FinalProject2

Ananya Gangavarapu

6/1/2021

Final Project:

In this project, we will In this project, we intend to analyze the stocks of 4 different highly profitable companies - AMZN (Amazon), AAPL (Apple Inc.) MSFT (Microsoft Corp.), FB (Facebook) with Time Series Analysis and do analysis of general stocks to see what variables will influence the general losses and gains for the market.

```
library(ggplot2)
library(tidyverse)
```

```
## -- Attaching packages ------------------------------------------------------------------------------

## v tibble  3.0.3     v dplyr   1.0.2
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.5.0
## v purrr   0.3.4

## -- Conflicts ------------------------------------------------------------------------------------------
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(olsrr)
```

```
## Warning: package 'olsrr' was built under R version 4.0.5

##
## Attaching package: 'olsrr'

## The following object is masked from 'package:datasets':
##
##     rivers
```

We import our libraries for the analysis

```
fundamental <- read_csv("C:\\Users\\Anigasan\\Downloads\\archive\\fundamentals.csv")
```

```
## Warning: Missing column names filled in: 'X1' [1]
```

```
## Parsed with column specification:
## cols(
##   .default = col_double(),
##   TickerSymbol = col_character(),
##   PeriodEnding = col_character()
## )

## See spec(...) for full column specifications.
```

```r
prices3 <- read_csv("C:\\Users\\Anigasan\\Downloads\\archive\\prices3.csv")
```

```
## Parsed with column specification:
## cols(
##   dates = col_double(),
##   symbol = col_character(),
##   open = col_double(),
##   close = col_double(),
##   low = col_double(),
##   high = col_double(),
##   volume = col_double()
## )
```

```r
prices <- read_csv("C:\\Users\\Anigasan\\Downloads\\archive\\prices.csv")
```

```
## Parsed with column specification:
## cols(
##   date = col_character(),
##   symbol = col_character(),
##   open = col_double(),
##   close = col_double(),
##   low = col_double(),
##   high = col_double(),
##   volume = col_double()
## )
```

```r
prices2 <- read_csv("C:\\Users\\Anigasan\\Downloads\\archive\\prices-split-adjusted.csv")
```

```
## Parsed with column specification:
## cols(
##   date = col_date(format = ""),
##   symbol = col_character(),
##   open = col_double(),
##   close = col_double(),
##   low = col_double(),
##   high = col_double(),
##   volume = col_double()
## )
```

```r
security <- read_csv("C:\\Users\\Anigasan\\Downloads\\archive\\securities.csv")
```

```
## Parsed with column specification:
## cols(
##   Tickersymbol = col_character(),
##   Security = col_character(),
##   SECfilings = col_character(),
##   GICSSector = col_character(),
##   GICSSubIndustry = col_character(),
##   AddressofHeadquarters = col_character(),
##   Datefirstadded = col_character(),
##   CIK = col_double()
## )
```

