CAPM and other Statistics for HSI Components Version 1.1

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Contents

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1 Introduction

CAPM Analysis on Hang Seng Index Components .
Hang Seng Index itself is used as the benchmark.

In finance, the capital asset pricing model (CAPM) is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic risk or market risk), often represented by the quantity beta in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset.

The model was introduced by Jack Treynor (1961, 1962),[1] William Sharpe (1964), John Lintner (1965a,b) and Jan Mossin (1966) independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Sharpe, Markowitz and Merton Miller jointly received the Nobel Memorial Prize in Economics for this contribution to the field of financial economics.[1]

We attempt to show the CAPM data for all HSI components with data from Yahoo starting with 2009-01-01 and generate some more charts and statistics on the way.

This document is generated on a daily basis to have snapshots of the data for further study , if one is so inclined.

[1] Wikipedia

2 CAPM Analysis

The general idea behind CAPM is that investors need to be compensated in two ways: time value of money and risk. The time value of money is represented by the risk-free (rf) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time and to the market premium (Rm-rf).[2]

2.1 HSI Components CAPM with HSI as benchmark

CAPM - Combined

```
## Warning message: missing values removed from data

##                      HSI Components to HSI
## Alpha                              -0.0009
## Beta                                1.1722
## Beta+                               1.2572
## Beta-                               1.1992
## R-squared                           0.6510
## Annualized Alpha                   -0.2006
## Correlation                         0.8069
## Correlation p-value                 0.0000
## Tracking Error                      0.2628
## Active Premium                     -0.2052
## Information Ratio                  -0.7807
## Treynor Ratio                      -0.3751
```

[2] http://www.investopedia.com/terms/c/capm.asp

CAPM - Distinct for each stock

```
##                     0001.HK 0002.HK 0003.HK 0004.HK 0005.HK 0006.HK
## Alpha                 0.000   0.000   0.000   0.000  -0.001   0.000
## Beta                  0.988   0.151   0.381   1.106   1.121   0.118
## Beta+                 0.954   0.044   0.280   1.113   1.215   0.064
## Beta-                 0.975   0.186   0.413   1.089   1.310   0.129
## R-squared             0.642   0.084   0.182   0.495   0.561   0.030
## Annualized Alpha      0.000   0.050   0.121   0.138  -0.137   0.081
## Correlation           0.801   0.289   0.426   0.703   0.749   0.173
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.193   0.257   0.266   0.293   0.261   0.290
## Active Premium       -0.021  -0.046   0.040   0.110  -0.178  -0.027
## Information Ratio    -0.110  -0.179   0.151   0.374  -0.683  -0.094
## Treynor Ratio         0.088   0.414   0.390   0.197  -0.062   0.691
##                     0011.HK 0012.HK 0013.HK 0016.HK 0017.HK 0019.HK
## Alpha                 0.000   0.000   0.000   0.000   0.000   0.000
## Beta                  0.639   1.022   0.949   1.003   1.129   0.780
## Beta+                 0.710   1.054   0.873   0.967   1.052   0.849
## Beta-                 0.673   0.996   0.990   0.981   1.146   0.728
## R-squared             0.453   0.560   0.528   0.643   0.503   0.384
## Annualized Alpha     -0.080   0.032   0.126   0.064  -0.093   0.052
## Correlation           0.673   0.748   0.726   0.802   0.709   0.620
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.206   0.237   0.235   0.195   0.295   0.264
## Active Premium       -0.134   0.006   0.102   0.049  -0.137   0.000
## Information Ratio    -0.651   0.024   0.434   0.252  -0.464   0.002
## Treynor Ratio        -0.040   0.112   0.222   0.157  -0.025   0.140
##                     0023.HK 0066.HK 0083.HK 0101.HK 0144.HK 0151.HK
## Alpha                 0.000   0.000   0.000   0.000   0.000   0.001
## Beta                  0.938   0.510   1.165   1.093   1.311   0.428
## Beta+                 1.022   0.431   1.137   1.246   1.262   0.192
## Beta-                 0.935   0.499   1.214   0.977   1.210   0.516
## R-squared             0.464   0.338   0.518   0.472   0.542   0.096
## Annualized Alpha      0.131   0.071   0.048   0.028   0.094   0.354
## Correlation           0.681   0.582   0.720   0.687   0.736   0.311
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.264   0.226   0.297   0.303   0.325   0.373
## Active Premium        0.098   0.011   0.016  -0.013   0.067   0.238
## Information Ratio     0.374   0.047   0.055  -0.043   0.207   0.638
## Treynor Ratio         0.221   0.234   0.107   0.087   0.134   0.810
##                     0267.HK 0291.HK 0293.HK 0322.HK 0330.HK 0386.HK
## Alpha                 0.000   0.001   0.000   0.001  -0.002   0.000
## Beta                  1.078   0.882   0.770   0.350   0.940   0.957
## Beta+                 1.030   0.772   0.732   0.262   0.742   0.805
## Beta-                 0.976   0.902   0.752   0.382   1.099   1.003
## R-squared             0.401   0.371   0.322   0.072   0.216   0.559
## Annualized Alpha      0.055   0.190   0.111   0.391  -0.358   0.137
## Correlation           0.634   0.609   0.567   0.268   0.465   0.748
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.345   0.302   0.298   0.369   0.468   0.222
## Active Premium        0.001   0.143   0.052   0.270  -0.475   0.118
## Information Ratio     0.003   0.474   0.173   0.731  -1.014   0.530
## Treynor Ratio         0.102   0.285   0.208   1.082  -0.390   0.236
##                     0388.HK 0494.HK 0688.HK 0700.HK 0762.HK 0836.HK
## Alpha                 0.000   0.001   0.000   0.002   0.000   0.000
## Beta                  1.159   1.233   1.184   0.936   0.705   0.560
```

```
## Beta+                 1.246   1.139   1.340   0.966   0.548   0.432
## Beta-                 1.103   0.898   0.926   0.784   0.648   0.662
## R-squared             0.706   0.454   0.473   0.356   0.256   0.181
## Annualized Alpha      0.080   0.378   0.023   0.468   0.115  -0.010
## Correlation           0.840   0.674   0.688   0.596   0.506   0.426
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.200   0.411   0.330   0.329   0.322   0.331
## Active Premium        0.079   0.129  -0.019   0.426   0.042  -0.101
## Information Ratio     0.394   0.314  -0.059   1.296   0.129  -0.305
## Treynor Ratio         0.162  -0.100   0.075   0.565   0.211   0.013
##                     0857.HK 0883.HK 0939.HK 0941.HK 1044.HK 1088.HK
## Alpha                 0.000   0.001   0.000   0.000   0.001   0.001
## Beta                  1.101   1.285   1.061   0.709   0.466   1.218
## Beta+                 1.012   1.191   1.003   0.706   0.360   1.139
## Beta-                 1.096   1.246   1.036   0.734   0.414   1.142
## R-squared             0.726   0.688   0.700   0.520   0.120   0.650
## Annualized Alpha      0.058   0.161   0.000  -0.084   0.416   0.153
## Correlation           0.852   0.829   0.836   0.721   0.346   0.806
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.179   0.238   0.182   0.194   0.357   0.240
## Active Premium        0.053   0.167  -0.014  -0.132   0.312   0.152
## Information Ratio     0.299   0.704  -0.076  -0.682   0.874   0.632
## Treynor Ratio         0.147   0.215   0.089  -0.033   0.891   0.214
##                     1109.HK 1199.HK 1299.HK 1398.HK 1880.HK 1898.HK
## Alpha                 0.000   0.000   0.001   0.000   0.002   0.000
## Beta                  1.163   1.332   0.820   1.126   0.825   1.496
## Beta+                 1.223   1.338   0.809   1.095   0.776   1.397
## Beta-                 0.777   1.427   1.053   1.055   0.898   1.438
## R-squared             0.361   0.492   0.410   0.687   0.223   0.664
## Annualized Alpha      0.078   0.032   0.216  -0.020   0.501   0.048
## Correlation           0.601   0.702   0.640   0.829   0.472   0.815
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.406   0.364   0.246   0.201   0.405   0.307
## Active Premium        0.006  -0.011   0.188  -0.034   0.407   0.037
## Information Ratio     0.014  -0.031   0.766  -0.171   1.004   0.122
## Treynor Ratio         0.098   0.073   0.074   0.066   0.625   0.098
##                     2318.HK 2388.HK 2600.HK 2628.HK 3328.HK 3988.HK
## Alpha                 0.000   0.001  -0.001  -0.001   0.000   0.000
## Beta                  1.324   0.877   1.538   1.090   1.192   1.034
## Beta+                 1.374   0.888   1.580   1.063   1.159   0.956
## Beta-                 1.225   0.846   1.394   1.065   1.215   1.009
## R-squared             0.623   0.442   0.622   0.638   0.728   0.632
## Annualized Alpha      0.028   0.227  -0.131  -0.130  -0.088   0.056
## Correlation           0.789   0.665   0.788   0.799   0.854   0.795
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.282   0.259   0.344   0.216   0.197   0.206
## Active Premium        0.012   0.196  -0.165  -0.160  -0.104   0.040
## Information Ratio     0.043   0.757  -0.480  -0.743  -0.529   0.194
## Treynor Ratio         0.091   0.348  -0.037  -0.047   0.004   0.144
```

3 HSI Components Risk

3.1 Correlation

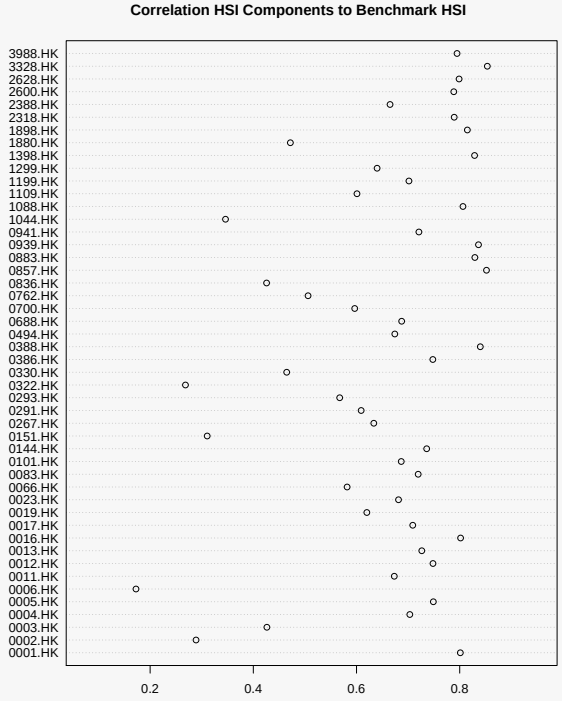
Correlation Combined

```
##                       Correlation p-value Lower CI Upper CI
## HSI Components to HSI      0.8069       0   0.7213   0.8681
```

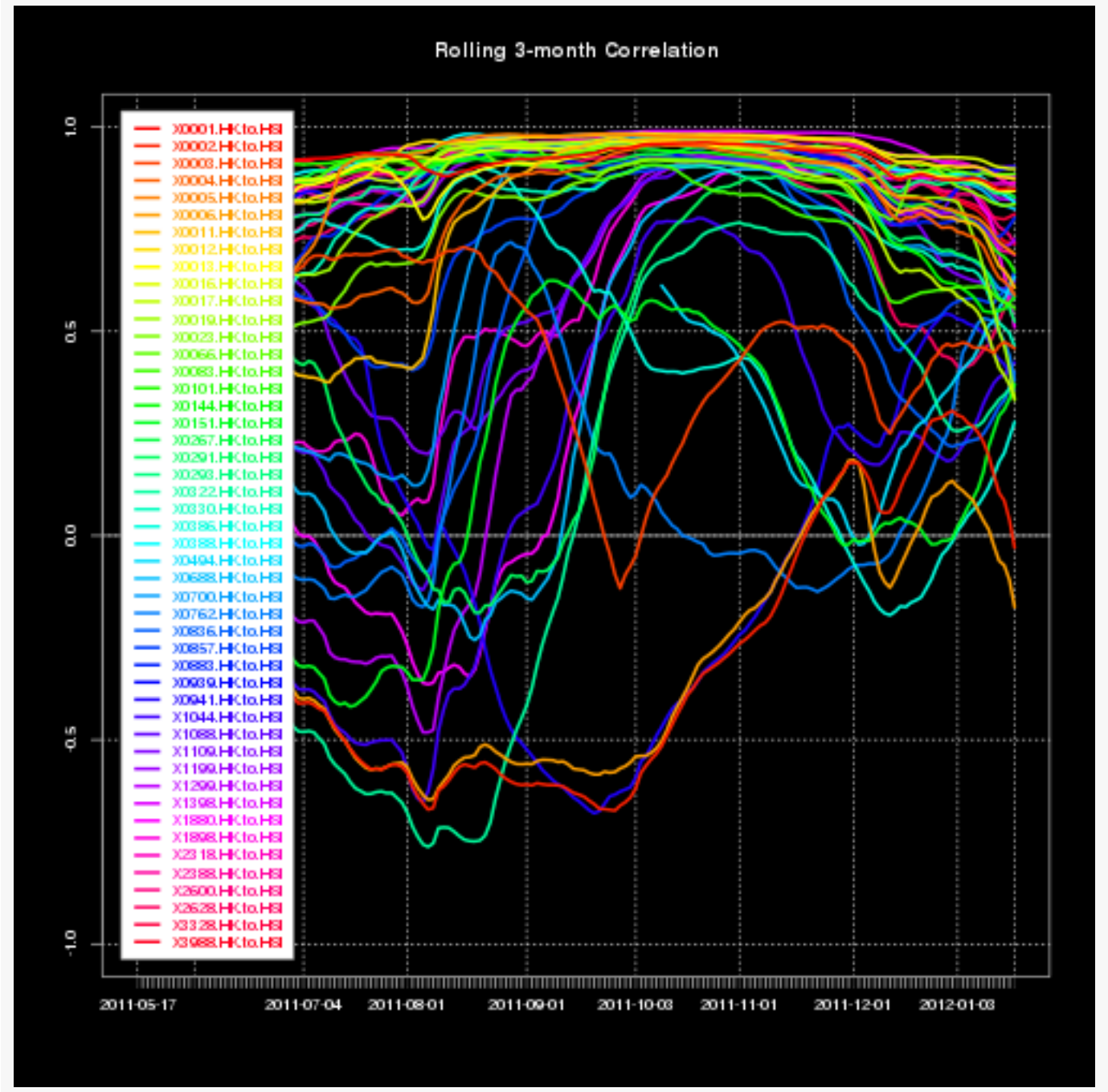
Correlation - Distinct

```
##         Correlation p-value Lower CI Upper CI
## 0001.HK      0.8012       0   0.7650   0.8323
## 0002.HK      0.2890       0   0.2009   0.3724
## 0003.HK      0.4263       0   0.3466   0.4999
## 0004.HK      0.7033       0   0.6527   0.7477
## 0005.HK      0.7489       0   0.7047   0.7873
## 0006.HK      0.1726       0   0.0803   0.2619
## 0011.HK      0.6732       0   0.6187   0.7214
## 0012.HK      0.7482       0   0.7040   0.7867
## 0013.HK      0.7265       0   0.6791   0.7679
## 0016.HK      0.8017       0   0.7656   0.8328
## 0017.HK      0.7090       0   0.6592   0.7527
## 0019.HK      0.6200       0   0.5589   0.6744
## 0023.HK      0.6814       0   0.6278   0.7285
## 0066.HK      0.5818       0   0.5163   0.6405
## 0083.HK      0.7195       0   0.6711   0.7617
## 0101.HK      0.6867       0   0.6339   0.7332
## 0144.HK      0.7360       0   0.6900   0.7761
## 0151.HK      0.3106       0   0.2235   0.3927
## 0267.HK      0.6335       0   0.5739   0.6863
## 0291.HK      0.6090       0   0.5466   0.6647
## 0293.HK      0.5674       0   0.5004   0.6276
## 0322.HK      0.2685       0   0.1795   0.3531
## 0330.HK      0.4647       0   0.3880   0.5350
## 0386.HK      0.7479       0   0.7036   0.7864
## 0388.HK      0.8399       0   0.8100   0.8655
## 0494.HK      0.6742       0   0.5452   0.7720
## 0688.HK      0.6875       0   0.6347   0.7338
## 0700.HK      0.5965       0   0.5327   0.6535
## 0762.HK      0.5061       0   0.4332   0.5724
## 0836.HK      0.4257       0   0.3460   0.4994
## 0857.HK      0.8519       0   0.8240   0.8757
## 0883.HK      0.8294       0   0.7978   0.8565
## 0939.HK      0.8364       0   0.8059   0.8624
## 0941.HK      0.7209       0   0.6727   0.7629
## 1044.HK      0.3461       0   0.2613   0.4256
## 1088.HK      0.8063       0   0.7709   0.8367
## 1109.HK      0.6009       0   0.5375   0.6574
## 1199.HK      0.7016       0   0.6507   0.7461
## 1299.HK      0.6399       0   0.5438   0.7195
## 1398.HK      0.8288       0   0.7971   0.8560
## 1880.HK      0.4718       0   0.3958   0.5415
## 1898.HK      0.8148       0   0.7808   0.8440
## 2318.HK      0.7893       0   0.7512   0.8221
## 2388.HK      0.6650       0   0.6094   0.7141
## 2600.HK      0.7885       0   0.7503   0.8214
## 2628.HK      0.7988       0   0.7622   0.8303
```

```
## 3328.HK      0.8535       0   0.8259   0.8770
## 3988.HK      0.7948       0   0.7575   0.8268
```



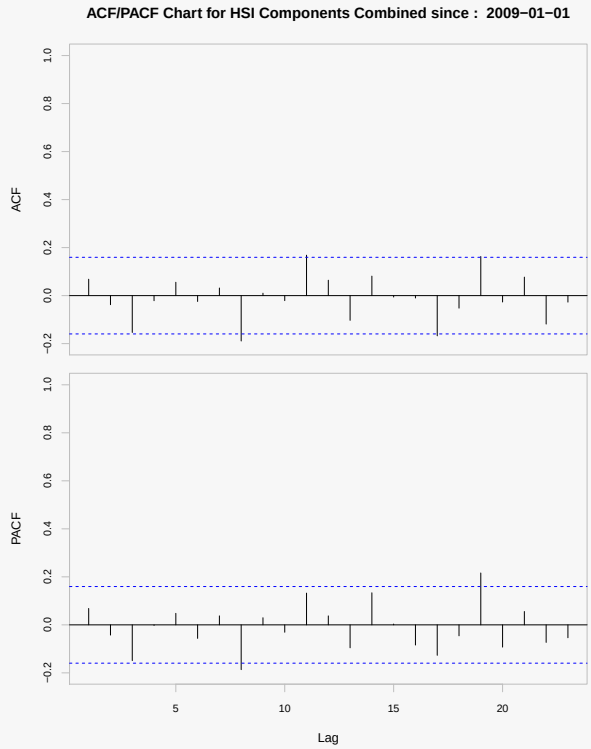
3 Month Rolling Correlation



3.2 Autocorrelation Coefficients - Combined

Autocorrelation Combined

```
##                  rho1    rho2    rho3    rho4   rho5    rho6 Q(6) p-value
## daily.returns 0.0683 -0.0378 -0.1537 -0.0213 0.0557 -0.0244       0.4831
```



3.3 Downside Risk - Combined

Downside Risk Combined

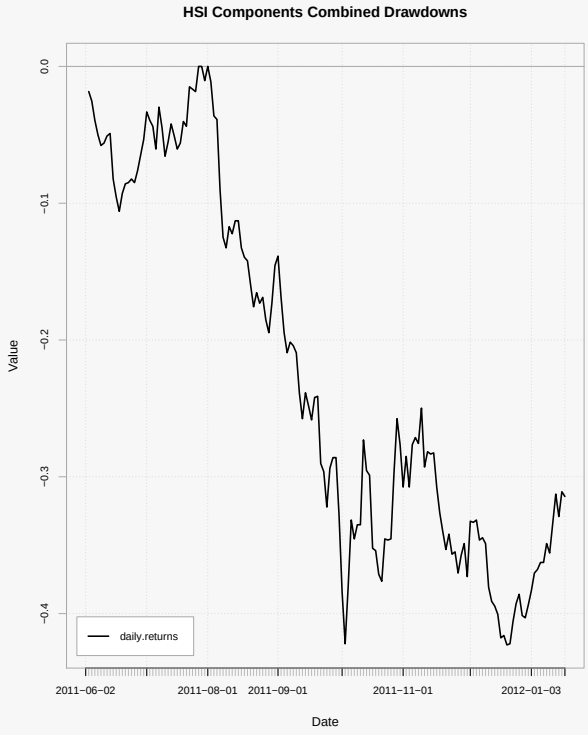
```
##                                HSI Components dailyReturn
## Semi Deviation                                      0.0261
## Gain Deviation                                      0.0202
## Loss Deviation                                      0.0177
## Downside Deviation (MAR=210%)                       0.0298
## Downside Deviation (Rf=0%)                          0.0269
## Downside Deviation (0%)                             0.0269
## Maximum Drawdown                                    0.4229
## Historical VaR (95%)                               -0.0441
## Historical ES (95%)                                -0.0630
## Modified VaR (95%)                                 -0.0438
## Modified ES (95%)                                  -0.0561
```

3.4 Drawdowns - Combined

Drawdowns Combined

```
## Warning message: Only 3 available in the data.
```

```
##         From     Trough         To   Depth Length To Trough Recovery
## 1 2011-08-02 2011-12-19       <NA> -0.4229    118        98       NA
## 2 2011-06-03 2011-06-20 2011-07-28 -0.1060     38        11       27
## 3 2011-07-29 2011-07-29 2011-08-01 -0.0104      2         1        1
```



3.5 Downside Deviation - Combined

Downside Deviation Combined

```
##                                 HSI Components
## Downside Deviation (MAR = 0%)          0.02685
```

3.6 Autocorrelation Coefficients - Distinct

```
##             rho1    rho2    rho3    rho4    rho5    rho6 Q(6) p-value
## X0001.HK  0.0500 -0.0682  0.0214 -0.0328  0.0079  0.0109       0.3451
## X0002.HK -0.1276 -0.0440 -0.0142  0.0261  0.0176 -0.0357       0.0153
## X0003.HK -0.0962 -0.0146 -0.0239  0.0487  0.0156  0.0265       0.1178
## X0004.HK  0.0087 -0.0391 -0.0280 -0.0325  0.0853 -0.0413       0.1481
## X0005.HK -0.0250 -0.0266  0.0594  0.0326 -0.0489  0.0294       0.3206
## X0006.HK -0.0926 -0.0645  0.0179 -0.0161  0.0089 -0.0738       0.0260
## X0011.HK  0.1150  0.0123 -0.0187  0.0032 -0.0475 -0.0820       0.0082
## X0012.HK  0.0684 -0.0267 -0.0483 -0.0082  0.0470  0.0082       0.2632
## X0013.HK  0.0008  0.0294  0.0106 -0.0118  0.0253 -0.0264       0.9314
## X0016.HK  0.0428 -0.0588  0.0245 -0.0078  0.0411  0.0176       0.4167
## X0017.HK  0.0748  0.0127  0.0076  0.0232  0.0459 -0.0263       0.3233
## X0019.HK  0.0489  0.0447 -0.0275 -0.1077 -0.0091  0.0250       0.0385
## X0023.HK  0.0865 -0.0088 -0.0090  0.0003 -0.0454 -0.0373       0.2071
## X0066.HK -0.0753  0.0020  0.0558 -0.0255 -0.0095 -0.0171       0.2793
## X0083.HK  0.1003 -0.0639 -0.0382  0.0032  0.0472  0.0048       0.0345
## X0101.HK -0.0665 -0.0332  0.0202 -0.0479 -0.0589  0.0189       0.1633
## X0144.HK  0.0655 -0.0103  0.0027 -0.0504 -0.1086  0.0000       0.0265
## X0151.HK -0.0166 -0.0290 -0.0887 -0.0971  0.0106 -0.0026       0.0283
## X0267.HK  0.1233  0.0369 -0.0540 -0.0231  0.0410  0.0433       0.0064
## X0291.HK -0.0363 -0.0194  0.0090 -0.0439  0.0092 -0.0032       0.8222
## X0293.HK  0.0245 -0.0482 -0.0710 -0.0558  0.0734  0.0693       0.0126
## X0322.HK -0.0120  0.0345 -0.0902 -0.0004 -0.0193 -0.0237       0.2439
## X0330.HK  0.0417  0.1220 -0.0171  0.0402 -0.0100 -0.0194       0.0248
## X0386.HK -0.0219 -0.0226 -0.0399 -0.0183 -0.0099  0.0346       0.7823
## X0388.HK  0.1008 -0.0132  0.0339 -0.0162  0.0038 -0.0126       0.1701
## X0494.HK  0.0519 -0.0101 -0.0026 -0.0462 -0.1600 -0.0020       0.5394
## X0688.HK  0.0761 -0.0529 -0.0496 -0.0499 -0.0078  0.0078       0.1088
## X0700.HK  0.0262 -0.0968 -0.0003 -0.0898  0.0052  0.0368       0.0199
## X0762.HK -0.0477 -0.0653 -0.0325 -0.0664  0.0172 -0.0147       0.1419
## X0836.HK -0.0578 -0.0361  0.0012  0.0082 -0.0095 -0.0140       0.7033
## X0857.HK  0.0446 -0.0129  0.0399 -0.0065 -0.0065  0.0067       0.8149
## X0883.HK  0.0437 -0.0486 -0.0136 -0.0309 -0.0600  0.0019       0.3332
## X0939.HK  0.0032 -0.0001  0.0208 -0.0579 -0.0341 -0.0324       0.5985
## X0941.HK -0.0149 -0.0184  0.0042 -0.0943  0.0023 -0.0203       0.2731
## X1044.HK -0.0342 -0.0451 -0.0986 -0.0586 -0.0406  0.0120       0.0290
## X1088.HK  0.0482 -0.0029 -0.0250 -0.0338  0.0302 -0.0318       0.5972
## X1109.HK  0.0285 -0.0170 -0.0552 -0.0927  0.0109 -0.0021       0.1328
## X1199.HK  0.0739  0.0491 -0.0049 -0.0672  0.0069  0.0341       0.1100
## X1299.HK -0.0207 -0.0932  0.0163 -0.0764 -0.1177 -0.0047       0.1728
## X1398.HK  0.0245 -0.0039  0.0665 -0.0264 -0.0244 -0.0343       0.4545
## X1880.HK  0.0054 -0.0831 -0.0834 -0.0255 -0.0352 -0.0358       0.0430
## X1898.HK  0.0974  0.0164  0.0033  0.0024 -0.0480 -0.0167       0.1523
## X2318.HK  0.0699 -0.0572 -0.0668 -0.0431  0.0666  0.0105       0.0246
## X2388.HK  0.0720  0.0273  0.0573 -0.0016 -0.0402 -0.0157       0.2084
## X2600.HK  0.0672 -0.0379 -0.0251 -0.0005  0.0070  0.0083       0.5309
## X2628.HK -0.0014 -0.0282  0.0393 -0.0639 -0.0059 -0.0033       0.5524
```

```
## X3328.HK  0.0248  0.0338 -0.0038 -0.0631  0.0049 -0.0122       0.6071
## X3988.HK  0.0410 -0.0210  0.0418 -0.0463 -0.0084 -0.0672       0.2315
```

