FINM3133 Time Series for Finance and Macroeconomics: Quiz 2

Date: 18 May 2025

Time allowed: 60 minutes   **Full mark: 100**

1. (44 points) The following series $\{Y_t\}$ is supposed to be Swedish krone (SEK) to the US dollar (USD) exchange rate (SEK/100$) over a period of 20 weeks. Each number in the table shows the average exchange rate of the corresponding week.

Week no.	1	2	3	4	5	6	7	8	9	10
SEK/100$	1084	1052	1028	1035	1013	1029	998	980	976	967
Week no.	11	12	13	14	15	16	17	18	19	20
SEK/100$	955	934	922	949	956	940	942	919	906	885

   (a) (10 points) Sketch the time series. Is the time series stationary?

   (b) (10 points) Find a transformation that gives an acceptable stationary time series and sketch the generated time series X_t.

   (c) (12 points) Based on the information in the following table (γ_k denotes the sample covariance of $\{X_t\}$ at lag k), estimate the autocorrelation function (lags 0 to 5) for $\{X_t\}$.

k	0	1	2	3	4	5
γ_k	241.7	-27.2	-6.7	-21.1	-39.3	37.5

   (d) (12 points) Based on the estimated autocorrelation function and the following sample partial autocorrelations of $\{X_t\}$, establish an ARIMA model for the exchange rate. (*Hint:* Let $n^{-1/2}$ be the approximate standard errors of both the sample autocorrelation and partial autocorrelation coefficients.)

k	2	3	4	5
$\hat{\phi}_{kk}$	0.20	-0.16	-0.02	0.06

2. (32 points) To which category of ARIMA(p, d, q) does each of the following process belong? Are they stationary/invertible? Why?

   (a) (16 points) $Y_t = 10 + 2Y_{t-1} - Y_{t-2} + e_t - 0.7e_{t-1}$

   (b) (16 points) $Y_t = 5 + 2Y_{t-1} - 1.5Y_{t-2} + 0.5Y_{t-3} + e_t - 0.4e_{t-1} + 0.03e_{t-2}$

3. (24 points) Suppose $\{e_t\}$ is a zero-mean white noise process with variance σ_e^2. Consider a stationary ARMA(1,2) model $Y_t = \phi Y_{t-1} + e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2}$ with $E(Y_t) = 0$, where e_t is independent of $\{Y_{t-1}, Y_{t-2}, \ldots\}$. Find the autocorrelation function ρ_1 for $\{Y_t\}$.