.50	-0.20	0.05
c,d,t	120	-3.75	-3.42	-3.16	-2.83	-0.73	-0.44	-0.17	0.25
	240	-3.66	-3.45	-3.20	-2.91	-0.80	-0.50	-0.21	0.03

Tables for the values for F-statistics for sets of π parameters

		π_3=π_4=0			π_5=π_6=0			π_7=π_8=0		
Regression	T	.90	.95	.99	.90	.95	.99	.90	.95	.99
nc,nd,nt	120	2.37	3.04	4.71	2.38	3.09	4.69	2.31	2.98	4.66
	240	2.33	2.94	4.50	2.32	2.96	4.34	2.40	3.11	4.92
c,nd,nt	120	2.32	3.00	4.68	2.32	3.04	4.59	2.27	2.97	4.67
	240	2.31	2.93	4.51	2.30	2.93	4.33	2.41	3.12	4.91
c,nd,t	120	2.30	2.94	4.54	2.29	2.96	4.54	2.30	3.00	4.67
	240	2.30	2.91	4.46	2.29	2.90	4.33	2.39	3.09	4.92
c,d,nt	120	4.83	5.62	7.86	4.89	5.86	8.07	4.94	5.86	8.24
	240	5.33	6.36	8.46	5.16	6.05	8.01	5.29	6.23	8.42
c,d,t	120	4.81	5.63	7.74	4.86	5.84	8.03	4.94	5.90	8.27
	240	5.35	6.31	8.38	5.15	6.05	7.98	5.30	6.22	8.18

		π_9=π_{10}=0			π_{11}=π_{12}=0			π_3=..=π_{12}=0		
Regression	T	.90	.95	.99	.90	.95	.99	.90	.95	.99
nc,nd,nt	120	2.29	2.98	4.53	2.33	3.08	4.98	1.68	1.95	2.46
	240	2.38	3.08	4.62	2.32	2.93	4.54	1.65	1.91	2.47
c,nd,nt	120	2.26	2.92	4.39	2.31	3.03	4.88	1.65	1.92	2.42
	240	2.35	3.05	4.57	2.31	2.92	4.56	1.65	1.90	2.45
c,nd,t	120	2.21	2.86	4.39	2.27	3.00	4.85	1.62	1.89	2.39
	240	2.34	3.02	4.54	2.30	2.91	4.54	1.64	1.88	2.43
c,d,nt	120	4.79	5.75	7.76	4.94	5.89	7.84	4.00	4.46	5.53
	240	5.21	6.16	8.43	5.15	6.03	7.85	4.09	4.48	5.41
c,d,t	120	4.76	5.71	7.68	4.92	5.84	7.88	4.00	4.45	5.51
	240	5.19	6.14	8.47	5.14	6.04	7.82	4.08	4.48	5.37

B.2 BIMONTHLY TIME SERIES

Tables for the values of the t-ratios for the individual π parameters

π_1 and π_2

		π_1				π_2			
Regression	T	.01	.025	.05	.10	.01	.025	.05	.10
nc,nd,nt	60	-2.45	-2.15	-1.84	-1.54	-2.52	-2.21	-1.88	-1.53
	120	-2.61	-2.22	-1.94	-1.60	-2.54	-2.21	-1.90	-1.58
c,nd,nt	60	-3.42	-3.05	-2.81	-2.48	-2.54	-2.18	-1.89	-1.53
	120	-3.40	-3.09	-2.85	-2.51	-2.54	-2.21	-1.90	-1.58
c,nd,t	60	-3.88	-3.61	-3.30	-3.03	-2.54	-2.15	-1.88	-1.54
	120	-3.90	-3.62	-3.34	-3.08	-2.54	-2.20	-1.91	-1.58
c,d,nt	60	-3.40	-2.99	-2.74	-2.42	-3.33	-3.01	-2.73	-2.40
	120	-3.38	-3.06	-2.80	-2.48	-3.35	-3.01	-2.77	-2.48
c,d,t	60	-3.84	-3.55	-3.26	-2.96	-3.33	-2.99	-2.73	-2.41
	120	-3.89	-3.58	-3.32	-3.05	-3.36	-3.01	-2.77	-2.47

π_3

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	60	-2.16	-1.81	-1.48	-1.11	1.36	1.76	2.14	2.34
	120	-2.15	-1.76	-1.48	-1.12	1.39	1.77	2.06	2.50
c,nd,nt	60	-2.12	-1.79	-1.45	-1.09	1.34	1.72	1.98	2.32
	120	-2.13	-1.76	-1.46	-1.11	1.38	1.75	2.05	2.47
c,nd,t	60	-2.12	-1.74	-1.44	-1.10	1.31	1.65	1.91	2.23
	120	-2.10	-1.72	-1.45	-1.10	1.36	1.70	2.05	2.40
c,d,nt	60	-1.50	-1.15	-0.82	-0.40	2.20	2.53	2.87	3.26
	120	-1.64	-1.18	-0.80	-0.40	2.32	2.67	3.00	3.38
c,d,t	60	-1.41	-1.05	-0.72	-0.36	2.18	2.51	2.83	3.18
	120	-1.52	-1.12	-0.76	-0.36	2.32	2.65	2.99	3.33

