Supplementary Material for Marginalised Gaussian Processes with Nested Sampling

1 Experimental Results

This section presents a more detailed description and results from our three sets of experiments: ground truth recovery, synthetic data, and realistic time series.

Ground Truth Recovery In this subsection we summarise the performance of ML-II, HMC and Nested sampling inference in recovering the true setting of the hyperparameters under two different noise settings, for 100 training data on a fixed domain [-1,1].

The top row of panels in Fig.1 indicate a low noise setting $\sigma_n = 0.01$ and the bottom row indicates a higher noise setting of $\sigma_n = 0.1$. The magenta star $\star$ denotes the true value and the red cross $\times$ denotes the ML-II estimate. The sampling schemes HMC and Nested are both better at recovering the target than the point estimate. While ML-II estimates the noise-level to a high precision when the noise is low (top-row, $\sigma_n = 0.01$), it does not fare so well when noise level is raised by an order of magnitude (bottom row, $\sigma_n = 0.1$). In this case, the estimate of the intrinsic noise level is off by several orders of magnitude. The sampling schemes prove to be far more robust in recovering the frequencies, bandwidths and noise level, especially when operating in the low signal-to-noise regime.

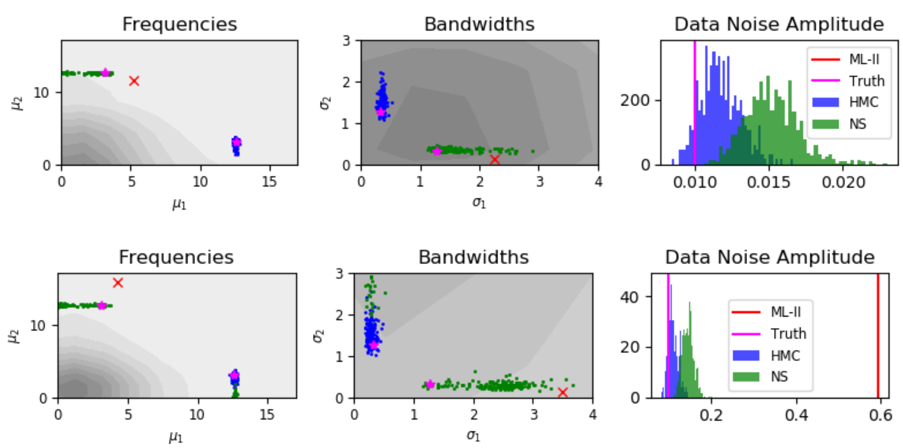

Figure 1: A comparison of hyperparameter estimation, where the ground truth is indicated by the magenta star. The grey shading indicates the prior. *Left:* Recovering the mean frequency parameters of the two spectral components. *Middle:* Recovering the two bandwidth parameters of the two spectral components. *Right:* Recovering the data noise level (σ_n). The true hyperparameters are $[\mu_1, \mu_2] = [3.14, 12.56]$ and $[\sigma_1, \sigma_2] = [1.27, 0.32]$. For frequencies and bandwidths we note the symmetry i.e. the estimates can converge on $[\mu_1, \mu_2]$ or $[\mu_2, \mu_1]$, and that the nested sampling algorithm successfully identifies both.

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Synthetic Data Fig.2 shows the test mean squared error across the three inference schemes. The sampling schemes largely dominate the ML-II method when the hyperparameters are well identified ($n\_train = 100$). The data generating configurations are the same as the ones described in the main paper.

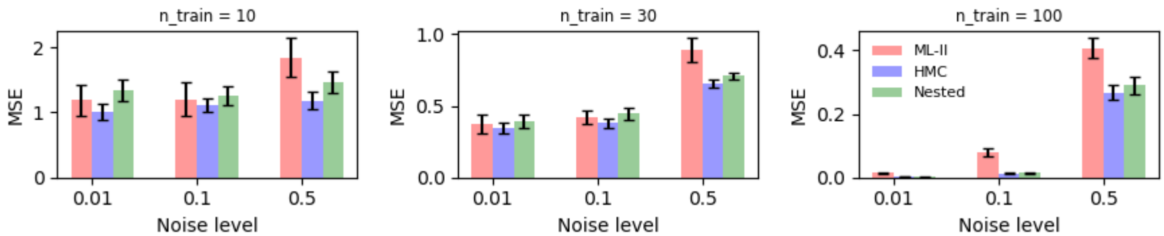

Figure 2: Mean-squared error for synthetic data sets under different noise levels and training set sizes.

