

AppendixA. Parameter Estimation for the TVP-SV-VAR Model

We set the TVP-SV-VAR prior specification as:

$$\begin{aligned}(\Sigma_\beta)_i^{-2} &\sim \text{Gamma}(40, 0.02), \\(\Sigma_a)_i^{-2} &\sim \text{Gamma}(4, 0.02), \\(\Sigma_h)_i^{-2} &\sim \text{Gamma}(4, 0.02),\end{aligned}$$

where Gamma denotes the Gamma distribution, $(\Sigma_\beta)_i^{-2}$, $(\Sigma_a)_i^{-2}$, and $(\Sigma_h)_i^{-2}$ denote the i -th diagonal element of the matrices. To avoid “over parameterization” in the time-varying model, we set the lag order of the model to 1.

The Markov Chain Monte Carlo (MCMC) procedure was run for 10,000 iterations, with the initial 1,000 samples discarded as burn-in to mitigate the influence of starting values. As we can see in Table 1, all Geweke statistics fall below the critical value of 1.96 at the 5% significance level, failing to reject the null hypothesis that the parameter converges to the posterior distribution. This indicates that the burn-in period sufficiently centralizes the Markov chains. The maximum inefficiency factor across parameter estimates is 86.33, being below commonly accepted thresholds (100). This satisfies posterior statistical requirements and confirms that posterior means approximate true parameter values, validating the estimation results.

Table 1: Parameter Estimation for the TVP-SV-VAR Model

Parameter	Mean	Stdev	95% Confidence Interval	Geweke Statistic	Inefficiency Factor
s_{b1}	0.0221	0.0012	[0.0199, 0.0247]	0.043	4.570
s_{b2}	0.0223	0.0012	[0.0200, 0.0248]	0.780	6.870
s_{a1}	0.0504	0.0076	[0.0377, 0.0670]	0.611	42.100
s_{h1}	0.1280	0.0299	[0.0795, 0.1992]	0.202	86.330
s_{h2}	0.0785	0.0169	[0.0518, 0.1177]	0.006	78.120

s_{bi} , s_{aj} , s_{hk} ($i, j, k = 1, 2$) denote the i -th, j -th, and k -th diagonal elements of Σ_β , Σ_a and Σ_h respectively.

Figure 1 displays autocorrelation coefficients, trace plots, and posterior density distributions. Autocorrelation coefficients decay rapidly to zero, indicating elimination of

sample autocorrelation after iterative sampling. Trace plots exhibit white noise-like fluctuations around posterior means, demonstrating strong serial independence. Posterior density distributions confirm stable parameter estimation.

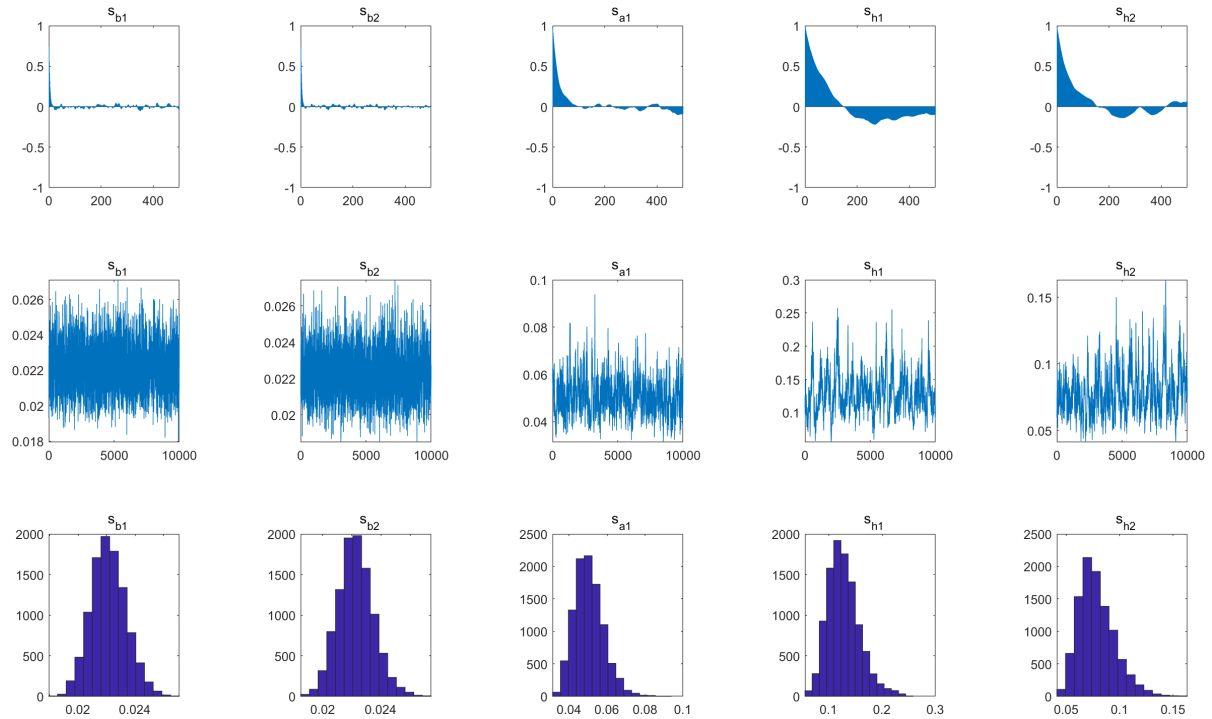


Figure 1: Parameter Estimation for the TVP-SV-VAR Model

The combined evidence from Table 1 and Figure 1 confirms the effectiveness of MCMC and establishes the reliable parameter estimation for TVP-SV-VAR model in subsequent analyses.