

Forecasting Australian GDP

Income Approach - Point forecasting

Summary of GDP - The most aggregate series

Method	ETS								ARIMA			
	MSE				MASE				MSE			
	1	2	3	4	1	2	3	4	1	2	3	4
Benchmark	-418.74	-135.45	-36.30	-3.10	-127.28	-69.39	-28.70	-21.03	-420.06	-128.25	-39.11	-15.4
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Bottom-up	-17.93	-3.68	7.80	9.35	-5.62	-3.49	-4.36	-15.49	-9.15	7.01	10.74	13.1
OLS	-0.18	3.45	6.05	6.70	0.05	0.96	3.47	1.50	2.12	2.46	2.54	1.9
WLS	-4.05	5.59	11.57	13.09	-0.67	2.96	3.32	-2.27	2.41	6.80	9.35	9.7
MinT Shrink	-0.72	5.86	9.33	9.70	3.25	5.14	4.63	-1.15	7.06	9.05	8.63	9.7

Summary of all aggregate level series

Method	ETS								ARIMA				
	MSE				MASE				MSE				
	1	2	3	4	1	2	3	4	1	2	3	4	
Benchmark	-320.17	-101.63	-29.68	-2.32	-96	-40.28	-11.83	-1.92	-298.21	-86.44	-19.78	0.71	-78.1
Base	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Bottom-up	-7.64	-2.49	0.73	1.55	-2	0.00	-2.15	-1.92	1.61	8.32	5.18	9.05	1.8
OLS	3.16	3.29	2.91	2.92	2	2.78	2.15	1.92	4.79	4.33	3.05	3.37	1.8
WLS	3.61	4.84	4.39	4.45	4	4.17	2.15	1.92	7.89	8.49	6.94	8.15	3.6
MinT Shrink	6.46	5.18	2.39	1.54	6	4.17	3.23	2.88	12.69	11.96	6.76	8.69	7.2

Summary of all disaggregate series

Method	ETS								ARIMA				
	MSE				MASE				MSE				
	1	2	3	4	1	2	3	4	1	2	3	4	
Benchmark	-200.06	-71.72	-21.93	-0.40	-61.02	-30.67	-11.11	-2.02	-191.76	-64.02	-7.71	6.65	-6
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Bottom-up	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
OLS	0.66	-2.57	-3.50	-3.73	-23.73	-26.67	-18.89	-12.12	-2.88	-5.33	-2.55	-4.91	-20
WLS	6.18	3.62	1.38	0.28	1.69	0.00	-1.11	0.00	2.43	-0.25	2.93	0.29	0
MinT Shrink	8.78	4.34	0.58	-1.43	3.39	1.33	1.11	1.01	4.81	1.57	2.15	0.47	0

Summary of all series in the hierarchy (Average over all series)

Method	ETS								ARIMA				
	MSE				MASE				MSE				
	1	2	3	4	1	2	3	4	1	2	3	4	
Benchmark	-295.40	-96.29	-28.41	-2.01	-71.43	-33.78	-10.99	-1.98	-276.70	-82.54	-17.73	1.68	-68
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Bottom-up	-6.06	-2.05	0.61	1.31	0.00	0.00	-1.10	0.00	1.28	6.88	4.30	7.57	1
OLS	2.64	2.24	1.86	1.87	-14.29	-14.86	-10.99	-6.93	3.24	2.65	2.09	2.01	-12
WLS	4.14	4.62	3.89	3.79	3.57	1.35	0.00	0.99	6.79	6.97	6.25	6.86	1
MinT Shrink	6.94	5.03	2.09	1.07	5.36	2.70	2.20	1.98	11.10	10.15	5.98	7.34	3

Income approach - Probabilistic forecasting (Non-parametric Bootstrap approach)

