

Exercise 2

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1. (a) Open the file `simulations.xlsx`. The sheet “White Noise” simulates $T = 1000$ observations from a (Gaussian) white noise process; i.e., 1000 uncorrelated mean-zero normals. By repeatedly pressing `F9`, you can draw new random numbers. Describe your observations.
(b) Similarly, the sheet “Random Walk” simulates $T = 1000$ observations from a (Gaussian) random walk. Describe your observations.
2. (a) Open the file `sp500.wp1`. Generate a new series `logsp500` containing the log prices, and a series `r` containing the continuously compounded returns. Make a time series plot for each, and a histogram of the returns. Describe your findings.
(b) Use the skewness and kurtosis given in the histogram to manually conduct a Jarque-Bera test.
(c) Generate a correlogram of the returns and interpret it.
(d) Test whether the first 10 autocorrelations are jointly significant at the 5% level.
(e) Generate a correlogram of the log prices and interpret it.
3. (a) Show that for the random walk $Y_t = Y_{t-1} + U_t$, where U_t is white noise and Y_0 some constant,

$$Y_t = Y_0 + U_1 + U_2 + \cdots + U_t = Y_0 + \sum_{s=1}^t U_s.$$

- (b) Building on the result from the previous question, show that

$$\mathbb{E}[Y_t] = Y_0, \quad \text{and} \\ \text{var}(Y_t) = \sigma^2 t.$$