

Anatomy of an Economic Recession; Trends & Indicators

Project Report

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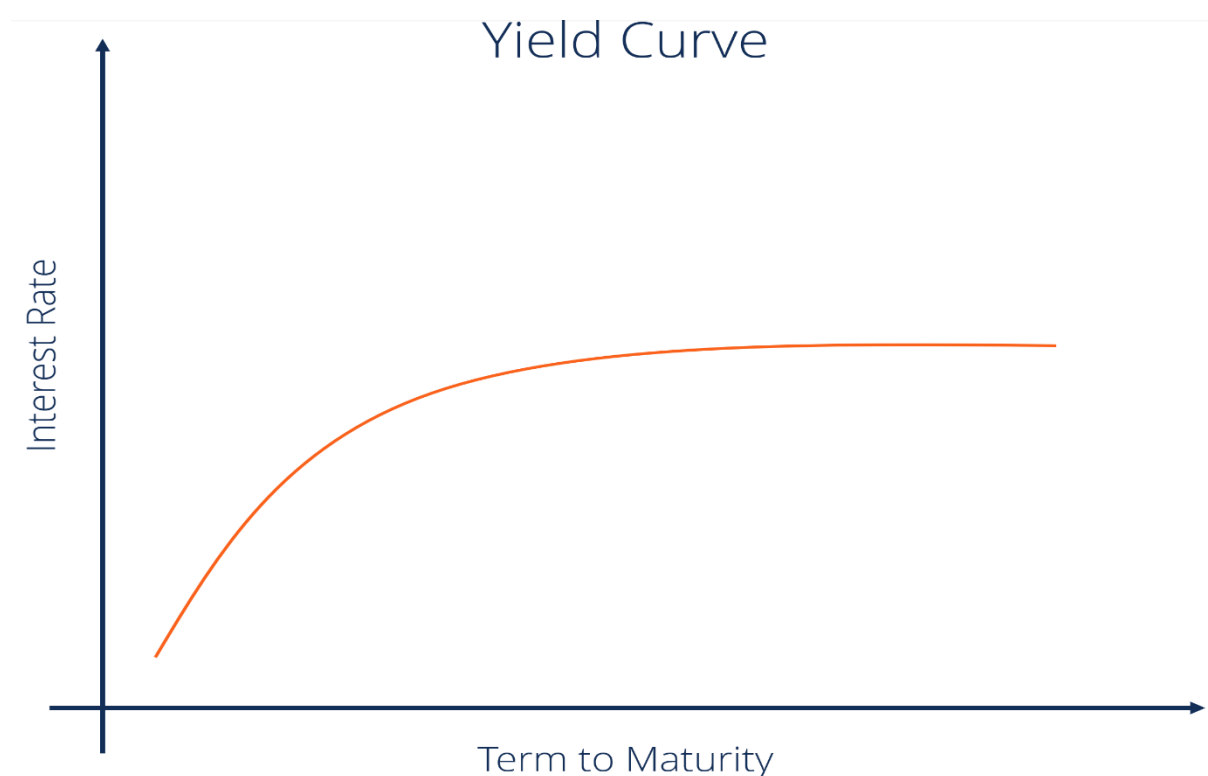
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What is an Economic Recession?

An economic recession is a phenomenon where a country's growth rate plummets significantly. It is visible in a country's GDP rate, income levels, employment, and industrial output. The economic recession by definition is a decrease in the growth rate two straight quarters. There are a lot of factors that can cause an economic recession. But there are also few indicators that give us some clue as to whether we are heading for a recession in the future. In this project I will exploring one of the indicators that is the Yield Curve. Based on the dataset we will also try to predict it based upon different models.