3.7 Downside Deviation - Distinct

```
##                                0001.HK 0002.HK 0003.HK 0004.HK 0005.HK
## Downside Deviation (MAR = 0%)  0.0193  0.0089  0.0157  0.0243  0.0258
##                                0006.HK 0011.HK 0012.HK 0013.HK 0016.HK
## Downside Deviation (MAR = 0%)  0.0111  0.0152  0.0215  0.0194  0.0198
##                                0017.HK 0019.HK 0023.HK 0066.HK 0083.HK
## Downside Deviation (MAR = 0%)  0.0246   0.021  0.0207  0.0134  0.0257
##                                0101.HK 0144.HK 0151.HK 0267.HK 0291.HK
## Downside Deviation (MAR = 0%)  0.0255   0.027  0.0218  0.0257   0.023
##                                0293.HK 0322.HK 0330.HK 0386.HK 0388.HK
## Downside Deviation (MAR = 0%)  0.0215  0.0202  0.0357  0.0208    0.02
##                                0494.HK 0688.HK 0700.HK 0762.HK 0836.HK
## Downside Deviation (MAR = 0%)  0.0345  0.0261  0.0248  0.0227  0.0205
##                                0857.HK 0883.HK 0939.HK 0941.HK 1044.HK
## Downside Deviation (MAR = 0%)  0.0211  0.0242  0.0212   0.016  0.0206
##                                1088.HK 1109.HK 1199.HK 1299.HK 1398.HK
## Downside Deviation (MAR = 0%)  0.0247  0.0291  0.0291  0.0202  0.0218
##                                1880.HK 1898.HK 2318.HK 2388.HK 2600.HK
## Downside Deviation (MAR = 0%)  0.0275  0.0302   0.027  0.0201    0.03
##                                2628.HK 3328.HK 3988.HK
## Downside Deviation (MAR = 0%)   0.022  0.0225  0.0219
```

4 General Statistics

Statistics Distinct

```
##                Observations NAs Minimum Quartile 1 Median Arithmetic Mean
## X0001.HK.Close          757  12   56.00      91.15  97.95          99.848
## X0002.HK.Close          757  12   51.10      52.55  56.95          59.111
## X0003.HK.Close          757  12   10.78      17.18  18.08          17.581
## X0004.HK.Close          757  12   15.20      36.55  41.55          41.706
## X0005.HK.Close          757  12   33.00      65.95  79.10          75.083
## X0006.HK.Close          757  12   41.10      43.40  47.00          48.846
## X0011.HK.Close          757  12   67.00     104.00 110.80         109.636
## X0012.HK.Close          757  12   23.75      42.60  48.60          47.003
## X0013.HK.Close          757  12   36.40      52.40  57.55          63.749
## X0016.HK.Close          757  12   55.80      99.85 111.50         108.103
## X0017.HK.Close          757  12    6.20      10.04  13.58          12.806
## X0019.HK.Close          757  12   42.90      84.80  92.60          92.759
## X0023.HK.Close          757  12   12.34      26.50  28.85          28.136
## X0066.HK.Close          757  12   16.14      25.10  26.90          26.027
## X0083.HK.Close          757  12    5.60      11.78  13.68          13.074
## X0101.HK.Close          757  12   13.66      25.50  29.20          28.633
## X0144.HK.Close          757  12   12.20      23.05  26.30          25.920
## X0151.HK.Close          757  12    2.77       4.62   6.14           5.794
## X0267.HK.Close          757  12    7.18      14.20  17.48          17.125
## X0291.HK.Close          757  12   10.66      23.20  27.95          26.035
## X0293.HK.Close          757  12    6.98      12.54  14.60          15.166
## X0322.HK.Close          757  12    8.27      16.08  19.16          18.080
## X0330.HK.Close          757  12    7.93      34.05  42.65          39.780
## X0386.HK.Close          757  12    3.65       6.18   6.76           6.760
## X0388.HK.Close          757  12   54.60     122.60 136.10         136.505
## X0494.HK.Close          158 611   11.60      13.55  14.40          14.442
## X0688.HK.Close          757  12    9.41      14.18  15.50          15.206
## X0700.HK.Close          766   3   41.80     126.72 154.55         146.930
## X0762.HK.Close          764   5    8.31       9.63  10.92          11.838
## X0836.HK.Close          757  12   11.10      14.20  15.36          15.448
## X0857.HK.Close          757  12    5.10       8.67   9.33           9.256
## X0883.HK.Close          757  12    6.08      11.02  13.12          13.490
## X0939.HK.Close          757  12    3.66       5.58   6.26           6.112
## X0941.HK.Close          757  12   63.00      73.20  75.75          75.568
## X1044.HK.Close          769   0   24.25      46.35  58.40          55.831
## X1088.HK.Close          757  12   13.90      29.85  33.10          31.561
## X1109.HK.Close          757  12    7.50      12.86  14.62          14.406
## X1199.HK.Close          757  12    5.40       9.36  10.88          11.108
## X1299.HK.Close          304 465   19.86      22.65  23.90          24.292
## X1398.HK.Close          757  12    3.03       4.94   5.74           5.462
## X1880.HK.Close          757  12    2.98       7.95  11.60          10.985
## X1898.HK.Close          757  12    4.43       9.45  10.62          10.454
## X2318.HK.Close          757  12   30.35      57.85  64.35          65.449
## X2388.HK.Close          757  12    6.30      16.66  18.36          18.662
## X2600.HK.Close          757  12    3.20       5.91   7.07           6.732
## X2628.HK.Close          757  12   17.24      26.10  30.60          29.811
## X3328.HK.Close          757  12    4.17       6.32   8.02           7.625
## X3988.HK.Close          757  12    1.84       3.04   3.94           3.671
##                Geometric Mean Quartile 3 Maximum SE Mean LCL Mean (0.95)
## X0001.HK.Close         98.460     114.00  135.70  0.5958          98.678
## X0002.HK.Close         58.753      64.05   75.00  0.2415          58.637
## X0003.HK.Close         17.442      19.00   21.00  0.0767          17.430
## X0004.HK.Close         39.950      51.35   62.00  0.4073          40.907
```

```
## X0005.HK.Close         74.032      83.15   98.00  0.4320          74.235
## X0006.HK.Close         48.491      52.80   64.80  0.2214          48.411
## X0011.HK.Close        108.857     120.00  134.00  0.4631         108.727
## X0012.HK.Close         46.170      53.25   60.50  0.3017          46.411
## X0013.HK.Close         61.791      78.40   95.90  0.5855          62.600
## X0016.HK.Close        106.339     118.80  146.30  0.6647         106.798
## X0017.HK.Close         12.349      15.36   18.54  0.1200          12.570
## X0019.HK.Close         90.269     109.50  136.40  0.7334          91.319
## X0023.HK.Close         27.589      32.20   35.90  0.1860          27.770
## X0066.HK.Close         25.797      28.30   31.15  0.1199          25.792
## X0083.HK.Close         12.803      14.80   18.56  0.0917          12.894
## X0101.HK.Close         28.024      32.50   40.30  0.2057          28.230
## X0144.HK.Close         25.369      28.95   37.55  0.1862          25.554
## X0151.HK.Close          5.641       6.93    8.19  0.0497           5.697
## X0267.HK.Close         16.622      20.65   24.40  0.1457          16.839
## X0291.HK.Close         25.001      30.85   35.25  0.2410          25.562
## X0293.HK.Close         14.626      18.36   24.05  0.1492          14.873
## X0322.HK.Close         17.433      20.70   25.95  0.1639          17.758
## X0330.HK.Close         36.082      50.80   64.30  0.5215          38.756
## X0386.HK.Close          6.685       7.56    9.15  0.0377           6.686
## X0388.HK.Close        132.529     161.30  197.50  1.1059         134.334
## X0494.HK.Close         14.390      15.40   17.92  0.1009          14.242
## X0688.HK.Close         15.075      16.66   19.44  0.0719          15.065
## X0700.HK.Close        136.679     178.88  225.00  1.7131         143.567
## X0762.HK.Close         11.609      13.66   17.40  0.0912          11.659
## X0836.HK.Close         15.361      16.66   20.15  0.0613          15.328
## X0857.HK.Close          9.153      10.08   12.36  0.0501           9.157
## X0883.HK.Close         13.050      16.42   20.95  0.1258          13.243
## X0939.HK.Close          6.044       6.83    8.28  0.0344           6.045
## X0941.HK.Close         75.462      77.95   91.45  0.1459          75.281
## X1044.HK.Close         53.643      67.70   78.25  0.5170          54.816
## X1088.HK.Close         30.896      35.25   40.80  0.2134          31.142
## X1109.HK.Close         14.162      16.40   20.00  0.0955          14.219
## X1199.HK.Close         10.866      12.72   16.76  0.0866          10.938
## X1299.HK.Close         24.216      26.10   29.55  0.1130          24.069
## X1398.HK.Close          5.397       5.99    7.03  0.0316           5.400
## X1880.HK.Close         10.216      14.26   17.54  0.1411          10.708
## X1898.HK.Close         10.213      11.78   15.86  0.0802          10.296
## X2318.HK.Close         63.939      76.55   94.30  0.4944          64.479
## X2388.HK.Close         17.863      22.95   28.95  0.1877          18.294
## X2600.HK.Close          6.520       7.88   10.66  0.0621           6.610
## X2628.HK.Close         29.186      34.55   41.00  0.2160          29.387
## X3328.HK.Close          7.473       8.73   10.56  0.0563           7.514
## X3988.HK.Close          3.609       4.15    5.00  0.0260           3.620
##                UCL Mean (0.95)  Variance   Stdev Skewness Kurtosis
## X0001.HK.Close         101.018  268.7235 16.3928  -0.0729  -0.1880
## X0002.HK.Close          59.585   44.1651  6.6457   0.4184  -1.2150
## X0003.HK.Close          17.732    4.4544  2.1105  -1.5836   1.9138
## X0004.HK.Close          42.506  125.5891 11.2067  -0.4474  -0.2764
## X0005.HK.Close          75.932  141.3068 11.8873  -0.8209   0.2324
## X0006.HK.Close          49.281   37.1209  6.0927   0.7105  -0.7064
## X0011.HK.Close         110.545  162.3202 12.7405  -0.5636   0.0154
## X0012.HK.Close          47.595   68.8959  8.3004  -0.9044   0.2399
## X0013.HK.Close          64.899  259.5496 16.1105   0.3965  -1.0037
## X0016.HK.Close         109.407  334.4402 18.2877  -0.8319   0.5609
## X0017.HK.Close          13.041   10.8962  3.3009  -0.5892  -0.8266
## X0019.HK.Close          94.199  407.1579 20.1782  -0.4786  -0.0199
```

```
## X0023.HK.Close          28.501   26.1983  5.1184  -1.1827   0.9421
## X0066.HK.Close          26.263   10.8818  3.2988  -1.3516   1.1210
## X0083.HK.Close          13.254    6.3693  2.5238  -1.0167   0.6650
## X0101.HK.Close          29.037   32.0234  5.6589  -0.5345  -0.0485
## X0144.HK.Close          26.285   26.2395  5.1225  -0.5018   0.2450
## X0151.HK.Close           5.892    1.8714  1.3680  -0.5080  -0.8403
## X0267.HK.Close          17.411   16.0741  4.0093  -0.4696  -0.6010
## X0291.HK.Close          26.509   43.9776  6.6316  -0.9876  -0.1894
## X0293.HK.Close          15.459   16.8423  4.1039   0.1241  -0.7971
## X0322.HK.Close          18.401   20.3429  4.5103  -0.7694  -0.2312
## X0330.HK.Close          40.803  205.9051 14.3494  -0.7591  -0.3074
## X0386.HK.Close           6.834    1.0768  1.0377  -0.6415   0.4680
## X0388.HK.Close         138.676  925.8489 30.4278  -0.5523   0.2329
## X0494.HK.Close          14.641    1.6086  1.2683   0.1288  -0.3025
## X0688.HK.Close          15.347    3.9145  1.9785  -0.7317   0.0307
## X0700.HK.Close         150.292 2248.0251 47.4133  -0.6733  -0.3148
## X0762.HK.Close          12.016    6.3479  2.5195   0.7714  -0.8449
## X0836.HK.Close          15.568    2.8411  1.6856   0.1333  -0.3698
## X0857.HK.Close           9.354    1.9014  1.3789  -0.7633   0.7996
## X0883.HK.Close          13.737   11.9867  3.4622  -0.0292  -0.7307
## X0939.HK.Close           6.180    0.8968  0.9470  -0.7137  -0.0174
## X0941.HK.Close          75.854   16.1124  4.0140   0.0421   0.7589
## X1044.HK.Close          56.846  205.5072 14.3355  -0.7182  -0.6171
## X1088.HK.Close          31.980   34.4802  5.8720  -1.3420   1.2968
## X1109.HK.Close          14.594    6.9047  2.6277  -0.4303  -0.2318
## X1199.HK.Close          11.278    5.6803  2.3833   0.0852  -0.5671
## X1299.HK.Close          24.514    3.8819  1.9703   0.4056  -0.9030
## X1398.HK.Close           5.524    0.7567  0.8699  -0.9439   0.2901
## X1880.HK.Close          11.262   15.0675  3.8817  -0.4143  -0.9671
## X1898.HK.Close          10.611    4.8696  2.2067  -0.5254   0.2580
## X2318.HK.Close          66.420  185.0549 13.6035  -0.2171  -0.3763
## X2388.HK.Close          19.031   26.6769  5.1650  -0.3852  -0.3007
## X2600.HK.Close           6.854    2.9232  1.7097  -0.4654  -0.6334
## X2628.HK.Close          30.235   35.3088  5.9421  -0.4298  -0.8846
## X3328.HK.Close           7.735    2.3988  1.5488  -0.5194  -0.8609
## X3988.HK.Close           3.722    0.5134  0.7165  -0.8245  -0.3489
```

4.1 Higher Moments - Distinct

```
##                 0001.HK 0002.HK 0003.HK 0004.HK 0005.HK 0006.HK 0011.HK
## CoSkewness       0.0000  0.0000  0.0000   0.000  0.0000  0.0000  0.0000
## CoKurtosis       0.0000  0.0000  0.0000   0.000  0.0000  0.0000  0.0000
## Beta CoVariance  0.9880  0.1507  0.3812   1.106  1.1212  0.1176  0.6393
## Beta CoSkewness  1.0044 -0.5296 -0.3936   1.832  0.9675 -0.1619  0.9658
## Beta CoKurtosis  0.9988  0.0870  0.3600   1.119  1.2798  0.0898  0.7202
##                 0012.HK 0013.HK 0016.HK 0017.HK 0019.HK 0023.HK 0066.HK
## CoSkewness        0.000  0.0000  0.0000   0.000  0.0000  0.0000  0.0000
## CoKurtosis        0.000  0.0000  0.0000   0.000  0.0000  0.0000  0.0000
## Beta CoVariance   1.022  0.9487  1.0026   1.129  0.7797  0.9380  0.5101
## Beta CoSkewness   1.980  0.1541  1.3493   0.680  1.3926  1.8081  0.2499
## Beta CoKurtosis   1.075  0.9008  0.9863   1.127  0.7972  0.9851  0.4533
##                 0083.HK 0101.HK 0144.HK 0151.HK 0267.HK 0291.HK 0293.HK
## CoSkewness        0.000   0.000   0.000  0.0000  0.0000  0.0000  0.0000
## CoKurtosis        0.000   0.000   0.000  0.0000  0.0000  0.0000  0.0000
## Beta CoVariance   1.165   1.093   1.311  0.4279  1.0784  0.8819  0.7701
## Beta CoSkewness   1.233   2.768   1.503 -1.4211  1.2943  0.1781  1.0462
## Beta CoKurtosis   1.172   1.167   1.208  0.3348  0.9846  0.7633  0.7552
##                 0322.HK 0330.HK 0386.HK 0388.HK 0494.HK 0688.HK 0700.HK
## CoSkewness       0.0000  0.0000  0.0000   0.000   0.000   0.000  0.0000
## CoKurtosis       0.0000  0.0000  0.0000   0.000   0.000   0.000  0.0000
## Beta CoVariance  0.3499  0.9399  0.9570   1.159   1.233   1.184  0.9359
## Beta CoSkewness -0.1654 -0.5512 -0.0559   1.789  -1.877   3.646  1.5737
## Beta CoKurtosis  0.3079  0.8980  0.8894   1.145   1.034   1.263  0.8987
##                 0762.HK 0836.HK 0857.HK 0883.HK 0939.HK 0941.HK 1044.HK
## CoSkewness       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
## CoKurtosis       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
## Beta CoVariance  0.7046  0.5601  1.1015  1.2849  1.0610  0.7093  0.4658
## Beta CoSkewness -0.4624 -0.7215  0.5491  0.8794  0.6204  0.6990  0.0120
## Beta CoKurtosis  0.5409  0.4933  1.0086  1.2093  1.0416  0.7032  0.3957
##                 1088.HK 1109.HK 1199.HK 1299.HK 1398.HK 1880.HK 1898.HK
## CoSkewness        0.000   0.000   0.000  0.0000   0.000  0.0000  0.0000
## CoKurtosis        0.000   0.000   0.000  0.0000   0.000  0.0000  0.0000
## Beta CoVariance   1.218   1.163   1.332  0.8204   1.126  0.8252  1.4963
## Beta CoSkewness   0.973   3.311   0.792  1.9588   0.981  0.2150  0.9659
## Beta CoKurtosis   1.093   1.142   1.257  0.9850   1.066  0.7689  1.3878
##                 2318.HK 2388.HK 2600.HK 2628.HK 3328.HK 3988.HK
## CoSkewness        0.000  0.0000   0.000   0.000  0.0000  0.0000
## CoKurtosis        0.000  0.0000   0.000   0.000  0.0000  0.0000
## Beta CoVariance   1.324  0.8772   1.538   1.090  1.1922  1.0340
## Beta CoSkewness   2.059  0.8404   2.163   0.897  0.9867  0.3071
## Beta CoKurtosis   1.318  0.8493   1.448   1.039  1.1841  0.9698
```

4.2 Higher Moments - Combined

```
##                 HSI Components to HSI Combined
## CoSkewness                              0.0000
## CoKurtosis                              0.0000
## Beta CoVariance                         1.1722
## Beta CoSkewness                        -0.2656
## Beta CoKurtosis                         1.1234
```

5 Principal Components Analysis

Principal components analysis, or PCA, seeks to find a set of orthogonal axes such that the first axis, or first principal component, accounts for as much variability as possible and subsequent axes are chosen to maximize variance while maintaining orthogonality with previous axes. Principal components are typically computed either by a singular value decomposition of the data matrix or an eigenvalue decomposition of a covariance or correlation matrix.[3] The calculation and chart below based on correlation. Future improvement here is to use sparse pca to reduce the number of important components to a more manageable number.[4] Principal component analysis (PCA) is an orthogonal transformation of possibly correlated variables into uncorrelated variables called principal components.

Terminology Factor loadings: The factor loadings, also called component loadings in PCA, are the correlation coefficients between the variables (rows) and factors (columns). Analogous to Pearson's r, the squared factor loading is the percent of variance in that indicator variable explained by the factor. To get the percent of variance in all the variables accounted for by each factor, add the sum of the squared factor loadings for that factor (column) and divide by the number of variables. (Note the number of variables equals the sum of their variances as the variance of a standardized variable is 1.) This is the same as dividing the factor's eigenvalue by the number of variables.

Interpreting factor loadings: By one rule of thumb in confirmatory factor analysis, loadings should be .7 or higher to confirm that independent variables identified a priori are represented by a particular factor, on the rationale that the .7 level corresponds to about half of the variance in the indicator being explained by the factor. However, the .7 standard is a high one and real-life data may well not meet this criterion, which is why some researchers, particularly for exploratory purposes, will use a lower level such as .4 for the central factor and .25 for other factors call loadings above .6 "high" and those below .4 "low". In any event, factor loadings must be interpreted in the light of theory, not by arbitrary cutoff levels.

In oblique rotation, one gets both a pattern matrix and a structure matrix. The structure matrix is simply the factor loading matrix as in orthogonal rotation, representing the variance in a measured variable explained by a factor on both a unique and common contributions basis. The pattern matrix, in contrast, contains coefficients which just represent unique contributions. The more factors, the lower the pattern coefficients as a rule since there will be more common contributions to variance explained. For oblique rotation, the researcher looks at both the structure and pattern coefficients when attributing a label to a factor.

Communality: The sum of the squared factor loadings for all factors for a given variable (row) is the variance in that variable accounted for by all the factors, and this is called the communality. The communality measures the percent of variance in a given variable explained by all the factors jointly and may be interpreted as the reliability of the indicator.

Spurious solutions: If the communality exceeds 1.0, there is a spurious solution, which may reflect too small a sample or the researcher has too many or too few factors.

Uniqueness of a variable: That is, uniqueness is the variability of a variable minus its communality.

Eigenvalues:/Characteristic roots: The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables. If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. Eigenvalues measure the amount of variation in the total sample accounted for by each factor.

Extraction sums of squared loadings: Initial eigenvalues and eigenvalues after extraction are the same for PCA extraction, but for other extraction methods, eigenvalues after extraction will be lower than their initial counterparts.

Factor scores (also called component scores in PCA): are the scores of each case (row) on each factor (column). To compute the factor score for a given case for a given factor, one takes the case's standardized score on each variable, multiplies by the corresponding factor loading of the variable for the given factor, and sums these products. Computing factor scores allows one to look for factor outliers. Also, factor scores may be used as variables in subsequent modeling.

Criteria for determining the number of factors Using one or more of the methods below, the researcher determines an appropriate range of solutions to investigate. Methods may not agree. For instance, the Kaiser criterion may suggest five factors and the scree test may suggest two, so the researcher may request 3-, 4-, and 5-factor solutions discuss each in terms of their relation to external data and theory.