We import the necessary files needed for our data analysis: - fundamental.csv contains the general stock information that you would find on the company balance sheet - prices, prices2, prices3 all contain the opening, closing, high, and low prices for each stock - security contains general information about each company within the New York Stock Exchange

```r
summary(fundamental)
```

```
##        X1       TickerSymbol       PeriodEnding       AccountsPayable
##  Min.   :   0   Length:1781        Length:1781        Min.   :0.000e+00
##  1st Qu.: 445   Class :character   Class :character   1st Qu.:5.160e+08
##  Median : 890   Mode  :character   Mode  :character   Median :1.334e+09
##  Mean   : 890                                         Mean   :4.673e+09
##  3rd Qu.:1335                                         3rd Qu.:3.246e+09
##  Max.   :1780                                         Max.   :2.070e+11
##
##  AccountsReceivable   Add'lincome/expenseitems  AfterTaxROE
##  Min.   :-6.452e+09   Min.   :-6.768e+09       Min.   :   0.0
##  1st Qu.:-1.040e+08   1st Qu.:-2.638e+06       1st Qu.:  10.0
##  Median :-1.830e+07   Median : 2.000e+06       Median :  16.0
##  Mean   :-6.353e+07   Mean   : 6.909e+07       Mean   :  43.6
##  3rd Qu.: 7.816e+06   3rd Qu.: 3.359e+07       3rd Qu.:  26.0
##  Max.   : 2.266e+10   Max.   : 1.416e+10       Max.   :5789.0
##
##  CapitalExpenditures  CapitalSurplus         CashRatio
##  Min.   :-3.798e+10   Min.   :-7.215e+08   Min.   :   0.00
##  1st Qu.:-1.151e+09   1st Qu.: 4.791e+08   1st Qu.:  17.00
##  Median :-3.580e+08   Median : 1.997e+09   Median :  41.00
##  Mean   :-1.252e+09   Mean   : 5.351e+09   Mean   :  74.46
##  3rd Qu.:-1.291e+08   3rd Qu.: 5.735e+09   3rd Qu.:  90.00
##  Max.   : 5.000e+06   Max.   : 1.080e+11   Max.   :1041.00
##                                            NA's   :299
##  CashandCashEquivalents ChangesinInventories  CommonStocks
##  Min.   :2.100e+04      Min.   :-5.562e+09   Min.   :0.000e+00
##  1st Qu.:3.088e+08      1st Qu.:-5.400e+07   1st Qu.:1.628e+06
##  Median :8.626e+08      Median : 0.000e+00   Median :7.725e+06
##  Mean   :8.521e+09      Mean   :-6.788e+07   Mean   :1.608e+09
##  3rd Qu.:2.310e+09      3rd Qu.: 0.000e+00   3rd Qu.:2.970e+08
##  Max.   :7.280e+11      Max.   : 3.755e+09   Max.   :1.580e+11
##
##  CostofRevenue        CurrentRatio    DeferredAssetCharges
##  Min.   :0.000e+00   Min.   :  17.0   Min.   :0.000e+00
```

```
##  1st Qu.:1.194e+09   1st Qu.: 109.0   1st Qu.:0.000e+00
##  Median :3.685e+09   Median : 152.0   Median :0.000e+00
##  Mean   :1.235e+10   Mean   : 186.8   Mean   :5.908e+08
##  3rd Qu.:9.801e+09   3rd Qu.: 226.0   3rd Qu.:1.471e+08
##  Max.   :3.650e+11   Max.   :1197.0   Max.   :3.686e+10
##                      NA's   :299
##  DeferredLiabilityCharges  Depreciation        EarningsBeforeInterestandTax
##  Min.   :0.000e+00        Min.   :-4.480e+08   Min.   :-2.793e+10
##  1st Qu.:0.000e+00        1st Qu.: 1.799e+08   1st Qu.: 5.852e+08
##  Median :2.060e+08        Median : 4.280e+08   Median : 1.139e+09
##  Mean   :1.611e+09        Mean   : 1.084e+09   Mean   : 2.710e+09
##  3rd Qu.:1.083e+09        3rd Qu.: 1.047e+09   3rd Qu.: 2.586e+09
##  Max.   :5.618e+10        Max.   : 2.952e+10   Max.   : 7.905e+10
##
##  EarningsBeforeTax    EffectofExchangeRate
##  Min.   :-2.823e+10   Min.   :-3.067e+09
##  1st Qu.: 4.900e+08   1st Qu.:-2.000e+07
##  Median : 9.601e+08   Median :-6.000e+05
##  Mean   : 2.375e+09   Mean   :-3.849e+07
##  3rd Qu.: 2.255e+09   3rd Qu.: 0.000e+00
##  Max.   : 7.873e+10   Max.   : 1.160e+09
##
##  EquityEarnings/LossUnconsolidatedSubsidiary  FixedAssets
##  Min.   :-1.633e+09                          Min.   :0.000e+00
##  1st Qu.: 0.000e+00                          1st Qu.:5.920e+08
##  Median : 0.000e+00                          Median :2.089e+09
##  Mean   : 9.134e+07                          Mean   :8.534e+09
##  3rd Qu.: 0.000e+00                          3rd Qu.:9.231e+09
##  Max.   : 1.501e+10                          Max.   :2.530e+11
##
##     Goodwill          GrossMargin      GrossProfit           IncomeTax
##  Min.   :0.000e+00   Min.   :  0.00   Min.   :-1.265e+10   Min.   :-8.013e+09
##  1st Qu.:1.222e+08   1st Qu.: 29.00   1st Qu.: 1.582e+09   1st Qu.: 1.030e+08
##  Median :1.260e+09   Median : 43.00   Median : 2.991e+09   Median : 2.689e+08
##  Mean   :3.930e+09   Mean   : 46.76   Mean   : 7.188e+09   Mean   : 6.694e+08
##  3rd Qu.:4.091e+09   3rd Qu.: 64.00   3rd Qu.: 6.944e+09   3rd Qu.: 6.264e+08
##  Max.   :1.050e+11   Max.   :100.00   Max.   : 1.490e+11   Max.   : 3.104e+10
##
##  IntangibleAssets    InterestExpense       Inventory
##  Min.   :0.000e+00   Min.   :0.000e+00   Min.   :0.000e+00
##  1st Qu.:0.000e+00   1st Qu.:3.005e+07   1st Qu.:0.000e+00
##  Median :3.180e+08   Median :1.223e+08   Median :3.804e+08
##  Mean   :1.965e+09   Mean   :3.263e+08   Mean   :1.467e+09
##  3rd Qu.:1.474e+09   3rd Qu.:3.200e+08   3rd Qu.:1.467e+09
##  Max.   :1.210e+11   Max.   :2.061e+10   Max.   :4.726e+10
##
##   Investments          Liabilities          LongTermDebt
##  Min.   :-1.650e+11   Min.   :-4.017e+10   Min.   :0.000e+00
##  1st Qu.:-2.150e+08   1st Qu.:-5.484e+07   1st Qu.:1.107e+09
##  Median :-9.700e+04   Median : 2.700e+07   Median :3.346e+09
##  Mean   :-9.677e+08   Mean   : 1.790e+08   Mean   :8.479e+09
##  3rd Qu.: 9.000e+06   3rd Qu.: 1.777e+08   3rd Qu.:7.781e+09
##  Max.   : 3.835e+10   Max.   : 3.710e+10   Max.   :4.290e+11
##
```

```
