Empirical Finance

Homework 2

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> Problem 1 The CSV files df_long_NYSE.csv and df_long_NASDAQ.csv on Canvas contain monthly
>
> individual stock data on the New York Stock Exchange (NYSE) and NASDAQ (Global Select), respectively. They were downloaded using the Python program, a1_download_prices.py. It obtains ticker symbols available at the time of running from the following URL: a) NYSE: https://www.nasdaqtrader.com/dynamic/symdir/otherlisted.txt b) NASDAQ: https://www.nasdaqtrader.com/dynamic/symdir/nasdaqlisted.txt 2. Compute returns as the relative change in closing price (Close) from the previous day. The first return on each stock should be missing. Do not fill missing returns with zero.

Here are the calculated returns for problem 2. We check that the first number for all symbols is missing.

```
>>>              Date Symbol      Close       ret
0      1999-11-01      A  25.365751       NaN
1      1999-12-01      A  46.485085  0.832592
2      2000-01-01      A  39.796024 -0.143897
3      2000-02-01      A  62.456089  0.569405
4      2000-03-01      A  62.531254  0.001203
...           ...    ...        ...       ...
649035 2025-02-01    ZWS  35.255585 -0.101673
649036 2025-03-01    ZWS  32.900681 -0.066795
649037 2025-04-01    ZWS  33.878323  0.029715
649038 2025-05-01    ZWS  36.102959  0.065665
649039 2025-06-01    ZWS  35.560001 -0.015039

[649040 rows x 4 columns]
```

> Problem 2 Implement Momentum Strategy and Form Portfolios

Next, we get the momentum portfolios. We get them in the code, but for ease of viewing I will only show the returns of the decile portfolios.

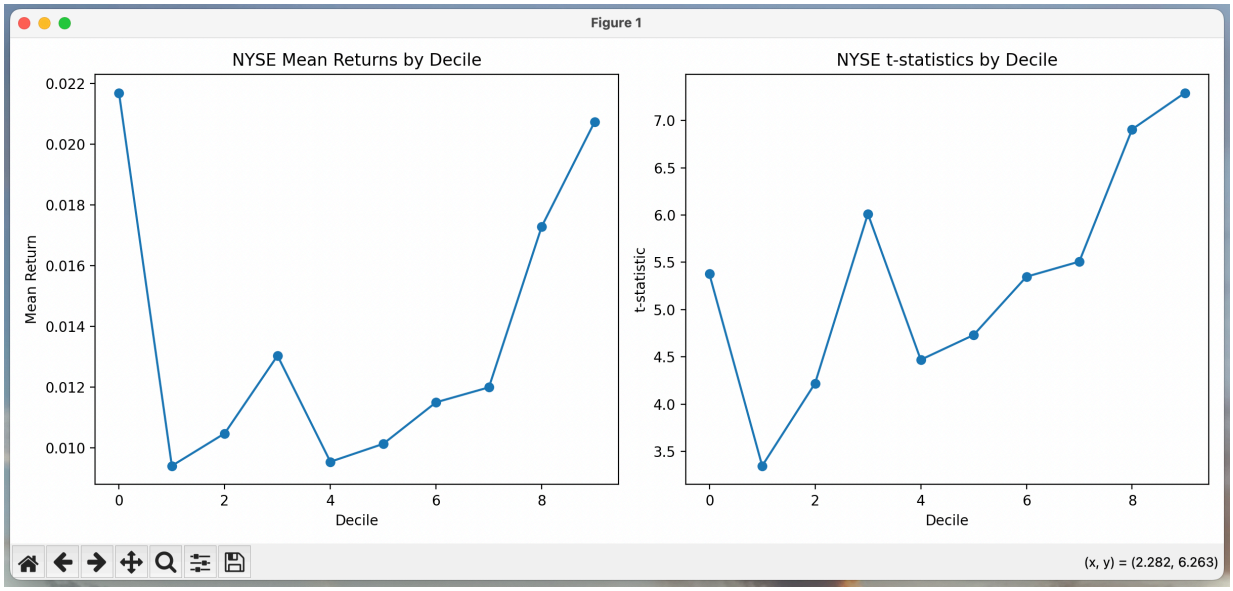
```
>>> nyse_ports
decile          0.0       1.0       2.0       3.0       4.0       5.0       6.0       7.0       8.0       9.0
Date
1974-03-01  0.040725 -0.067125 -0.016129 -0.003546 -0.035260 -0.028165 -0.067165  0.053957 -0.030076  0.035724
1974-04-01 -0.060869 -0.036055 -0.147541  0.011022 -0.059908 -0.037037 -0.075999 -0.044368  0.031008 -0.082927
1974-05-01  0.079383 -0.166668 -0.028845 -0.064906 -0.047619 -0.053921 -0.012238  0.064285 -0.052632 -0.079788
1974-06-01 -0.089109 -0.166666  0.147001  0.006825 -0.072727  0.045382  0.020725 -0.040268 -0.063492  0.110060
1974-07-01  0.010870 -0.150001 -0.052291 -0.115646 -0.119605 -0.039217 -0.206294 -0.118644  0.000000 -0.031495
...              ...       ...       ...       ...       ...       ...       ...       ...       ...       ...
2025-02-01  0.107677 -0.039205 -0.019700 -0.005221 -0.003799 -0.001594 -0.010105 -0.008428 -0.027712 -0.064656
2025-03-01 -0.048722 -0.040316 -0.034310 -0.036407 -0.022585 -0.028213 -0.019995 -0.038219 -0.055470 -0.053192
2025-04-01 -0.022882 -0.041491 -0.038343 -0.027780 -0.004299 -0.017855 -0.009510 -0.012902 -0.014030  0.004916
2025-05-01  0.094644  0.047513  0.070600  0.048717  0.026616  0.034820  0.032970  0.031180  0.056939  0.082687
2025-06-01  0.106200  0.034542  0.068207  0.026558  0.012022  0.010474  0.010346  0.011938  0.004154  0.024309
```