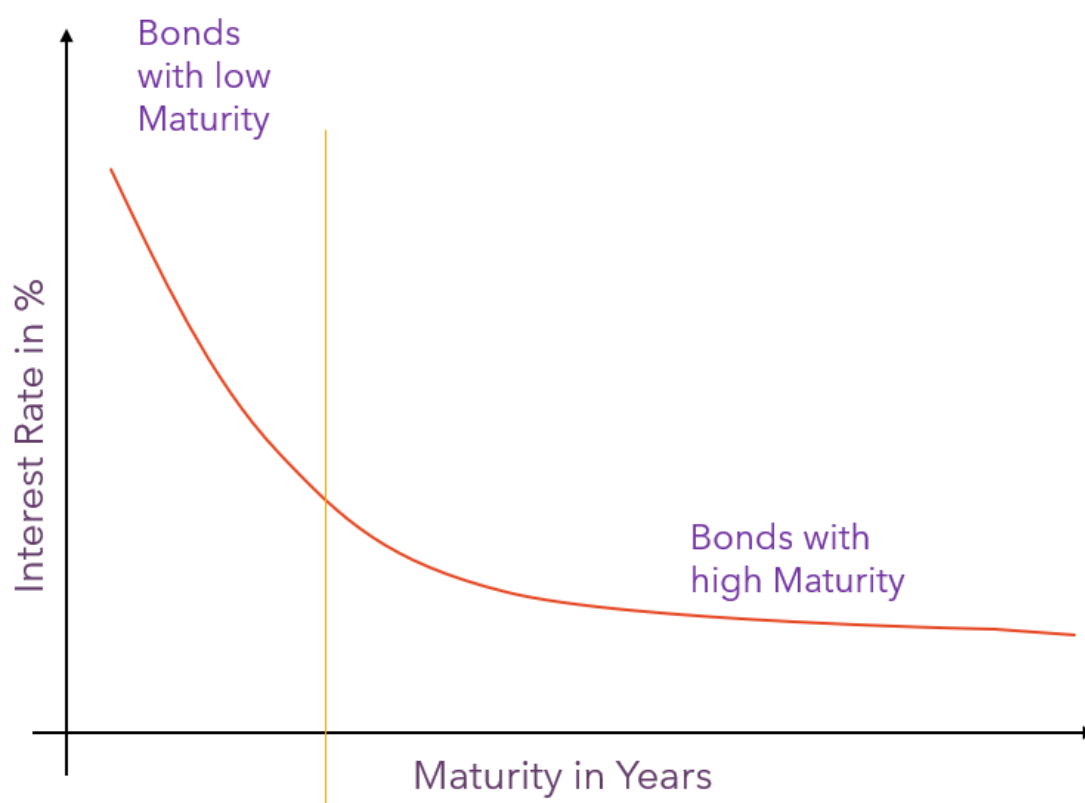
What is a Yield Curve?

A yield curve is generally the plot of Treasury bond. It is plotted against Interest rate in the Y axis and Maturity in the X axis. This Curve Usually looks like the following. The maturity is the investment time of the bond. Generally, more the maturity greater is the risk that a particular investor bearing hence higher is the return in the form of interest. This curve naturally looks like the following and is a sign that economy is in a normal state. What is interesting about bonds is that, it is considered a really safe investment and due to this investor like to invest in them in times of uncertainty.



Yield Curve Inversion

Since bonds are considered really safe form of invest a lot of companies and investor look at it as a safe that increases your wealth no matter the ongoing chaos or imminent in the market. When investors get spooky about economic health of a country then they start investing more into bonds for the long term. When high maturity bonds are subscribed a lot then the interest rate over them declines, in some situations the interest offered on short term bonds increase than their high maturity counter parts. This inverts the curve. For the last 50+ years inversions in the yield curve have occurred before every recession that has happened. Due to this it's really important that we analyse and try and predict its inversion so that we can get a good grasp about the future health of the economy.

