Exchange rates modeling using Copulas

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Motivations

- National economical, trade and financial situation will be reflected in the exchange rate, that is, exchange rate movements can see the country in a given period of the financial situation.
- The financial situation of each country must be among the dependent, but not know the extent of dependency.

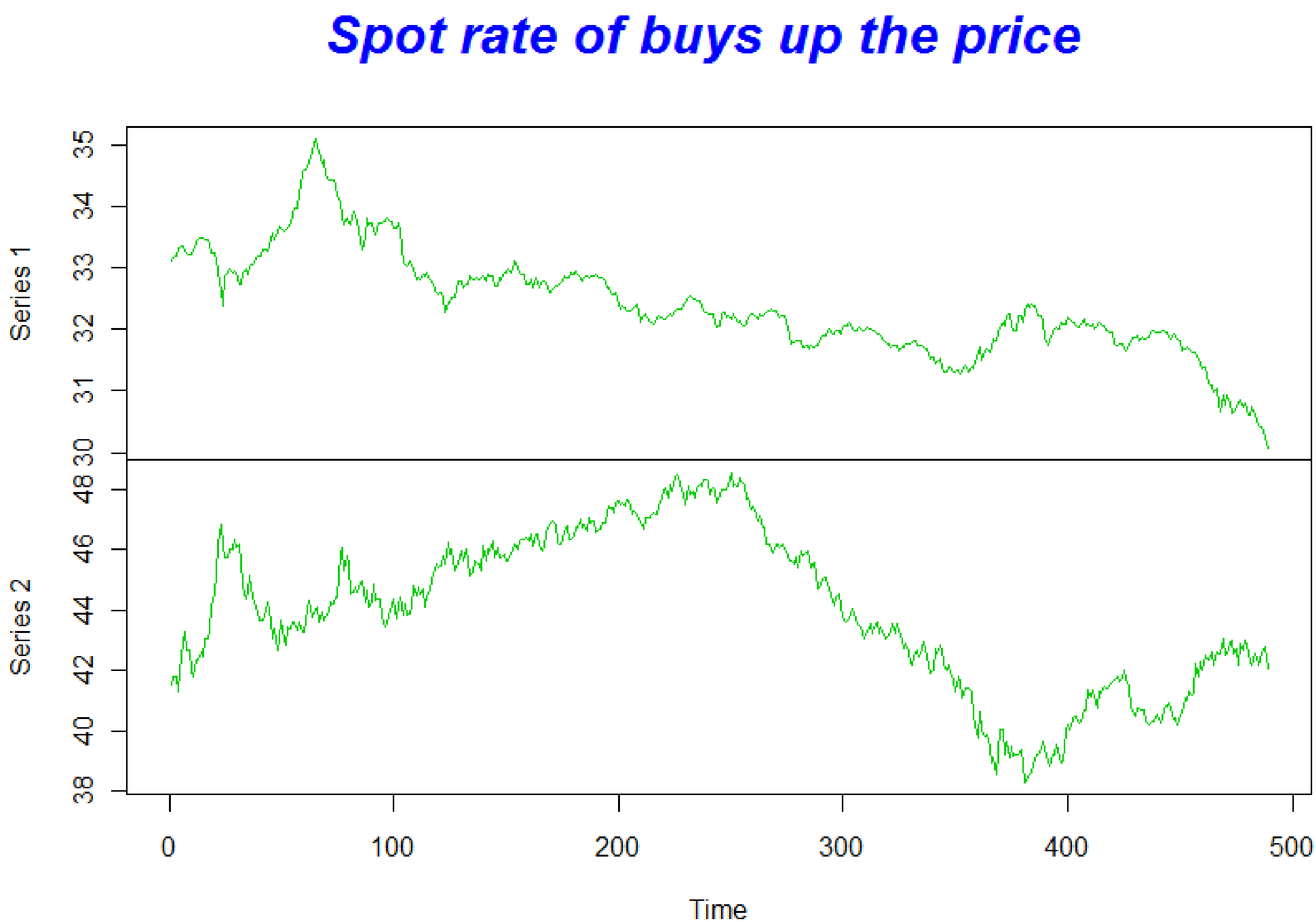
Motivations

- In the simple case, we do exchange rate research for the two developed countries.
- Using Copula function to describe the correlation of these two countries, and then write down their joint model, can predict the future of exchange rate movements for these two countries.

Introduction to the data

- We use the spot exchange rate which is the daily closing price of the exchange rate as a representative of every day from the Bank of Taiwan
- The number is a total of three years of data, about five hundred, 489 exactly.