Comprehensibility: A purely subjective criterion would be to retain those factors whose meaning is comprehensible to the researcher. This is not recommended.[5]

[3] http://blog.revolutionanalytics.com/2011/06/big-data-pca.html

[4] http://statmath.wu.ac.at/courses/optimization/Presentations/Nops+Thomas-sPCA1.pdf

[5] http://en.wikipedia.org/wiki/Factoranalysis

5.1 PCA with stats package princomp function

```
## Importance of components:
##                         Comp.1  Comp.2  Comp.3  Comp.4  Comp.5  Comp.6
## Standard deviation     5.1764 1.53115 1.18699 1.10716 1.06946 1.03587
## Proportion of Variance 0.5582 0.04884 0.02935 0.02554 0.02383 0.02235
## Cumulative Proportion  0.5582 0.60708 0.63643 0.66197 0.68579 0.70815
##                         Comp.7  Comp.8  Comp.9 Comp.10 Comp.11 Comp.12
## Standard deviation     0.95781 0.95363 0.88747 0.87034 0.83235 0.81215
## Proportion of Variance 0.01911 0.01895 0.01641 0.01578 0.01443 0.01374
## Cumulative Proportion  0.72726 0.74621 0.76262 0.77840 0.79283 0.80657
##                        Comp.13 Comp.14 Comp.15 Comp.16  Comp.17  Comp.18
## Standard deviation     0.79077 0.77788 0.74248 0.72245 0.687984 0.649094
## Proportion of Variance 0.01303 0.01261 0.01148 0.01087 0.009861 0.008778
## Cumulative Proportion  0.81960 0.83220 0.84369 0.85456 0.864424 0.873202
##                         Comp.19  Comp.20  Comp.21  Comp.22  Comp.23
## Standard deviation     0.644979 0.635966 0.616805 0.593053 0.584778
## Proportion of Variance 0.008667 0.008426 0.007926 0.007327 0.007124
## Cumulative Proportion  0.881868 0.890295 0.898221 0.905548 0.912672
##                         Comp.24 Comp.25  Comp.26  Comp.27 Comp.28  Comp.29
## Standard deviation     0.563901  0.5455 0.538928 0.524510 0.50578 0.485932
## Proportion of Variance 0.006625  0.0062 0.006051 0.005731 0.00533 0.004919
## Cumulative Proportion  0.919297  0.9255 0.931548 0.937279 0.94261 0.947528
##                         Comp.30  Comp.31  Comp.32  Comp.33 Comp.34
## Standard deviation     0.475740 0.460032 0.453652 0.436784 0.43153
## Proportion of Variance 0.004715 0.004409 0.004287 0.003975 0.00388
## Cumulative Proportion  0.952244 0.956652 0.960940 0.964915 0.96879
##                         Comp.35  Comp.36  Comp.37 Comp.38  Comp.39
## Standard deviation     0.421045 0.404820 0.385055 0.36462 0.354735
## Proportion of Variance 0.003693 0.003414 0.003089 0.00277 0.002622
## Cumulative Proportion  0.972487 0.975902 0.978990 0.98176 0.984382
##                         Comp.40  Comp.41  Comp.42  Comp.43  Comp.44
## Standard deviation     0.351162 0.339172 0.321553 0.304734 0.280293
## Proportion of Variance 0.002569 0.002397 0.002154 0.001935 0.001637
## Cumulative Proportion  0.986951 0.989347 0.991502 0.993436 0.995073
##                         Comp.45 Comp.46  Comp.47   Comp.48
## Standard deviation     0.268802 0.25174 0.235462 0.2131351
## Proportion of Variance 0.001505 0.00132 0.001155 0.0009464
## Cumulative Proportion  0.996578 0.99790 0.999054 1.0000000

##
## Loadings:
##          Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6 Comp.7 Comp.8 Comp.9
## X0001.HK -0.175                -0.155         0.101
## X0002.HK         0.460                -0.106  0.192 -0.158  0.324
## X0003.HK         0.349  0.203 -0.278  0.104         0.246        -0.106
## X0004.HK -0.161                -0.107                0.120         0.185
## X0005.HK -0.172                                      0.154
## X0006.HK         0.468 -0.121  0.136 -0.126                0.411
## X0011.HK -0.159         0.120 -0.208 -0.110  0.176                0.152
## X0012.HK -0.161                -0.207
## X0013.HK -0.168                -0.134         0.168
## X0016.HK -0.170                -0.138                0.194
## X0017.HK -0.137                -0.211                0.197  0.178 -0.390
## X0019.HK -0.114         0.199 -0.138        -0.124 -0.488 -0.157 -0.369
## X0023.HK -0.149         0.137        -0.192  0.164 -0.245 -0.102  0.232
## X0066.HK -0.133  0.126  0.193 -0.212        -0.106 -0.113         0.199
```

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## X0083.HK -0.154               -0.139         0.100  0.197
## X0101.HK -0.157        -0.114 -0.127         0.145  0.130         0.128
## X0144.HK -0.155                0.167  0.152                0.109
## X0151.HK -0.103 -0.120  0.439  0.216  0.127 -0.235  0.206  0.132 -0.232
## X0267.HK -0.158         0.110 -0.108               -0.130
## X0291.HK -0.121                                           0.182 -0.312
## X0293.HK -0.138 -0.150                      0.116 -0.281        -0.210
## X0322.HK        -0.120  0.559               0.133         0.137  0.104
## X0330.HK                      -0.158  0.372 -0.375 -0.190  0.445  0.226
## X0386.HK -0.130  0.239 -0.155  0.185  0.269               -0.291
## X0388.HK -0.165               -0.162 -0.111 -0.107
## X0494.HK -0.132                            -0.270  0.223  0.117  0.256
## X0688.HK -0.154 -0.155 -0.163                                0.128  0.107
## X0700.HK -0.146        -0.130  0.291 -0.116  0.132
## X0762.HK -0.131  0.142         0.290  0.129               -0.117
## X0836.HK                      -0.127  0.640  0.286 -0.130         0.148
## X0857.HK -0.154  0.159                0.180 -0.101  0.106 -0.190
## X0883.HK -0.169                0.139                      -0.101
## X0939.HK -0.169
## X0941.HK -0.114  0.340  0.106         0.130 -0.129
## X1044.HK -0.117         0.293  0.295
## X1088.HK -0.167
## X1109.HK -0.152 -0.219 -0.127                      -0.137         0.164
## X1199.HK -0.161        -0.157                       0.123
## X1299.HK -0.137                      0.106  0.393
## X1398.HK -0.175                     -0.132
## X1880.HK -0.130                0.244         0.262         0.204 -0.212
## X1898.HK -0.162                            -0.125 -0.161         0.123
## X2318.HK -0.165                     -0.122 -0.122 -0.112 -0.129
## X2388.HK -0.165                     -0.186        -0.109
## X2600.HK -0.154        -0.114       -0.105 -0.124         0.112
## X2628.HK -0.151                             -0.200        -0.105  0.131
## X3328.HK -0.173        -0.101                             -0.105
## X3988.HK -0.167                                           -0.137
##          Comp.10 Comp.11 Comp.12 Comp.13 Comp.14 Comp.15 Comp.16 Comp.17
## X0001.HK                                                   0.103  -0.127
## X0002.HK                          -0.204   0.114          -0.204
## X0003.HK          0.199            0.265  -0.333   0.179   0.158
## X0004.HK                  0.169
## X0005.HK
## X0006.HK         -0.322            0.251          -0.180   0.257
## X0011.HK  0.104
## X0012.HK -0.112            0.223
## X0013.HK  0.176
## X0016.HK                                                  -0.116  -0.140
## X0017.HK  0.110  -0.195  -0.246  -0.197
## X0019.HK  0.185  -0.230   0.109   0.213  -0.149
## X0023.HK          0.160                                           -0.266
## X0066.HK                  0.182  -0.309          -0.356   0.135   0.129
## X0083.HK -0.210           0.224  -0.221
## X0101.HK  0.102                   0.217                  -0.168
## X0144.HK  0.121                          -0.129                  -0.332
## X0151.HK -0.173  -0.128                  -0.160           0.152  -0.148
## X0267.HK         -0.162   0.127                  -0.124  -0.235
## X0291.HK -0.210   0.485   0.170   0.289   0.458           0.144   0.152
## X0293.HK          0.151                    0.179  -0.239          -0.153
## X0322.HK -0.277          -0.379   0.180          -0.171  -0.334
```

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## X0330.HK  0.116   0.173          -0.193           0.240  -0.102   0.107
## X0386.HK                          0.107          -0.122  -0.142   0.205
## X0388.HK                                                           0.203
## X0494.HK  0.318                   0.352   0.239                   -0.287
## X0688.HK -0.205   0.132                  -0.319
## X0700.HK                  0.102  -0.127          -0.138  -0.159
## X0762.HK -0.165  -0.154   0.174  -0.123   0.180   0.534  -0.144
## X0836.HK -0.237  -0.290          0.112           -0.120   0.215
## X0857.HK          0.124                   0.103  -0.130  -0.248
## X0883.HK                                  0.174          -0.143
## X0939.HK                 -0.293  -0.128                   0.180
## X0941.HK -0.109   0.348          -0.170  -0.144  -0.188          -0.236
## X1044.HK  0.281           0.275           0.165           0.381   0.311
## X1088.HK                  0.122   0.129           0.193  -0.103  -0.119
## X1109.HK -0.221           0.135   0.153  -0.224
## X1199.HK                          -0.149           -0.137          -0.156
## X1299.HK  0.220   0.149  -0.113                   0.196   0.105   0.140
## X1398.HK                 -0.253                            0.156
## X1880.HK  0.274   0.179                  -0.266                   0.185
## X1898.HK  0.156          -0.158           0.141
## X2318.HK         -0.128           0.141
## X2388.HK  0.168          -0.175  -0.119           0.176
## X2600.HK -0.151                   0.110  -0.178                   0.195
## X2628.HK -0.145                                  -0.233           0.415
## X3328.HK                 -0.162                            0.191
## X3988.HK -0.112          -0.320                   0.103   0.204
##          Comp.18 Comp.19 Comp.20 Comp.21 Comp.22 Comp.23 Comp.24 Comp.25
## X0001.HK -0.157                                                   -0.162
## X0002.HK                                          0.161           -0.211
## X0003.HK         -0.290  -0.218  -0.135   0.240  -0.185
## X0004.HK  0.138                                   0.169  -0.150  -0.234
## X0005.HK                 -0.165   0.188  -0.276
## X0006.HK -0.146                   0.135                    0.179
## X0011.HK                                  -0.102           0.309
## X0012.HK -0.113           0.302  -0.114  -0.204          -0.161  -0.150
## X0013.HK                 -0.130                            0.111
## X0016.HK -0.184           0.199   0.171
## X0017.HK                                  0.105           0.324  -0.177
## X0019.HK          0.164   0.146   0.266
## X0023.HK                 -0.165   0.133          -0.273
## X0066.HK  0.352   0.165                   0.117          -0.203   0.130
## X0083.HK -0.223                   0.115                  -0.199   0.408
## X0101.HK          0.223   0.196  -0.295  -0.202
## X0144.HK  0.320  -0.111                                    0.260
## X0151.HK          0.162  -0.155                   0.165  -0.189
## X0267.HK         -0.184                   0.217  -0.371   0.126   0.168
## X0291.HK  0.185   0.213           0.124                   0.167
## X0293.HK -0.163  -0.332  -0.360  -0.192           0.328  -0.213
## X0322.HK                  0.132
## X0330.HK -0.251                   0.119                           0.156
## X0386.HK         -0.123   0.101                   0.215           0.232
## X0388.HK  0.164          -0.261  -0.219           0.141  -0.118
## X0494.HK          0.172                   0.263          -0.101
## X0688.HK -0.121           0.103           0.146           0.138
## X0700.HK -0.118   0.319          -0.159   0.300           0.152   0.276
## X0762.HK                                  0.246  -0.154          -0.123
## X0836.HK          0.149          -0.106          -0.111
```
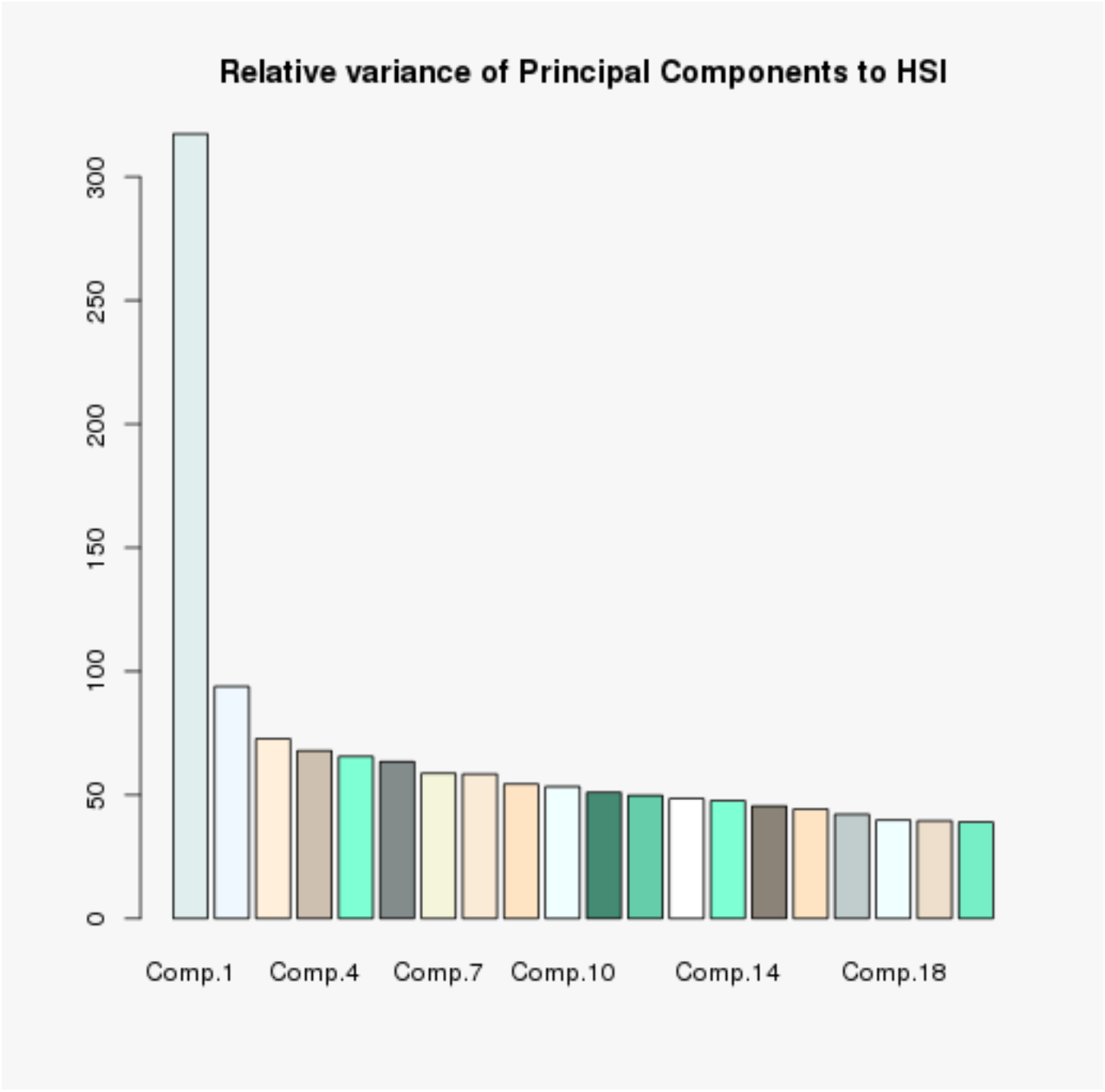
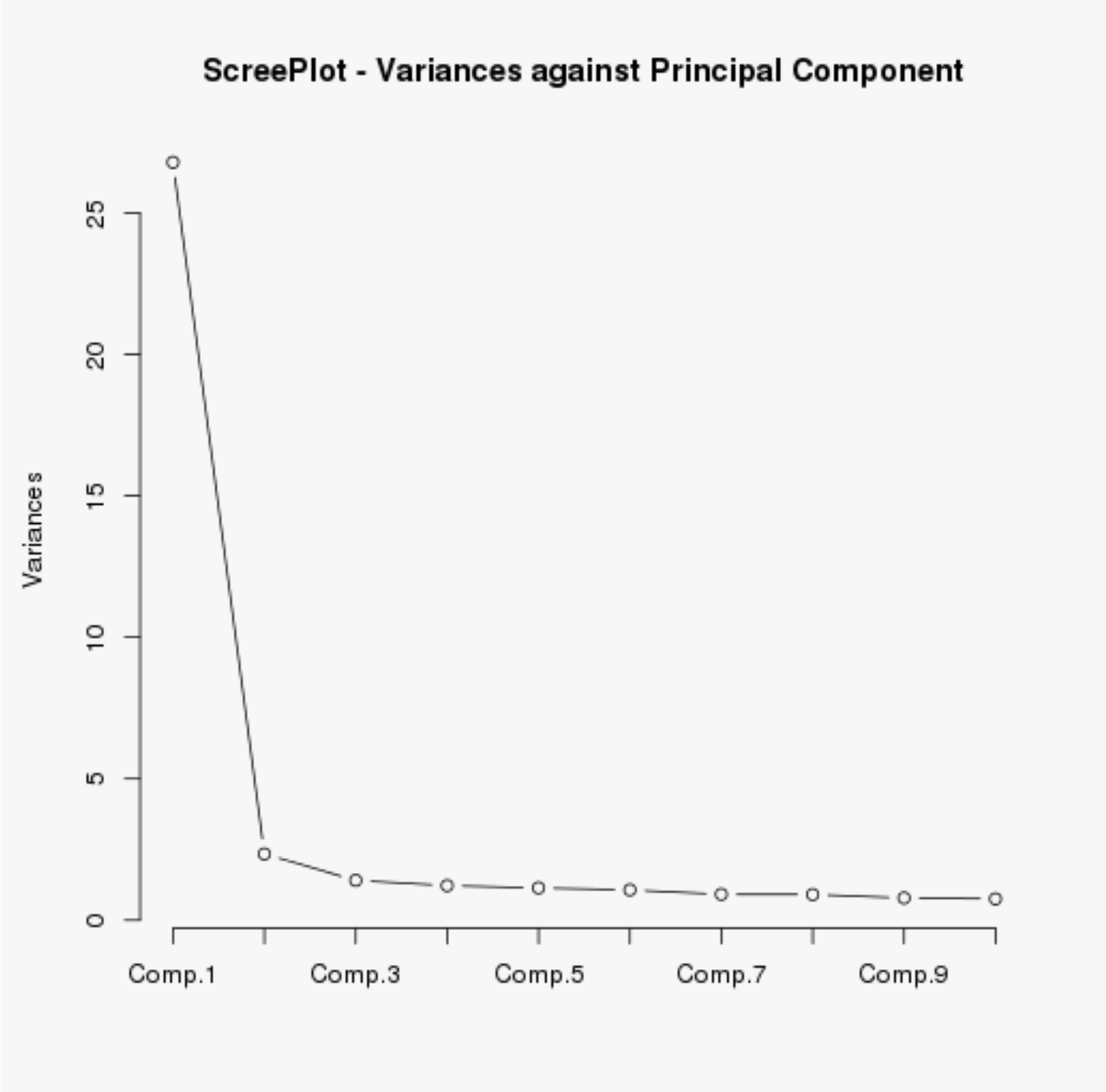

```
## X0857.HK         -0.238                  -0.256
## X0883.HK         -0.218           0.169          -0.138  -0.138
## X0939.HK                  0.107  -0.189   0.154
## X0941.HK -0.192   0.224   0.177  -0.176                   0.124  -0.259
## X1044.HK -0.154  -0.238   0.231          -0.170           0.333
## X1088.HK  0.187   0.148                  -0.284                  0.159
## X1109.HK         -0.131                                   0.168
## X1199.HK  0.168                   0.339
## X1299.HK          0.107           0.453   0.259   0.344
## X1398.HK                  0.116                            -0.115
## X1880.HK          0.104          -0.146  -0.191  -0.403  -0.419  -0.126
## X1898.HK                                  0.195  -0.207          -0.178
## X2318.HK -0.249   0.103  -0.133
## X2388.HK                 -0.165  -0.182  -0.110           0.163   0.150
## X2600.HK  0.394  -0.177   0.314           0.155   0.139
## X2628.HK -0.166   0.186  -0.333   0.152                           -0.188
## X3328.HK                                                 -0.154
## X3988.HK                                  -0.114                  0.107
##          Comp.26 Comp.27 Comp.28 Comp.29 Comp.30 Comp.31 Comp.32 Comp.33
## X0001.HK  0.151  -0.102
## X0002.HK  0.104   0.380           0.198                           0.141
## X0003.HK          0.193                  -0.132   0.104
## X0004.HK         -0.197   0.218  -0.502                  -0.109   0.217
## X0005.HK                 -0.188          -0.105           0.106
## X0006.HK         -0.210          -0.180          -0.110  -0.137
## X0011.HK         -0.236           0.240   0.246   0.190  -0.275
## X0012.HK -0.122                           -0.264   0.268
## X0013.HK         -0.259   0.186          -0.364  -0.291   0.266
## X0016.HK  0.104           0.159                                  -0.232
## X0017.HK         -0.174  -0.240           0.280  -0.165   0.105
## X0019.HK          0.173  -0.171  -0.144
## X0023.HK         -0.220  -0.214  -0.210   0.224   0.159   0.109
## X0066.HK                                  -0.197  -0.252
## X0083.HK                 -0.107   0.185   0.188           0.338
## X0101.HK          0.148  -0.315          -0.178  -0.123  -0.281
## X0144.HK -0.384           0.124   0.197  -0.171   0.191           0.364
## X0151.HK  0.231                           0.109  -0.131  -0.232   0.121
## X0267.HK -0.192           0.243                           -0.345  -0.127
## X0291.HK                  0.139
## X0293.HK                 -0.223   0.110  -0.101                  -0.177
## X0322.HK                                  -0.122           0.274
## X0330.HK                         -0.127  -0.117
## X0386.HK                  0.190           0.246           0.238
## X0388.HK                                  0.131   0.140   0.195
## X0494.HK -0.133   0.114  -0.158           0.256           0.174
## X0688.HK          0.258                   0.139  -0.236           0.113
## X0700.HK  0.344           -0.127  -0.159  -0.239   0.197           0.108
## X0762.HK -0.185  -0.123  -0.217           -0.120
## X0836.HK  0.153                           0.117   0.139
## X0857.HK  0.229                  -0.112           -0.185
## X0883.HK  0.110   0.105                           -0.243  -0.216   0.330
## X0939.HK -0.128           0.133                   -0.183          -0.169
## X0941.HK -0.104  -0.221                   0.140   0.100
## X1044.HK
## X1088.HK                  0.215                   -0.215   0.136  -0.445
## X1109.HK          0.174                           -0.197          -0.178
## X1199.HK          0.312           -0.179           0.290          -0.374
```

```
## X1299.HK -0.150                                                -0.151
## X1398.HK          0.141   0.112                                        0.108
## X1880.HK -0.151
## X1898.HK  0.359  -0.121   0.227   0.412
## X2318.HK -0.158           0.214                   0.204           0.244
## X2388.HK  0.164           0.134           0.112   0.122  -0.106
## X2600.HK  0.162  -0.280  -0.215   0.147           0.199
## X2628.HK -0.246                   0.272                   -0.151
## X3328.HK  0.102          -0.140           0.122
## X3988.HK -0.179          -0.128          -0.122
##           Comp.34 Comp.35 Comp.36 Comp.37 Comp.38 Comp.39 Comp.40 Comp.41
## X0001.HK -0.131  -0.107                   0.335           0.203
## X0002.HK         -0.128                                   0.160
## X0003.HK                  -0.115
## X0004.HK                  -0.181   0.217           0.210  -0.207  -0.183
## X0005.HK -0.255   0.119   0.383  -0.130   0.241   0.465
## X0006.HK
## X0011.HK -0.329  -0.124          -0.196  -0.135   0.150  -0.132  -0.133
## X0012.HK  0.161  -0.202   0.349  -0.153  -0.187           -0.130  -0.128
## X0013.HK -0.109                  -0.131                   0.193  -0.206
## X0016.HK         -0.120  -0.113           0.251  -0.319  -0.139   0.242
## X0017.HK  0.226  -0.116                  -0.133
## X0019.HK -0.182                   0.155                   -0.143
## X0023.HK  0.192           0.175                   -0.186   0.111   0.222
## X0066.HK  0.144                  -0.193                   -0.107   0.148
## X0083.HK          0.270  -0.227   0.196
## X0101.HK          0.238           0.240   0.147  -0.107   0.200   0.189
## X0144.HK                          0.165   0.129           -0.182
## X0151.HK  0.164           0.142                   -0.169
## X0267.HK                  0.304   0.105                    0.270  -0.189
## X0291.HK
## X0293.HK         -0.114
## X0322.HK
## X0330.HK         -0.133
## X0386.HK         -0.144   0.159           0.218  -0.195
## X0388.HK -0.345   0.295   0.237   0.271  -0.130  -0.259   0.122   0.127
## X0494.HK                          -0.208
## X0688.HK -0.105                           0.105   0.188
## X0700.HK         -0.165   0.165           -0.181          -0.125
## X0762.HK                                  0.221           -0.116
## X0836.HK -0.106
## X0857.HK  0.178   0.273          -0.110  -0.231           -0.165
## X0883.HK -0.285  -0.149  -0.210           -0.158  -0.195
## X0939.HK -0.240                  -0.113  -0.232   0.171           0.219
## X0941.HK -0.150   0.225                                           -0.102
## X1044.HK                  -0.109   0.126
## X1088.HK         -0.257           0.201  -0.205   0.164   0.114   0.209
## X1109.HK          0.183           -0.195          -0.213  -0.253  -0.172
## X1199.HK          0.117  -0.228                           0.133  -0.233
## X1299.HK  0.192   0.125   0.210           -0.116
## X1398.HK         -0.189                                           0.254
## X1880.HK                          -0.139
## X1898.HK  0.122   0.175           0.240                   -0.256
## X2318.HK  0.274           -0.216  -0.309  -0.196   0.162   0.357   0.187
## X2388.HK  0.143   0.240  -0.181  -0.267   0.335           -0.219
## X2600.HK          0.119  -0.167                           0.258
## X2628.HK         -0.157  -0.108   0.108           -0.148  -0.209
```

```
## X3328.HK  0.232  -0.279           0.294   0.222   0.239          -0.379
## X3988.HK                                  -0.153  -0.295          -0.386
##           Comp.42 Comp.43 Comp.44 Comp.45 Comp.46 Comp.47 Comp.48
## X0001.HK  0.296  -0.221   0.204   0.350  -0.132   0.495   0.156
## X0002.HK          0.126   0.159                           0.144
## X0003.HK          0.111
## X0004.HK          0.224                                   0.128
## X0005.HK -0.103   0.230                   0.278  -0.107   0.105
## X0006.HK         -0.130
## X0011.HK -0.283  -0.232                           0.107
## X0012.HK  0.109          -0.241          -0.191          -0.183
## X0013.HK          0.128  -0.104  -0.438                   -0.270
## X0016.HK -0.128           0.261  -0.215   0.156  -0.383   0.219
## X0017.HK                         0.112
## X0019.HK
## X0023.HK          0.115  -0.127  -0.203  -0.151
## X0066.HK         -0.170           0.127
## X0083.HK  0.113   0.193                           0.104
## X0101.HK -0.211          -0.105                   0.145
## X0144.HK  0.115  -0.107                                   0.124
## X0151.HK -0.172
## X0267.HK  0.110   0.152
## X0291.HK
## X0293.HK -0.135
## X0322.HK         -0.108  -0.120
## X0330.HK
## X0386.HK -0.264   0.134  -0.207                   0.119
## X0388.HK         -0.298                           -0.136  -0.105
## X0494.HK  0.147   0.107   0.122
## X0688.HK -0.218                          -0.455  -0.272  -0.213
## X0700.HK  0.134
## X0762.HK         -0.213                                   -0.130
## X0836.HK  0.112                                  -0.167
## X0857.HK  0.137  -0.153   0.415  -0.160  -0.175          -0.121
## X0883.HK  0.167          -0.410   0.150   0.152  -0.173
## X0939.HK  0.104   0.121          -0.323  -0.183   0.203   0.402
## X0941.HK                 -0.161           0.145          -0.128
## X1044.HK
## X1088.HK  0.131                   0.270          -0.101
## X1109.HK         -0.114  -0.133           0.466   0.177   0.127
## X1199.HK -0.230          -0.116          -0.161   0.210  -0.100
## X1299.HK  0.151                           0.101
## X1398.HK          0.140   0.200           0.330   0.265  -0.612
## X1880.HK                  0.148
## X1898.HK -0.255                   0.188                   0.106
## X2318.HK -0.154  -0.234                   0.135           0.115
## X2388.HK  0.277   0.175  -0.198   0.120  -0.141  -0.194
## X2600.HK  0.213   0.230
## X2628.HK          0.138                   -0.183   0.112
## X3328.HK  0.140  -0.356          -0.321           -0.175   0.101
## X3988.HK -0.201   0.200   0.343   0.323           -0.205
##
##                Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6 Comp.7 Comp.8
## SS loadings     1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
## Proportion Var  0.021  0.021  0.021  0.021  0.021  0.021  0.021  0.021
## Cumulative Var  0.021  0.042  0.062  0.083  0.104  0.125  0.146  0.167
##                Comp.9 Comp.10 Comp.11 Comp.12 Comp.13 Comp.14 Comp.15
```

```
## SS loadings     1.000   1.000   1.000   1.000   1.000   1.000   1.000
## Proportion Var  0.021   0.021   0.021   0.021   0.021   0.021   0.021
## Cumulative Var  0.187   0.208   0.229   0.250   0.271   0.292   0.312
##                Comp.16 Comp.17 Comp.18 Comp.19 Comp.20 Comp.21 Comp.22
## SS loadings      1.000   1.000   1.000   1.000   1.000   1.000   1.000
## Proportion Var   0.021   0.021   0.021   0.021   0.021   0.021   0.021
## Cumulative Var   0.333   0.354   0.375   0.396   0.417   0.438   0.458
##                Comp.23 Comp.24 Comp.25 Comp.26 Comp.27 Comp.28 Comp.29
## SS loadings      1.000   1.000   1.000   1.000   1.000   1.000   1.000
## Proportion Var   0.021   0.021   0.021   0.021   0.021   0.021   0.021
## Cumulative Var   0.479   0.500   0.521   0.542   0.562   0.583   0.604
##                Comp.30 Comp.31 Comp.32 Comp.33 Comp.34 Comp.35 Comp.36
## SS loadings      1.000   1.000   1.000   1.000   1.000   1.000   1.000
## Proportion Var   0.021   0.021   0.021   0.021   0.021   0.021   0.021
## Cumulative Var   0.625   0.646   0.667   0.688   0.708   0.729   0.750
##                Comp.37 Comp.38 Comp.39 Comp.40 Comp.41 Comp.42 Comp.43
## SS loadings      1.000   1.000   1.000   1.000   1.000   1.000   1.000
## Proportion Var   0.021   0.021   0.021   0.021   0.021   0.021   0.021
## Cumulative Var   0.771   0.792   0.813   0.833   0.854   0.875   0.896
##                Comp.44 Comp.45 Comp.46 Comp.47 Comp.48
## SS loadings      1.000   1.000   1.000   1.000   1.000
## Proportion Var   0.021   0.021   0.021   0.021   0.021
## Cumulative Var   0.917   0.938   0.958   0.979   1.000
```


