# Mid term Exam for Financial Econometrics with Python

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# 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:

| Price<br>Ticker<br>Date | Adj Close<br>AMZN | Close<br>AMZN | High<br>AMZN | Low<br>AMZN | Open<br>AMZN | Volume<br>AMZN |
|---|---|---|---|---|---|---|
| 1999-01-21 00:00:00+00:00 | 2.650000 | 2.650000 | 2.759375 | 2.314063 | 2.612500 | 940964000 |
| 1999-01-22 00:00:00+00:00 | 3.075000 | 3.075000 | 3.146875 | 2.468750 | 2.487500 | 875316000 |
| 1999-01-25 00:00:00+00:00 | 2.809375 | 2.809375 | 3.084375 | 2.750000 | 3.037500 | 546476000 |
| 1999-01-26 00:00:00+00:00 | 2.877344 | 2.877344 | 3.031250 | 2.765625 | 2.815625 | 490696000 |
| 1999-01-27 00:00:00+00:00 | 3.140625 | 3.140625 | 3.493750 | 3.000000 | 3.353125 | 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.

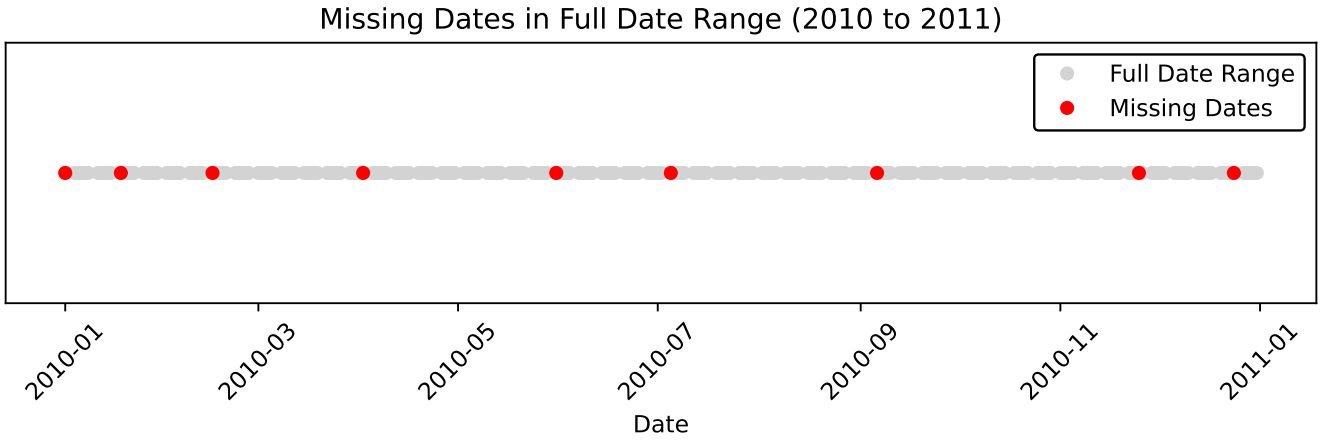


Figure 1: Missing Dates in Full Date Range (2010 to 2011)

We count only 9 days without data over the 25-year range. Thus, the full data contains at least 25 years of values

## 3 First Results

### 3.1 Prices Evolutions

Then, ploting the prices evolution:

