Foreign Exchange Analysis

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Foreign Exchange Background

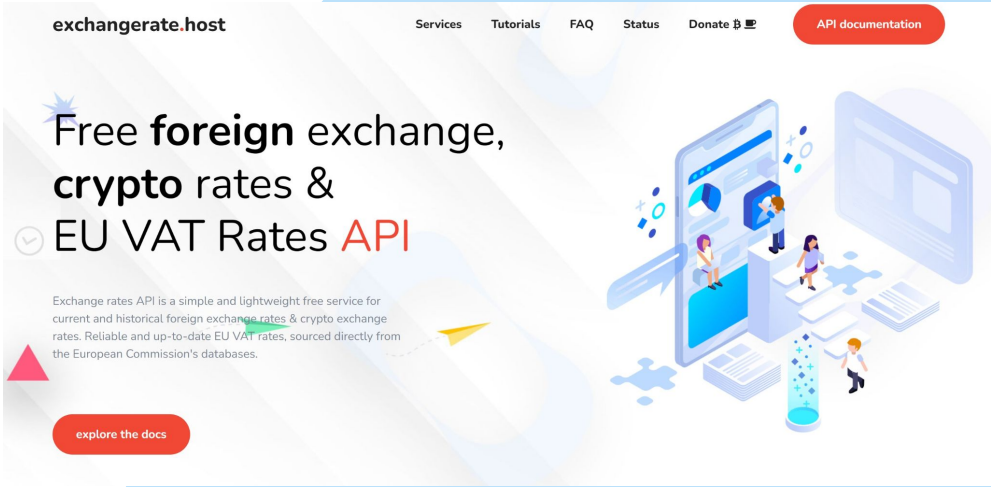
Foreign Exchange Market

- Trade of different world currencies
- Pegged currencies: fixed exchange rate, currency follows the movement of another

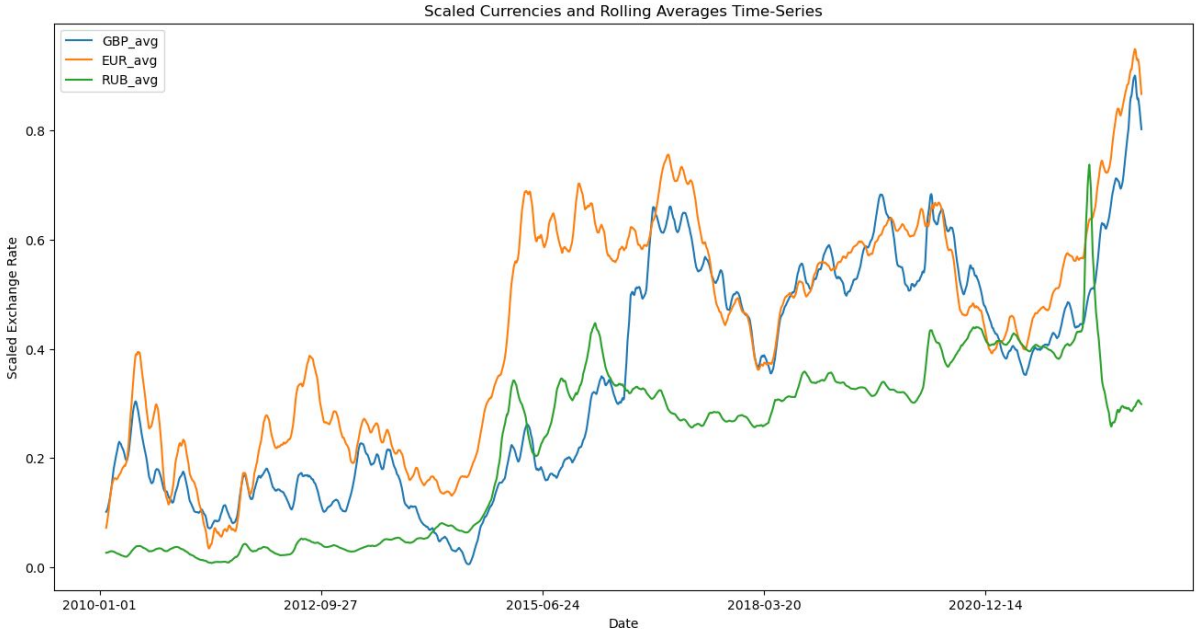
Introduction to Data

Data Collection

- Exchange Rate API
- Time-series data of the various currencies from 2010 - 2022
- Set base to be ‘USD’
- Requested API and read data into Pandas dataframes for analysis



