Lecture 1: Empirical Properties of Returns

Econ 589
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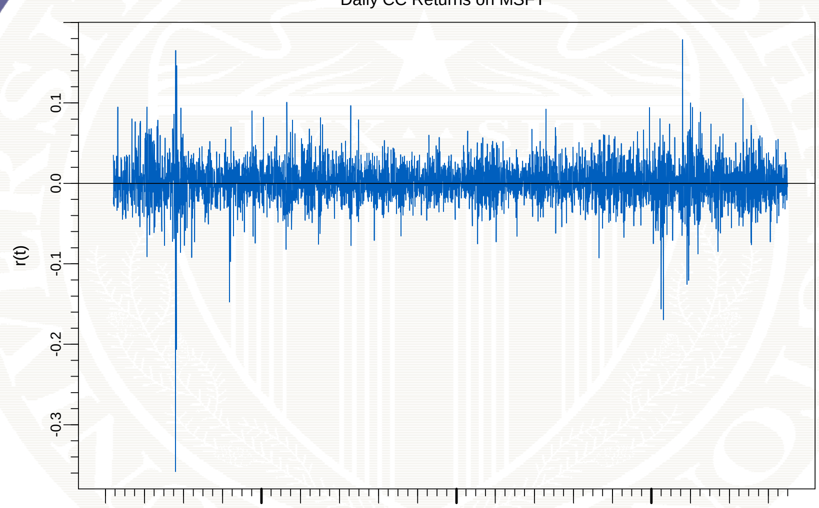
Spring 2011
Updated: March 29, 2011

Daily CC Returns on MSFT



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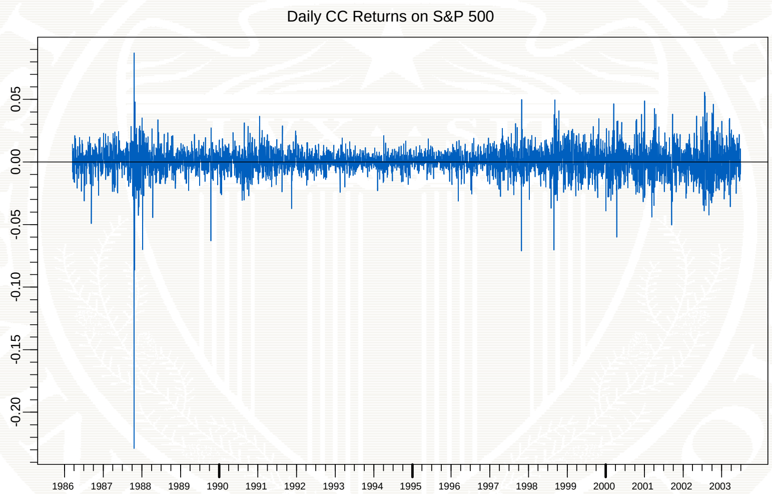
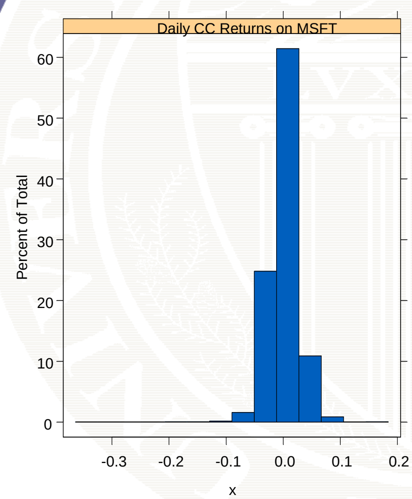
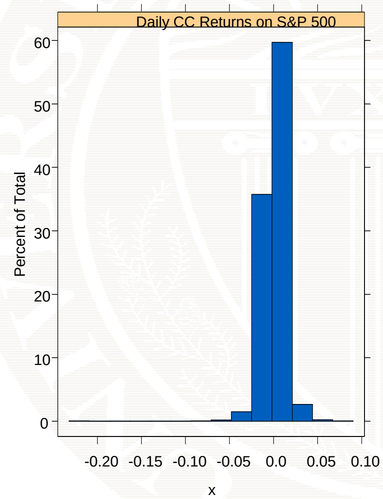


