

R exercises: week 5

FINANCIAL ECONOMETRICS

2024-2025

Paolo Gorgi



CHAPTER 9 and 10: Univariate and Multivariate SV model

1. Inspect carefully the R file `Simulate_SV.R`, which contains code to simulate from the SV model. Then do the following:
 - Generate a time series of length $T = 3000$ from an SV model with parameters $(\omega, \beta, \sigma_\eta^2) = (0, 0.8, 0.2)$. Plot the ACF and PACF of the squared series y_t^2 . Comment on the results.
 - Generate a time series of length $T = 3000$ from an SV model with parameters $(\omega, \beta, \sigma_\eta^2) = (0, 0, 0.2)$. Plot the ACF and PACF of the squared series y_t^2 . Comment on the results. Is there autocorrelation on y_t^2 ? Why?
 - Generate a time series of length $T = 3000$ from an SV model with parameters $(\omega, \beta, \sigma_\eta^2) = (0, 0.8, 0)$. Plot the ACF and PACF of the squared series y_t^2 . Comment on the results. Is there autocorrelation on y_t^2 ? Why?
2. Write R code to generate from an SV-MA(1) model. Generate a time series of length $T = 3000$ with parameters $(\omega, \alpha_1, \sigma_\eta^2) = (0, 0.5, 0.2)$. Plot the generated series as well as the ACF and PACF of the squared observations y_t^2 . How many lags are significant? Comment on the results.
3. Write R code to generate from an SV-ARMA(1,1) model. Generate a time series of length $T = 3000$ with parameters $(\omega, \beta_1, \alpha_1, \sigma_\eta^2) = (0, 0.9, 0.4, 0.2)$. Plot the generated series as well as the ACF and PACF of the squared observations y_t^2 . Comment on the results.
4. Inspect carefully the R file `Simulate_multivariate_SV.R`, which contains code to generate from a bivariate SV model. Then do the following:
 - Generate a time series of length $T = 3000$ from the bivariate SV model setting the correlation ρ_{12} to zero. Plot the stochastic variances, covariance and correlation. Comment on the results.
 - Generate a time series of length $T = 3000$ from the bivariate SV model setting the correlation ρ_{12} to 0.99. Plot the stochastic variances, covariance and correlation. Comment on the results.

CHAPTER 12: Estimation of the SV model

1. Inspect carefully the R file `estimate_SV_II.R`, which contains code to estimate the SV model by indirect inference¹. Then do the following:
 - Estimate the SV model by indirect inference for the weekly log-returns of IBM from 2000 to 2017. Obtain the filtered volatility.
 - Add also the second lag autocorrelation of $|y_t|$ as auxiliary statistic for the indirect inference estimator. Obtain the parameter estimate and the filtered volatility for the series in the previous question. Comment the results.

¹See also the Lecture Notes for a detailed explanation of the code