Neural networks and econometric models in forecasting stock returns

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Agenda

Reason

- Money around us
- Profit and utility maximization
- New methods are needed
- How to find the best model in case of different markets?

Consequence

- Data $\Rightarrow$ Big Data
- Statistics $\Rightarrow$ AI & Econometrics
- Machine Learning vs Econometrics
- Deep Learning vs Econometrics

Motivation

- **Theoretical**: Further rapid development of forecasting models.
- **Practical**: Much easier $\Rightarrow$ much quicker — "Buy, hold or sell"?
  As a result — much reliable decisions $\Rightarrow$ investors are happy.

Targets

- Help traders to make accurate decisions on "Buy, hold or sell"?
- Make stock deals more "secure" (low risk) and profitable.
- Make people stop being scared of stock market.

Tasks

- Provide the sequential models' comparison based on empirical data.
- Find the "best" model, according to the topology function.
- **Data**: 15 American and Chinese companies.

  Markets: Developed (US) and developing (China).

  NB! Various industries (for overall result).

Hypothesis

Essential:

- Market Efficiency [Fama, 1970] - impossible to predict anything.

In contrast:

- Market Fractality [Mandelbrot, 2006] - markets have long memory.
- Market "inefficiency" [Sewell, 2011] - Market Efficiency is not true (but best for today).

Trial:

- Neural Network approach is the best for developed and developing markets.

Data analysis

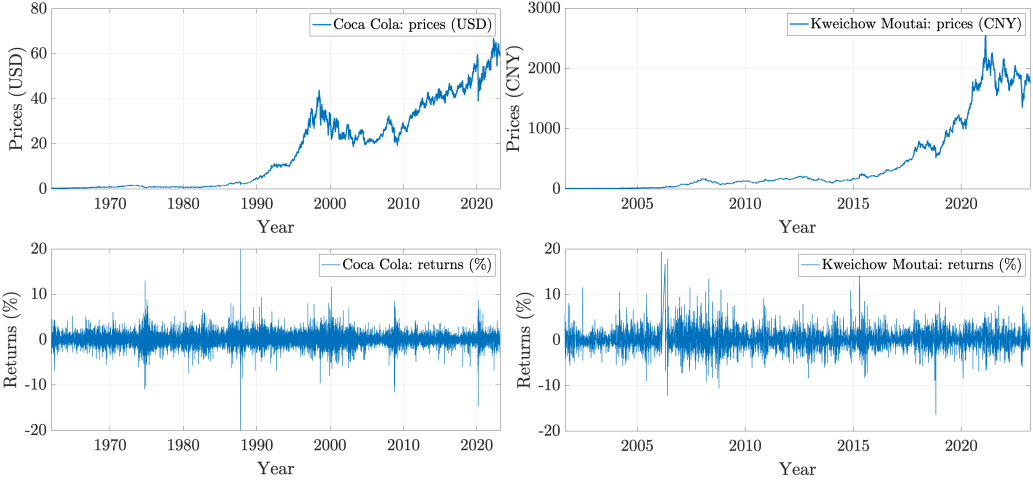
What: Stock prices of 15 US and China companies.

From: New York and Shanghai (not Hong-kong) stocks.

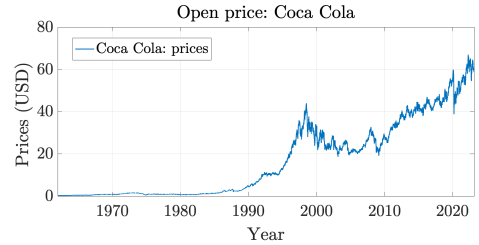
Period: IPO (different for each company) – 13/12/2022.

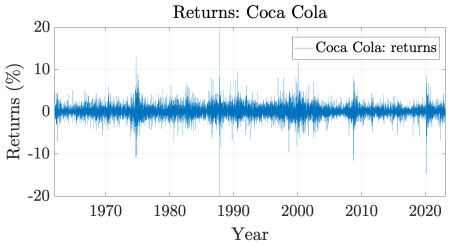
Industries: IT (AMD), media (Netflix), sales (Ebay), taxi (Uber), auto (Ford), sport (Nike), energy (General Electric) and so on.

