Assignment 3

DUE DATE: Tuesday 2nd, March 2021.

I pledge to the Honor Code and to obey all rules for taking and performing homework assignments as specified by the course instructor.

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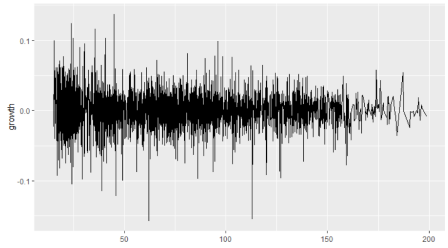
All data are downloadable from BE moodle

1.(30 points) Consider the growth rates of the U.S. real gross domestic product (GDP) from 1947.I to 2012.IV. The original data, from Federal Reserve Bank of St Louis, are in the file q-gdpmc1.txt (year, month, day, gnp), and the GDP are in millions of 2005 chained dollars. The growth rate is the first differenced series of the log(GDP).

(a) Plot the GDP growth rates. The reduction in volatility, starting in the 1980s, is referred to as



(b) Test $H_0 : \rho_1 = ... = \rho_{12} = 0$ versus $H_a : \rho_i \neq 0 \ \exists 1 \leqslant i \leqslant 12$. Draw the conclusion.

- **B.** Box-Ljung test

data: loggdpgroowth
X-squared = 19.749, df = 12, p-value = 0.07198

(c) Let μ be the mean of U.S. GDP growth rates. Test $H_0 : \mu = 0$ versus $H_a : \mu \neq 0$. Draw your conclusion.

- **C.** One Sample t-test

data: loggdpgroowth
t = 1.348, df = 5301, p-value = 0.1777
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
-0.0001729021 0.0009339813
sample estimates:
mean of x
0.0003805396

⊕. $t = 12.786$, $df = 262$, $p\text{-value} < 2.2e^{-16}$, So we reject H_0, we conclude that H_a; $\mu \neq 0$. Growth rate isn't equal to 0.

2.(40 points) Consider the daily simple returns of Amazon (AMZN) stock, CRSP value-weighted index (VW), CRSP equal-weighted index (EW), and the S&P composite index (SP) from January 2, 2008 to December 31, 2012. Returns of indices include dividends. The data are in the file d-amzn3dx.txt (date, amzn, vw, ew, sp).

(a) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each simple return series.

⊕ AMZN ⇒ Sample mean : 0.00210, SD = 0.016641, Skewness = −0.113083
excess kurtosis = 6.298940, minimum = −0.089763, maximume = 0.114895

⊕. VWrtn ⇒ Sample mean : 0.00210, SD = 0.016641, skewness = −0.113083,
excess kurtosis 6.298940, Minimum = −0.089763, Maximum = 0.114895

⊕ ewrth = Sample mean = 0.000517, SD = 0.015385, Skewness = −0.168185.
excess kurtosis = 5.275824, Mimimum = −0.078240, Maximum = 0.107422

⊕ sprtn ⇒ Sample mean = 0.00014, SD = 0.016573, Skewness = −0.018307
excess kurtosis = 7.154386, Minimum −0.090350, Maximume. = 0.115800

(b) Transform the simple returns to log returns. Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each log return series.

⊕ log return (amzn), Sample mean = 0.00791, SD = 0.028736
skewness = 0.62718, kurtosis. = 7.249289, Minimum = −0.136759
Maximum = 0.237402

⊕ log return (vwrtn), Sample mean = 0.00072, SD = 0.016679
Skewness = −0.137276, kurtosis = 6.194861, maximum = −0.094050
maximume = 0.10896.

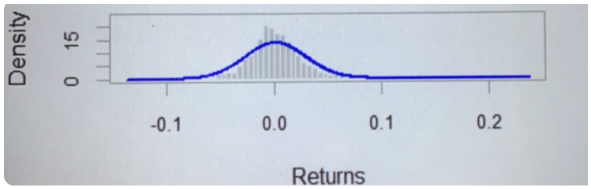
⊕. log return (ewrtn) ⇒ Sample mean = 0.000399, SD = 0.015420
skewness = −0.0334, kurtosis = 5.193084, minimum = 0.081470, maximum = 0.102035

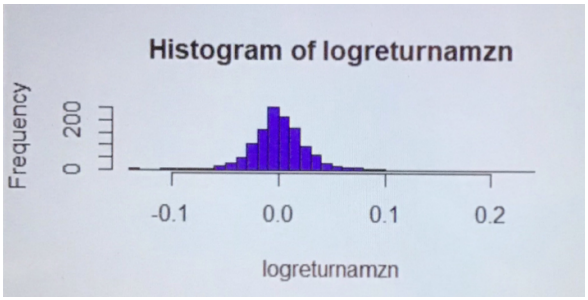
⊕ log return (sprtn), Sample mean = −0.000023, SD = 0.016594
skewness = 0.242080, kurtosis = 6.952084, minimume = −0.094695, maximum = 0.109572

(c) Test the null hypothesis that the mean of the log returns of AMZN is zero.

t = 0.97705, df = 1258, P_value = 0.3287, We accept H_0; Since $\mu = 0$
So, we can say that market is efficrent.