Time Series Here we present further results from the benchmark time series experiments. Instead of making full use of the data, we consider only the first 100 points as training data, followed by testing with the subsequent 30 points. As with the results from the full training set, significant performance gains are found when marginalising the hyperparameters of the spectral mixture kernels. However in this case, the nested sampling algorithm doesn't offer a performance advantage over HMC. We speculate this may be due to the simpler likelihood surface associated with the smaller set of training data. Fewer modes in the surface would facilitate exploration via HMC.

2 Spectral Priors

Figure 3 shows the parameter space for the frequency and bandwidth of a single spectral component. The likelihood surfaces adjacent to any of the dashed lines are mirror images of each other. It is therefore preferable to avoid exploring multiple copies of these regions when performing nested sampling, as it will attempt to locate the duplicate modes, dispersing the live points.

To give a clearer picture of how the parameters of the spectral mixture kernel are inferred via nested sampling, we take as a example the radio experiment. The posterior distribution in this case can

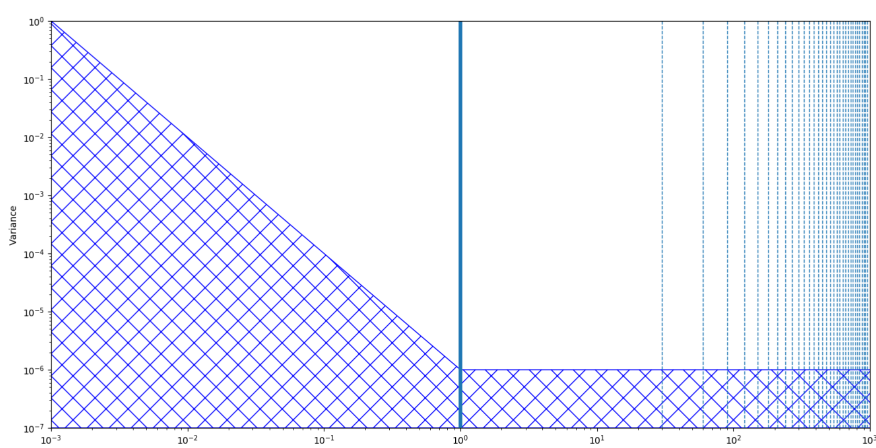

Figure 3: Schematic of the observability of a spectral component as a function of frequency and variance. The fundamental frequency is denoted by the solid vertical line, while dashed vertical lines indicate multiples of the Nyquist frequency. The hatched region denotes the regime where the variance is deemed too low to be observed.

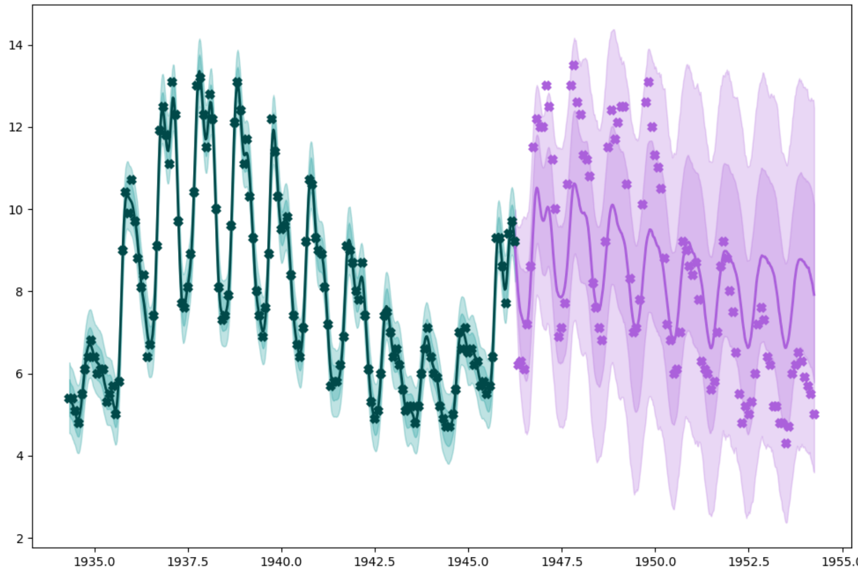

Figure 4: 68 and 95 per cent confidence intervals for the radio dataset, derived from nested sampling of a seven-component spectral mixture kernel.

be seen in Figure 4. The corresponding joint posterior distribution of the 22 hyperparameters are displayed in Fig.5.