Exploratory Analysis



* Upward movement represents a decrease in currency value

Machine Learning & Results

1. **Simple Linear Regression**

2. **Multiple Linear Regression**

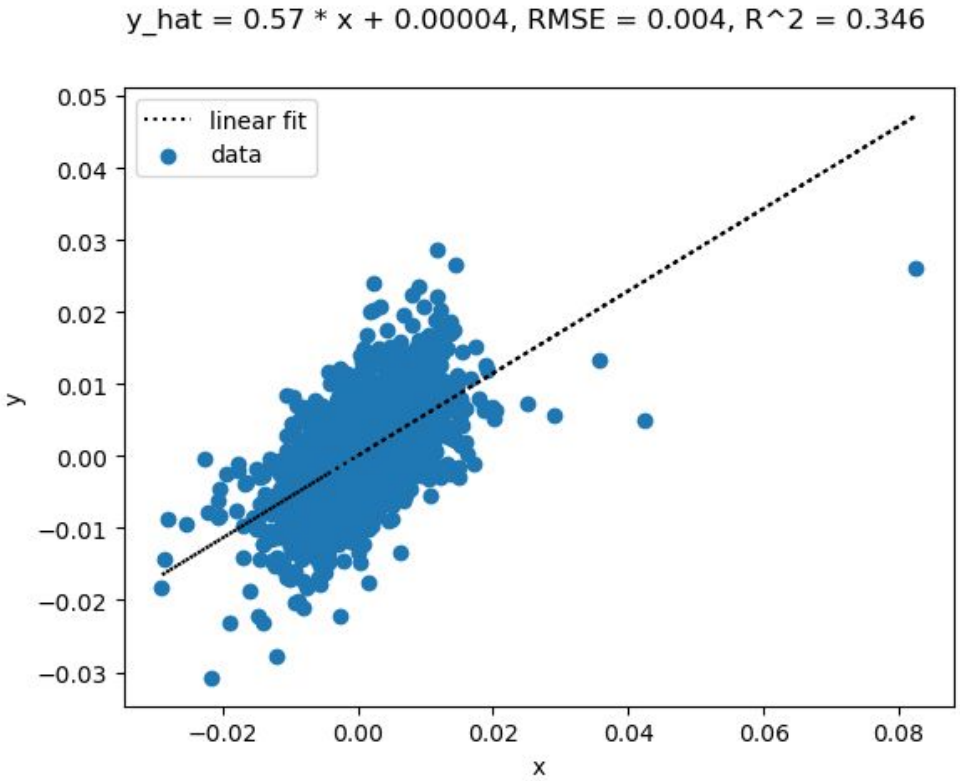
Goal: Find potential linear/explainable relationships between percentage changes in currencies

Simple Linear Regression

- Determine if a linear model can be used to see if the fluctuations of GBP can explain fluctuations in EUR
- Used percent change between currencies as a form of scaling

$$\hat{y}_i = b_0 + b_1 x_i$$

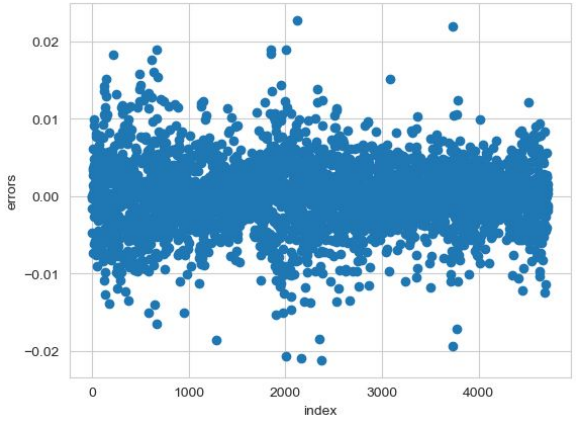
Simple Linear Regression



Linear fit of ΔGBP to ΔEUR

- Random assumptions met
- Around 35% of variability in ΔEUR can be explained by ΔGBP

