ECOM073 Midterm test

Wednesday, 31 March, 9:00am-10:20am (60 test, 20 min for uploading)

The paper and submission link will be setup in ECOM073 module page inside the Assessments tab on QMPLUS. You can upload the photos /scan of your handwritten work

Midterm 2021

Wednesday, 31 March, 9:00-10:20 am

1) Basic definitions: stationarity, white noise, i.i.d and others
2) Summary statistics: mean, variance, skewness, kurtosis, Jarque Bera test
3) Testing for absence of correlation
4) AR(p), MA(q) models, selection of order p, q
5) Checking the fit of the model
6) Forecasting using AR, MA models
7) IAC and BIC information criterions

Test covers: **Lecture 2-5, Problem Sets 2-5**

Examples for preparation:

Problem Set 2: 2.1

Problem Set 3: 3.1, 3.2,

Problem Set 4: 4.3, 4.5

Problem Set 5: 5.2

See below also Problems of Quizzes 2-5

Mini problems - Quiz 2

Learn, solve, submit, get feedback

Question 1. Analyse the rise and drop of the GameStop share price in January – February 2021.

Which strategies were used by stock market players?

Were they successful?

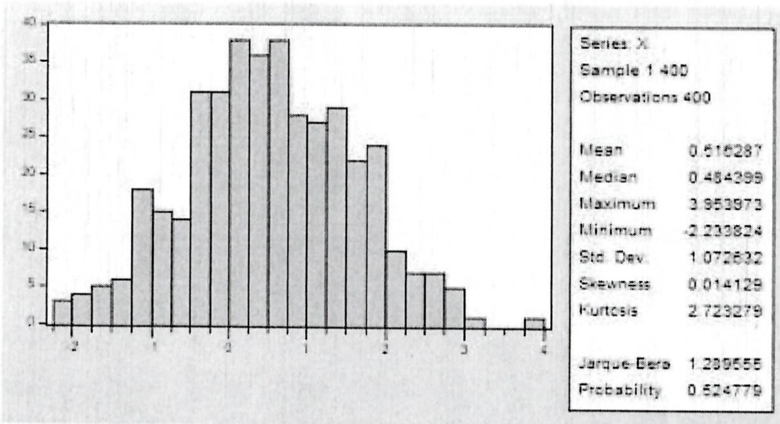
https://www.google.com/search?q=gamestop+share+price&oq=gam&aqs=chrome.0.69i59j69i57j69i59j0i433j46i131i199i291i433j69i61j69i60l2.5247j0j7&sourceid=chrome&ie=UTF-8

Question 2. Define the 1/N Portfolio strategy. Comment on its advantages/disadvantages

Use the note "The magic of equal-weighted portfolios".
https://justusjp.medium.com/the-magic-of-equal-weighted-portfolios-dac58e1e1da0

Question 3. The researcher computed summary statistics of the time series X using a sample containing N = 400 observations, see the output below.

1. Test whether skewness S(X) equals 0
2. Test whether kurtosis K(X) equals 3
3. Test whether X has normal distribution



1. How to test $H_0: S(X) = 0$ against $H_1: S(X) \neq 0$
2. How to test $H_0: K(X) = 3$ against $H_1: K(X) \neq 3$
3. How to use Jarque–Bera test to test whether distribution is normal

Quiz 3: mini problems 1,2,3

Question 1. a) Suppose that

$$X_t = \varepsilon_t + t, \quad t = 1, 2, ...$$

where ε_t is a white noise sequence with zero mean and variance $E\varepsilon_t^2 = 1$. Investigate whether time series X_t is covariance stationary.

b) Suppose that

$$X_t = t\varepsilon_t, \quad t = 1, 2, ...$$

where ε_t is a white noise sequence with zero mean and variance $E\varepsilon_t^2 = 1$. Investigate whether time series X_t is covariance stationary.

Question 2. Explain why the following sequence

$$\rho_1 = 0.8, \quad \rho_2 = 0.5, \quad \rho_3 = \rho_1 + \rho_2, \quad \rho_4 = \rho_1 + \rho_2 + \rho_3, ...$$

cannot be the auto-correlation function of a covariance stationary sequence.

A. Note: If X_t covariance stationary, then

- $EX_t = \mu$ for all t
- $Var(X_t) = \sigma^2$ for all t
- $Cov(X_t, X_{t+k}) = \gamma_k$ does not depend on t.

