



Financial Risk Analysis

Team 9

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Agenda

- Problem Statement
- Data Set
- Approach
- Prediction – Impacted Stocks, VAR

Problem Statement

- Estimate the VAR (Value at Risk) associated with the given portfolio of stocks for a specific time period. Also provide insights on the stocks that are most impacted during this time frame

Dataset

- Portfolio of 3000 Stocks
 - Open, Close, High, Low, Volume and Adj Close
 - These values are captured on a daily basis
 - Market factors (S&P 500, NASDAQ, Bonds, Oil)
 - ~ 9 Million Records

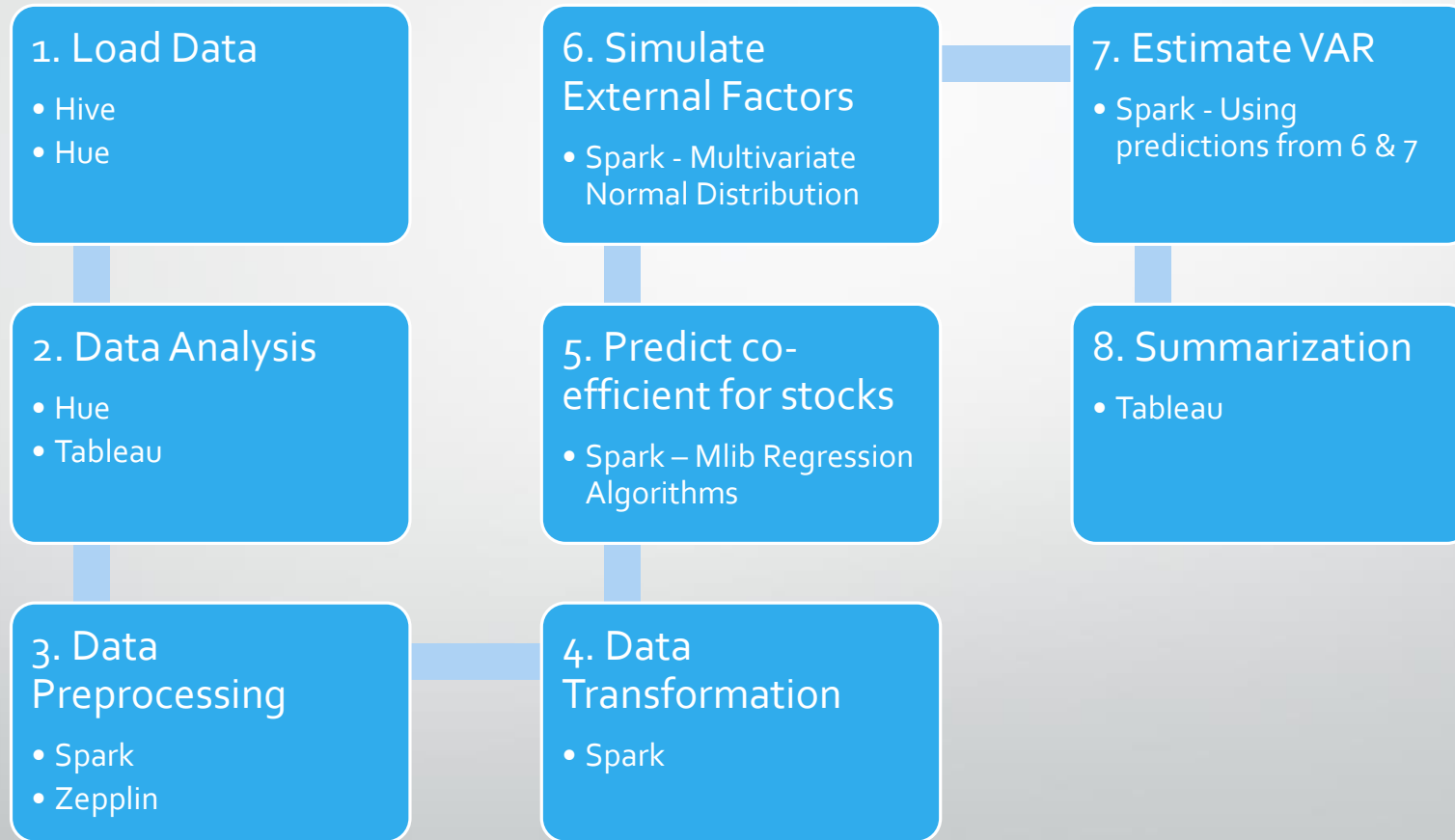
Additional Information

- The value of stocks are impacted by external factors (S&P 500, NASDAQ, Bonds, Oil)
- Financial Risk Analysis
 - Estimate the factor co-efficient associated with each of the stock by using the historical data
 - Using Monte Carlo simulation, estimate these external factors
 - Compute the VAR using estimated external factors and stock co-efficient

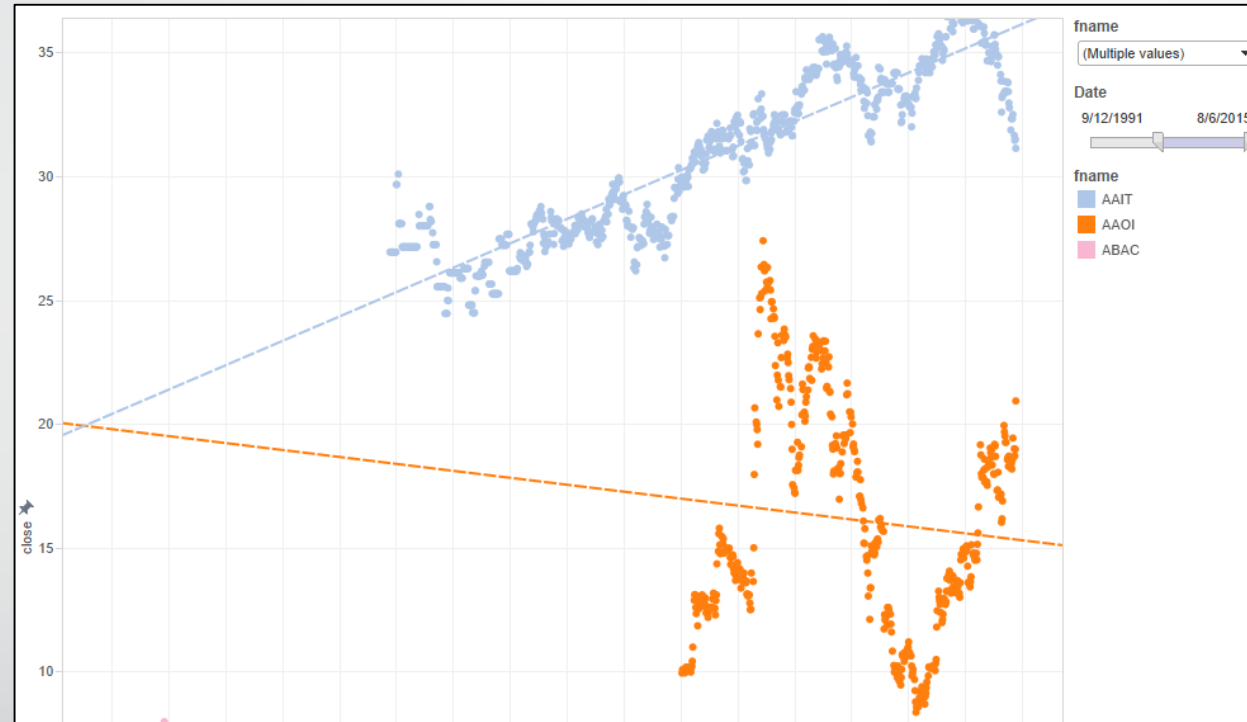
Environment Used

- Amazon EMR v3.8
 - 1 Master mx3 large instances
 - 4 Slaves mx3 large instances
- Spark 1.3.1
- Hue 0.17
- Hive
- Apache Zeppelin Bootstrapped
- Tableau