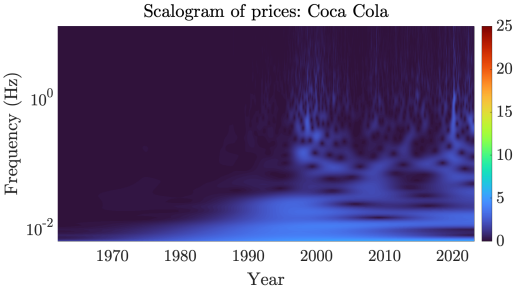
Data analysis (visual insights) — Open prices and returns: US & China

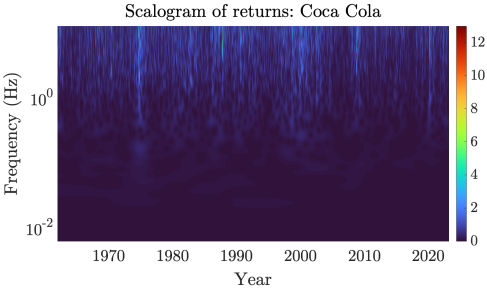


Data analysis (scalogram insights) — Coca Cola

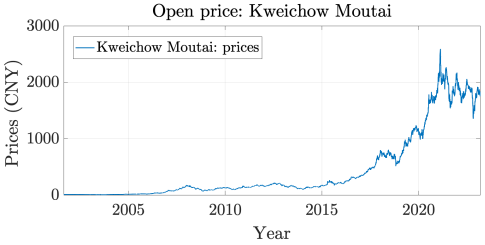


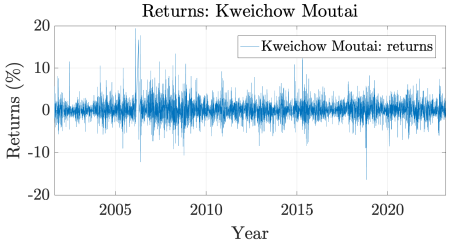


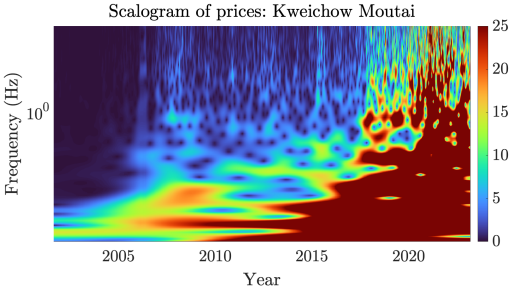


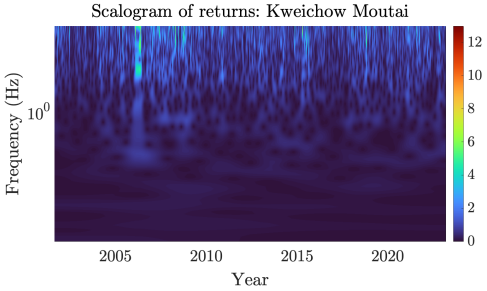


Data analysis (scalogram insights): Kweichow Moutai









Method

Econometric approach:

1. EWMA
2. ARIMA
3. ARIMA + (FI)GARCH
4. ARFIMA
5. ARFIMA + (FI)GARCH
6. SSA (Singular Spectrum Analysis)

Network approach:

1. MLP/RNN/WN
2. MSSA/EWMA + MLP/RNN/WN
3. No "transformers" $\Leftarrow$ [Zeng et al., 2022]

Metrics Function:

$$\text{WAPE}(\hat{y}, y) = \frac{\sum_{t=1}^{n} |y_t - \hat{y}_t|}{\sum_{t=1}^{n} |y_t|} \qquad (1)$$

Tables of comparison

content...

Discussion

content...

References

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Conclusion

Thank you for attention!