

FINM 35000 Problem Set 1: ESG and Climate Risk

Instructor: Joanna Harris, TA: Lisheng Su

Due October 11, 2023, 6PM

Submission instructions: please submit one copy per group of your responses to sections 1 and 2. The submission should include a PDF or Word document with the written results, tables and figures and a separate code file (in a programming language of your choosing). Please use a different font color for responses typed by each group member.¹ Please make sure to write the names of all group members at the top of the writeup (the font color of the names should match each group member's responses). Section 3 is **individual** and optional. If you would like to submit a response to Section 3, please do so in a separate submission.

Supplementary files: the files you will need to complete this assignment can be found <https://www.dropbox.com/sh/evyxpn5y9fmw0qu/AAD2nBjjkoHMmILOnAfzCarKa?dl=0>

1 ESG (40 points)

1. The file `MSCI_sample.csv` contains MSCI ESG ratings for a random sample of firms.² Following equations 1 and 2 of Pástor et al. (2022), compute the firm-level greenness measure, $g_{i,t}$. In order to do the value-weighting (this will also apply when you construct the GMB portfolio), use the fields PRC (price) and SHROUT (shares outstanding) to compute the market cap of each firm at each date. Then, \bar{G}_t is the market cap weighted average. You do not need to report anything at this step, but will need to use this measure later.
 - (a) (5 points) In your own words, explain what the unadjusted greenness score, G_{it} , measures. Make sure to mention why we need to include E_weight .
 - (b) (5 points) Why does the paper focus on the adjusted greenness score?
2. (10 points) Use the description in Section 4 of the paper to replicate Figure 3.³
3. (10 points) What is the monthly return and Sharpe ratio of the green minus brown portfolio?⁴
4. (10 points) How does Pástor et al. (2022) explain that green stocks outperform bad stocks when the theoretical model from Pástor et al. (2021) suggests that brown stocks should outperform? Make sure to focus on the distinction between expected and realized returns.

¹For questions where the output is a figure, you can write a note with the name of the group member that created the figure.

²Due to data licensing, I cannot share the data for the full sample.

³Your figure will look slightly different because your data is a random sample.

⁴The instructions for constructing the green minus brown portfolio are in the paper.

2 Climate Risk (60 points)

The first two parts of this problem are just to give you a chance to explore the industry returns data. The third part is specifically related to climate risk.

1. (5 points) The file `49_Industry_Portfolios.csv` contains monthly returns of stocks in 49 different industries.⁵ Import this file into your program of choice. Restrict the sample to start in January 2004 and end in June 2018.⁶ Calculate the cumulative return of each industry over the sample period.⁷ Which were the three highest and three lowest performing industries in this sample?
2. (10 points) For each industry, calculate the standard deviation of returns. Use this to calculate the Sharpe ratio. Which industries have the three highest and three lowest Sharpe ratios? How do these compare to those with the highest and lowest returns?
3. In the next sub-questions, we are going to focus on days where attention to climate change is high. We will identify these days in two ways: using Google Trends searches and using the Ardia et al. (2020) climate concerns data.
 - (a) (20 points) Go to <https://trends.google.com/trends/?geo=US> and go to the page for the Climate Change topic.⁸ Change the timing to 2004-present and download the data.
 - i. Pick three months where this measure was high. Can you find any news events from those months that might be leading Google searches for climate change to be particularly high? Discuss.
 - ii. Merge the Google Trends data with the data from `49_Industry_Portfolios.csv`. For each industry, regress returns on the Google Trends Climate Change topic score.⁹ Create a table with three columns: column 1 has the industry name, column 2 has the OLS regression coefficient and column 3 has the p-value for that coefficient. Sort the table from largest to smallest coefficient.
 - iii. Comment on the ordering of the industries. Is it in line with what you would have expected?
 - iv. Repeat i.-iii. for two new climate change-related Google search terms of your choice. One of these terms should be related to physical risk (e.g. heat wave, hurricane, wildfire) and one should be related to transition risk (e.g. environmental regulation, carbon tax, cap and trade).
 - (b) (25 points) Download the Ardia et al. (2020) data from <https://sentometrics-research.com/download/mccc/>. Focus on the tab “SSRN 2022 version (monthly).” Repeat problem 3a using this data instead of Google Trends. Instead of Google searches for the Climate Change topic, use the column called “Aggregate.” Instead of Google searches for physical and transition risk topics, choose one physical risk-related and one transition-risk related series from the Ardia et al. (2020) data. Try to choose the series that are most closely related to the Google searches you

⁵This file comes from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research

⁶This is to ensure that there is Google Trends data and Ardia et al. (2020) for the entire sample you are using.

⁷Hint: cumulative return is computed by multiplying the return in each month plus 1. For example, if the return in one month is +3% and the return in the next month is -1%, the cumulative return over the two months would be $1.03 \times 0.99 = 1.0197$, which is 1.97%. The file displays returns in percentage points (i.e. 1.5 means 1.5%). Make sure to replace -99.99 and -999 with null values.

⁸Make sure to use the topic, not the search term.

⁹Hint: make sure to include a constant in your regressions. Specifically, the equation you are estimating is: $RET_{it} = \alpha + \beta CLIM_{it} + \varepsilon_{it}$, where RET_{it} is the return of industry i in month t , $CLIM_{it}$ is the Google Trends score for the Climate Change topic in month t and α is a constant.

chose above. Comment on the similarities and differences in the industry rankings you find when using the Ardia et al. (2020) compared to the Google data.

3 Reading Response (15 points)

Optional for extra credit. Must be completed individually.

Read Lins et al. (2017) and answer the following questions.

1. (5 points) Why are the authors particularly interested in studying the performance of socially responsible firms during crisis times (instead of studying performance of these firms more generally)?
2. (5 points) Focusing on Section IV, describe the authors' findings related to the effect of CSR on operating performance and capital raising. Conceptually, explain why CSR would matter for these outcomes during crisis times?
3. (5 points) What questions are you left with after reading this paper?

References

- Ardia, D., Bluteau, K., Boudt, K., and Inghelbrecht, K. (2020). Climate change concerns and the performance of green versus brown stocks. *National Bank of Belgium, Working Paper Research*, (395).
- Lins, K. V., Servaes, H., and Tamayo, A. (2017). Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *the Journal of Finance*, 72(4):1785–1824.
- Pástor, L., Stambaugh, R. F., and Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, 142(2):550–571.
- Pástor, L., Stambaugh, R. F., and Taylor, L. A. (2022). Dissecting green returns. *Journal of Financial Economics*, 146(2):403–424.