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                              -0.0004
## Beta                                1.1899
## Beta+                               1.2576
## Beta-                               1.1992
## R-squared                           0.6438
## Annualized Alpha                   -0.1056
## Correlation                         0.8024
## Correlation p-value                 0.0000
## Tracking Error                      0.2706
## Active Premium                     -0.1444
## Information Ratio                  -0.5338
## Treynor Ratio                      -0.2759
```

[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   0.001  -0.001   0.000
## Beta                  0.990   0.150   0.380   1.110   1.121   0.117
## Beta+                 0.954   0.044   0.278   1.115   1.211   0.065
## Beta-                 0.975   0.186   0.413   1.089   1.310   0.129
## R-squared             0.641   0.082   0.180   0.494   0.560   0.030
## Annualized Alpha      0.009   0.046   0.116   0.163  -0.135   0.076
## Correlation           0.800   0.287   0.424   0.703   0.748   0.172
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.193   0.257   0.266   0.294   0.261   0.289
## Active Premium       -0.012  -0.062   0.027   0.140  -0.176  -0.044
## Information Ratio    -0.060  -0.240   0.100   0.475  -0.675  -0.152
## Treynor Ratio         0.111   0.402   0.391   0.236  -0.048   0.666
##                     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                  0.641   1.021   0.948   1.004   1.134   0.783
## Beta+                 0.710   1.056   0.872   0.967   1.055   0.849
## Beta-                 0.673   0.996   0.990   0.981   1.146   0.728
## R-squared             0.454   0.558   0.528   0.643   0.503   0.386
## Annualized Alpha     -0.072   0.026   0.126   0.072  -0.066   0.068
## Correlation           0.674   0.747   0.727   0.802   0.709   0.621
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.206   0.237   0.234   0.195   0.296   0.264
## Active Premium       -0.132   0.000   0.103   0.059  -0.108   0.015
## Information Ratio    -0.642   0.001   0.439   0.300  -0.363   0.057
## Treynor Ratio        -0.016   0.120   0.237   0.180   0.013   0.175
##                     0023.HK 0066.HK 0083.HK 0101.HK 0144.HK 0151.HK
## Alpha                 0.001   0.000   0.000   0.000   0.000   0.001
## Beta                  0.942   0.509   1.168   1.099   1.310   0.424
## Beta+                 1.023   0.430   1.140   1.251   1.262   0.193
## Beta-                 0.935   0.499   1.214   0.977   1.210   0.516
## R-squared             0.465   0.338   0.518   0.468   0.542   0.095
## Annualized Alpha      0.155   0.069   0.066   0.055   0.089   0.327
## Correlation           0.682   0.581   0.720   0.684   0.736   0.308
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.264   0.226   0.297   0.307   0.325   0.374
## Active Premium        0.124   0.002   0.038   0.017   0.068   0.203
## Information Ratio     0.471   0.008   0.128   0.054   0.209   0.544
## Treynor Ratio         0.261   0.243   0.137   0.126   0.145   0.766
##                     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                  1.079   0.881   0.771   0.347   0.937   0.955
## Beta+                 1.031   0.772   0.730   0.261   0.740   0.806
## Beta-                 0.976   0.902   0.752   0.382   1.099   1.003
## R-squared             0.402   0.371   0.322   0.071   0.215   0.558
## Annualized Alpha      0.061   0.183   0.121   0.369  -0.365   0.123
## Correlation           0.634   0.609   0.568   0.266   0.464   0.747
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.344   0.301   0.298   0.370   0.467   0.222
## Active Premium        0.009   0.135   0.060   0.240  -0.488   0.103
## Information Ratio     0.026   0.448   0.201   0.650  -1.044   0.463
## Treynor Ratio         0.121   0.292   0.236   1.044  -0.391   0.235
##                     0388.HK 0494.HK 0688.HK 0700.HK 0762.HK 0836.HK
## Alpha                 0.000   0.002   0.000   0.002   0.000   0.000
## Beta                  1.159   1.241   1.185   0.934   0.703   0.557
```

```
## Beta+                 1.246   1.142   1.340   0.965   0.546   0.434
## Beta-                 1.103   0.898   0.926   0.784   0.648   0.662
## R-squared             0.706   0.459   0.474   0.355   0.255   0.179
## Annualized Alpha      0.081   0.443   0.032   0.454   0.105  -0.032
## Correlation           0.840   0.678   0.688   0.596   0.505   0.423
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.200   0.408   0.330   0.329   0.322   0.332
## Active Premium        0.082   0.196  -0.008   0.415   0.028  -0.130
## Information Ratio     0.413   0.480  -0.024   1.263   0.087  -0.391
## Treynor Ratio         0.176  -0.006   0.096   0.568   0.211  -0.014
##                     0857.HK 0883.HK 0939.HK 0941.HK 1044.HK 1088.HK
## Alpha                 0.000   0.000   0.000   0.000   0.001   0.000
## Beta                  1.101   1.282   1.062   0.709   0.462   1.216
## Beta+                 1.013   1.191   1.004   0.706   0.360   1.139
## Beta-                 1.096   1.246   1.036   0.734   0.414   1.142
## R-squared             0.725   0.686   0.700   0.520   0.118   0.649
## Annualized Alpha      0.051   0.144   0.002  -0.084   0.392   0.139
## Correlation           0.852   0.828   0.836   0.721   0.344   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   0.193   0.357   0.240
## Active Premium        0.048   0.155  -0.011  -0.137   0.281   0.142
## Information Ratio     0.269   0.650  -0.063  -0.708   0.788   0.591
## Treynor Ratio         0.154   0.216   0.104  -0.021   0.860   0.217
##                     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   0.826   1.126   0.824   1.495
## Beta+                 1.224   1.339   0.816   1.097   0.774   1.399
## Beta-                 0.777   1.427   1.053   1.055   0.898   1.438
## R-squared             0.362   0.493   0.412   0.686   0.222   0.664
## Annualized Alpha      0.079   0.032   0.247  -0.022   0.491   0.040
## Correlation           0.601   0.702   0.642   0.828   0.471   0.815
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.406   0.363   0.246   0.201   0.405   0.306
## Active Premium        0.010  -0.008   0.215  -0.036   0.398   0.036
## Information Ratio     0.024  -0.021   0.875  -0.177   0.984   0.118
## Treynor Ratio         0.113   0.086   0.140   0.077   0.632   0.106
##                     2318.HK 2388.HK 2600.HK 2628.HK 3328.HK 3988.HK
## Alpha                 0.000   0.001   0.000   0.000   0.000   0.000
## Beta                  1.327   0.877   1.540   1.093   1.192   1.033
## Beta+                 1.377   0.886   1.583   1.064   1.160   0.958
## Beta-                 1.225   0.846   1.394   1.065   1.215   1.009
## R-squared             0.622   0.442   0.622   0.638   0.728   0.631
## Annualized Alpha      0.043   0.226  -0.125  -0.116  -0.090   0.048
## Correlation           0.788   0.665   0.788   0.799   0.853   0.794
## Correlation p-value   0.000   0.000   0.000   0.000   0.000   0.000
## Tracking Error        0.283   0.259   0.344   0.216   0.196   0.206
## Active Premium        0.033   0.195  -0.154  -0.145  -0.104   0.032
## Information Ratio     0.117   0.754  -0.449  -0.672  -0.530   0.154
## Treynor Ratio         0.117   0.362  -0.021  -0.021   0.015   0.149
```

3 HSI Components Risk

3.1 Correlation

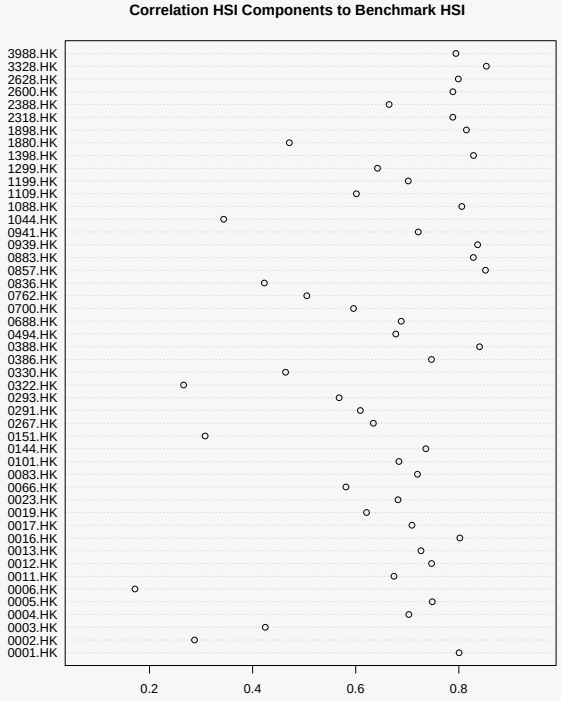
Correlation Combined

```
##                       Correlation p-value Lower CI Upper CI
## HSI Components to HSI      0.8024       0   0.7161   0.8645
```

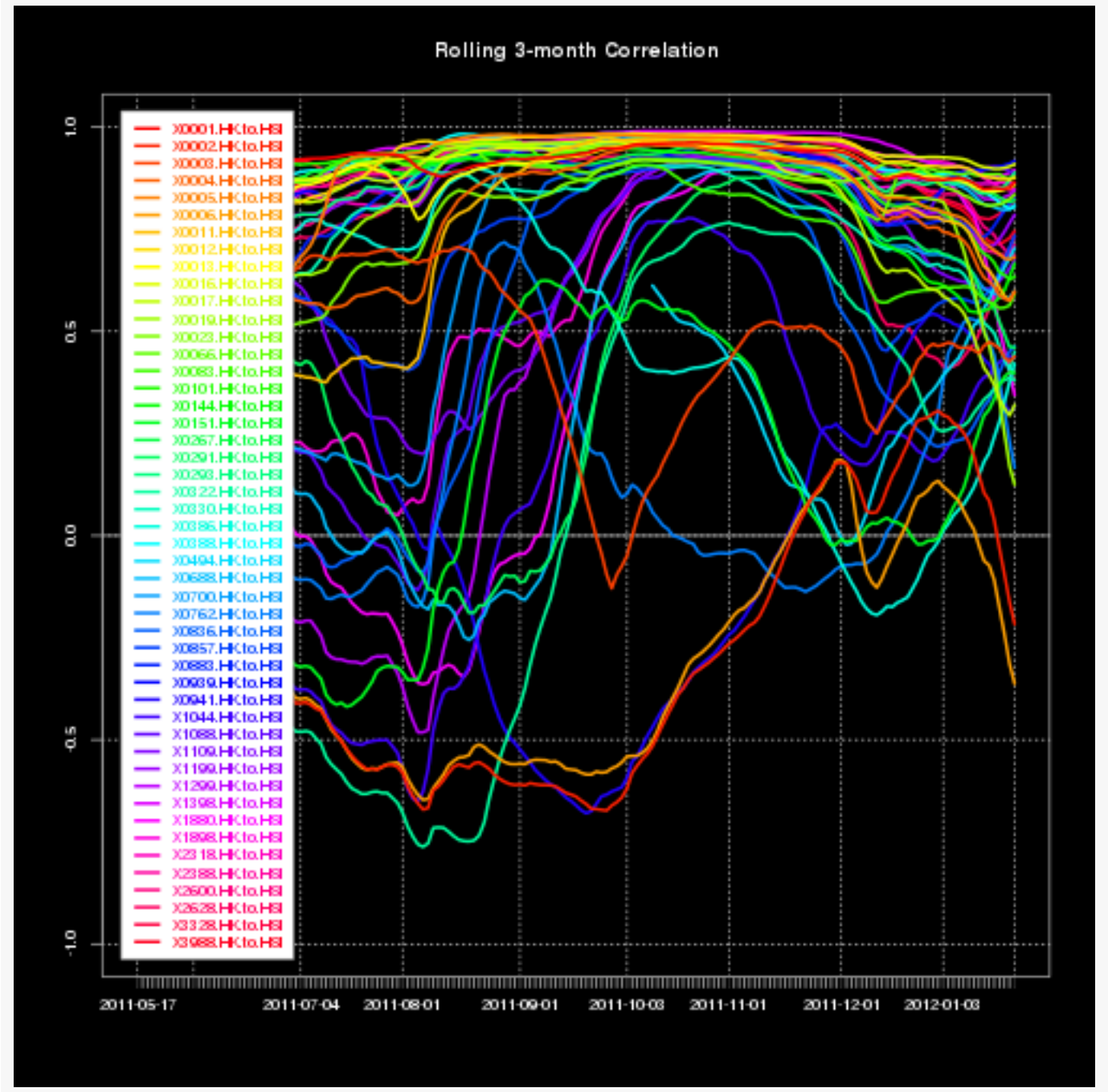
Correlation - Distinct

```
##         Correlation p-value Lower CI Upper CI
## 0001.HK      0.8005       0   0.7642   0.8317
## 0002.HK      0.2873       0   0.1993   0.3707
## 0003.HK      0.4245       0   0.3448   0.4981
## 0004.HK      0.7030       0   0.6525   0.7473
## 0005.HK      0.7484       0   0.7043   0.7868
## 0006.HK      0.1717       0   0.0796   0.2609
## 0011.HK      0.6741       0   0.6197   0.7220
## 0012.HK      0.7471       0   0.7028   0.7856
## 0013.HK      0.7266       0   0.6793   0.7678
## 0016.HK      0.8019       0   0.7658   0.8329
## 0017.HK      0.7090       0   0.6593   0.7525
## 0019.HK      0.6210       0   0.5601   0.6752
## 0023.HK      0.6820       0   0.6287   0.7289
## 0066.HK      0.5810       0   0.5156   0.6396
## 0083.HK      0.7197       0   0.6715   0.7619
## 0101.HK      0.6838       0   0.6307   0.7305
## 0144.HK      0.7360       0   0.6901   0.7761
## 0151.HK      0.3079       0   0.2209   0.3901
## 0267.HK      0.6342       0   0.5749   0.6869
## 0291.HK      0.6089       0   0.5466   0.6644
## 0293.HK      0.5678       0   0.5011   0.6279
## 0322.HK      0.2661       0   0.1771   0.3507
## 0330.HK      0.4639       0   0.3874   0.5341
## 0386.HK      0.7469       0   0.7025   0.7855
## 0388.HK      0.8402       0   0.8104   0.8656
## 0494.HK      0.6777       0   0.5510   0.7738
## 0688.HK      0.6882       0   0.6356   0.7343
## 0700.HK      0.5957       0   0.5320   0.6527
## 0762.HK      0.5051       0   0.4322   0.5714
## 0836.HK      0.4227       0   0.3429   0.4965
## 0857.HK      0.8517       0   0.8238   0.8754
## 0883.HK      0.8281       0   0.7963   0.8553
## 0939.HK      0.8364       0   0.8060   0.8624
## 0941.HK      0.7213       0   0.6732   0.7632
## 1044.HK      0.3438       0   0.2590   0.4234
## 1088.HK      0.8058       0   0.7703   0.8362
## 1109.HK      0.6013       0   0.5382   0.6577
## 1199.HK      0.7019       0   0.6512   0.7464
## 1299.HK      0.6422       0   0.5471   0.7210
## 1398.HK      0.8285       0   0.7967   0.8556
## 1880.HK      0.4712       0   0.3952   0.5408
## 1898.HK      0.8147       0   0.7807   0.8439
## 2318.HK      0.7883       0   0.7502   0.8213
## 2388.HK      0.6648       0   0.6093   0.7139
## 2600.HK      0.7884       0   0.7503   0.8213
## 2628.HK      0.7990       0   0.7625   0.8304
```

```
## 3328.HK      0.8534       0   0.8258   0.8769
## 3988.HK      0.7943       0   0.7571   0.8264
```



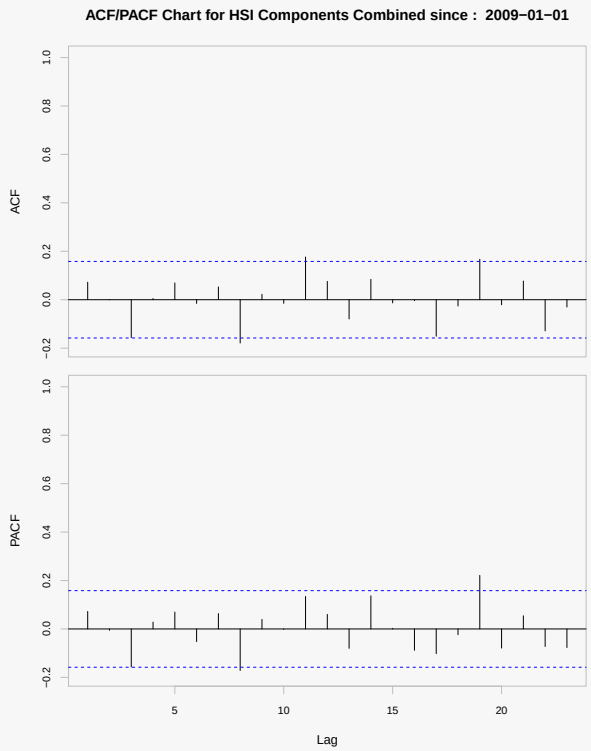
3 Month Rolling Correlation



3.2 Autocorrelation Coefficients - Combined

Autocorrelation Combined

```
##                  rho1   rho2    rho3  rho4   rho5    rho6 Q(6) p-value
## daily.returns 0.0722 -4e-04 -0.1568 0.005 0.0694 -0.0152       0.4509
```



3.3 Downside Risk - Combined

Downside Risk Combined

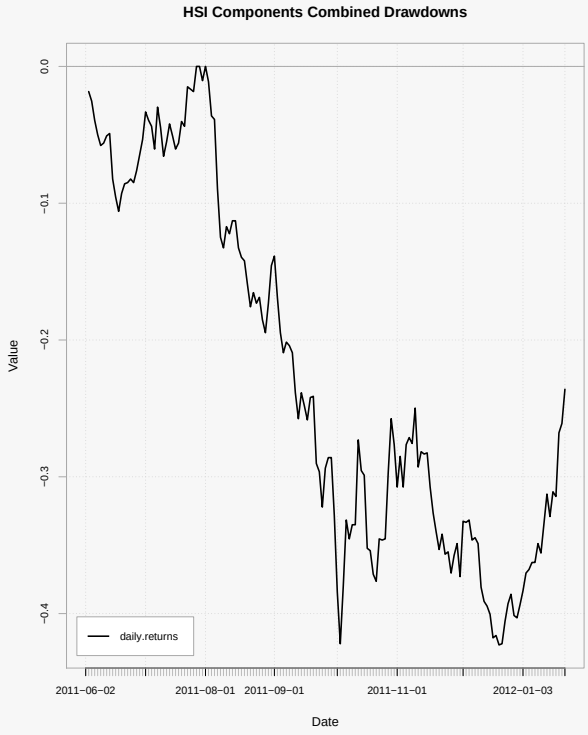
```
##                                HSI Components dailyReturn
## Semi Deviation                                     0.0260
## Gain Deviation                                     0.0207
## Loss Deviation                                     0.0177
## Downside Deviation (MAR=210%)                      0.0298
## Downside Deviation (Rf=0%)                         0.0269
## Downside Deviation (0%)                            0.0269
## Maximum Drawdown                                   0.4229
## Historical VaR (95%)                              -0.0432
## Historical ES (95%)                               -0.0630
## Modified VaR (95%)                                -0.0437
## Modified ES (95%)                                 -0.0557
```

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    121        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  0.0521 -0.0613  0.0204 -0.0311  0.0084  0.0122       0.4046
## X0002.HK -0.1256 -0.0470 -0.0101  0.0262  0.0198 -0.0348       0.0163
## X0003.HK -0.0992 -0.0149 -0.0216  0.0485  0.0159  0.0270       0.1020
## X0004.HK  0.0094 -0.0311 -0.0309 -0.0268  0.0875 -0.0399       0.1638
## X0005.HK -0.0239 -0.0256  0.0619  0.0326 -0.0485  0.0285       0.3109
## X0006.HK -0.0895 -0.0635  0.0176 -0.0146  0.0097 -0.0717       0.0342
## X0011.HK  0.1181  0.0159 -0.0151  0.0055 -0.0464 -0.0817       0.0067
## X0012.HK  0.0665 -0.0236 -0.0504 -0.0067  0.0468  0.0085       0.2761
## X0013.HK  0.0023  0.0319  0.0114 -0.0119  0.0258 -0.0258       0.9186
## X0016.HK  0.0469 -0.0545  0.0258 -0.0062  0.0415  0.0187       0.4149
## X0017.HK  0.0796  0.0228  0.0094  0.0261  0.0446 -0.0200       0.2649
## X0019.HK  0.0503  0.0441 -0.0309 -0.1058 -0.0090  0.0253       0.0389
## X0023.HK  0.0905 -0.0052 -0.0085  0.0007 -0.0453 -0.0371       0.1760
## X0066.HK -0.0750  0.0005  0.0559 -0.0247 -0.0108 -0.0156       0.2830
## X0083.HK  0.1012 -0.0568 -0.0377  0.0057  0.0460  0.0056       0.0424
## X0101.HK -0.0724 -0.0196  0.0154 -0.0410 -0.0567  0.0190       0.2033
## X0144.HK  0.0658 -0.0104  0.0028 -0.0501 -0.1089 -0.0007       0.0254
## X0151.HK -0.0152 -0.0299 -0.0893 -0.0956  0.0108 -0.0021       0.0290
## X0267.HK  0.1241  0.0380 -0.0539 -0.0226  0.0404  0.0433       0.0059
## X0291.HK -0.0363 -0.0195  0.0087 -0.0440  0.0093 -0.0033       0.8196
## X0293.HK  0.0256 -0.0466 -0.0711 -0.0564  0.0738  0.0697       0.0119
## X0322.HK -0.0112  0.0348 -0.0898 -0.0013 -0.0190 -0.0226       0.2491
## X0330.HK  0.0418  0.1215 -0.0165  0.0395 -0.0095 -0.0196       0.0256
## X0386.HK -0.0221 -0.0238 -0.0404 -0.0160 -0.0105  0.0349       0.7745
## X0388.HK  0.1014 -0.0102  0.0342 -0.0147  0.0036 -0.0131       0.1663
## X0494.HK  0.0586 -0.0007  0.0021 -0.0387 -0.1562  0.0014       0.5539
## X0688.HK  0.0784 -0.0492 -0.0479 -0.0480 -0.0076  0.0098       0.1170
## X0700.HK  0.0256 -0.0975  0.0008 -0.0896  0.0055  0.0361       0.0194
## X0762.HK -0.0470 -0.0676 -0.0296 -0.0676  0.0185 -0.0149       0.1299
## X0836.HK -0.0523 -0.0367 -0.0009  0.0076 -0.0125 -0.0158       0.7478
## X0857.HK  0.0445 -0.0128  0.0400 -0.0045 -0.0071  0.0075       0.8139
## X0883.HK  0.0430 -0.0513 -0.0121 -0.0290 -0.0598  0.0016       0.3279
## X0939.HK  0.0028  0.0041  0.0203 -0.0553 -0.0335 -0.0315       0.6358
## X0941.HK -0.0144 -0.0176  0.0037 -0.0943  0.0008 -0.0208       0.2733
## X1044.HK -0.0337 -0.0454 -0.0986 -0.0579 -0.0396  0.0127       0.0297
## X1088.HK  0.0479 -0.0026 -0.0256 -0.0329  0.0302 -0.0324       0.5973
## X1109.HK  0.0290 -0.0165 -0.0540 -0.0910  0.0100 -0.0005       0.1470
## X1199.HK  0.0742  0.0496 -0.0047 -0.0664  0.0068  0.0344       0.1081
## X1299.HK -0.0141 -0.0798  0.0206 -0.0740 -0.1136 -0.0071       0.2407
## X1398.HK  0.0224  0.0000  0.0642 -0.0221 -0.0252 -0.0317       0.5227
## X1880.HK  0.0056 -0.0822 -0.0837 -0.0285 -0.0370 -0.0338       0.0415
## X1898.HK  0.0970  0.0172  0.0023  0.0054 -0.0491 -0.0155       0.1492
## X2318.HK  0.0690 -0.0442 -0.0694 -0.0371  0.0645  0.0112       0.0407
## X2388.HK  0.0723  0.0270  0.0587 -0.0013 -0.0393 -0.0147       0.2021
## X2600.HK  0.0654 -0.0301 -0.0283  0.0046  0.0052  0.0109       0.5843
## X2628.HK  0.0035 -0.0189  0.0423 -0.0569 -0.0084 -0.0009       0.6520
```