We make use of the dynesty package in order to perform nested sampling. The full set of configuration parameters used can be found in Table 1.

Table 1: A summary of the configuration settings used to perform nested sampling. Most of these adhere to the default set-up in dynesty, with the most significant changes being in the sampling method, and a reduction in the number of live points.

	Fiducial	Default
method	rslice	auto
live points	100	500
Bound	multi	multi
slices	5	5
dlogz	0.01	0.01
max iter	None	None
max call	None	None
min eff	3	10
vol dec	0.5	0.5

Time-Series The tables below summarize the posterior samples and sampler statistics based on the trace containing joint samples from the HMC run. The columns hpd_2.5 and hpd_97.5 calculate the highest posterior density interval based on marginal posteriors. $\text{n\_eff} = \dfrac{MN}{1 + 2\sum_{t=1}^{T} \hat{\rho}_t}$ computes effective sample size where M is the number of chains, N is the number of samples in each chain and ρ_t denotes auto-correlation at lag t. For the results reported below $N = 500$ and $M = 1$. Each chain was run with 500 warm-up iterations for the sampler to adapt to an optimal step-size. The 22 hyperparameters sampled are the mean frequencies, bandwidths and weights $\{\text{mu[i], bw[i], w[i]}\}_{i=0}^{6}$

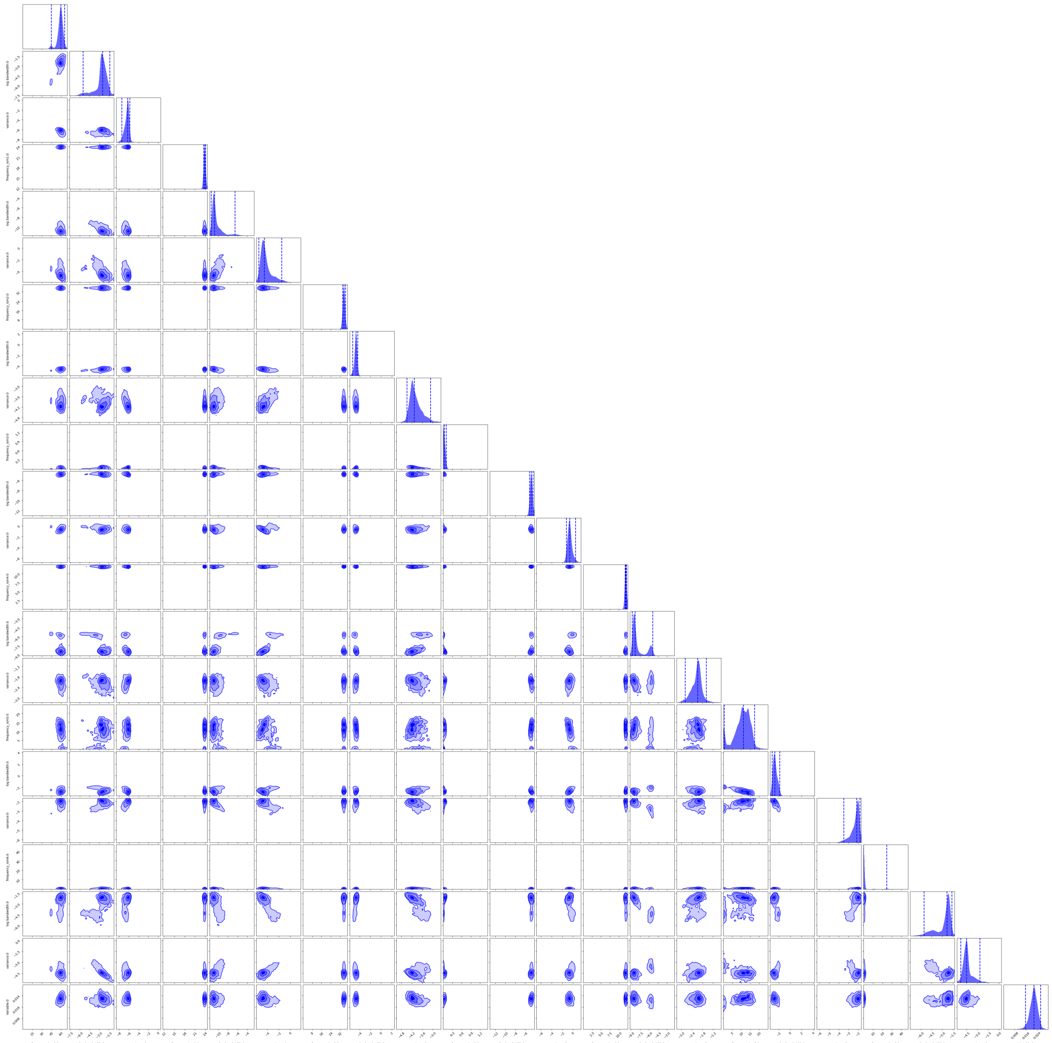

Figure 5: Joint posterior distributions for the 22 hyperparameters associated with Figure 4.

for a 7 component spectral mixture kernel. The hyperparameter n denotes the noise standard deviation σ_n.

Airline

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	5.441	12.788	0.003	27.993	4.533	10.0
mu[1]	0.375	0.554	0.002	1.155	0.05	23.0
mu[2]	14.32	0.178	14.036	14.683	0.046	27.0
