Master in Financial Engineering (EPFL)

Course: Financial Econometrics

Exercise session: Principal Components Analysis

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Exercise 1: The data file *d_swaps.txt* contains the following daily swap rates from 7/3/2000 to 7/15/2005. Especially, we make use of the following series (with different maturities): swp1y (1-year maturity), swp2y (2-year maturity), swp3y (3-year maturity), sw4y (4-year maturity), sw5y, sw7y, sw10y, and sw30y (30-year maturity).

Part I: Swap rates or first-difference swap rates?

1. Plot the daily swap rates series and the first-difference of each series.
   Remark: Let $\{x_t\}$ denote a (financial) time series. The first-differenced series is defined to be $\{y_t\}$ where $y_t = x_t - x_{t-1}$.

2. Determine the covariance (resp., correlation) matrix for the level series and the first-differenced series.

3. Comment the previous results.

Part II: Principal component analysis

Using all curves

1. Run a principal component analysis

2. Provide the eigenvalue decomposition, the contribution of each component (i.e., the % variation explained by each component) and the cumulative contribution (i.e, the explained cumulative % variation).

3. How many components can one choose?

4. Interpret the principal components.

5. Propose an approximate factor model with 1, 2, and 3 factor respectively.