Assignment 1

Your client wishes to hedge their price risk exposure to Oman stocks and seek your help in doing so. As of December 31, 2021, they have invested $100M in a portfolio that tracks the MSCI Oman index. They would like to have the hedged portfolio vary as little as possible on a daily basis.

The hedge will be in place from Jan 1, 2022 to Dec 31, 2022.

The MSCI data can be downloaded at:

https://www.msci.com/end-of-day-data-country

Note: I will describe how to access the data in class. Use the "Oman" index, not the "Oman Domestic" index. When downloading, select "Index Level" to be "Gross".

You will use futures contracts on MSCI indices to create your hedge. In order to do so, create an account at Bloomberg. After doing so, at the landing page:

1. Search for "generic futures".
2. Click on "Index/Stats" and then click on "Futures". This will bring you to the landing page to access all futures contracts.
3. In the search box below "Name" type "MSCI" <GO>. This will result in Bloomberg displaying futures contracts on MSCI indices.

I suggest focus on contracts traded on Eurex (EUX). This is because there tends to be more trading on Eurex, which means you are more likely to get reliable futures prices. To find futures contracts traded on Eurex, use the search box below "Source" and type "EUX" <GO>.

You are looking for "Generic 1st" contracts. This is the contract that is set to expire next.

"Generic 1st" is a continuous contract, which means that at a given date before "expiry", the price data in the series switches to the next futures contract. Assume the contract is "rolled-over" on the last day before the contract "expires".

To access the data:

1. Click on the "Name" of the series of interest. This will bring up the "Futures Contract Table" page.
2. Look for the "Related Functions Menu" at the top, middle left part of the screen.
3. From this drop-down menu, select "GP Line Chart".
4. Select the start date as 01/01/2021 <GO>. This will pull up date from Jan 1, 2021 to the current date.
5. "96) Actions / Table". When the table appears, click "Edit Chart" on the right hand side of the screen. When the menu appears, click "Volume".
6. To extract the data, select "97) Edit / Copy Data to Clipboard". This data can be copied to a text editor or excel.

Select **three** contracts to use in the hedge. For each contract, download the historical price data from January 1, 2021 to December 31, 2021. Choose futures contracts with non-zero "open interest".

Analysis Task 1: For each contract, state why you think this contract will offer the best hedge.

The justification should be based on logic, not on a high correlation between the changes in prices for futures and spot contract. There should be a reason why you think there could be a high correlation. State why you expect there to be a high correlation.

Data Task 1: Plot the prices for the spot asset and futures contracts. Should be three graphs in total (one for each futures contract).

Data Task 2: Plot the trading volume for the futures contracts. Should be three graphs in total (one for each futures contract).

Data Task 3: Is there missing data? If so, you will have to adjust the data to "fill in" the missing observations. Propose one method of doing so. State what assumptions must hold in order for your method to be valid.

To find the contract specifications, google the name of the futures contract and exchange. This should produce links to the contract page on the exchange. Go to the exchange website and find the find the contract specifications for each of the futures contracts.

Data Task 4: Identify the information you will use to construct the hedge. Create a table which displays this information. There should be one table with information about the three contracts.

You will use two different types of hedging.

1. "Naïve" hedging. Find the number of contracts that most closely matches the dollar value of the portfolio on a given day.

Data Task 5: Plot the value of the hedged portfolio, which includes the MSCI index and the futures contract.

Calculate the daily returns for the hedged portfolio. This is done using

$r_t = (P_t / P_{t-1}) - 1$

where r_t is the return on day t, and P_t is the value of the portfolio at day t.

Data Task 6: Create a table that shows the arithmetic average and standard deviation for each proposed hedged portfolio returns.

Identify the best and worst contract for hedging MSCI Oman risk.

Analysis Task 2: What do you think explains the difference in the hedged portfolio returns of the best and worst hedging instruments.

Data Task 7: Plot the distribution of the best hedged portfolio. Identify three days in which the hedge performed poorly.

Analysis Task 3: What explains the poor returns identified in Data Task 7?

2. Optimal Hedging

Data Task 8: Now create an optimal hedge using a regression. You can use simple linear regression. If you know of another estimation procedure, you are welcome to you that. Use daily changes in the spot and futures prices when estimating the hedge ratio.

Describe how you estimated the hedge ratio. Create a table displaying the estimated results, statistical significance of the parameters and estimates of the "goodness of fit".

I leave it to you to select the time period for data used to estimate the hedge ratio.

The key is to not to use data from the day you want to hedge, or any days after you want to hedge.

Using data from the day you want to hedge is called "data snooping". In the real world, you do not have this information in advance, and including the information you don't have can leaded in ineffective hedges.

To avoid "data snooping" you can:

1. Use a **fixed window** of historical data, with the last date in the window is December 31, 2021.

You calculate the optimal number using this data. You then do not change the "h" parameter during the hedging period. So you use the same h each day, and use the equation in Week 2 to estimate the optimal number of contracts.

Another approach is to use a **"rolling window"** where you use X number of days to calculate "h" which you then apply to the calculate the number of contracts needed to hedge the next day's risk.

You then increment or "roll forward" the window one day, recalculate the "h" parameter, find the optimal number, and rebalance the number of contracts needed.

I encourage you to avoid "data snooping" when estimating the hedge ratio.

Instead, reflect on how the hedge performed relative to what you expected. Doing so will open greater opportunities to learn about what works and what doesn't work when hedging.

Please note that your grade will NOT depend on the actual fit of your hedge. Instead, your grade depends on the clarity and thoughtfulness of your analysis.

Data Task 9: Create a table that shows the arithmetic average and standard deviation for each proposed hedged portfolio returns.

Identify the best and worst contract for hedging MSCI Oman risk.

Analysis Task 4: What do you think explains the difference in the hedged portfolio returns of the best and worst hedging instruments.

Data Task 10: Plot the distribution of the hedged portfolio. Identify three days in which the hedge performed poorly.

Analysis Task 5: What explains the poor returns identified in Data Task 10?

Analysis Task 6: How does the hedge using the hedge ratio compare to the hedge using a naive dollar matching strategy?

Deliverables

Written Report due November 2 at the start of class. Maximum 10 pages, 12 point font and 1.5 line spacing. Follow the format below:

Executive Summary (maximum 1 page) highlighting what you feel are the most significant results of your analysis.

Analysis Task 1

Data Task 1

Data Task 2

Data Task 3

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Data Task 10

Analysis Task 5

Analysis Task 6

Bibliography

Include tables and/or figures addressing the requested data analysis in the Data Task section of each task. Each table should have a self-explanatory title, and include labels for the numerical information presented.

Note: If you draw on outside sources when writing your report, you must cite the source and include the source in a bibliography. This includes any graphs or figures you may happen to find on the internet. Use the APA style when citing works.

If you draw on outside sources when writing your report and do not cite these sources and reference them in a bibliography, you will receive a 50 (fifty) percent deduction on your final grade. If you are unfamiliar with the APA style, please google "APA style" for more information.