On the two-step smoothing technique for decomposition of financial time series data.

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This is a summary of my talk at the International Conference on Economics and Mathematical Sciences held at Josai University. I spoke on the new smoothing technique introduced in the paper by Shibata and Miura (1995).

1. Decomposition procedure.

The function lowess in the S software (Beckers and Chambers 1988) for statistical data analysis performs local regression at each time point and by connecting these points on the regression line coresponding to each time point it draws a curve which smoothes the original plot of the time series data.

Shibata and Miura (1995) applied the lowess function to the Japanese Yen Interest rate data twice, first to the original time series data with a span of yearly length, and secondly to the residuals series, which is the interest rate subtracted by the smooth value, with a span of monthly length. The first smoothing curve was named as long-term trend and the second one as short-term trend. The final residuals series was called irregular. Thus they decomposed the original time series into three time series.

2. The results of application of the decomposition procedure to the Japanese Yen Interest rate

Shibata and Miura (1995) applied the decomposition procedure to the seven time series data of interest rates; ranging from three months interest rate to ten year swap interest rate.

They were succesful in three aspects. First, the long-term trends for each time series data was drawn very well along with the movement of the Japanese prime interest rate. The trend was understood that it represents the macro-market nature of the data. Second, the short-term trend seemed to have represented the specific and local nature of the Japanese maket. It had , approximately but not precisely, a cyclic movements of three months lengths. This was understood to corespond to the demand of Yen cash in Japan. The third aspect was that the irregulars behave stationarily. The seven residual series together fit well to multivariate autoregressive model of order 2.

The second author came to the idea or concept of three levels of uncertainty; macro-level, micro- or local- level and dayly-level (See also Kishino and Miura (1995)), because the three decomposed time series really represent the movement of three levels of uncertainty described rather implicitly and heuristically in the financial articles in the Japanese newspapers and magazines, which he had analytically read.

3. Some thoughts in the decomposition.

Shibata and Miura (1995) does not claim that their decomposition procedure works well to any other financial time series. They think that the interest rate time series data had a certain structure and in the process of analysis they (practically the first author) created the two step-smoothing to squeeze out the structure they had seen after some trials and errors. The main stance in the analysis was that they (especially the first author) wanted the residual series to be stationary, which means that they wanted to take out all the nonstationary staff into the smoothing curve. It should be noted that the second smoothing short-term rather cyclic movement could not be taken out by the first smoothing since the span in the first smoothing was too long.

4. A remark

The decomposition procedure worked well to depict the structure of the time series data, retrospectively. The function lowess uses the data on both sides (future and past) of each time point. (At the right and left end of the whole time points it has some devise to compute the regression.) The authors did not mention whether or not the decomposition procedure be used well for a prediction purpose. This may require some specific device and will be a good subject in a future work.

References

R.A.Beckers, J.M.Chambers and A.R.Wilks. (1988) The new S Language. Wadsworth. California.

H.Kishino and R.Miura. (1995) Pricing of Bonds and their Derivatives with Multi-factor Stochastic Interest Rates : A Note. In Nonlinear and Convex Analysis in Economic Theory, edited by T.Maruyama and W.Takahashi. Springer. (Lecture Notes in Economics and Mathematical Systems.

R.Shibata and R.Miura (1995) Decomposition of Japanese Yen Interest rate Data through Local Regression. Technical Report No.434. July 1995. Department of Statistics, University of California, Berkeley, California. (to be published in the Journal of Financial Engineering and the Japanese Markets. 1997)