SLR Assumptions

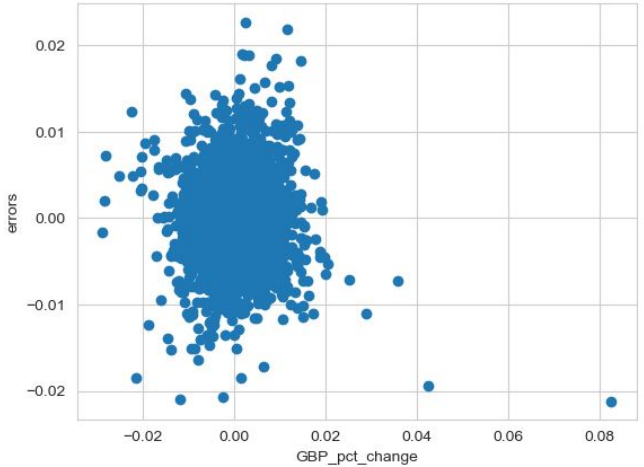


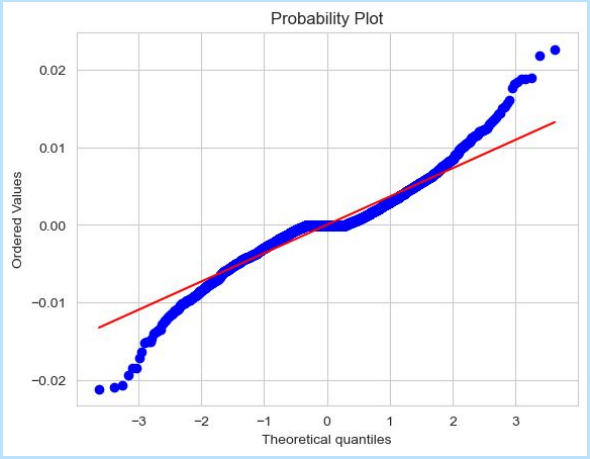
Independence

Passed

Constant Variance

Passed





Normality

Questionable

Multiple Linear Regression

- Determine if there is a relationship between the EUR and other European countries (BGN, CZK, HRK, HUF, PLN, RON, SEK)
- The goal is to see if the movement of the Euro could be predicted/explained
- Used percent changed between the currencies
- Random Forests to evaluate importance of features (currencies)

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_m x_m$$

Multiple Linear Regression Cont.

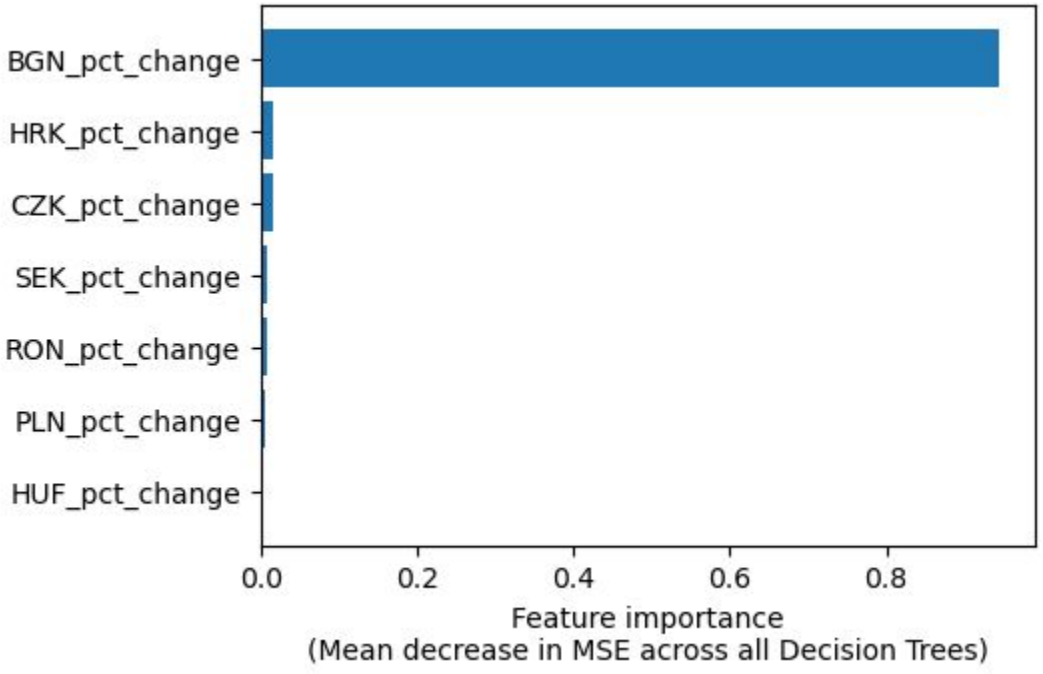
$$EUR = 0.00 + 0.04 \times BGN + 0.33 \times CZK + 0.10 \times HRK + 0.09 \times PLN + 0.03 \times RON + 0.15 \times SEK$$