##  LongTermInvestments MinorityInterest       MiscStocks
##  Min.   :0.000e+00   Min.   :-1.050e+08   Min.   :-151000000
##  1st Qu.:0.000e+00   1st Qu.: 0.000e+00   1st Qu.:         0
##  Median :9.260e+07   Median : 1.000e+06   Median :         0
##  Mean   :2.321e+10   Mean   : 4.167e+08   Mean   :  42436180
##  3rd Qu.:1.488e+09   3rd Qu.: 8.500e+07   3rd Qu.:         0
##  Max.   :1.650e+12   Max.   : 6.319e+10   Max.   :3713000000
##
##  NetBorrowings         NetCashFlow         NetCashFlow-Operating
##  Min.   :-9.909e+10   Min.   :-4.293e+10   Min.   :-1.606e+10
##  1st Qu.:-7.340e+07   1st Qu.:-1.550e+08   1st Qu.: 6.642e+08
##  Median : 1.063e+08   Median : 1.000e+07   Median : 1.237e+09
##  Mean   : 5.155e+08   Mean   : 5.273e+07   Mean   : 3.258e+09
##  3rd Qu.: 7.810e+08   3rd Qu.: 2.457e+08   3rd Qu.: 3.049e+09
##  Max.   : 4.971e+10   Max.   : 5.044e+10   Max.   : 1.080e+11
##
##  NetCashFlows-Financing NetCashFlows-Investing   NetIncome
##  Min.   :-1.880e+11     Min.   :-1.660e+11     Min.   :-2.353e+10
##  1st Qu.:-1.092e+09     1st Qu.:-2.296e+09     1st Qu.: 3.528e+08
##  Median :-3.541e+08     Median :-7.568e+08     Median : 6.861e+08
##  Mean   :-4.578e+08     Mean   :-2.718e+09     Mean   : 1.706e+09
##  3rd Qu.: 1.279e+08     3rd Qu.:-2.560e+08     3rd Qu.: 1.697e+09
##  Max.   : 1.180e+11     Max.   : 1.070e+11     Max.   : 5.339e+10
##
##  NetIncomeAdjustments NetIncomeApplicabletoCommonShareholders
##  Min.   :-5.810e+10   Min.   :-2.312e+10
##  1st Qu.:-7.200e+06   1st Qu.: 3.512e+08
##  Median : 8.895e+07   Median : 6.820e+08
##  Mean   : 2.198e+08   Mean   : 1.688e+09
##  3rd Qu.: 3.431e+08   3rd Qu.: 1.679e+09
##  Max.   : 1.722e+10   Max.   : 5.339e+10
##
##  NetIncome-Cont.Operations NetReceivables      Non-RecurringItems
##  Min.   :-2.276e+10        Min.   :0.000e+00   Min.   :-2.524e+09
##  1st Qu.: 3.534e+08        1st Qu.:4.336e+08   1st Qu.: 0.000e+00
##  Median : 6.851e+08        Median :1.083e+09   Median : 0.000e+00
##  Mean   : 1.748e+09        Mean   :3.242e+09   Mean   : 2.185e+08
##  3rd Qu.: 1.673e+09        3rd Qu.:2.383e+09   3rd Qu.: 5.000e+07
##  Max.   : 5.989e+10        Max.   :9.282e+10   Max.   : 2.090e+10
##
##  OperatingIncome      OperatingMargin   OtherAssets        OtherCurrentAssets
##  Min.   :-2.791e+10   Min.   :  0.00   Min.   :0.000e+00   Min.   :0.000e+00
##  1st Qu.: 5.259e+08   1st Qu.:  9.00   1st Qu.:1.070e+08   1st Qu.:5.034e+07
##  Median : 1.021e+09   Median : 15.00   Median :4.110e+08   Median :1.837e+08
##  Mean   : 2.269e+09   Mean   : 18.18   Mean   :4.860e+09   Mean   :6.071e+08
##  3rd Qu.: 2.260e+09   3rd Qu.: 23.00   3rd Qu.:1.385e+09   3rd Qu.:5.480e+08
##  Max.   : 7.123e+10   Max.   :437.00   Max.   :3.260e+11   Max.   :3.509e+10
##
##  OtherCurrentLiabilities  OtherEquity         OtherFinancingActivities
##  Min.   :0.000e+00       Min.   :-2.961e+10   Min.   :-9.504e+10
##  1st Qu.:0.000e+00       1st Qu.:-5.522e+08   1st Qu.:-1.900e+07
##  Median :1.287e+08       Median :-9.500e+07   Median : 0.000e+00
##  Mean   :1.501e+10       Mean   :-6.208e+08   Mean   : 4.844e+08
##  3rd Qu.:8.710e+08       3rd Qu.: 0.000e+00   3rd Qu.: 0.000e+00
```