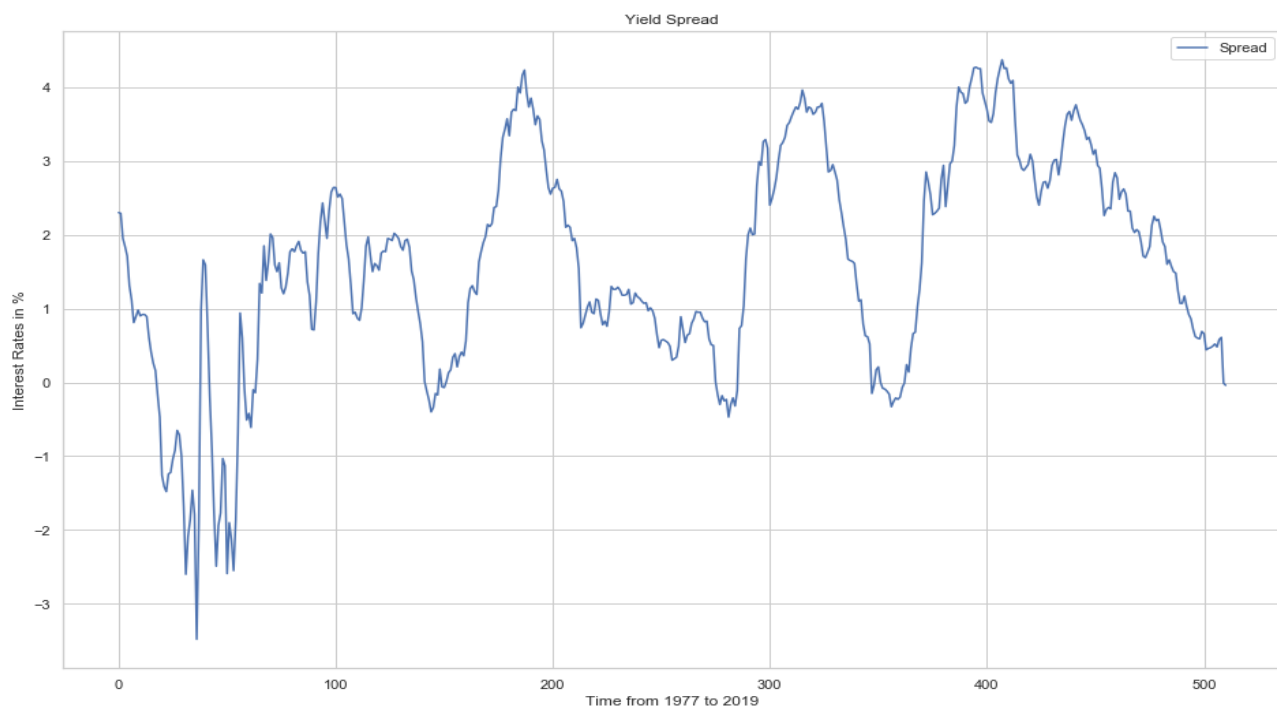


Spread of the bonds

The spread of the bonds is the difference between the interest rate of high maturity bond and low maturity bond. For our prediction we are considering 1-year bond and 30-year bond to get the spread.



Every time the High maturity bond goes below the low maturity bond an inversion of the yield curve happens. And this is what we are going to predict using models.



Dataset

| | Date | 1 yr | 30YR | SPREAD | SP500 | GOLD | OIL | CHHUSD | JPYUSD | UNEMP IDX |
|---|------------|------|------|--------|-------|--------|-----|--------|--------|-----------|
| 0 | 01-03-1977 | 5.50 | 7.80 | 2.30 | 0.0 | 148.34 | 0.0 | 2.55 | 280.23 | 7.4 |
| 1 | 01-04-1977 | 5.44 | 7.73 | 2.29 | 0.0 | 149.18 | 0.0 | 2.53 | 275.21 | 7.2 |
| 2 | 01-05-1977 | 5.84 | 7.80 | 1.95 | 0.0 | 146.54 | 0.0 | 2.52 | 277.43 | 7.0 |
| 3 | 01-06-1977 | 5.80 | 7.64 | 1.84 | 0.0 | 140.83 | 0.0 | 2.49 | 272.86 | 7.2 |
| 4 | 01-07-1977 | 5.94 | 7.64 | 1.71 | 0.0 | 143.40 | 0.0 | 2.41 | 264.86 | 6.9 |

- Spread
- S&P500
- Gold
- Oil
- USD/Swiss Franc (Exch. rate)
- USD/Japanese Yen (Exch. rate)
- Unemployment Index

