Mid term Exam for Financial Econometrics with Python

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Contents

1 Introduction

For the midterm assignment, we composed a group of 4 with Gavini Charles; Fournier Justin; Prat Paul and Blanc Mathieu. This document contains all the results of our assignment, including tables, figures, and calculations. It is composed by 1 parts, first, importing the good python libraries, then initialising variables to separate the differents datas (daily, monthly, ..., returns, logreturns,...)

2 Preliminary

2.1 AMAZON

The chosen stock is Amazon, because it is higly related in the current actuality. We are very interested in a major company such as Amazon, which has grown significantly over time. The ticker from yahoo finance is "***AMZN*** " on the Nasdaq stock exchange AMAZON on Yahoo Finance First, importing the Amazon stock with yfinance, then display the pandas table. We will import 25 years, 8 months and 25 days of data (from 1999-01-21 to 2024-10-16).

2.2 Data Table

The data printed here, is the preview of the Amazon stock extraction from yahoo fiannce:

Date	Open	High	Low	Close	Adj Close	Volume
1999-01-21	2.612500	2.759375	2.314063	2.650000	2.650000	940964000
1999-01-22	2.487500	3.146875	2.468750	3.075000	3.075000	875316000
1999-01-25	3.037500	3.084375	2.750000	2.809375	2.809375	546476000
1999-01-26	2.815625	3.031250	2.765625	2.877344	2.877344	490696000
1999-01-27	3.353125	3.493750	3.000000	3.140625	3.140625	700452000

Table 1: Preview of Amazon Stock Data from Yahoo Finance

2.3 Checking the 25 Years range condition

We have to check that the data is correctly displayed over a 25years range, hopefully, the introduction from Amazon is from january 1999, so it we should be able to find a 25 year range of data of the Amazon stock. To check that we can compute a python code to count the gaps and visualize the dates of gaps in order to see for any huge gap that would be problematic for analyzing data.

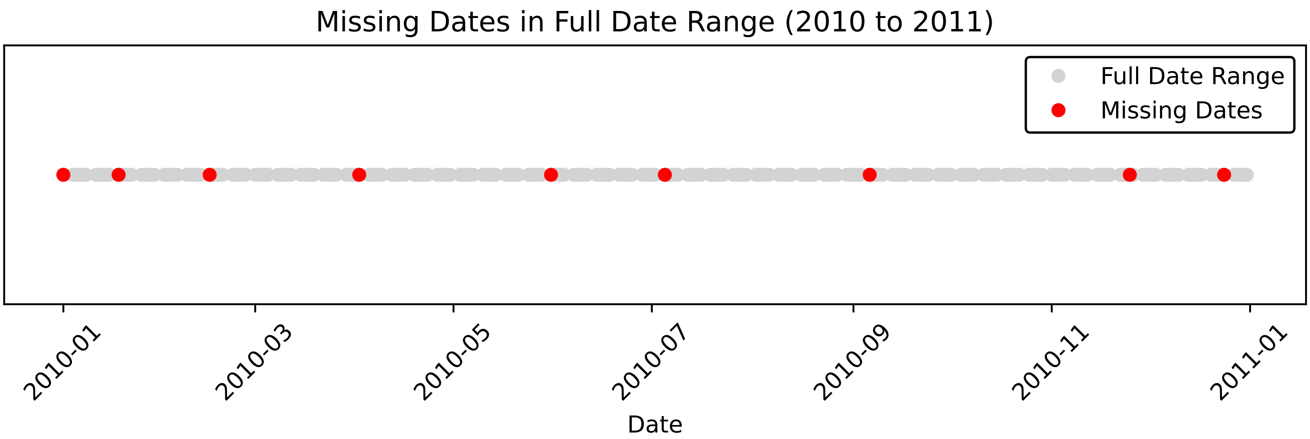

Figure 1: Missing Dates in Full Date Range (2010 to 2011)

We count less than 10 days of data gaps ponctually for one year over the 25-years range. Thus, the full data is still relevant to use for ou analysis of stilyzed facts.

3 First Results

3.1 Prices Evolutions

Then, ploting the prices evolution:

