Capstone 1: Experimental design

Research Proposal

The following document explains in detail the research proposal to be analyzed, the different hypothesis that will be tested, as well as the data that will be used and the possible audience to whom the insights may provide some interest.

1. Data

For this project I will be using four different publicly available datasets, explained in this table:

Dataset Name	Meaning
ESGE	ESG Emerging Markets Exchange Traded Fund
ESGD	ESG Europe, Australia, Far East Exchange Traded Fund
ESGU	ESG U.S.A. Exchange Traded Fund
VIX	CBOE Volatility Index

Each dataset is further explained here:

ESG Emerging Markets Exchange Traded Fund (ESGE):

Seeks to track the investment results of an index composed of large- and mid-capitalization emerging market equities that have positive environmental, social and governance characteristics as identified by the index provider.

ESG Europe, Australia, Far East Exchange Traded Fund (ESGD):

Seeks to track the investment results of an index composed of large- and mid-capitalization developed market equities, excluding the U.S. and Canada that have positive environmental, social and governance characteristics as identified by the index provider

ESG U.S.A Exchange Traded Fund (ESGU):

Seeks to track the investment results of an index composed of U.S. companies that have positive environmental, social and governance characteristics as identified by the index provider while exhibiting risk and return characteristics similar to those of the parent index.

CBOE Volatility Index (VIX):

A real-time market index that represents the market's expectation of 30-day forward-looking volatility.

Here are the links for the different datasets:

1. **ESG Emerging Markets Exchange Traded Fund (ESGE):**
   https://finance.yahoo.com/quote/ESGE/history?p=ESGE

2. **ESG Europe, Australia, Far East Exchange Traded Fund (ESGD):**
   https://finance.yahoo.com/quote/ESGD/history?p=ESGD

3. **ESG U.S.A Exchange Traded Fund (ESGU):**
   https://finance.yahoo.com/quote/ESGU?p=ESGU&.tsrc=fin-srch

4. **CBOE Volatility Index (VIX):**
   https://finance.yahoo.com/quote/%5EVIX?p=^VIX&.tsrc=fin-srch

2. Research design

For this project the following questions will be answered:

1. Which period (months) since 2016 has had the greatest volatility as measured by the VIX Index?

2. Prior to the period of greatest volatility. Is there a significant difference in the means of daily returns between the three different Exchange Traded Funds?

3. During the period of greatest volatility. Is there a significant difference in the means of daily returns between the three different Exchange Traded Funds?

4. If there is any significant difference between the means of daily returns, how large is that difference and in which period?

In order to answer these questions, the following hypothesis will be tested for each period:

> *Ho: There is not a significant difference between the means of daily returns for the three different instruments.*
>
> *Ha: There is a significant difference between the means of daily returns for the three different instruments.*

The datasets contains the following columns which will be used for the analysis:
- Open: The open price recorded during the trading day
- High: The highest price recorded during the trading day
- Low: The lowest price recorded during the trading day
- Close: The close price recorded at the end of the trading day

In order to calculate the daily returns for each trading day, we will use this simple formula:

$$Return = \frac{Ending\ price - Starting\ price}{Starting\ price} \, x\ 100$$

After testing for normality between the different daily returns of each instrument, we will perform an ANOVA test, we want to test if there is a difference of means for independent variables.

3. Audience

For the last couple of years there has been an increasing attraction to financial assets that follows the ESG (Environmental, Social, Governance) framework. This project could be for the interest of potential investors and analysts who wish to know if the different profiles and returns of the three ETFs (Exchange Traded Funds) that follow this framework differ in a significant way, specially in turbulent periods in the markets such as the beginning of 2020.