Predictive ability of multivariate forecast distribution of the whole hierarchy

Method	ETS								ARIMA				
	ES				VS				ES				
	1	2	3	4	1	2	3	4	1	2	3	4	
Benchmark	-103.31	-39.64	-8.52	3.84	-164.35	-52.47	-9.68	6.05	-95.27	-36.15	-5.41	4.93	-150
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Bottom-up	0.44	1.11	-0.99	-2.29	1.38	3.24	2.69	2.65	2.21	3.09	0.98	1.26	4
OLS	2.35	2.25	1.77	1.85	0.72	-1.08	-0.74	-0.11	2.29	2.02	1.61	1.55	-0
WLS	4.63	4.69	2.90	2.03	7.26	5.43	3.72	2.66	4.35	4.59	3.51	3.55	6
MinT Sample	5.52	0.75	-1.62	-2.32	8.63	-1.24	-8.06	-13.44	0.20	-3.64	-5.26	-1.72	-0
MinT Shrink	6.34	5.16	3.18	2.27	9.84	6.06	3.34	1.05	6.32	4.61	3.34	4.88	8

Predictive ability of univariate forecast distributions

Summary of GDP - The most aggregate series

Method	ETS (CRPS)				ARIMA (CRPS)			
	1	2	3	4	1	2	3	4
Benchmark	-139.03	-60.56	-17.03	-5.22	-144.75	-56.38	-22.61	-9.99
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottom-up	-6.01	-2.62	-2.92	-12.05	-7.99	1.29	-2.93	-4.41
OLS	-0.13	1.60	3.20	1.62	0.59	1.55	0.67	0.36
WLS	-0.95	3.20	3.80	-0.75	-0.63	2.79	1.46	0.27
MinT Sample	3.29	1.26	-0.09	-4.15	-4.68	-9.35	-9.40	-5.79
MinT Shrink	1.61	4.31	3.91	-0.74	1.28	1.43	1.04	1.28

Summary of all aggregate level series

Method	ETS (CRPS)				ARIMA (CRPS)			
	1	2	3	4	1	2	3	4
Benchmark	-116.05	-44.38	-8.96	3.46	-104.93	-41.23	-8.22	3.04
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	2.12	2.22	1.99	1.84	2.18	1.75	0.99	1.69
WLS	3.28	3.20	1.68	0.71	3.22	2.75	1.30	2.20
MinT Sample	4.02	-1.54	-2.53	-3.34	-0.69	-5.80	-7.97	-3.03
MinT Shrink	4.84	3.53	2.07	1.09	5.93	3.13	1.02	3.81

Summary of all disaggregate series

Method	ETS (CRPS)				ARIMA (CRPS)			
	1	2	3	4	1	2	3	4
Benchmark	-81.67	-32.82	-6.70	3.68	-78.46	-31.91	-6.22	3.38
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	-6.79	-8.46	-6.40	-4.31	-8.31	-10.13	-8.85	-8.94
WLS	1.91	1.17	0.80	0.74	0.05	0.17	0.68	0.65
MinT Sample	1.32	-2.31	-1.66	-3.82	-5.67	-7.72	-8.88	-6.51
MinT Shrink	3.91	2.19	1.99	1.30	0.36	-0.37	-0.04	1.06

Summary of all series in the hierarchy

Method	ETS (CRPS)				ARIMA (CRPS)			
	1	2	3	4	1	2	3	4
Benchmark	-104.77	-40.82	-8.29	3.52	-96.44	-38.38	-7.63	3.14
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	-0.81	-1.07	-0.48	0.05	-1.18	-1.88	-1.91	-1.40
WLS	2.83	2.58	1.42	0.72	2.20	1.96	1.12	1.75
MinT Sample	3.13	-1.78	-2.27	-3.48	-2.29	-6.38	-8.24	-4.04
MinT Shrink	4.53	3.11	2.05	1.15	4.14	2.06	0.71	3.01