Relative variance of Principal Components to HSI
0
50
100
150
200
250
300
Comp.1
Comp.4
Comp.7
Comp.10
Comp.14
Comp.18



The Cattell scree test plots the components as the X axis and the corresponding eigenvalues as the Y-axis. As one moves to the right, toward later components, the eigenvalues drop. When the drop ceases and the curve makes an elbow toward less steep decline, Cattell's scree test says to drop all further components after the one starting the elbow. This rule is sometimes criticised for being amenable to researcher-controlled "fudging". That is, as picking the "elbow" can be subjective because the curve has multiple elbows or is a smooth curve, the researcher may be tempted to set the cut-off at the number of factors desired by his or her research agenda.

5.2 PCA with psyche package principal Function

principal(...) Does an eigen value decomposition and returns eigen values, loadings, and degree of fit for a specified number of components. Basically it is just doing a principal components analysis (PCA) for n principal components of either a correlation or covariance matrix. Can show the residual correlations as well. The quality of reduction in the squared correlations is reported by comparing residual correlations to original correlations. Unlike princomp, this returns a subset of just the best nfactors. The eigen vectors are rescaled by the sqrt of the eigen values to produce the component loadings more typical in factor analysis.[6]

Rotation Methods[7] The unrotated output maximises the variance accounted for by the first and subsequent factors, and forcing the factors to be orthogonal. This data-compression comes at the cost of having most items load on the early factors, and usually, of having many items load substantially on more than one factor. Rotation serves to make the output more understandable, by seeking so-called "Simple Structure": A pattern of loadings where items load most strongly on one factor, and much more weakly on the other factors. Rotations can be orthogonal or oblique (allowing the factors to correlate).

[6] from psyche package help(principal)

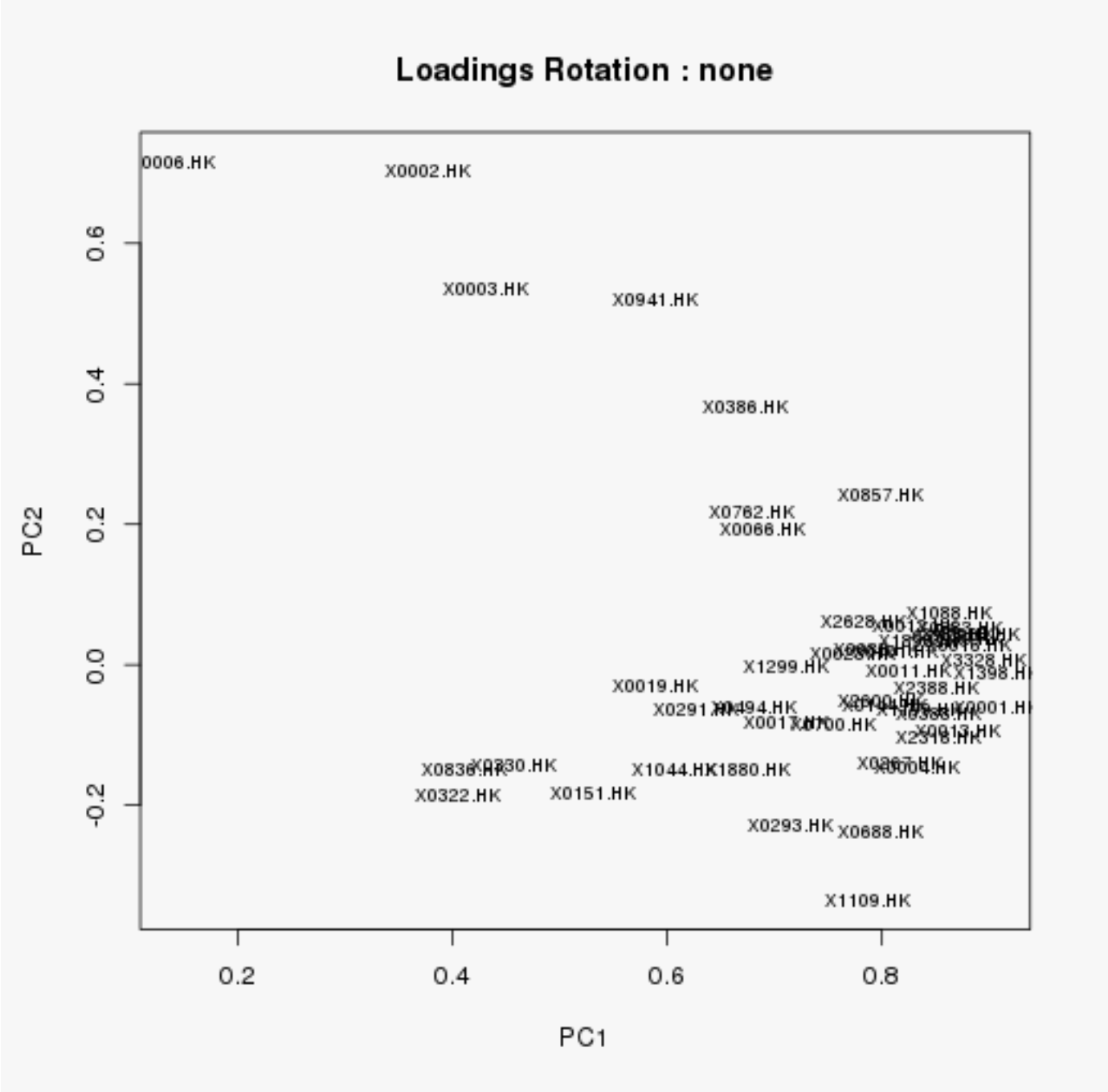
[7] http://en.wikipedia.org/wiki/Factoranalysis

5.2.1 Rotation : none

```
## Principal Components Analysis
## Call: principal(r = dxtaRetok, nfactors = 5, rotate = "none")
## Standardized loadings (pattern matrix) based upon correlation matrix
##          item  PC1   PC2   PC3   PC4   PC5   h2   u2
## X1398.HK   40 0.91 -0.01 -0.07  0.05 -0.14 0.85 0.15
## X0001.HK    1 0.91 -0.06 -0.01 -0.17 -0.05 0.86 0.14
## X3328.HK   47 0.90  0.01 -0.12  0.04 -0.05 0.82 0.18
## X0005.HK    5 0.89  0.04 -0.05  0.02 -0.02 0.79 0.21
## X0016.HK   10 0.88  0.03 -0.01 -0.15 -0.09 0.81 0.19
## X0939.HK   33 0.87  0.04 -0.02  0.09 -0.07 0.78 0.22
## X0883.HK   32 0.87  0.05 -0.07  0.15  0.02 0.79 0.21
## X0013.HK    9 0.87 -0.09 -0.03 -0.15  0.01 0.79 0.21
## X3988.HK   48 0.86  0.04 -0.02 -0.01 -0.09 0.76 0.24
## X1088.HK   36 0.86  0.07  0.00  0.10  0.06 0.76 0.24
## X0388.HK   25 0.85 -0.07 -0.01 -0.18 -0.12 0.78 0.22
## X2318.HK   43 0.85 -0.10 -0.10  0.01 -0.13 0.76 0.24
## X2388.HK   44 0.85 -0.03  0.07 -0.04 -0.20 0.77 0.23
## X1898.HK   42 0.84  0.03 -0.04 -0.01 -0.05 0.71 0.29
## X1199.HK   38 0.83 -0.06 -0.19  0.11  0.09 0.75 0.25
## X0004.HK    4 0.83 -0.15 -0.07 -0.12 -0.07 0.74 0.26
## X0012.HK    8 0.83  0.06 -0.01 -0.23 -0.03 0.75 0.25
## X0011.HK    7 0.82 -0.01  0.14 -0.23 -0.12 0.77 0.23
## X0267.HK   19 0.82 -0.14  0.13 -0.12  0.05 0.72 0.28
## X0101.HK   16 0.81  0.02 -0.14 -0.14  0.06 0.70 0.30
## X0144.HK   17 0.80 -0.06 -0.03  0.19  0.16 0.71 0.29
## X2600.HK   45 0.80 -0.05 -0.14  0.05 -0.11 0.68 0.32
## X0857.HK   31 0.80  0.24 -0.08  0.10  0.19 0.75 0.25
## X0688.HK   27 0.80 -0.24 -0.19  0.10 -0.09 0.75 0.25
## X0083.HK   15 0.79  0.02 -0.10 -0.15 -0.01 0.67 0.33
## X1109.HK   37 0.79 -0.33 -0.15  0.05 -0.04 0.76 0.24
## X2628.HK   46 0.78  0.06 -0.03  0.04 -0.05 0.62 0.38
## X0023.HK   13 0.77  0.02  0.16 -0.01 -0.20 0.67 0.33
## X0700.HK   28 0.76 -0.08 -0.15  0.32 -0.12 0.72 0.28
## X0293.HK   21 0.72 -0.23 -0.02  0.01  0.08 0.57 0.43
## X1299.HK   39 0.71  0.00  0.07 -0.02  0.11 0.52 0.48
## X0017.HK   11 0.71 -0.08 -0.10 -0.23  0.05 0.58 0.42
## X0066.HK   14 0.69  0.19  0.23 -0.23 -0.01 0.62 0.38
## X0494.HK   26 0.68 -0.06  0.04  0.09 -0.03 0.48 0.52
## X0762.HK   29 0.68  0.22  0.09  0.32  0.14 0.64 0.36
## X1880.HK   41 0.67 -0.15  0.00  0.27  0.02 0.55 0.45
## X0386.HK   24 0.67  0.37 -0.18  0.21  0.29 0.75 0.25
## X0291.HK   20 0.63 -0.06 -0.07 -0.08  0.03 0.41 0.59
## X1044.HK   35 0.61 -0.15  0.35  0.33  0.00 0.62 0.38
## X0941.HK   34 0.59  0.52  0.13  0.10  0.14 0.66 0.34
## X0019.HK   12 0.59 -0.03  0.24 -0.15 -0.03 0.43 0.57
## X0151.HK   18 0.53 -0.18  0.52  0.24  0.14 0.66 0.34
## X0330.HK   23 0.46 -0.14 -0.10 -0.18  0.40 0.43 0.57
## X0006.HK    6 0.14  0.72 -0.14  0.15 -0.13 0.59 0.41
## X0002.HK    2 0.38  0.70  0.09 -0.04 -0.11 0.66 0.34
## X0003.HK    3 0.43  0.53  0.24 -0.31  0.11 0.64 0.36
## X0322.HK   22 0.40 -0.18  0.66  0.06 -0.08 0.65 0.35
## X0836.HK   30 0.41 -0.15  0.03 -0.14  0.68 0.68 0.32
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    26.80 2.34 1.41 1.23 1.14
```

```
## Proportion Var  0.56 0.05 0.03 0.03 0.02
## Cumulative Var  0.56 0.61 0.64 0.66 0.69
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  53.29 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.48
##  0.3The number of observations was  158  with Chi Square =  1434  with prob <  2.4e-27
##  0.3
## Fit based upon off diagonal values = 1


##              PC1       PC2
## X0001.HK 0.9058 -0.062055
## X0002.HK 0.3770  0.704432
## X0003.HK 0.4311  0.534445
## X0004.HK 0.8330 -0.147353
## X0005.HK 0.8891  0.041816
## X0006.HK 0.1397  0.716043
## X0011.HK 0.8239 -0.008911
## X0012.HK 0.8311  0.056009
## X0013.HK 0.8701 -0.093032
## X0016.HK 0.8797  0.028934
## X0017.HK 0.7107 -0.082635
## X0019.HK 0.5883 -0.029979
## X0023.HK 0.7732  0.015167
## X0066.HK 0.6895  0.193203
## X0083.HK 0.7950  0.023386
## X0101.HK 0.8130  0.017854
## X0144.HK 0.8036 -0.057446
## X0151.HK 0.5307 -0.183313
## X0267.HK 0.8171 -0.138767
## X0291.HK 0.6269 -0.064502
## X0293.HK 0.7150 -0.229095
## X0322.HK 0.4047 -0.184304
## X0330.HK 0.4575 -0.142176
## X0386.HK 0.6729  0.366121
## X0388.HK 0.8536 -0.068718
## X0494.HK 0.6816 -0.059226
## X0688.HK 0.7977 -0.237751
## X0700.HK 0.7553 -0.083521
## X0762.HK 0.6791  0.217134
## X0836.HK 0.4118 -0.149927
## X0857.HK 0.7985  0.242696
## X0883.HK 0.8725  0.052301
## X0939.HK 0.8732  0.036167
## X0941.HK 0.5886  0.520140
## X1044.HK 0.6061 -0.149507
## X1088.HK 0.8622  0.074231
## X1109.HK 0.7867 -0.334883
## X1199.HK 0.8343 -0.064524
## X1299.HK 0.7109 -0.003491
## X1398.HK 0.9075 -0.012794
## X1880.HK 0.6737 -0.148046
## X1898.HK 0.8374  0.034457
## X2318.HK 0.8523 -0.103665
## X2388.HK 0.8515 -0.033578
## X2600.HK 0.7995 -0.052757
```

```
## X2628.HK 0.7828  0.061523
## X3328.HK 0.8950  0.007080
## X3988.HK 0.8644  0.043069
```



5.2.2 Rotation : varimax

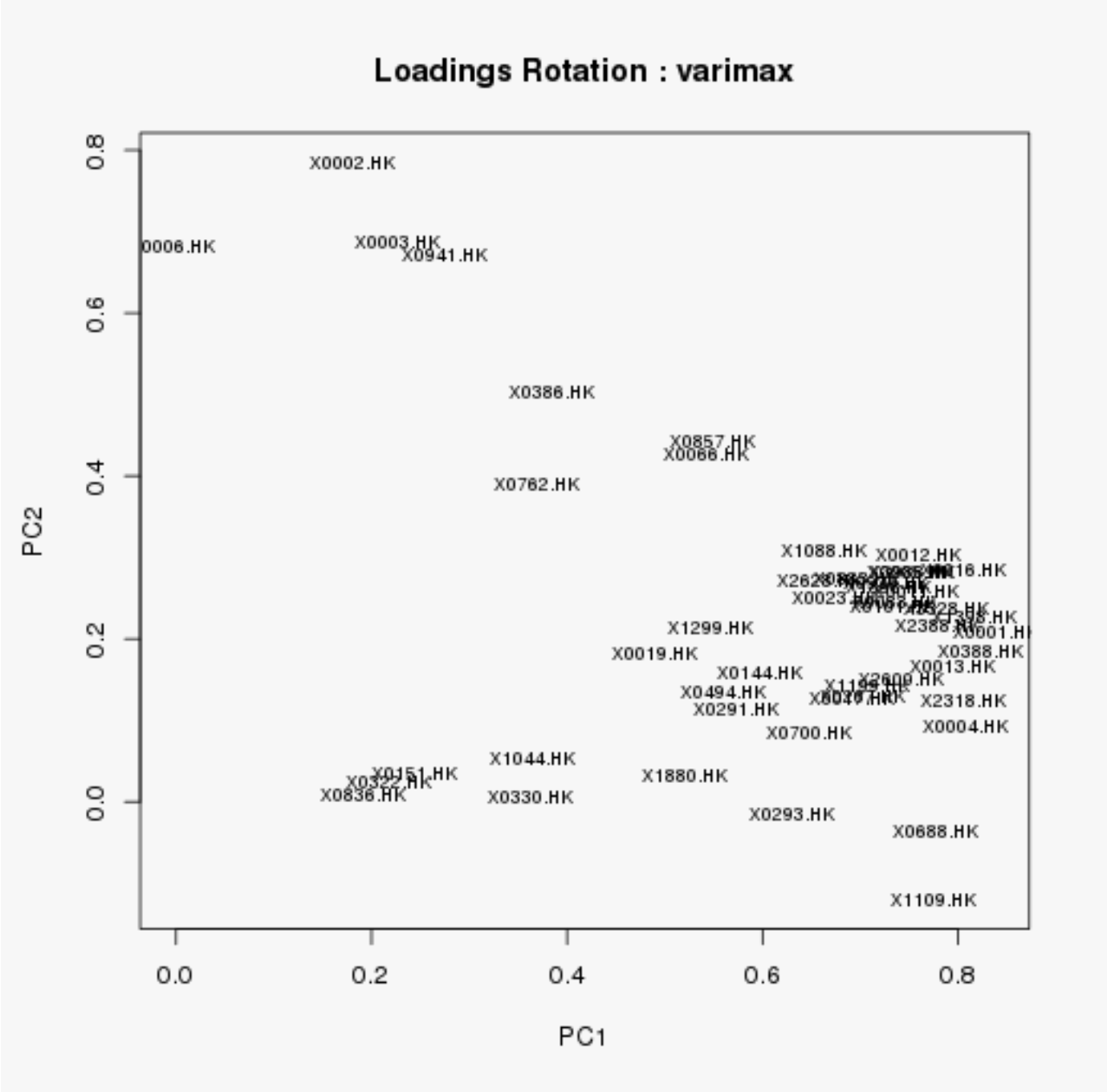
Varimax rotation is an orthogonal rotation of the factor axes to maximize the variance of the squared loadings of a factor (column) on all the variables (rows) in a factor matrix, which has the effect of differentiating the original variables by extracted factor. Each factor will tend to have either large or small loadings of any particular variable. A varimax solution yields results which make it as easy as possible to identify each variable with a single factor. This is the most common rotation option.

```
## Principal Components Analysis
## Call: principal(r = dxtaRetok, nfactors = 5, rotate = "varimax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##          item  PC1   PC2   PC3   PC4   PC5   h2   u2
## X0001.HK    1 0.84  0.21  0.23  0.10  0.22 0.86 0.14
## X0388.HK   25 0.82  0.19  0.21  0.06  0.14 0.78 0.22
## X1398.HK   40 0.82  0.23  0.20  0.30  0.06 0.85 0.15
## X0004.HK    4 0.81  0.09  0.18  0.13  0.17 0.74 0.26
## X0016.HK   10 0.81  0.28  0.21  0.10  0.15 0.81 0.19
## X2318.HK   43 0.80  0.12  0.17  0.25  0.08 0.76 0.24
## X0013.HK    9 0.80  0.17  0.21  0.12  0.26 0.79 0.21
## X3328.HK   47 0.79  0.24  0.15  0.31  0.15 0.82 0.18
## X2388.HK   44 0.78  0.22  0.31  0.15  0.02 0.77 0.23
## X0688.HK   27 0.78 -0.04  0.12  0.34  0.10 0.75 0.25
## X1109.HK   37 0.77 -0.12  0.16  0.30  0.17 0.76 0.24
## X0012.HK    8 0.76  0.30  0.17  0.03  0.22 0.75 0.25
## X0011.HK    7 0.76  0.26  0.33 -0.03  0.14 0.77 0.23
## X3988.HK   48 0.75  0.28  0.22  0.22  0.11 0.76 0.24
## X0005.HK    5 0.75  0.28  0.21  0.28  0.17 0.79 0.21
## X2600.HK   45 0.74  0.15  0.12  0.29  0.07 0.68 0.32
## X0083.HK   15 0.74  0.24  0.10  0.11  0.21 0.67 0.33
## X0101.HK   16 0.73  0.24  0.08  0.15  0.28 0.70 0.30
## X1898.HK   42 0.73  0.26  0.19  0.23  0.14 0.71 0.29
## X0939.HK   33 0.73  0.27  0.24  0.32  0.11 0.78 0.22
## X1199.HK   38 0.71  0.14  0.10  0.40  0.25 0.75 0.25
## X0267.HK   19 0.70  0.13  0.36  0.10  0.27 0.72 0.28
## X0883.HK   32 0.70  0.27  0.20  0.41  0.16 0.79 0.21
## X0017.HK   11 0.69  0.13  0.08  0.03  0.28 0.58 0.42
## X0023.HK   13 0.67  0.25  0.37  0.13 -0.02 0.67 0.33
## X1088.HK   36 0.66  0.31  0.25  0.35  0.21 0.76 0.24
## X2628.HK   46 0.66  0.27  0.19  0.26  0.11 0.62 0.38
## X0700.HK   28 0.65  0.09  0.15  0.52 -0.02 0.72 0.28
## X0293.HK   21 0.63 -0.02  0.23  0.23  0.26 0.57 0.43
## X0144.HK   17 0.60  0.16  0.24  0.44  0.29 0.71 0.29
## X0291.HK   20 0.57  0.11  0.11  0.13  0.20 0.41 0.59
## X0494.HK   26 0.56  0.14  0.26  0.26  0.11 0.48 0.52
## X0857.HK   31 0.55  0.44  0.12  0.39  0.30 0.75 0.25
## X1299.HK   39 0.55  0.21  0.27  0.19  0.27 0.52 0.48
## X0066.HK   14 0.54  0.43  0.32 -0.07  0.19 0.62 0.38
## X1880.HK   41 0.52  0.03  0.28  0.44  0.11 0.55 0.45
## X0019.HK   12 0.49  0.18  0.36 -0.04  0.15 0.43 0.57
## X0002.HK    2 0.18  0.78  0.04  0.04 -0.09 0.66 0.34
## X0003.HK    3 0.23  0.69  0.18 -0.19  0.22 0.64 0.36
## X0006.HK    6 0.00  0.68 -0.21  0.20 -0.22 0.59 0.41
## X0941.HK   34 0.27  0.67  0.19  0.26  0.17 0.66 0.34
## X0386.HK   24 0.39  0.50 -0.02  0.49  0.32 0.75 0.25
## X0322.HK   22 0.22  0.02  0.77 -0.02  0.00 0.65 0.35
## X0151.HK   18 0.24  0.03  0.71  0.25  0.19 0.66 0.34
## X1044.HK   35 0.36  0.05  0.58  0.37  0.06 0.62 0.38
## X0762.HK   29 0.37  0.39  0.29  0.49  0.16 0.64 0.36
```

```
## X0836.HK   30 0.19  0.01  0.14  0.12  0.78 0.68 0.32
## X0330.HK   23 0.36  0.01  0.03  0.07  0.54 0.43 0.57
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    19.38 4.28 3.48 3.31 2.47
## Proportion Var  0.40 0.09 0.07 0.07 0.05
## Cumulative Var  0.40 0.49 0.57 0.63 0.69
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  53.29 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.48
##  0.3The number of observations was  158  with Chi Square =  1434  with prob <  2.4e-27
##  0.3
## Fit based upon off diagonal values = 1
```

```
##                PC1       PC2
## X0001.HK  0.839271  0.207776
## X0002.HK  0.180701  0.784970
## X0003.HK  0.225857  0.687545
## X0004.HK  0.807335  0.093105
## X0005.HK  0.751654  0.282774
## X0006.HK -0.003038  0.681277
## X0011.HK  0.756762  0.258627
## X0012.HK  0.759818  0.303389
## X0013.HK  0.795428  0.165991
## X0016.HK  0.805354  0.284018
## X0017.HK  0.691202  0.127896
## X0019.HK  0.490661  0.181579
## X0023.HK  0.673358  0.250515
## X0066.HK  0.542102  0.427176
## X0083.HK  0.735771  0.244324
## X0101.HK  0.733372  0.240667
## X0144.HK  0.596337  0.159032
## X0151.HK  0.244177  0.034714
## X0267.HK  0.701907  0.128479
## X0291.HK  0.573147  0.114065
## X0293.HK  0.630543 -0.015695
## X0322.HK  0.217979  0.024937
## X0330.HK  0.361556  0.006800
## X0386.HK  0.385339  0.503780
## X0388.HK  0.822400  0.185082
## X0494.HK  0.559868  0.135224
## X0688.HK  0.777541 -0.036034
## X0700.HK  0.648283  0.085138
## X0762.HK  0.368578  0.389604
## X0836.HK  0.191470  0.009663
## X0857.HK  0.549525  0.441693
## X0883.HK  0.695597  0.274564
## X0939.HK  0.727415  0.269811
## X0941.HK  0.273606  0.672111
## X1044.HK  0.363967  0.053528
## X1088.HK  0.662505  0.308010
## X1109.HK  0.774739 -0.119853
## X1199.HK  0.707514  0.143684
## X1299.HK  0.547027  0.212703
## X1398.HK  0.817023  0.226156
```

```
## X1880.HK  0.520173  0.031221
## X1898.HK  0.727825  0.263204
## X2318.HK  0.804920  0.123920
## X2388.HK  0.778757  0.215885
## X2600.HK  0.741752  0.150208
## X2628.HK  0.658079  0.270360
## X3328.HK  0.787144  0.238587
## X3988.HK  0.753191  0.281089
```