```
## X3328.HK  0.0253  0.0340 -0.0030 -0.0606  0.0045 -0.0117       0.6348
## X3988.HK  0.0403 -0.0206  0.0405 -0.0434 -0.0096 -0.0658       0.2646
```

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  0.0133  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  0.0356  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  0.0211   0.016  0.0205
##                                1088.HK 1109.HK 1199.HK 1299.HK 1398.HK
## Downside Deviation (MAR = 0%)  0.0246  0.0291  0.0291  0.0202  0.0217
##                                1880.HK 1898.HK 2318.HK 2388.HK 2600.HK
## Downside Deviation (MAR = 0%)  0.0274  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          760  12   56.00     91.188  97.950          99.866
## X0002.HK.Close          760  12   51.10     52.550  57.000          59.124
## X0003.HK.Close          760  12   10.78     17.180  18.090          17.584
## X0004.HK.Close          760  12   15.20     36.550  41.550          41.712
## X0005.HK.Close          760  12   33.00     65.900  79.075          75.040
## X0006.HK.Close          760  12   41.10     43.438  47.050          48.864
## X0011.HK.Close          760  12   67.00    103.400 110.700         109.596
## X0012.HK.Close          760  12   23.75     42.575  48.550          46.987
## X0013.HK.Close          760  12   36.40     52.400  57.675          63.785
## X0016.HK.Close          760  12   55.80     99.888 111.500         108.108
## X0017.HK.Close          760  12    6.20      9.915  13.570          12.787
## X0019.HK.Close          760  12   42.90     84.638  92.550          92.707
## X0023.HK.Close          760  12   12.34     26.500  28.900          28.148
## X0066.HK.Close          760  12   16.14     25.100  26.850          26.025
## X0083.HK.Close          760  12    5.60     11.795  13.670          13.073
## X0101.HK.Close          760  12   13.66     25.500  29.150          28.625
## X0144.HK.Close          760  12   12.20     23.050  26.300          25.918
## X0151.HK.Close          760  12    2.77      4.628   6.140           5.801
## X0267.HK.Close          760  12    7.18     14.200  17.370          17.114
## X0291.HK.Close          760  12   10.66     23.387  27.900          26.042
## X0293.HK.Close          760  12    6.98     12.540  14.620          15.164
## X0322.HK.Close          760  12    8.27     16.125  19.180          18.100
## X0330.HK.Close          760  12    7.93     33.975  42.625          39.667
## X0386.HK.Close          760  12    3.65      6.180   6.760           6.770
## X0388.HK.Close          760  12   54.60    122.600 135.650         136.488
## X0494.HK.Close          161 611   11.60     13.640  14.400          14.495
## X0688.HK.Close          760  12    9.41     14.180  15.490          15.206
## X0700.HK.Close          769   3   41.80    126.800 154.800         147.065
## X0762.HK.Close          767   5    8.31      9.630  10.940          11.848
## X0836.HK.Close          760  12   11.10     14.200  15.360          15.445
## X0857.HK.Close          760  12    5.10      8.670   9.335           9.264
## X0883.HK.Close          760  12    6.08     11.035  13.140          13.499
## X0939.HK.Close          760  12    3.66      5.588   6.250           6.112
## X0941.HK.Close          760  12   63.00     73.237  75.750          75.573
## X1044.HK.Close          772   0   24.25     46.837  58.400          55.887
## X1088.HK.Close          760  12   13.90     29.887  33.100          31.575
## X1109.HK.Close          760  12    7.50     12.860  14.600          14.405
## X1199.HK.Close          760  12    5.40      9.360  10.880          11.107
## X1299.HK.Close          307 465   19.86     22.650  23.950          24.308
## X1398.HK.Close          760  12    3.03      4.940   5.735           5.462
## X1880.HK.Close          760  12    2.98      7.957  11.680          10.990
## X1898.HK.Close          760  12    4.43      9.450  10.600          10.452
## X2318.HK.Close          760  12   30.35     57.888  64.350          65.428
## X2388.HK.Close          760  12    6.30     16.660  18.370          18.669
## X2600.HK.Close          760  12    3.20      5.897   7.055           6.722
## X2628.HK.Close          760  12   17.24     26.050  30.575          29.781
## X3328.HK.Close          760  12    4.17      6.290   8.020           7.619
## X3988.HK.Close          760  12    1.84      3.040   3.940           3.669
##                Geometric Mean Quartile 3 Maximum SE Mean LCL Mean (0.95)
## X0001.HK.Close         98.483    114.000  135.70  0.5935          98.701
## X0002.HK.Close         58.767     64.050   75.00  0.2407          58.652
## X0003.HK.Close         17.445     19.000   21.00  0.0764          17.433
## X0004.HK.Close         39.963     51.312   62.00  0.4057          40.916
```

```
## X0005.HK.Close          73.990     83.150   98.00  0.4311          74.193
## X0006.HK.Close          48.510     52.913   64.80  0.2208          48.431
## X0011.HK.Close         108.818    119.550  134.00  0.4618         108.689
## X0012.HK.Close          46.157     53.212   60.50  0.3006          46.397
## X0013.HK.Close          61.832     78.250   95.90  0.5836          62.640
## X0016.HK.Close         106.351    118.800  146.30  0.6621         106.808
## X0017.HK.Close          12.329     15.360   18.54  0.1200          12.552
## X0019.HK.Close          90.224    109.500  136.40  0.7311          91.272
## X0023.HK.Close          27.602     32.200   35.90  0.1854          27.784
## X0066.HK.Close          25.796     28.262   31.15  0.1194          25.791
## X0083.HK.Close          12.803     14.800   18.56  0.0914          12.893
## X0101.HK.Close          28.018     32.425   40.30  0.2049          28.223
## X0144.HK.Close          25.370     28.950   37.55  0.1854          25.554
## X0151.HK.Close           5.648      6.940    8.19  0.0497           5.704
## X0267.HK.Close          16.613     20.613   24.40  0.1453          16.829
## X0291.HK.Close          25.011     30.812   35.25  0.2401          25.571
## X0293.HK.Close          14.626     18.360   24.05  0.1486          14.872
## X0322.HK.Close          17.453     20.700   25.95  0.1637          17.779
## X0330.HK.Close          35.921     50.800   64.30  0.5235          38.640
## X0386.HK.Close           6.693      7.572    9.15  0.0379           6.695
## X0388.HK.Close         132.528    161.225  197.50  1.1016         134.326
## X0494.HK.Close          14.440     15.480   17.92  0.1037          14.290
## X0688.HK.Close          15.076     16.660   19.44  0.0716          15.066
## X0700.HK.Close         136.831    179.000  225.00  1.7082         143.712
## X0762.HK.Close          11.620     13.800   17.40  0.0910          11.670
## X0836.HK.Close          15.359     16.660   20.15  0.0610          15.326
## X0857.HK.Close           9.161     10.100   12.36  0.0502           9.166
## X0883.HK.Close          13.060     16.420   20.95  0.1254          13.252
## X0939.HK.Close           6.044      6.830    8.28  0.0343           6.045
## X0941.HK.Close          75.468     77.950   91.45  0.1454          75.287
## X1044.HK.Close          53.699     67.763   78.25  0.5159          54.874
## X1088.HK.Close          30.911     35.250   40.80  0.2127          31.157
## X1109.HK.Close          14.162     16.400   20.00  0.0951          14.218
## X1199.HK.Close          10.867     12.720   16.76  0.0863          10.938
## X1299.HK.Close          24.233     26.100   29.55  0.1123          24.087
## X1398.HK.Close           5.397      5.990    7.03  0.0315           5.400
## X1880.HK.Close          10.224     14.260   17.54  0.1406          10.714
## X1898.HK.Close          10.212     11.780   15.86  0.0799          10.295
## X2318.HK.Close          63.923     76.550   94.30  0.4926          64.461
## X2388.HK.Close          17.873     22.950   28.95  0.1870          18.302
## X2600.HK.Close           6.508      7.880   10.66  0.0622           6.600
## X2628.HK.Close          29.155     34.513   41.00  0.2158          29.357
## X3328.HK.Close           7.467      8.723   10.56  0.0562           7.508
## X3988.HK.Close           3.608      4.150    5.00  0.0260           3.618
##                 UCL Mean (0.95)  Variance   Stdev Skewness Kurtosis
## X0001.HK.Close         101.031  267.7453 16.3629  -0.0762  -0.1783
## X0002.HK.Close          59.597   44.0353  6.6359   0.4131  -1.2146
## X0003.HK.Close          17.733    4.4384  2.1068  -1.5893   1.9372
## X0004.HK.Close          42.509  125.1045 11.1850  -0.4498  -0.2651
## X0005.HK.Close          75.886  141.2421 11.8845  -0.8105   0.2138
## X0006.HK.Close          49.298   37.0589  6.0876   0.7022  -0.7150
## X0011.HK.Close         110.502  162.0867 12.7313  -0.5553   0.0069
## X0012.HK.Close          47.577   68.6884  8.2878  -0.8996   0.2399
## X0013.HK.Close          64.931  258.8547 16.0890   0.3906  -1.0040
## X0016.HK.Close         109.407  333.1316 18.2519  -0.8344   0.5757
## X0017.HK.Close          13.023   10.9372  3.3071  -0.5779  -0.8491
## X0019.HK.Close          94.142  406.2524 20.1557  -0.4717  -0.0225
```

```
## X0023.HK.Close          28.512   26.1344  5.1122  -1.1883   0.9576
## X0066.HK.Close          26.259   10.8407  3.2925  -1.3517   1.1318
## X0083.HK.Close          13.252    6.3450  2.5189  -1.0168   0.6761
## X0101.HK.Close          29.027   31.9145  5.6493  -0.5310  -0.0430
## X0144.HK.Close          26.282   26.1372  5.1125  -0.5018   0.2569
## X0151.HK.Close           5.899    1.8762  1.3697  -0.5108  -0.8386
## X0267.HK.Close          17.400   16.0389  4.0049  -0.4626  -0.6041
## X0291.HK.Close          26.513   43.8147  6.6193  -0.9921  -0.1757
## X0293.HK.Close          15.455   16.7771  4.0960   0.1259  -0.7884
## X0322.HK.Close          18.422   20.3689  4.5132  -0.7724  -0.2282
## X0330.HK.Close          40.695  208.2756 14.4318  -0.7501  -0.3429
## X0386.HK.Close           6.844    1.0939  1.0459  -0.6067   0.4653
## X0388.HK.Close         138.651  922.2707 30.3689  -0.5517   0.2440
## X0494.HK.Close          14.700    1.7317  1.3159   0.1947  -0.2921
## X0688.HK.Close          15.347    3.8993  1.9747  -0.7331   0.0423
## X0700.HK.Close         150.418 2243.9379 47.3702  -0.6795  -0.3067
## X0762.HK.Close          12.027    6.3533  2.5206   0.7598  -0.8643
## X0836.HK.Close          15.565    2.8315  1.6827   0.1376  -0.3616
## X0857.HK.Close           9.363    1.9121  1.3828  -0.7575   0.7842
## X0883.HK.Close          13.745   11.9573  3.4579  -0.0356  -0.7276
## X0939.HK.Close           6.180    0.8933  0.9451  -0.7153  -0.0055
## X0941.HK.Close          75.858   16.0564  4.0070   0.0386   0.7702
## X1044.HK.Close          56.900  205.5054 14.3355  -0.7232  -0.6113
## X1088.HK.Close          31.992   34.3911  5.8644  -1.3480   1.3150
## X1109.HK.Close          14.591    6.8783  2.6226  -0.4293  -0.2225
## X1199.HK.Close          11.276    5.6581  2.3787   0.0862  -0.5575
## X1299.HK.Close          24.529    3.8721  1.9678   0.3849  -0.9199
## X1398.HK.Close           5.524    0.7538  0.8682  -0.9455   0.3027
## X1880.HK.Close          11.266   15.0163  3.8751  -0.4190  -0.9587
## X1898.HK.Close          10.609    4.8512  2.2025  -0.5239   0.2681
## X2318.HK.Close          66.395  184.4438 13.5810  -0.2128  -0.3705
## X2388.HK.Close          19.037   26.5857  5.1561  -0.3898  -0.2906
## X2600.HK.Close           6.844    2.9401  1.7147  -0.4562  -0.6574
## X2628.HK.Close          30.204   35.3926  5.9492  -0.4197  -0.9011
## X3328.HK.Close           7.729    2.3986  1.5487  -0.5096  -0.8732
## X3988.HK.Close           3.720    0.5119  0.7155  -0.8193  -0.3503
```

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  0.9896  0.1498  0.3799   1.110  1.1210  0.1170  0.6407
## Beta CoSkewness  0.9959 -0.5686 -0.4398   1.858  0.9464 -0.1721  0.9781
## Beta CoKurtosis  0.9989  0.0870  0.3600   1.120  1.2796  0.0898  0.7203
##                 0012.HK 0013.HK 0016.HK 0017.HK 0019.HK 0023.HK 0066.HK
## CoSkewness        0.000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
## CoKurtosis        0.000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
## Beta CoVariance   1.021  0.9485  1.0038  1.1344  0.7826  0.9419  0.5095
## Beta CoSkewness   2.047  0.1022  1.3613  0.6321  1.4166  1.8437  0.2348
## Beta CoKurtosis   1.075  0.9009  0.9863  1.1275  0.7975  0.9855  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   1.168   1.099   1.310  0.4244  1.0795  0.8807  0.7713
## Beta CoSkewness   1.230   2.855   1.518 -1.5090  1.3023  0.1417  1.0490
## Beta CoKurtosis   1.173   1.167   1.208  0.3349  0.9846  0.7634  0.7551
##                 0322.HK 0330.HK 0386.HK 0388.HK 0494.HK 0688.HK 0700.HK
## CoSkewness       0.0000  0.0000  0.0000   0.000  0.0000   0.000  0.0000
## CoKurtosis       0.0000  0.0000  0.0000   0.000  0.0000   0.000  0.0000
## Beta CoVariance  0.3468  0.9374  0.9550   1.159  1.2406   1.185  0.9339
## Beta CoSkewness -0.1846 -0.6346 -0.1014   1.827 -0.7777   3.783  1.6179
## Beta CoKurtosis  0.3076  0.8979  0.8895   1.145  1.0347   1.263  0.8983
##                 0762.HK 0836.HK 0857.HK 0883.HK 0939.HK 0941.HK 1044.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  0.7027  0.5566  1.1006   1.282  1.0616  0.7093  0.4625
## Beta CoSkewness -0.5277 -0.7720  0.5252   0.871  0.5959  0.6982  0.0008
## Beta CoKurtosis  0.5409  0.4934  1.0087   1.209  1.0418  0.7032  0.3954
##                 1088.HK 1109.HK 1199.HK 1299.HK 1398.HK 1880.HK 1898.HK
## CoSkewness       0.0000   0.000  0.0000  0.0000  0.0000  0.0000  0.0000
## CoKurtosis       0.0000   0.000  0.0000  0.0000  0.0000  0.0000  0.0000
## Beta CoVariance  1.2159   1.163  1.3322  0.8265  1.1262  0.8235  1.4953
## Beta CoSkewness  0.9715   3.440  0.7631  1.8351  0.9821  0.1789  0.9462
## Beta CoKurtosis  1.0928   1.141  1.2569  0.9868  1.0663  0.7687  1.3879
##                 2318.HK 2388.HK 2600.HK 2628.HK 3328.HK 3988.HK
## CoSkewness        0.000  0.0000   0.000  0.0000  0.0000  0.0000
## CoKurtosis        0.000  0.0000   0.000  0.0000  0.0000  0.0000
## Beta CoVariance   1.327  0.8766   1.540  1.0934  1.1922  1.0330
## Beta CoSkewness   2.096  0.8340   2.200  0.8732  0.9795  0.2767
## Beta CoKurtosis   1.319  0.8491   1.448  1.0395  1.1842  0.9700
```

4.2 Higher Moments - Combined

```
##                 HSI Components to HSI Combined
## CoSkewness                              0.0000
## CoKurtosis                              0.0000
## Beta CoVariance                         1.1899
## Beta CoSkewness                         0.2615
## Beta CoKurtosis                         1.1257
```

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      5.161 1.53487 1.1981 1.12855 1.07129 1.03014
## Proportion of Variance  0.555 0.04908 0.0299 0.02653 0.02391 0.02211
## Cumulative Proportion   0.555 0.60405 0.6339 0.66048 0.68439 0.70650
##                           Comp.7  Comp.8  Comp.9 Comp.10 Comp.11 Comp.12
## Standard deviation     0.95335 0.94884 0.87923 0.87167  0.8315 0.80729
## Proportion of Variance 0.01893 0.01876 0.01611 0.01583  0.0144 0.01358
## Cumulative Proportion  0.72544 0.74419 0.76030 0.77613  0.7905 0.80411
##                          Comp.13 Comp.14 Comp.15 Comp.16 Comp.17 Comp.18
## Standard deviation     0.78651 0.77570 0.74007 0.73433  0.6929 0.67635
## Proportion of Variance 0.01289 0.01254 0.01141 0.01123  0.0100 0.00953
## Cumulative Proportion  0.81700 0.82953 0.84094 0.85218  0.8622 0.87171
##                           Comp.19  Comp.20  Comp.21  Comp.22  Comp.23
## Standard deviation     0.643018 0.641587 0.615169 0.596207 0.588886
## Proportion of Variance 0.008614 0.008576 0.007884 0.007405 0.007225
## Cumulative Proportion  0.880323 0.888899 0.896783 0.904189 0.911413
##                           Comp.24  Comp.25  Comp.26 Comp.27  Comp.28
## Standard deviation     0.566826 0.561879 0.541910 0.52538 0.512243
## Proportion of Variance 0.006694 0.006577 0.006118 0.00575 0.005467
## Cumulative Proportion  0.918107 0.924684 0.930802 0.93655 0.942019
##                           Comp.29  Comp.30 Comp.31  Comp.32  Comp.33
## Standard deviation     0.482088 0.480339 0.45696 0.454602 0.437966
## Proportion of Variance 0.004842 0.004807 0.00435 0.004305 0.003996
## Cumulative Proportion  0.946861 0.951668 0.95602 0.960323 0.964320
##                           Comp.34 Comp.35  Comp.36  Comp.37  Comp.38 Comp.39
## Standard deviation     0.434983 0.42029 0.401300 0.391631 0.374956 0.36197
## Proportion of Variance 0.003942 0.00368 0.003355 0.003195 0.002929 0.00273
## Cumulative Proportion  0.968262 0.97194 0.975297 0.978492 0.981421 0.98415
##                           Comp.40  Comp.41  Comp.42  Comp.43  Comp.44
## Standard deviation     0.355776 0.341716 0.319590 0.303210 0.279502
## Proportion of Variance 0.002637 0.002433 0.002128 0.001915 0.001628
## Cumulative Proportion  0.986788 0.989220 0.991348 0.993263 0.994891
##                           Comp.45  Comp.46  Comp.47   Comp.48
## Standard deviation     0.270639 0.258511 0.241603 0.2162998
## Proportion of Variance 0.001526 0.001392 0.001216 0.0009747
## Cumulative Proportion  0.996417 0.997809 0.999025 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                -0.157         0.102
## X0002.HK         0.461                 0.109  0.178 -0.360
## X0003.HK         0.353 -0.146 -0.269 -0.183         0.131 -0.194  0.107
## X0004.HK -0.161 -0.107  0.105 -0.109                       -0.155 -0.181
## X0005.HK -0.171                                    0.141
## X0006.HK         0.466  0.106  0.117  0.170        -0.366 -0.182
## X0011.HK -0.160                -0.261         0.152                -0.161
## X0012.HK -0.160                -0.182                0.117
## X0013.HK -0.168                -0.107         0.169
## X0016.HK -0.170                -0.157                0.143 -0.145
## X0017.HK -0.138         0.149 -0.172                       -0.258  0.356
## X0019.HK -0.115        -0.120 -0.217        -0.126 -0.131  0.481  0.392
## X0023.HK -0.150                -0.134  0.186  0.119         0.279 -0.214
## X0066.HK -0.132  0.136 -0.142 -0.235        -0.120         0.159 -0.193
```

```
## X0083.HK -0.154         0.130 -0.113         0.106        -0.180
## X0101.HK -0.154         0.167                0.156        -0.115
## X0144.HK -0.156                0.197
## X0151.HK -0.100 -0.109 -0.497  0.113        -0.199        -0.256  0.228
## X0267.HK -0.159               -0.113                       0.102
## X0291.HK -0.121                                    -0.181         0.333
## X0293.HK -0.139 -0.151                             0.126 -0.232  0.166  0.248
## X0322.HK        -0.116 -0.543 -0.135  0.135  0.130        -0.141 -0.122
## X0330.HK                             -0.464 -0.332 -0.473 -0.122 -0.166
## X0386.HK -0.129  0.244         0.283 -0.190         0.233  0.190
## X0388.HK -0.166               -0.156        -0.121
## X0494.HK -0.133                             -0.273        -0.242 -0.215
## X0688.HK -0.155 -0.154  0.128  0.118  0.100        -0.143        -0.119
## X0700.HK -0.146                0.271  0.216  0.111
## X0762.HK -0.130  0.152 -0.158  0.264                       0.125
## X0836.HK                             -0.621  0.362         0.123 -0.185
## X0857.HK -0.155  0.162         0.150 -0.145         0.228
## X0883.HK -0.168                0.160                0.120
## X0939.HK -0.169
## X0941.HK -0.115  0.338 -0.110               -0.102
## X1044.HK -0.115        -0.371  0.193  0.108
## X1088.HK -0.167                0.107
## X1109.HK -0.152 -0.212                             -0.154        -0.176
## X1199.HK -0.162         0.106  0.165                       -0.145
## X1299.HK -0.138                                    0.403  0.125
## X1398.HK -0.176                       0.121
## X1880.HK -0.130                0.212  0.106  0.267 -0.183         0.249
## X1898.HK -0.162                             -0.140 -0.132  0.108 -0.119
## X2318.HK -0.165                             -0.131         0.148
## X2388.HK -0.164                       0.157                0.125
## X2600.HK -0.155         0.110               -0.130 -0.115
## X2628.HK -0.152                             -0.202  0.138        -0.134
## X3328.HK -0.173                             -0.102
## X3988.HK -0.167                             -0.111         0.132
##          Comp.10 Comp.11 Comp.12 Comp.13 Comp.14 Comp.15 Comp.16 Comp.17
## X0001.HK                                                          -0.149
## X0002.HK                        -0.170  -0.173          -0.170   0.152
## X0003.HK          0.202          0.137   0.378   0.285   0.199   0.132
## X0004.HK                 0.179                             -0.136
## X0005.HK                                                           0.128
## X0006.HK  0.102  -0.351          0.221          -0.117   0.235  -0.121
## X0011.HK -0.121
## X0012.HK  0.147          0.208          -0.124                  -0.171
## X0013.HK -0.165
## X0016.HK                                                  -0.130  -0.126
## X0017.HK         -0.230  -0.218  -0.220
## X0019.HK -0.113  -0.287   0.102   0.159   0.200          -0.103
## X0023.HK          0.170                                           -0.197
## X0066.HK -0.130   0.132   0.191  -0.254          -0.291   0.292   0.103
## X0083.HK  0.187          0.235  -0.171  -0.157                  -0.126
## X0101.HK                -0.103   0.226                  -0.255  -0.133
## X0144.HK -0.139                          0.125  -0.104          -0.185
## X0151.HK  0.181  -0.130          -0.125   0.132                  -0.202
## X0267.HK         -0.139   0.155                  -0.171  -0.135   0.151
## X0291.HK  0.218   0.453          0.438  -0.371          0.182   0.118
## X0293.HK          0.119                 -0.162  -0.268
## X0322.HK  0.288          -0.371   0.162          -0.248  -0.260   0.178
```

