# S&P500 returns and dividends

**Get data from URL.**

We'll get S&P500 annual dividends (real not nominal).

```
MyData <- read.csv("SP500_divs_closes_inflation_adj.csv")
head(MyData)
```

```
##           Date Dividend  Close
## 1 Dec 31, 1871     5.41 101.05
## 2 Dec 31, 1872     6.10 103.86
## 3 Dec 31, 1873     7.13  99.08
## 4 Dec 31, 1874     7.54 103.74
## 5 Dec 31, 1875     7.21 108.11
## 6 Dec 31, 1876     7.34  85.35
```

```
spot_ts <- ts(MyData$Close, start=1871, freq=1)
spot_ts
```

```
## Time Series:
## Start = 1871
## End = 2020
## Frequency = 1
##   [1]  101.05  103.86   99.08  103.74  108.11   85.35   92.61  113.72  134.53
##  [10]  172.83  152.95  152.96  147.61  134.68  171.17  183.68  166.86  172.49
##  [19]  185.94  163.20  197.71  186.77  165.87  170.14  168.63  171.55  192.72
##  [28]  236.56  203.09  241.18  270.34  256.94  212.19  261.77  306.49  284.11
##  [37]  208.04  266.54  267.80  264.15  262.73  249.59  220.14  194.79  235.95
##  [46]  215.13  135.45  125.13  120.33   98.42  113.61  139.33  134.24  160.85
##  [55]  185.87  201.39  266.51  382.37  333.92  264.34  152.66  144.56  210.01
##  [64]  179.08  262.25  328.11  209.49  234.83  232.74  196.79  149.60  157.03
##  [73]  179.12  199.33  260.41  186.07  164.58  168.33  188.92  219.63  240.09
##  [82]  258.86  248.93  350.69  433.29  432.92  378.15  504.44  520.91  527.09
##  [91]  605.55  562.88  650.73  725.99  771.84  675.12  733.05  753.58  628.38
## [100]  617.82  661.05  731.01  542.45  366.30  458.19  466.68  379.79  383.97
## [109]  374.91  402.08  327.16  388.07  429.49  427.80  499.63  625.60  569.45
## [118]  619.85  701.86  636.02  792.43  802.75  850.91  814.15 1046.64 1266.67
## [127] 1567.93 1999.05 2221.27 2006.22 1693.34 1296.74 1608.36 1629.40 1696.04
## [136] 1850.52 1717.99 1078.22 1363.80 1531.84 1509.15 1690.84 2049.05 2282.51
## [145] 2129.95 2464.14 2960.28 2724.46 3342.29 3814.52
```

```
div_ts <- ts(MyData$Dividend, start=1871, freq=1)
div_ts
```