Distribution of Daily CC Returns on MSFT



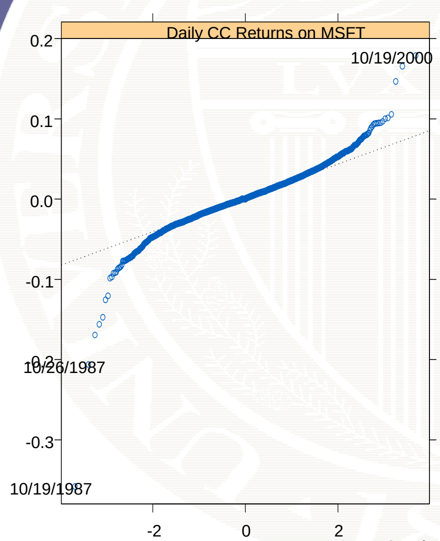

```
Sample Quantiles:
     min       1Q median      3Q    max
 -0.3583 -0.01282      0 0.01554 0.1787

Sample Moments:
     mean     std skewness kurtosis
 0.001278 0.02539  -0.7275    16.12

Number of Observations:  4365
```

Distribution of Daily CC Returns on S&P 500




```
Sample Quantiles:
    min        1Q    median      3Q     max
 -0.229 -0.004697 0.0004677 0.00581 0.08709

Sample Moments:
      mean     std skewness kurtosis
 0.0003276 0.01135   -2.083    45.18

Number of Observations:  4365
```

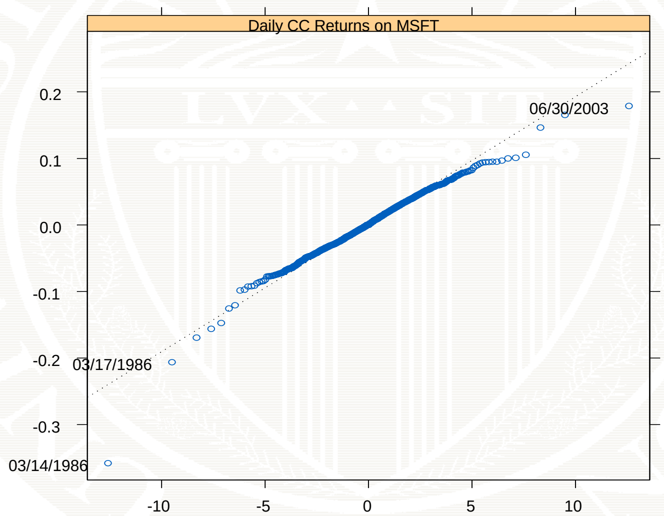

Normal QQ-Plot



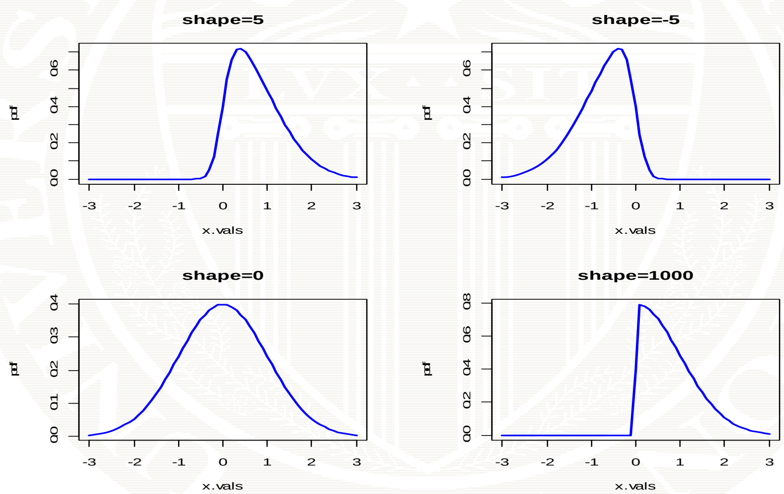
Test for Normality

```
Test for Normality: Jarque-Bera

Null Hypothesis: data is normally
distributed

Test Statistics:
              MSFT
Test Stat 31685.64
  p.value     0.00

Dist. under Null: chi-square with 2
degrees of freedom
   Total Observ.: 4365
```