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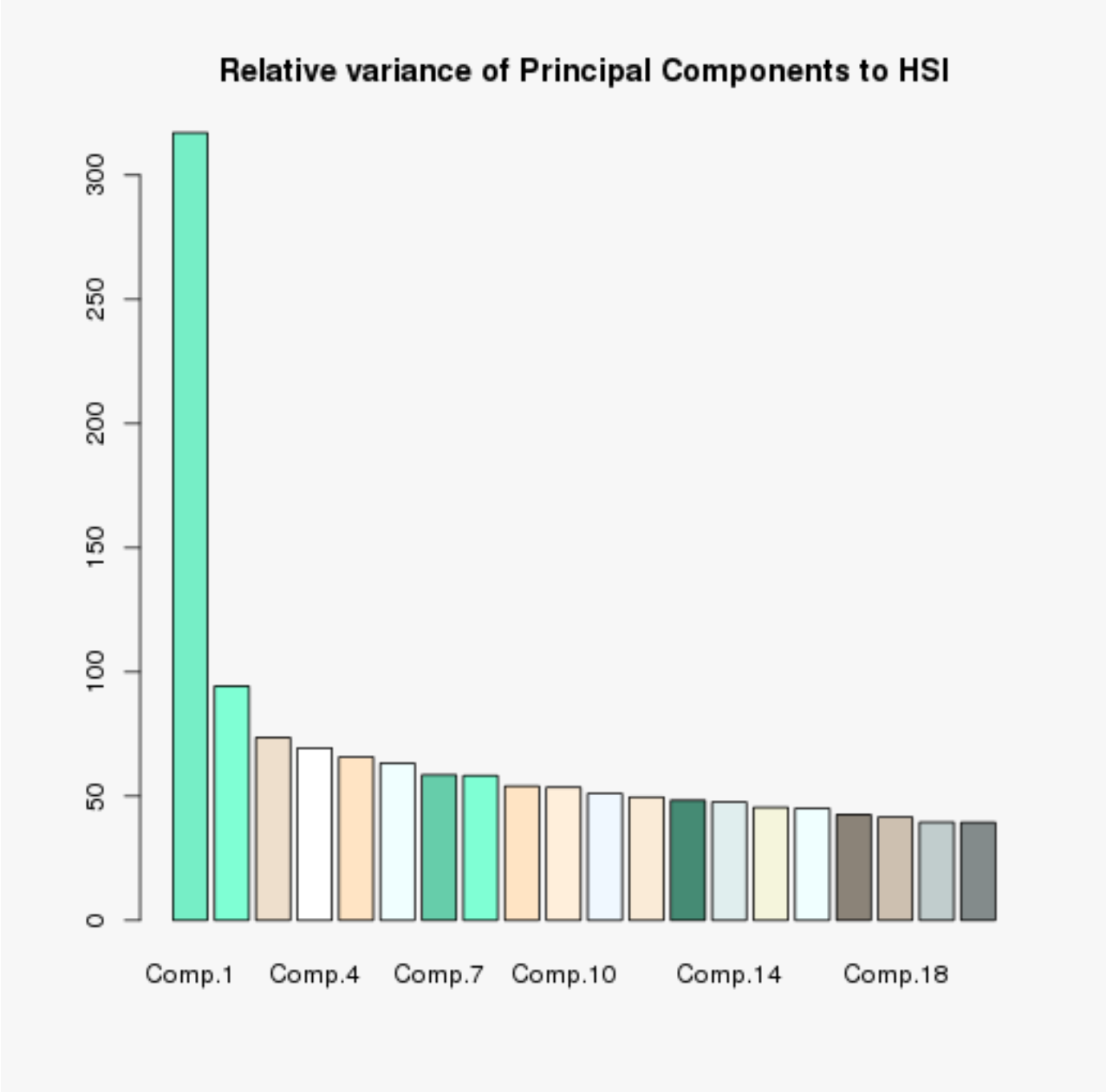
## X0330.HK -0.143   0.160          -0.178           0.182  -0.216
## X0386.HK                          0.100          -0.123          0.207
## X0388.HK                                                  0.133   0.240
## X0494.HK -0.323                   0.436  -0.113                  -0.266
## X0688.HK  0.160   0.182   0.103           0.300
## X0700.HK                  0.127  -0.155          -0.160
## X0762.HK  0.147  -0.105   0.213          -0.215   0.443  -0.315
## X0836.HK  0.249  -0.265                                   0.229
## X0857.HK          0.114           0.118          -0.181  -0.172   0.125
## X0883.HK                                  -0.179
## X0939.HK  0.116          -0.288  -0.121  -0.121                  -0.132
## X0941.HK          0.342          -0.138          -0.253  -0.111  -0.415
## X1044.HK -0.285           0.247          -0.219           0.360
## X1088.HK                  0.125           0.117   0.175  -0.130
## X1109.HK  0.193           0.157           0.255
## X1199.HK                          -0.147          -0.139
## X1299.HK -0.236   0.122  -0.142                   0.196
## X1398.HK  0.101          -0.255                                   0.133
## X1880.HK -0.281   0.135                   0.246                   0.119
## X1898.HK -0.120          -0.179   0.127  -0.114
## X2318.HK  0.121  -0.127           0.109
## X2388.HK -0.148          -0.178  -0.116  -0.119   0.189
## X2600.HK  0.170                           0.196                   0.179
## X2628.HK  0.115                           0.138  -0.220           0.362
## X3328.HK                  -0.162                   0.112   0.188
## X3988.HK  0.138          -0.318                   0.136   0.136  -0.128
##           Comp.18 Comp.19 Comp.20 Comp.21 Comp.22 Comp.23 Comp.24 Comp.25
## X0001.HK           0.165
## X0002.HK          -0.102                   0.118           0.206
## X0003.HK  0.191   0.300                   -0.242   0.121
## X0004.HK                          0.123   0.199   0.183  -0.165
## X0005.HK  0.153          -0.138  -0.129   0.183  -0.228
## X0006.HK           0.156          -0.147                  -0.106
## X0011.HK                                                   0.121
## X0012.HK -0.228           0.249   0.101           -0.174          -0.101
## X0013.HK                  -0.123   0.105                   0.107
## X0016.HK                          -0.189  -0.107                  -0.150
## X0017.HK                                  -0.151   0.107           0.424
## X0019.HK          -0.134          -0.282                   0.124
## X0023.HK  0.271                   -0.127          -0.130  -0.220   0.160
## X0066.HK          -0.359                                   -0.146  -0.185
## X0083.HK -0.105   0.122           -0.178                           -0.135
## X0101.HK -0.216  -0.175           0.246           -0.146           0.117
## X0144.HK  0.366           0.199           0.127                   0.309
## X0151.HK                  -0.161           0.200                   -0.258
## X0267.HK  0.119   0.138   0.112           -0.353          -0.126   0.126
## X0291.HK          -0.268  -0.106  -0.118
## X0293.HK           0.464           0.253   0.294   0.294           -0.126
## X0322.HK                  0.111
## X0330.HK -0.234   0.123           -0.139
## X0386.HK -0.150           0.174                   0.156   0.142  -0.139
## X0388.HK                          0.296   0.173   0.145
## X0494.HK  0.121  -0.107                   -0.149   0.228
## X0688.HK           0.118          -0.110  -0.162           0.151
## X0700.HK                  -0.284   0.128  -0.387           0.370  -0.152
## X0762.HK                                  -0.156   0.227  -0.283   0.159
## X0836.HK                  -0.134   0.102  -0.115
```

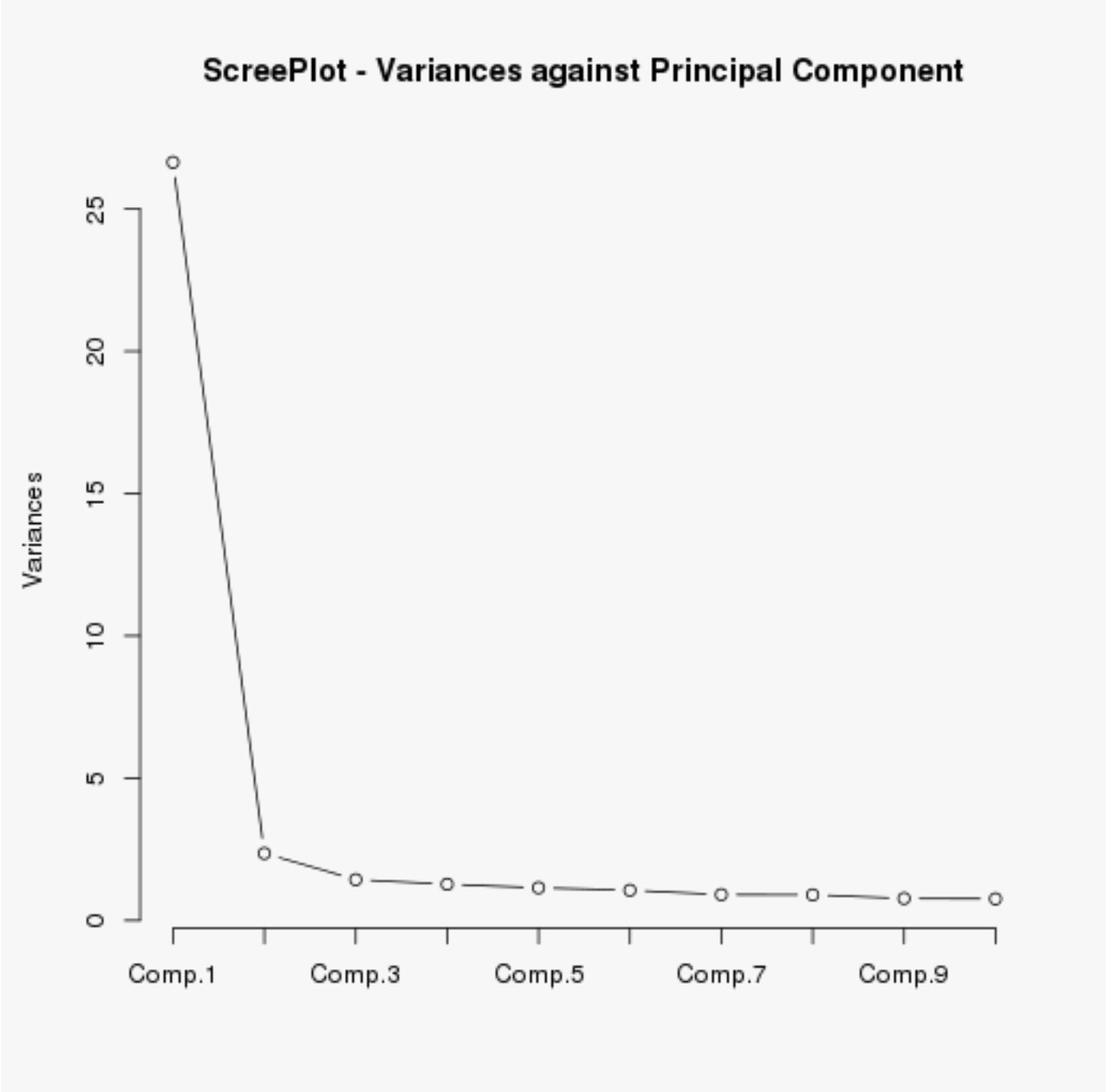
```
## X0857.HK          0.162   0.183           0.148  -0.212   0.124
## X0883.HK  0.158   0.167   0.130  -0.178          -0.111          -0.172
## X0939.HK                          0.142           0.170
## X0941.HK -0.215                   0.129                           0.224
## X1044.HK -0.383   0.164   0.201                                   0.156   0.344
## X1088.HK  0.166  -0.180           0.110   0.190  -0.265   0.143
## X1109.HK                  0.123                                   0.149   0.123
## X1199.HK  0.284                  -0.279                           0.104
## X1299.HK -0.179          -0.157  -0.420   0.221   0.406
## X1398.HK
## X1880.HK -0.196  -0.102           0.136  -0.107  -0.316  -0.519  -0.131
## X1898.HK                                 -0.273                   -0.244
## X2318.HK -0.158   0.129  -0.237
## X2388.HK                 -0.145   0.214          -0.114   0.281
## X2600.HK         -0.273   0.433                   0.276
## X2628.HK -0.157          -0.440  -0.124   0.167          -0.161   0.238
## X3328.HK
## X3988.HK                                                         0.135
##          Comp.26 Comp.27 Comp.28 Comp.29 Comp.30 Comp.31 Comp.32 Comp.33
## X0001.HK -0.210  -0.118   0.109                           -0.108   0.117
## X0002.HK -0.283   0.278  -0.134          -0.222
## X0003.HK                 -0.104           0.146           0.136
## X0004.HK -0.131           0.167  -0.437   0.273                   0.118
## X0005.HK                 -0.136   0.195   0.144   0.148  -0.139   0.167
## X0006.HK  0.228  -0.147                   0.171  -0.115
## X0011.HK  0.324  -0.195                  -0.317   0.224           0.462
## X0012.HK -0.105   0.196           0.230   0.132   0.223   0.128
## X0013.HK -0.133  -0.167   0.384   0.282   0.159  -0.243  -0.262
## X0016.HK -0.145           0.121                   0.113
## X0017.HK         -0.170  -0.165  -0.133          -0.133  -0.180  -0.156
## X0019.HK          0.130  -0.215           0.134          -0.114   0.116
## X0023.HK         -0.317  -0.152  -0.222           0.156          -0.211
## X0066.HK  0.117                   0.122   0.176  -0.275          -0.105
## X0083.HK  0.433          -0.130          -0.234          -0.241  -0.303
## X0101.HK                 -0.310   0.113   0.104  -0.257   0.357
## X0144.HK  0.148   0.240   0.258   0.226           0.166
## X0151.HK         -0.158          -0.122  -0.206  -0.183   0.192
## X0267.HK  0.189   0.156   0.246  -0.207  -0.128  -0.161   0.293
## X0291.HK                  0.127  -0.104
## X0293.HK                 -0.142   0.198                   0.104
## X0322.HK                                  0.176          -0.205  -0.115
## X0330.HK  0.152                           0.182
## X0386.HK  0.217                  -0.207           0.157  -0.263
## X0388.HK                         -0.168           0.203  -0.183
## X0494.HK          0.166  -0.201          -0.150          -0.259
## X0688.HK          0.192  -0.104          -0.144  -0.190  -0.157
## X0700.HK  0.121  -0.189  -0.122           0.279   0.135   0.121
## X0762.HK                          0.170   0.141
## X0836.HK -0.142          -0.132                   0.151           0.113
## X0857.HK         -0.168          -0.162          -0.217          -0.145
## X0883.HK                 -0.121                  -0.245           0.423
## X0939.HK          0.163                          -0.178           0.202
## X0941.HK -0.178           0.109                   0.138           0.108
## X1044.HK
## X1088.HK  0.119           0.221                  -0.191  -0.125  -0.157
## X1109.HK          0.130  -0.140                  -0.172  -0.122  -0.118
## X1199.HK -0.131   0.207          -0.108   0.215   0.219   0.212  -0.152
```

```
## X1299.HK                                                    0.164
## X1398.HK          0.156          -0.150
## X1880.HK
## X1898.HK -0.307  -0.229   0.233   0.170  -0.311           0.103  -0.225
## X2318.HK          0.169   0.202                   0.160   0.122  -0.215
## X2388.HK                          -0.177                   0.144
## X2600.HK         -0.355           0.199           0.152   0.176
## X2628.HK                          0.202  -0.210           0.141
## X3328.HK                 -0.221
## X3988.HK  0.165                   0.166   0.119
##           Comp.34 Comp.35 Comp.36 Comp.37 Comp.38 Comp.39 Comp.40 Comp.41
## X0001.HK                                   0.259  -0.234   0.155
## X0002.HK -0.151   0.102                           -0.162
## X0003.HK                 -0.125
## X0004.HK -0.230          -0.179                    0.360  -0.112   0.161
## X0005.HK         -0.219   0.384  -0.142   0.370           -0.323
## X0006.HK                  0.103  -0.111
## X0011.HK                         -0.125  -0.133           -0.171
## X0012.HK          0.259   0.356          -0.267   0.131
## X0013.HK                                          -0.171           0.196
## X0016.HK  0.242   0.114  -0.112           0.100           0.339  -0.324
## X0017.HK          0.238                   -0.145
## X0019.HK         -0.128           0.141           0.170
## X0023.HK -0.107   0.168   0.175   0.104  -0.103  -0.231           -0.212
## X0066.HK                         -0.214                           -0.178
## X0083.HK         -0.256  -0.230   0.116
## X0101.HK         -0.220           0.165   0.211  -0.157   0.144
## X0144.HK -0.380                           0.136   0.177   0.112  -0.143
## X0151.HK -0.129           0.148                   -0.104   0.118
## X0267.HK  0.143           0.309           0.128  -0.149           0.287
## X0291.HK
## X0293.HK  0.161   0.154
## X0322.HK
## X0330.HK
## X0386.HK          0.135   0.149           0.122  -0.143   0.226
## X0388.HK         -0.394   0.202   0.399  -0.162  -0.103   0.167
## X0494.HK                         -0.189
## X0688.HK                                  0.195           -0.141
## X0700.HK -0.123   0.107   0.144   0.185  -0.150   0.112
## X0762.HK                         -0.129   0.121
## X0836.HK
## X0857.HK -0.115  -0.194          -0.150  -0.187   0.184  -0.175
## X0883.HK -0.252           -0.230          -0.224  -0.138
## X0939.HK  0.224                                           -0.340  -0.244
## X0941.HK  0.116  -0.208                                            0.195
## X1044.HK                 -0.121   0.147
## X1088.HK  0.407   0.242  -0.121   0.289                   -0.260
## X1109.HK  0.151  -0.108   0.122  -0.226  -0.249   0.205   0.209
## X1199.HK  0.357           -0.220          -0.109  -0.113           0.226
## X1299.HK                  0.224
## X1398.HK          0.161                   0.126                   -0.258
## X1880.HK                         -0.125  -0.117
## X1898.HK         -0.157           0.180           0.285           -0.106
## X2318.HK -0.300           -0.210  -0.243  -0.116  -0.355  -0.327
## X2388.HK         -0.149   -0.140  -0.451   0.148   0.159   0.194
## X2600.HK                  -0.159                   -0.247
## X2628.HK          0.167   -0.109                    0.153   0.144  -0.138
```

```
## X3328.HK          0.340           0.107   0.337   0.185           0.468
## X3988.HK                                  -0.282           0.254   0.303
##          Comp.42 Comp.43 Comp.44 Comp.45 Comp.46 Comp.47 Comp.48
## X0001.HK  0.293   0.189   0.193  -0.252   0.416   0.429  -0.104
## X0002.HK         -0.138   0.157   0.116                   -0.134
## X0003.HK         -0.119
## X0004.HK -0.136  -0.235                                   -0.115
## X0005.HK         -0.184          -0.112  -0.267
## X0006.HK          0.132
## X0011.HK -0.301   0.227                                   0.110
## X0012.HK                  -0.241           0.168  -0.123   0.156
## X0013.HK         -0.130  -0.111   0.436                   0.283
## X0016.HK                  0.273   0.170  -0.326  -0.264  -0.257
## X0017.HK          0.121           -0.143
## X0019.HK                                  0.108
## X0023.HK         -0.106  -0.124   0.209
## X0066.HK          0.181           -0.127
## X0083.HK  0.104  -0.208
## X0101.HK -0.180           -0.115
## X0144.HK  0.118                                           -0.124
## X0151.HK -0.175
## X0267.HK  0.105  -0.152                  -0.117
## X0291.HK
## X0293.HK -0.119                           -0.102
## X0322.HK          0.109  -0.122
## X0330.HK
## X0386.HK -0.274  -0.115  -0.216
## X0388.HK  0.125   0.299                           -0.165
## X0494.HK  0.132  -0.122   0.119
## X0688.HK -0.203                            0.272  -0.467   0.190
## X0700.HK  0.107
## X0762.HK          0.219                    0.108           0.148
## X0836.HK  0.107                                   -0.128
## X0857.HK  0.119   0.109   0.425   0.160   0.151           0.131
## X0883.HK  0.182           -0.392  -0.149  -0.169
## X0939.HK         -0.145           0.378   0.225   0.106  -0.345
## X0941.HK                  -0.158          -0.182           0.120
## X1044.HK
## X1088.HK  0.168                   -0.284
## X1109.HK                  -0.118          -0.276   0.407  -0.127
## X1199.HK -0.250           -0.120           0.226   0.102   0.127
## X1299.HK  0.178                           -0.148
## X1398.HK         -0.120   0.191           -0.249   0.305   0.641
## X1880.HK                  0.146
## X1898.HK -0.258                   -0.174                   -0.112
## X2318.HK          0.279                   -0.185           -0.129
## X2388.HK  0.250  -0.180  -0.212  -0.127           -0.214
## X2600.HK  0.226  -0.224
## X2628.HK         -0.160           0.116   0.199
## X3328.HK  0.137   0.327           0.318  -0.105  -0.114  -0.116
## X3988.HK -0.247  -0.222   0.342  -0.314           -0.155  -0.152
##
##                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  0.188   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   0.812   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