$R^2 = 0.86$

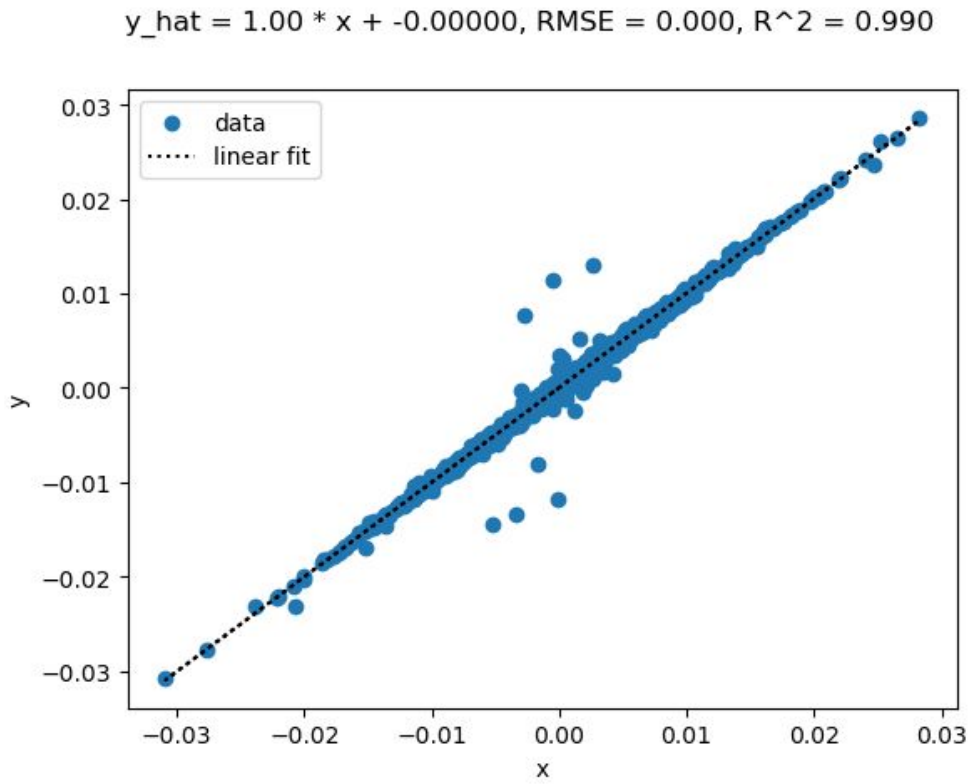
* All currency abbreviations represent percent change

Random Forest Regression

- 7 Non-Euro EU currencies used as features in rfr produce an r2 score of 0.993
- 99.3% of the variability in ΔEUR can be explained by the 7 currencies



Aside: Regression on a Currency Peg



Linear fit of ΔDKK to ΔEUR

- DKK is pegged to EUR
- Random assumptions not met
- 99% of variability in ΔEUR can be explained by ΔGBP

Multiple Linear Regression Cont.