QQ-Plot: Student-t with 4 degrees of freedom

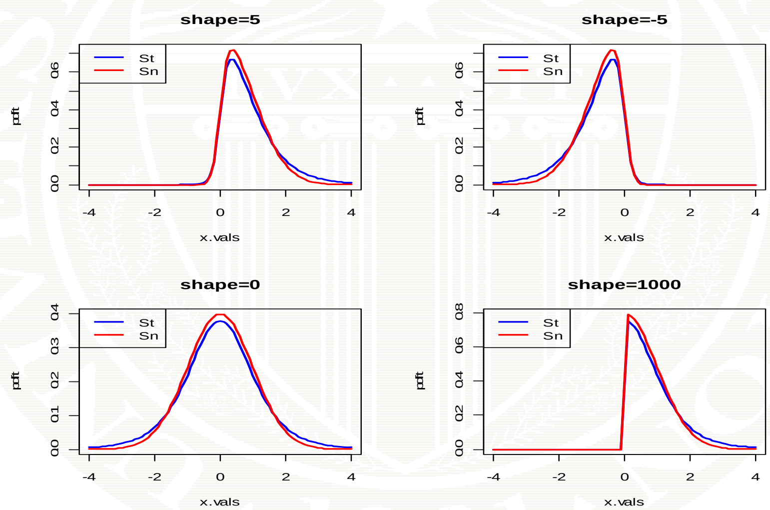


Skew Normal Distribution



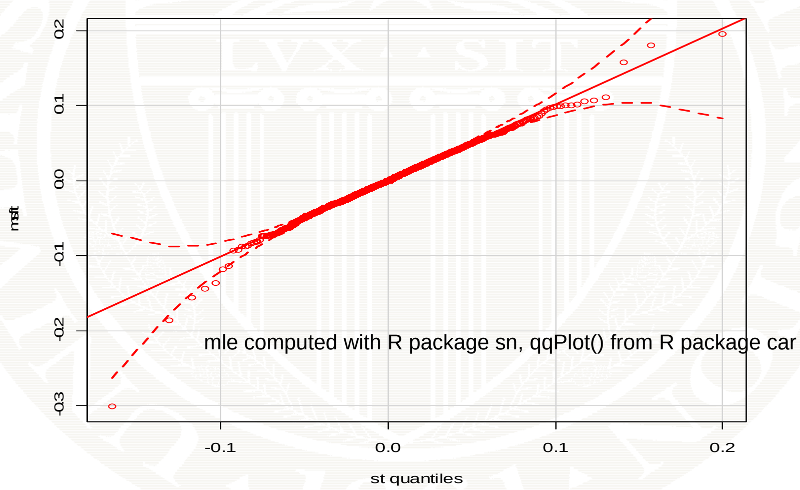
$\xi = 0, \omega = 1$

Skew t Distribution

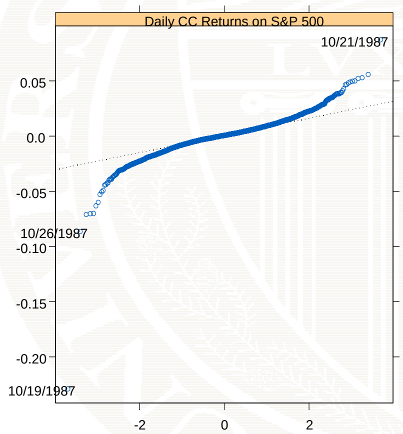


$\xi = 0, \omega = 1, \nu = 5$

QQ-Plot: MLE of Skew-t for MSFT
location = -0.004, scale = 0.020, shape = 0.298, df = 4.973