π_4

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	60	-2.49	-2.14	-1.87	-1.54	1.01	1.36	1.71	2.10
	120	-2.62	-2.18	-1.87	-1.57	1.01	1.38	1.70	2.00
c,nd,nt	60	-2.45	-2.15	-1.85	-1.54	0.99	1.33	1.68	2.04
	120	-2.61	-2.18	-1.87	-1.57	1.00	1.36	1.68	1.99
c,nd,t	60	-2.44	-2.14	-1.86	-1.56	0.95	1.31	1.67	2.03
	120	-2.58	-2.17	-1.84	-1.57	0.99	1.35	1.66	1.99
c,d,nt	60	-3.77	-3.47	-3.21	-2.90	-0.74	-0.41	-0.13	0.18
	120	-3.94	-3.57	-3.31	-3.00	-0.80	-0.46	-0.19	0.08
c,d,t	60	-3.76	-3.45	-3.20	-2.89	-0.73	-0.41	-0.14	0.21
	120	-3.91	-3.58	-3.32	-3.00	-0.80	-0.48	-0.20	0.07

π_5

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	60	-2.62	-2.11	-1.75	-1.37	1.13	1.49	1.78	2.17
	120	-2.38	-2.02	-1.73	-1.38	1.11	1.44	1.72	2.15
c,nd,nt	60	-2.59	-2.07	-1.73	-1.36	1.10	1.47	1.79	2.11
	120	-2.37	-2.02	-1.73	-1.38	1.09	1.42	1.70	2.13
c,nd,t	60	-2.55	-2.03	-1.73	-1.35	1.06	1.42	1.72	2.08
	120	-2.36	-2.01	-1.73	-1.38	1.07	1.41	1.68	2.07
c,d,nt	60	-3.33	-2.94	-2.62	-2.29	0.41	0.78	1.16	1.48
	120	-3.39	-3.04	-2.69	-2.29	0.46	0.83	1.15	1.56
c,d,t	60	-3.31	-2.91	-2.58	-2.20	0.41	0.78	1.14	1.47
	120	-3.30	-3.01	-2.68	-2.27	0.46	0.82	1.13	1.54

π_6

Regression	T	.01	.025	.05	.10	.90	.95	.975	.99
nc,nd,nt	60	-2.68	-2.17	-1.84	-1.49	1.04	1.41	1.77	2.15
	120	-2.61	-2.20	-1.87	-1.55	1.00	1.37	1.71	2.14
c,nd,nt	60	-2.67	-2.19	-1.82	-1.48	1.02	1.39	1.73	2.12
	120	-2.60	-2.20	-1.87	-1.55	0.99	1.36	1.68	2.11
c,nd,t	60	-2.72	-2.19	-1.82	-1.49	0.90	1.35	1.69	2.04
	120	-2.61	-2.20	-1.87	-1.55	0.95	1.35	1.67	2.09
c,d,nt	60	-3.83	-3.48	-3.21	-2.87	-0.72	-0.37	-0.08	0.20
	120	-3.93	-3.57	-3.28	-2.98	-0.79	-0.44	-0.20	0.14
c,d,t	60	-3.82	-3.49	-3.19	-2.87	-0.74	-0.40	-0.10	0.20
	120	-3.91	-3.58	-3.32	-3.00	-0.80	-0.48	-0.20	0.07

Tables for the values for *F*-statistics for pairs of π parameters

Regression	T	$\pi_3=\pi_4=0$			$\pi_5=\pi_6=0$		
		.90	.95	.99	.90	.95	.99
nc,nd,nt	60	2.28	2.95	4.66	2.32	3.15	5.10
	120	2.38	3.11	4.81	2.34	3.06	4.64
c,nd,nt	60	2.25	2.89	4.68	2.26	3.08	5.01
	120	2.35	3.07	4.78	2.31	3.05	4.56
c,nd,t	60	2.21	2.84	4.64	2.22	3.03	4.86
	120	2.32	3.03	4.73	2.29	3.01	4.45
c,d,nt	60	5.09	6.15	8.44	5.15	6.22	8.77
	120	5.44	6.46	8.71	5.46	6.45	8.76
c,d,t	60	5.08	6.05	8.19	5.04	6.14	8.79
	120	5.42	6.47	8.66	5.43	6.42	8.73