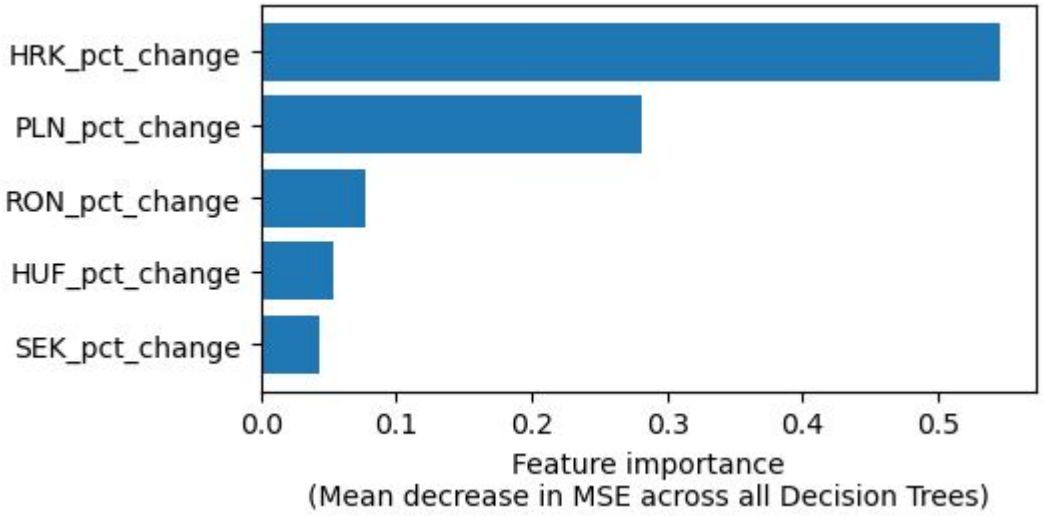
$$EUR = 0.00 + 0.15 \times HRK + 0.19 \times PLN + 0.04 \times RON + 0.21 \times SEK$$

$$R^2 = 0.81$$

* All currency abbreviations represent percent change

Non-Pegged Non-Euro Regression

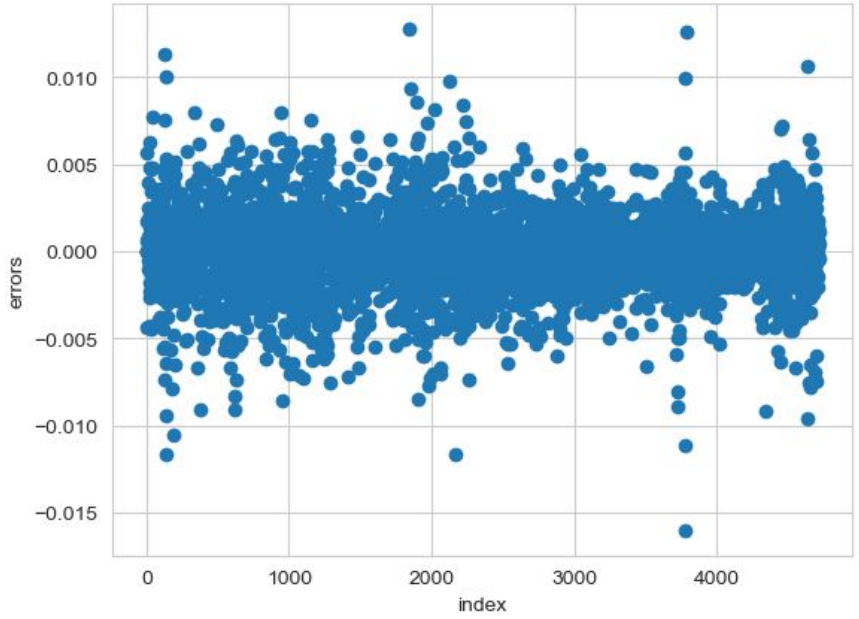
- 5 Non-Pegged Non-Euro EU currencies used as features in rfr produce an r2 score of 0.987
- 98.7% of the variability in ΔEUR can be explained by the 5 currencies