mu[3]	2.749	7.062	0.033	25.552	2.913	12.0
mu[4]	6.939	0.151	6.701	7.211	0.033	22.0
mu[5]	0.596	1.298	0.02	1.797	0.137	42.0
mu[6]	1.252	6.518	0.003	2.238	0.826	51.0
bw[0]	0.69	5.153	0.002	1.213	0.256	58.0
bw[1]	1.309	9.737	0.003	1.269	0.976	239.0
bw[2]	0.125	0.111	0.003	0.351	0.014	15.0
bw[3]	1.236	3.694	0.014	3.213	0.314	8.0
bw[4]	0.177	0.092	0.027	0.309	0.021	22.0
bw[5]	0.459	0.685	0.004	1.313	0.072	42.0
bw[6]	6.0	25.438	0.003	29.574	5.349	12.0
w[0]	0.829	2.259	0.001	3.031	0.436	3.0
w[1]	1.815	6.441	0.009	5.089	0.352	38.0
w[2]	0.202	0.4	0.009	0.575	0.041	20.0
w[3]	1.084	3.843	0.002	4.105	0.366	9.0
w[4]	1.223	7.289	0.048	2.011	0.627	245.0
w[5]	3.423	6.384	0.008	17.871	1.976	15.0
w[6]	1.929	3.752	0.002	9.162	0.993	5.0
n	0.155	0.035	0.088	0.211	0.008	27.0

Solar

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	1.203	2.736	0.001	3.387	0.288	142.0
mu[1]	4.683	8.516	0.003	22.88	2.765	11.0
mu[2]	2.105	4.909	0.006	7.927	0.555	135.0
mu[3]	2.275	5.065	0.002	8.911	1.148	33.0
mu[4]	1.746	3.948	0.001	4.9	0.738	125.0
mu[5]	1.812	4.58	0.002	4.037	0.695	127.0
mu[6]	23.475	1.726	20.725	27.323	0.28	61.0
bw[0]	1.897	6.4	0.005	3.111	0.649	96.0
bw[1]	3.812	8.317	0.001	25.13	1.349	26.0
bw[2]	7.012	19.894	0.007	29.453	5.351	11.0
bw[3]	9.663	14.208	0.002	32.005	9.512	3.0
bw[4]	6.376	12.311	0.005	29.365	4.035	16.0
bw[5]	1.265	2.48	0.001	3.064	0.324	120.0
bw[6]	4.002	3.254	0.768	9.662	0.689	25.0
w[0]	0.572	1.021	0.002	1.874	0.062	144.0
w[1]	0.67	1.459	0.001	2.286	0.148	111.0
w[2]	0.354	0.653	0.0	1.318	0.043	80.0
w[3]	0.467	0.911	0.004	1.877	0.138	83.0
w[4]	0.617	2.012	0.002	1.634	0.133	28.0
w[5]	0.738	2.445	0.0	2.079	0.112	197.0
w[6]	0.166	0.07	0.066	0.32	0.008	48.0
n	0.226	0.027	0.182	0.273	0.004	43.0