Approach

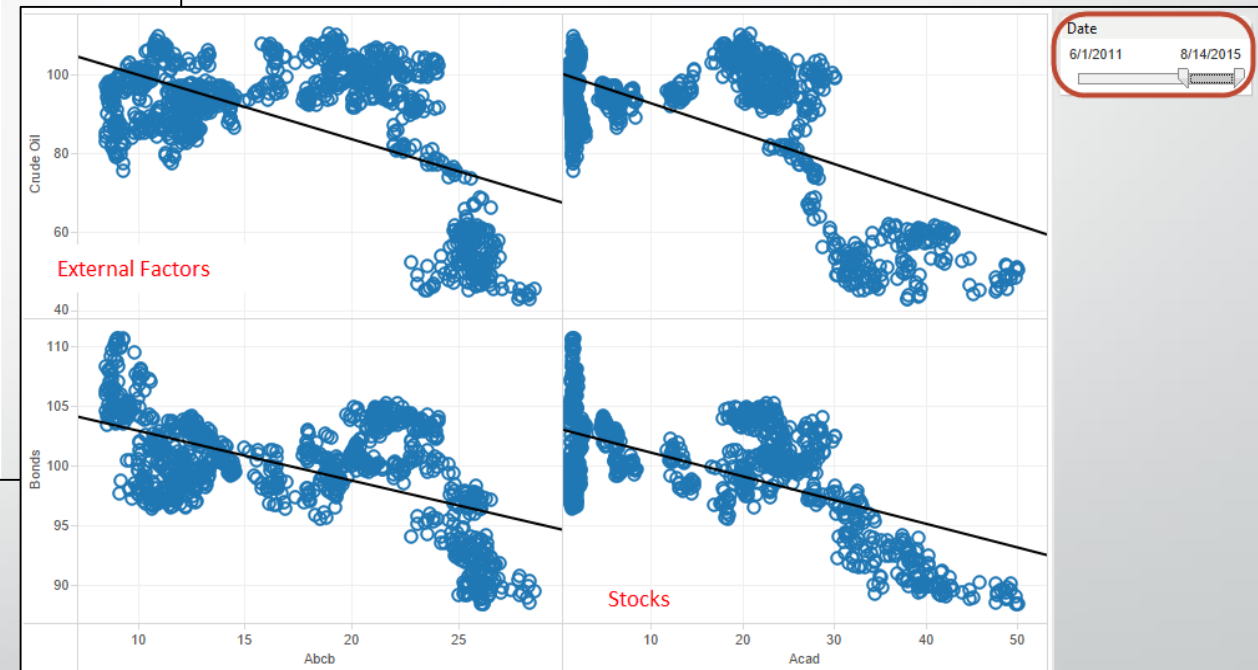
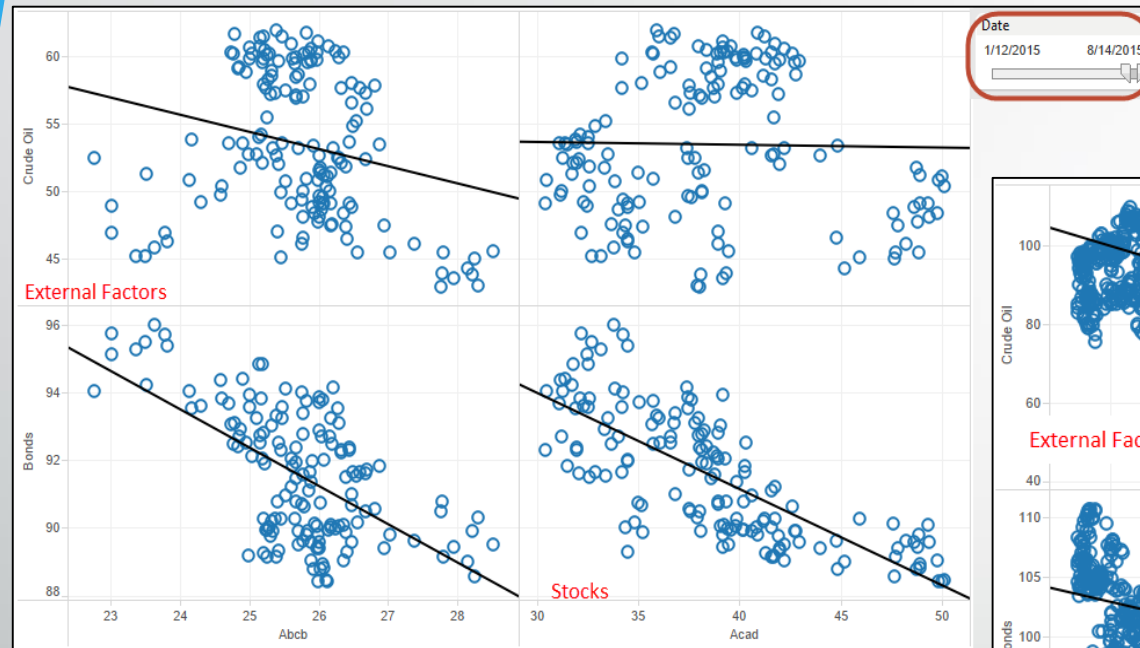


