Data Analysis for Hedge Fund Returns Using the ICSFA Textile Plot

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Outline

- Introduction to the ICS FinAnalyzer (ICSFA)
- Data analysis for hedge fund return data
  - Dataset used for data analysis
    - C/S Tremont Hedge fund Index
    - CISDM hedge fund database
  - Analyses by ICSFA
    - Disnormality and serial correlation of distribution of hedge fund returns
    - Test of several risk measurements on the ICSFA
    - Fitting of multi factor model
    - Clustering of hedge fund return data
1. The ICS FinAnalyzer
The ICS FinAnalyzer

• Basic concepts
  – The ICSFA
    • provides us with a simple interface for exploring data stored in relational database management systems.
    • provides us with enough background information of the data.
    • has functions to perform typical analysis for financial data.

We designed the ICSFA using a framework of DandD (Data and Description) suggested by Data Science Laboratory in Keio University [Yokouchi and Shibata (2004)].
ICSFA adopts textile plot [Kumasaka and Shibata (2006)] for an interface to handle the data. Through the interface, we can examine performance of an individual hedge fund, or performances of hedge funds with the same strategy, for example, Equity Long/Short, Global Macro, Convertible Arbitrage and so on.
Each of 53 blue broken lines represents an individual hedge fund respectively.
By pushing the “Data” tab, we can obtain a list of information of hedge funds displayed on the Textile plot.
User can select data by mouse clicking or dragging. Red lines indicate the selected data.

The textile plot allows us to browse several datasets as a chart simultaneously.

In this plot, the blue lines are time series of monthly returns of hedge funds, and the red lines are returns of S&P 500, USD INDEX, and USD LIBOR 1 month.
User can obtain detailed information of the selected fund on a textile plot by calling the screening window.
This plot shows transpose of the time series data. Each of broken lines represents returns of hedge funds one month. The left most axis corresponds to date information, and the other axes correspond to individual hedge funds respectively.

We can easily understand distribution of returns of a hedge fund by browsing each axis.
2. Disnormality and Serial Correlation of Hedge Fund Returns
Distribution of hedge fund returns

• Many studies on hedge fund returns said that
  – distribution of returns of hedge fund or hedge fund index has negative skewness and large kurtosis. That is the returns are not normally distributed.
    • Malkiel and Saha (2005)
    • Miura et al. (2008)
  – there are serial correlation among returns of a hedge fund or hedge fund index.
    • Getmansky, Lo, and Makarov (2004)
    • Miura et al. (2008)
Table: Statistics, p value of Shapiro-Wilk Test and p value of Box-Ljung Test with CS/Tremont Hedge Fund Index (Jan. 1994 to Mar. 2009)

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The table 3-1 shows that returns of almost all the strategy of hedge fund index may be not normally distributed and most of the distributions may have negative skewness and large kurtosis. There may be also serial correlation in them.

We would like to pay attention to Distressed Securities Index because of its illiquidity.

From Jun. 1994 to Dec. 1998

LTCM crisis
This is detailed information of the Distressed Securities Index, which are provided by the ICSFA automatically. The Index has negative skewness and large kurtosis as the previous studies proved.

Outlier of the histogram corresponds to the return on the period of the LTCM crisis.
In order to eliminate impact of the LTCM crisis, we somewhat shorten the period.

This is a histogram of the returns from Jan. 1994 to Dec. 1997.

Its skewness and kurtosis are close to 0.
The returns of the Distressed Securities index just before the LTCM crisis pass the Shapiro Wilk normality test although there may remain still serial correlation.

Negative skewness, large kurtosis and disnormality of the return distribution of hedge fund index may arise from the financial crisis. We also checked several distressed securities hedge funds and confirmed the same property in returns of them.
3. Application of the existing risk measurements using the Textile Plot
Values of VAR95 are calculated using monthly returns from 1993 to 1997.

As far as the plot shows, the values of VAR95 are underestimated. We checked CVaR95 and CCD, and the results followed a similar pattern of VAR95.
Values of VAR95 are calculated using monthly returns from 1993 to 1998. The period includes that of the LTCM crisis.

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We checked CVaR95 and CCD, and the results followed a similar pattern of VAR95.
4. Multi Factor Model
Style Analysis

• We perform style analysis of hedge fund returns in CISDM database using multi factor model suggested by Fung and Hsieh (2001).
    • S&P500 return,
    • Fama and French SMB (size spread factor),
    • a bond market factor
    • a credit spread factor
    • a bond trend following factor
    • a currency trend following factor
    • a commodity trend following factor

For capturing the nonlinear payoff strategies commonly used by many hedge funds.

We would like to introduce a few results of the model fitting.
7 factors suggested by Fung and Hsieh (2001).
Average of sensitivity of Equity Long/Short hedge fund returns.

In this plot, sensitivity of equity market factor and size spread factor are always higher than other factors.

From 12-1994 to 12-1996

From 12-1994 to 12-1998
Average of sensitivity of Distressed Securities hedge fund returns.

Adjusted determination coefficients increase after the LTCM crisis, and simultaneously sensitivity of credit spread factor increases. This may mean a kind of revelation of liquid risk.
Average of sensitivity of Fixed Income Arbitrage hedge fund returns.

As with the case of distressed securities hedge funds, adjusted determination coefficients increase after the LTCM crisis, and simultaneously sensitivity of credit spread factor increases.
5. Classification of hedge funds using measurements of dissimilarity and its application
Classification of hedge fund returns in the same category

- The returns of hedge funds with the same category are differently distributed very much nonetheless they has a common strategy.
  - This result seems to depend on ability of each fund manager.
  - Then, we would like to classify the fund managers who take similar tactics of investment.

We try to classify the returns of hedge funds with the same strategy by defining a dissimilarity between $R_{i,t}$ (a return of FUND i at time t ) and $R_{j,t}$ as

$$\text{Dissimilarity}_{i,j} = \frac{1}{T} \sum_{t=1}^{T} \left( R_{i,t} - R_{j,t} \right)^2.$$
Moving average of dissimilarities of all pairs of hedge fund returns in the same strategy
Moving average of correlations of all pairs of hedge fund returns in the same strategy.
Monthly returns of Equity Long/Short (From Jan. 1994 to Dec. 1998)
We divide hedge funds with Equity Long/Short strategy into three clusters based on Euclidian distances between all pairs of returns of hedge funds.

The red line indicates returns of S&P500.

From Jan. 1994 to Dec. 1998
Monthly returns of cluster 1, the first principal component of the cluster1 (its contribution is about 51%) and S&P500 (From Jan. 1994 to Dec. 1998)

The two red lines respectively indicate returns of S&P500 and the principal component. The red lines of the two are very similar to each other.

The funds in the cluster 1 seem to have a long position in S&P500 and their portfolios have over 50% of S&P500.

From Jan. 1994 to Dec. 1998
Conclusion

- The ICSFA Textile Plot is useful for exploratory financial data analysis.
  - Through our exploratory analysis, we found
    - that disnormality of hedge fund returns often arises from the financial crisis.
    - that the existing risk measurements don’t always work at the period of the financial crisis.
    - that clustering and principal component analysis is often useful for style analysis of hedge fund.
  - We continue data analysis using the ICSFA and will organize the results into a paper.
- A part of the ICSFA will be open to public in the near future.
  - We are preparing a home page for the ICSFA in Hitotsubashi University ICS web site.
  - Through the web site, user will be able to download a part of the ICSFA freely.

I would like to thank you all for listening attentively.
References