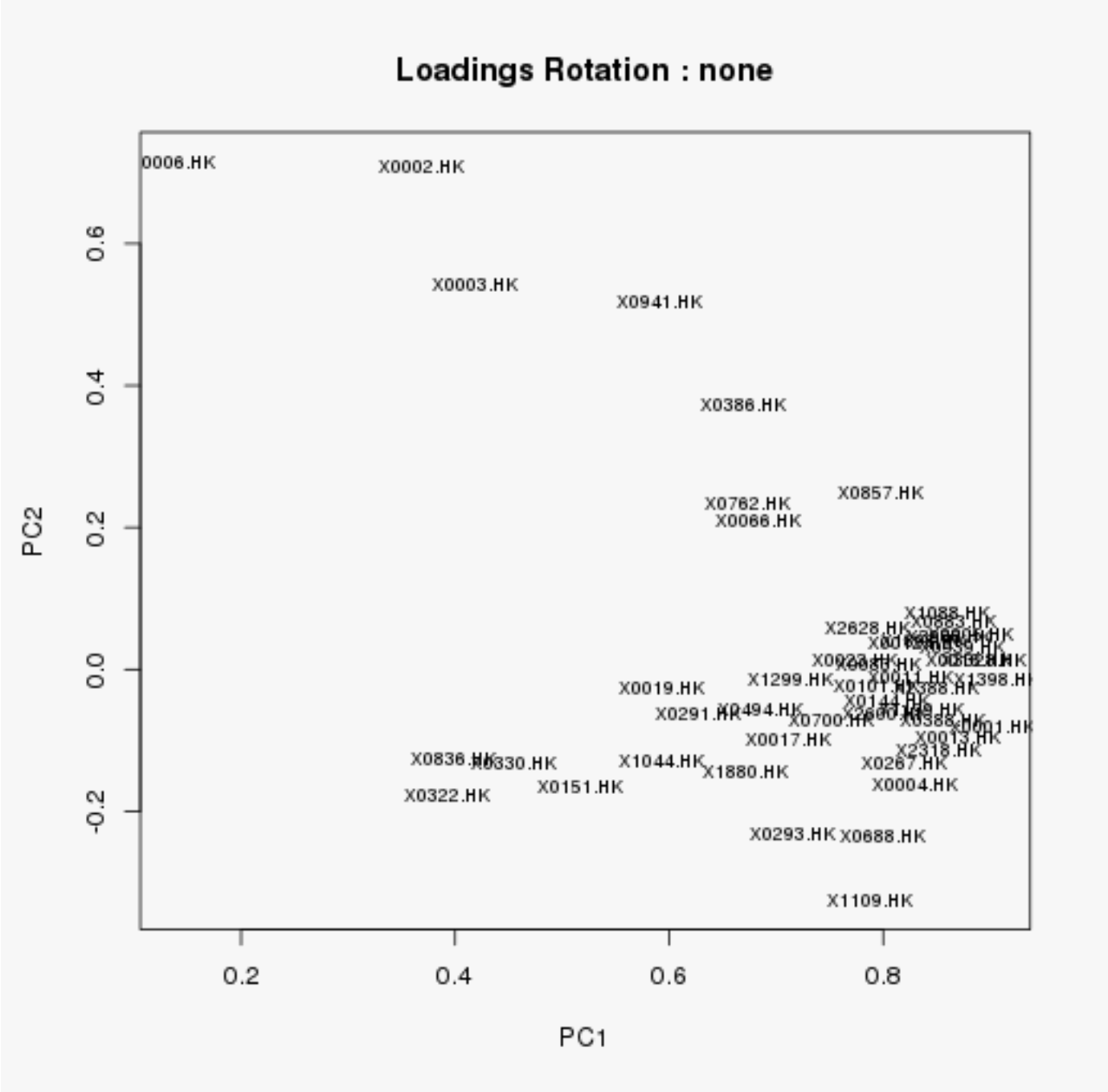
5.2.1 Rotation : none

```
## 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  0.04 -0.13 0.85 0.15
## X0001.HK    1 0.90 -0.08 -0.07 -0.18 -0.01 0.86 0.14
## X3328.HK   47 0.89  0.01 -0.10  0.07 -0.03 0.82 0.18
## X0005.HK    5 0.88  0.05 -0.03  0.02 -0.02 0.78 0.22
## X0016.HK   10 0.88  0.01 -0.07 -0.18 -0.05 0.81 0.19
## X0939.HK   33 0.87  0.03 -0.01  0.07 -0.09 0.78 0.22
## X0013.HK    9 0.87 -0.10 -0.06 -0.12  0.04 0.78 0.22
## X0883.HK   32 0.87  0.07 -0.01  0.18 -0.03 0.79 0.21
## X3988.HK   48 0.86  0.05 -0.02 -0.01 -0.05 0.75 0.25
## X1088.HK   36 0.86  0.08  0.04  0.12  0.03 0.76 0.24
## X0388.HK   25 0.86 -0.07 -0.06 -0.18 -0.03 0.77 0.23
## X2318.HK   43 0.85 -0.12 -0.12  0.00 -0.11 0.76 0.24
## X2388.HK   44 0.85 -0.03  0.05 -0.10 -0.17 0.76 0.24
## X1898.HK   42 0.84  0.04 -0.03  0.01 -0.01 0.70 0.30
## X1199.HK   38 0.84 -0.06 -0.13  0.19  0.06 0.76 0.24
## X0004.HK    4 0.83 -0.16 -0.13 -0.12 -0.03 0.75 0.25
## X0012.HK    8 0.83  0.04 -0.08 -0.21  0.04 0.73 0.27
## X0011.HK    7 0.82 -0.01  0.05 -0.29 -0.06 0.77 0.23
## X0267.HK   19 0.82 -0.13  0.10 -0.13  0.09 0.72 0.28
## X0144.HK   17 0.80 -0.04  0.04  0.22  0.08 0.70 0.30
## X2600.HK   45 0.80 -0.06 -0.13  0.06 -0.10 0.68 0.32
## X0688.HK   27 0.80 -0.24 -0.15  0.13 -0.11 0.75 0.25
## X0857.HK   31 0.80  0.25 -0.03  0.17  0.15 0.75 0.25
## X0083.HK   15 0.80  0.01 -0.16 -0.13  0.02 0.67 0.33
## X0101.HK   16 0.79 -0.02 -0.20 -0.11  0.06 0.69 0.31
## X1109.HK   37 0.79 -0.32 -0.11  0.11 -0.02 0.75 0.25
## X2628.HK   46 0.79  0.06 -0.04  0.02 -0.04 0.62 0.38
## X0023.HK   13 0.77  0.01  0.09 -0.15 -0.20 0.67 0.33
## X0700.HK   28 0.75 -0.07 -0.06  0.31 -0.23 0.72 0.28
## X0293.HK   21 0.72 -0.23 -0.02  0.02  0.05 0.57 0.43
## X1299.HK   39 0.71 -0.01  0.05 -0.04  0.05 0.52 0.48
## X0017.HK   11 0.71 -0.10 -0.18 -0.19  0.10 0.60 0.40
## X0494.HK   26 0.69 -0.06  0.06  0.06 -0.03 0.48 0.52
## X0066.HK   14 0.68  0.21  0.17 -0.27  0.09 0.62 0.38
## X0762.HK   29 0.67  0.23  0.19  0.30  0.01 0.63 0.37
## X1880.HK   41 0.67 -0.14  0.08  0.24 -0.11 0.55 0.45
## X0386.HK   24 0.67  0.37 -0.09  0.32  0.20 0.74 0.26
## X0291.HK   20 0.63 -0.06 -0.06 -0.03  0.06 0.41 0.59
## X0019.HK   12 0.59 -0.03  0.14 -0.24  0.03 0.43 0.57
## X1044.HK   35 0.59 -0.13  0.44  0.22 -0.12 0.63 0.37
## X0941.HK   34 0.59  0.52  0.13  0.06  0.09 0.65 0.35
## X0006.HK    6 0.14  0.72 -0.13  0.13 -0.18 0.60 0.40
## X0002.HK    2 0.37  0.71  0.06 -0.10 -0.12 0.67 0.33
## X0003.HK    3 0.42  0.54  0.17 -0.30  0.20 0.63 0.37
## X0322.HK   22 0.39 -0.18  0.65 -0.15 -0.14 0.65 0.35
## X0151.HK   18 0.52 -0.17  0.59  0.13  0.04 0.67 0.33
## X0836.HK   30 0.40 -0.13  0.11  0.10  0.66 0.64 0.36
## X0330.HK   23 0.45 -0.13 -0.05  0.03  0.50 0.47 0.53
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    26.64 2.36 1.44 1.27 1.15
```

```
## Proportion Var  0.55 0.05 0.03 0.03 0.02
## Cumulative Var  0.55 0.60 0.63 0.66 0.68
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  52.76 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.32
##  0.3The number of observations was  161  with Chi Square =  1443  with prob <  4.2e-28
##  0.3
## Fit based upon off diagonal values = 1


##              PC1       PC2
## X0001.HK 0.9017 -0.079623
## X0002.HK 0.3693  0.708011
## X0003.HK 0.4182  0.541428
## X0004.HK 0.8297 -0.163571
## X0005.HK 0.8824  0.048499
## X0006.HK 0.1366  0.715290
## X0011.HK 0.8247 -0.010967
## X0012.HK 0.8263  0.036593
## X0013.HK 0.8691 -0.096361
## X0016.HK 0.8793  0.013563
## X0017.HK 0.7120 -0.098307
## X0019.HK 0.5939 -0.027254
## X0023.HK 0.7736  0.014086
## X0066.HK 0.6835  0.208320
## X0083.HK 0.7957  0.006534
## X0101.HK 0.7929 -0.021857
## X0144.HK 0.8032 -0.044226
## X0151.HK 0.5175 -0.166615
## X0267.HK 0.8189 -0.132965
## X0291.HK 0.6269 -0.062011
## X0293.HK 0.7155 -0.232047
## X0322.HK 0.3934 -0.177369
## X0330.HK 0.4548 -0.131713
## X0386.HK 0.6682  0.374430
## X0388.HK 0.8552 -0.071796
## X0494.HK 0.6854 -0.056668
## X0688.HK 0.7992 -0.235882
## X0700.HK 0.7512 -0.070811
## X0762.HK 0.6733  0.233733
## X0836.HK 0.3976 -0.127110
## X0857.HK 0.7977  0.248292
## X0883.HK 0.8663  0.066984
## X0939.HK 0.8742  0.031591
## X0941.HK 0.5918  0.519098
## X1044.HK 0.5926 -0.127700
## X1088.HK 0.8597  0.080690
## X1109.HK 0.7865 -0.324850
## X1199.HK 0.8352 -0.057626
## X1299.HK 0.7141 -0.013660
## X1398.HK 0.9066 -0.014235
## X1880.HK 0.6707 -0.144481
## X1898.HK 0.8367  0.040416
## X2318.HK 0.8517 -0.115230
## X2388.HK 0.8487 -0.026681
## X2600.HK 0.8010 -0.061827
```

```
## X2628.HK 0.7858  0.060005
## X3328.HK 0.8942  0.013875
## X3988.HK 0.8625  0.046828
```



5.2.2 Rotation : varimax

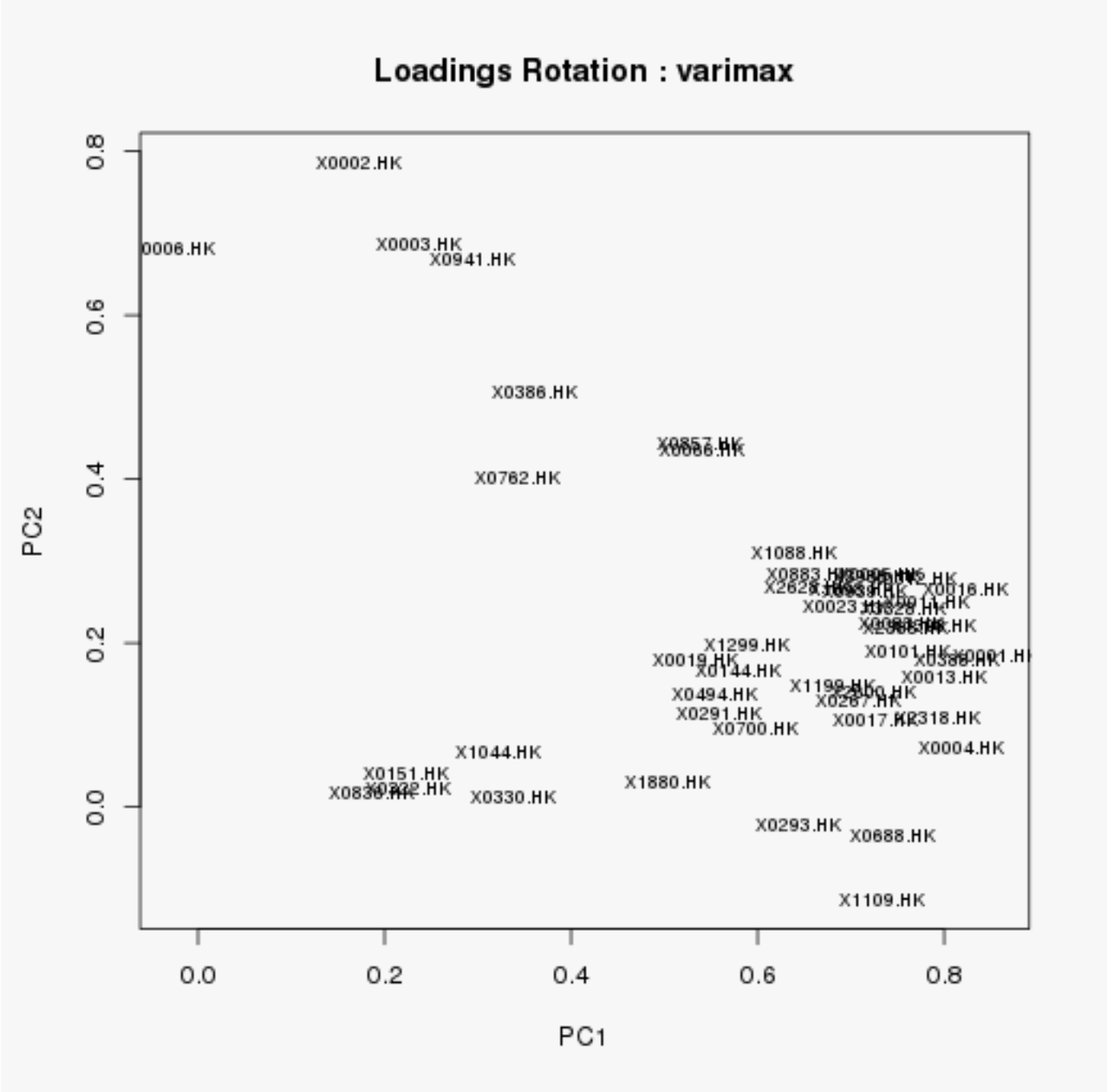
Varimax rotation is an orthogonal rotation of the factor axes to maximize the variance of the squared loadings of a factor (column) on all the variables (rows) in a factor matrix, which has the effect of differentiating the original variables by extracted factor. Each factor will tend to have either 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   PC4   PC3   PC5   h2   u2
## X0001.HK    1  0.86  0.18  0.14  0.20  0.18 0.86 0.14
## X0016.HK   10  0.82  0.26  0.14  0.18  0.12 0.81 0.19
## X0004.HK    4  0.82  0.07  0.17  0.15  0.14 0.75 0.25
## X0388.HK   25  0.81  0.18  0.12  0.20  0.14 0.77 0.23
## X0013.HK    9  0.80  0.16  0.17  0.20  0.23 0.78 0.22
## X2318.HK   43  0.79  0.11  0.30  0.15  0.09 0.76 0.24
## X1398.HK   40  0.79  0.22  0.36  0.19  0.07 0.85 0.15
## X0011.HK    7  0.78  0.25  0.01  0.30  0.10 0.77 0.23
## X0012.HK    8  0.77  0.28  0.08  0.15  0.19 0.73 0.27
## X0101.HK   16  0.76  0.19  0.15  0.03  0.21 0.69 0.31
## X2388.HK   44  0.76  0.22  0.21  0.31  0.02 0.76 0.24
## X3328.HK   47  0.76  0.24  0.37  0.14  0.16 0.82 0.18
## X0083.HK   15  0.75  0.22  0.15  0.07  0.17 0.67 0.33
## X0688.HK   27  0.74 -0.04  0.41  0.12  0.10 0.75 0.25
## X1109.HK   37  0.73 -0.11  0.37  0.17  0.19 0.75 0.25
## X0005.HK    5  0.73  0.29  0.32  0.20  0.17 0.78 0.22
## X3988.HK   48  0.73  0.28  0.28  0.21  0.13 0.75 0.25
## X0017.HK   11  0.73  0.11  0.04  0.04  0.23 0.60 0.40
## X2600.HK   45  0.72  0.14  0.34  0.11  0.08 0.68 0.32
## X0939.HK   33  0.72  0.26  0.36  0.23  0.11 0.78 0.22
## X0267.HK   19  0.71  0.13  0.13  0.34  0.27 0.72 0.28
## X1898.HK   42  0.70  0.27  0.29  0.18  0.16 0.70 0.30
## X0023.HK   13  0.69  0.25  0.15  0.32 -0.04 0.67 0.33
## X1199.HK   38  0.68  0.15  0.44  0.09  0.26 0.76 0.24
## X0883.HK   32  0.65  0.28  0.46  0.20  0.18 0.79 0.21
## X2628.HK   46  0.65  0.27  0.29  0.17  0.13 0.62 0.38
## X0293.HK   21  0.64 -0.02  0.24  0.21  0.23 0.57 0.43
## X1088.HK   36  0.64  0.31  0.39  0.24  0.22 0.76 0.24
## X0700.HK   28  0.60  0.10  0.57  0.16 -0.02 0.72 0.28
## X1299.HK   39  0.59  0.20  0.19  0.24  0.20 0.52 0.48
## X0144.HK   17  0.58  0.17  0.45  0.23  0.29 0.70 0.30
## X0291.HK   20  0.56  0.11  0.17  0.11  0.20 0.41 0.59
## X0494.HK   26  0.55  0.14  0.28  0.25  0.13 0.48 0.52
## X0066.HK   14  0.54  0.44 -0.04  0.31  0.20 0.62 0.38
## X0857.HK   31  0.54  0.44  0.40  0.10  0.32 0.75 0.25
## X0019.HK   12  0.53  0.18 -0.04  0.31  0.14 0.43 0.57
## X1880.HK   41  0.50  0.03  0.46  0.28  0.08 0.55 0.45
## X0002.HK    2  0.17  0.79  0.05  0.04 -0.11 0.67 0.33
## X0003.HK    3  0.24  0.69 -0.18  0.17  0.21 0.63 0.37
## X0006.HK    6 -0.03  0.68  0.21 -0.21 -0.21 0.60 0.40
## X0941.HK   34  0.29  0.67  0.24  0.16  0.18 0.65 0.35
## X0386.HK   24  0.36  0.51  0.49 -0.03  0.33 0.74 0.26
## X0762.HK   29  0.34  0.40  0.49  0.29  0.18 0.63 0.37
## X0322.HK   22  0.23  0.02 -0.02  0.78 -0.01 0.65 0.35
## X0151.HK   18  0.22  0.04  0.25  0.71  0.22 0.67 0.33
## X1044.HK   35  0.32  0.07  0.40  0.59  0.08 0.63 0.37
```

```
## X0836.HK   30  0.19  0.02  0.11  0.14  0.76 0.64 0.36
## X0330.HK   23  0.34  0.01  0.09  0.04  0.59 0.47 0.53
##
##                  PC1  PC2  PC4  PC3  PC5
## SS loadings    19.01 4.21 4.02 3.24 2.38
## Proportion Var  0.40 0.09 0.08 0.07 0.05
## Cumulative Var  0.40 0.48 0.57 0.63 0.68
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  52.76 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.32
##  0.3The number of observations was  161  with Chi Square =  1443  with prob <  4.2e-28
##  0.3
## Fit based upon off diagonal values = 1


##                PC1      PC2
## X0001.HK  0.85598  0.18402
## X0002.HK  0.17304  0.78648
## X0003.HK  0.23596  0.68633
## X0004.HK  0.81921  0.07197
## X0005.HK  0.73069  0.28501
## X0006.HK -0.02666  0.68226
## X0011.HK  0.78118  0.25120
## X0012.HK  0.76843  0.27756
## X0013.HK  0.79991  0.15733
## X0016.HK  0.82174  0.26458
## X0017.HK  0.72630  0.10730
## X0019.HK  0.53229  0.18024
## X0023.HK  0.69419  0.24572
## X0066.HK  0.54010  0.43598
## X0083.HK  0.75416  0.22309
## X0101.HK  0.76169  0.19039
## X0144.HK  0.57904  0.16744
## X0151.HK  0.22235  0.04206
## X0267.HK  0.70834  0.12907
## X0291.HK  0.55791  0.11342
## X0293.HK  0.64335 -0.02266
## X0322.HK  0.22610  0.02381
## X0330.HK  0.33781  0.01214
## X0386.HK  0.36192  0.50689
## X0388.HK  0.81389  0.17908
## X0494.HK  0.55292  0.13646
## X0688.HK  0.74490 -0.03569
## X0700.HK  0.59698  0.09614
## X0762.HK  0.34167  0.40146
## X0836.HK  0.18576  0.01717
## X0857.HK  0.53719  0.44279
## X0883.HK  0.65491  0.28435
## X0939.HK  0.71541  0.26253
## X0941.HK  0.29375  0.66903
## X1044.HK  0.32083  0.06805
## X1088.HK  0.63934  0.30960
## X1109.HK  0.73415 -0.11290
## X1199.HK  0.68048  0.14742
## X1299.HK  0.58762  0.19695
## X1398.HK  0.78915  0.22190
```