Time series plot for the data



Series 1 : USD ; Series 2 : EUR

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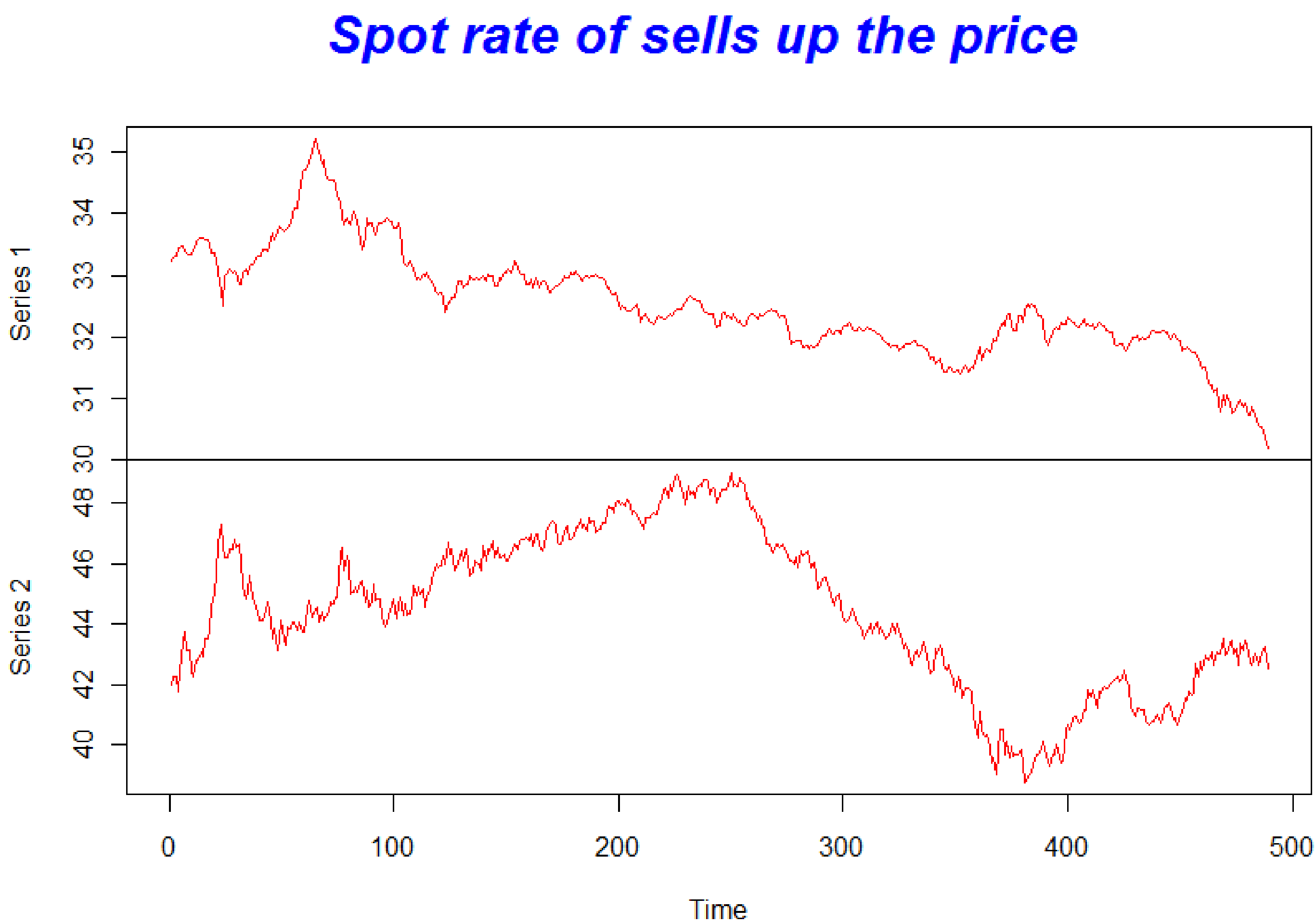

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Introduction of Proposed Methods

- We provide a very flexible structure in modeling multivariate financial assets.
- Marginal processes: Stochastic model, Geometric Brownian motion
  - $S(t) = S(0)\exp\left\{\sigma W(t) + (\alpha - \frac{1}{2}\sigma^2)t\right\}$, where α and σ are parameters.
- Dependence relation: A well-known copula function
  - Frank Copula, Plackett Copula, Normal Copula, or Gumbel Copula

Proposed methods I

Marginal process + Copula function

Marginal process:
- Assume that the process follow GBM.
- Use Gibber Sampler to estimate parameters

Copula function:
- Calculate F1(x) and F2(x) and then graph the scatter plot.
- Choose the best copula function by way of Rosenblatt(1952).

Joint Distribution Function

Proposed methods II

Marginal process

- Assume that the process follow GBM.
- Use Gibber Sampler to estimate parameters

+

Copula function

- Given the estimated parameter, use MLE to estimate parameters of copula function.
- Choose the best copula function by way of Rosenblatt(1952).

Joint Distribution Function

Reference

- Shang Chan, Chiou (200?), Multivariate Continuous Time Models through Copula, ?