Mauna

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	0.323	0.638	0.003	0.819	0.07	270.0
mu[1]	0.259	0.271	0.005	0.675	0.018	254.0
mu[2]	0.264	0.232	0.002	0.718	0.011	298.0
mu[3]	0.247	0.263	0.0	0.685	0.012	429.0
mu[4]	0.257	0.255	0.003	0.722	0.011	440.0
mu[5]	0.269	0.272	0.0	0.765	0.013	440.0
mu[6]	0.245	0.212	0.003	0.639	0.009	363.0
bw[0]	0.185	0.218	0.004	0.534	0.01	528.0
bw[1]	0.196	0.282	0.0	0.473	0.016	360.0
bw[2]	0.172	0.166	0.002	0.478	0.007	376.0
bw[3]	0.183	0.232	0.001	0.522	0.01	531.0
bw[4]	0.18	0.197	0.001	0.535	0.009	309.0
bw[5]	0.171	0.15	0.002	0.452	0.007	467.0
bw[6]	0.179	0.175	0.002	0.477	0.008	420.0
w[0]	1.532	3.161	0.001	6.289	0.166	278.0
w[1]	1.269	2.35	0.0	5.433	0.109	346.0
w[2]	1.38	3.057	0.001	5.211	0.198	406.0
w[3]	2.197	8.752	0.001	7.209	0.41	470.0
w[4]	1.878	5.825	0.002	6.786	0.297	496.0
w[5]	1.568	4.4	0.002	5.362	0.21	478.0
w[6]	1.517	3.262	0.0	6.029	0.138	421.0
n	0.219	0.009	0.203	0.237	0.0	463.0

Wheat

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	4.383	9.584	0.002	23.762	1.981	35.0
mu[1]	3.528	5.881	0.002	14.145	1.43	26.0
mu[2]	4.223	6.242	0.002	16.112	1.321	48.0
mu[3]	2.584	5.283	0.001	14.086	1.306	83.0
mu[4]	2.262	4.318	0.002	13.331	1.41	29.0
mu[5]	1.556	3.831	0.002	5.861	0.346	188.0
mu[6]	2.844	4.772	0.006	13.514	2.003	14.0
bw[0]	13.452	17.514	0.002	42.654	10.143	3.0
bw[1]	6.74	12.879	0.006	34.173	3.169	38.0
bw[2]	8.622	42.731	0.003	33.009	3.253	56.0
bw[3]	6.486	13.446	0.004	34.901	2.667	33.0
bw[4]	1.689	5.909	0.002	3.659	0.573	119.0
bw[5]	12.765	17.856	0.001	40.11	11.495	3.0
bw[6]	2.688	7.035	0.004	13.883	0.804	110.0
w[0]	0.444	1.161	0.001	1.848	0.139	67.0
w[1]	0.657	2.901	0.001	2.495	0.133	135.0
w[2]	0.625	1.675	0.002	2.855	0.1	179.0
w[3]	0.397	0.868	0.0	1.3	0.111	61.0
w[4]	0.771	2.275	0.004	2.92	0.126	236.0
w[5]	0.708	2.032	0.002	2.381	0.155	107.0
w[6]	0.838	2.728	0.002	3.272	0.157	136.0
n	0.129	0.053	0.021	0.199	0.006	92.0