5.2.3 Rotation : quatimax

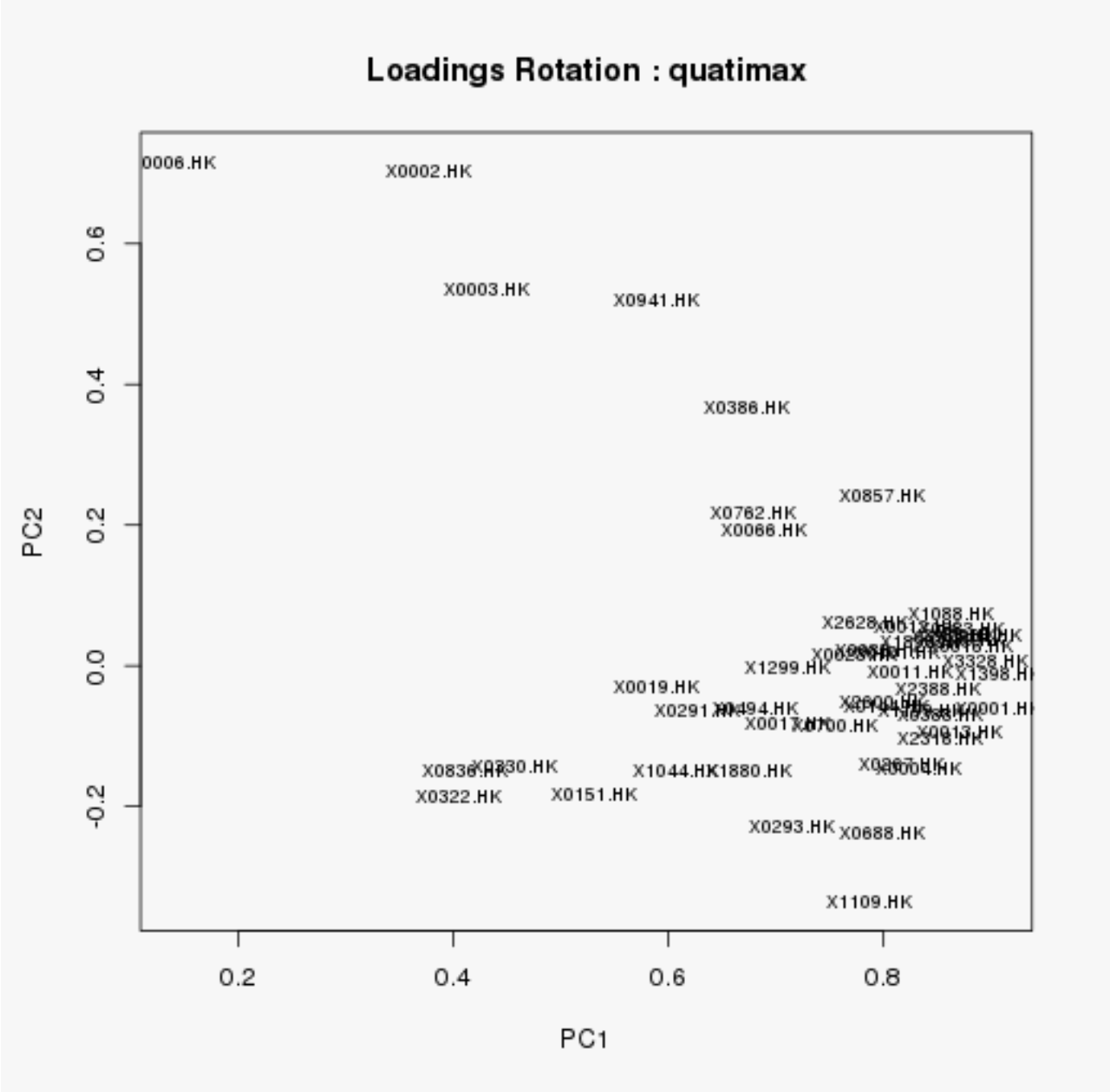
Quartimax rotation is an orthogonal alternative which minimizes the number of factors needed to explain each variable. This type of rotation often generates a general factor on which most variables are loaded to a high or medium degree. Such a factor structure is usually not helpful to the research purpose.

```
## Principal Components Analysis
## Call: principal(r = dxtaRetok, nfactors = 5, rotate = "quatimax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##          item  PC1   PC2   PC3   PC4   PC5   h2   u2
## X1398.HK   40 0.91 -0.01 -0.07  0.05 -0.14 0.85 0.15
## X0001.HK    1 0.91 -0.06 -0.01 -0.17 -0.05 0.86 0.14
## X3328.HK   47 0.90  0.01 -0.12  0.04 -0.05 0.82 0.18
## X0005.HK    5 0.89  0.04 -0.05  0.02 -0.02 0.79 0.21
## X0016.HK   10 0.88  0.03 -0.01 -0.15 -0.09 0.81 0.19
## X0939.HK   33 0.87  0.04 -0.02  0.09 -0.07 0.78 0.22
## X0883.HK   32 0.87  0.05 -0.07  0.15  0.02 0.79 0.21
## X0013.HK    9 0.87 -0.09 -0.03 -0.15  0.01 0.79 0.21
## X3988.HK   48 0.86  0.04 -0.02 -0.01 -0.09 0.76 0.24
## X1088.HK   36 0.86  0.07  0.00  0.10  0.06 0.76 0.24
## X0388.HK   25 0.85 -0.07 -0.01 -0.18 -0.12 0.78 0.22
## X2318.HK   43 0.85 -0.10 -0.10  0.01 -0.13 0.76 0.24
## X2388.HK   44 0.85 -0.03  0.07 -0.04 -0.20 0.77 0.23
## X1898.HK   42 0.84  0.03 -0.04 -0.01 -0.05 0.71 0.29
## X1199.HK   38 0.83 -0.06 -0.19  0.11  0.09 0.75 0.25
## X0004.HK    4 0.83 -0.15 -0.07 -0.12 -0.07 0.74 0.26
## X0012.HK    8 0.83  0.06 -0.01 -0.23 -0.03 0.75 0.25
## X0011.HK    7 0.82 -0.01  0.14 -0.23 -0.12 0.77 0.23
## X0267.HK   19 0.82 -0.14  0.13 -0.12  0.05 0.72 0.28
## X0101.HK   16 0.81  0.02 -0.14 -0.14  0.06 0.70 0.30
## X0144.HK   17 0.80 -0.06 -0.03  0.19  0.16 0.71 0.29
## X2600.HK   45 0.80 -0.05 -0.14  0.05 -0.11 0.68 0.32
## X0857.HK   31 0.80  0.24 -0.08  0.10  0.19 0.75 0.25
## X0688.HK   27 0.80 -0.24 -0.19  0.10 -0.09 0.75 0.25
## X0083.HK   15 0.79  0.02 -0.10 -0.15 -0.01 0.67 0.33
## X1109.HK   37 0.79 -0.33 -0.15  0.05 -0.04 0.76 0.24
## X2628.HK   46 0.78  0.06 -0.03  0.04 -0.05 0.62 0.38
## X0023.HK   13 0.77  0.02  0.16 -0.01 -0.20 0.67 0.33
## X0700.HK   28 0.76 -0.08 -0.15  0.32 -0.12 0.72 0.28
## X0293.HK   21 0.72 -0.23 -0.02  0.01  0.08 0.57 0.43
## X1299.HK   39 0.71  0.00  0.07 -0.02  0.11 0.52 0.48
## X0017.HK   11 0.71 -0.08 -0.10 -0.23  0.05 0.58 0.42
## X0066.HK   14 0.69  0.19  0.23 -0.23 -0.01 0.62 0.38
## X0494.HK   26 0.68 -0.06  0.04  0.09 -0.03 0.48 0.52
## X0762.HK   29 0.68  0.22  0.09  0.32  0.14 0.64 0.36
## X1880.HK   41 0.67 -0.15  0.00  0.27  0.02 0.55 0.45
## X0386.HK   24 0.67  0.37 -0.18  0.21  0.29 0.75 0.25
## X0291.HK   20 0.63 -0.06 -0.07 -0.08  0.03 0.41 0.59
## X1044.HK   35 0.61 -0.15  0.35  0.33  0.00 0.62 0.38
## X0941.HK   34 0.59  0.52  0.13  0.10  0.14 0.66 0.34
## X0019.HK   12 0.59 -0.03  0.24 -0.15 -0.03 0.43 0.57
## X0151.HK   18 0.53 -0.18  0.52  0.24  0.14 0.66 0.34
## X0330.HK   23 0.46 -0.14 -0.10 -0.18  0.40 0.43 0.57
## X0006.HK    6 0.14  0.72 -0.14  0.15 -0.13 0.59 0.41
## X0002.HK    2 0.38  0.70  0.09 -0.04 -0.11 0.66 0.34
## X0003.HK    3 0.43  0.53  0.24 -0.31  0.11 0.64 0.36
## X0322.HK   22 0.40 -0.18  0.66  0.06 -0.08 0.65 0.35
## X0836.HK   30 0.41 -0.15  0.03 -0.14  0.68 0.68 0.32
```

```
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    26.80 2.34 1.41 1.23 1.14
## Proportion Var  0.56 0.05 0.03 0.03 0.02
## Cumulative Var  0.56 0.61 0.64 0.66 0.69
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  53.29 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.48
##  0.3The number of observations was  158  with Chi Square =  1434  with prob <  2.4e-27
##  0.3
## Fit based upon off diagonal values = 1
```

```
##              PC1       PC2
## X0001.HK 0.9058 -0.062055
## X0002.HK 0.3770  0.704432
## X0003.HK 0.4311  0.534445
## X0004.HK 0.8330 -0.147353
## X0005.HK 0.8891  0.041816
## X0006.HK 0.1397  0.716043
## X0011.HK 0.8239 -0.008911
## X0012.HK 0.8311  0.056009
## X0013.HK 0.8701 -0.093032
## X0016.HK 0.8797  0.028934
## X0017.HK 0.7107 -0.082635
## X0019.HK 0.5883 -0.029979
## X0023.HK 0.7732  0.015167
## X0066.HK 0.6895  0.193203
## X0083.HK 0.7950  0.023386
## X0101.HK 0.8130  0.017854
## X0144.HK 0.8036 -0.057446
## X0151.HK 0.5307 -0.183313
## X0267.HK 0.8171 -0.138767
## X0291.HK 0.6269 -0.064502
## X0293.HK 0.7150 -0.229095
## X0322.HK 0.4047 -0.184304
## X0330.HK 0.4575 -0.142176
## X0386.HK 0.6729  0.366121
## X0388.HK 0.8536 -0.068718
## X0494.HK 0.6816 -0.059226
## X0688.HK 0.7977 -0.237751
## X0700.HK 0.7553 -0.083521
## X0762.HK 0.6791  0.217134
## X0836.HK 0.4118 -0.149927
## X0857.HK 0.7985  0.242696
## X0883.HK 0.8725  0.052301
## X0939.HK 0.8732  0.036167
## X0941.HK 0.5886  0.520140
## X1044.HK 0.6061 -0.149507
## X1088.HK 0.8622  0.074231
## X1109.HK 0.7867 -0.334883
## X1199.HK 0.8343 -0.064524
## X1299.HK 0.7109 -0.003491
## X1398.HK 0.9075 -0.012794
## X1880.HK 0.6737 -0.148046
## X1898.HK 0.8374  0.034457
```

```
## X2318.HK 0.8523 -0.103665
## X2388.HK 0.8515 -0.033578
## X2600.HK 0.7995 -0.052757
## X2628.HK 0.7828  0.061523
## X3328.HK 0.8950  0.007080
## X3988.HK 0.8644  0.043069
```



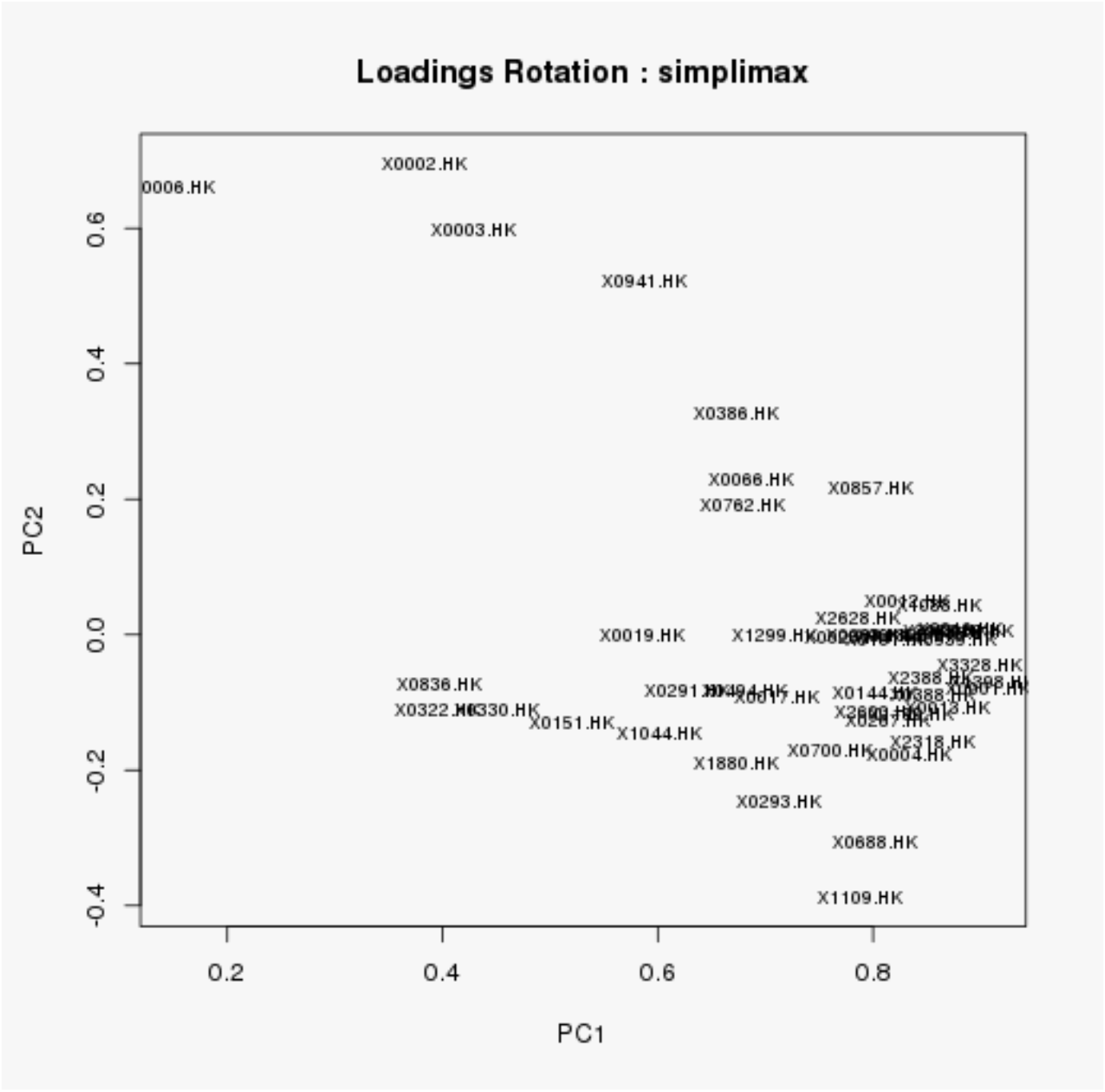
5.2.4 Rotation : simplimax

A compromise between Varimax and Quartimax criteria.

```
## Warning message: convergence not obtained in GPFoblq. 1000 iterations used.

## Principal Components Analysis
## Call: principal(r = dxtaRetok, nfactors = 5, rotate = "simplimax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##          item  PC1   PC2   PC3   PC4   PC5   h2   u2
## X1398.HK   40 0.91 -0.07 -0.05  0.04 -0.10 0.85 0.15
## X0001.HK    1 0.91 -0.08  0.01 -0.17 -0.01 0.86 0.14
## X3328.HK   47 0.90 -0.05 -0.10  0.03 -0.01 0.82 0.18
## X0005.HK    5 0.89  0.00 -0.03  0.02  0.02 0.79 0.21
## X0016.HK   10 0.88  0.01  0.01 -0.15 -0.05 0.81 0.19
## X0939.HK   33 0.88 -0.01  0.00  0.09 -0.03 0.78 0.22
## X0883.HK   32 0.87  0.00 -0.06  0.15  0.05 0.79 0.21
## X0013.HK    9 0.87 -0.11 -0.01 -0.16  0.05 0.79 0.21
## X3988.HK   48 0.87  0.01  0.00 -0.01 -0.05 0.76 0.24
## X1088.HK   36 0.86  0.04  0.02  0.10  0.09 0.76 0.24
## X2318.HK   43 0.86 -0.16 -0.08  0.00 -0.09 0.76 0.24
## X0388.HK   25 0.86 -0.09  0.01 -0.18 -0.08 0.78 0.22
## X2388.HK   44 0.85 -0.06  0.10 -0.02 -0.17 0.77 0.23
## X1898.HK   42 0.84  0.00 -0.02 -0.01 -0.02 0.71 0.29
## X1199.HK   38 0.84 -0.12 -0.18  0.07  0.13 0.75 0.25
## X0004.HK    4 0.83 -0.18 -0.06 -0.13 -0.03 0.74 0.26
## X0012.HK    8 0.83  0.05  0.00 -0.23  0.01 0.75 0.25
## X0011.HK    7 0.82  0.00  0.17 -0.21 -0.09 0.77 0.23
## X0101.HK   16 0.81 -0.01 -0.13 -0.16  0.10 0.70 0.30
## X0267.HK   19 0.81 -0.13  0.15 -0.10  0.07 0.72 0.28
## X2600.HK   45 0.80 -0.11 -0.12  0.03 -0.07 0.68 0.32
## X0144.HK   17 0.80 -0.09 -0.02  0.18  0.20 0.71 0.29
## X0688.HK   27 0.80 -0.31 -0.18  0.06 -0.05 0.75 0.25
## X0857.HK   31 0.80  0.22 -0.08  0.10  0.23 0.75 0.25
## X0083.HK   15 0.80  0.00 -0.09 -0.17  0.02 0.67 0.33
## X1109.HK   37 0.79 -0.39 -0.13  0.02  0.00 0.76 0.24
## X2628.HK   46 0.79  0.02 -0.02  0.04 -0.02 0.62 0.38
## X0023.HK   13 0.78  0.00  0.19  0.02 -0.18 0.67 0.33
## X0700.HK   28 0.76 -0.17 -0.13  0.30 -0.09 0.72 0.28
## X0293.HK   21 0.71 -0.25 -0.01  0.00  0.11 0.57 0.43
## X0017.HK   11 0.71 -0.09 -0.10 -0.25  0.08 0.58 0.42
## X1299.HK   39 0.71  0.00  0.09  0.00  0.14 0.52 0.48
## X0066.HK   14 0.69  0.23  0.25 -0.19  0.01 0.62 0.38
## X0494.HK   26 0.68 -0.08  0.06  0.10  0.00 0.48 0.52
## X0762.HK   29 0.68  0.19  0.11  0.34  0.16 0.64 0.36
## X0386.HK   24 0.67  0.33 -0.19  0.19  0.32 0.75 0.25
## X1880.HK   41 0.67 -0.19  0.02  0.27  0.05 0.55 0.45
## X0291.HK   20 0.63 -0.08 -0.06 -0.10  0.06 0.41 0.59
## X1044.HK   35 0.60 -0.15  0.38  0.38  0.01 0.62 0.38
## X0941.HK   34 0.59  0.52  0.14  0.14  0.15 0.66 0.34
## X0019.HK   12 0.59  0.00  0.25 -0.12 -0.02 0.43 0.57
## X0330.HK   23 0.45 -0.11 -0.11 -0.20  0.43 0.43 0.57
## X0002.HK    2 0.38  0.70  0.10  0.01 -0.11 0.66 0.34
## X0006.HK    6 0.15  0.66 -0.14  0.16 -0.13 0.59 0.41
## X0003.HK    3 0.43  0.60  0.25 -0.25  0.12 0.64 0.36
## X0322.HK   22 0.40 -0.11  0.70  0.16 -0.10 0.65 0.35
## X0151.HK   18 0.52 -0.13  0.55  0.31  0.13 0.66 0.34
## X0836.HK   30 0.40 -0.07  0.01 -0.16  0.71 0.68 0.32
```

```
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    26.76 2.34 1.42 1.23 1.17
## Proportion Var  0.56 0.05 0.03 0.03 0.02
## Cumulative Var  0.56 0.61 0.64 0.66 0.69
##
##  With component correlations of
##       PC1   PC2   PC3   PC4   PC5
## PC1  1.00  0.03 -0.01  0.00 -0.03
## PC2  0.03  1.00 -0.15  0.06 -0.10
## PC3 -0.01 -0.15  1.00 -0.18  0.10
## PC4  0.00  0.06 -0.18  1.00  0.01
## PC5 -0.03 -0.10  0.10  0.01  1.00
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  53.29 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.48
##  0.3The number of observations was  158  with Chi Square =  1434  with prob <  2.4e-27
##  0.3
## Fit based upon off diagonal values = 1

##              PC1        PC2
## X0001.HK 0.9063 -0.0781355
## X0002.HK 0.3826  0.6959107
## X0003.HK 0.4283  0.5962440
## X0004.HK 0.8344 -0.1777797
## X0005.HK 0.8908  0.0049601
## X0006.HK 0.1498  0.6594309
## X0011.HK 0.8236 -0.0016697
## X0012.HK 0.8318  0.0491563
## X0013.HK 0.8695 -0.1065586
## X0016.HK 0.8816  0.0072580
## X0017.HK 0.7104 -0.0909407
## X0019.HK 0.5850 -0.0007249
## X0023.HK 0.7751 -0.0034529
## X0066.HK 0.6872  0.2276857
## X0083.HK 0.7967 -0.0015449
## X0101.HK 0.8138 -0.0061354
## X0144.HK 0.8014 -0.0871749
## X0151.HK 0.5202 -0.1309026
## X0267.HK 0.8133 -0.1267843
## X0291.HK 0.6269 -0.0818444
## X0293.HK 0.7126 -0.2453312
## X0322.HK 0.3957 -0.1123471
## X0330.HK 0.4500 -0.1115204
## X0386.HK 0.6735  0.3270281
## X0388.HK 0.8554 -0.0899960
## X0494.HK 0.6817 -0.0841066
## X0688.HK 0.8012 -0.3072253
## X0700.HK 0.7607 -0.1719417
## X0762.HK 0.6778  0.1925489
## X0836.HK 0.3969 -0.0735925
## X0857.HK 0.7983  0.2156334
## X0883.HK 0.8745  0.0019801
## X0939.HK 0.8756 -0.0079531
## X0941.HK 0.5881  0.5234517
```

```
## X1044.HK 0.6012 -0.1467415
## X1088.HK 0.8622  0.0447287
## X1109.HK 0.7878 -0.3874011
## X1199.HK 0.8355 -0.1172798
## X1299.HK 0.7078 -0.0002962
## X1398.HK 0.9117 -0.0698990
## X1880.HK 0.6734 -0.1907208
## X1898.HK 0.8396 -0.0007020
## X2318.HK 0.8559 -0.1581155
## X2388.HK 0.8543 -0.0648570
## X2600.HK 0.8038 -0.1126101
## X2628.HK 0.7851  0.0241781
## X3328.HK 0.8983 -0.0461114
## X3988.HK 0.8669  0.0068046
```