Next are the nasdaq portfolios

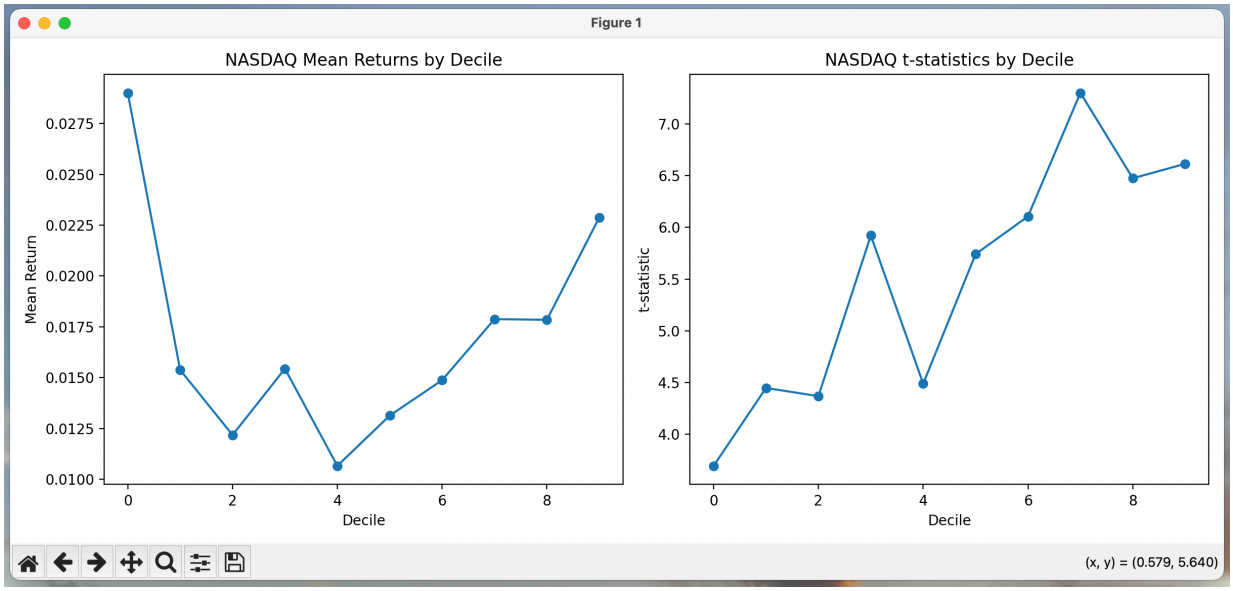
```
>>> nasdaq_ports
decile          0.0       1.0       2.0       3.0       4.0       5.0       6.0       7.0       8.0       9.0
Date
1984-02-01 -0.102362 -0.050001 -0.092592 -0.105263 -0.117978 -0.074258 -0.005556  0.012345 -0.015624  0.103447
1984-03-01 -0.087720  0.048190  0.014706       NaN -0.031847  0.026738 -0.111111  0.016760  0.000000 -0.062500
1984-04-01  0.884508 -0.020409  0.052632  0.392857 -0.104347 -0.153646 -0.057143 -0.021978 -0.012195 -0.066666
1984-05-01 -0.015384 -0.192307  0.015152  0.010416 -0.048544 -0.012500 -0.021538 -0.067416  0.000000  0.107142
1984-06-01 -0.030928 -0.074627 -0.142857 -0.032258  0.063746  0.025157 -0.012659 -0.041667  0.024097 -0.006173
...              ...       ...       ...       ...       ...       ...       ...       ...       ...       ...
2025-02-01 -0.085240 -0.058206 -0.047032 -0.029783 -0.032758  0.007047 -0.017542 -0.020517 -0.036520 -0.071777
2025-03-01 -0.151343 -0.093999 -0.070384 -0.050169 -0.055922 -0.043993 -0.072323 -0.058348 -0.085132 -0.084198
2025-04-01  0.022986 -0.016160 -0.030610 -0.027934 -0.014583 -0.014870  0.007487 -0.004862 -0.006530 -0.002835
2025-05-01  0.074507  0.033878  0.093188  0.040943  0.060532  0.036227  0.042916  0.038487  0.077177  0.058551
2025-06-01  0.087608  0.048692  0.052818  0.012206  0.023072  0.011713  0.032596  0.001901 -0.000650  0.024940
```