```
##  Max.   :1.360e+12       Max.   : 3.678e+10   Max.   : 8.964e+10
##
##  OtherInvestingActivities OtherLiabilities    OtherOperatingActivities
##  Min.   :-5.672e+10       Min.   :0.000e+00   Min.   :-3.367e+10
##  1st Qu.:-2.530e+08       1st Qu.:1.790e+08   1st Qu.:-8.400e+07
##  Median :-1.400e+07       Median :6.960e+08   Median :-8.959e+06
##  Mean   :-4.054e+08       Mean   :9.076e+09   Mean   : 7.145e+06
##  3rd Qu.: 5.000e+07       3rd Qu.:2.587e+09   3rd Qu.: 2.650e+07
##  Max.   : 1.160e+10       Max.   :7.660e+11   Max.   : 8.751e+10
##
##  OtherOperatingItems  Pre-TaxMargin      Pre-TaxROE       ProfitMargin
##  Min.   :-8.716e+07   Min.   :  0.00   Min.   :   0.00   Min.   :  0.00
##  1st Qu.: 0.000e+00   1st Qu.:  8.00   1st Qu.:  13.00   1st Qu.:  6.00
##  Median : 7.173e+07   Median : 14.00   Median :  22.00   Median : 10.00
##  Mean   : 8.688e+08   Mean   : 17.75   Mean   :  59.65   Mean   : 13.96
##  3rd Qu.: 6.080e+08   3rd Qu.: 22.00   3rd Qu.:  36.00   3rd Qu.: 17.00
##  Max.   : 5.487e+10   Max.   :442.00   Max.   :9089.00   Max.   :369.00
##
##    QuickRatio      ResearchandDevelopment RetainedEarnings
##  Min.   :  10.00   Min.   :0.000e+00      Min.   :-1.990e+10
##  1st Qu.:  77.25   1st Qu.:0.000e+00      1st Qu.: 1.100e+09
##  Median : 115.00   Median :0.000e+00      Median : 3.337e+09
##  Mean   : 146.95   Mean   :3.503e+08      Mean   : 9.207e+09
##  3rd Qu.: 180.00   3rd Qu.:6.541e+07      3rd Qu.: 9.012e+09
##  Max.   :1197.00   Max.   :1.274e+10      Max.   : 4.120e+11
##  NA's   :299
##  SaleandPurchaseofStock Sales,GeneralandAdmin.
##  Min.   :-5.885e+10     Min.   :-4.870e+08
##  1st Qu.:-7.495e+08     1st Qu.: 5.598e+08
##  Median :-2.102e+08     Median : 1.338e+09
##  Mean   :-7.652e+08     Mean   : 3.981e+09
##  3rd Qu.: 2.385e+06     3rd Qu.: 3.430e+09
##  Max.   : 5.410e+09     Max.   : 9.704e+10
##
##  Short-TermDebt/CurrentPortionofLong-TermDebt Short-TermInvestments
##  Min.   :0.000e+00                            Min.   :0.000e+00
##  1st Qu.:4.278e+06                            1st Qu.:0.000e+00
##  Median :2.131e+08                            Median :0.000e+00
##  Mean   :3.054e+09                            Mean   :1.124e+09
##  3rd Qu.:9.560e+08                            3rd Qu.:2.550e+08
##  Max.   :3.240e+11                            Max.   :1.070e+11
##
##   TotalAssets        TotalCurrentAssets  TotalCurrentLiabilities
##  Min.   :2.705e+06   Min.   :0.000e+00   Min.   :0.000e+00
##  1st Qu.:6.553e+09   1st Qu.:1.044e+09   1st Qu.:5.641e+08
##  Median :1.517e+10   Median :2.747e+09   Median :1.702e+09
##  Mean   :5.570e+10   Mean   :6.727e+09   Mean   :4.700e+09
##  3rd Qu.:3.600e+10   3rd Qu.:6.162e+09   3rd Qu.:4.381e+09
##  Max.   :2.570e+12   Max.   :1.400e+11   Max.   :9.028e+10
##
##   TotalEquity         TotalLiabilities    TotalLiabilities&Equity
##  Min.   :-1.324e+10   Min.   :2.577e+06   Min.   :2.705e+06
##  1st Qu.: 2.201e+09   1st Qu.:3.843e+09   1st Qu.:6.553e+09
##  Median : 4.983e+09   Median :9.141e+09   Median :1.517e+10
```

```
##  Mean   : 1.189e+10   Mean   :4.380e+10   Mean   :5.568e+10
##  3rd Qu.: 1.081e+10   3rd Qu.:2.390e+10   3rd Qu.:3.600e+10
##  Max.   : 2.560e+11   Max.   :2.340e+12   Max.   :2.570e+12
##
##   TotalRevenue       TreasuryStock           ForYear     EarningsPerShare
##  Min.   :1.514e+06   Min.   :-2.300e+11   Min.   :1215   Min.   :-61.200
##  1st Qu.:3.714e+09   1st Qu.:-3.041e+09   1st Qu.:2013   1st Qu.:  1.590
##  Median :8.023e+09   Median :-3.068e+08   Median :2014   Median :  2.810
##  Mean   :2.029e+10   Mean   :-3.952e+09   Mean   :2013   Mean   :  3.354
##  3rd Qu.:1.749e+10   3rd Qu.: 0.000e+00   3rd Qu.:2015   3rd Qu.:  4.590
##  Max.   :4.860e+11   Max.   : 0.000e+00   Max.   :2016   Max.   : 50.090
##                                           NA's   :173    NA's   :219
##  EstimatedSharesOutstanding
##  Min.   :-1.514e+09
##  1st Qu.: 1.493e+08
##  Median : 2.929e+08
##  Mean   : 6.024e+08
##  3rd Qu.: 5.492e+08
##  Max.   : 1.611e+10
##  NA's   :219
```

