

TP 9

ACF, PACF and ARMA Models

This TP shows techniques to estimate the parameters of a conditional mean model such as examining the ACF and PACF, as well as the Ljung-Box Q-test. The goal is to select the simplest model that adequately describes your data.

Theory

Complete the following sentences that will help you solve the problem set.

- If the dies off more or less geometrically with increasing lag number, it is a sign that the series obeys a AR process.
- If the dies off more or less geometrically with increasing lag number, it is a sign that the series obeys a MA process.
- If the drops to zero after a small number of lags q , it is a sign that the series obeys a $MA(q)$ process.
- If the drops to zero after a small number of lags p , it is a sign that the series obeys a $AR(p)$ process.
- If we see no geometric decrease neither in the ACF nor in the PACF, but that there is at least one non zero coefficient, it is a sign that the process

Preestimation Analysis on Simulated Data

Given the correlograms and partial correlograms below, estimate the value of p and q for ARMA models that would best correspond to the two simulated series. (The horizontal lines correspond to 5% confidence bounds.)

ARMA Representation and Stocks

Use the stock price series provided in the files *TP9.xls* and *TP9.mat*.

1. Plot and comment the sample ACF and PACF for Coca-Cola and Credit Suisse. (Use the Matlab functions *parcorr* and *autocorr*.)
2. Repeat point 1. on the first differences of the log-prices (i.e. the logarithmic returns).

3. You can quantify the preceding qualitative checks for correlation with a formal hypothesis test. Using the Ljung-Box-Pierce Q-test, test the presence of correlation in the returns for up to 20 lags at the 0.05 level of significance. (Use the Matlab function *lbqtest*.)
4. Estimate the coefficients of an $AR(p)$ for Credit Suisse by OLS. Remark: you should have noticed that there is no clear pattern that would reject an MA representation. However, for simplicity you are not asked to estimate an $ARMA(p,q)$ which would involve maximum likelihood.
5. Check that the residuals of your estimated model are white noise with the Ljung-Box test.