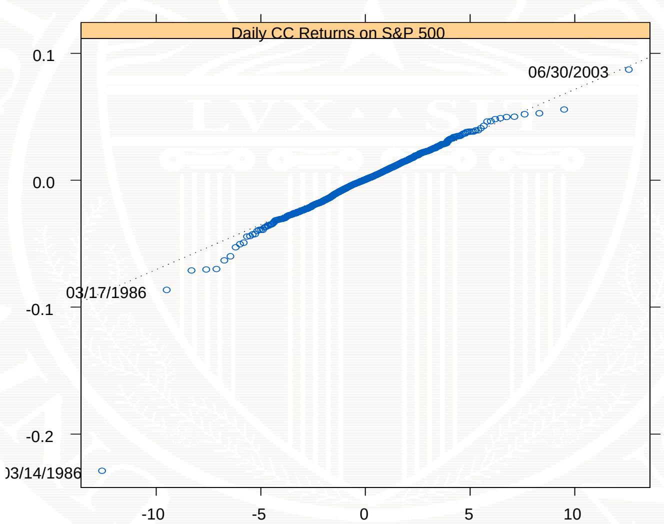
Normal QQ-Plot

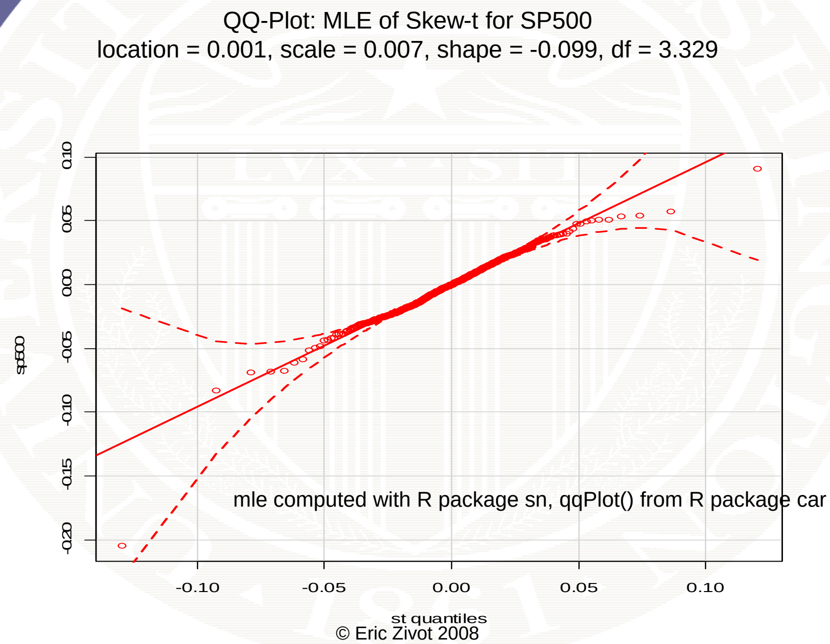


Test for Normality

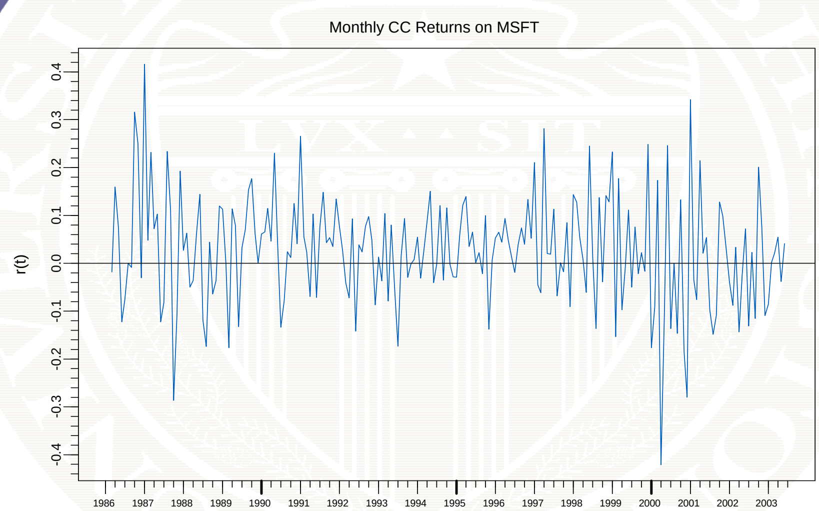
```
Test for Normality: Jarque-Bera

Null Hypothesis: data is normally
distributed

Test Statistics:
             SP500
Test Stat 326705.3
  p.value      0.0

Dist. under Null: chi-square with 2
degrees of freedom
   Total Observ.: 4365
```


