Predicting Stock Market Returns with Macroeconomic Variables by Country Economic Profile

A Machine Learning Approach

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Introduction

Motivation

- **Why predict the stock market with macroeconomic indicators?**
  - There are dynamic interdependencies between the real and financial sectors
  - Knowing how well different macroeconomic variables predict the stock market sheds light on the empirical links between the sectors
  - May inform how financial indicators are devised
  - May reveal monetary policy transmission channels
- **Why use Machine Learning?**
  - Avoid limitations of traditional econometrics tools: restrictive assumptions and limited predictive power
  - Identify non-linear empirical relationships
  - Automated feature selection
- **Risk and Investment Management**
  - A working predictive model that is accurate will help inform investment decisions and risk management steps

Research Question

What are the macroeconomic variables that predict the direction of stock market index returns and how do the predictors differ by economic profile of a country?

- **Country Economic Profile:**
  - Want to know whether the most important predictors depend on the state of the economy
  - For comprehensiveness, we deal with a country's economic profile, which comprises of a set of macroeconomic indicators instead of just using one economic index

- **Stock Market Indexes:**
  - An index adequately captures the performance of the stock market

- **Potential variations / extensions:**
  - Instead of predicting direction of return (binary class), predict multiple intervals of return (multiple classes), or use continuous prediction
  - In addition to macro variables, webscrap for media and investor sentiment to use as predictors

Research Question

Potential Implications

- **Challenges traditional financial theories:**
  - Accurately predicting stock returns using information that is available to the public will provide evidence against traditional theories of Market Efficiency

- **Heterogeneous predictors by Country Economic Profiles:**
  - If we find that certain predictors are only important for countries of a certain economic profile, the different drivers of financial growth can be identified
  - May aid policy making in countries of various economic states
  - May inform future model building and variable selection for stock investment in various countries

- **Produce warning signals for recessions:**
  - An accurate working model may generate signals of recessions if it predicts a dip or crash in the stock market index

Data & Method

DATA

y: Stock Market Index Return	(Response) Percentage change of the country's major stock market index over a month.
X: Macroeconomic Variables	(Predictors) Monthly, contemporaneous and lagged. E.g. Yield Curve spreads, inflation and interest rates

METHOD

Determine Main Country Economic Profiles

- Centroid-based clustering to form clusters of countries that have similar economic profiles, measured by economic indicators: GNI/GDP per capita etc.

Feature Selection with Regularization

- For the average economic profile in each cluster, represented by the country closest to each cluster center, fit a binary logistic classifier with LASSO.
- Interpret the most important predictors by economic profile.

Prediction

- Using the selected features, for each economic profile, fit 3 other classifiers (KNN, Naive-Bayes, Random Forest).
- Evaluate the 4 models with K-Fold Cross Validation (among other measures) and select the best model.

Literature Review

- **Predicting the bear stock market: Macroeconomic variables as leading indicators (Chen, 2008):**
  - Investigates the usefulness of various macroeconomic variables in predicting recessions
  - We will draw variables from her paper, but employ classification methods instead of a Markov-Switching model, and predict several indexes instead of only the S&P 500

- **Random Forest Based Feature Selection of Macroeconomic Variables for Stock Market Prediction (Nti, Adekoya, Weyori, 2019):**
  - Applies random forest based feature selection of macroeconomic variables for Ghana Stock Exchange and draws conclusions between features and different sectors of the economy
  - We will employ similar classification method but utilize it for distinct economic profiles of countries instead of different sectors in a single economy

- **Macroeconomic Factors in Modelling the SMEs Bankruptcy Risk (Ptak-Chmielewska, Matuszyk, 2019):**
  - Uses logistic regression to evaluate bankruptcy risk for SMEs by using financial ratios and macroeconomic variables for Polish Market
  - We will employ a similar binary logistic classifier but includes regularization. Instead of bankruptcy risk, we classify stock market growth (non-negative or negative), which implicitly models stock market risk.