Problem Set 1
Econ 136, Spring 2024

This problem set is due by 5PM Monday, February 5th, on Gradescope.

Note on rounding: please round all percentage returns to two digits after the decimal point: e.g., 5.45% or 1.0545.

1. **Internet Exercise: US and Foreign Stock Markets in the Past Five Years**

   This exercise is designed to introduce you to the recent behaviour of the US and foreign stock markets and give you an idea of the finance-related tools available on the Internet. Go to the Yahoo Finance website at `https://finance.yahoo.com/`. Type `^DJI` in the search box at the top and press enter. This will take you to a page with a chart showing the performance of the Dow Jones Industrial Average over the past day. You can change the historical range by clicking `5Y` to see the past five years, or `Max` to see all available historical data, etc. Click on `Full Screen` in the upper right corner to expand the plot.

   (a) Note that you may change the scale by going to `Settings` (upper right corner of the chart) and choosing either `Linear` or `Logarithmic`. Using the all the available historical data (i.e., `Max`), what are the advantages and the disadvantages of using each? Which gives a better picture of the past performance of the index?

   (b) Using the most recent 5 years worth of data, compare the performance of the Dow Jones with that of the S&P500 (another major US stock market index), the Nasdaq (a US index dominated by technology stocks), and the Nikkei 225 (the major Japanese stock index) by clicking `Comparison` (upper left corner of the chart) then searching and adding these indexes. You should see results plotted for the 4 indexes. You can also get historical prices for each index by going back (out of full screen mode), entering their symbol in the search box, press enter, and click on `Historical Data`. Compare the indexes over the past five years. To do this, rank the indexes by annual geometric average return and annual arithmetic average return – use the closing prices on 1/12/2018, 1/11/2019, 1/13/2020, 1/13/2021, 1/13/2022, and 1/13/2023 in your analysis. Is your ranking different using annual geometric versus annual arithmetic average returns? If yes, which ranking agrees with the graphical evidence? If not, do you find any anomalies in either the geometric average returns or the arithmetic average returns of any of the indexes? If your selection criteria was past five year performance, would you use the annual geometric average return or annual arithmetic average return to choose an index in which to invest?

2. **How much is your return?**

   (a) Calculate the net simple return of Bang.com between 2001 and 2003 given that its stock price was \$80 on January 1, 2001 and fell to \$12.77 on January 1, 2003. The company paid \$0.53 in dividends on January 1, 2003, and no dividends before. What is the (geometric) average return per year?

   (b) Calculate the net simple return of Rolling S Co. in 1980 given the following information:

   - stock price on January 1, 1980 was \$91,
   - stock price on December 31, 1980 was \$107.20,
   - the company paid a dividend of \$.80 per share on December 30, 1980,
   - the inflation rate in 1980 was 14% per year.

   Calculate both the nominal and the real return. Which would you use to compare the 1980 performance of Rolling S to that of other companies? Which would you use to compare it to the company's performance in some other year, say 1990?

3. **Create your portfolio**

   In this question, "return" always means "net simple return." Use the price data in the table below to answer the question. You may assume that no dividends have been paid over the course of the holding period.

Name	Price 1/2/2008	Price 1/2/2009	Shares Outstanding
Historic Co.	\$60	\$63	50
Present Ltd.	\$28	\$21	50
Optimistic Inc.	\$32	\$36	100

   (a) Compute the 2008 weights in an i) equal-weighted, ii) price-weighted, iii) value-weighted stock index, which includes only the three companies in the table. Compute the returns on these three portfolios.

   (b) Suppose you hold a portfolio of these stocks in order to match the performance of one of the indexes from part (a). Note, by the end of 2008, the portfolio weights may change. What adjustments do you have to make in your portfolio at the end of 2008 to maintain the weighting scheme for each of the three indexes, and why?

4. **Arbitrage and the Law of One Price**

Each of the following situations is an arbitrage opportunity. For each situation, explain the source of the arbitrage opportunity and how you would trade to exploit it.

(a)

State	Asset 1	Asset 2
State 1	1	5
State 2	-0.6	-3
Price	0.5	4

(b)

State	Asset 1	Asset 2
State 1	1.5	4.5
State 2	2	5.5
Price	1	3

(c)

State	Asset 1	Asset 2	Asset 3
State 1	1	0	4
State 2	0	1	7
Price	0.6	0.3	4.2