```r
head(fundamental, 5)
```

```
## # A tibble: 5 x 79
##      X1 TickerSymbol PeriodEnding AccountsPayable AccountsReceiva~
##   <dbl> <chr>        <chr>                  <dbl>            <dbl>
## 1     0 AAL          12/31/2012        3068000000       -222000000
## 2     1 AAL          12/31/2013        4975000000        -93000000
## 3     2 AAL          12/31/2014        4668000000       -160000000
## 4     3 AAL          12/31/2015        5102000000        352000000
## 5     4 AAP          12/29/2012        2409453000        -89482000
## # ... with 74 more variables: `Add'lincome/expenseitems` <dbl>,
## #   AfterTaxROE <dbl>, CapitalExpenditures <dbl>, CapitalSurplus <dbl>,
## #   CashRatio <dbl>, CashandCashEquivalents <dbl>, ChangesinInventories <dbl>,
## #   CommonStocks <dbl>, CostofRevenue <dbl>, CurrentRatio <dbl>,
## #   DeferredAssetCharges <dbl>, DeferredLiabilityCharges <dbl>,
## #   Depreciation <dbl>, EarningsBeforeInterestandTax <dbl>,
## #   EarningsBeforeTax <dbl>, EffectofExchangeRate <dbl>,
## #   `EquityEarnings/LossUnconsolidatedSubsidiary` <dbl>, FixedAssets <dbl>,
## #   Goodwill <dbl>, GrossMargin <dbl>, GrossProfit <dbl>, IncomeTax <dbl>,
## #   IntangibleAssets <dbl>, InterestExpense <dbl>, Inventory <dbl>,
## #   Investments <dbl>, Liabilities <dbl>, LongTermDebt <dbl>,
## #   LongTermInvestments <dbl>, MinorityInterest <dbl>, MiscStocks <dbl>,
## #   NetBorrowings <dbl>, NetCashFlow <dbl>, `NetCashFlow-Operating` <dbl>,
## #   `NetCashFlows-Financing` <dbl>, `NetCashFlows-Investing` <dbl>,
## #   NetIncome <dbl>, NetIncomeAdjustments <dbl>,
## #   NetIncomeApplicabletoCommonShareholders <dbl>,
## #   `NetIncome-Cont.Operations` <dbl>, NetReceivables <dbl>,
## #   `Non-RecurringItems` <dbl>, OperatingIncome <dbl>, OperatingMargin <dbl>,
## #   OtherAssets <dbl>, OtherCurrentAssets <dbl>, OtherCurrentLiabilities <dbl>,
## #   OtherEquity <dbl>, OtherFinancingActivities <dbl>,
## #   OtherInvestingActivities <dbl>, OtherLiabilities <dbl>,
## #   OtherOperatingActivities <dbl>, OtherOperatingItems <dbl>,
## #   `Pre-TaxMargin` <dbl>, `Pre-TaxROE` <dbl>, ProfitMargin <dbl>,
```

```
## #   QuickRatio <dbl>, ResearchandDevelopment <dbl>, RetainedEarnings <dbl>,
## #   SaleandPurchaseofStock <dbl>, `Sales,GeneralandAdmin.` <dbl>,
## #   `Short-TermDebt/CurrentPortionofLong-TermDebt` <dbl>,
## #   `Short-TermInvestments` <dbl>, TotalAssets <dbl>, TotalCurrentAssets <dbl>,
## #   TotalCurrentLiabilities <dbl>, TotalEquity <dbl>, TotalLiabilities <dbl>,
## #   `TotalLiabilities&Equity` <dbl>, TotalRevenue <dbl>, TreasuryStock <dbl>,
## #   ForYear <dbl>, EarningsPerShare <dbl>, EstimatedSharesOutstanding <dbl>
```

```r
dim(fundamental)
```

```
## [1] 1781   79
```

```r
summary(prices3)
```

```
##      dates           symbol               open              close        
##  Min.   :     1   Length:851264      Min.   :   0.85   Min.   :   0.86  
##  1st Qu.:212817   Class :character   1st Qu.:  33.84   1st Qu.:  33.85  
##  Median :425633   Mode  :character   Median :  52.77   Median :  52.80  
##  Mean   :425633                      Mean   :  70.84   Mean   :  70.86  
##  3rd Qu.:638448                      3rd Qu.:  79.88   3rd Qu.:  79.89  
##  Max.   :851264                      Max.   :1584.44   Max.   :1578.13  
##       low                high              volume         
##  Min.   :   0.83   Min.   :   0.88   Min.   :        0  
##  1st Qu.:  33.48   1st Qu.:  34.19   1st Qu.:  1221500  
##  Median :  52.23   Median :  53.31   Median :  2476250  
##  Mean   :  70.12   Mean   :  71.54   Mean   :  5415113  
##  3rd Qu.:  79.11   3rd Qu.:  80.61   3rd Qu.:  5222500  
##  Max.   :1549.94   Max.   :1600.93   Max.   :859643400  
```