```
## X1880.HK  0.50273  0.03125
## X1898.HK  0.70016  0.26601
## X2318.HK  0.79403  0.11006
## X2388.HK  0.75875  0.21977
## X2600.HK  0.72343  0.13994
## X2628.HK  0.65215  0.26748
## X3328.HK  0.75527  0.24223
## X3988.HK  0.72645  0.28120
```



5.2.3 Rotation : quatimax

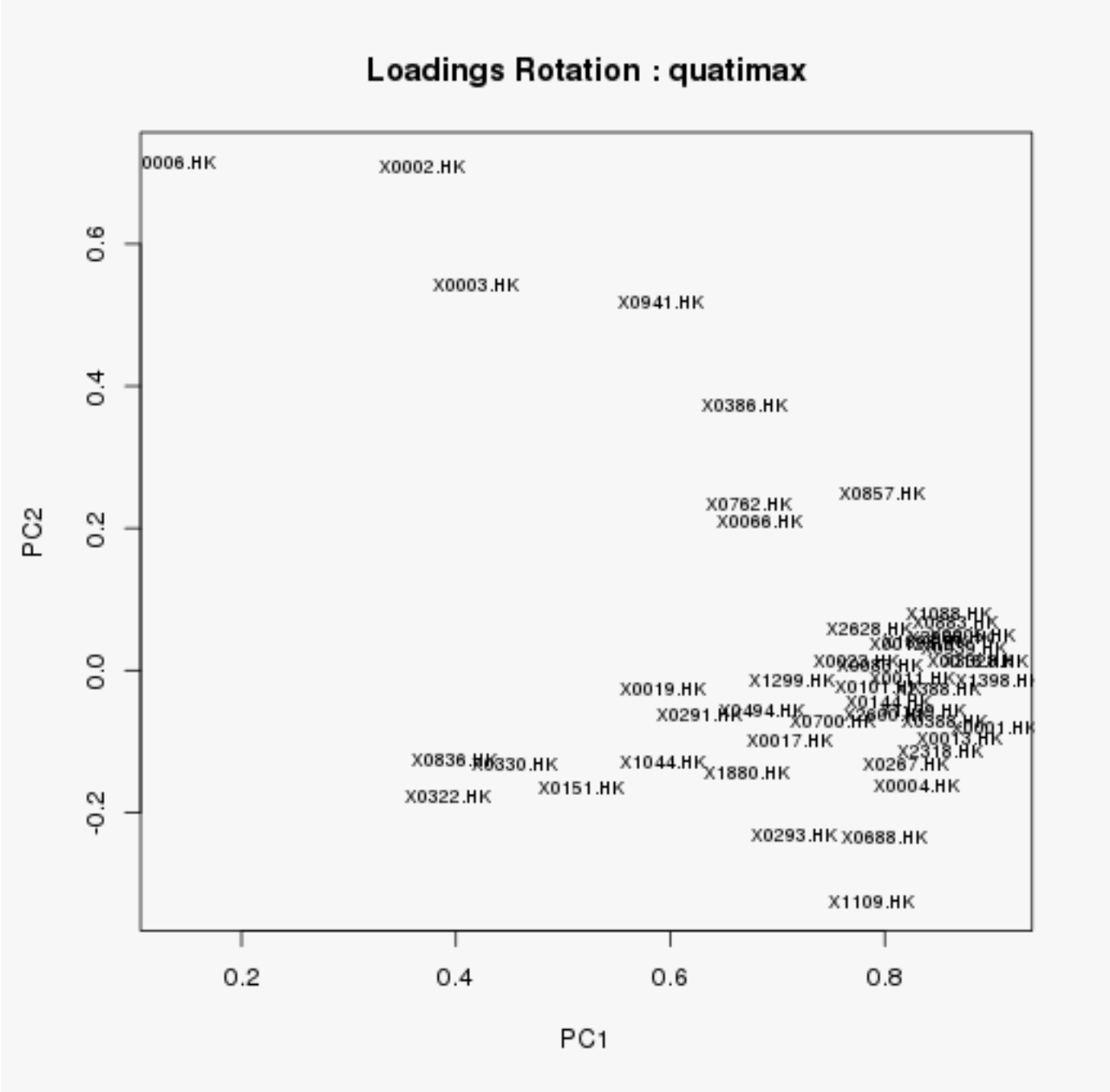
Quartimax rotation is an orthogonal alternative which minimizes the number of factors needed to explain each variable. This type of rotation often generates a general factor on which most variables are loaded to a high or medium degree. Such a factor structure is usually not helpful to the research purpose.

```
## 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  0.04 -0.13 0.85 0.15
## X0001.HK    1 0.90 -0.08 -0.07 -0.18 -0.01 0.86 0.14
## X3328.HK   47 0.89  0.01 -0.10  0.07 -0.03 0.82 0.18
## X0005.HK    5 0.88  0.05 -0.03  0.02 -0.02 0.78 0.22
## X0016.HK   10 0.88  0.01 -0.07 -0.18 -0.05 0.81 0.19
## X0939.HK   33 0.87  0.03 -0.01  0.07 -0.09 0.78 0.22
## X0013.HK    9 0.87 -0.10 -0.06 -0.12  0.04 0.78 0.22
## X0883.HK   32 0.87  0.07 -0.01  0.18 -0.03 0.79 0.21
## X3988.HK   48 0.86  0.05 -0.02 -0.01 -0.05 0.75 0.25
## X1088.HK   36 0.86  0.08  0.04  0.12  0.03 0.76 0.24
## X0388.HK   25 0.86 -0.07 -0.06 -0.18 -0.03 0.77 0.23
## X2318.HK   43 0.85 -0.12 -0.12  0.00 -0.11 0.76 0.24
## X2388.HK   44 0.85 -0.03  0.05 -0.10 -0.17 0.76 0.24
## X1898.HK   42 0.84  0.04 -0.03  0.01 -0.01 0.70 0.30
## X1199.HK   38 0.84 -0.06 -0.13  0.19  0.06 0.76 0.24
## X0004.HK    4 0.83 -0.16 -0.13 -0.12 -0.03 0.75 0.25
## X0012.HK    8 0.83  0.04 -0.08 -0.21  0.04 0.73 0.27
## X0011.HK    7 0.82 -0.01  0.05 -0.29 -0.06 0.77 0.23
## X0267.HK   19 0.82 -0.13  0.10 -0.13  0.09 0.72 0.28
## X0144.HK   17 0.80 -0.04  0.04  0.22  0.08 0.70 0.30
## X2600.HK   45 0.80 -0.06 -0.13  0.06 -0.10 0.68 0.32
## X0688.HK   27 0.80 -0.24 -0.15  0.13 -0.11 0.75 0.25
## X0857.HK   31 0.80  0.25 -0.03  0.17  0.15 0.75 0.25
## X0083.HK   15 0.80  0.01 -0.16 -0.13  0.02 0.67 0.33
## X0101.HK   16 0.79 -0.02 -0.20 -0.11  0.06 0.69 0.31
## X1109.HK   37 0.79 -0.32 -0.11  0.11 -0.02 0.75 0.25
## X2628.HK   46 0.79  0.06 -0.04  0.02 -0.04 0.62 0.38
## X0023.HK   13 0.77  0.01  0.09 -0.15 -0.20 0.67 0.33
## X0700.HK   28 0.75 -0.07 -0.06  0.31 -0.23 0.72 0.28
## X0293.HK   21 0.72 -0.23 -0.02  0.02  0.05 0.57 0.43
## X1299.HK   39 0.71 -0.01  0.05 -0.04  0.05 0.52 0.48
## X0017.HK   11 0.71 -0.10 -0.18 -0.19  0.10 0.60 0.40
## X0494.HK   26 0.69 -0.06  0.06  0.06 -0.03 0.48 0.52
## X0066.HK   14 0.68  0.21  0.17 -0.27  0.09 0.62 0.38
## X0762.HK   29 0.67  0.23  0.19  0.30  0.01 0.63 0.37
## X1880.HK   41 0.67 -0.14  0.08  0.24 -0.11 0.55 0.45
## X0386.HK   24 0.67  0.37 -0.09  0.32  0.20 0.74 0.26
## X0291.HK   20 0.63 -0.06 -0.06 -0.03  0.06 0.41 0.59
## X0019.HK   12 0.59 -0.03  0.14 -0.24  0.03 0.43 0.57
## X1044.HK   35 0.59 -0.13  0.44  0.22 -0.12 0.63 0.37
## X0941.HK   34 0.59  0.52  0.13  0.06  0.09 0.65 0.35
## X0006.HK    6 0.14  0.72 -0.13  0.13 -0.18 0.60 0.40
## X0002.HK    2 0.37  0.71  0.06 -0.10 -0.12 0.67 0.33
## X0003.HK    3 0.42  0.54  0.17 -0.30  0.20 0.63 0.37
## X0322.HK   22 0.39 -0.18  0.65 -0.15 -0.14 0.65 0.35
## X0151.HK   18 0.52 -0.17  0.59  0.13  0.04 0.67 0.33
## X0836.HK   30 0.40 -0.13  0.11  0.10  0.66 0.64 0.36
## X0330.HK   23 0.45 -0.13 -0.05  0.03  0.50 0.47 0.53
```

```
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    26.64 2.36 1.44 1.27 1.15
## Proportion Var  0.55 0.05 0.03 0.03 0.02
## Cumulative Var  0.55 0.60 0.63 0.66 0.68
##
## Test of the hypothesis that 5 components are sufficient.
##
## The degrees of freedom for the null model are  1128  and the objective function was  52.76 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.32
##  0.3The number of observations was  161  with Chi Square =  1443  with prob <  4.2e-28
##  0.3
## Fit based upon off diagonal values = 1
```

```
##              PC1       PC2
## X0001.HK 0.9017 -0.079623
## X0002.HK 0.3693  0.708011
## X0003.HK 0.4182  0.541428
## X0004.HK 0.8297 -0.163571
## X0005.HK 0.8824  0.048499
## X0006.HK 0.1366  0.715290
## X0011.HK 0.8247 -0.010967
## X0012.HK 0.8263  0.036593
## X0013.HK 0.8691 -0.096361
## X0016.HK 0.8793  0.013563
## X0017.HK 0.7120 -0.098307
## X0019.HK 0.5939 -0.027254
## X0023.HK 0.7736  0.014086
## X0066.HK 0.6835  0.208320
## X0083.HK 0.7957  0.006534
## X0101.HK 0.7929 -0.021857
## X0144.HK 0.8032 -0.044226
## X0151.HK 0.5175 -0.166615
## X0267.HK 0.8189 -0.132965
## X0291.HK 0.6269 -0.062011
## X0293.HK 0.7155 -0.232047
## X0322.HK 0.3934 -0.177369
## X0330.HK 0.4548 -0.131713
## X0386.HK 0.6682  0.374430
## X0388.HK 0.8552 -0.071796
## X0494.HK 0.6854 -0.056668
## X0688.HK 0.7992 -0.235882
## X0700.HK 0.7512 -0.070811
## X0762.HK 0.6733  0.233733
## X0836.HK 0.3976 -0.127110
## X0857.HK 0.7977  0.248292
## X0883.HK 0.8663  0.066984
## X0939.HK 0.8742  0.031591
## X0941.HK 0.5918  0.519098
## X1044.HK 0.5926 -0.127700
## X1088.HK 0.8597  0.080690
## X1109.HK 0.7865 -0.324850
## X1199.HK 0.8352 -0.057626
## X1299.HK 0.7141 -0.013660
## X1398.HK 0.9066 -0.014235
## X1880.HK 0.6707 -0.144481
## X1898.HK 0.8367  0.040416
```

```
## X2318.HK 0.8517 -0.115230
## X2388.HK 0.8487 -0.026681
## X2600.HK 0.8010 -0.061827
## X2628.HK 0.7858  0.060005
## X3328.HK 0.8942  0.013875
## X3988.HK 0.8625  0.046828
```



5.2.4 Rotation : simplimax

A compromise between Varimax and Quartimax criteria.

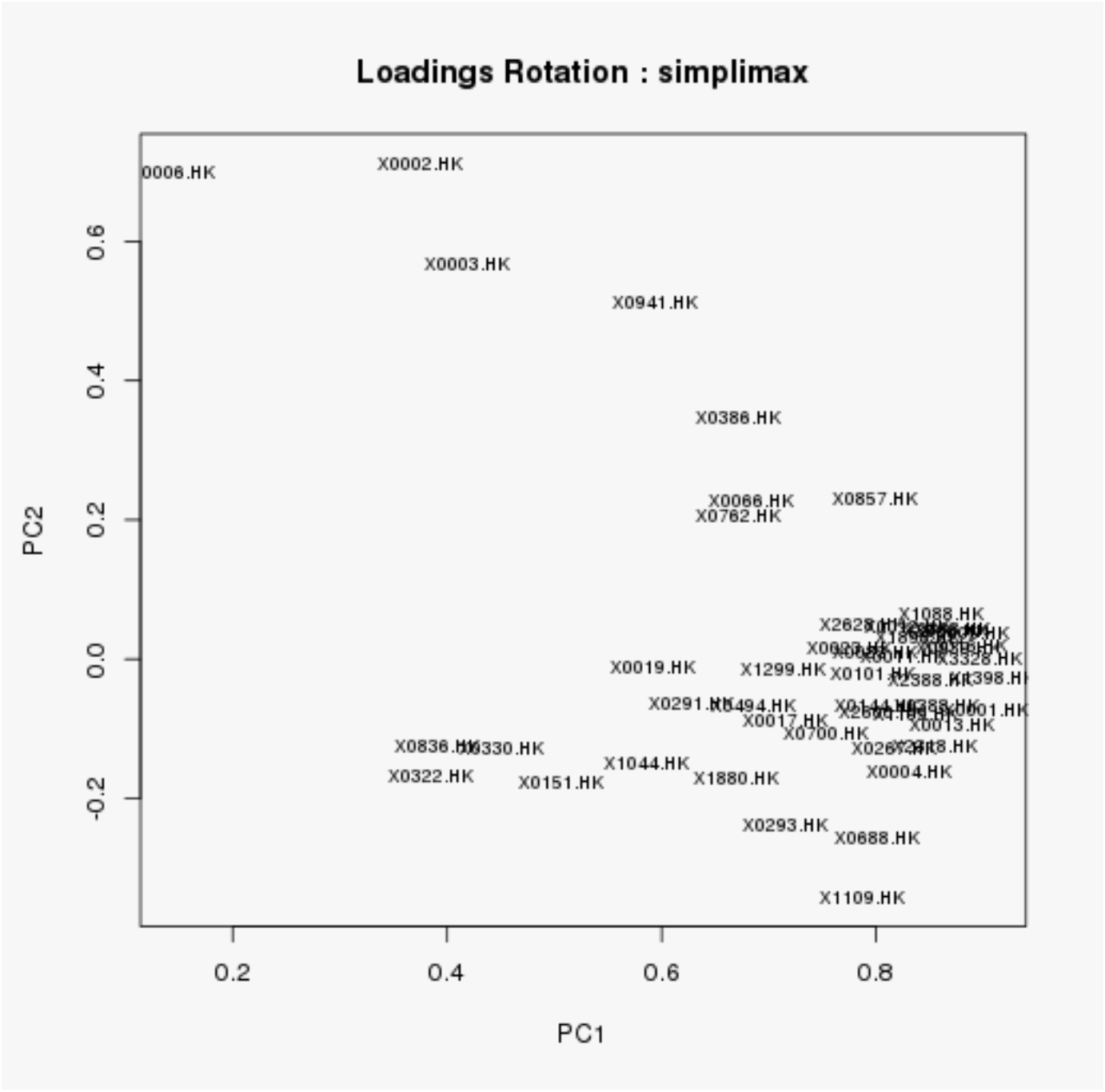
```
## Warning message: convergence not obtained in GPFoblq. 1000 iterations used.

## 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 -0.03 -0.05 -0.03 -0.10 0.85 0.15
## X0001.HK    1 0.90 -0.07 -0.01  0.20  0.04 0.86 0.14
## X3328.HK   47 0.90  0.00 -0.07 -0.06  0.00 0.82 0.18
## X0005.HK    5 0.88  0.04  0.00 -0.01  0.01 0.78 0.22
## X0016.HK   10 0.88  0.02 -0.01  0.20  0.00 0.81 0.19
## X0939.HK   33 0.88  0.02  0.01 -0.06 -0.06 0.78 0.22
## X0013.HK    9 0.87 -0.09  0.00  0.14  0.09 0.78 0.22
## X0883.HK   32 0.87  0.04 -0.01 -0.17 -0.01 0.79 0.21
## X3988.HK   48 0.86  0.04  0.02  0.02 -0.02 0.75 0.25
## X1088.HK   36 0.86  0.06  0.06 -0.11  0.05 0.76 0.24
## X0388.HK   25 0.86 -0.07  0.00  0.19  0.01 0.77 0.23
## X2318.HK   43 0.85 -0.13 -0.10  0.02 -0.07 0.76 0.24
## X2388.HK   44 0.85 -0.03  0.09  0.11 -0.13 0.76 0.24
## X1898.HK   42 0.84  0.03  0.00  0.01  0.02 0.70 0.30
## X1199.HK   38 0.84 -0.08 -0.12 -0.16  0.08 0.76 0.24
## X0004.HK    4 0.83 -0.16 -0.08  0.14  0.01 0.75 0.25
## X0012.HK    8 0.83  0.05  0.00  0.23  0.09 0.73 0.27
## X0011.HK    7 0.83  0.00  0.13  0.30 -0.01 0.77 0.23
## X0267.HK   19 0.82 -0.13  0.16  0.14  0.13 0.72 0.28
## X2600.HK   45 0.80 -0.08 -0.12 -0.04 -0.07 0.68 0.32
## X0144.HK   17 0.80 -0.07  0.04 -0.21  0.10 0.70 0.30
## X0688.HK   27 0.80 -0.26 -0.16 -0.11 -0.08 0.75 0.25
## X0857.HK   31 0.80  0.23  0.00 -0.15  0.17 0.75 0.25
## X0083.HK   15 0.80  0.01 -0.09  0.15  0.06 0.67 0.33
## X0101.HK   16 0.80 -0.02 -0.14  0.14  0.10 0.69 0.31
## X2628.HK   46 0.79  0.05 -0.01 -0.01 -0.01 0.62 0.38
## X1109.HK   37 0.79 -0.34 -0.11 -0.09  0.00 0.75 0.25
## X0023.HK   13 0.77  0.02  0.13  0.15 -0.16 0.67 0.33
## X0700.HK   28 0.75 -0.11 -0.11 -0.30 -0.22 0.72 0.28
## X0017.HK   11 0.71 -0.09 -0.11  0.22  0.14 0.60 0.40
## X0293.HK   21 0.71 -0.24  0.00  0.00  0.08 0.57 0.43
## X1299.HK   39 0.71 -0.02  0.09  0.05  0.08 0.52 0.48
## X0494.HK   26 0.68 -0.07  0.07 -0.05 -0.01 0.48 0.52
## X0066.HK   14 0.68  0.23  0.26  0.27  0.13 0.62 0.38
## X0762.HK   29 0.67  0.21  0.17 -0.31  0.01 0.63 0.37
## X0386.HK   24 0.67  0.35 -0.08 -0.30  0.21 0.74 0.26
## X1880.HK   41 0.67 -0.17  0.05 -0.24 -0.11 0.55 0.45
## X0291.HK   20 0.63 -0.06 -0.03  0.04  0.09 0.41 0.59
## X0941.HK   34 0.59  0.51  0.18 -0.06  0.10 0.65 0.35
## X0019.HK   12 0.59 -0.01  0.21  0.24  0.06 0.43 0.57
## X1044.HK   35 0.59 -0.15  0.41 -0.25 -0.11 0.63 0.37
## X0002.HK    2 0.37  0.71  0.12  0.09 -0.10 0.67 0.33
## X0006.HK    6 0.14  0.70 -0.12 -0.13 -0.19 0.60 0.40
## X0003.HK    3 0.42  0.57  0.29  0.30  0.23 0.63 0.37
## X0322.HK   22 0.38 -0.17  0.66  0.10 -0.13 0.65 0.35
## X0151.HK   18 0.51 -0.18  0.58 -0.17  0.05 0.67 0.33
## X0836.HK   30 0.39 -0.13  0.16 -0.09  0.68 0.64 0.36
## X0330.HK   23 0.45 -0.13  0.01  0.00  0.52 0.47 0.53
```

```
##
##                  PC1  PC2  PC3  PC4  PC5
## SS loadings    26.62 2.36 1.45 1.27 1.15
## Proportion Var  0.55 0.05 0.03 0.03 0.02
## Cumulative Var  0.55 0.60 0.63 0.66 0.68
##
##  With component correlations of
##       PC1   PC2   PC3   PC4   PC5
## PC1  1.00  0.00 -0.02 -0.01 -0.03
## PC2  0.00  1.00 -0.06 -0.07  0.00
## PC3 -0.02 -0.06  1.00 -0.09 -0.08
## PC4 -0.01 -0.07 -0.09  1.00 -0.09
## PC5 -0.03  0.00 -0.08 -0.09  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  52.76 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.32
##  0.3The number of observations was  161  with Chi Square =  1443  with prob <  4.2e-28
##  0.3
## Fit based upon off diagonal values = 1

##              PC1        PC2
## X0001.HK 0.9033 -0.0736442
## X0002.HK 0.3744  0.7122269
## X0003.HK 0.4185  0.5678007
## X0004.HK 0.8316 -0.1623546
## X0005.HK 0.8839  0.0389521
## X0006.HK 0.1446  0.7007800
## X0011.HK 0.8253  0.0048200
## X0012.HK 0.8284  0.0465624
## X0013.HK 0.8698 -0.0936996
## X0016.HK 0.8818  0.0191077
## X0017.HK 0.7142 -0.0880091
## X0019.HK 0.5922 -0.0114855
## X0023.HK 0.7746  0.0163742
## X0066.HK 0.6825  0.2267778
## X0083.HK 0.7988  0.0096480
## X0101.HK 0.7961 -0.0194649
## X0144.HK 0.8016 -0.0670334
## X0151.HK 0.5068 -0.1775065
## X0267.HK 0.8164 -0.1276032
## X0291.HK 0.6275 -0.0643655
## X0293.HK 0.7142 -0.2389344
## X0322.HK 0.3837 -0.1681526
## X0330.HK 0.4510 -0.1290360
## X0386.HK 0.6704  0.3473201
## X0388.HK 0.8567 -0.0659084
## X0494.HK 0.6847 -0.0672868
## X0688.HK 0.8010 -0.2564604
## X0700.HK 0.7533 -0.1064176
## X0762.HK 0.6716  0.2058279
## X0836.HK 0.3900 -0.1259376
## X0857.HK 0.7988  0.2312155
## X0883.HK 0.8673  0.0448554
## X0939.HK 0.8756  0.0173411
## X0941.HK 0.5928  0.5125739
```

