Comparing MSM using TCN moments and typical MSM moments

100 samples were generated from the model using as true parameter values those in column 1 of Table 6, the posterior means for the first sample period.

We compare the Bayesian MSM estimator using as moments the TCN fitted parameters, exactly as described in Section 5.4.2, with a more standard approach to MSM, using a vector of sample moments, instead of the TCN fitted parameters. For this alternative estimator Equation (6) is replaced with

$$m(\theta) = \hat{Z} - \frac{1}{S}\sum_{s=1}^{S} \hat{Z}^s(\theta),$$

where $\hat{Z}$ is a vector of sample moments, and $\hat{Z}^s(\theta)$ is a vector of the same moments, using a sample simulated at θ. The vector of sample moments has 12 elements, and includes means, standard deviations and first order autocorrelations for each of the 3 variables generated by the model, as well as the 3 correlations between pairs of variables. This choice of sample moments is intended to be representative of a «plain vanilla» version of the method of simulated moments. This estimator is overidentified, while the MSM estimator based on the TCN moments is exactly identified.

We used the same proposal density for the two versions, for each of the 100 replications. This was the multivariate normal random walk proposal as defined in Section 5.4.2. The proposal covariance, Σ_p, was computed as the sample covariance of the TCN fitted parameters for 1000 independent samples from the model, each drawn at the true parameter vector. This is a favorable proposal density, that leads to good mixing and a good acceptance rate. It is simple to construct this proposal when using the TCN estimator. It would be more difficult to arrive at a similarly good proposal if one were working only with the plain vanilla MSM estimator, because one would lack a reliable initial estimate to use to sample draws to compute the covariance.

We computed MCMC chains of length 200 (after a burn-in period) for each of the 100 samples, and for each chain, we use the posterior mean as a point estimator. The procedure led to an average acceptance rate of 27% for the TCN version and 25% for the vanilla version. This good acceptance rate, and the fact that we are only interested in the posterior mean as a point estimate, rather than tail behavior, is the reason that we used relatively short chains of length 200.

The results are in the following table. In general, the two estimators have similar bias. RMSE is lower for the estimator that uses the TCN moments. On average, RMSE of the TCN based estimator is 73% that of the vanilla based estimator. In this experiment, the TCN based moments lead to relatively efficient estimation.

parameter	Vanilla Moments		TCN moments	
	bias	rmse	bias	rmse
μ	0.003	0.015	-0.002	0.011
κ	0.001	0.021	0.005	0.018
α	-0.072	0.212	0.023	0.142
σ	0.021	0.077	0.005	0.057
ρ	-0.008	0.047	0.006	0.032
λ_0	0.004	0.006	0.002	0.005
λ_1	0.325	0.800	0.065	0.636
τ	0.000	0.001	-0.000	0.001