Temperature

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	3.109	6.892	0.005	11.861	0.989	5.0
mu[1]	2.38	4.257	0.004	11.02	0.576	43.0
mu[2]	5.926	0.072	5.772	6.045	0.007	89.0
mu[3]	4.169	13.09	0.007	11.535	0.759	43.0
mu[4]	16.579	24.229	0.049	65.489	16.668	4.0
mu[5]	5.897	9.641	0.036	11.901	2.623	4.0
mu[6]	4.71	10.925	0.005	11.537	2.075	17.0
bw[0]	14.533	35.555	0.014	91.228	14.155	2.0
bw[1]	8.093	19.723	0.002	45.652	2.39	29.0
bw[2]	0.056	0.064	0.002	0.173	0.029	3.0
bw[3]	374.1	56.544	265.853	439.078	30.709	4.0
bw[4]	28.195	101.687	0.035	92.316	10.997	3.0
bw[5]	7.815	25.062	0.008	43.333	3.286	4.0
bw[6]	5.504	18.456	0.003	18.906	1.731	29.0
w[0]	0.097	0.279	0.001	0.224	0.022	29.0
w[1]	0.168	0.58	0.002	0.42	0.039	43.0
w[2]	1.026	1.325	0.146	2.456	0.158	51.0
w[3]	0.338	0.037	0.258	0.404	0.004	93.0
w[4]	0.11	0.234	0.002	0.342	0.016	74.0
w[5]	0.16	0.462	0.001	0.533	0.036	30.0
w[6]	0.234	0.618	0.001	1.037	0.075	51.0
n	0.128	0.116	0.003	0.325	0.069	9.0

Internet

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	41.251	0.164	40.951	41.573	0.007	499.0
mu[1]	1.77	2.182	0.004	5.986	0.473	34.0
mu[2]	171.99	10.505	157.377	188.833	9.412	1.0
mu[3]	6.61	11.249	0.003	35.521	3.684	27.0
mu[4]	1.641	3.151	0.002	6.501	0.344	71.0
mu[5]	82.101	0.797	79.981	83.175	0.311	13.0
mu[6]	46.981	0.219	46.621	47.455	0.014	364.0
bw[0]	0.316	0.102	0.161	0.52	0.006	292.0
bw[1]	2.425	2.307	0.008	6.059	0.381	38.0
bw[2]	31.925	9.213	17.522	48.392	7.874	2.0
bw[3]	36.062	10.448	12.062	48.814	9.154	1.0
bw[4]	2.481	4.185	0.002	6.395	1.324	9.0
bw[5]	1.794	1.53	0.096	4.191	1.465	1.0
bw[6]	0.215	0.413	0.005	0.478	0.04	182.0
w[0]	0.573	0.708	0.052	1.85	0.065	257.0
w[1]	0.685	1.551	0.023	1.712	0.112	80.0
w[2]	0.009	0.002	0.006	0.012	0.001	2.0
w[3]	0.116	0.027	0.063	0.165	0.004	44.0
w[4]	0.752	1.515	0.015	2.814	0.096	75.0
w[5]	0.098	0.121	0.016	0.26	0.034	125.0
w[6]	0.198	0.408	0.007	0.529	0.025	359.0
n	0.051	0.004	0.045	0.059	0.001	24.0

Call centre

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	5.997	7.882	0.005	17.992	3.029	11.0
mu[1]	2.364	3.009	0.004	9.135	1.19	5.0
mu[2]	4.539	4.103	0.007	9.503	1.899	11.0
mu[3]	1.236	2.341	0.003	3.874	0.285	64.0
mu[4]	21.956	10.027	0.14	27.02	5.682	7.0
mu[5]	1.139	1.933	0.001	3.801	0.403	34.0
mu[6]	0.707	1.614	0.005	2.178	0.168	33.0
bw[0]	2.164	5.396	0.002	9.925	0.537	22.0
bw[1]	1.591	2.024	0.001	6.096	0.801	18.0
bw[2]	3.397	6.896	0.006	19.817	3.386	11.0
bw[3]	4.497	8.251	0.002	20.325	1.67	22.0
bw[4]	1.351	5.237	0.001	3.323	1.416	4.0
bw[5]	0.934	1.577	0.002	3.587	0.319	22.0
bw[6]	4.642	10.421	0.003	28.471	2.406	30.0
w[0]	0.6	4.572	0.001	2.309	0.226	19.0
w[1]	0.565	1.936	0.001	1.916	0.257	25.0
w[2]	0.368	0.958	0.003	1.844	0.103	21.0
w[3]	0.949	3.11	0.004	4.606	0.315	22.0
w[4]	0.188	0.828	0.003	0.435	0.075	19.0
w[5]	0.817	1.771	0.001	3.043	0.159	21.0
w[6]	1.592	5.663	0.004	5.312	0.558	31.0
n	0.104	0.037	0.028	0.155	0.007	32.0