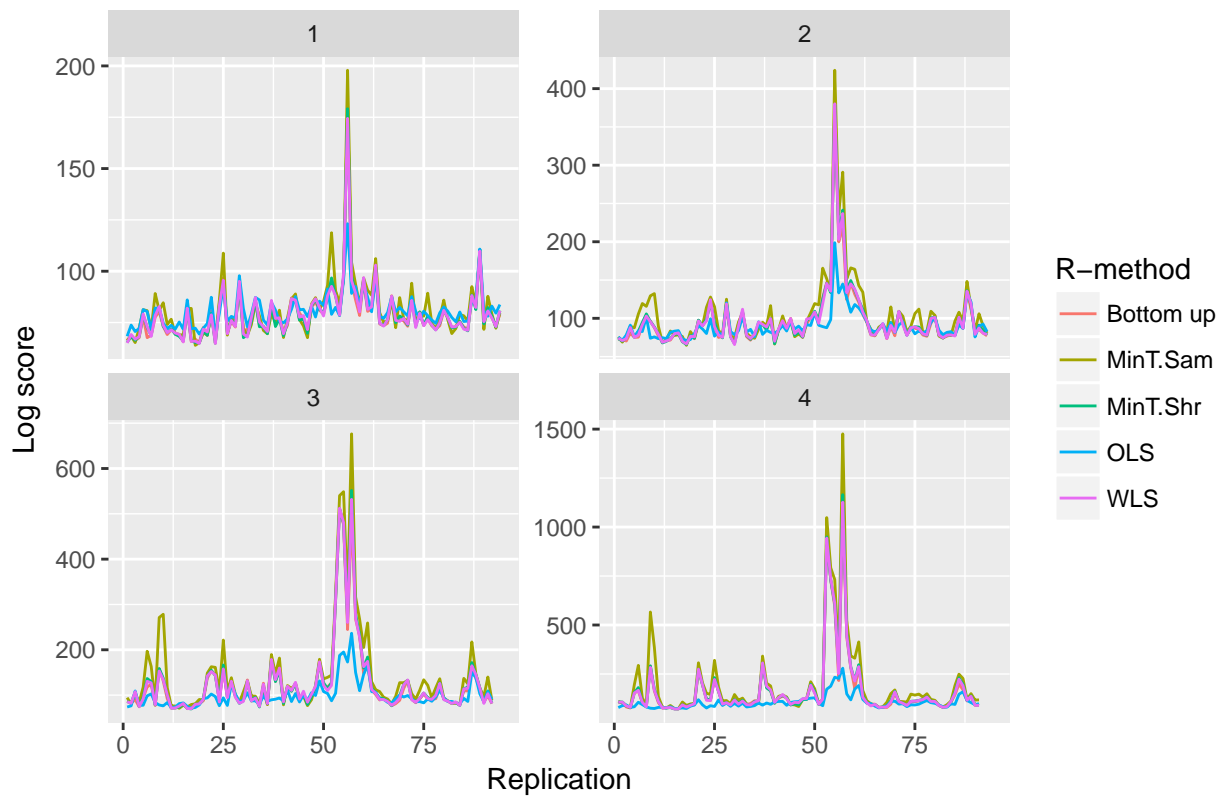
Income approach - Probabilistic forecasting (Parametric approach assuming Gaussianity)

Predictive ability in the multivariate forecast distribution of the whole hierarchy