Problem 3. Analyze and Tabulate Results

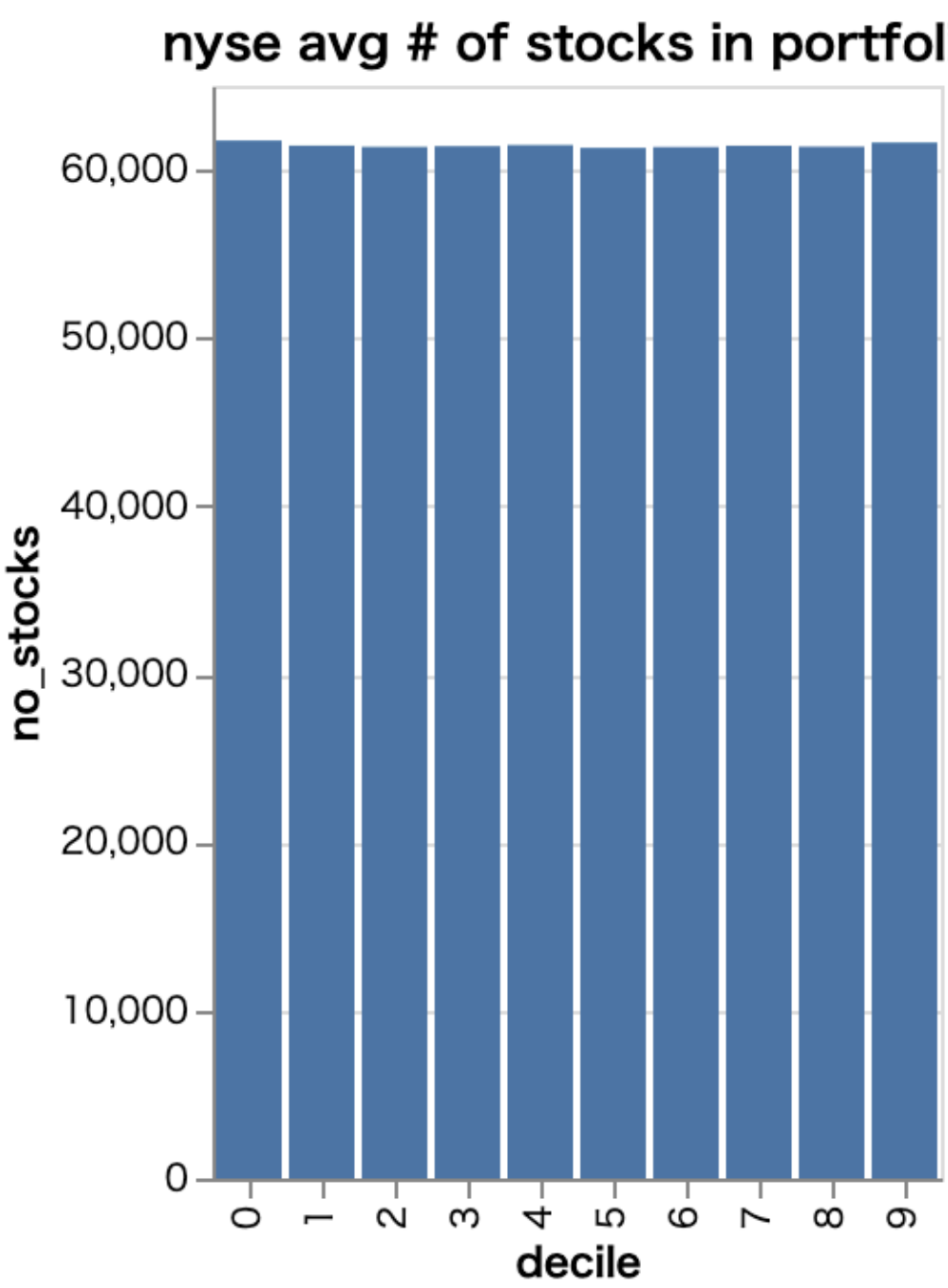
These are the nyse analysis results (Mean return and t-values)