```
## X1044.HK 0.5857 -0.1501774
## X1088.HK 0.8596  0.0647487
## X1109.HK 0.7865 -0.3418375
## X1199.HK 0.8364 -0.0790852
## X1299.HK 0.7133 -0.0153854
## X1398.HK 0.9091 -0.0279734
## X1880.HK 0.6692 -0.1711904
## X1898.HK 0.8381  0.0325238
## X2318.HK 0.8541 -0.1252042
## X2388.HK 0.8498 -0.0286077
## X2600.HK 0.8038 -0.0757561
## X2628.HK 0.7875  0.0507462
## X3328.HK 0.8965 -0.0007571
## X3988.HK 0.8641  0.0393798
```


Loadings Rotation : simplimax
0006.HK
X0002.HK
X0003.HK
X0941.HK
X0386.HK
X0066.HK
X0857.HK
X0762.HK
X1088.HK
X0019.HK
X1299.HK
X0101.HK
X0291.HK
X0494.HK
X0017.HK
X0700.HK
X0013.HK
X0836.HK
X0330.HK
X1044.HK
X0322.HK
X0151.HK
X1880.HK
X0004.HK
X0293.HK
X0688.HK
X1109.HK
PC2
PC1
0.6
0.4
0.2
0.0
-0.2
0.2
0.4
0.6
0.8

5.2.5 Rotation : oblimin

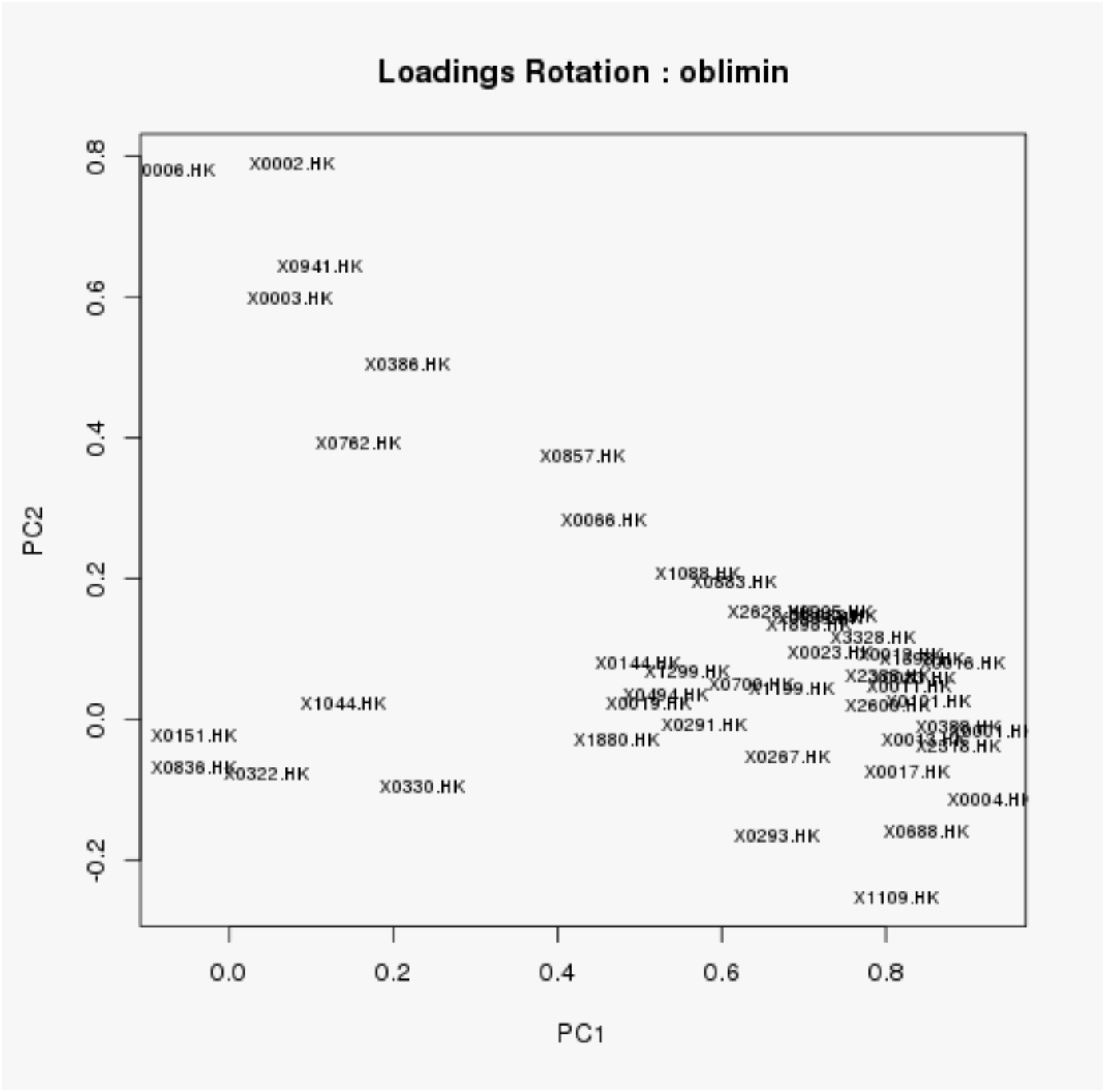
Direct oblimin rotation is the standard method when one wishes a non-orthogonal (oblique) solution – that is, one in which the factors are allowed to be correlated. This will result in higher eigenvalues but diminished interpretability of the factors.

```
## 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
## X0001.HK    1  0.93 -0.02  0.01  0.02 -0.11 0.86 0.14
## X0004.HK    4  0.93 -0.11 -0.04  0.00 -0.04 0.75 0.25
## X0016.HK   10  0.89  0.08  0.00 -0.03 -0.11 0.81 0.19
## X0388.HK   25  0.89 -0.01  0.02 -0.01 -0.11 0.77 0.23
## X2318.HK   43  0.89 -0.04  0.00 -0.04  0.09 0.76 0.24
## X0101.HK   16  0.85  0.02 -0.16  0.09 -0.06 0.69 0.31
## X0688.HK   27  0.85 -0.16 -0.01 -0.01  0.23 0.75 0.25
## X0013.HK    9  0.85 -0.03  0.03  0.09 -0.07 0.78 0.22
## X1398.HK   40  0.84  0.09  0.06 -0.05  0.12 0.85 0.15
## X0083.HK   15  0.83  0.06 -0.11  0.05 -0.07 0.67 0.33
## X0011.HK    7  0.83  0.05  0.11 -0.06 -0.24 0.77 0.23
## X0017.HK   11  0.82 -0.08 -0.15  0.11 -0.15 0.60 0.40
## X0012.HK    8  0.82  0.09 -0.04  0.06 -0.17 0.73 0.27
## X1109.HK   37  0.81 -0.25  0.04  0.08  0.19 0.75 0.25
## X2388.HK   44  0.80  0.06  0.17 -0.13 -0.02 0.76 0.24
## X2600.HK   45  0.80  0.02 -0.02 -0.03  0.14 0.68 0.32
## X3328.HK   47  0.78  0.12  0.01  0.06  0.13 0.82 0.18
## X3988.HK   48  0.74  0.15  0.08  0.02  0.04 0.75 0.25
## X0023.HK   13  0.73  0.10  0.20 -0.18 -0.08 0.67 0.33
## X0005.HK    5  0.73  0.15  0.07  0.07  0.06 0.78 0.22
## X0939.HK   33  0.72  0.14  0.12  0.01  0.12 0.78 0.22
## X1898.HK   42  0.71  0.14  0.06  0.06  0.05 0.70 0.30
## X1199.HK   38  0.69  0.04 -0.01  0.19  0.22 0.76 0.24
## X0267.HK   19  0.68 -0.05  0.20  0.15 -0.12 0.72 0.28
## X0293.HK   21  0.67 -0.17  0.09  0.13  0.05 0.57 0.43
## X2628.HK   46  0.66  0.15  0.05  0.04  0.07 0.62 0.38
## X0700.HK   28  0.63  0.05  0.12 -0.09  0.40 0.72 0.28
## X0883.HK   32  0.62  0.19  0.11  0.10  0.21 0.79 0.21
## X0291.HK   20  0.58 -0.01  0.00  0.11  0.00 0.41 0.59
## X1088.HK   36  0.57  0.21  0.16  0.15  0.13 0.76 0.24
## X1299.HK   39  0.56  0.07  0.13  0.11 -0.03 0.52 0.48
## X0494.HK   26  0.53  0.03  0.17  0.05  0.09 0.48 0.52
## X0019.HK   12  0.51  0.02  0.19  0.03 -0.24 0.43 0.57
## X0144.HK   17  0.50  0.08  0.17  0.23  0.22 0.70 0.30
## X1880.HK   41  0.47 -0.03  0.25  0.02  0.29 0.55 0.45
## X0066.HK   14  0.46  0.28  0.18  0.10 -0.30 0.62 0.38
## X0857.HK   31  0.43  0.37  0.03  0.29  0.14 0.75 0.25
## X0002.HK    2  0.08  0.79  0.02 -0.13 -0.12 0.67 0.33
## X0006.HK    6 -0.07  0.78 -0.18 -0.17  0.14 0.60 0.40
## X0941.HK   34  0.11  0.64  0.14  0.18 -0.01 0.65 0.35
## X0003.HK    3  0.07  0.60  0.09  0.17 -0.40 0.63 0.37
## X0386.HK   24  0.22  0.51 -0.05  0.36  0.27 0.74 0.26
## X0762.HK   29  0.16  0.39  0.31  0.17  0.26 0.63 0.37
## X0322.HK   22  0.04 -0.08  0.80 -0.10 -0.18 0.65 0.35
## X0151.HK   18 -0.04 -0.02  0.77  0.19  0.05 0.67 0.33
## X1044.HK   35  0.14  0.02  0.65  0.04  0.20 0.63 0.37
## X0836.HK   30 -0.04 -0.07  0.10  0.80 -0.07 0.64 0.36
## X0330.HK   23  0.24 -0.10 -0.05  0.59 -0.07 0.47 0.53
```

```
##
##                  PC1  PC2  PC3  PC5  PC4
## SS loadings    22.03 3.66 3.23 2.44 1.50
## Proportion Var  0.46 0.08 0.07 0.05 0.03
## Cumulative Var  0.46 0.54 0.60 0.65 0.68
##
##  With component correlations of
##      PC1  PC2  PC3  PC5  PC4
## PC1 1.00 0.39 0.52 0.47 0.17
## PC2 0.39 1.00 0.18 0.16 0.04
## PC3 0.52 0.18 1.00 0.24 0.06
## PC5 0.47 0.16 0.24 1.00 0.09
## PC4 0.17 0.04 0.06 0.09 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  52.76 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.32
##  0.3The number of observations was  161  with Chi Square =  1443  with prob <  4.2e-28
##  0.3
## Fit based upon off diagonal values = 1

##                PC1       PC2
## X0001.HK  0.93104 -0.016359
## X0002.HK  0.07645  0.790504
## X0003.HK  0.07385  0.600263
## X0004.HK  0.92861 -0.112568
## X0005.HK  0.73109  0.151821
## X0006.HK -0.06849  0.780521
## X0011.HK  0.82827  0.047999
## X0012.HK  0.81743  0.093593
## X0013.HK  0.84597 -0.027968
## X0016.HK  0.89241  0.080667
## X0017.HK  0.82496 -0.075434
## X0019.HK  0.51220  0.022412
## X0023.HK  0.73260  0.096186
## X0066.HK  0.45525  0.282790
## X0083.HK  0.83393  0.059037
## X0101.HK  0.85109  0.024382
## X0144.HK  0.49845  0.081223
## X0151.HK -0.04369 -0.022056
## X0267.HK  0.68102 -0.053485
## X0291.HK  0.57950 -0.007041
## X0293.HK  0.66810 -0.165064
## X0322.HK  0.04415 -0.078135
## X0330.HK  0.23517 -0.095811
## X0386.HK  0.21785  0.505614
## X0388.HK  0.88820 -0.010972
## X0494.HK  0.53264  0.033967
## X0688.HK  0.84831 -0.158864
## X0700.HK  0.63456  0.049424
## X0762.HK  0.15689  0.393149
## X0836.HK -0.04407 -0.068406
## X0857.HK  0.42984  0.373413
## X0883.HK  0.61633  0.194918
## X0939.HK  0.71853  0.143423
## X0941.HK  0.11052  0.644463
```

```
## X1044.HK  0.13837  0.023073
## X1088.HK  0.57160  0.206693
## X1109.HK  0.81410 -0.253016
## X1199.HK  0.68642  0.043538
## X1299.HK  0.55832  0.067787
## X1398.HK  0.84297  0.087193
## X1880.HK  0.47190 -0.030130
## X1898.HK  0.70564  0.135441
## X2318.HK  0.88817 -0.039354
## X2388.HK  0.80304  0.062690
## X2600.HK  0.80170  0.018056
## X2628.HK  0.65922  0.152706
## X3328.HK  0.78377  0.115606
## X3988.HK  0.73766  0.145473
```


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
0006.HK
X0002.HK
X0941.HK
X0003.HK
X0386.HK
X0762.HK
X0857.HK
X0066.HK
X1088.HK
X0883.HK
X3328.HK
X0023.HK
X0144.HK
X1299.HK
X0494.HK
X1044.HK
X0151.HK
X0836.HK
X0322.HK
X0330.HK
X0291.HK
X1880.HK
X0267.HK
X0017.HK
X0004.HK
X0293.HK
X0688.HK
X1109.HK

5.2.6 Rotation : promax

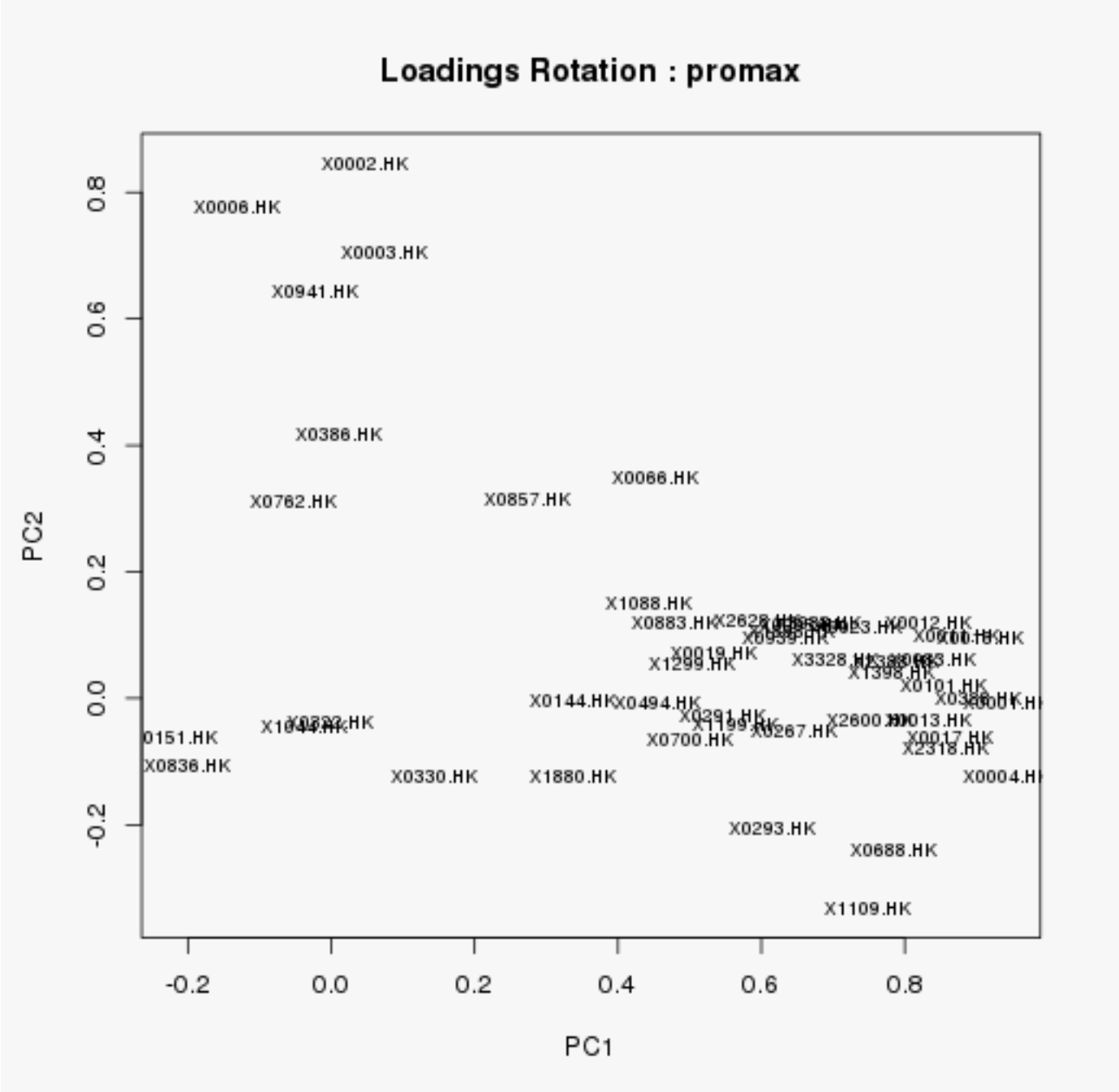
Promax rotation is an alternative non-orthogonal (oblique) rotation method which is computationally faster than the direct oblimin method and therefore is sometimes used for very large datasets.

```
## 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
## X0001.HK    1  0.94 -0.01 -0.02 -0.01  0.01 0.86 0.14
## X0004.HK    4  0.94 -0.12  0.03 -0.06 -0.02 0.75 0.25
## X0016.HK   10  0.90  0.10 -0.01 -0.03 -0.06 0.81 0.19
## X0388.HK   25  0.90  0.00 -0.02  0.00 -0.03 0.77 0.23
## X0011.HK    7  0.87  0.10 -0.16  0.13 -0.08 0.77 0.23
## X0017.HK   11  0.86 -0.06 -0.10 -0.17  0.12 0.60 0.40
## X2318.HK   43  0.86 -0.08  0.20 -0.05 -0.09 0.76 0.24
## X0101.HK   16  0.85  0.02  0.02 -0.20  0.08 0.69 0.31
## X0083.HK   15  0.84  0.06  0.02 -0.14  0.02 0.67 0.33
## X0012.HK    8  0.83  0.12 -0.07 -0.05  0.05 0.73 0.27
## X0013.HK    9  0.83 -0.03  0.03  0.00  0.08 0.78 0.22
## X2388.HK   44  0.79  0.06  0.10  0.15 -0.18 0.76 0.24
## X0688.HK   27  0.78 -0.24  0.34 -0.07 -0.07 0.75 0.25
## X1398.HK   40  0.78  0.04  0.28  0.00 -0.12 0.85 0.15
## X2600.HK   45  0.75 -0.03  0.26 -0.08 -0.09 0.68 0.32
## X1109.HK   37  0.75 -0.33  0.29 -0.01  0.05 0.75 0.25
## X0023.HK   13  0.74  0.11  0.04  0.19 -0.23 0.67 0.33
## X3328.HK   47  0.70  0.06  0.29 -0.06  0.00 0.82 0.18
## X3988.HK   48  0.68  0.12  0.19  0.03 -0.04 0.75 0.25
## X0005.HK    5  0.66  0.12  0.23  0.01  0.01 0.78 0.22
## X0267.HK   19  0.65 -0.05  0.00  0.18  0.16 0.72 0.28
## X1898.HK   42  0.64  0.11  0.20  0.01  0.01 0.70 0.30
## X0939.HK   33  0.63  0.10  0.29  0.06 -0.06 0.78 0.22
## X0293.HK   21  0.62 -0.21  0.15  0.06  0.12 0.57 0.43
## X2628.HK   46  0.59  0.12  0.21  0.00 -0.02 0.62 0.38
## X1199.HK   38  0.56 -0.04  0.38 -0.10  0.14 0.76 0.24
## X0291.HK   20  0.55 -0.03  0.09 -0.04  0.10 0.41 0.59
## X0019.HK   12  0.53  0.07 -0.17  0.21  0.04 0.43 0.57
## X1299.HK   39  0.50  0.06  0.10  0.10  0.09 0.52 0.48
## X0883.HK   32  0.48  0.12  0.41  0.03  0.03 0.79 0.21
## X0494.HK   26  0.46 -0.01  0.22  0.13  0.01 0.48 0.52
## X0066.HK   14  0.45  0.35 -0.17  0.19  0.09 0.62 0.38
## X1088.HK   36  0.44  0.15  0.33  0.08  0.09 0.76 0.24
## X0002.HK    2  0.05  0.85  0.04 -0.02 -0.22 0.67 0.33
## X0006.HK    6 -0.13  0.78  0.28 -0.25 -0.30 0.60 0.40
## X0003.HK    3  0.07  0.71 -0.28  0.09  0.17 0.63 0.37
## X0941.HK   34 -0.02  0.64  0.21  0.07  0.11 0.65 0.35
## X0700.HK   28  0.50 -0.07  0.58  0.03 -0.20 0.72 0.28
## X0762.HK   29 -0.05  0.31  0.51  0.22  0.09 0.63 0.37
## X0386.HK   24  0.01  0.42  0.50 -0.19  0.29 0.74 0.26
## X1880.HK   41  0.34 -0.12  0.45  0.19 -0.05 0.55 0.45
## X0144.HK   17  0.34 -0.01  0.42  0.09  0.19 0.70 0.30
## X0857.HK   31  0.27  0.32  0.36 -0.07  0.23 0.75 0.25
## X0322.HK   22  0.00 -0.04 -0.07  0.87 -0.10 0.65 0.35
## X0151.HK   18 -0.22 -0.06  0.24  0.77  0.18 0.67 0.33
## X1044.HK   35 -0.04 -0.05  0.41  0.62 -0.02 0.63 0.37
## X0836.HK   30 -0.20 -0.11  0.05  0.05  0.90 0.64 0.36
## X0330.HK   23  0.14 -0.12  0.01 -0.10  0.66 0.47 0.53
##
```

```
##                  PC1  PC2  PC4  PC3  PC5
## SS loadings    19.90 3.37 5.25 2.42 1.92
## Proportion Var  0.41 0.07 0.11 0.05 0.04
## Cumulative Var  0.41 0.48 0.59 0.64 0.68
##
##  With component correlations of
##      PC1  PC2  PC4  PC3  PC5
## PC1 1.00 0.47 0.58 0.58 0.62
## PC2 0.47 1.00 0.30 0.29 0.36
## PC4 0.58 0.30 1.00 0.33 0.40
## PC3 0.58 0.29 0.33 1.00 0.40
## PC5 0.62 0.36 0.40 0.40 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  52.76 0.3
## The degrees of freedom for the model are 898  and the objective function was  10.32
##  0.3The number of observations was  161  with Chi Square =  1443  with prob <  4.2e-28
##  0.3
## Fit based upon off diagonal values = 1
```

