# Department of Accounting and Finance
# Lancaster University

## AcF 351b Career Skills in Accounting and Finance

## Python for Data Analysis

## Stream Assignment

1. Overview

Python for Data Analysis stream is designed to provide introductory programming knowledge to students who have no or little prior programming experience. Throughout the five sessions, this module has covered Python language basics, scientific computing and web scraping packages and introduction to corporate bond markets. The assignment therefore is intended to give students the opportunity to practice on what have learned from the course and encourage students to do independent work towards writing a complete script to download public data and conducting basic analysis in the fields of accounting and finance.

In this coursework, students are expected to assess the consequence of Brexit on British corporate bonds. Students are also encouraged to be creative and explore further on research questions that are meaningful to the above topic, e.g. how long will the Brexit affect the UK economy according to the bond investors?

This document sets out the details of the stream coursework requirements along with some instructions/tips and core reading list.

2. Coursework Submission

- Submission Deadline: Jan 8th, 2021, at 00:00 GMT.
- Submission Location: the Moodle
- Submission Documents:
  - Part 1: A **Jupyter Notebook** file for your Python script. You are required to provide codes to demonstrate the workflow to obtain, process and analyze your data. This part contributes **50%** of your coursework assessment. In general, this coding part should consist of the followings (for detailed instructions see Section 3 Part 1):
    - Sub-section to access financial data from CRSP, Compustat and TRACE on WRDS;
    - Sub-section to merge, clean, process and analyze on the above downloaded data;

    **NOTE**:

    - Make sure that your codes can be run in other's environment and your results can be reproduced;
    - Make sure you also put short comments/markdown text to highlight what you are doing for those codes.

- Part 2: A **Microsoft Word** document for your report. You are required to write a report to interpret the results from your analysis. This part contributes **50%** of your coursework assessment. You should include the following:
  - A cover sheet on the first page of your report including the details of your full name and student ID;
  - A short introduction to the background of Brexit.
  - Analysis on the data and main findings (for detailed instructions see the Section 3 Part 2);
  - A short conclusion;
  - References

  **NOTE**:
  - The coursework assignment should be kept as short and concise as possible. The overall length of the coursework **MUST NOT EXCEED** 2,000 words (Please note that the word limit *excludes* tables, the list of references, and appendices containing illustrative and supporting material, but *includes* footnotes.)
  - Completed reports that exceed the maximum word limit will be **SEVERELY PENALIZED**.
  - Make sure to use **12 point Times New Roman** font with generous margins and **1.5 line spacing** consistently.
  - For more detailed guidance on writing your report, please refer to the general outline of the AcF351b module.

3. Instructions:

The spreadsheet named *"acf351b_python_data.csv"* provides a list of American and British corporate bonds traded in the US bond markets. You are expected to assess the consequence of Brexit on corporate bond pricing by analyzing the data.

Part I (50%)

a. Download monthly corporate bond yield data during Jan 2015 to Dec 2017 for all bonds in the spreadsheet from TRACE on WRDS. Note that for each bond issue that is traded at least once within a given month, the daily yield is the last yield that occurs on the trading day. The monthly yield is then calculated as the MEDIAN of daily yields in the month for the bond issue. [10%]
b. Compute 180-day stock return volatility during Jan 2015 to Dec 2017 for all bond issues/issuers in the spreadsheet from CRSP on WRDS. You can download daily stock return data from CRSP on WRDS (crspa.dsf). [10%]
c. Compute quarterly market leverage and book leverage during Jan 2015 to Dec 2017 for all bond issuers in the spreadsheet. You can download the data on outstanding debt, outstanding shares and quarterly closing price (PRCCQ) from Compustat. [10%] Follow the formula below to compute the two measures of financial leverage:
   i. Book Leverage= $\frac{Totoal\ Outstanding\ Debt}{Total\ Assets}$
   ii. Market Leverage =$\frac{Total\ Outstanding\ Debt}{market\ capitalization}$
d. *acf351b_ratings.csv* provides historical credit ratings for all bond issues in the spreadsheet. For each bond issue, locate the latest ratings prior to the trade date the yield of which you use as the monthly yield. [10%]

For example, for a bond issue, if the median of daily yields of March, 2016 occurs on March 20th, then you should try to locate the latest credit rating of the bond prior to March 20th. If multiple credit rating agencies (S&P, Moody's and Fitch) rate the bond issue, select the LOWEST one. See Appendix 3 regarding how to compare credit ratings across rating agencies.