Data Analysis – Missing Data Handling



- Note: The missing data was filled with observations from nearest neighbor as latest records are more relevant in time series data than using mean.

Data Analysis – Correlation



- Note: It was observed that there was no direct relationship between stocks and external factors as they vary across time

Zeppelin – Dynamic Form

The screenshot displays the Zeppelin Notebook interface with a blue header bar containing the Zeppelin logo, "Notebook", and "Interpreter" tabs. A green "Connected" status indicator is in the top right. The main area shows a Scala code block with a try-catch statement for parsing an input string into an integer. Below the code, a dynamic form is rendered, outlined in red. The form contains three input fields: "Financial RiskAnalysis Param in %" with the value "5", "Number Of Trials (Min 100)", and "Time interval". Below these fields, the current values of the variables are displayed: "financialRiskAnalysisParam: Option[Int] = Some(5)", "nTrials: Option[Int] = None", and "slidingWindow: Option[Int] = None". The form is followed by another code block that uses the inputs to define a regression algorithm. The form's dynamic nature is evident as it updates the variable values based on the user's input.

```
Some(s.toInt)
} catch {
  case e: Exception => None
}
}

toInt: (s: String)Option[Int]
Took 1 seconds.
```

```
val financialRiskAnalysisParam = toInt(z.input("Financial RiskAnalysis Param in %").toString)
val nTrials = toInt(z.input("Number Of Trials (Min 100)").toString)
val slidingWindow = toInt(z.input("Time interval").toString)
```

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Financial RiskAnalysis Param in % Number Of Trials (Min 100) Time interval

5

financialRiskAnalysisParam: Option[Int] = Some(5)
nTrials: Option[Int] = None
slidingWindow: Option[Int] = None
Took 3 seconds.

```
val algoName = z.input("Regression Algorithm To be used (Values : LinearRegressionWithSGD_L0,LinearRegressionWithSGD_L1,LinearRegressionWithSGD_L2,RidgeRegressionWithSGD,LassoWithSGD)").toString
```