```r
head(prices3, 5)
```

```
## # A tibble: 5 x 7
##   dates symbol  open close   low  high  volume
##   <dbl> <chr>  <dbl> <dbl> <dbl> <dbl>   <dbl>
## 1     1 WLTW    123.  126.  122.  126. 2163600
## 2     2 WLTW    125.  120.  120.  126. 2386400
## 3     3 WLTW    116.  115.  115.  120. 2489500
## 4     4 WLTW    115.  117.  114.  117. 2006300
## 5     5 WLTW    117.  115.  114.  117. 1408600
```

```r
dim(prices3)
```

```
## [1] 851264      7
```

```r
summary(security)
```

```
##  Tickersymbol         Security           SECfilings          GICSSector       
##  Length:505         Length:505         Length:505         Length:505        
##  Class :character   Class :character   Class :character   Class :character  
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character  
```

```
##
##
##
##   GICSSubIndustry    AddressofHeadquarters Datefirstadded          CIK
##   Length:505         Length:505            Length:505         Min.   :   1800
##   Class :character   Class :character      Class :character   1st Qu.:  86312
##   Mode  :character   Mode  :character      Mode  :character   Median : 831001
##                                                               Mean   : 707449
##                                                               3rd Qu.:1075531
##                                                               Max.   :1659166
```

```r
head(security, 5)
```

```
## # A tibble: 5 x 8
##   Tickersymbol Security SECfilings GICSSector GICSSubIndustry AddressofHeadqu~
##   <chr>        <chr>    <chr>      <chr>      <chr>           <chr>
## 1 MMM          3M Comp~ reports    Industria~ Industrial Con~ St. Paul, Minne~
## 2 ABT          Abbott ~ reports    Health Ca~ Health Care Eq~ North Chicago, ~
## 3 ABBV         AbbVie   reports    Health Ca~ Pharmaceuticals North Chicago, ~
## 4 ACN          Accentu~ reports    Informati~ IT Consulting ~ Dublin, Ireland
## 5 ATVI         Activis~ reports    Informati~ Home Entertain~ Santa Monica, C~
## # ... with 2 more variables: Datefirstadded <chr>, CIK <dbl>
```

```r
dim(security)
```

```
## [1] 505   8
```

Here we check the datasets for the summary of the different variables they have, the first 5 rows, and their dimensions.

```r
appleprice <- filter(prices3, symbol == 'AAPL')
microprice <- filter(prices3, symbol == 'MSFT')
fbprice <- filter(prices3, symbol == 'FB')
amazonprice <- filter(prices3, symbol == 'AMZN')

appleprice
```

```
## # A tibble: 1,762 x 7
##     dates symbol  open close   low  high    volume
##     <dbl> <chr>  <dbl> <dbl> <dbl> <dbl>     <dbl>
##  1   255 AAPL    213.  214.  212.  214. 123432400
##  2   722 AAPL    215.  214.  213.  216. 150476200
##  3  1190 AAPL    214.  211.  211.  215. 138040000
##  4  1658 AAPL    212.  211.  209.  212. 119282800
##  5  2126 AAPL    210.  212.  209.  212. 111902700
##  6  2594 AAPL    213.  210.  208.  213. 115557400
##  7  3062 AAPL    209.  208.  206.  210. 148614900
##  8  3530 AAPL    208.  211.  204.  211. 151473000
##  9  3998 AAPL    210.  209.  209.  210. 108223500
## 10  4466 AAPL    211.  206.  206.  212. 148516900
## # ... with 1,752 more rows
```

```r
microprice
```

```
## # A tibble: 1,762 x 7
##    dates symbol  open close   low  high   volume
##    <dbl> <chr>  <dbl> <dbl> <dbl> <dbl>    <dbl>
##  1   545 MSFT    30.6  31.0  30.6  31.1 38409100
##  2  1013 MSFT    30.8  31.0  30.6  31.1 49749600
##  3  1481 MSFT    30.9  30.8  30.5  31.1 58182400
##  4  1949 MSFT    30.6  30.5  30.2  30.7 50559700
##  5  2417 MSFT    30.3  30.7  30.2  30.9 51197400
##  6  2885 MSFT    30.7  30.3  30.1  30.8 68754700
##  7  3353 MSFT    30.2  30.1  29.9  30.4 65912100
##  8  3821 MSFT    30.3  30.4  30.0  30.5 51863500
##  9  4289 MSFT    30.3  31.0  30.3  31.1 63228100
## 10  4757 MSFT    31.1  30.9  30.7  31.2 79913200
## # ... with 1,752 more rows
```