```
##                  PC1        PC2
## X0001.HK  0.9428350 -0.0076429
## X0002.HK  0.0455055  0.8460844
## X0003.HK  0.0731993  0.7051502
## X0004.HK  0.9418544 -0.1229007
## X0005.HK  0.6563023  0.1174939
## X0006.HK -0.1321841  0.7759951
## X0011.HK  0.8731858  0.0982574
## X0012.HK  0.8332312  0.1191501
## X0013.HK  0.8313139 -0.0331693
## X0016.HK  0.9049738  0.0950925
## X0017.HK  0.8627528 -0.0600843
## X0019.HK  0.5342500  0.0705997
## X0023.HK  0.7370025  0.1121929
## X0066.HK  0.4521688  0.3484067
## X0083.HK  0.8395005  0.0603184
## X0101.HK  0.8546936  0.0187145
## X0144.HK  0.3372516 -0.0050469
## X0151.HK -0.2179565 -0.0603803
## X0267.HK  0.6456198 -0.0508754
## X0291.HK  0.5456977 -0.0266660
## X0293.HK  0.6157243 -0.2072322
## X0322.HK -0.0003398 -0.0385846
## X0330.HK  0.1441912 -0.1246808
## X0386.HK  0.0113764  0.4183014
## X0388.HK  0.9034276 -0.0002266
## X0494.HK  0.4559238 -0.0054168
## X0688.HK  0.7843964 -0.2411229
## X0700.HK  0.4996541 -0.0650457
## X0762.HK -0.0537106  0.3120788
## X0836.HK -0.2022254 -0.1076901
## X0857.HK  0.2738014  0.3156969
## X0883.HK  0.4801267  0.1210648
## X0939.HK  0.6330759  0.0970916
## X0941.HK -0.0219716  0.6434789
## X1044.HK -0.0368977 -0.0462186
```

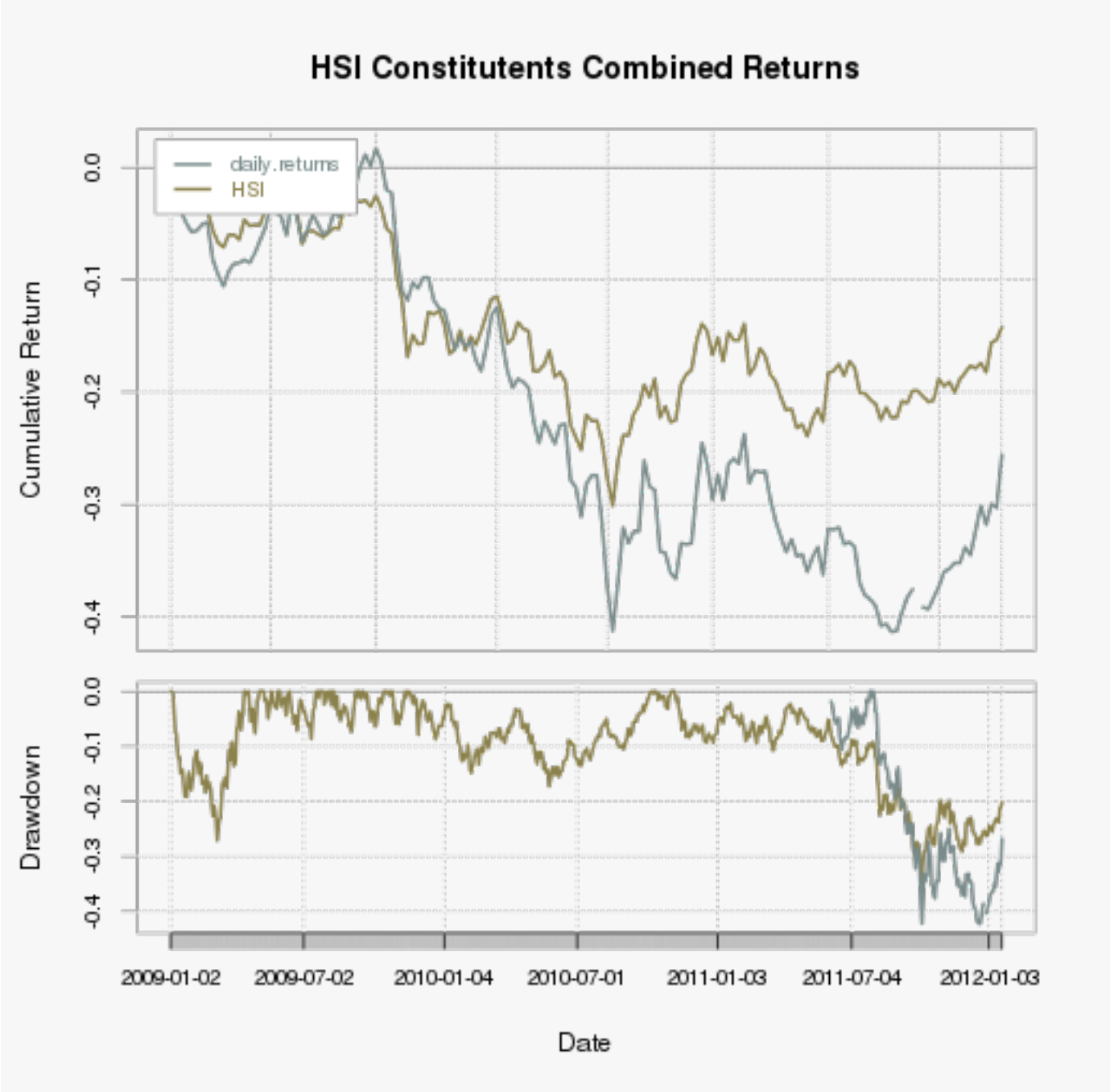
```
## X1088.HK  0.4429778  0.1520992
## X1109.HK  0.7483877 -0.3315253
## X1199.HK  0.5649666 -0.0414762
## X1299.HK  0.5037379  0.0552736
## X1398.HK  0.7816685  0.0411001
## X1880.HK  0.3375562 -0.1220520
## X1898.HK  0.6410733  0.1063179
## X2318.HK  0.8578154 -0.0802173
## X2388.HK  0.7880993  0.0597281
## X2600.HK  0.7519603 -0.0333176
## X2628.HK  0.5942881  0.1215982
## X3328.HK  0.7019303  0.0622847
## X3988.HK  0.6789520  0.1204251
```



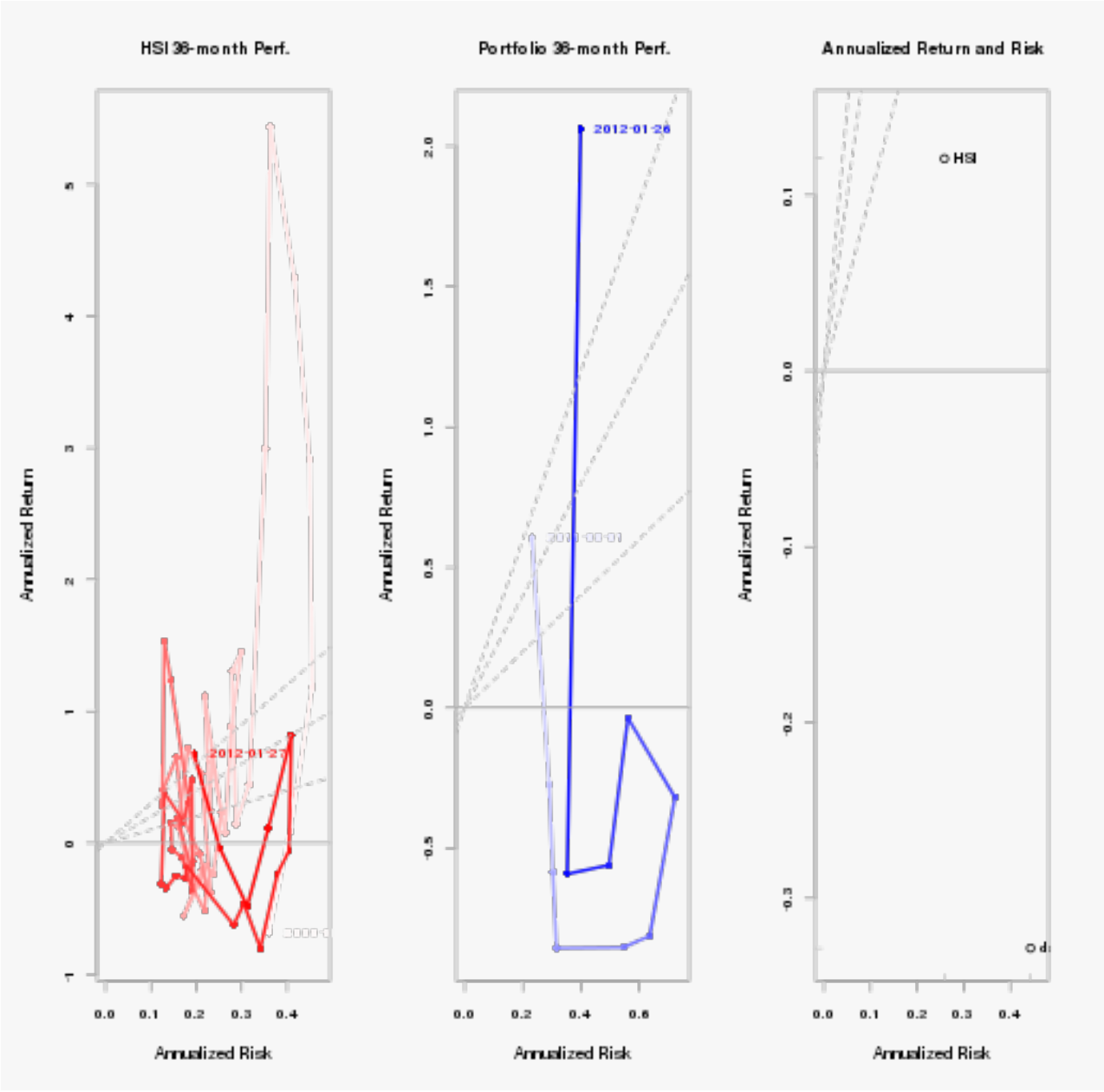
PCA is a science in itself and can not be fully covered and even less interpreted in this paper. The factors produced by principal component analysis are conceptualized as being linear combinations of the variables whereas the factors produced by common factor analysis are conceptualized as being latent 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

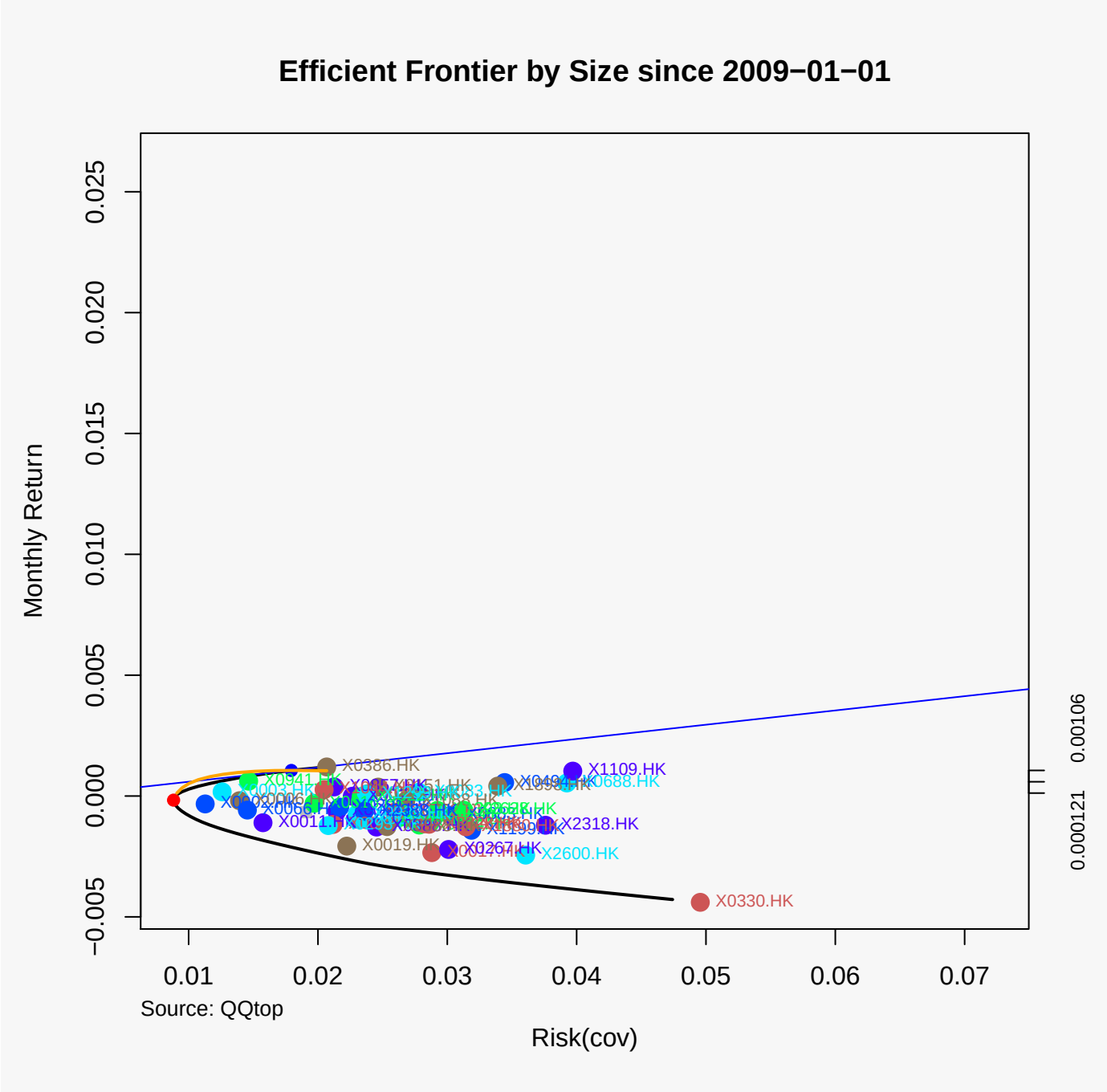
6.1 Performance Chart



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   0.0000   0.0000   0.0000
## 25   0.0000   0.1435   0.0000   0.0000   0.0000   0.2427   0.1190   0.0000
## 37   0.0000   0.2612   0.2257   0.0000   0.0000   0.2206   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   0.0212   0.0304   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.1761   0.4832   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.0778   0.3015   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0026   0.0000   0.0543   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   0.9484   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.3407   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.1155   0.0000
## 37   0.0000   0.0089   0.0000   0.0005   0.0522   0.0544   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   0.0695   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   0.0501   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   0.0000   0.0000   0.0000
## 25   0.0000   0.0587   0.0000   0.0000   0.0000   0.0835   0.0938   0.0000
## 37   0.0000   0.2611   0.2259   0.0000   0.0000   0.2206   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   0.0050   0.0039   0.0000   0.0000   0.0000   0.0000
## 13   0.0000   0.0000   0.1296   0.2951   0.0000   0.0000   0.0000   0.0000
## 25   0.0000   0.0000   0.1081   0.3796   0.0000   0.0000   0.0000   0.0000
## 37   0.0000   0.0000   0.0000   0.0026   0.0000   0.0543   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   0.9910   0.0000
## 13   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.5753   0.0000
## 25   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.2763   0.0000
## 37   0.0000   0.0090   0.0000   0.0005   0.0521   0.0544   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   0.0501   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  0.0474  0.0474  0.1253  0.0742
## 13 -0.0029 -0.0029  0.0252  0.0252  0.0645  0.0470
## 25 -0.0015 -0.0015  0.0137  0.0137  0.0340  0.0275
## 37 -0.0002 -0.0002  0.0088  0.0088  0.0191  0.0159
## 49  0.0012  0.0012  0.0207  0.0207  0.0426  0.0267
##
## Description:
##  Sat Jan 28 13:04:03 2012 by user:
```

7 HSI Components Ratios

7.1 Sharpe Ratio - Combined

```
##                                          daily.returns
## Annualized StdDev Sharpe (Rf=0%, p=95%):       -0.7407
## Annualized VaR Sharpe (Rf=0%, p=95%):          -7.5157
## Annualized ES Sharpe (Rf=0%, p=95%):           -5.8916
```

7.2 Sharpe - Distinct

```
##                                          X0001.HK X0002.HK X0003.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.3416   0.4422   0.6358
## Annualized VaR Sharpe (Rf=0%, p=95%):      3.6398   4.4491   6.0781
## Annualized ES Sharpe (Rf=0%, p=95%):       2.8306   3.1290   2.6195
##                                          X0004.HK X0005.HK X0006.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.6351  -0.1392   0.4381
## Annualized VaR Sharpe (Rf=0%, p=95%):      6.9387  -1.4479   4.4828
## Annualized ES Sharpe (Rf=0%, p=95%):       5.4498  -0.6976   3.1992
##                                          X0011.HK X0012.HK X0013.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):  -0.0413    0.342   0.6599
## Annualized VaR Sharpe (Rf=0%, p=95%):     -0.4746    3.781   7.2312
## Annualized ES Sharpe (Rf=0%, p=95%):      -0.4481    3.010   5.5915
##                                          X0016.HK X0017.HK X0019.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.5525   0.0344   0.4165
## Annualized VaR Sharpe (Rf=0%, p=95%):      5.9025   0.3625   4.1261
## Annualized ES Sharpe (Rf=0%, p=95%):       4.6028   0.2538   2.4359
##                                          X0023.HK X0066.HK X0083.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.6833   0.5405   0.3777
## Annualized VaR Sharpe (Rf=0%, p=95%):      8.4760   6.3166   3.9936
## Annualized ES Sharpe (Rf=0%, p=95%):       8.2447   5.3790   2.9126
##                                          X0101.HK X0144.HK X0151.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.3303   0.4084   0.9041
## Annualized VaR Sharpe (Rf=0%, p=95%):      3.6100   4.3836   9.6775
## Annualized ES Sharpe (Rf=0%, p=95%):       2.8653   3.4789   7.3165
##                                          X0267.HK X0291.HK X0293.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2946   0.6806   0.5125
## Annualized VaR Sharpe (Rf=0%, p=95%):      3.4141   7.3679   5.3575
## Annualized ES Sharpe (Rf=0%, p=95%):       2.9041   5.8946   4.0019
##                                          X0322.HK X0330.HK X0386.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    1.065  -0.6947   0.6734
## Annualized VaR Sharpe (Rf=0%, p=95%):      14.540  -6.3920   6.9343
## Annualized ES Sharpe (Rf=0%, p=95%):       14.540  -3.4089   5.2125
##                                          X0388.HK X0494.HK X0688.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.5679  -0.0128   0.2538
## Annualized VaR Sharpe (Rf=0%, p=95%):      6.4313  -0.1293   2.9504
## Annualized ES Sharpe (Rf=0%, p=95%):       5.2396  -0.1054   2.5381
##                                          X0700.HK X0762.HK X0836.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):    1.305   0.4112  -0.0232
## Annualized VaR Sharpe (Rf=0%, p=95%):      13.800   4.5845  -0.2376
## Annualized ES Sharpe (Rf=0%, p=95%):       10.238   3.6712  -0.1887
##                                          X0857.HK X0883.HK X0939.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.5041    0.685   0.3336
## Annualized VaR Sharpe (Rf=0%, p=95%):      5.0726    7.170   3.3065
## Annualized ES Sharpe (Rf=0%, p=95%):       3.8410    5.379   2.2937
##                                          X0941.HK X1044.HK X1088.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):  -0.0582    1.142   0.6699
## Annualized VaR Sharpe (Rf=0%, p=95%):     -0.6134   12.626   6.7861
## Annualized ES Sharpe (Rf=0%, p=95%):      -0.4725    9.816   5.2069
##                                          X1109.HK X1199.HK X1299.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2611   0.2305   0.3671
## Annualized VaR Sharpe (Rf=0%, p=95%):      3.0728   2.5375   3.7855
## Annualized ES Sharpe (Rf=0%, p=95%):       2.6527   2.0368   2.3761
##                                          X1398.HK X1880.HK X1898.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.2434    1.141   0.3303
## Annualized VaR Sharpe (Rf=0%, p=95%):      2.7412   12.965   3.2339
```

```
## Annualized ES Sharpe (Rf=0%, p=95%):       2.2343   10.247   2.1906
##                                          X2318.HK X2388.HK X2600.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):   0.3528   0.9222  -0.0635
## Annualized VaR Sharpe (Rf=0%, p=95%):      3.7363  10.5629  -0.6759
## Annualized ES Sharpe (Rf=0%, p=95%):       2.6760   8.5410  -0.5348
##                                          X2628.HK X3328.HK X3988.HK
## Annualized StdDev Sharpe (Rf=0%, p=95%):  -0.0653   0.0484    0.453
## Annualized VaR Sharpe (Rf=0%, p=95%):     -0.6503   0.4898    4.762
## Annualized ES Sharpe (Rf=0%, p=95%):      -0.4547   0.3617    3.450
```

7.3 Information Ratio - Combined

```
## [1] "Information Ratio :  -0.5338"
```

7.4 Information Ratio - Distinct

```
##                         X0001.HK X0002.HK X0003.HK X0004.HK X0005.HK
## Information Ratio: HSI  -0.0605  -0.2398   0.0999   0.4748  -0.6751
##                         X0006.HK X0011.HK X0012.HK X0013.HK X0016.HK
## Information Ratio: HSI  -0.1521   -0.642    6e-04   0.4388   0.3001
##                         X0017.HK X0019.HK X0023.HK X0066.HK X0083.HK
## Information Ratio: HSI  -0.3626    0.057   0.4711   0.0079   0.1282
##                         X0101.HK X0144.HK X0151.HK X0267.HK X0291.HK
## Information Ratio: HSI   0.0541   0.2087    0.544   0.0261   0.4485
##                         X0293.HK X0322.HK X0330.HK X0386.HK X0388.HK
## Information Ratio: HSI   0.2007   0.6499   -1.044   0.4626   0.4133
##                         X0494.HK X0688.HK X0700.HK X0762.HK X0836.HK
## Information Ratio: HSI   0.4799  -0.0238    1.263   0.0871  -0.3909
##                         X0857.HK X0883.HK X0939.HK X0941.HK X1044.HK
## Information Ratio: HSI   0.2692   0.6502  -0.0626  -0.7079   0.7876
##                         X1088.HK X1109.HK X1199.HK X1299.HK X1398.HK
## Information Ratio: HSI   0.5914   0.0243  -0.0213   0.8754  -0.1766
##                         X1880.HK X1898.HK X2318.HK X2388.HK X2600.HK
## Information Ratio: HSI    0.984   0.1185   0.1167   0.7544  -0.4488
##                         X2628.HK X3328.HK X3988.HK
## Information Ratio: HSI  -0.6719  -0.5305   0.1542
```

