

Portfolio Theory

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Seminar 2

Content:

- Get the Alpha Vantage API
- Download data
- Assemble the dataset

Get the Alpha Vantage API

Go to <https://www.alphavantage.co/> and click on “GET FREE API KEY”

Stock Market API, *Reimagined*

- ▶ Realtime & historical stock market data APIs
 - ▶ Forex, commodity & crypto data feeds
 - ▶ 60+ technical & economic indicators
 - ▶ Market news API & sentiments
 - ▶ Global coverage

STOCK MARKET API

GLOBAL NEWS API

GET FREE API KEY

Get the Alpha Vantage API

Next, fill the required fields and click again on “GET FREE API KEY”. The API will appear on the same page.

Which of the following best describes you?

Student



Organization (e.g. company, university, etc.):

Masaryk University

Email:

GET FREE API KEY

Download data

- Open the script “Code_2.R”.
- Load the “dplyr” and “alphavantage” packages using the “library” function. If they are not available, install them from the menu or with the “install.packages” function.
- Download data for American Express (Ticker symbol “AXP”)
- We are interested in the closing prices.
- Notice the extreme price drops in the unadjusted closing prices after some dividend payments.
- The adjusted prices account for the dividends and correct for this effect.

Download data

	timestamp	open	high	low	close	adjusted_close	volume	dividend_amount
1	1999-12-31	150.00	168.900	149.300	166.30	34.9667	36990702	0.000
2	2000-01-31	164.50	165.800	145.500	164.80	34.7031	52298968	0.225
3	2000-02-29	164.60	169.500	124.000	134.20	28.2595	64612833	0.000
4	2000-03-31	137.00	157.310	119.500	148.90	31.3550	74165598	0.000
5	2000-04-28	149.80	159.800	131.800	149.50	31.4989	58372732	0.080
6	2000-05-31	149.60	154.100	47.500	51.44	32.5145	68704168	0.000
7	2000-06-30	53.81	57.190	51.000	52.13	32.9506	85591000	0.000

- Store the “timestamp” column in a separate object and name it “date”.
- Store the “adjusted_close” column in a separate object and name it “AXP”.
- Remove “AXP_all”.
- For the other stocks we directly keep only the column with the adjusted prices (column 6).

Download data

Now we download the risk-free rate. Go to https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html and download the Fama-French 3 factors in CSV format.

U.S. Research Returns Data (Downloadable Files)

Changes in CRSP Data

Fama/French 3 Factors [TXT](#) [CSV](#) [Details](#) [Historical Archives](#)

Fama/French 3 Factors [Weekly] [TXT](#) [CSV](#) [Details](#)

Fama/French 3 Factors [Daily] [TXT](#) [CSV](#) [Details](#)

Fama/French 5 Factors (2x3) [TXT](#) [CSV](#) [Details](#) [Historical Archives](#)

Fama/French 5 Factors (2x3) [Daily] [TXT](#) [CSV](#) [Details](#)

Extract the .csv file from the .zip archive and open it with the notepad.

Download data

- Delete the first 3 lines and name the first column as “date”

 F-F_Research_Data_Factors - Blocco note di Windows

File Modifica Formato Visualizza ?

This file was created by CMPT_ME_BEME_RETS using the 202312 CRSP database.
The 1-month TBill return is from Ibbotson and Associates, Inc.

```
,Mkt-RF,SMB,HML,RF
192607, 2.96, -2.56, -2.43, 0.22
192608, 2.64, -1.17, 3.82, 0.25
192609, 0.36, -1.40, 0.13, 0.23
192610, -3.24, -0.09, 0.70, 0.32
192611, 2.53, -0.10, -0.51, 0.31
192612, 2.62, -0.03, -0.05, 0.28
```



 *F-F_Research_Data_Factors - Blocco note di Windows

File Modifica Formato Visualizza ?

```
date,Mkt-RF,SMB,HML,RF
192607, 2.96, -2.56, -2.43, 0.22
192608, 2.64, -1.17, 3.82, 0.25
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192611, 2.53, -0.10, -0.51, 0.31
192612, 2.62, -0.03, -0.05, 0.28
```

Download data

- Data from Alpha Vantage start in December 1999, but we will lose one period when computing the return, so delete the lines before “200001”.
- Also delete the annual factors. Make sure to leave one empty line at the end.
- Save the .csv file with the name “FF3.CSV” in the same folder in which “Code_2.R” is located. This allows R to open it without specifying its path.

Download data

- Load the “readr” package (install it first if not available).
- Load data in R with the “read_csv” function.
- Only keep the fifth column (which contains the risk-free rate) and call it “Rfree”.
- We divide this rate by 100 because it is expressed in percentage.

Assemble the dataset

- First we compute the (adjusted) returns from the prices.
- We lose the first observation when differencing to compute returns. Therefore, we also remove the first observation from the “date” object.
- Data from Alpha Vantage span up to today, but the risk-free rate only spans up to December 2023.
- The last price observations also do not coincide with the last trading day of the month.
- Therefore, both in “date” and “DJIA_ret”, we only keep observations up to when “Rfree” spans to.

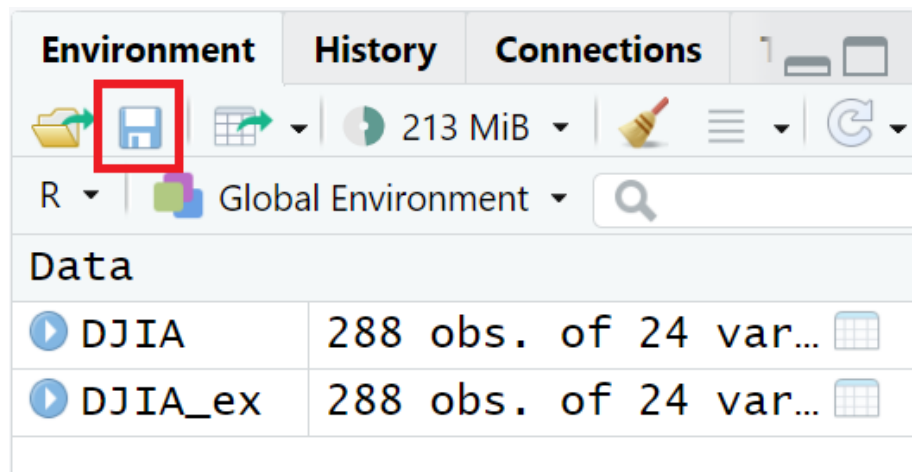
Assemble the dataset

- Finally we bind the date, the risk-free rate and the returns and call this new object “DJIA”. This is the dataset with the DJIA returns.
- Usually it is useful to have a dataset of excess returns, i.e., the returns minus the risk-free rate.
- To subtract the risk-free rate from the returns we use the “matrix” function to turn the vector of risk-free rate into a matrix. This gives us a matrix with 1 column.
- We call the object with excess returns “DJIA_exret”.
- We bind the date, the risk-free rate and the excess returns and call this new object “DJIA_ex”.

Assemble the dataset

We now have a dataset with returns and one with excess returns, plus the risk-free rates.

We delete everything else and we save the environment as an “.RData” file.



We will be able to load this file in the future and have our dataset ready to be used.