5053-hw1 LIU, Liangjie 21094937

1. (a) Compute the first 24 lags of ACF and PACF of the simple return series of Decile 1 portfolio.

ACF: [ 1. 0.22456128 -0.00215612 -0.07622322 -0.02973589 -0.02236116 -0.05065079 -0.0503511 -0.08492762 -0.07922587 -0.00448568 0.07566051 0.26752714 0.01766952 -0.05160729 -0.09218498 -0.02438723 -0.04173056 -0.09113585 -0.08018132 -0.05086801 -0.05762566 -0.04871422 0.05264791 0.24732463]

PACF: [ 1. 0.22506819 -0.05564005 -0.06731191 0.00318794 -0.02068808 -0.05085435 -0.03236082 -0.07657688 -0.05768586 0.01680366 0.06200173 0.24655303 -0.10950884 -0.03024777 -0.05944057 -0.00383516 -0.0492873 -0.07295287 -0.0370297 -0.00110313 -0.05059673 -0.06483611 0.03969557 0.17896128]

(b) Test the hypothesis that the first 12 lags of ACF are zero. That is, H0 : ρ1 = · · · = ρ12 = 0 versus H1 : ρi 6= 0 for some 1 ≤ i ≤ 12. Draw your conclusion.

lb\_stat lb\_pvalue

12 69.652382 3.720227e-10

p-value < 0.05: Reject 𝐻\_0. There is significant evidence that at least one of the first 12 lags are non-zero.

1. (a) Compute the ACF of the simple returns for the first 12 lags.

ACF: [ 1. 0.1366922 -0.06237143 -0.03337735 -0.05910569 -0.0090983 0.00276946 -0.01111476 -0.07820778 -0.02708135 0.04301872 -0.03555275 0.00529402]

(b) Test the hypothesis that all 12 ACFs are zero. That is, H0 : ρ1 =· · · = ρ12 = 0 versus the alternative hypothesis H1 : ρi 6= 0 for some i, 1 ≤ i ≤ 12. Draw your conclusion.

lb\_stat lb\_pvalue

12 16.811541 0.156825

p-value ≥ 0.05: Fail to reject 𝐻\_0. There is not enough evidence to conclude that the first 12 lags have non-zero autocorrelation.

1. (a) Compute the 12 lags of ACF and PACF of ct. Test the null hypothesis that the first 12 lags of ACF are zero. Draw your conclusion.

ACF of c\_t: [1. 0.5834442 0.59637012 0.55793032 0.50079595 0.56627591 0.55148108 0.52988917 0.55545063 0.54580214 0.56355919 0.49762566 0.50298513]

PACF of c\_t: [ 1. 0.58441661 0.39003075 0.21402368 0.07183054 0.22557983 0.16354837 0.0735764 0.12242671 0.11973931 0.12840863 -0.04477735 0.0155138]

lb\_stat lb\_pvalue

12 2186.64584 0.0

Conclusion: p-value=0.0000 < 0.05. Reject H0; there is evidence of autocorrelationwithin the first 12 lags.

(b)ACF of z\_t: [ 1. -0.51552667 0.06183221 0.02222489 -0.14716833 0.09616349 0.00837264 -0.05639724 0.04227394 -0.03310702 0.1004575 -0.08557486 0.04165747]

(c)ct=0.3234+0.9782ct−1+et−0.8160et−1 + 0.0652et−2 − 0.0997et−3 − 0.1061et−4 + 0.1913et−5 , where e\_t is a white noise error term with variance 𝜎\_2= 0.0339

4.(a)

gnp\_growth\_t =0.0168+0.4171gnp\_growth\_t−1 +0.2002gnp\_growth \_t−2 −0.1648gnp\_growth\_t−3 + e\_t , where e\_t is white noise with variance sigma^2 =9.312x10^(-5)

(b)

gnp\_growth\_t = const + phi1 \* gnp\_growth\_{t-1} + phi2 \* gnp\_growth\_{t-2} + phi3 \*gnp\_growth\_{t-3} + e\_t

1 - phi1 \* z - phi2 \* z^2 - phi3 \* z^3 = 0

0.1648\*z^3 - 0.2002\*z^2 - 0.4171\*z + 1 = 0

root： [-1.87108499+0.j 1.54294541+0.92862094j 1.54294541-0.92862094j]

[(1.5429454082989171+0.9286209436386492j), (1.5429454082989171-0.9286209436386492j)]

theta 0.5417783272210729

business cycles（season）： 11.59733601638836

business cycles（year）： 2.89933400409709

(c)

gnp\_growth mean mean\_se

239 0.014008 0.009650

240 0.016122 0.010456

241 0.016661 0.011061

242 0.017088 0.011085

5.(a)

dec9\_t = 0.0109+e\_t +0.1593e\_t−1 where e\_t is a white noise error term with variance 𝜎\_2= 0.0027

(b)YES.

Both the constant and MA(1) coefficients are statistically significant, and the Ljung-Box test (p=0.83) shows no residual autocorrelation. Although the residuals are not normally distributed (JB p=0.00), there is no heteroskedasticity issue (ARCH p≈0.88), so the model is acceptable for point forecasts, with caution advised for interval forecasts.

(c)Forecasts and Standard Errors:

dec9 mean mean\_se

444 0.009026 0.051953

445 0.010896 0.052608

446 0.010896 0.052608

447 0.010896 0.052608