QQ-Plot: Student-t with 4 degrees of freedom

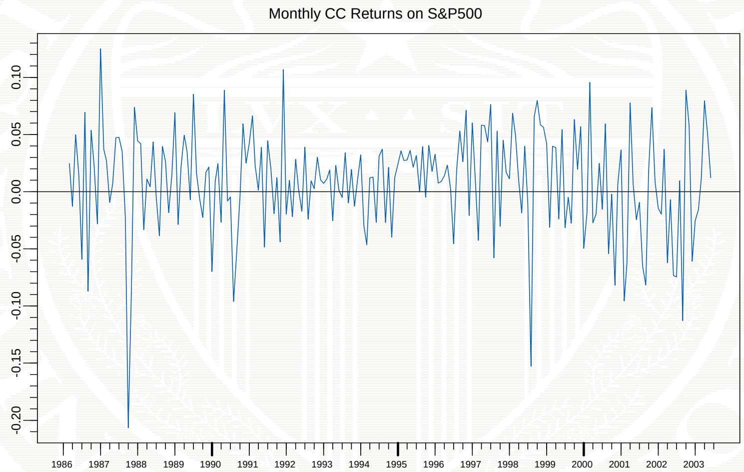




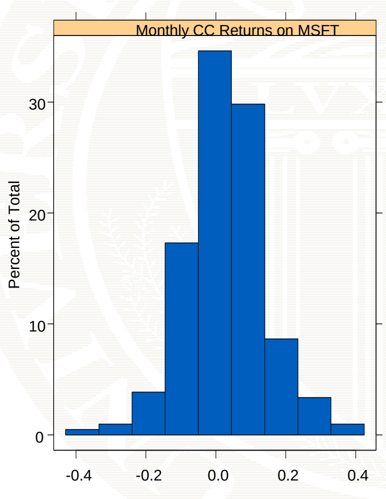
QQ-Plot: MLE of Skew-t for SP500
location = 0.001, scale = 0.007, shape = -0.099, df = 3.329
sp500
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
mle computed with R package sn, qqPlot() from R package car
-0.10
-0.05
0.00
0.05
0.10
st quantiles



Monthly CC Returns on MSFT
r(t)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

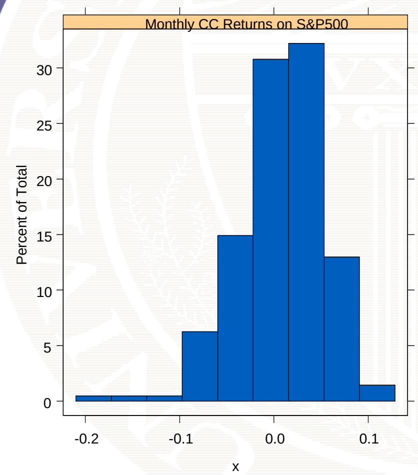


Distribution for Monthly Returns on MSFT



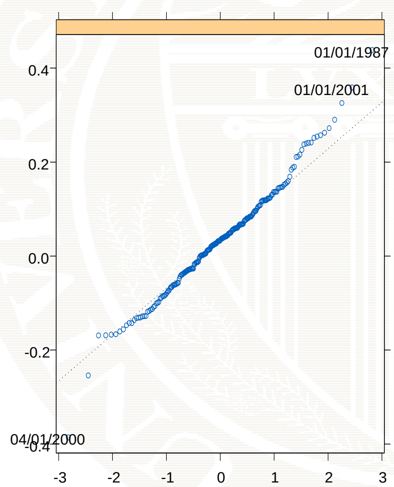

```
Sample Quantiles:
     min      1Q median      3Q    max
 -0.3861 -0.03587 0.0336 0.09736 0.4384

Sample Moments:
    mean    std skewness kurtosis
 0.03357 0.1145   0.1845    4.004

Number of Observations:  208
```

Distribution for Monthly Returns on S&P 500




```
Sample Quantiles:
     min      1Q median      3Q
max
 -0.2066 -0.01921 0.0122 0.03875
0.125

Sample Moments:
     mean    std skewness kurtosis
 0.008219 0.0459  -0.8377    5.186

Number of Observations:  208
```