e. Compute the monthly credit spreads for all bond issues in the spreadsheet. [10%]
    i. Calculate the time to maturity for each bond issue and trade in your data. For example, if a bond matures on March 31st, 2025 and the median yield trading day of March, 2016 is March 15th, 2016, then the time to maturity for the bond in March, 2016 is 9.04 years.
    ii. For each bond issue and trade, locate the zero-coupon yield of US treasury with the time to maturity closest to the bond issue's. For example, if the median yield trading day of March, 2016 is March 15th, 2016 and the time to maturity is 9.04 years, you should locate the zero-coupon yield on March 15th, 2016 of US 10-year (the closest time to maturity) treasury bond.
    iii. Once you obtain the appropriate zero-coupon yield, take the difference between the yields of the bond issue and the zero-coupon yield and the result is the credit spreads.

Part II (50%)

In this task, the assessment will be carried out primarily based on your academic report in Microsoft Word documents. Conduct data analysis and provide detailed summary statistics on your data and explore relevant questions (but certainly not restricted to) and interpret:

a. What are the average credit spreads of British and American bonds?
b. Does the cross-sectional difference change over time? i.e. plot the monthly time-series data of British and American bonds and observe the trends from 2015 to 2017
c. What are the consequences of Brexit on British bonds traded in the US, including on the bond yields and trading volume? Please elaborate and justify your arguments.

Appendix 1: The Definitions Of Variables In The *acf351b_python_data.csv*

| Variable | Definition | Remarks |
|---|---|---|
| CUSIP_ID | Unique ID for each bond issue. | |
| ISSUE_ID | Unique ID for each bond issue. | For merging with credit ratings data |
| offering_amt | The par value of debt initially issued. | |
| offering_date | The date the issue was originally offered. | |
| maturity | Date that the issue's principal is due for repayment | |
| yankee | A flag indicating that the issue has been issued by a foreign issuer, but has been registered with the SEC and is payable in dollars. | |
| country_domicile | The Country of Domicile or country of permanent residence of this issuer. | |
| coupon | The current applicable annual interest rate that the bond's issuer is obligated to pay the bondholders. | |
| asset_backed | Flag indicating that the issue is an asset-backed issue, that is collateralized by a portfolio of loans or assets other than single family mortgages | |
| putable | Put option flag. A put option provides the bondholder with the option, but not the obligation, to sell the security back to the issuer at a specified price and time, under certain circumstances. | |
| convertible | Flag indicating the issue can be converted to the common stock (or other security) of the issuer. | |
| callable | A flag indicating that the issue is callable. | |
| bond_type | the CONVERTIBLE table. | |
| | CDEB | US Corporate Debentures |
| | CMTZ | US Corporate MTN Zero |
| | CMTN | US Corporate MTN |
| | RNT | Retail Note |
| | USBN | US Corporate Bank Note |
| | CCOV | US Corporate Convertible |
| | PS | Preferred Security |
| | UCID | US Corporate Insured Debenture |
| security_level | | |
| | SEN | Senior |
| | SUB | Subordinate |
| | SS | Senior Secured |
| | SENS | Senior Subordinate |
| | JUNS | Junior Subordinate |

Appendix 2: The Definitions Of Variables In The *acf351b_ratings.csv*

| Variable | Definition | Remarks |
|---|---|---|
| issue_id | Unique ID for each bond issue. | |
| rating_date | The date the rating was assigned to the security. | |
| rating_type | A code representing the type of rating | |
| | DPR | Duff and Phelps Rating |
| | FR | Fitch Rating |
| | FT | Fitch Credit Trend |
| | MR | Moody's Rating |
| | SPR | Standard and Poor's Rating |

Appendix 3: Rating Equivalence across Three Major Rating Agencies

| MR | SPR | FR |
|---|---|---|
| Aaa | AAA | AAA |
| Aa1, Aa2, Aa3 | AA+, AA, AA- | AA+, AA, AA- |
| A1, A2, A3 | A+, A, A- | A+, A, A- |
| Baa1, Baa2, Baa3 | BBB+,BBB, BBB- | BBB+,BBB, BBB- |
| Ba1, Ba2, Ba3 | BB+,BB,BB- | BB+,BB,BB- |
| B1, B2, B3 | B+,B,B- | B+,B,B- |
| Caa1, Caa2, Caa3, Ca,C | CCC+,CCC,CCC-,CC,C,D | CCC, CC, C, DDD, DD, D |