(d) Obtain the histogram (with nclass=40) and sample density plot of the daily log returns of Amazon stock.





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3. (30 points) Answer the same questions as Problem 2 but using monthly returns for for Abbott Laboratories (ABT), CRSP value-weighted index (VW), CRSP equal-weighted index (EW), and S&P composite index from January 1972 to December 2012. The returns include dividend distributions. Data file is m-abt3dx.txt (date, RET, vwretd, ewretd , sprtrn).

(a). Sample mean, SD, Skewness, excess kurtosis, minimum, and max

⊕ abt, sample mean: 0.014073, SD = 0.064795
Skewness = 0.097058, kurtosis = 2.469971, minimum = −0.234146
maximum = 0.382326

⊕ VW, Sample mean = 0.0092020, SD = 0.046341
Skewness = −0.555341, Kurtosis = 2.073657, Minimum = −0.225363
maximum = 0.165585

⊕ EW, Sample mean = 0.011583, SD = 0.057299
Skewness = −0.200025, Kurtosis = 3.288104, Minimum = −0.242298
Maximum = 0.299260

⊕ SP, Sample mean = 0.006386, SD = 0.044788
Skewness = −0.494303, kurtosis = 1.889774, Minimum = −0.217630
Maximum = 0.163047

(b) Sample return to log return

⊕ Log-return (abt), Sample mean = 0.011924, SD = 0.064287
Skewness = −0.297125, kurtosis = 2.005416, minimum = −0.266764
Maximum = 0.323768

⊕ Log-return (VW), Sample mean = 0.007803, SD = 0.046745
Skewness = −0.839542, kurtosis = 3.00331, Minimum = −0.255331
Maximum = 0.153223

⊕ Log-return (EW), Sample mean = 0.009887, SD = 0.057491
Skewness = −0.662276, kurtosis = 3.976081, minimum = −0.217748
Maximum = 0.261795

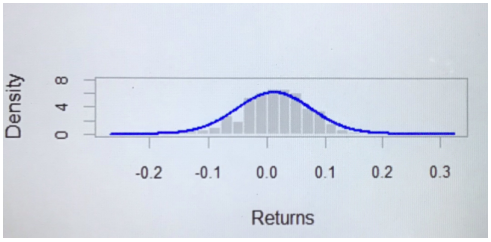
⊕ Log return (SP), Sample mean = 0.005360, SD = 0.045145
Skewness = −0.71125, kurtosis = 2.659018, maximum = −0.245428
Maximum = 0.151043

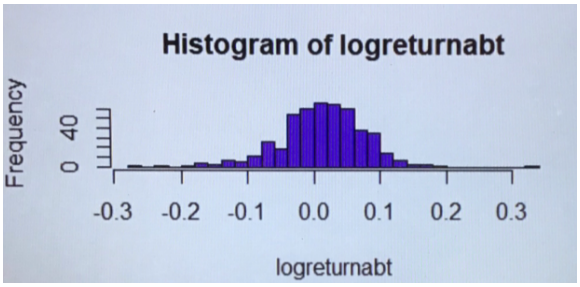
(c) Test the null hypothesis that the mean of the log return abt is zero.

$t = 4.1143$, $df = 491$, P-value $= 4.555\ e^{-0.5}$

We reject H_0. So, we can conclude that log return is not equal to 0.

(d) obtain the histogram with n = 40 of abt.





4. **(30 points)** Consider the monthly stock returns of value-weighted index from January 1972 to December 2012 in Problem 3. Perform the tests and draw conclusions using the 5 % significance level.

(a) Test $H_0 : \mu = 0$ versus $H_a : \mu \neq 0$, where μ denotes the mean of the return.

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① For VW, $t = 3.7499$, $df = 491$, P-value $= 0.000198$, so we reject H_0 at 0.05 level of significance. We can conclude that $\mu \neq 0$. Mean of return is not equal to zero (0).

② For ew, $t = 3.8145$, df: 491, P_value $= 0.0001588$

So, we rejected H_0 at 0.05 level of significance we can conclude that $\mu \neq 0$. Mean of return is not equal to zero(0).

③. For sp, $t = 2.6333$, $df = 491$, P-Value $= 0.008722$.

So, we rejected H_0 at 0.05 level of significance. We can conclude that $\mu \neq 0$. Mean of return is not equals to zero. (0)

(b) Test $H_0 : m_3 = 0$ versus $H_a : m_3 \neq 0$, where m_3 denotes the skewness of the return.

①. log return ew skewness test $= t_{cal} = -6.0154543$., $p = 1.7933..$

we reject H_0 at 0.05 level of significance. We can conclude that $\mu_3 \neq 0$

Skewness of return is not equal to zero. (0).