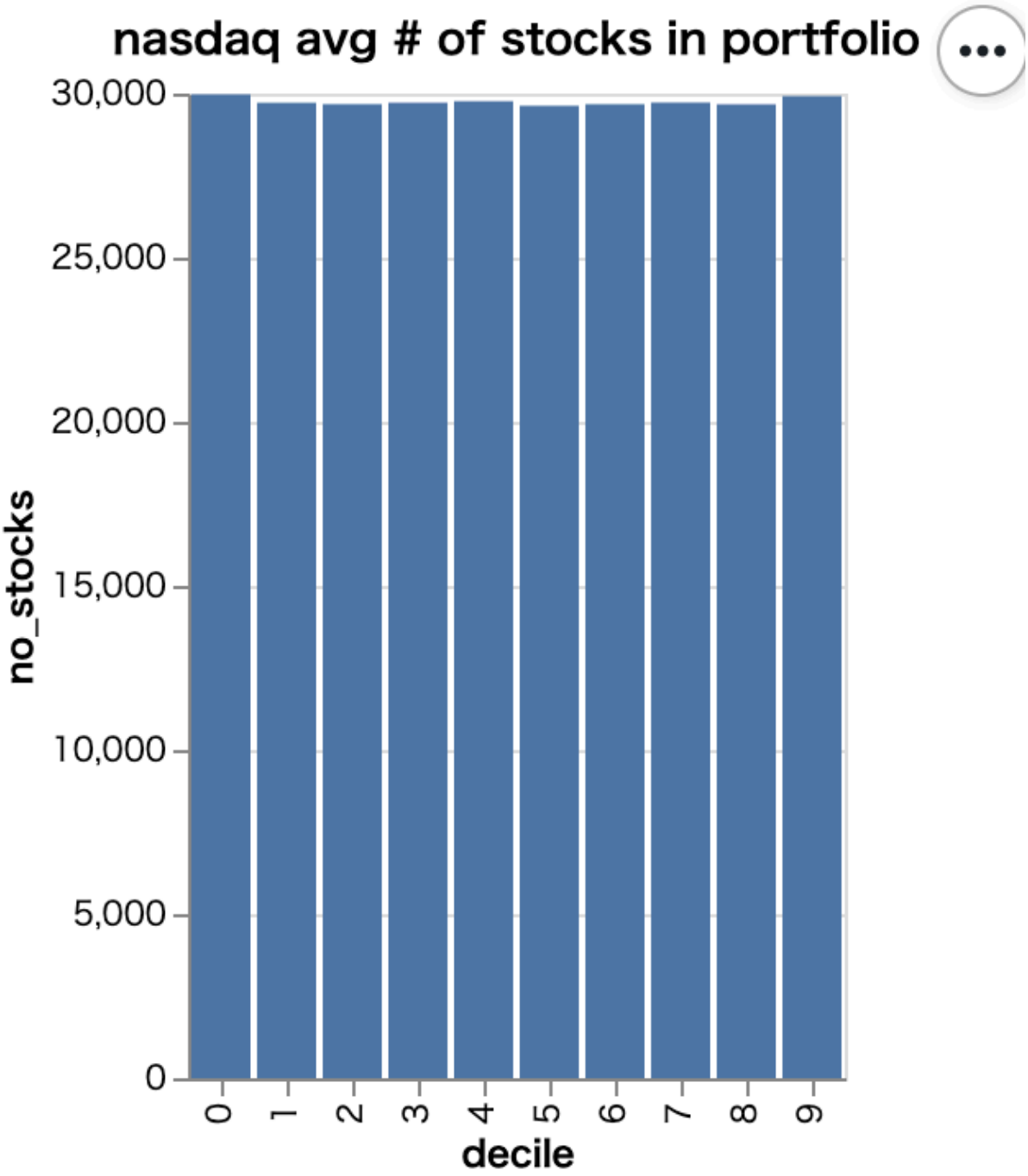
And here are the nasdaq analysis results.



