List 02. Intro to Time series with Python

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Python package: `pandas, numpy, yfinance, pandas-datareader`[1]

#**1**. From FRED database load quarterly data on US GDP from 1990 Q1 up to now (series gdp)

1. set a right time index
2. visualize the series gdp
3. visualize the series $\log(gdp)$
4. visualize the series $\Delta \log(gdp)$
5. visualize the series $\Delta^2 \log(gdp)$
6. draw a histogram for $\log(gdp), \Delta \log(gdp)$
7. draw a scatter plot $\log(gdp_t)$ vs $\log(gdp_{t-1})$
8. draw a scatter plot $\Delta \log(gdp_t)$ vs $\Delta \log(gdp_{t-1})$
9. calculate
$$\text{corr}(\log(gdp_t), \log(gdp_{t-1}))$$
and test its significance (formally!)
10. calculate
$$\text{corr}(\Delta \log(gdp_t), \Delta \log(gdp_{t-1}))$$
and test its significance (formally!)

[1] `conda install -c conda-forge yfinance pandas-datareader`
`pip install yfinance pandas-datareader`

#**2**. From FRED database load monthly data on US M2 from 1990-01 up to now (series $m2$)

1. set a right time index
2. visualize the series $m2$
3. visualize the series $\log(m2)$
4. visualize the series $\Delta \log(m2)$
5. visualize the series $\Delta^2 \log(m2)$
6. draw a histogram for $\log(m2), \Delta \log(m2)$
7. draw a scatter plot $\log(m2_t)$ vs $\log(m2_{t-1})$
8. draw a scatter plot $\Delta \log(m2_t)$ vs $\Delta \log(m2_{t-1})$
9. calculate
$$\text{corr}(\log(m2_t), \log(m2_{t-1}))$$
and test its significance (formally!)
10. calculate
$$\text{corr}(\Delta \log(m2_t), \Delta \log(m2_{t-1}))$$
and test its significance (formally!)

#**3**. From FRED database load daily data on 3-month rate ($rate1$) and 10-year rate ($rate2$) for US stock from 1990-01-01 up to now

1. aggregate into monthly multivariate time series $rates$
2. visualize the series $rates$ in two ways
   - as subplots
   - on the same plot
3. visualize the series $\Delta \log(rates)$ in two ways
4. visualize the series $\Delta^2 \log(rates)$ in two ways
5. draw a histogram for $rates, \Delta rates, \Delta^2 rates$ in two ways

6. draw a histogram for $rate1$ vs $rate2$
7. draw a scatter plot $\Delta rate1$ vs $\Delta rate2$
8. calculate corr$(rate1, rate2)$ and test its significance (formally!)
9. calculate corr$(\Delta rate1, \Delta rate2)$ and test its significance (formally!)

#**4**. From `finance.yahoo.com` database load daily data on S&P500 (series y_t) from 2000-01-01 up to now

1. visualize the series y
2. visualize the series $\Delta \log(y)$
3. visualize the series $\Delta^2 \log(y)$
4. draw a histogram for $y, \Delta y, \Delta^2 y$