Radio

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	2.133	4.166	0.004	9.105	0.505	132.0
mu[1]	35.677	0.329	35.074	36.331	0.014	544.0
mu[2]	1.206	2.126	0.004	2.306	0.189	259.0
mu[3]	2.261	4.327	0.006	10.189	0.635	61.0
mu[4]	24.16	0.936	22.76	26.284	0.099	119.0
mu[5]	11.856	0.322	11.308	12.461	0.025	242.0
mu[6]	4.822	14.166	0.003	23.511	2.629	28.0
bw[0]	3.814	8.143	0.001	22.917	1.724	42.0
bw[1]	0.312	0.356	0.001	0.935	0.024	225.0
bw[2]	12.055	201.131	0.004	23.783	9.925	25.0
bw[3]	7.647	11.432	0.004	31.073	5.255	7.0
bw[4]	1.571	1.582	0.002	3.603	0.29	46.0
bw[5]	0.644	0.211	0.303	1.099	0.014	309.0
bw[6]	7.423	15.978	0.005	32.507	3.135	15.0
w[0]	0.605	1.691	0.0	1.91	0.088	61.0
w[1]	0.068	0.219	0.003	0.191	0.013	264.0
w[2]	0.525	0.908	0.002	1.795	0.047	51.0
w[3]	0.513	1.382	0.002	1.744	0.11	44.0
w[4]	0.065	0.09	0.004	0.152	0.006	299.0
w[5]	0.418	0.367	0.096	0.944	0.024	320.0
w[6]	0.512	1.849	0.001	1.943	0.13	10.0
n	0.127	0.045	0.01	0.179	0.015	10.0

Gas Production

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	0.42	0.436	0.001	1.189	0.023	259.0
mu[1]	3.401	8.313	0.003	15.849	1.277	4.0
mu[2]	0.59	0.973	0.005	1.684	0.067	243.0
mu[3]	0.497	0.638	0.006	1.403	0.043	239.0
mu[4]	0.627	0.909	0.009	2.232	0.117	77.0
mu[5]	23.603	0.13	23.338	23.823	0.008	254.0
mu[6]	0.445	0.56	0.001	1.423	0.051	89.0
bw[0]	0.417	0.697	0.002	1.22	0.08	179.0
bw[1]	44.173	34.247	0.012	80.13	30.245	2.0
bw[2]	1.262	1.578	0.008	4.241	0.346	32.0
bw[3]	0.864	1.164	0.002	3.511	0.218	35.0
bw[4]	1.241	1.535	0.004	4.415	0.426	19.0
bw[5]	0.304	0.076	0.152	0.43	0.006	161.0
bw[6]	0.648	0.985	0.009	2.929	0.162	52.0
w[0]	1.831	8.71	0.001	4.979	0.424	231.0
w[1]	0.467	1.844	0.001	2.03	0.506	4.0
w[2]	1.365	6.084	0.001	4.867	0.379	41.0
w[3]	0.967	2.627	0.001	3.494	0.152	62.0
w[4]	0.901	2.221	0.001	3.711	0.116	23.0
w[5]	0.301	0.28	0.036	0.901	0.025	103.0
w[6]	1.111	2.54	0.002	4.1	0.134	82.0
n	0.029	0.025	0.002	0.061	0.023	1.0