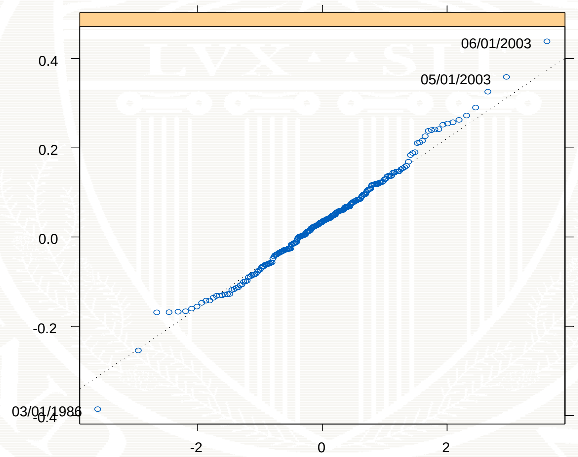

Normal QQ-Plot



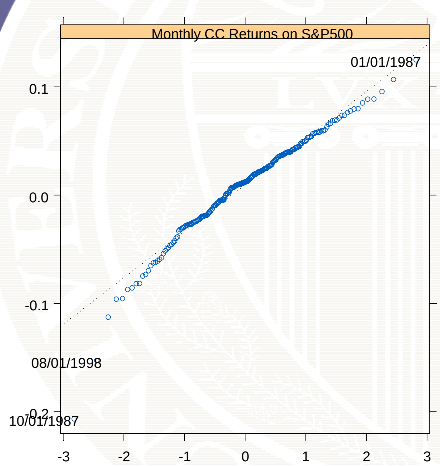
Tests for Normality

```
Test for Normality: Shapiro-Wilks

Test Statistics:
                 MSFT
Test Stat 0.9906
  p.value 0.9558

Dist. under Null: normal
   Total Observ.: 208

Test for Normality: Jarque-Bera

Test Statistics:
                 MSFT
Test Stat 9.9223
  p.value 0.0070

Dist. under Null: chi-square with
2 degrees of freedom
   Total Observ.: 208
```

QQ-Plot: Student's t with 10 df



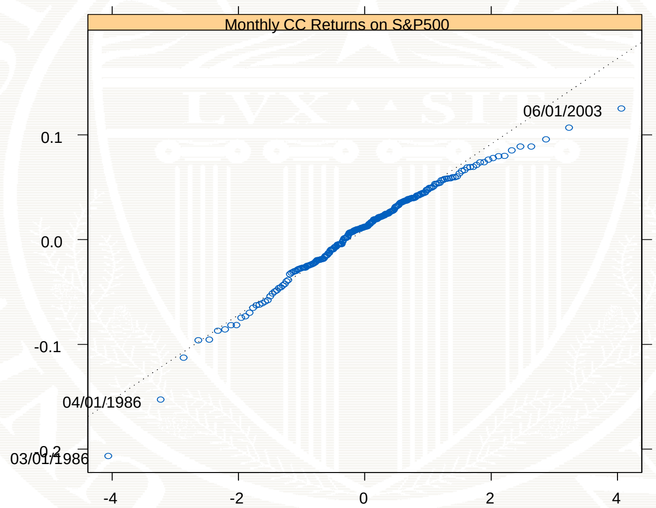
Normal QQ-Plot



Tests for Normality

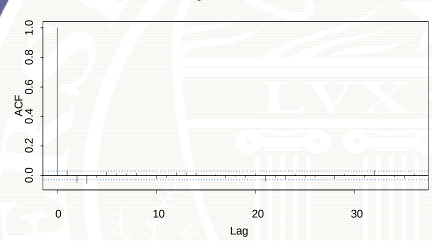
```
Test for Normality: Shapiro-Wilks

Test Statistics:
           SP500
Test Stat 0.9699
  p.value 0.0154

Dist. under Null: normal
   Total Observ.: 208

Test for Normality: Jarque-Bera

Test Statistics:
            SP500
Test Stat 65.7551
  p.value  0.0000

Dist. under Null: chi-square with 2
degrees of freedom
   Total Observ.: 208
```