B. Correlation function $\rho_k = \gamma_k / \gamma_0$ has properties:

- $\rho_0 = 1$
- $\rho_k = \rho_{-k}$
- $|\rho_k| \le 1$ for any k.

Question 3. Using the following EVIEWS correlogram of time series X_t, determine whether x_t is a white noise time series.

Correlogram of Y

Date: 29/11/20 Time: 10:53
Sample: 1 400
Included observations: 400

ACF

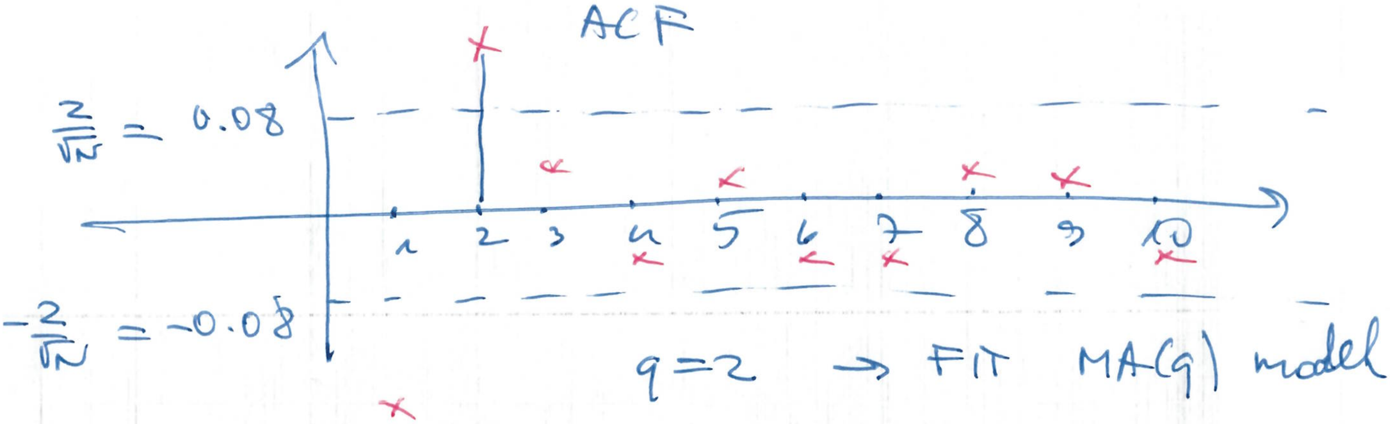
p-value of Ljung Box test

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.023	-0.023	0.2196	0.639
		2	-0.032	-0.033	0.6458	0.724
		3	-0.036	-0.037	1.1600	0.763
		4	-0.057	-0.060	2.4792	0.648
		5	0.050	0.045	3.4877	0.625
		6	-0.076	-0.080	5.8704	0.438
		7	0.067	0.063	7.7087	0.359
		8	-0.009	-0.012	7.7392	0.459
		9	0.012	0.016	7.7940	0.555
		10	-0.041	-0.049	8.4897	0.581

Testing for absence of correlation can be done using two methods:

(1) ACF

(2) Ljung Box test



Quiz 4: mini problems 1,2,3

$N = 625$, $\frac{2}{\sqrt{N}} = 0.08$

Question 1. Using the following EVIEWS correlogram, determine the order q of an $MA(q)$ model you would fit to the data.