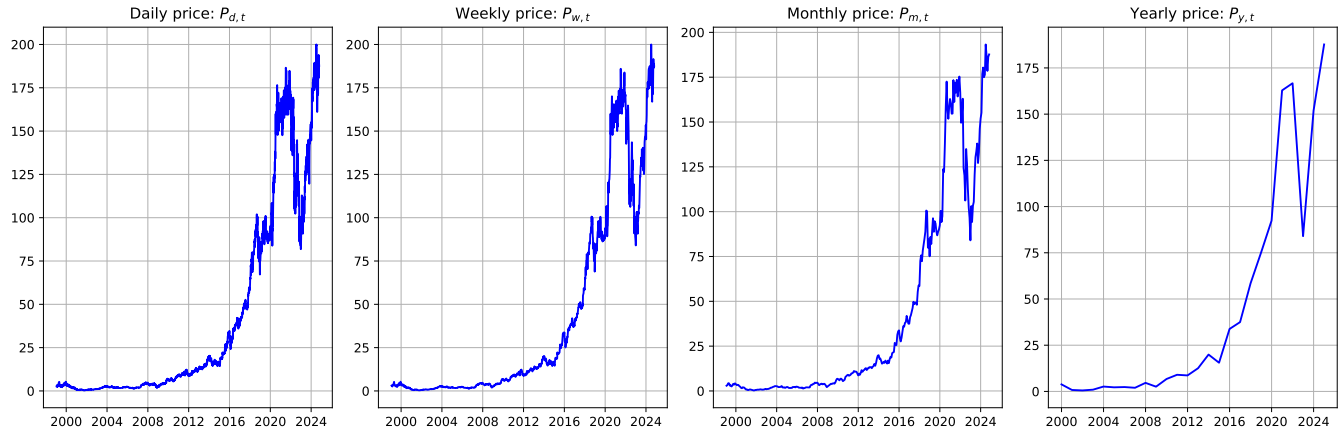


Figure 2: Prices over time by frequency

### 3.2 Calculating Returns


Figure 3: Prices, returns and log returns

### 3.3 Squared Returns

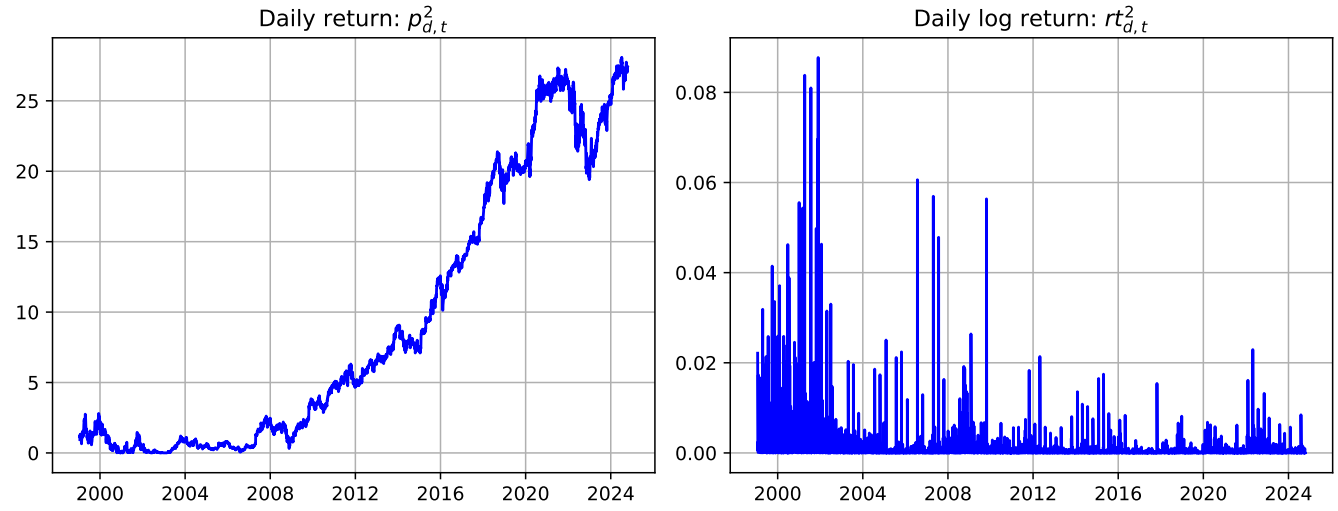


Figure 4: Squared daily returns and daily log returns

## 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 $p(t-1)$.

Indeed, The graph demonstrates a strong linear relationship between $\log(p_t)$ and $\log(p_{t-1})$, indicating that Amazon's prices exhibit non-stationarity, as the prices at time $t$ are highly dependent on those at $t-1$. Moreover, the next graph prooves that Amazon's empirical ACF is slowly decaying which is often a symptom on non-stationarity.