②. log return SP, skewness test $= t_{cal} = -6.46001$

$p = 1.04695 \text{---} e^{-10}$

We rejected H_0 at 0.05 level of significance.

we can conclude that $\mu_3 \neq 0$. Skewness of return is not equal to 0.

③. log return VW skewness test $= t_{cal} = -7.6256$

$p = 2.4287 \text{---} e^{-14}$

We reject H_0 at 0.05 level of significance.
We can conclude that $\mu_3 \neq 0$.
Skewness of return isn't equal to 0.

(c) Test $H_0 : K = 3$ versus $H_a : K \neq 3$, where K denotes the kurtosis. (Excess kurtosis = 0.)

①. log return ew kurtosis test $= t_{cal} = 18132$, $p = 0$

we reject H_0 at 0.05 level. of significance..
we can conclude that $K \neq 3$. So, there is no excess kurtosis.

②. log return vw kurtosis test $= t_{cal} = 13.70899 \Rightarrow p = 0$

we reject H_0 at 0.05 level of significance.
we can conclude that $k \neq 3$.
So, there is excess kurtosis.

③. log return SP kurtosis test $= t_{cal} = 12.1439$, $p = 0$

We reject H_0 at 0.05 level of significance. We can conclude that $k \neq 3$.

So, there is excess kurtosis.

5. **(40 points)** Consider the daily log returns of Amazon stock from January 2, 2008 to December 31, 1012 as in Problem 2.

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(a) Perform the following tests: (i) Test the null hypothesis that the log return is symmetric with respect to its mean; (ii) Test the null hypothesis that the excess kurtosis of the returns is zero; (iii) Construct a 95 % confidence interval for the expected daily log return of Amazon stock

①. Normally test, X-squard $= 2851.9397$

P- value $= 2.2 e^{-16}$

So, we reject H_0 at 0.05 level of significance. We conclude that log-return is not symmetric which respect to its mean.

②. kurtosis test, t-value $= 52.623$, P-value $= 0$

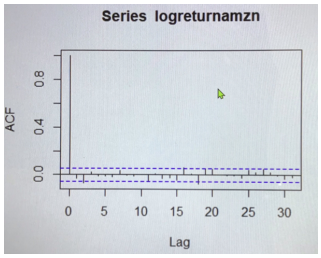
So, we reject H_0 at 0.05 level of significance.

We conclude that there is excess kurtosis in logreturn on $k \neq 3$

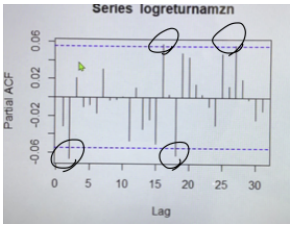
③.

95%. confidence interval for amzn $= -0.000779557$, 0.002381007

(b) Compute ACF and PACF of the daily log returns of Amazon stock and Test $H_0 : \rho_1 = \ldots = \rho_{12} = 0$ versus $H_a : \rho_i \neq 0$ $\exists 1 \leq i \leq 12$. Draw the conclusion.



Today log return can't be explained by yesterday's log return.
These log return can be explained by yesterday's log return.



Conduct Auto correlation test (Box. test)

X-squred = 12.488, df = 12, P-value = 0.4073

Since P-value is greater than 0.05.

So, we accept H_0. We can conclude that $P_1 = P_2 = \ldots P_{12} = 0$

6. **(40 points)** Daily foreign exchange rates (spot rates) can be obtained from the Federal Reserve Bank in St Louis (FRED). The data are the noon buying rates in New York City certified by the Federal Reserve Bank of New York. Consider the exchange rates between the U.S. dollar and the Euro from January 4, 1999 to March 8, 2013. See the file d-exuseu.txt.

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(a) Compute the daily log return of the exchange rate.

Start from −0.00441, −0.0106 ---

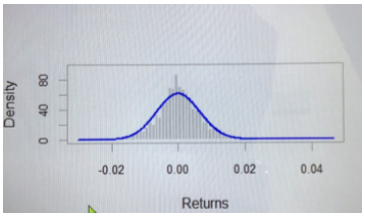
(b) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of the log returns of the exchange rate.

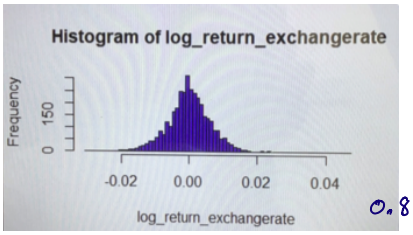
Sample mean = 0.000027, S.D = 0.006511, Skewness = 0.116750

excess kurtosis = 2.058184, minimum = −0.030031.

maximum = 0.046208

(c). (c) Obtain a density plot of the daily long returns of Dollar-Euro exchange rate.





0.8066

nrkcance, that is mea

(d) Test $H_0 : \mu = 0$ versus $H_a : \mu \neq 0$, where μ denotes the mean of the daily log return of Dollar-Euro exchange rate.

(d).

t = 0.24489, df = 3565, P-value =

Ho is accepted at 0.05 level of sig n

$\mu = 0$. Market is efficient.