Loadings Rotation : simplimax
X0002.HK
0006.HK
X0003.HK
X0941.HK
X0386.HK
X0066.HK
X0857.HK
X0762.HK
X2628.HK
X0019.HK
X1299.HK
X3328.HK
X0836.HK
X0151.HK
X1044.HK
X0700.HK
X0004.HK
X2318.HK
X1880.HK
X0293.HK
X0688.HK
X1109.HK
PC2
PC1
0.6
0.4
0.2
0.0
-0.2
-0.4
0.2
0.4
0.6
0.8

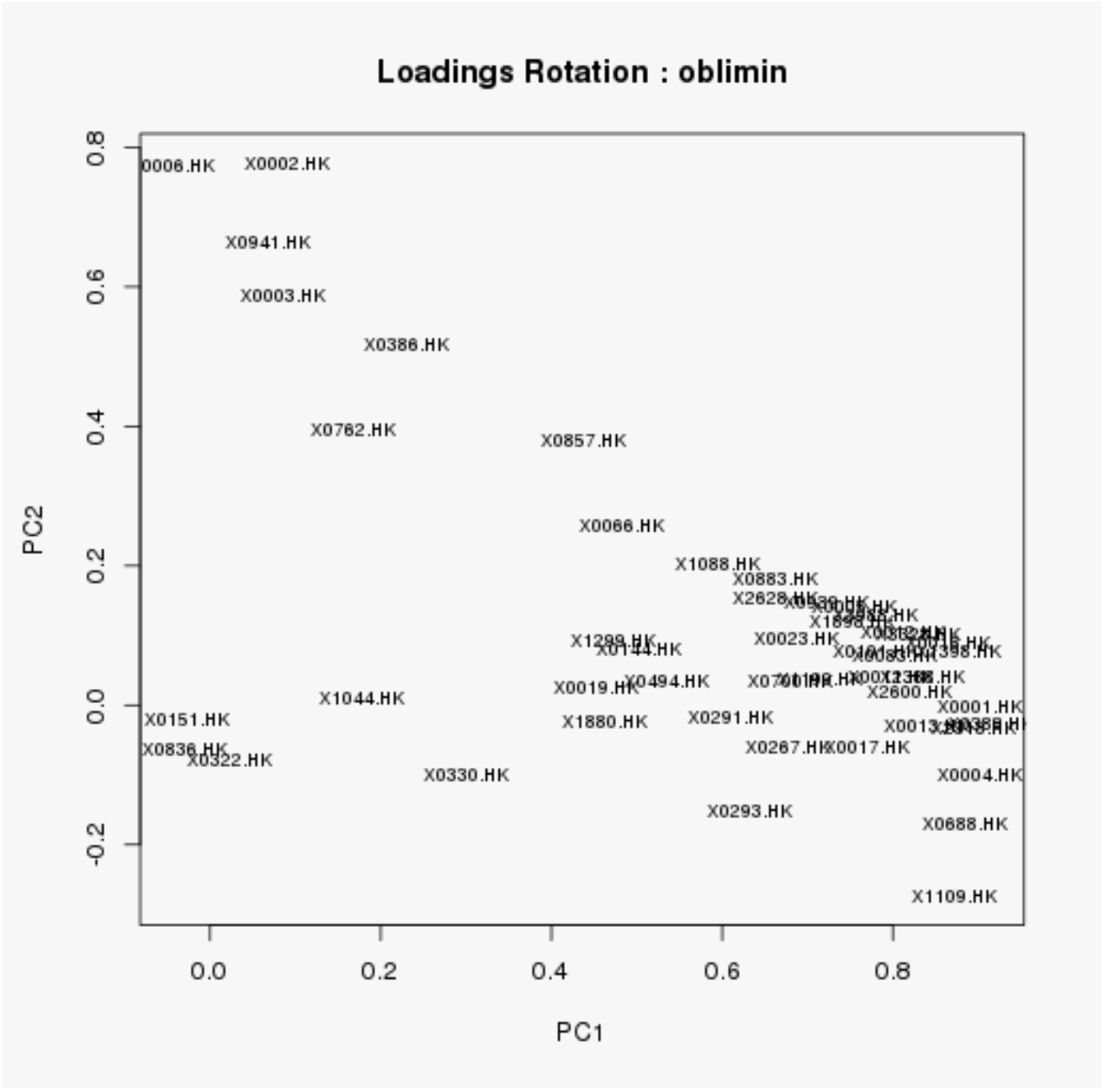
5.2.5 Rotation : oblimin

Direct oblimin rotation is the standard method when one wishes a non-orthogonal (oblique) solution – that is, one in which the factors are allowed to be correlated. This will result in higher eigenvalues but diminished interpretability of the factors.

```
## Principal Components Analysis
## Call: principal(r = dxtaRetok, nfactors = 5, rotate = "oblimin")
## Standardized loadings (pattern matrix) based upon correlation matrix
##          item   PC1   PC2   PC3   PC5   PC4   h2   u2
## X0388.HK   25  0.92 -0.03  0.00 -0.03 -0.14 0.78 0.22
## X0004.HK    4  0.90 -0.10 -0.02  0.02 -0.05 0.74 0.26
## X0001.HK    1  0.90  0.00  0.02  0.06 -0.12 0.86 0.14
## X2318.HK   43  0.89 -0.03  0.00 -0.06  0.08 0.76 0.24
## X0688.HK   27  0.88 -0.17 -0.03 -0.02  0.21 0.75 0.25
## X1398.HK   40  0.88  0.08  0.05 -0.08  0.09 0.85 0.15
## X1109.HK   37  0.87 -0.27  0.01  0.05  0.16 0.76 0.24
## X0016.HK   10  0.87  0.09  0.01  0.00 -0.12 0.81 0.19
## X0013.HK    9  0.84 -0.03  0.02  0.12 -0.09 0.79 0.21
## X2388.HK   44  0.83  0.04  0.15 -0.14 -0.05 0.77 0.23
## X3328.HK   47  0.83  0.10  0.00  0.02  0.11 0.82 0.18
## X2600.HK   45  0.82  0.02 -0.02 -0.05  0.12 0.68 0.32
## X0012.HK    8  0.81  0.10 -0.04  0.07 -0.19 0.75 0.25
## X0083.HK   15  0.80  0.07 -0.09  0.08 -0.08 0.67 0.33
## X0011.HK    7  0.80  0.04  0.13 -0.03 -0.25 0.77 0.23
## X3988.HK   48  0.78  0.13  0.07 -0.02  0.01 0.76 0.24
## X0101.HK   16  0.78  0.08 -0.11  0.16 -0.05 0.70 0.30
## X0017.HK   11  0.77 -0.06 -0.12  0.15 -0.14 0.58 0.42
## X0005.HK    5  0.76  0.14  0.06  0.06  0.06 0.79 0.21
## X1898.HK   42  0.75  0.12  0.04  0.02  0.02 0.71 0.29
## X0939.HK   33  0.72  0.15  0.12 -0.01  0.11 0.78 0.22
## X1199.HK   38  0.71  0.04 -0.03  0.17  0.21 0.75 0.25
## X0023.HK   13  0.69  0.10  0.24 -0.16 -0.07 0.67 0.33
## X0700.HK   28  0.68  0.03  0.09 -0.10  0.38 0.72 0.28
## X0267.HK   19  0.68 -0.06  0.20  0.14 -0.12 0.72 0.28
## X0883.HK   32  0.66  0.18  0.10  0.08  0.20 0.79 0.21
## X2628.HK   46  0.66  0.15  0.07  0.01  0.07 0.62 0.38
## X0293.HK   21  0.63 -0.15  0.11  0.16  0.07 0.57 0.43
## X0291.HK   20  0.61 -0.02 -0.03  0.10 -0.02 0.41 0.59
## X1088.HK   36  0.60  0.20  0.15  0.13  0.12 0.76 0.24
## X0494.HK   26  0.54  0.03  0.18  0.02  0.09 0.48 0.52
## X0144.HK   17  0.50  0.08  0.18  0.23  0.23 0.71 0.29
## X0066.HK   14  0.48  0.26  0.18  0.06 -0.30 0.62 0.38
## X1299.HK   39  0.47  0.09  0.17  0.19 -0.01 0.52 0.48
## X1880.HK   41  0.46 -0.02  0.25  0.06  0.29 0.55 0.45
## X0019.HK   12  0.45  0.02  0.25  0.03 -0.22 0.43 0.57
## X0857.HK   31  0.44  0.38  0.04  0.27  0.15 0.75 0.25
## X0002.HK    2  0.09  0.78  0.00 -0.12 -0.14 0.66 0.34
## X0006.HK    6 -0.04  0.77 -0.18 -0.19  0.12 0.59 0.41
## X0941.HK   34  0.07  0.66  0.19  0.17  0.03 0.66 0.34
## X0003.HK    3  0.09  0.59  0.08  0.17 -0.40 0.64 0.36
## X0386.HK   24  0.23  0.52 -0.04  0.34  0.28 0.75 0.25
## X0762.HK   29  0.17  0.40  0.32  0.16  0.28 0.64 0.36
## X0322.HK   22  0.02 -0.08  0.80 -0.08 -0.18 0.65 0.35
## X0151.HK   18 -0.03 -0.02  0.78  0.16  0.07 0.66 0.34
## X1044.HK   35  0.18  0.01  0.63  0.01  0.20 0.62 0.38
## X0836.HK   30 -0.03 -0.06  0.10  0.82 -0.04 0.68 0.32
## X0330.HK   23  0.30 -0.10 -0.08  0.52 -0.05 0.43 0.57
```

```
##
##                  PC1  PC2  PC3  PC5  PC4
## SS loadings    22.22 3.65 3.28 2.35 1.42
## Proportion Var  0.46 0.08 0.07 0.05 0.03
## Cumulative Var  0.46 0.54 0.61 0.66 0.69
##
##  With component correlations of
##      PC1  PC2  PC3  PC5  PC4
## PC1 1.00 0.39 0.54 0.45 0.15
## PC2 0.39 1.00 0.18 0.15 0.01
## PC3 0.54 0.18 1.00 0.24 0.03
## PC5 0.45 0.15 0.24 1.00 0.06
## PC4 0.15 0.01 0.03 0.06 1.00
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  53.29 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.48
##  0.3The number of observations was  158  with Chi Square =  1434  with prob <  2.4e-27
##  0.3
## Fit based upon off diagonal values = 1

##                PC1       PC2
## X0001.HK  0.90073 -0.002758
## X0002.HK  0.09118  0.777657
## X0003.HK  0.08502  0.588455
## X0004.HK  0.90164 -0.099504
## X0005.HK  0.75544  0.142701
## X0006.HK -0.04349  0.774683
## X0011.HK  0.79758  0.040032
## X0012.HK  0.81133  0.103752
## X0013.HK  0.83961 -0.030374
## X0016.HK  0.86530  0.089782
## X0017.HK  0.76994 -0.058798
## X0019.HK  0.45261  0.024913
## X0023.HK  0.68673  0.096173
## X0066.HK  0.48284  0.257734
## X0083.HK  0.80172  0.072741
## X0101.HK  0.77993  0.076180
## X0144.HK  0.50268  0.081860
## X0151.HK -0.02786 -0.018865
## X0267.HK  0.67817 -0.059827
## X0291.HK  0.60946 -0.017379
## X0293.HK  0.63200 -0.152310
## X0322.HK  0.02178 -0.078587
## X0330.HK  0.30038 -0.100826
## X0386.HK  0.23107  0.517049
## X0388.HK  0.91542 -0.025105
## X0494.HK  0.53522  0.034658
## X0688.HK  0.88487 -0.169724
## X0700.HK  0.68001  0.033763
## X0762.HK  0.16824  0.395304
## X0836.HK -0.03058 -0.064544
## X0857.HK  0.43622  0.380561
## X0883.HK  0.66319  0.179898
## X0939.HK  0.72282  0.147552
## X0941.HK  0.06787  0.664850
```

```
## X1044.HK  0.17772  0.011747
## X1088.HK  0.59582  0.203397
## X1109.HK  0.87225 -0.273250
## X1199.HK  0.71484  0.039244
## X1299.HK  0.47339  0.093757
## X1398.HK  0.87805  0.077919
## X1880.HK  0.46236 -0.022885
## X1898.HK  0.75201  0.119704
## X2318.HK  0.89468 -0.033674
## X2388.HK  0.83463  0.040178
## X2600.HK  0.82032  0.020492
## X2628.HK  0.66181  0.154111
## X3328.HK  0.82846  0.100805
## X3988.HK  0.78050  0.130857
```


Loadings Rotation : oblimin
PC2
PC1
0.8
0.6
0.4
0.2
0.0
-0.2
0.0
0.2
0.4
0.6
0.8
X0002.HK
X0941.HK
X0003.HK
X0386.HK
X0762.HK
X0857.HK
X0066.HK
X1088.HK
X0883.HK
X0023.HK
X0494.HK
X0019.HK
X1044.HK
X0151.HK
X0836.HK
X0322.HK
X1880.HK
X0291.HK
X0267.HK
X0017.HK
X2600.HK
X0001.HK
X0004.HK
X0330.HK
X0293.HK
X0688.HK
X1109.HK

5.2.6 Rotation : promax

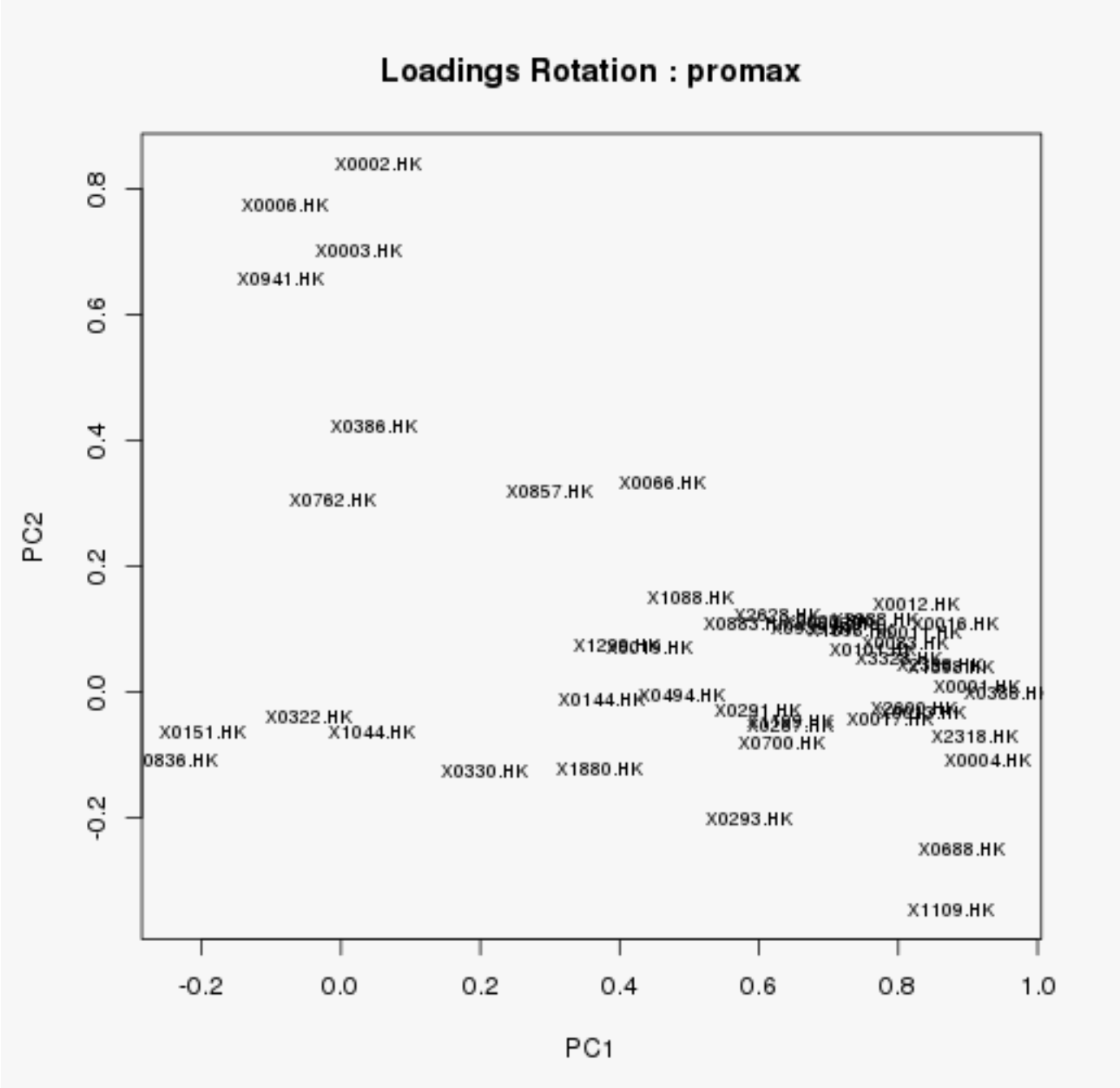
Promax rotation is an alternative non-orthogonal (oblique) rotation method which is computationally faster than the direct oblimin method and therefore is sometimes used for very large datasets.

```
## Principal Components Analysis
## Call: principal(r = dxtaRetok, nfactors = 5, rotate = "promax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##          item   PC1   PC2   PC4   PC3   PC5   h2   u2
## X0388.HK   25  0.96  0.00 -0.08 -0.01 -0.05 0.78 0.22
## X0004.HK    4  0.93 -0.11  0.01 -0.04  0.00 0.74 0.26
## X0001.HK    1  0.91  0.01 -0.04  0.00  0.04 0.86 0.14
## X2318.HK   43  0.91 -0.07  0.15 -0.04 -0.11 0.76 0.24
## X0688.HK   27  0.89 -0.25  0.25 -0.09 -0.07 0.75 0.25
## X0016.HK   10  0.88  0.11 -0.02 -0.01 -0.04 0.81 0.19
## X1398.HK   40  0.88  0.04  0.20 -0.01 -0.15 0.85 0.15
## X1109.HK   37  0.88 -0.35  0.19 -0.03  0.02 0.76 0.24
## X2388.HK   44  0.86  0.04  0.03  0.14 -0.20 0.77 0.23
## X0013.HK    9  0.83 -0.03  0.00 -0.01  0.11 0.79 0.21
## X0011.HK    7  0.83  0.10 -0.17  0.14 -0.05 0.77 0.23
## X0012.HK    8  0.83  0.14 -0.09 -0.05  0.06 0.75 0.25
## X2600.HK   45  0.82 -0.03  0.20 -0.08 -0.11 0.68 0.32
## X0083.HK   15  0.81  0.08  0.00 -0.13  0.06 0.67 0.33
## X3328.HK   47  0.80  0.05  0.23 -0.07 -0.03 0.82 0.18
## X0017.HK   11  0.79 -0.04 -0.09 -0.14  0.16 0.58 0.42
## X3988.HK   48  0.77  0.11  0.13  0.03 -0.08 0.76 0.24
## X0101.HK   16  0.76  0.07  0.05 -0.16  0.15 0.70 0.30
## X1898.HK   42  0.73  0.10  0.14  0.00 -0.03 0.71 0.29
## X0005.HK    5  0.71  0.11  0.19  0.00  0.01 0.79 0.21
## X0023.HK   13  0.70  0.11  0.03  0.24 -0.22 0.67 0.33
## X0939.HK   33  0.68  0.10  0.25  0.06 -0.07 0.78 0.22
## X0267.HK   19  0.64 -0.05 -0.01  0.20  0.15 0.72 0.28
## X1199.HK   38  0.64 -0.05  0.34 -0.11  0.13 0.75 0.25
## X0700.HK   28  0.63 -0.08  0.48  0.00 -0.20 0.72 0.28
## X2628.HK   46  0.63  0.12  0.19  0.02 -0.05 0.62 0.38
## X0291.HK   20  0.60 -0.03  0.04 -0.06  0.09 0.41 0.59
## X0293.HK   21  0.59 -0.20  0.15  0.08  0.16 0.57 0.43
## X0883.HK   32  0.58  0.11  0.36  0.02  0.01 0.79 0.21
## X1088.HK   36  0.50  0.15  0.30  0.08  0.08 0.76 0.24
## X0494.HK   26  0.49 -0.01  0.20  0.14 -0.02 0.48 0.52
## X0066.HK   14  0.46  0.33 -0.16  0.19  0.06 0.62 0.38
## X0019.HK   12  0.44  0.07 -0.13  0.27  0.03 0.43 0.57
## X1299.HK   39  0.39  0.07  0.13  0.13  0.18 0.52 0.48
## X0002.HK    2  0.05  0.84  0.05 -0.04 -0.21 0.66 0.34
## X0006.HK    6 -0.08  0.78  0.26 -0.27 -0.30 0.59 0.41
## X0003.HK    3  0.03  0.70 -0.22  0.08  0.17 0.64 0.36
## X0941.HK   34 -0.09  0.66  0.29  0.11  0.11 0.66 0.34
## X0386.HK   24  0.05  0.42  0.52 -0.18  0.29 0.75 0.25
## X0762.HK   29 -0.01  0.30  0.52  0.23  0.09 0.64 0.36
## X1880.HK   41  0.37 -0.12  0.40  0.18  0.00 0.55 0.45
## X0144.HK   17  0.37 -0.01  0.40  0.10  0.20 0.71 0.29
## X0857.HK   31  0.30  0.32  0.37 -0.06  0.22 0.75 0.25
## X0322.HK   22 -0.05 -0.04 -0.07  0.88 -0.08 0.65 0.35
## X0151.HK   18 -0.20 -0.06  0.25  0.79  0.16 0.66 0.34
## X1044.HK   35  0.04 -0.06  0.36  0.61 -0.03 0.62 0.38
## X0836.HK   30 -0.24 -0.11  0.11  0.04  0.94 0.68 0.32
## X0330.HK   23  0.21 -0.12  0.03 -0.12  0.59 0.43 0.57
##
```

```
##                   PC1  PC2  PC4  PC3  PC5
## SS loadings    20.86 3.37 4.21 2.54 1.93
## Proportion Var  0.43 0.07 0.09 0.05 0.04
## Cumulative Var  0.43 0.50 0.59 0.65 0.69
##
##  With component correlations of
##      PC1  PC2  PC4  PC3  PC5
## PC1 1.00 0.48 0.51 0.61 0.63
## PC2 0.48 1.00 0.22 0.31 0.35
## PC4 0.51 0.22 1.00 0.27 0.27
## PC3 0.61 0.31 0.27 1.00 0.41
## PC5 0.63 0.35 0.27 0.41 1.00
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  53.29 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.48
##  0.3The number of observations was  158  with Chi Square =  1434  with prob <  2.4e-27
##  0.3
## Fit based upon off diagonal values = 1
```

```
##                PC1       PC2
## X0001.HK  0.91378  0.009840
## X0002.HK  0.05235  0.840104
## X0003.HK  0.02629  0.703049
## X0004.HK  0.92847 -0.107977
## X0005.HK  0.71381  0.108972
## X0006.HK -0.07925  0.775064
## X0011.HK  0.83025  0.096227
## X0012.HK  0.82657  0.139786
## X0013.HK  0.83380 -0.031384
## X0016.HK  0.88279  0.108459
## X0017.HK  0.78882 -0.043176
## X0019.HK  0.44255  0.070511
## X0023.HK  0.69788  0.110347
## X0066.HK  0.46212  0.332486
## X0083.HK  0.80985  0.077781
## X0101.HK  0.76332  0.066832
## X0144.HK  0.37421 -0.011544
## X0151.HK -0.19862 -0.063506
## X0267.HK  0.64394 -0.054893
## X0291.HK  0.59952 -0.030469
## X0293.HK  0.58714 -0.201699
## X0322.HK -0.04665 -0.041037
## X0330.HK  0.20648 -0.124903
## X0386.HK  0.04764  0.423451
## X0388.HK  0.95761 -0.003163
## X0494.HK  0.48840 -0.006710
## X0688.HK  0.89157 -0.248509
## X0700.HK  0.63368 -0.082680
## X0762.HK -0.01192  0.304957
## X0836.HK -0.23808 -0.107181
## X0857.HK  0.29854  0.319438
## X0883.HK  0.58272  0.107116
## X0939.HK  0.67805  0.102424
## X0941.HK -0.08599  0.655907
## X1044.HK  0.04380 -0.062410
```