QQ-Plot: Student's t with 7 df

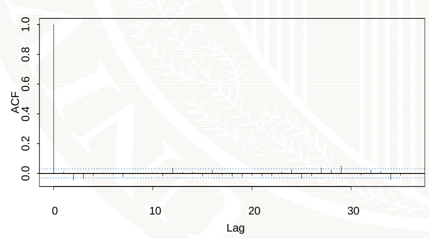


Testing for Autocorrelation

Daily CC Returns on MSFT

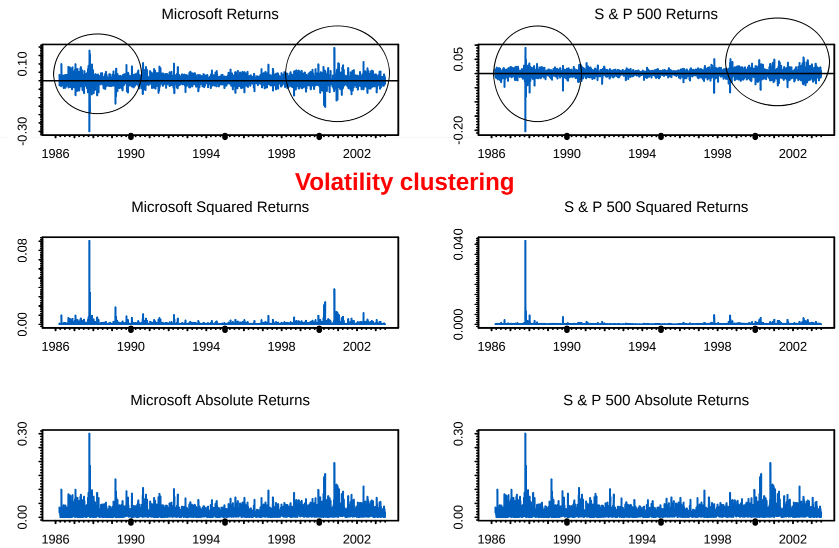


Daily CC Returns on S&P 500

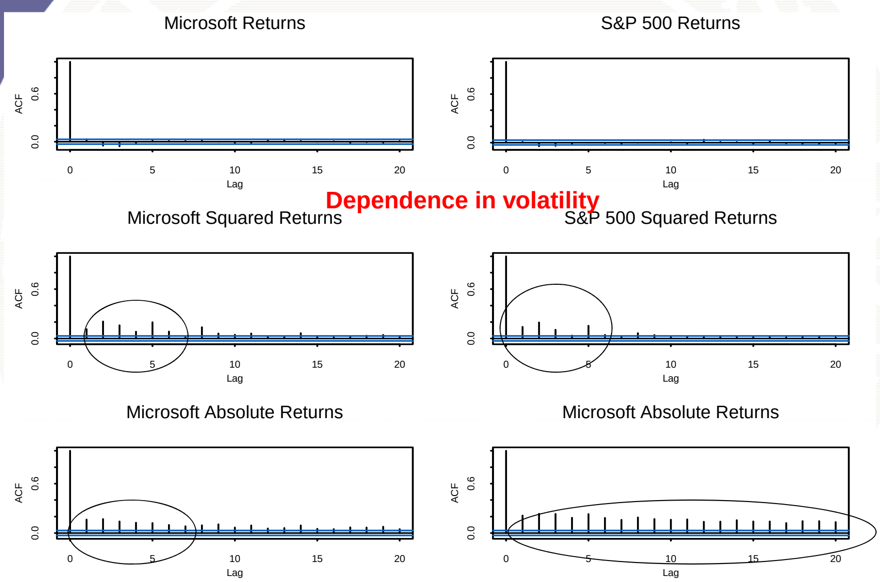



```
Test for Autocorrelation: Ljung-Box

Null Hypothesis: no autocorrelation

Test Statistics:
             SP500
Test Stat 35.1892
  p.value  0.0191

Dist. under Null: chi-square with 20
degrees of freedom
   Total Observ.: 4365

Test for Autocorrelation: Ljung-Box

Null Hypothesis: no autocorrelation

Test Statistics:
              MSFT
Test Stat 43.2323
  p.value  0.0019

Dist. under Null: chi-square with 20
degrees of freedom
   Total Observ.: 4365
```