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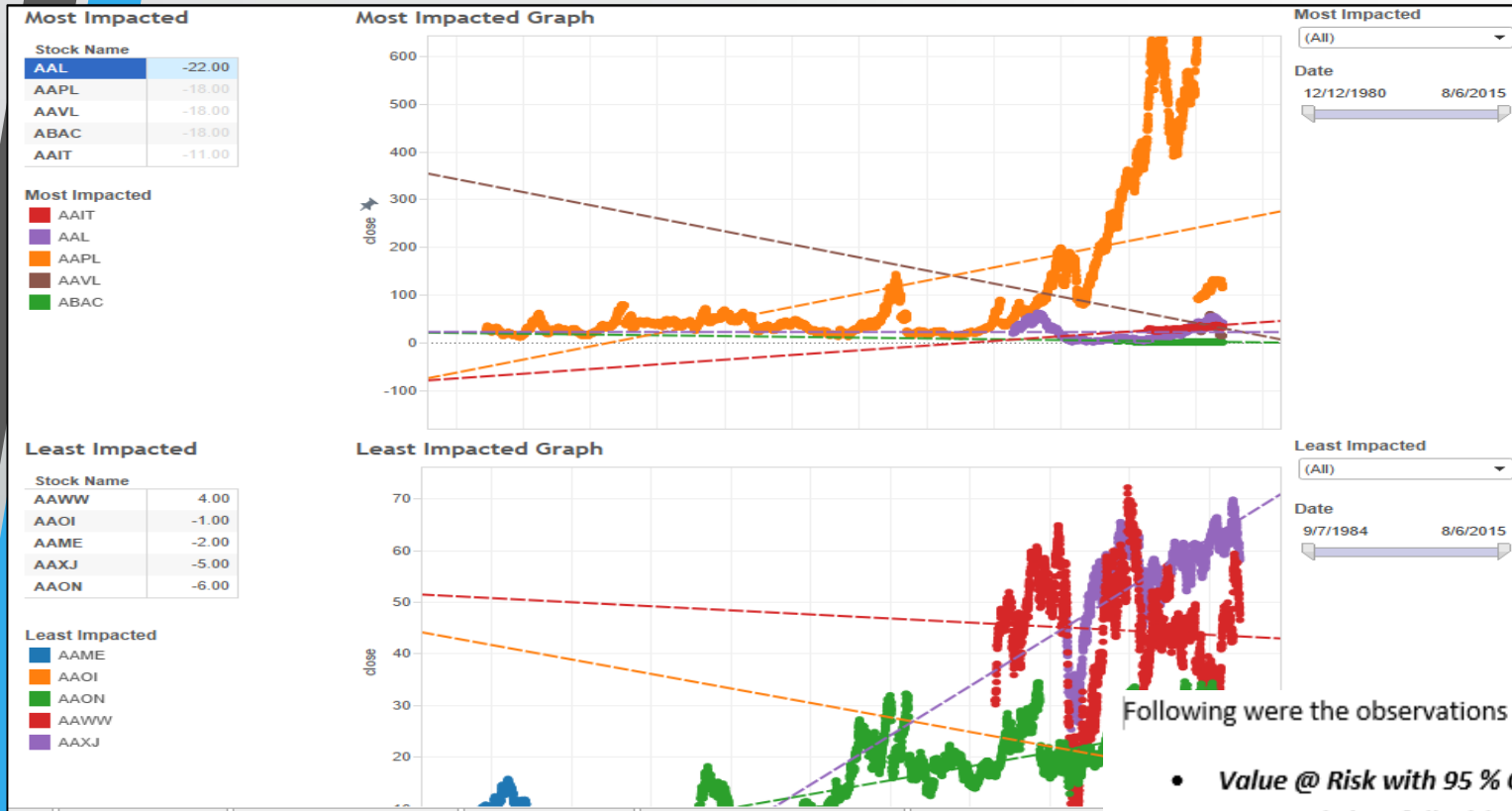
Regression Algorithm To be used (Values :
LinearRegressionWithSGD_L0,LinearRegressionWithSGD_L1,LinearRegressionWithSGD_L2,RidgeRegressionWithSGD,LassoWithSGD)

algoName: String =
Took 1 seconds.

```
def trimToRegion(history: Array[(String,DateTime, Double)], start: DateTime, end: DateTime)
: Array[(String,DateTime, Double)] = {
  var trimmed = history.dropWhile(_._2 < start).takeWhile(_._2 <= end)
```

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Prediction – Impacted Stocks



Following were the observations on performing this financial risk analysis

- **Value @ Risk with 95 % Confidence Interval:** - 0.11
- **Expected Shortfall with 95% Confidence Interval:** - 0.152

A back testing of value at risk and expected shortfall was performed by computing the confidence intervals using Kupiec testing and the numbers were acceptable

- **VaR Confidence Interval:** (-0.121, -0.07)
- **ES Confidence Interval:** (-0.1649, -0.080)



Thanks !!!