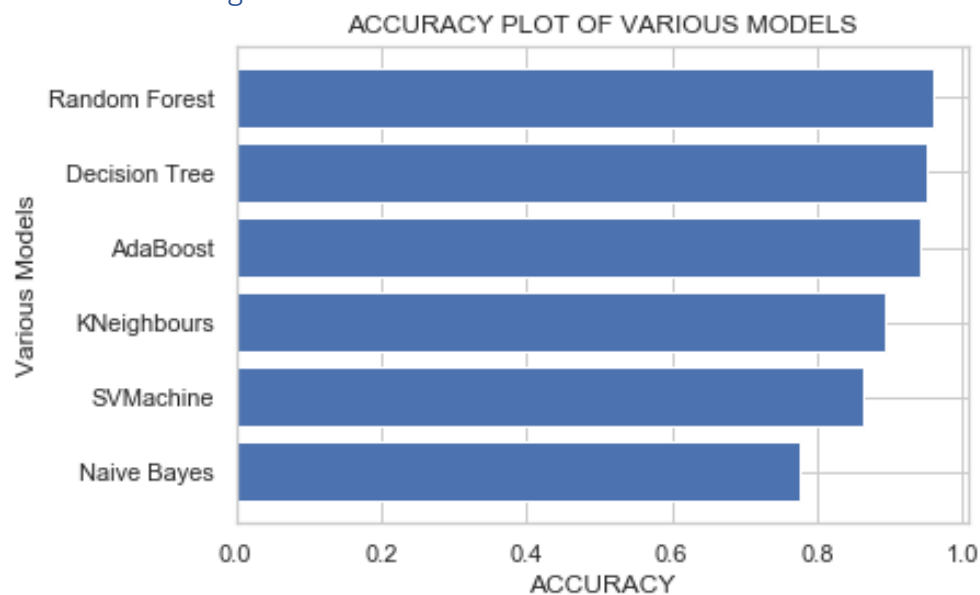
The total entities are 511. The Spread is converted in binary form. If it is above 0 then it is considered as 1 and below 0 it is considered zero. Since the objective is the predict only inversions this way it become really straight forward to achieve it.

The below figure shows the correlation of the different features.



Results of Various Models

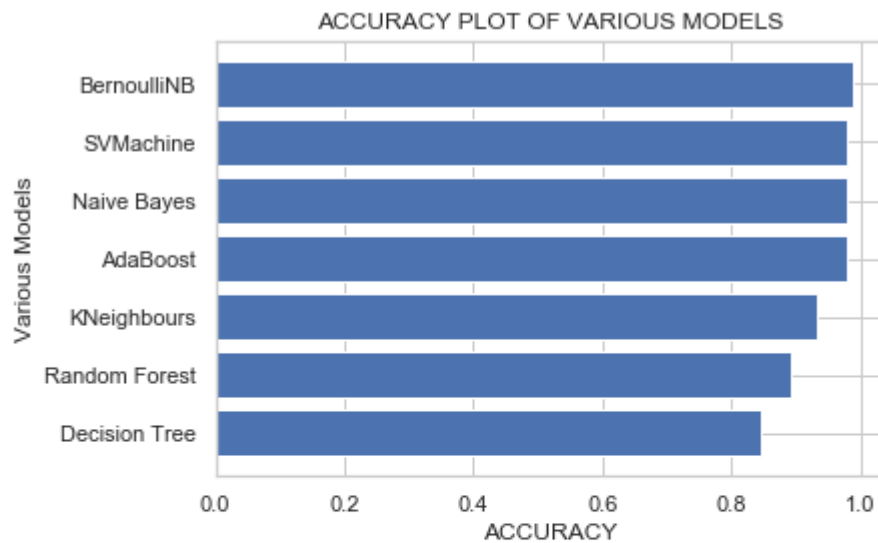
With Data Leakage



```
AdaBoost      : 0.941747572815534
Decision Tree : 0.9514563106796117
Random Forest : 0.9611650485436893
SVMachine     : 0.8640776699029126
KNeighbours   : 0.8932038834951457
Naive Bayes   : 0.7766990291262136
```

In this presentation the professor indicated that I could be leaking data while splitting the dataset. Which was true. The leaking caused some models to perform a lot better than they should have. I corrected the leakage and the new result is below.

After Correcting Data Leakage



```
AdaBoost      : 0.9805825242718447
Decision Tree : 0.8446601941747572
Random Forest : 0.8932038834951457
SVMachine     : 0.9805825242718447
KNeighbours   : 0.9320388349514563
NaiveBayesGausi : 0.9805825242718447
BernoulliNB   : 0.9902912621359223
```

Conclusion

I think the reason why this happened is dependent a lot on the nature of the dataset which has fewer inversions as opposed to positive values. And the overall data is also a lot less to train on. That's why decision tree may be pruning these little inversions and in the process the inversions are lost. At the same time, I think due to the small size of the dataset the decision tree is learning less and tries to overfit.

Bayes on other hand inherently assumes that the features are independent and in a small dataset that is a better strategy to win prediction than finding meaningful relationships among various features like the decision tree.

Learnings

- Which models performs the best and worse on a dataset, and Why?
- Exploratory Data Analysis (EDA).
- Why & how not to leak data!