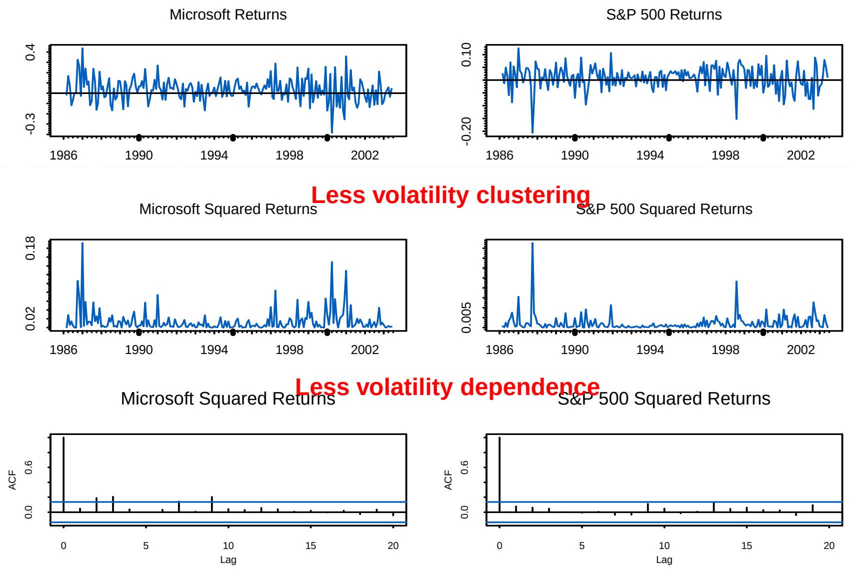
Stylized Facts of Daily Asset Returns



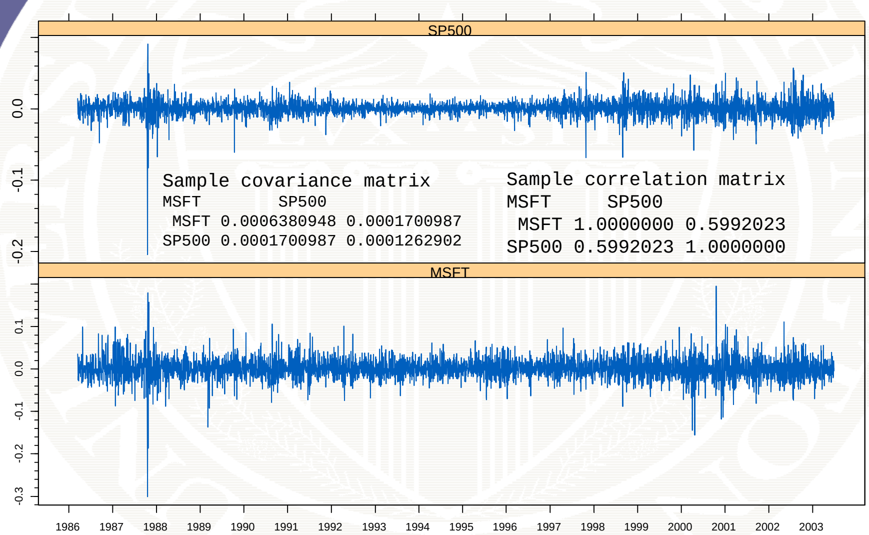
Sample Autocorrelations of Daily Returns



Stylized Facts for Monthly Asset Returns

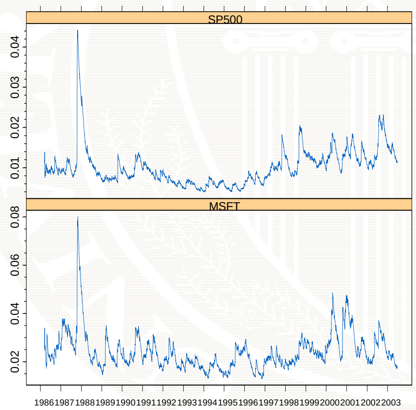


MSFT and S&P 500 Daily Returns



EWMA Volatilities and Correlations

EWMA Conditional Volatilities



EWMA Conditional Correlation