

First test in Macro-econometrics

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1. Stationarity.[12 points]

- (a) What conditions does a process (X_t) have to fulfill in order to be covariance-stationary?
- (b) What is a white noise? Is the white noise covariance-stationary? In this and the following question: if the answer is yes, show that all conditions from (a) hold; if the answer is no, motivate which condition does not hold.
- (c) What is a random walk? Is the random walk covariance-stationary?
- (d) What is a first-order moving-average process? Is the MA(1) process stationary?

2. For the following ARMA(1,1) processes, provide the characteristic polynomials $\phi(z)$ and $\theta(z)$, and check whether they fulfill the conditions for the ARMA(1,1) to be stable (asymptotically stationary):[8 points]

(a) $X_t = 0.5X_{t-1} + \varepsilon_t - 0.5\varepsilon_{t-1}$;

(b) $X_t = 0.5X_{t-1} + \varepsilon_t + 0.5\varepsilon_{t-1}$;

(c) $X_t = X_{t-1} + \varepsilon_t + 0.5\varepsilon_{t-1}$;

(d) $X_t = 2X_{t-1} + \varepsilon_t$.

3. Your computer program does not provide partial autocorrelation functions (PACF) but it can estimate autoregressive models.[6 points]
- (a) Describe how you could retrieve an estimate for the PACF values $\psi_j, j = 1, \dots, p$ for given data (not command syntax, just the idea);
 - (b) If an AR(3) process has generated the data, what pattern do you expect to see in your PACF?

4. You wish to test for unit roots in non-trending data using the Dickey-Fuller test, but you only have access to a software that does not explicitly provide that test, just regression analysis. You also have access to tables of significance points.[9 points]
- (a) In a preliminary lag order search via AIC, you choose an AR(2) model as having the best fit to your data. Indicate the regression that you would have to run now, and also indicate where in the typical regression printout you would find the test statistic that you should compare to your table of significance points.
 - (b) What distinguishes the $DF-\mu$ from the $DF-\tau$ test?
 - (c) Given that the DF -test does not reject, what is your conclusion concerning the generating process for your data?