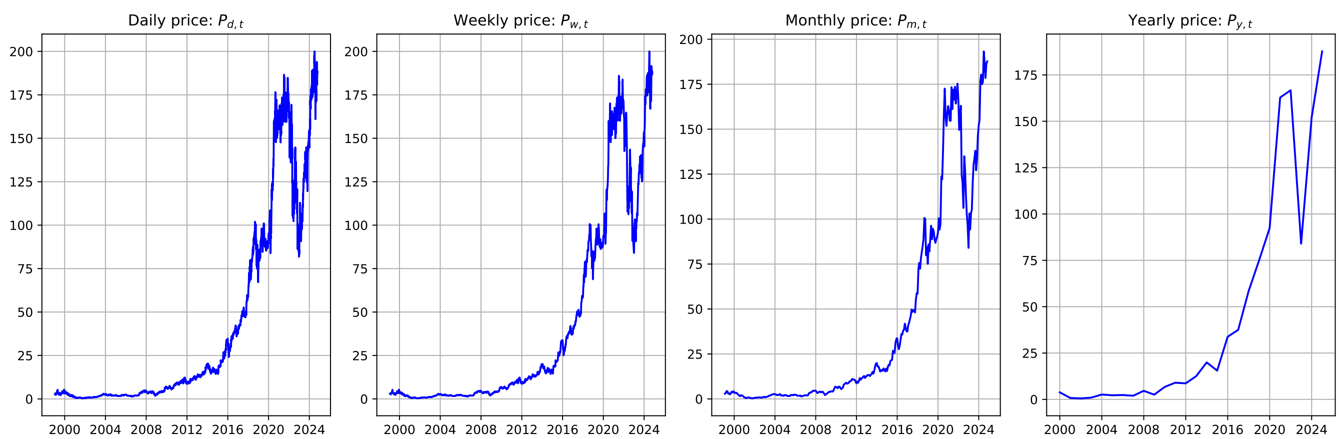

Figure 2: Prices over time by frequency

3.2 Calculating Returns

Figure 3: Prices, returns and log returns

3.3 Squared Returns

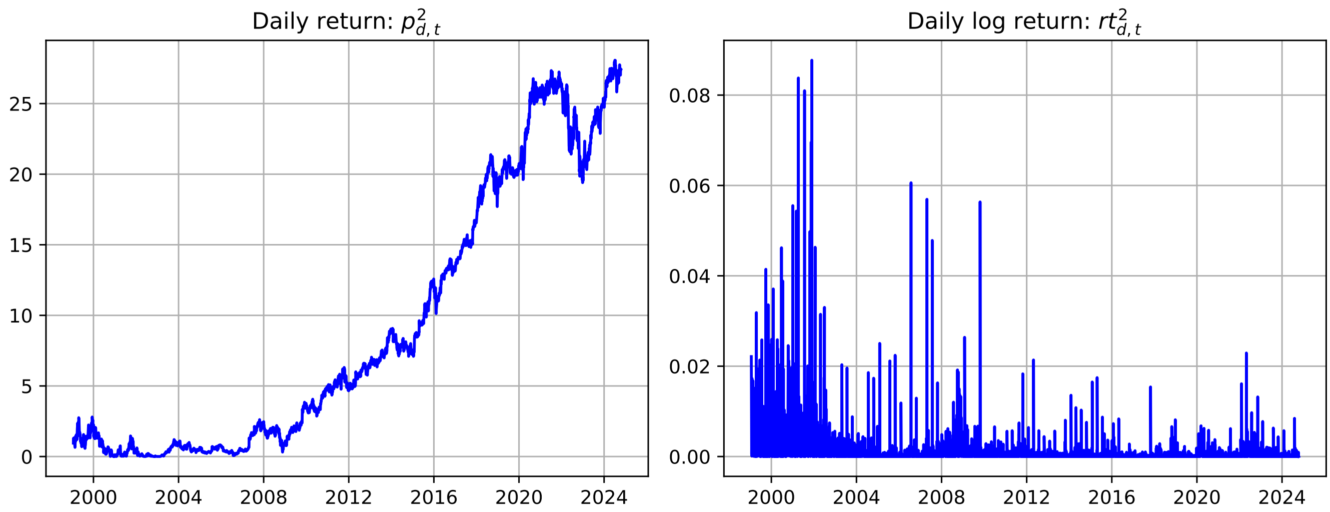

Figure 4: Squared daily returns and daily log returns

4 Amazon and the 8 Stylized Facts

4.1 Prices are non-stationary

The first feature that will highlight non-stationarity of the prices is the comparison of p_t vs p_{t-1}.