Also for a check, here are the bar plots for the avg number of stocks in the portfolios NYSE:


nyse avg # of stocks in portfolio
60,000
50,000
40,000
30,000
20,000
10,000
0
no_stocks
0
1
2
3
4
5
6
7
8
9
decile

NASDAQ



Problem 4. Compare NYSE and NASDAQ

Calculate the difference in returns between the corresponding deciles and test if the difference is statistically significant.

```
--- NYSE vs NASDAQ Difference ---
        Mean Difference (NYSE-NASDAQ)  t-statistic   p-value
decile
0.0                         -0.004535    -0.695247  0.487227
1.0                         -0.003405    -1.451889  0.147166
2.0                         -0.000905    -0.647924  0.517334
3.0                         -0.004440    -2.497519  0.012830
4.0                          0.000795     0.449182  0.653497
5.0                         -0.001928    -1.476246  0.140514
6.0                         -0.002884    -1.704137  0.088983
7.0                         -0.005141    -3.126714  0.001872
8.0                         -0.001924    -1.064470  0.287635
9.0                         -0.001786    -0.903042  0.366943
>>>
```

1. **Statistical Significance**:
   - All deciles in both markets show statistically significant returns (p-values < 0.05)
   - The t-statistics are generally strong (>2) for all deciles
   - NYSE shows particularly strong significance in the extreme deciles (0 and 9)
2. **Return Patterns**:
   - Both markets show evidence of momentum effect:
     - NYSE: Decile 0 (21.69%) and Decile 9 (20.73%)
     - NASDAQ: Decile 0 (29.01%) and Decile 9 (22.88%)
   - NASDAQ shows more extreme momentum returns:
     - Higher returns in the top decile
     - Larger spread between extreme deciles
     - This suggests momentum effects are stronger in NASDAQ stocks, which feels intuitive because the nasdaq has more growth stocks.
3. **Comparison**:
   - NASDAQ has generally higher returns across deciles
   - The spread between extreme deciles is:
     - NYSE: ~0.957% (21.69% - 20.73%)
     - NASDAQ: ~6.13% (29.01% - 22.88%)
   - This suggests momentum strategies might be more profitable in NASDAQ stocks
4. **Economic Significance**:
   - The returns are economically meaningful
   - Monthly returns of 2-3% in extreme deciles suggest substantial investment opportunities
   - The effect is persistent across both markets

Problem 5 Potential concerns

My first thoughts for the two biggest potential concerns were

1. Survivorship bias, I would guess that usually, such data would show us only the past values for stocks that are currently still there, so companies that went bankrupt won't be in here.
2. Are dividends, stock buybacks or stock splits considered in this dataset?