After extensive research and literature review of economic fundamentals the below factors were used to model recession probabilities.

**1. Payrolls\_3mo\_vs\_12mo**

Total Nonfarm Payroll is a measure of the total number of U.S. workers in the economy, responsible for roughly 80 per cent of workforce that make a significant contribution to a nations GDP. This provides important view of a nation’s economic situation as it may show the number of jobs added or lost in the economy. For instance, increase in employment may indicate that firms are recruiting, that also indicates growth in business. For prediction, we've taken difference between 3 months and 12 months in non-payroll. This is an indicator of whether the employment has been going up or down.

**2. Effective\_Fed\_Funds\_12\_chg**

The effective rate of the federal funds is that interest rate banks charge each other for overnight loans to meet their reserve ratio. The setting of Fed Funds Rate limits is one of the Federal Reserve 's key monetary tools. Its values are decided by government economic strategies and the change of fed funds over a duration of 12 months is a strong indicator of if the economy is performing well.

**3. CPI\_All\_Items\_3\_mo\_annualised'(inflation feature)**

All items are a measure of the average monthly variation in the cost of goods and services charged urban consumers between any two periods. The CPI can be used to detect inflation and deflation cycles. Massive increases in the CPI over a short period of time may clearly indicate a period of inflation, and a significant decrease in the CPI over a short period of time may imply a period of deflation.

**4. 3M\_10Y\_Treasury\_Spread**

This is also known as the yield curve , and is the difference (or spread) between the yield on the 10-year Treasury bond and 3 months. Treasury rates are a class of "risk-free" assets perform a significant role in the global framework for asset allocation. Treasury rate shifts can indicate changing expectations regarding economic advancement and market risk. The US treasury yield curve compares the short term treasury bills yield to long term treasury bill and bonds. All treasury securities are often referred to as notes or treasuries for shorts. We have taken 3 months and 10 years Treasury spread because the yield curve trend has good history of forecasting recessions in anticipation. One of these reasons is that if investors see hard time on the horizon, they move capital away from volatile assets and lock in a risk free return for a longer time period into longer-term treasuries.

**5. 10Y\_Treasury\_Rate\_12\_chg**

After selecting 3 months and 10 years Treasury spread as first bond feature .As a second feature we have considered  12 months changes in 3-month treasury rate and the 10-year treasury rates and the 12-month change in the 10-year vs. 3-month treasury spread. While comparing correlations with monetary and employment rate, the 12 months changes in 3 months treasury rate and 10 year vs. 3 months are extremely correlated. So we decided to choose the 12 months changes in 10-year treasury rate as my second Bond Market feature, as it can be a measure of long-term growth expectations.

**6. S&P\_500\_Index\_12\_chg**

The S&P500 is an indicator of the stock market performance of 500 largest companies listed in the Unites states stock exchange. Stock market always has been an indicator of how well the economy is performing. The 12 moth change in S&P index is used in this research to predict recession probabilities.