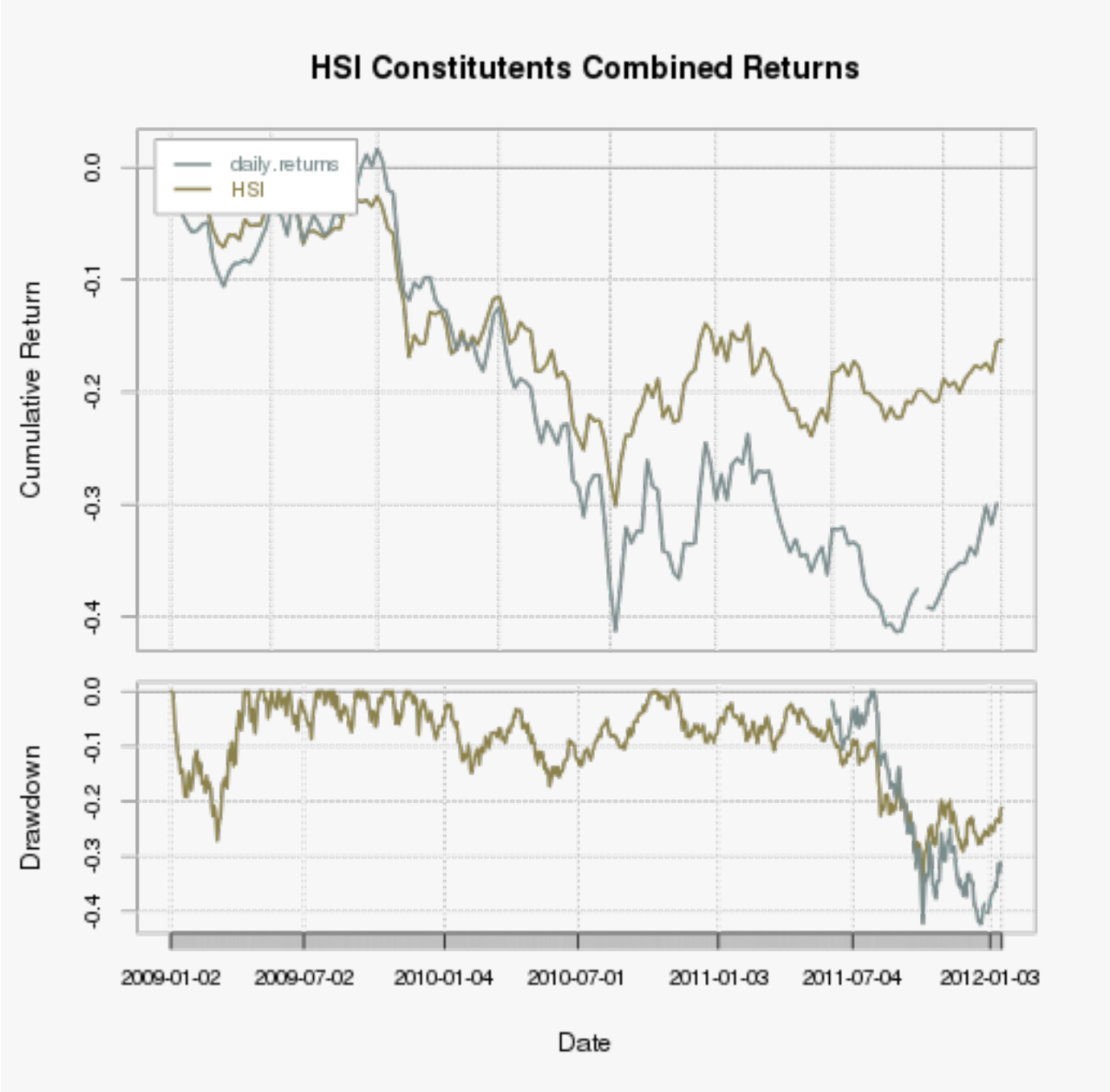
```
## X1088.HK  0.50293  0.149839
## X1109.HK  0.87556 -0.345967
## X1199.HK  0.64375 -0.046336
## X1299.HK  0.39440  0.072925
## X1398.HK  0.87573  0.038880
## X1880.HK  0.37109 -0.123239
## X1898.HK  0.73148  0.098349
## X2318.HK  0.91027 -0.071342
## X2388.HK  0.85938  0.044357
## X2600.HK  0.82389 -0.026840
## X2628.HK  0.62744  0.123081
## X3328.HK  0.80215  0.053179
## X3988.HK  0.76650  0.114306
```



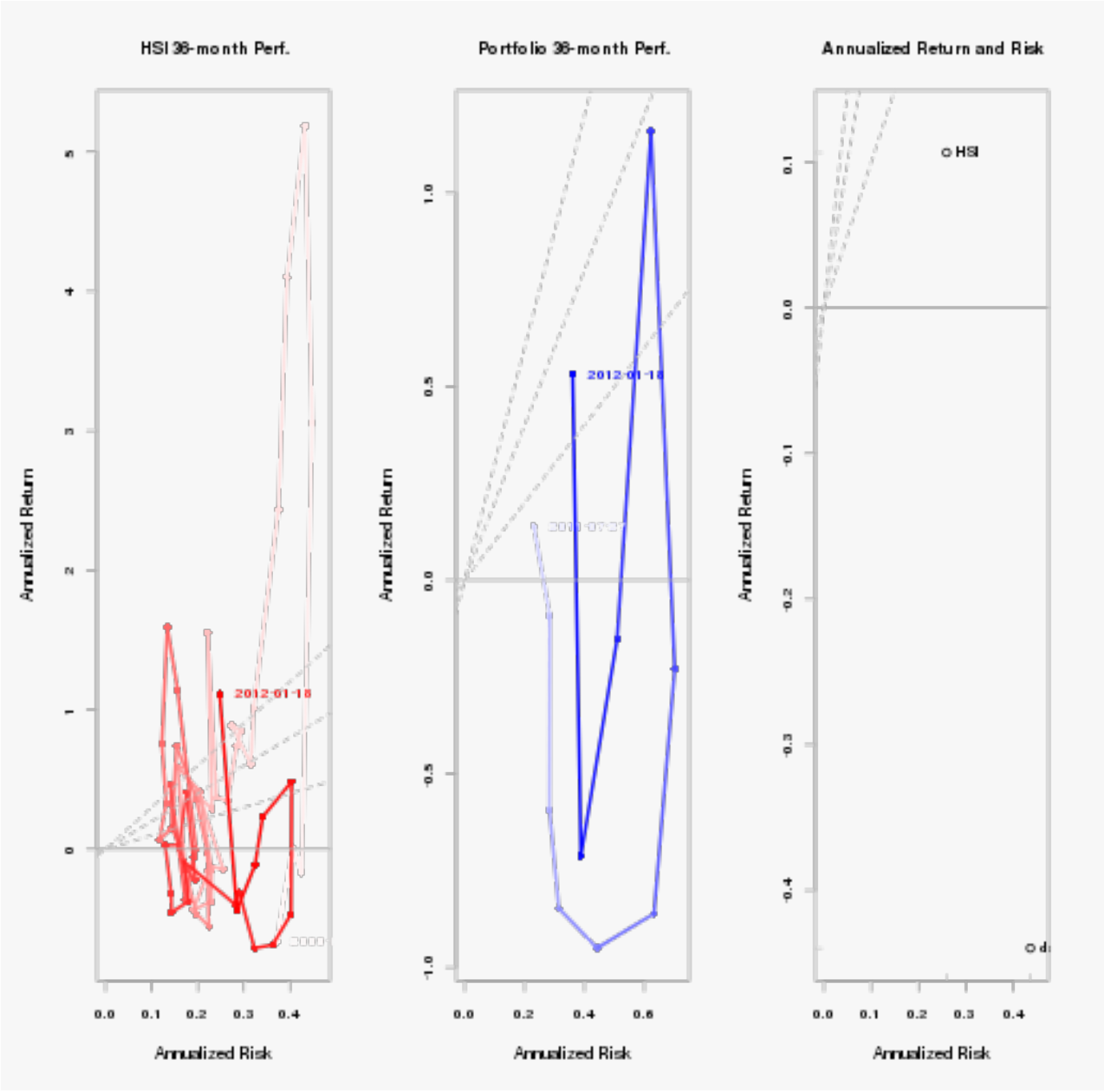
PCA is a science in itself and can not be fully covered and even less interpreted in this paper. The factors produced by principal component analysis are conceptualized as being linear combinations of the variables whereas the factors produced by common factor analysis are conceptualized as being latent variables. Note : Kaiser criterion: The Kaiser rule is to drop all components with eigenvalues under 1.0 – this being the eigenvalue equal to the information accounted for by an average single item.

6 HSI Components Performance

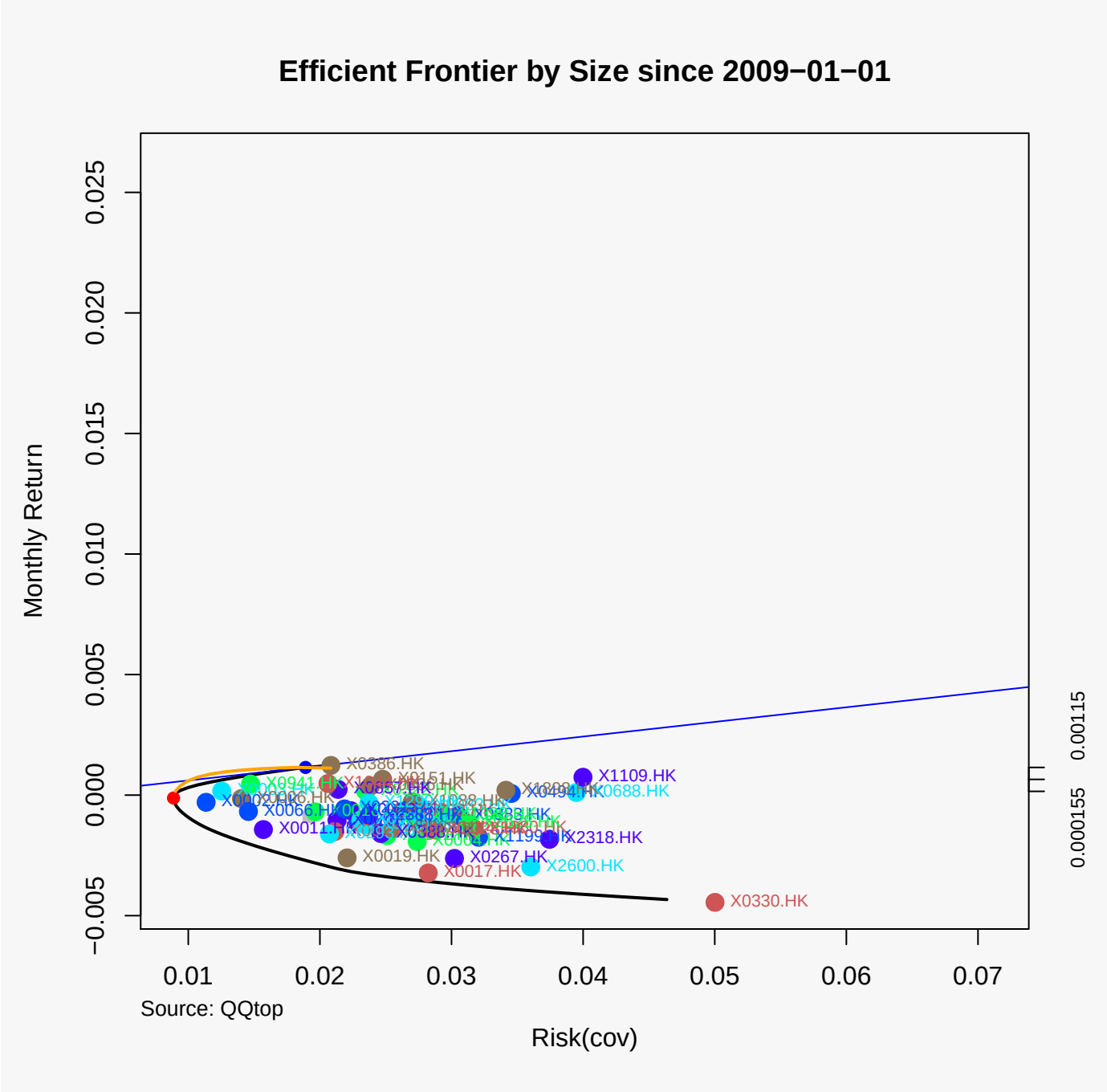
6.1 Performance Chart



6.2 Performance SnailTrail Chart



6.3 HSI Components Frontier




```
##
## Title:
##  MV Portfolio Frontier
##  Estimator:         covEstimator
##  Solver:            solveRquadprog
##  Optimize:          minRisk
##  Constraints:       LongOnly
##  Portfolio Points:  5 of 49
##
## Portfolio Weights:
##    X0001.HK X0002.HK X0003.HK X0004.HK X0005.HK X0006.HK X0011.HK X0012.HK
```

```
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0393   0.0000   0.0000
## 25   0.0000   0.1556   0.0000   0.0000   0.0000   0.2546   0.1705   0.0000
## 37   0.0000   0.2600   0.2269   0.0000   0.0000   0.2179   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X0013.HK X0016.HK X0017.HK X0019.HK X0023.HK X0066.HK X0083.HK X0101.HK
## 1    0.0000   0.0000   0.0951   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.3223   0.5119   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.1002   0.2476   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0103   0.0000   0.0622   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X0144.HK X0151.HK X0267.HK X0291.HK X0293.HK X0322.HK X0330.HK X0386.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.9049   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.1265   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0223   0.0000   0.0493   0.0000
## 37   0.0000   0.0039   0.0000   0.0000   0.0496   0.0521   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.0000
##    X0388.HK X0494.HK X0688.HK X0700.HK X0762.HK X0836.HK X0857.HK X0883.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0000   0.0000   0.0696   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X0939.HK X0941.HK X1044.HK X1088.HK X1109.HK X1199.HK X1299.HK X1398.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0476   0.0000   0.0000   0.0000   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X1880.HK X1898.HK X2318.HK X2388.HK X2600.HK X2628.HK X3328.HK X3988.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##
## Covariance Risk Budgets:
##    X0001.HK X0002.HK X0003.HK X0004.HK X0005.HK X0006.HK X0011.HK X0012.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0016   0.0000   0.0000
## 25   0.0000   0.0835   0.0000   0.0000   0.0000   0.1221   0.1628   0.0000
## 37   0.0000   0.2607   0.2256   0.0000   0.0000   0.2178   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X0013.HK X0016.HK X0017.HK X0019.HK X0023.HK X0066.HK X0083.HK X0101.HK
## 1    0.0000   0.0000   0.0250   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.3541   0.4524   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.1624   0.3442   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0107   0.0000   0.0627   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X0144.HK X0151.HK X0267.HK X0291.HK X0293.HK X0322.HK X0330.HK X0386.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.9750   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.1919   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0228   0.0000   0.1023   0.0000
## 37   0.0000   0.0039   0.0000   0.0000   0.0508   0.0518   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.0000
##    X0388.HK X0494.HK X0688.HK X0700.HK X0762.HK X0836.HK X0857.HK X0883.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
```

```
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0000   0.0000   0.0690   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X0939.HK X0941.HK X1044.HK X1088.HK X1109.HK X1199.HK X1299.HK X1398.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0471   0.0000   0.0000   0.0000   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##    X1880.HK X1898.HK X2318.HK X2388.HK X2600.HK X2628.HK X3328.HK X3988.HK
## 1    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## 49   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
##
## Target Return and Risks:
##       mean      mu     Cov   Sigma    CVaR     VaR
## 1  -0.0043 -0.0043  0.0464  0.0464  0.1218  0.0799
## 13 -0.0029 -0.0029  0.0205  0.0205  0.0555  0.0415
## 25 -0.0015 -0.0015  0.0122  0.0122  0.0305  0.0265
## 37 -0.0002 -0.0002  0.0089  0.0089  0.0193  0.0168
## 49  0.0012  0.0012  0.0208  0.0208  0.0429  0.0277
##
## Description:
##  Thu Jan 19 21:14:31 2012 by user:
```

7 HSI Components Ratios

7.1 Sharpe Ratio - Combined

```
##                                          daily.returns
## Annualized StdDev Sharpe (Rf=0%, p=95%):        -1.008
## Annualized VaR Sharpe (Rf=0%, p=95%):          -10.045
## Annualized ES Sharpe (Rf=0%, p=95%):            -7.843
```

7.2 Sharpe - Distinct

```
##                                          X0001.HK X0002.HK X0003.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2713   0.4581   0.6367
## Annualized VaR Sharpe (Rf=0%, p=95%):      2.8832   4.6102   6.0878
## Annualized ES Sharpe (Rf=0%, p=95%):       2.2422   3.2405   2.6190
##                                          X0004.HK X0005.HK X0006.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.5313  -0.1786   0.4563
## Annualized VaR Sharpe (Rf=0%, p=95%):      5.7821  -1.8563   4.6692
## Annualized ES Sharpe (Rf=0%, p=95%):       4.5380  -0.8980   3.3301
##                                          X0011.HK X0012.HK X0013.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   -0.104   0.3202   0.6166
## Annualized VaR Sharpe (Rf=0%, p=95%):      -1.195   3.5400   6.7540
## Annualized ES Sharpe (Rf=0%, p=95%):       -1.143   2.8213   5.2339
##                                          X0016.HK X0017.HK X0019.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    0.483  -0.0685   0.3316
## Annualized VaR Sharpe (Rf=0%, p=95%):       5.156  -0.7181   3.2790
## Annualized ES Sharpe (Rf=0%, p=95%):        4.028  -0.5021   1.9364
##                                          X0023.HK X0066.HK X0083.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.5757   0.5201    0.295
## Annualized VaR Sharpe (Rf=0%, p=95%):      7.1391   6.0800    3.113
## Annualized ES Sharpe (Rf=0%, p=95%):       7.0329   5.1857    2.271
##                                          X0101.HK X0144.HK X0151.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2299    0.378   0.9632
## Annualized VaR Sharpe (Rf=0%, p=95%):      2.4805    4.056  10.3186
## Annualized ES Sharpe (Rf=0%, p=95%):       1.9499    3.223   7.7869
##                                          X0267.HK X0291.HK X0293.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2465   0.6644   0.4517
## Annualized VaR Sharpe (Rf=0%, p=95%):      2.8553   7.1891   4.7177
## Annualized ES Sharpe (Rf=0%, p=95%):       2.4349   5.7564   3.5292
##                                          X0322.HK X0330.HK X0386.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    1.112  -0.6934   0.6766
## Annualized VaR Sharpe (Rf=0%, p=95%):      15.205  -6.3795   6.9658
## Annualized ES Sharpe (Rf=0%, p=95%):       15.205  -3.4068   5.2381
##                                          X0388.HK X0494.HK X0688.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    0.520   -0.225   0.1982
## Annualized VaR Sharpe (Rf=0%, p=95%):       5.887   -2.271   2.3034
## Annualized ES Sharpe (Rf=0%, p=95%):        4.807   -1.862   1.9887
##                                          X0700.HK X0762.HK X0836.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    1.297   0.4108   0.0216
## Annualized VaR Sharpe (Rf=0%, p=95%):      13.718   4.5789   0.2221
## Annualized ES Sharpe (Rf=0%, p=95%):       10.185   3.6658   0.1762
##                                          X0857.HK X0883.HK X0939.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.4794   0.6819   0.2855
## Annualized VaR Sharpe (Rf=0%, p=95%):      4.8221   7.1382   2.8276
## Annualized ES Sharpe (Rf=0%, p=95%):       3.6552   5.3561   1.9635
##                                          X0941.HK X1044.HK X1088.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):  -0.0915     1.19   0.6595
## Annualized VaR Sharpe (Rf=0%, p=95%):     -0.9645    13.16   6.6792
## Annualized ES Sharpe (Rf=0%, p=95%):      -0.7445    10.21   5.1301
##                                          X1109.HK X1199.HK X1299.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    0.226   0.1958   0.1927
## Annualized VaR Sharpe (Rf=0%, p=95%):       2.659   2.1546   1.9783
## Annualized ES Sharpe (Rf=0%, p=95%):        2.298   1.7321   1.2453
##                                          X1398.HK X1880.HK X1898.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2089    1.128   0.3042
## Annualized VaR Sharpe (Rf=0%, p=95%):      2.3516   12.818   2.9764
```

```
## Annualized ES Sharpe (Rf=0%, p=95%):       1.9228   10.134   2.0189
##                                          X2318.HK X2388.HK X2600.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2754   0.8849  -0.1110
## Annualized VaR Sharpe (Rf=0%, p=95%):      2.9062  10.1309  -1.1799
## Annualized ES Sharpe (Rf=0%, p=95%):       2.0769   8.2039  -0.9347
##                                          X2628.HK X3328.HK X3988.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):  -0.1451   0.0123   0.4373
## Annualized VaR Sharpe (Rf=0%, p=95%):     -1.4423   0.1244   4.5959
## Annualized ES Sharpe (Rf=0%, p=95%):      -1.0089   0.0920   3.3328
```

7.3 Information Ratio - Combined

```
## [1] "Information Ratio :  -0.7807"
```

7.4 Information Ratio - Distinct

```
##                         X0001.HK X0002.HK X0003.HK X0004.HK X0005.HK
## Information Ratio: HSI  -0.1096  -0.1791   0.1512   0.3741  -0.6831
##                         X0006.HK X0011.HK X0012.HK X0013.HK X0016.HK
## Information Ratio: HSI  -0.0942  -0.6513   0.0242   0.4337   0.2524
##                         X0017.HK X0019.HK X0023.HK X0066.HK X0083.HK
## Information Ratio: HSI  -0.4642   0.0016   0.3736   0.0469   0.0547
##                         X0101.HK X0144.HK X0151.HK X0267.HK X0291.HK
## Information Ratio: HSI  -0.0427   0.2071   0.6379   0.0032   0.4735
##                         X0293.HK X0322.HK X0330.HK X0386.HK X0388.HK
## Information Ratio: HSI   0.1733   0.7312   -1.014   0.5296   0.3945
##                         X0494.HK X0688.HK X0700.HK X0762.HK X0836.HK
## Information Ratio: HSI    0.314  -0.0586    1.296   0.1288  -0.3049
##                         X0857.HK X0883.HK X0939.HK X0941.HK X1044.HK
## Information Ratio: HSI   0.2986   0.7036  -0.0762  -0.6817   0.8741
##                         X1088.HK X1109.HK X1199.HK X1299.HK X1398.HK
## Information Ratio: HSI   0.6315   0.0141  -0.0313   0.7657  -0.1709
##                         X1880.HK X1898.HK X2318.HK X2388.HK X2600.HK
## Information Ratio: HSI    1.004   0.1219    0.043   0.7574  -0.4805
##                         X2628.HK X3328.HK X3988.HK
## Information Ratio: HSI  -0.7426  -0.5289   0.1943
```