Sulphuric

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	1.772	3.57	0.001	5.829	0.382	185.0
mu[1]	1.453	2.574	0.006	5.071	0.154	311.0
mu[2]	22.989	0.348	22.328	23.562	0.024	225.0
mu[3]	1.411	2.556	0.0	4.972	0.148	207.0
mu[4]	4.033	7.702	0.003	18.205	0.484	303.0
mu[5]	1.525	3.802	0.001	5.29	0.199	346.0
mu[6]	1.543	2.66	0.004	5.067	0.197	203.0
bw[0]	5.62	20.395	0.005	27.175	1.676	148.0
bw[1]	2.885	8.916	0.004	7.272	0.451	278.0
bw[2]	0.347	0.357	0.005	0.956	0.022	246.0
bw[3]	3.312	10.408	0.003	7.598	0.856	180.0
bw[4]	47.825	8.657	31.747	60.9	0.717	148.0
bw[5]	3.491	11.531	0.005	7.831	0.714	154.0
bw[6]	2.584	6.788	0.001	6.768	0.558	224.0
w[0]	0.482	0.956	0.001	1.774	0.048	200.0
w[1]	0.463	0.753	0.001	1.808	0.041	208.0
w[2]	0.245	0.427	0.007	0.978	0.031	215.0
w[3]	0.473	0.847	0.002	1.484	0.042	293.0
w[4]	0.14	0.033	0.082	0.206	0.003	147.0
w[5]	0.462	0.808	0.002	1.587	0.041	286.0
w[6]	0.583	1.186	0.003	1.912	0.099	195.0
n	0.154	0.067	0.026	0.247	0.006	120.0

Unemployment

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	58.239	12.011	60.011	61.384	3.346	90.0
mu[1]	0.705	0.34	0.154	1.395	0.173	3.0
mu[2]	1.142	1.295	0.168	4.885	0.391	14.0
mu[3]	0.755	0.913	0.292	1.064	0.143	12.0
mu[4]	0.227	0.433	0.051	0.554	0.151	1.0
mu[5]	40.609	0.062	40.482	40.71	0.031	5.0
mu[6]	20.163	0.193	19.775	20.467	0.016	145.0
bw[0]	0.408	0.643	0.129	0.673	0.071	11.0
bw[1]	26.706	33.094	0.035	128.937	17.066	3.0
bw[2]	5.543	2.269	1.766	9.23	0.881	7.0
bw[3]	0.321	0.675	0.017	0.458	0.156	6.0
bw[4]	2.36	1.738	0.024	5.186	1.003	3.0
bw[5]	0.039	0.031	0.014	0.085	0.008	8.0
bw[6]	0.444	0.15	0.224	0.691	0.101	3.0
w[0]	0.147	0.157	0.018	0.516	0.077	3.0
w[1]	0.009	0.067	0.0	0.004	0.011	7.0
w[2]	0.14	0.078	0.048	0.265	0.035	5.0
w[3]	0.659	0.267	0.226	1.158	0.074	14.0
w[4]	0.046	0.054	0.009	0.098	0.014	11.0
w[5]	0.697	0.424	0.274	1.544	0.147	9.0
w[6]	0.142	0.103	0.076	0.452	0.028	9.0
n	0.332	0.023	0.311	0.373	0.015	3.0

Wages

Hyperparameter	mean	sd	hpd_2.5	hpd_97.5	mc_error	n_eff
mu[0]	1.542	4.166	0.005	5.093	0.421	252.0
mu[1]	1.22	1.94	0.003	4.967	0.142	144.0
mu[2]	3.257	7.751	0.001	12.743	0.503	167.0
mu[3]	1.156	2.102	0.003	4.076	0.13	317.0
mu[4]	1.247	2.158	0.002	4.449	0.145	304.0
mu[5]	1.019	2.277	0.006	2.733	0.127	165.0
mu[6]	1.333	4.205	0.002	3.371	0.231	367.0
bw[0]	18.312	37.535	0.007	63.801	20.519	3.0
bw[1]	6.334	16.083	0.002	53.011	2.865	60.0
bw[2]	37.885	35.134	0.001	81.245	11.687	12.0
bw[3]	4.097	12.883	0.002	13.988	1.195	168.0
bw[4]	6.489	16.944	0.001	56.899	4.051	42.0
bw[5]	2.811	8.865	0.005	8.177	0.961	153.0
bw[6]	8.981	28.072	0.001	60.48	4.561	74.0
w[0]	0.523	1.176	0.004	2.09	0.173	142.0
w[1]	0.635	1.554	0.0	2.563	0.101	106.0
w[2]	0.433	1.163	0.004	1.467	0.086	172.0
w[3]	1.19	9.678	0.001	1.985	0.437	241.0
w[4]	0.565	1.152	0.004	2.121	0.06	230.0
w[5]	0.67	1.739	0.002	2.758	0.09	262.0
w[6]	0.967	4.25	0.001	2.997	0.205	261.0
n	0.15	0.032	0.083	0.197	0.005	72.0