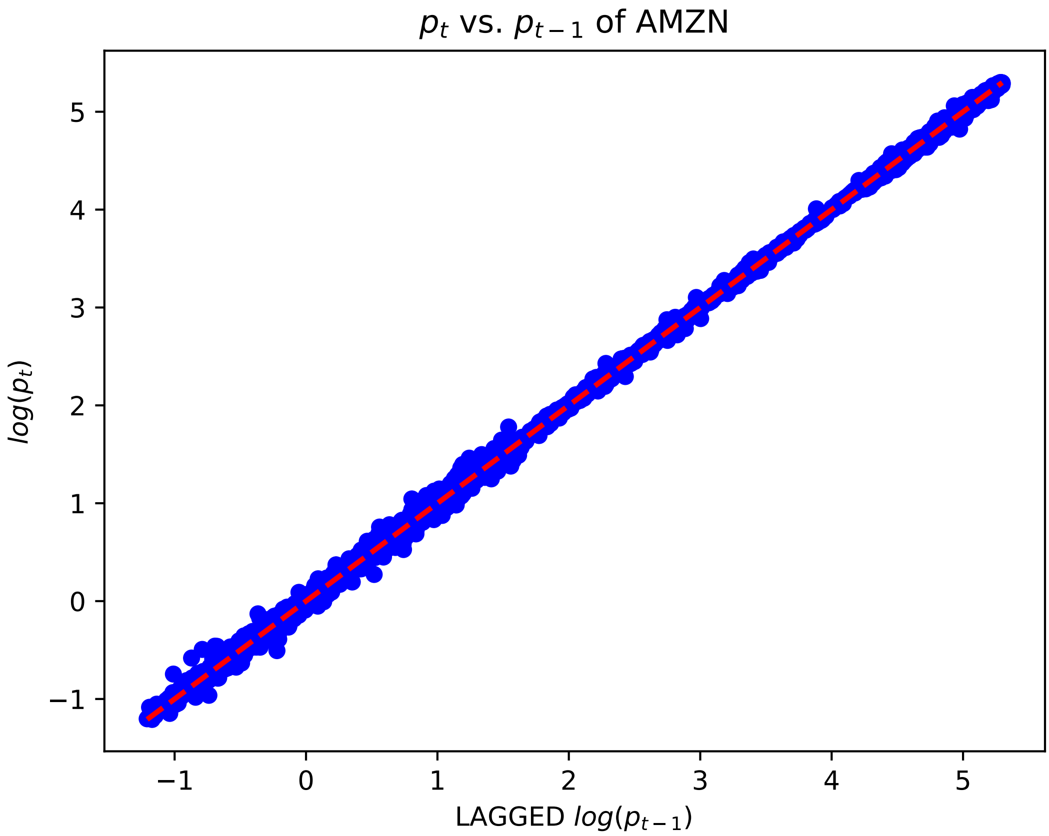

Figure 5: Comparison of $\log(p_t)$ vs $\log(p_{t-1})$

The graph in Figure 5 demonstrates this strong linear relationship, indicating that Amazon's prices at time t are highly dependent on those at $t-1$ and lack mean reversion, supporting the idea of non-stationarity.
Additionally, the empirical autocorrelation function (ACF) of Amazon's daily prices shows a slow decay, further suggesting non-stationarity, as shown in the next figure.

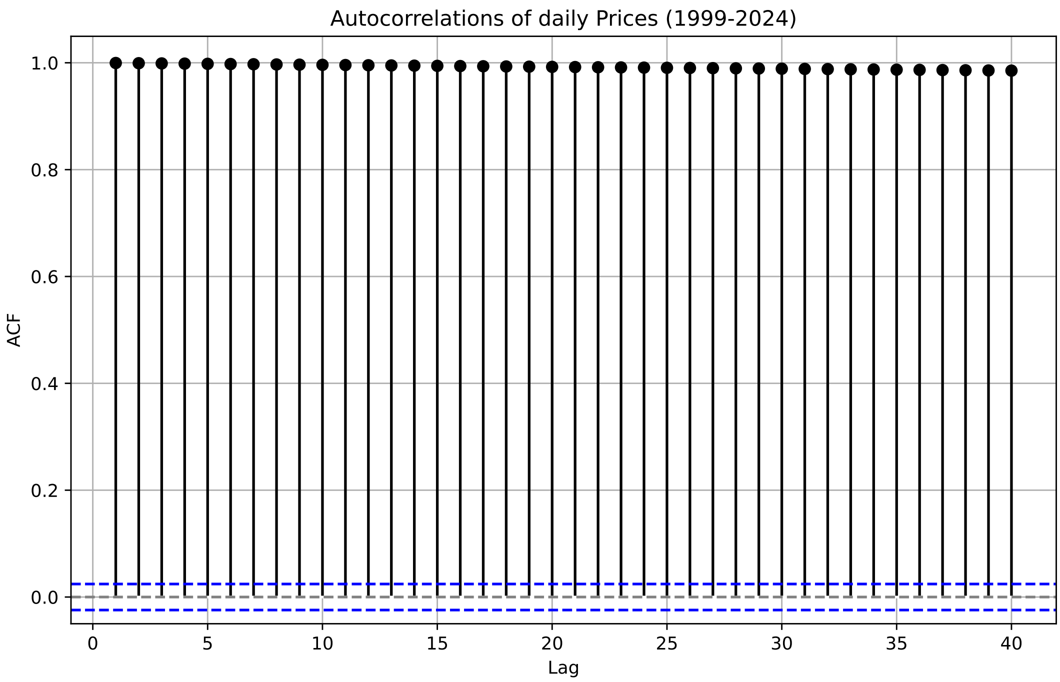

Figure 6: Autocorrelations of daily Prices (1999-2024)

4.2 Returns are stationary

4.3 Asymmetry

4.4 Heavy tails

4.5 Gaussianity

4.5.1 High frequency non-Gaussianity

4.5.2 Aggregational Gaussianity

4.6 Returns are not autocorrelated

4.7 Volatility clustering and long range dependence of squared returns

4.8 Leverage effect

A Appendix: Python Code

Below is the Python code used in this analysis.

```python
# Python code example
import numpy as np
import pandas as pd

def analyze_data(data):
    mean = np.mean(data)
    std_dev = np.std(data)
    return mean, std_dev

data = [1, 2, 3, 4, 5]
mean, std_dev = analyze_data(data)
print(f"Mean: {mean}, Standard Deviation: {std_dev}")
```

Listing 1: Python Code for Analysis