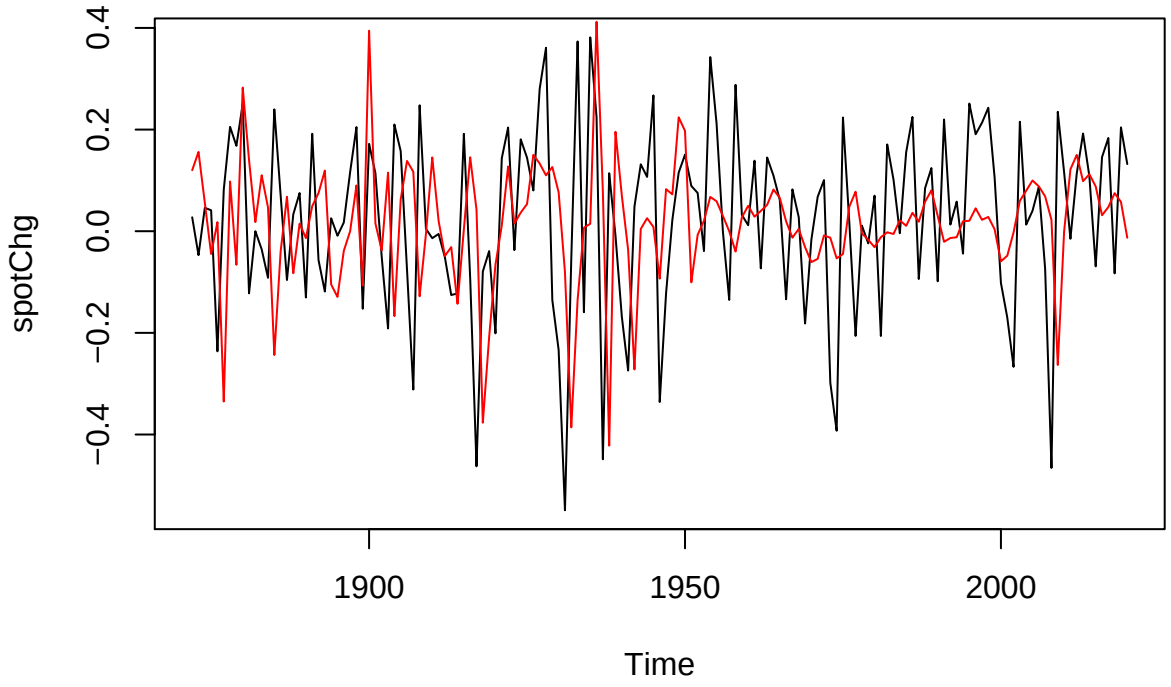
```
## Time Series:
## Start = 1871
## End = 2020
## Frequency = 1
##   [1]  5.41  6.10  7.13  7.54  7.21  7.34  5.25  5.79  5.42  7.19  8.27  8.42
##  [13]  9.40  9.85  7.72  7.42  7.94  7.31  7.42  7.32  7.69  8.29  9.34  8.41
```

```
##  [25]  7.39  7.11  7.11  7.78  6.99 10.37 10.53 10.14 11.38  9.63 10.25 11.77
##  [37] 13.23 11.64 11.58 13.39 13.67 13.02 12.62 10.94 10.98 12.70 13.25  9.09
##  [49]  7.38  6.91  6.99  7.94  8.06  8.36  8.82 10.25 11.71 13.07 14.83 16.01
##  [61] 14.77 10.04  8.77  8.83  8.96 13.53 14.61  9.58 11.65 12.50 12.05  9.18
##  [73]  9.22  9.46  9.54  8.69  9.44 10.15 12.70 15.47 13.99 13.89 14.18 15.17
##  [85] 16.09 16.58 16.58 15.93 16.37 17.21 17.71 18.43 19.41 21.07 22.50 22.94
##  [97] 22.65 22.75 22.05 20.75 19.65 19.49 19.24 18.24 17.44 18.30 19.78 19.70
## [109] 19.37 18.77 18.55 18.51 18.41 18.81 19.01 19.71 20.08 21.28 23.06 23.76
## [121] 23.27 22.96 22.69 23.14 23.62 24.71 25.27 25.99 26.09 24.59 23.43 23.37
## [133] 24.81 26.87 29.69 32.43 34.73 35.51 27.29 27.27 30.80 35.79 39.49 44.18
## [145] 48.25 49.79 52.21 56.27 59.61 58.85
```

```
logspot <- log(spot_ts)
logdiv <- log(div_ts)
spotChg <- diff(logspot)
divChg <- diff(logdiv)
divChg
```

```
## Time Series:
## Start = 1872
## End = 2020
## Frequency = 1
##   [1]  0.1200396783  0.1560224632  0.0559109476 -0.0447532307  0.0178698913
##   [6] -0.3351107660  0.0979042150 -0.0660364761  0.2825953563  0.1399433373
##  [11]  0.0179753192  0.1100998610  0.0467617659 -0.2436570911 -0.0396353069
##  [16]  0.0677342181 -0.0826700015  0.0149357834 -0.0135687292  0.0493104555
##  [21]  0.0751291856  0.1192562831 -0.1048847783 -0.1292937390 -0.0386254911
##  [26]  0.0000000000  0.0900540944 -0.1070757819  0.3944364660  0.0153113039
##  [31] -0.0377403280  0.1153694305 -0.1669742029  0.0623944798  0.1382762157
##  [36]  0.1169330569 -0.1280395358 -0.0051679702  0.1452286876  0.0206954910
##  [41] -0.0487170140 -0.0312037797 -0.1428570601  0.0036496391  0.1455265574
##  [46]  0.0423955590 -0.3768226442 -0.2084012696 -0.0658040008  0.0115109185
##  [51]  0.1274327190  0.0150002813  0.0365448706  0.0535634429  0.1502558356
##  [56]  0.1331654720  0.1098763500  0.1263326285  0.0765613709 -0.0806154305
##  [61] -0.3860209823 -0.1352403079  0.0068182082  0.0146152124  0.4121392152
##  [66]  0.0767967836 -0.4220286338  0.1956285880  0.0704224643 -0.0366639844
##  [71] -0.2720374553  0.0043478329  0.0256973455  0.0084211024 -0.0933205462
##  [76]  0.0827830409  0.0725177253  0.2241282880  0.1973006711 -0.1005598759
##  [81] -0.0071736319  0.0206633643  0.0674872723  0.0588781676  0.0299991887
##  [86]  0.0000000000 -0.0399930258  0.0272462675  0.0500402188  0.0286388416
##  [91]  0.0398503199  0.0518086255  0.0820618306  0.0656650814  0.0193668025
##  [96] -0.0127222598  0.0044052935 -0.0312525435 -0.0607663552 -0.0544689084
## [101] -0.0081758248 -0.0129100683 -0.0533744606 -0.0448505662  0.0481346414
## [106]  0.0777702663 -0.0040526905 -0.0168931583 -0.0314656268 -0.0117900615
## [111] -0.0021586625 -0.0054171313  0.0214946481  0.0105765132  0.0361609647
## [116]  0.0185981737  0.0580433696  0.0803318504  0.0299039797 -0.0208385172
## [121] -0.0134114059 -0.0118292727  0.0196384230  0.0205310890  0.0451142092
## [126]  0.0224099014  0.0280939273  0.0038402505 -0.0592122429 -0.0483226037
## [131] -0.0025641040  0.0597936492  0.0797636249  0.0997998661  0.0882736315
## [136]  0.0685199464  0.0222104802 -0.2632940122 -0.0007331379  0.1217274931
## [141]  0.1501538348  0.0983789505  0.1122247227  0.0881236298  0.0314183329
## [146]  0.0474598868  0.0748874860  0.0576618118 -0.0128315115
```

```
plot(spotChg)
lines(divChg, col="red")
```




```
ccf(spotChg,divChg, main="")
```