8 HSI Components Table Latest Quotes

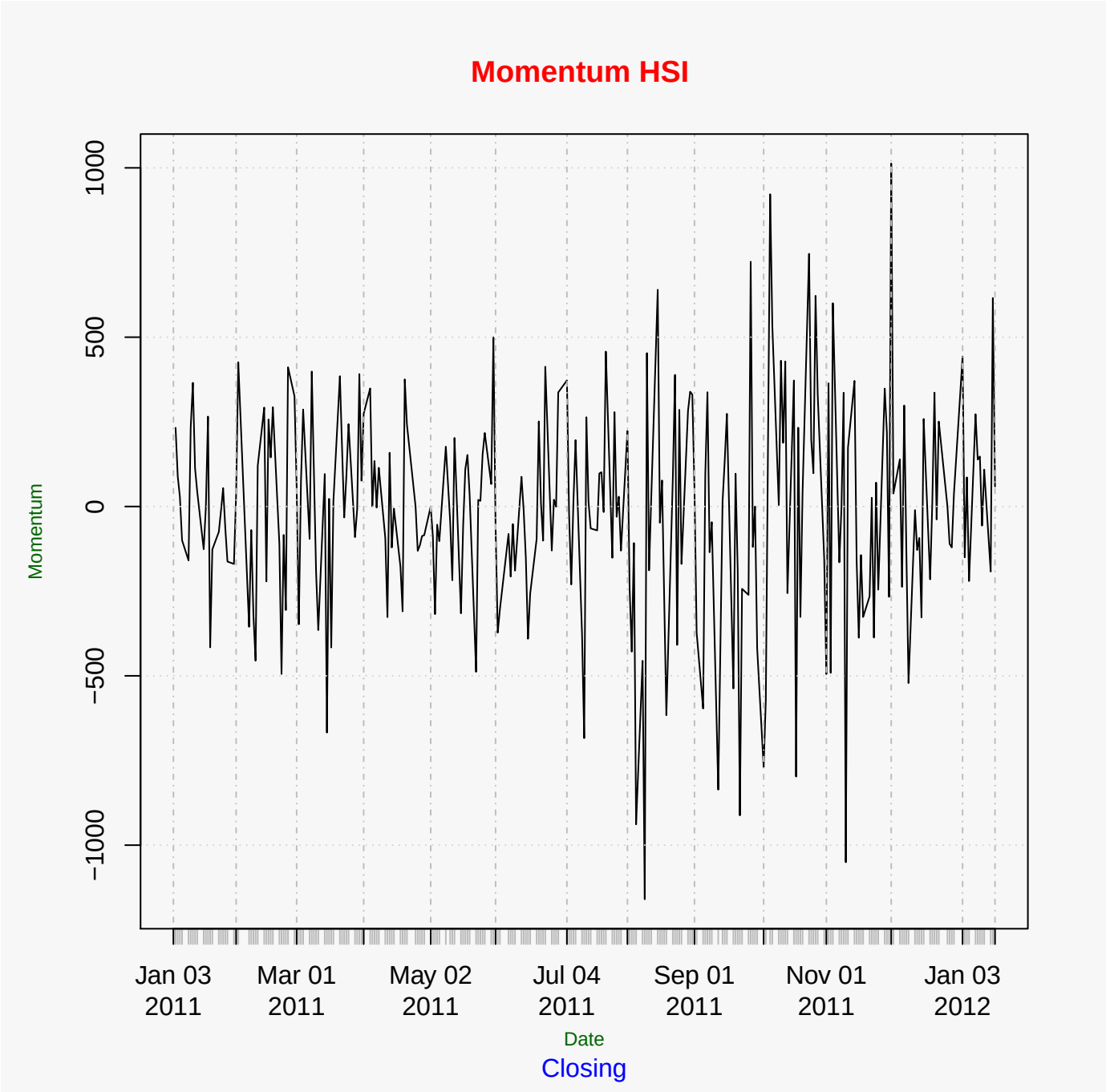
```
## [1] "Date :  2012-01-19 02:59:00"

##                    Name    Bid    Ask Change   52-week Range
## 0001.HK     CHEUNG KONG 103.40 103.50   4.70  79.10 - 137.60
## 0002.HK    CLP HOLDINGS  62.25  62.30  -0.65   59.85 - 75.20
## 0003.HK  HK & CHINA GAS  17.98  18.00  -0.32   16.70 - 19.68
## 0004.HK  WHARF HOLDINGS  42.50  42.55   2.75   33.15 - 63.80
## 0005.HK   HSBC HOLDINGS  62.20  62.25   0.25   56.35 - 91.90
## 0006.HK    POWER ASSETS  53.50  53.55  -0.50   48.10 - 64.80
## 0011.HK  HANG SENG BANK  97.80  98.05   1.25  84.40 - 134.40
## 0012.HK  HENDERSON LAND  43.35  43.45   1.60   33.20 - 61.50
## 0013.HK       HUTCHISON  72.00  72.05   1.45   53.60 - 97.45
## 0016.HK         SHK PPT 107.60 108.00   3.70  85.45 - 147.00
## 0017.HK   NEW WORLD DEV   7.90   7.93   0.42    7.00 - 17.98
## 0019.HK SWIRE PACIFIC A  77.35  77.40   1.10  79.30 - 137.20
## 0023.HK  BANK OF E ASIA  30.05  30.20   0.85   21.85 - 36.60
## 0066.HK MTR CORPORATION  25.00  25.10  -0.30   22.45 - 31.55
## 0083.HK       SINO LAND  12.46  12.48   0.64    9.33 - 18.90
## 0101.HK   HANG LUNG PPT  26.45  26.50   2.35   20.85 - 40.50
## 0144.HK  CHINA MER HOLD  25.00  25.05   0.00   19.00 - 37.60
## 0151.HK WANT WANT CHINA   7.71   7.74   0.02     5.68 - 8.30
## 0267.HK   CITIC PACIFIC  14.16  14.18   0.24   10.26 - 24.60
## 0291.HK CHINA RESOURCES  27.45  27.65   0.05   24.10 - 35.50
## 0293.HK  CATHAY PAC AIR  14.38  14.40   0.48   11.80 - 24.10
## 0322.HK          TINGYI  23.50  23.65   0.05   17.32 - 26.00
## 0330.HK ESPRIT HOLDINGS  11.22  11.30  -0.18    7.55 - 45.65
## 0386.HK    SINOPEC CORP   9.09   9.10  -0.04     6.22 - 8.90
## 0388.HK            HKEX 130.50 130.80   2.30  99.15 - 198.60
## 0494.HK       LI & FUNG  16.86  16.90   0.34   10.82 - 51.95
## 0688.HK  CHINA OVERSEAS  14.84  14.90   0.40    9.99 - 17.86
## 0700.HK         TENCENT 179.10 179.80  -1.50 139.90 - 230.80
## 0762.HK    CHINA UNICOM  14.48  14.50  -0.12   10.24 - 17.68
## 0836.HK CHINA RES POWER  15.00  15.02  -0.46   10.82 - 16.44
## 0857.HK      PETROCHINA  11.32  11.34   0.00    8.59 - 12.50
## 0883.HK           CNOOC  15.48  15.50  -0.30   11.20 - 21.30
## 0939.HK             CCB   6.08   6.09   0.15     4.41 - 8.47
## 0941.HK    CHINA MOBILE  76.15  76.20   0.80   68.05 - 83.80
## 1044.HK    HENGAN INT'L  70.90  71.40  -0.35   54.10 - 75.40
## 1088.HK   CHINA SHENHUA  34.90  35.00   0.05   27.10 - 40.20
## 1109.HK  CHINA RES LAND  13.64  13.78   0.10    7.28 - 17.24
## 1199.HK   COSCO PACIFIC  10.74  10.76   0.12    7.52 - 17.16
## 1299.HK             AIA  25.65  25.70   0.85   19.84 - 29.90
## 1398.HK            ICBC   5.43   5.44   0.10     3.46 - 6.90
## 1880.HK     BELLE INT'L  12.34  12.40   0.30   11.56 - 17.54
## 1898.HK      CHINA COAL   9.91   9.92   0.07    6.59 - 15.08
## 2318.HK         PING AN  59.50  59.65   3.90   37.35 - 96.25
## 2388.HK   BOC HONG KONG  20.15  20.20   0.15   14.24 - 29.40
## 2600.HK          CHALCO   4.01   4.02   0.22     3.20 - 8.30
## 2628.HK      CHINA LIFE  21.70  21.75   0.60   17.04 - 36.90
## 3328.HK        BANKCOMM   6.00   6.01   0.03     4.15 - 9.53
## 3988.HK   BANK OF CHINA   3.29   3.30   0.02     2.20 - 5.02
```

9 Hang Seng Index

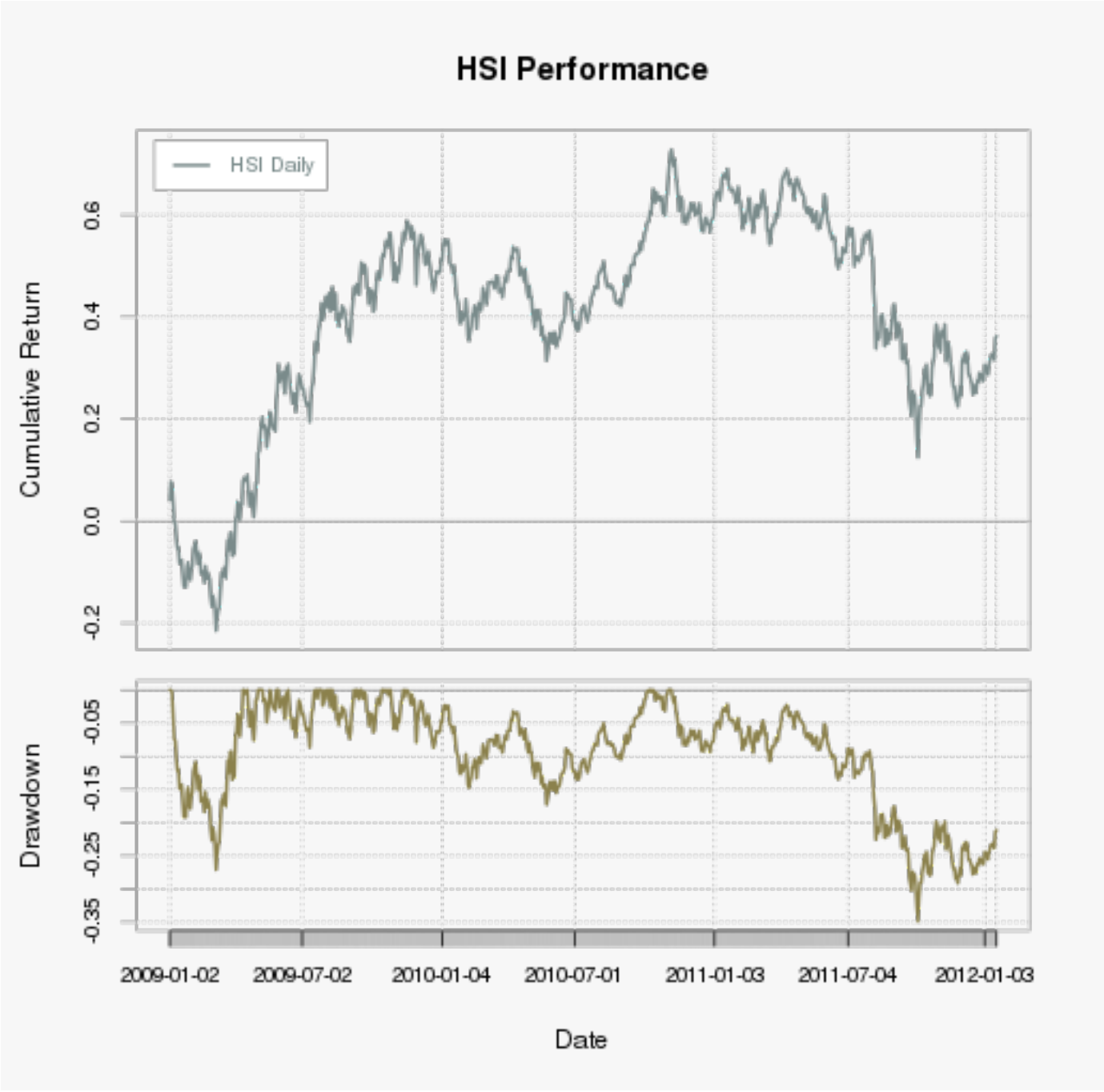
Latest Hang Seng Index

	Trade Time	Name	Last	Change	Days Range	52−week Range
^HSI	2012−01−19 03:01:00	HANG SENG INDEX	19943	256	19776.32 − 19956.539	16170.30 − 24468.60

9.1 Hang Seng Index - Momentum



9.2 HSI Performance



9.3 HSI Ratios

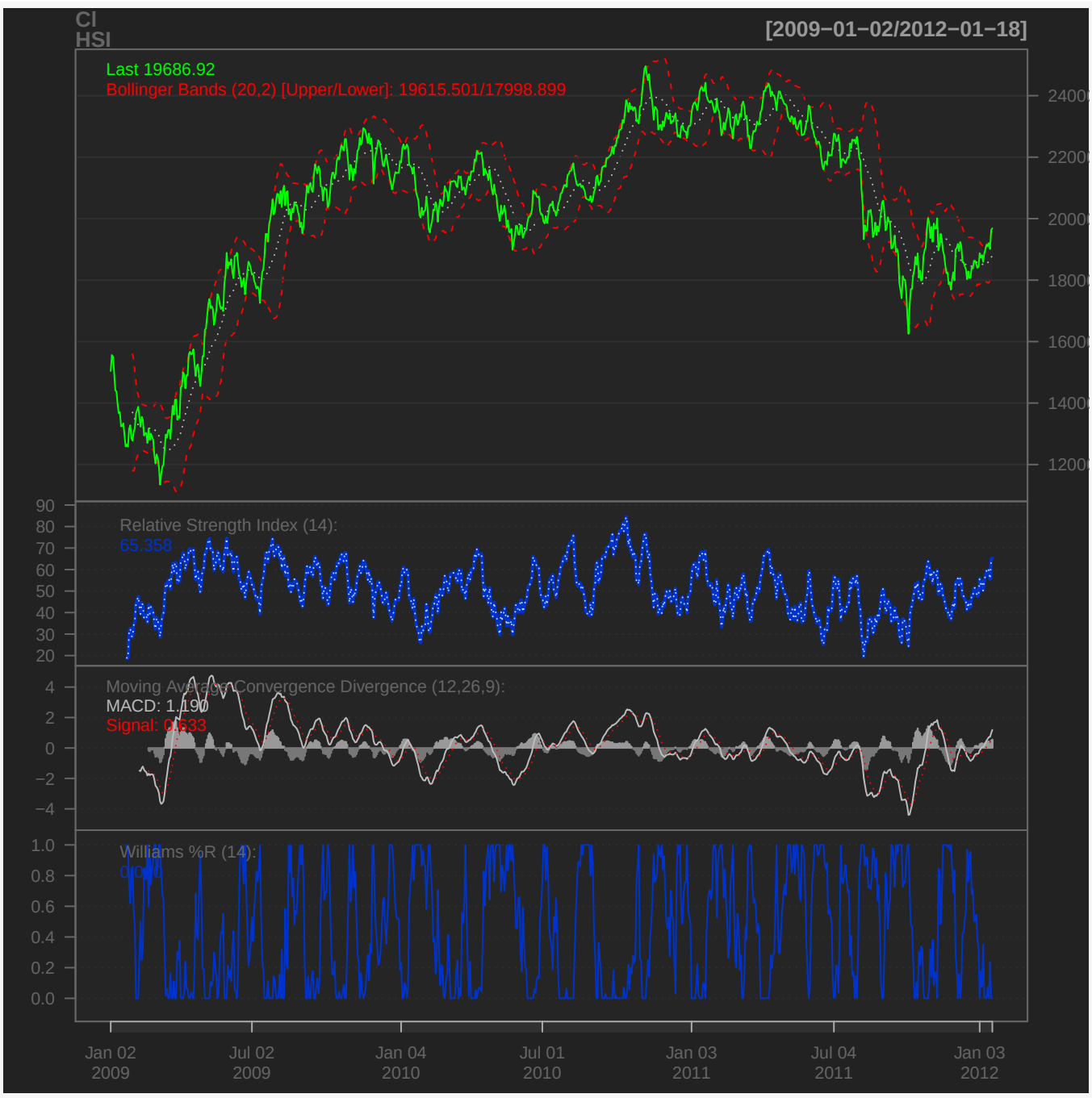
```
##              RSI
## 2012-01-05 54.48
## 2012-01-06 50.21
## 2012-01-09 54.92
## 2012-01-10 57.14
## 2012-01-11 59.43
## 2012-01-12 58.15
## 2012-01-13 59.94
## 2012-01-16 55.43
## 2012-01-17 64.62
## 2012-01-18 65.36
```

```
##              macd  signal
## 2012-01-05 0.0629 -0.2598
## 2012-01-06 0.0592 -0.1960
## 2012-01-09 0.1725 -0.1223
## 2012-01-10 0.3183 -0.0342
## 2012-01-11 0.4913  0.0709
## 2012-01-12 0.5965  0.1760
## 2012-01-13 0.7180  0.2844
## 2012-01-16 0.7232  0.3722
## 2012-01-17 0.9781  0.4934
## 2012-01-18 1.1897  0.6326
```

```
## [1] "BBands"
```

```
##                dn  mavg    up   pctB
## 2012-01-05 17908 18530 19151 0.7282
## 2012-01-06 17967 18497 19028 0.5901
## 2012-01-09 18002 18485 18969 0.8934
## 2012-01-10 17974 18506 19039 0.9674
## 2012-01-11 17933 18535 19137 1.0120
## 2012-01-12 17919 18567 19216 0.9073
## 2012-01-13 17914 18610 19306 0.9269
## 2012-01-16 17996 18659 19322 0.7662
## 2012-01-17 17964 18726 19489 1.0912
## 2012-01-18 17999 18807 19616 1.0442
```

```
##            WPR %
## 2012-01-05  7.52
## 2012-01-06 35.23
## 2012-01-09  1.45
## 2012-01-10  0.00
## 2012-01-11  0.00
## 2012-01-12  7.31
## 2012-01-13  0.00
## 2012-01-16 23.83
## 2012-01-17  0.00
## 2012-01-18  0.00
```


CI
HSI
[2009−01−02/2012−01−18]
Last 19686.92
Bollinger Bands (20,2) [Upper/Lower]: 19615.501/17998.899
Relative Strength Index (14):
65.358
Moving Average Convergence Divergence (12,26,9):
MACD: 1.190
Signal: 0.633
Williams %R (14):
Jan 02 2009
Jul 02 2009
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 04 2011
Jan 03 2012

9.4 HSI Volatility

9.5 HSI Statistics

```
##                                           HSI-Daily HSI-Monthly
## Annualized StdDev Sharpe (Rf=0%, p=95%):    0.4118      0.3806
## Annualized VaR Sharpe (Rf=0%, p=95%):       4.2248      0.9120
## Annualized ES Sharpe (Rf=0%, p=95%):        3.1265      0.7151

##          HSI-Daily HSI-Monthly
## Skewness    0.1238      0.1174

##          HSI-Daily HSI-Monthly
## Kurtosis     1.384   -0.003363
```

```
##       Index               HSI Daily
##  Min.   :2009-01-02   Min.   :-0.056605
##  1st Qu.:2009-10-07   1st Qu.:-0.008138
##  Median :2010-07-13   Median : 0.000286
##  Mean   :2010-07-11   Mean   : 0.000535
##  3rd Qu.:2011-04-13   3rd Qu.: 0.010190
##  Max.   :2012-01-18   Max.   : 0.074147

##       Index              HSI Monthly
##  Min.   :2009-01-30   Min.   :-0.14329
##  1st Qu.:2009-10-30   1st Qu.:-0.02346
##  Median :2010-07-30   Median : 0.00812
##  Mean   :2010-07-30   Mean   : 0.00960
##  3rd Qu.:2011-04-29   3rd Qu.: 0.03806
##  Max.   :2012-01-18   Max.   : 0.17074
```

10 Dataset First and Last Rows Info

```
##            X0001.HK.Close
## 2009-01-02           76.9
## 2012-01-18           98.9
##            X0002.HK.Close
## 2009-01-02          52.40
## 2012-01-18          62.85
##            X0003.HK.Close
## 2009-01-02          12.08
## 2012-01-18          18.32
##            X0004.HK.Close
## 2009-01-02           22.0
## 2012-01-18           39.8
##            X0005.HK.Close
## 2009-01-02          77.00
## 2012-01-18          61.95
##            X0006.HK.Close
## 2009-01-02          42.75
## 2012-01-18          54.05
##            X0011.HK.Close
## 2009-01-02          104.7
## 2012-01-18           96.8
##            X0012.HK.Close
## 2009-01-02          30.35
## 2012-01-18          42.00
##            X0013.HK.Close
## 2009-01-02          39.85
## 2012-01-18          70.70
##            X0016.HK.Close
## 2009-01-02           67.3
## 2012-01-18          104.5
##            X0017.HK.Close
## 2009-01-02           8.18
## 2012-01-18           7.50
##            X0019.HK.Close
## 2009-01-02          55.75
## 2012-01-18          76.05
##            X0023.HK.Close
## 2009-01-02          16.68
## 2012-01-18          29.35
##            X0066.HK.Close
## 2009-01-02          18.08
## 2012-01-18          25.35
##            X0083.HK.Close
## 2009-01-02           8.36
## 2012-01-18          11.90
##            X0101.HK.Close
## 2009-01-02          18.36
## 2012-01-18          24.15
##            X0144.HK.Close
## 2009-01-02          15.40
## 2012-01-18          25.05
##            X0151.HK.Close
## 2009-01-02           3.17
## 2012-01-18           7.75
##            X0267.HK.Close
```

```
## 2009-01-02          10.20
## 2012-01-18          13.94
##            X0291.HK.Close
## 2009-01-02          14.00
## 2012-01-18          27.45
##            X0293.HK.Close
## 2009-01-02           8.91
## 2012-01-18          13.92
##            X0322.HK.Close
## 2009-01-02           8.98
## 2012-01-18          23.55
##            X0330.HK.Close
## 2009-01-02          44.80
## 2012-01-18          11.38
##            X0386.HK.Close
## 2009-01-02           4.96
## 2012-01-18           9.15
##            X0388.HK.Close
## 2009-01-02           76.6
## 2012-01-18          128.3
##            X0494.HK.Close
## 2011-06-02          17.92
## 2012-01-18          16.50
##            X0688.HK.Close
## 2009-01-02          11.22
## 2012-01-18          14.50
##            X0700.HK.Close
## 2009-01-01           50.0
## 2012-01-18          181.6
##            X0762.HK.Close
## 2009-01-01           9.63
## 2012-01-18          14.66
##            X0836.HK.Close
## 2009-01-02          15.12
## 2012-01-18          15.46
##            X0857.HK.Close
## 2009-01-02            7.2
## 2012-01-18           11.3
##            X0883.HK.Close
## 2009-01-02           7.59
## 2012-01-18          15.78
##            X0939.HK.Close
## 2009-01-02           4.52
## 2012-01-18           5.93
##            X0941.HK.Close
## 2009-01-02           81.2
## 2012-01-18           75.6
##            X1044.HK.Close
## 2009-01-01           24.9
## 2012-01-18           71.8
##            X1088.HK.Close
## 2009-01-02          17.40
## 2012-01-18          34.85
##            X1109.HK.Close
## 2009-01-02            9.9
## 2012-01-18           13.7
##            X1199.HK.Close
```

```
## 2009-01-02           8.07
## 2012-01-18          10.66
##            X1299.HK.Close
## 2010-10-29           23.1
## 2012-01-18           24.8
##            X1398.HK.Close
## 2009-01-02           4.30
## 2012-01-18           5.33
##            X1880.HK.Close
## 2009-01-02            3.5
## 2012-01-18           12.2
##            X1898.HK.Close
## 2009-01-02           6.55
## 2012-01-18           9.86
##            X2318.HK.Close
## 2009-01-02          39.60
## 2012-01-18          55.75
##            X2388.HK.Close
## 2009-01-02           9.06
## 2012-01-18          20.15
##            X2600.HK.Close
## 2009-01-02           4.55
## 2012-01-18           3.82
##            X2628.HK.Close
## 2009-01-02          24.75
## 2012-01-18          21.10
##            X3328.HK.Close
## 2009-01-02           5.91
## 2012-01-18           5.99
##            X3988.HK.Close
## 2009-01-02           2.17
## 2012-01-18           3.29
```

11 Notes

This paper was generated using R and following R libraries :
qmao XML quantmod PerformanceAnalytics
fPortfolio fBasic grid gridExtra knitr

Market Data Source : yahoo.finance

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