MLR Assumptions

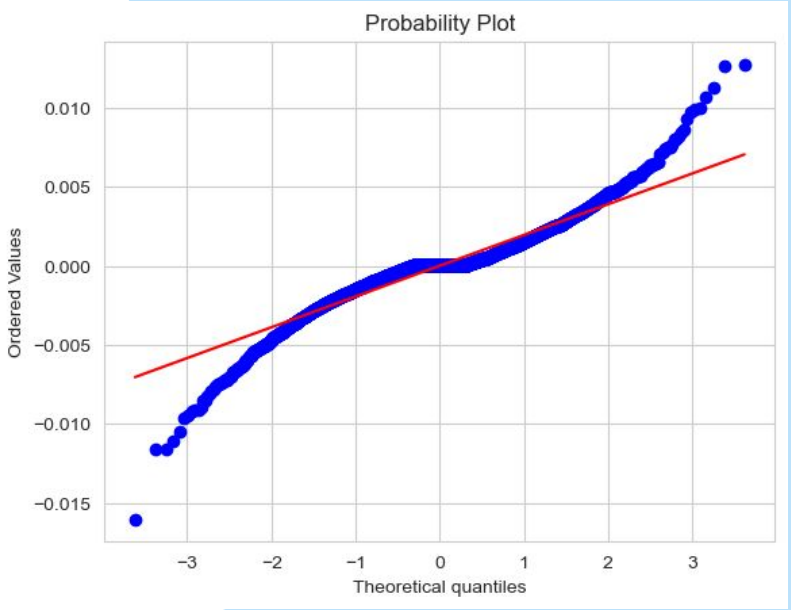
Independence

Passed

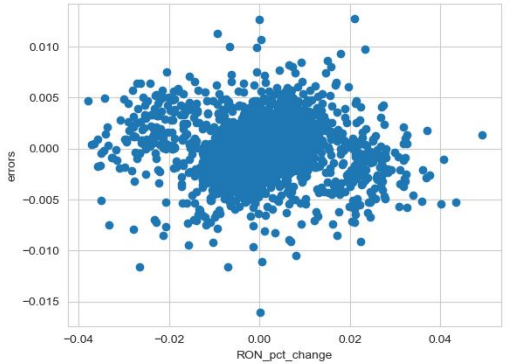


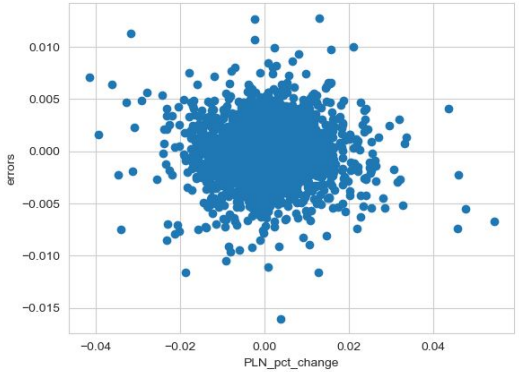
Normality

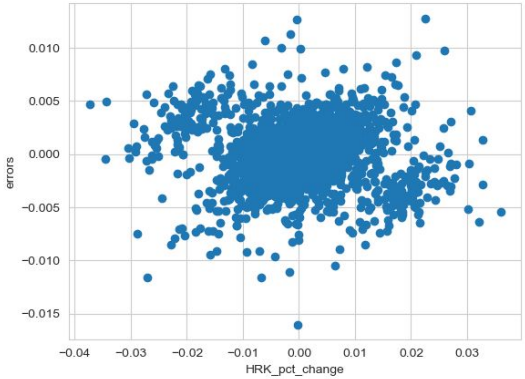
Questionable

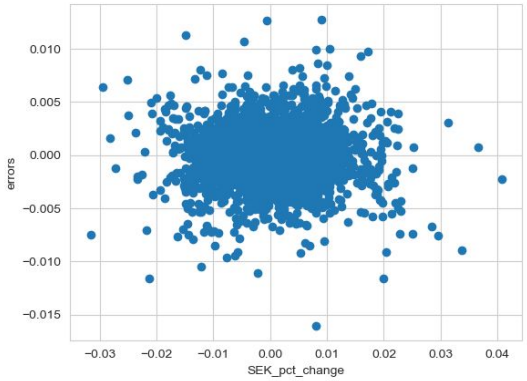


MLR Assumptions Cont.



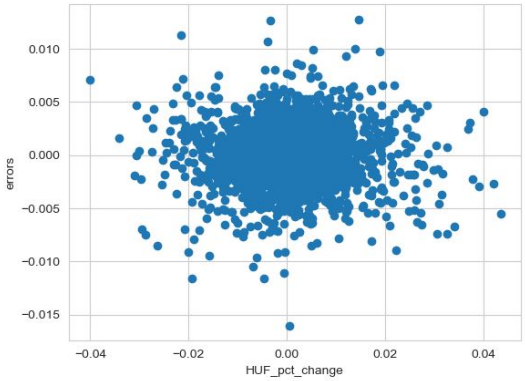






Constant Variance

Passed



Summary

- EU: political collection of 27 countries
- Changes in the multiple features of Non-Euro EU currencies give an understanding as to how the Euro moves
- Croatia, Poland, Romania, Hungary, and Sweden do not have pegs to any other currencies or standards, yet together they strongly model the movement of the Euro.

Next Steps

- Simulating several investment decisions according to our model and look at the overall ROI at the end
- Models failed some randomness assumptions, results can't be immediately taken for granted or trusted
- Using forecasting models for time-series data like the ARIMA, addressing the issue that time isn’t accounted for

Thank You