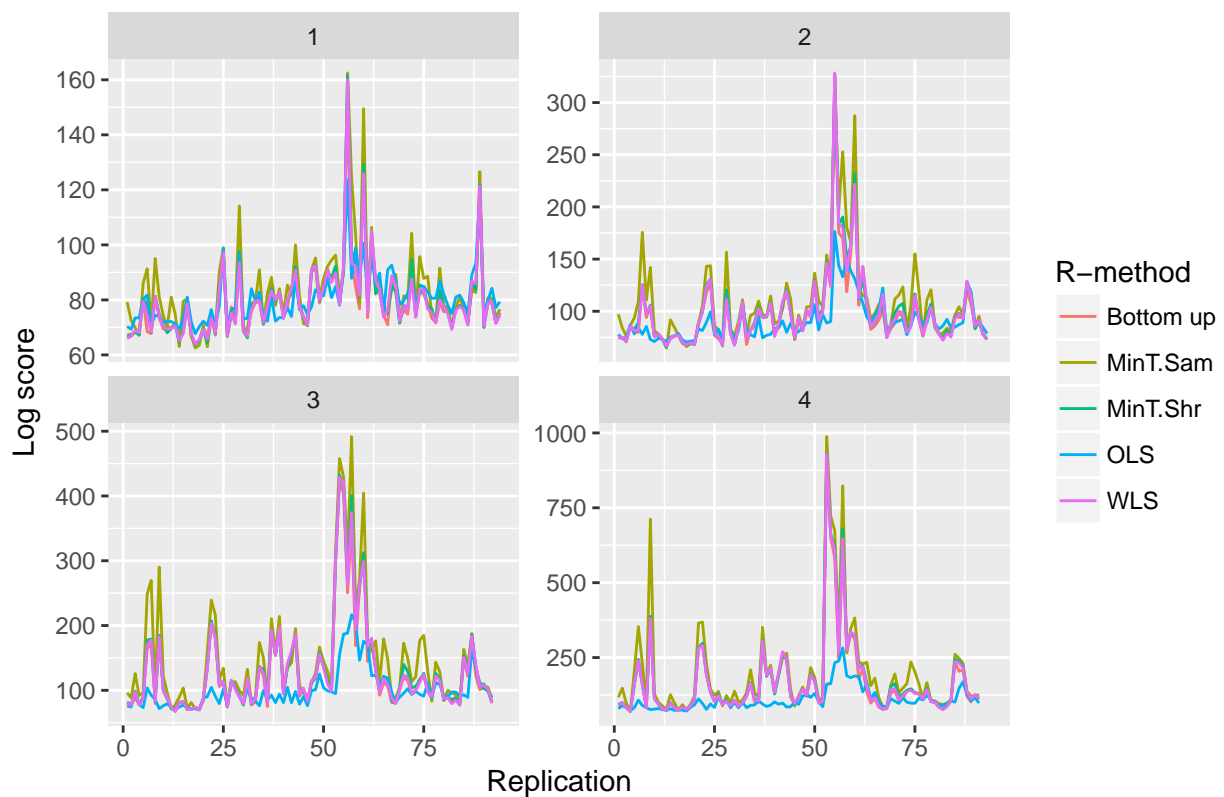
Method	ETS								ARIMA				
	ES				VS				ES				
	1	2	3	4	1	2	3	4	1	2	3	4	
Benchmark	-96.14	-36.28	-6.59	5.26	-156.30	-50.32	-9.15	6.00	-88.32	-32.30	-3.07	6.61	-145.3
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Bottom-up	-0.09	0.84	-1.11	-2.53	1.08	2.99	2.51	2.44	2.24	3.06	0.81	1.09	4.0
OLS	1.87	1.93	1.33	1.41	1.01	-0.62	-0.60	0.00	1.62	1.63	1.18	1.06	-0.0
WLS	3.85	4.00	2.05	1.16	7.41	5.61	3.62	2.64	3.51	3.77	2.62	2.68	6.0
MinT Sample	4.58	-0.14	-2.41	-2.78	8.48	-1.36	-8.09	-13.39	-0.44	-4.27	-5.78	-2.11	-0.0
MinT Shrink	5.43	4.54	2.40	1.61	9.84	6.16	3.39	1.13	5.59	3.93	2.67	4.20	8.0