Correlogram of Y

Date: 04/10/20 Time: 09:39
Sample: 1 625
Included observations: 625

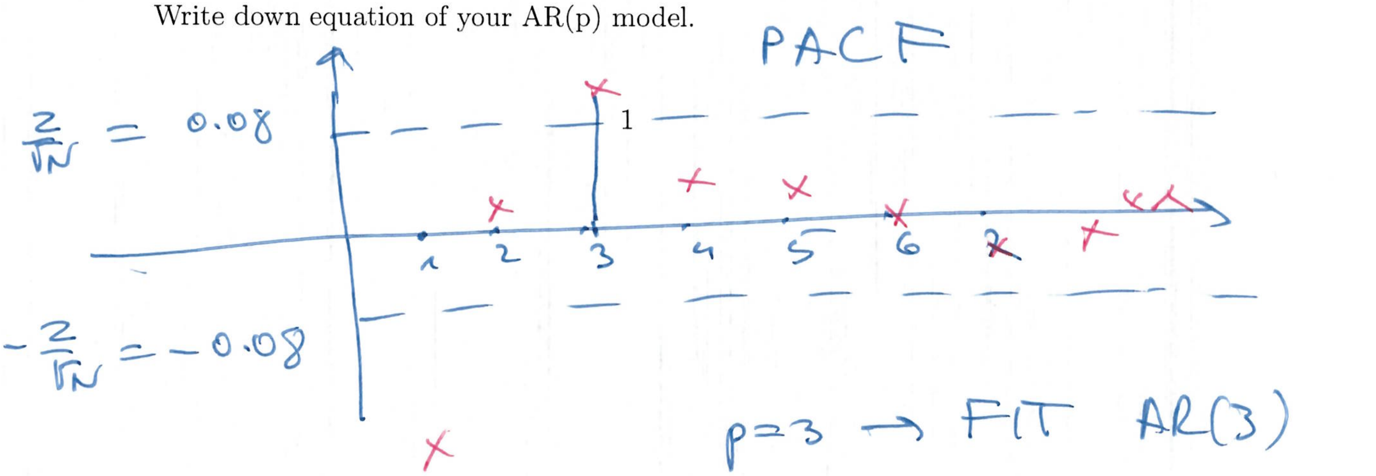
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.487	-0.487	149.22	0.000
		2	0.289	0.067	201.67	0.000
		3	0.012	0.232	201.77	0.000
		4	-0.016	0.074	201.94	0.000
		5	0.062	0.015	204.35	0.000
		6	-0.013	0.000	204.47	0.000
		7	-0.019	-0.051	204.70	0.000
		8	0.039	-0.001	205.68	0.000
		9	0.007	0.059	205.72	0.000
		10	-0.047	-0.033	207.13	0.000

Question 2.

Using AIC information criterion values obtained fitting an AR(p) model, select the order p of an AR model you would fit to the data:

p	0	1	2	3	4	5	6
AIC	3	-2.3	-2	-1.1	0.6	1.7	1.8

Write down equation of your AR(p) model.



Question 3.
Consider an MA(1) time series

$$Y_t = \varepsilon_t + 0.5\varepsilon_{t-1},$$

where ε_t is a white noise sequence with zero mean and variance 1.

- Find $E[Y_t]$ and $Var(Y_t)$.
- Find the auto-covariance function γ_1 and autocorrelation function ρ_1. What is ρ_k for $k \geq 2$?

Quiz 5: mini problems 1, 2, 3

Question 1.

Suppose $X_1, ..., X_t$ is a sample from a stationary MA(1) time series

$$X_t = 0.2X_{t-1} + \varepsilon_t,$$

where ε_t is an i.i.d. sequence with zero mean and variance 1.

- **(a)** Find the 1-step ahead forecast $\hat{X}_t(1)$ of X_{t+1}, the forecast error and the variance of the forecast error.
- **(b)** Find the 2-step ahead forecast $\hat{X}_t(2)$ of X_{t+2}, the forecast error and the variance of the forecast error.
- **(c)** What can you say about the k-step ahead forecast $\hat{X}_t(1)$ this time series?

Question 2.

Suppose $X_1, ..., X_t$ is a sample from a stationary MA(1) time series

$$X_t = 1 + \varepsilon_t - 0.8\varepsilon_{t-1},$$

where ε_t is an i.i.d. sequence with zero mean and variance 1.

- **(a)** Find the 1-step ahead forecast $\hat{X}_t(1)$ of X_{t+1}, the forecast error and the variance of the forecast error.
- **(b)** Find the 2-step ahead forecast $\hat{X}_t(2)$ of X_{t+2}, the forecast error and the variance of the forecast error.
- **(c)** What can you say about the k-step ahead forecast $\hat{X}_t(1)$ this time series?

Question 3.

Consider an AR(1) time series

$$X_t = 1 - 0.4X_{t-1} + \varepsilon_t,$$

where ε_t is a white noise sequence with zero mean and variance σ_ε^2.

- Find $E[X_t]$.
- Given $X_t = 5$, find the 1-step ahead forecast $\hat{X}_t(1)$ of X_{t+1}