8 HSI Components Table Latest Quotes

```
## [1] "Date :  2012-01-27 02:59:00"

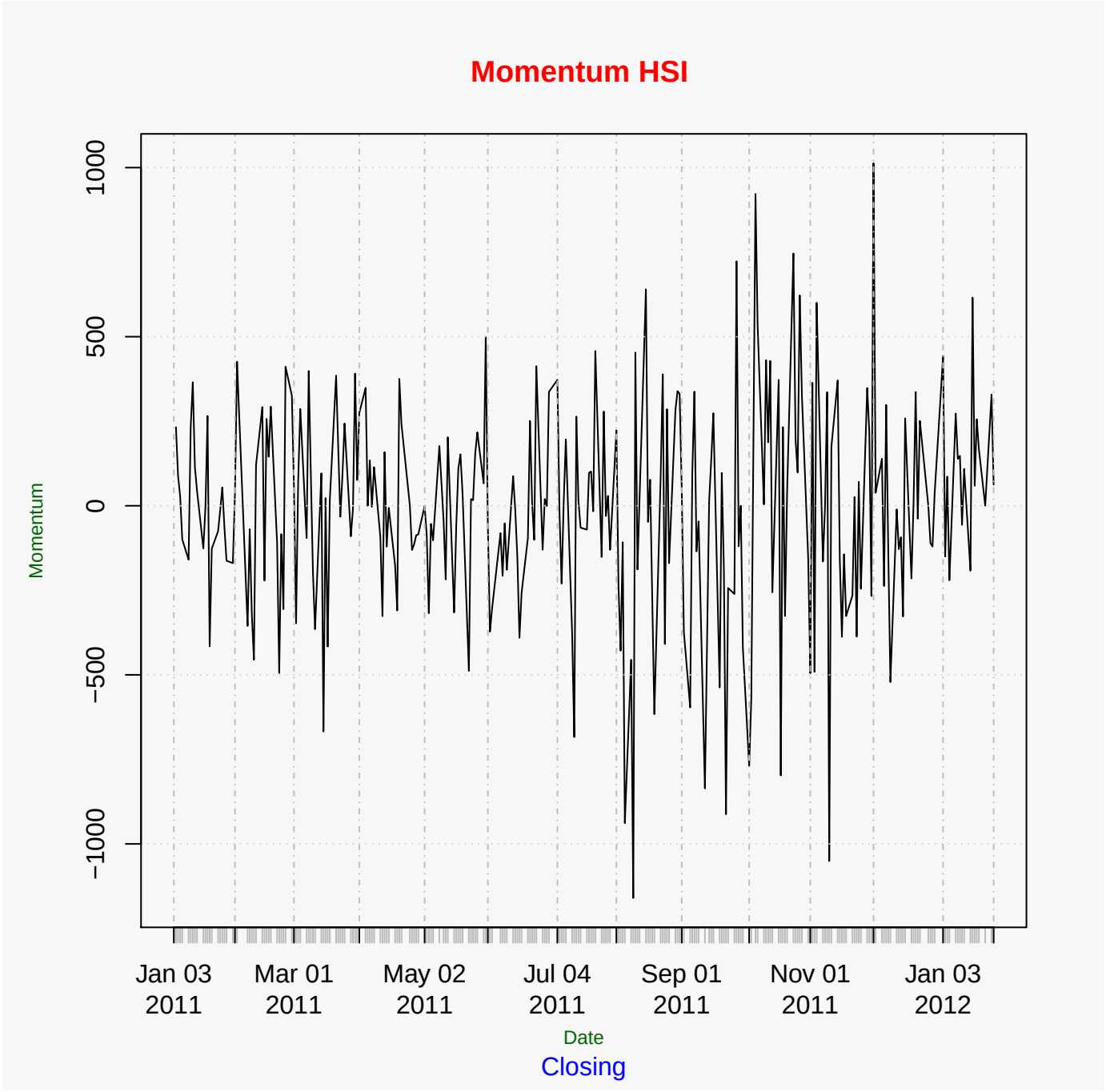
##                    Name    Bid    Ask Change   52-week Range
## 0001.HK     CHEUNG KONG 103.40 103.50  -2.20  79.10 - 137.60
## 0002.HK    CLP HOLDINGS  62.90  63.05   0.55   59.85 - 75.20
## 0003.HK  HK & CHINA GAS  18.20  18.28  -0.10   16.70 - 19.68
## 0004.HK  WHARF HOLDINGS  43.90  43.95  -0.55   33.15 - 61.70
## 0005.HK   HSBC HOLDINGS  65.60  65.70   0.60   56.35 - 91.90
## 0006.HK    POWER ASSETS  54.60  54.70   1.25   48.10 - 64.80
## 0011.HK  HANG SENG BANK 102.40 102.50   0.90  84.40 - 134.40
## 0012.HK  HENDERSON LAND  43.30  43.35   0.40   33.20 - 61.50
## 0013.HK       HUTCHISON  73.35  73.60   0.05   53.60 - 97.45
## 0016.HK         SHK PPT 109.50 109.90  -1.30  85.45 - 133.10
## 0017.HK   NEW WORLD DEV   8.60   8.61   0.08    7.00 - 15.22
## 0019.HK SWIRE PACIFIC A  81.85  81.95  -0.05  79.30 - 124.80
## 0023.HK  BANK OF E ASIA  31.85  32.20  -0.30   21.85 - 35.90
## 0066.HK MTR CORPORATION  25.65  25.80   0.10   22.45 - 31.55
## 0083.HK       SINO LAND  13.00  13.08   0.02    9.33 - 18.90
## 0101.HK   HANG LUNG PPT  27.00  27.05  -0.10   20.85 - 40.50
## 0144.HK  CHINA MER HOLD  26.80  26.90   0.90   19.00 - 37.60
## 0151.HK WANT WANT CHINA   7.14   7.15  -0.25     5.68 - 8.30
## 0267.HK   CITIC PACIFIC  14.86  14.88   0.10   10.26 - 24.60
## 0291.HK CHINA RESOURCES  27.15  27.25  -0.65   24.10 - 35.50
## 0293.HK  CATHAY PAC AIR  14.82  14.92   0.14   11.80 - 24.10
## 0322.HK          TINGYI  22.70  22.80   0.00   17.32 - 26.00
## 0330.HK ESPRIT HOLDINGS  11.72  11.74   0.38    7.55 - 45.65
## 0386.HK    SINOPEC CORP   9.22   9.23   0.09     6.22 - 9.22
## 0388.HK            HKEX 134.20 134.40   0.10  99.15 - 198.60
## 0494.HK       LI & FUNG  18.40  18.42   0.60   10.82 - 50.75
## 0688.HK  CHINA OVERSEAS  15.04  15.10  -0.52    9.99 - 17.86
## 0700.HK         TENCENT 181.10 181.20  -1.60 139.90 - 230.80
## 0762.HK    CHINA UNICOM  14.96  14.98   0.32   10.24 - 17.68
## 0836.HK CHINA RES POWER  14.84  14.88   0.20   10.82 - 16.44
## 0857.HK      PETROCHINA  11.42  11.44  -0.10    8.59 - 12.50
## 0883.HK           CNOOC  15.80  15.84   0.00   11.20 - 21.30
## 0939.HK             CCB   6.21   6.22   0.03     4.41 - 8.47
## 0941.HK    CHINA MOBILE  78.95  79.00   1.45   68.05 - 83.80
## 1044.HK    HENGAN INT'L  68.35  68.40  -1.15   54.10 - 75.40
## 1088.HK   CHINA SHENHUA  34.75  34.85  -0.30   27.10 - 40.20
## 1109.HK  CHINA RES LAND  14.06  14.10  -0.30    7.28 - 17.24
## 1199.HK   COSCO PACIFIC  11.18  11.22   0.06    7.52 - 17.16
## 1299.HK             AIA  26.30  26.35   0.05   19.84 - 29.90
## 1398.HK            ICBC   5.59   5.60   0.05     3.46 - 6.90
## 1880.HK     BELLE INT'L  12.32  12.34  -0.06   11.56 - 17.54
## 1898.HK      CHINA COAL  10.02  10.06  -0.14    6.59 - 15.08
## 2318.HK         PING AN  61.40  61.50   0.45   37.35 - 96.25
## 2388.HK   BOC HONG KONG  20.70  20.80  -0.05   14.24 - 25.80
## 2600.HK          CHALCO   4.07   4.08  -0.05     3.20 - 8.30
## 2628.HK      CHINA LIFE  22.85  22.90  -0.20   17.04 - 31.10
## 3328.HK        BANKCOMM   6.32   6.34   0.11     4.15 - 9.53
## 3988.HK   BANK OF CHINA   3.36   3.37   0.02     2.20 - 5.02
```

9 Hang Seng Index

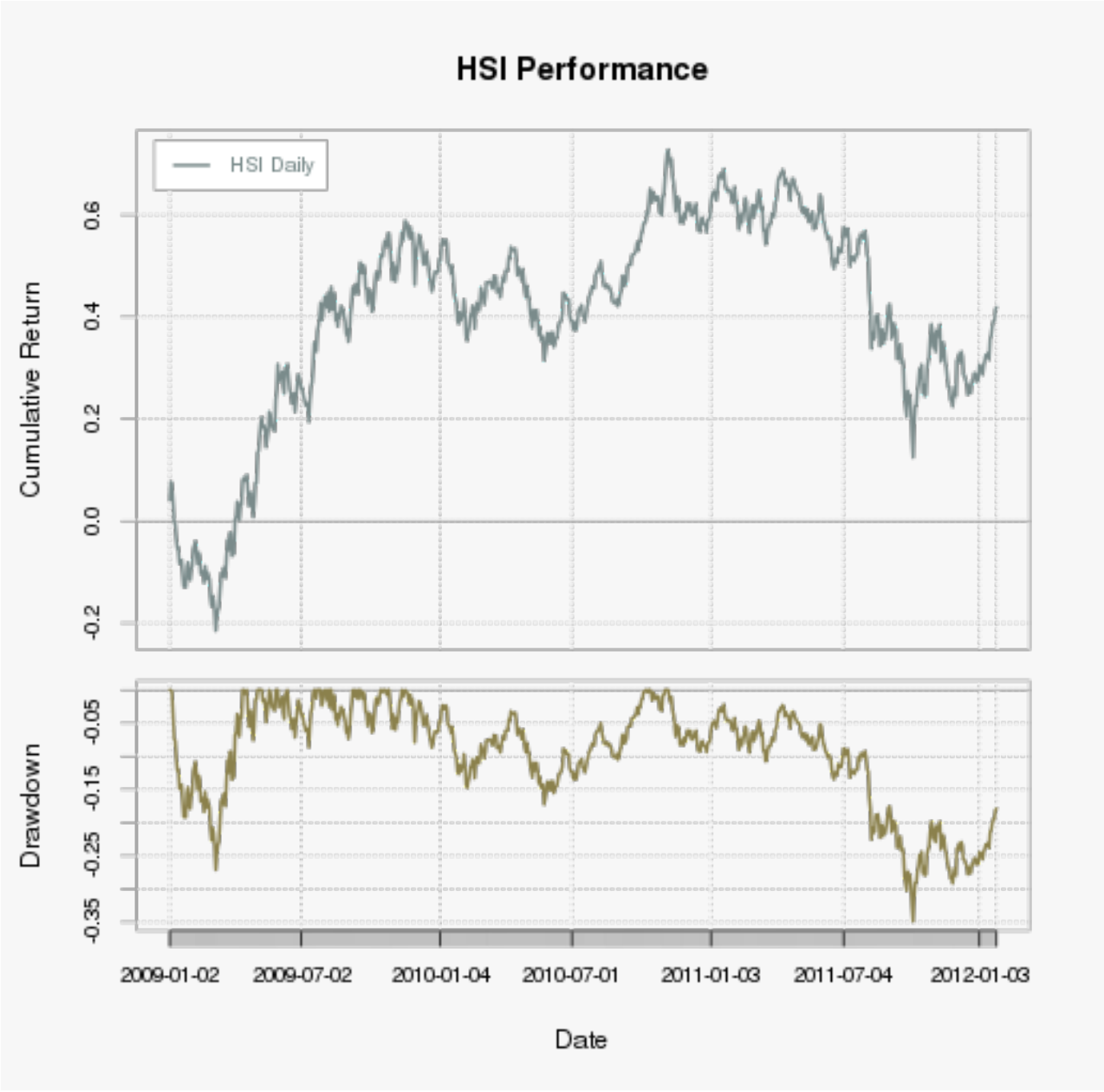
Latest Hang Seng Index

	Trade Time	Name	Last	Change	Days Range	52−week Range
^HSI	2012−01−27 03:01:00	HANG SENG INDEX	20502	62.53	20384.051 − 20590.801	16170.30 − 24468.60

9.1 Hang Seng Index - Momentum



9.2 HSI Performance



9.3 HSI Ratios

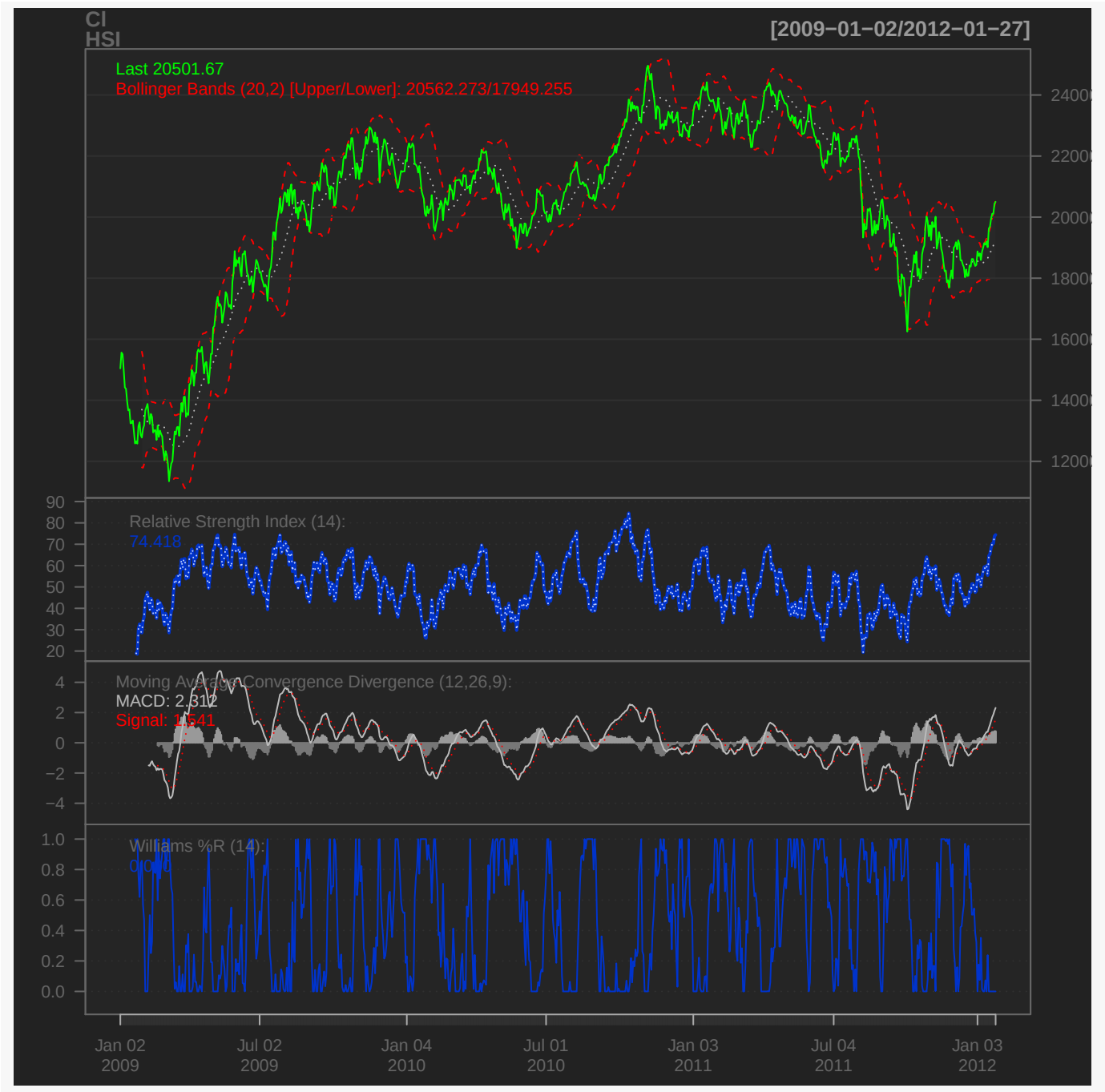
```
##              RSI
## 2012-01-12 58.15
## 2012-01-13 59.94
## 2012-01-16 55.43
## 2012-01-17 64.62
## 2012-01-18 65.36
## 2012-01-19 68.43
## 2012-01-20 70.29
## 2012-01-23 70.29
## 2012-01-26 73.80
## 2012-01-27 74.42
```

```
##              macd signal
## 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
## 2012-01-19 1.4466 0.7954
## 2012-01-20 1.6981 0.9759
## 2012-01-23 1.8730 1.1554
## 2012-01-26 2.1206 1.3484
## 2012-01-27 2.3124 1.5412
```

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

```
##                dn  mavg    up   pctB
## 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
## 2012-01-19 18022 18900 19778 1.0937
## 2012-01-20 17991 18985 19979 1.0660
## 2012-01-23 18005 19072 20138 0.9869
## 2012-01-26 17962 19162 20362 1.0321
## 2012-01-27 17949 19256 20562 0.9768
```

```
##            WPR %
## 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
## 2012-01-19  0.00
## 2012-01-20  0.00
## 2012-01-23  0.00
## 2012-01-26  0.00
## 2012-01-27  0.00
```


CI
HSI
[2009−01−02/2012−01−27]
Last 20501.67
Bollinger Bands (20,2) [Upper/Lower]: 20562.273/17949.255
Relative Strength Index (14):
74.418
Moving Average Convergence Divergence (12,26,9):
MACD: 2.312
Signal: 1.541
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%):    0.4667      0.4322
## Annualized VaR Sharpe (Rf=0%, p=95%):       4.7917      1.0462
## Annualized ES Sharpe (Rf=0%, p=95%):        3.5365      0.8289
```

```
##          HSI-Daily HSI-Monthly
## Skewness    0.1166      0.1288
```

```
##          HSI-Daily HSI-Monthly
## Kurtosis     1.393     -0.1372
```

```
##       Index              HSI Daily
##  Min.   :2009-01-02   Min.   :-0.056605
##  1st Qu.:2009-10-08   1st Qu.:-0.008080
##  Median :2010-07-15   Median : 0.000300
##  Mean   :2010-07-15   Mean   : 0.000585
##  3rd Qu.:2011-04-18   3rd Qu.: 0.010193
##  Max.   :2012-01-27   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   : 0.01080
##  3rd Qu.:2011-04-29   3rd Qu.: 0.03806
##  Max.   :2012-01-27   Max.   : 0.17074
```

10 Dataset First and Last Rows Info

```
##            X0001.HK.Close
## 2009-01-02           76.9
## 2012-01-26          105.4
##            X0002.HK.Close
## 2009-01-02           52.4
## 2012-01-26           62.5
##            X0003.HK.Close
## 2009-01-02          12.08
## 2012-01-26          18.34
##            X0004.HK.Close
## 2009-01-02          22.00
## 2012-01-26          44.35
##            X0005.HK.Close
## 2009-01-02          77.00
## 2012-01-26          65.05
##            X0006.HK.Close
## 2009-01-02          42.75
## 2012-01-26          53.60
##            X0011.HK.Close
## 2009-01-02          104.7
## 2012-01-26          101.5
##            X0012.HK.Close
## 2009-01-02          30.35
## 2012-01-26          42.95
##            X0013.HK.Close
## 2009-01-02          39.85
## 2012-01-26          73.45
##            X0016.HK.Close
## 2009-01-02           67.3
## 2012-01-26          111.0
##            X0017.HK.Close
## 2009-01-02           8.18
## 2012-01-26           8.54
##            X0019.HK.Close
## 2009-01-02          55.75
## 2012-01-26          82.10
##            X0023.HK.Close
## 2009-01-02          16.68
## 2012-01-26          32.40
##            X0066.HK.Close
## 2009-01-02          18.08
## 2012-01-26          25.70
##            X0083.HK.Close
## 2009-01-02           8.36
## 2012-01-26          13.08
##            X0101.HK.Close
## 2009-01-02          18.36
## 2012-01-26          27.15
##            X0144.HK.Close
## 2009-01-02           15.4
## 2012-01-26           26.0
##            X0151.HK.Close
## 2009-01-02           3.17
## 2012-01-26           7.41
##            X0267.HK.Close
```

```
## 2009-01-02          10.20
## 2012-01-26          14.78
##            X0291.HK.Close
## 2009-01-02           14.0
## 2012-01-26           27.9
##            X0293.HK.Close
## 2009-01-02           8.91
## 2012-01-26          14.74
##            X0322.HK.Close
## 2009-01-02           8.98
## 2012-01-26          22.80
##            X0330.HK.Close
## 2009-01-02          44.80
## 2012-01-26          11.32
##            X0386.HK.Close
## 2009-01-02           4.96
## 2012-01-26           9.14
##            X0388.HK.Close
## 2009-01-02           76.6
## 2012-01-26          134.2
##            X0494.HK.Close
## 2011-06-02          17.92
## 2012-01-26          17.84
##            X0688.HK.Close
## 2009-01-02          11.22
## 2012-01-26          15.54
##            X0700.HK.Close
## 2009-01-01           50.0
## 2012-01-26          183.3
##            X0762.HK.Close
## 2009-01-01           9.63
## 2012-01-26          14.68
##            X0836.HK.Close
## 2009-01-02          15.12
## 2012-01-26          14.76
##            X0857.HK.Close
## 2009-01-02           7.20
## 2012-01-26          11.56
##            X0883.HK.Close
## 2009-01-02           7.59
## 2012-01-26          15.86
##            X0939.HK.Close
## 2009-01-02           4.52
## 2012-01-26           6.20
##            X0941.HK.Close
## 2009-01-02           81.2
## 2012-01-26           77.6
##            X1044.HK.Close
## 2009-01-01          24.90
## 2012-01-26          69.45
##            X1088.HK.Close
## 2009-01-02          17.40
## 2012-01-26          35.25
##            X1109.HK.Close
## 2009-01-02           9.90
## 2012-01-26          14.38
##            X1199.HK.Close
```

```
## 2009-01-02           8.07
## 2012-01-26          11.18
##            X1299.HK.Close
## 2010-10-29           23.1
## 2012-01-26           26.4
##            X1398.HK.Close
## 2009-01-02           4.30
## 2012-01-26           5.52
##            X1880.HK.Close
## 2009-01-02           3.50
## 2012-01-26          12.38
##            X1898.HK.Close
## 2009-01-02           6.55
## 2012-01-26          10.20
##            X2318.HK.Close
## 2009-01-02          39.60
## 2012-01-26          61.15
##            X2388.HK.Close
## 2009-01-02           9.06
## 2012-01-26          20.80
##            X2600.HK.Close
## 2009-01-02           4.55
## 2012-01-26           4.12
##            X2628.HK.Close
## 2009-01-02          24.75
## 2012-01-26          23.05
##            X3328.HK.Close
## 2009-01-02           5.91
## 2012-01-26           6.23
##            X3988.HK.Close
## 2009-01-02           2.17
## 2012-01-26           3.34
```

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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