Method	ETS				ARIMA			
	1	2	3	4	1	2	3	4
Bottom-up	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OLS	-2.6202	5.6523	20.1662	34.2084	-1.7115	7.2382	21.1612	34.3326
WLS	-0.2564	-1.2158	-1.6048	-1.8090	-0.4037	-1.5222	-1.6978	-2.0367
MinT Sample	-3.4253	-10.1779	-15.7191	-20.5008	-4.9823	-11.2533	-15.9803	-18.7421
MinT Shrink	-0.1630	-1.5999	-2.3983	-2.9095	-0.8188	-2.3546	-2.9066	-3.3077

Multivariate log scores for ETS method



Multivariate log scores for ARIMA method



Predictive ability of univariate forecast distributions

Summary of GDP - The most aggregate series

Method	ETS								ARIMA				
	CRPS				LS				CRPS				
	1	2	3	4	1	2	3	4	1	2	3	4	
Benchmark	-129.45	-55.66	-14.67	-4.17	-5.53	11.47	28.94	36.32	-133.77	-50.95	-19.67	-7.94	-4.00
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	-0.82	1.61	2.64	1.09	-1.27	-1.57	-1.10	-1.18	-0.25	1.11	0.15	-0.06	-0.00
WLS	-1.80	2.88	2.92	-2.21	-2.55	-2.78	-1.76	-2.72	-1.39	2.32	0.65	-0.41	-1.00
MinT Sample	2.88	0.92	-0.49	-4.32	-2.22	-5.82	-12.33	-17.64	-4.91	-9.54	-9.82	-6.08	-3.00
MinT Shrink	1.01	4.31	3.22	-1.83	-1.95	-2.81	-3.96	-6.27	0.89	1.17	0.43	0.78	-1.00

Summary of all aggregate level series

Method	ETS								ARIMA				
	CRPS				LS				CRPS				
	1	2	3	4	1	2	3	4	1	2	3	4	1
Benchmark	-108.81	-41.06	-7.27	4.76	-6.09	10.39	23.15	30.46	-97.82	-37.19	-5.84	4.74	-5.03
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	1.43	1.86	1.48	1.33	-1.12	-2.70	-4.01	-4.50	1.29	1.27	0.53	1.15	-1.21
WLS	2.47	2.69	0.97	-0.11	-1.73	-3.80	-6.31	-7.52	2.45	2.07	0.50	1.49	-1.61
MinT Sample	3.19	-2.24	-3.30	-3.63	-1.73	-7.01	-14.84	-18.70	-1.34	-6.29	-8.33	-3.23	-4.72
MinT Shrink	4.02	3.13	1.40	0.59	-1.52	-4.22	-8.03	-9.58	5.22	2.49	0.51	3.26	-1.61