## 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

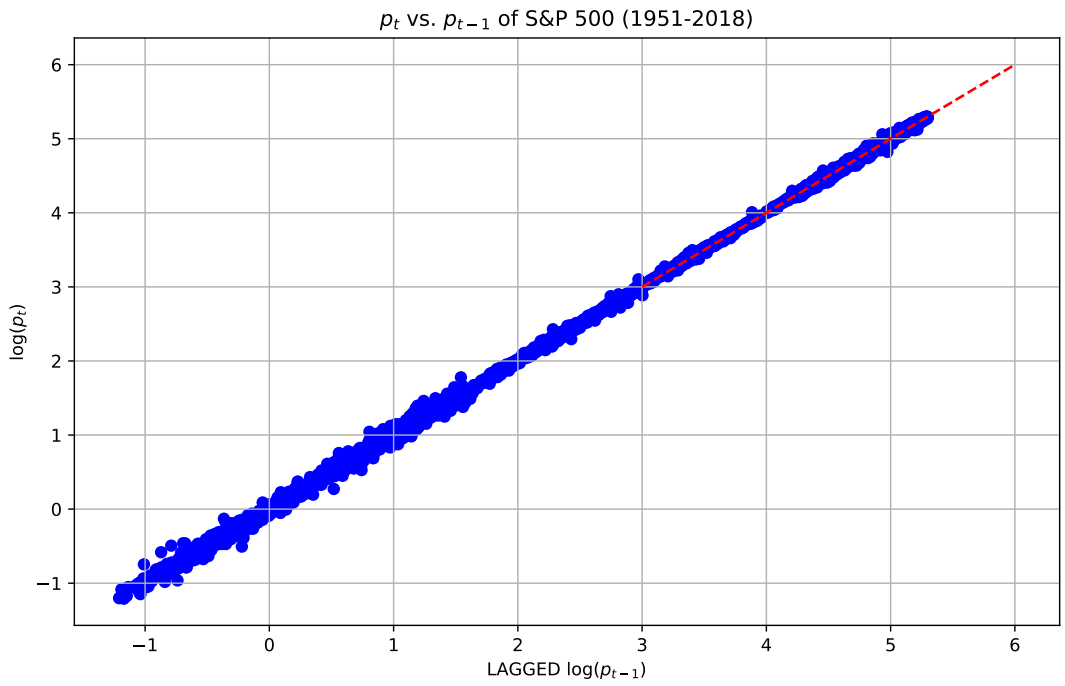


Figure 5: Comparison of $\log(p_t)$ vs $\log(p_{t-1})$

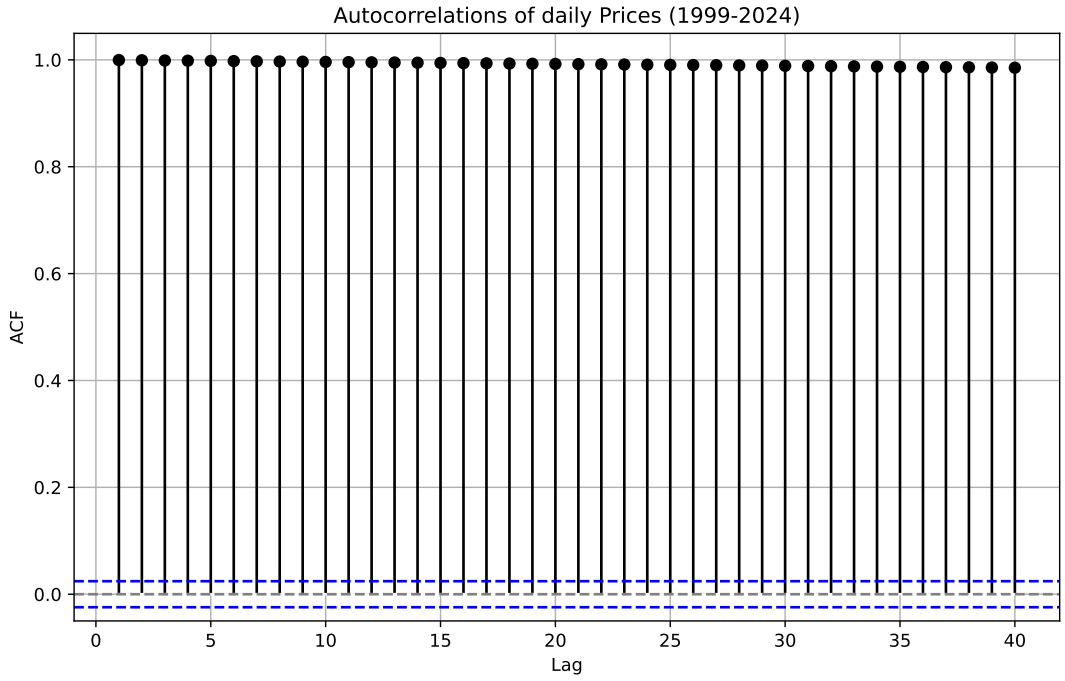


Figure 6: Autocorrelations of daily Prices (1999-2024)