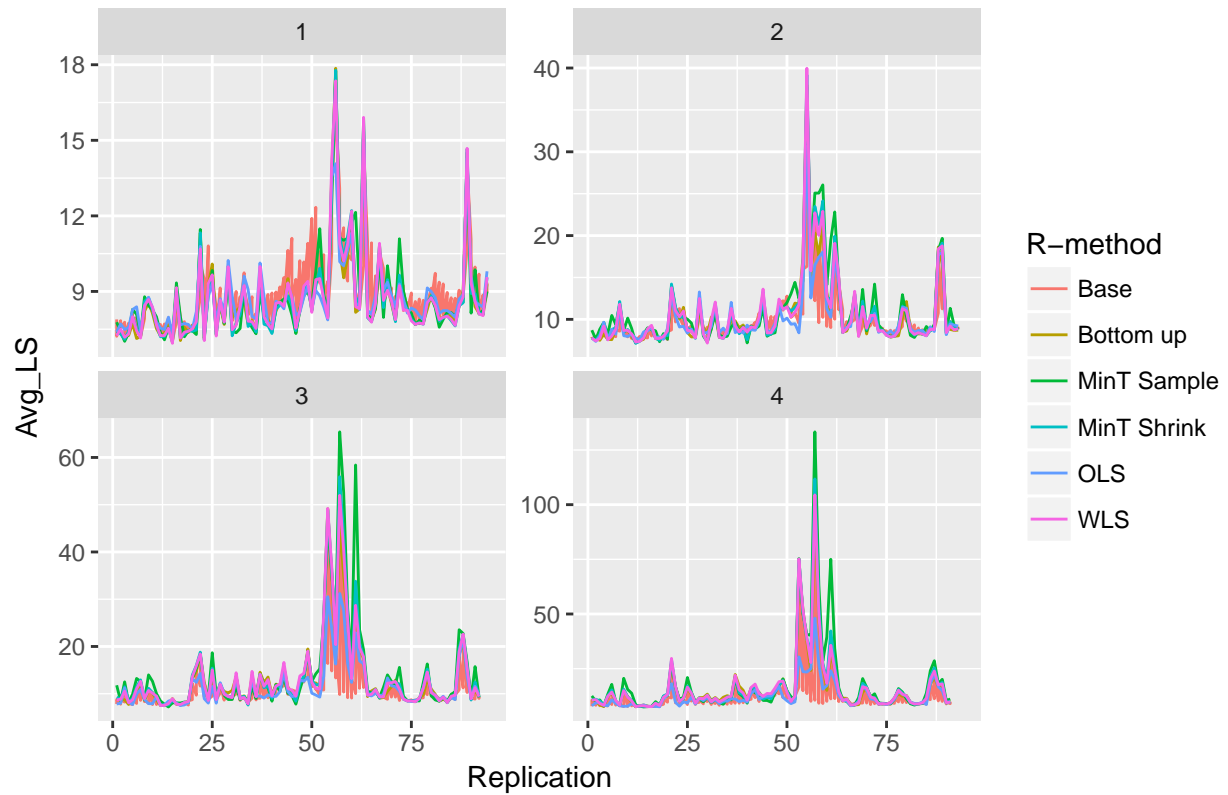
Summary of all disaggregate series

Method	ETS								ARIMA				
	CRPS				LS				CRPS				
	1	2	3	4	1	2	3	4	1	2	3	4	1
Benchmark	-74.79	-29.85	-4.80	5.13	-8.12	9.06	28.41	43.29	-72.44	-28.79	-4.24	4.85	-7.85
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	-6.37	-7.66	-5.73	-3.82	-2.79	6.22	21.18	34.84	-7.87	-9.25	-7.89	-8.12	-2.28
WLS	1.64	0.61	0.28	0.20	-0.13	-0.84	-1.07	-0.90	-0.31	-0.35	0.24	0.26	-0.25
MinT Sample	0.72	-3.14	-2.34	-4.16	-1.65	-5.48	-8.13	-10.65	-6.11	-8.48	-9.33	-6.84	-3.54
MinT Shrink	3.45	1.61	1.58	1.00	0.13	-1.05	-1.72	-2.13	0.20	-0.86	-0.39	0.78	-0.76

Summary of all series in the hierarchy

Method	ETS								ARIMA				
	CRPS				LS				CRPS				
	1	2	3	4	1	2	3	4	1	2	3	4	1
Benchmark	-97.58	-37.60	-6.54	4.87	-7.31	9.64	26.30	38.47	-89.67	-34.63	-5.37	4.77	-6.69
Base	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OLS	-1.15	-1.08	-0.65	-0.17	-2.09	2.41	10.97	20.04	-1.65	-1.94	-1.95	-1.54	-1.73
WLS	2.20	2.04	0.77	-0.02	-0.81	-2.12	-3.11	-3.41	1.56	1.33	0.42	1.13	-0.81
MinT Sample	2.38	-2.52	-3.02	-3.78	-1.74	-6.17	-10.82	-13.66	-2.87	-6.96	-8.63	-4.28	-4.04
MinT Shrink	3.83	2.66	1.46	0.71	-0.58	-2.41	-4.20	-4.96	3.60	1.47	0.24	2.54	-1.04

Average univariate log scores for ETS method



Average univariate log scores for ARIMA method