```r
fbprice
```

```
## # A tibble: 1,008 x 7
##     dates symbol  open close   low  high    volume
##     <dbl> <chr>  <dbl> <dbl> <dbl> <dbl>     <dbl>
##  1 354497 FB      27.4  28    27.4  28.2  69846400
##  2 354980 FB      27.9  27.8  27.6  28.5  63140600
##  3 355463 FB      28.0  28.8  27.8  28.9  72715400
##  4 355946 FB      28.7  29.4  28.6  29.8  83781800
##  5 356429 FB      29.5  29.1  28.9  29.6  45871300
##  6 356912 FB      29.7  30.6  29.5  30.6 104787700
##  7 357395 FB      30.6  31.3  30.3  31.5  95316400
##  8 357878 FB      31.3  31.7  31.1  32.0  89598000
##  9 358361 FB      32.1  31.0  30.6  32.2  98892800
## 10 358844 FB      30.6  30.1  29.9  31.7 173242600
## # ... with 998 more rows
```

```r
amazonprice
```

```
## # A tibble: 1,762 x 7
##    dates symbol  open close   low  high   volume
##    <dbl> <chr>  <dbl> <dbl> <dbl> <dbl>    <dbl>
##  1   285 AMZN    136.  134.  133.  137.  7599900
##  2   752 AMZN    133.  135.  132.  135.  8851900
##  3  1220 AMZN    135.  132.  132.  135.  7178800
##  4  1688 AMZN    132.  130   129.  132. 11030200
##  5  2156 AMZN    131.  134.  129.  134.  9830500
##  6  2624 AMZN    133.  130.  129.  133.  8779400
##  7  3092 AMZN    129.  127.  127.  130.  9096300
##  8  3560 AMZN    128.  129.  126.  130. 10723200
##  9  4028 AMZN    129.  127.  126.  130.  9774900
## 10  4496 AMZN    129.  127.  127.  130. 15376500
## # ... with 1,752 more rows
```

For our time series analysis on 4 profitable companies, we utilize the filter function to allow us to get 4 different dataframes for analysis

```r
fit <- lm(TotalRevenue ~ EarningsPerShare + GrossProfit + EarningsBeforeTax + ProfitMargin + NetIncome +
fit2 <- lm(CapitalExpenditures ~ TotalAssets + TotalCurrentAssets + OtherEquity + Investments + LongTerm
ols_step_forward_p(fit, details = TRUE)
```

```
## Forward Selection Method
## ---------------------------
##
## Candidate Terms:
##
## 1. EarningsPerShare
## 2. GrossProfit
## 3. EarningsBeforeTax
## 4. ProfitMargin
## 5. NetIncome
## 6. NetBorrowings
## 7. Goodwill
##
## We are selecting variables based on p value...
##
##
## Forward Selection: Step 1
##
## - GrossProfit
##
##                               Model Summary
## -----------------------------------------------------------------------
## R                        0.817       RMSE              23610626684.342
## R-Squared                0.668       Coef. Var                 116.355
## Adj. R-Squared           0.668       MSE                  5.574617e+20
## Pred R-Squared           0.661       MAE              10756704268.329
## -----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                      ANOVA
## -----------------------------------------------------------------------------
##                     Sum of
##                    Squares          DF     Mean Square       F          Sig.
## -----------------------------------------------------------------------------
## Regression    1.994363e+24           1    1.994363e+24    3577.579    0.0000
## Residual      9.917244e+23        1779    5.574617e+20
## Total         2.986088e+24        1780
## -----------------------------------------------------------------------------
##
##                                              Parameter Estimates
## -----------------------------------------------------------------------------------------------------
##       model             Beta      Std. Error    Std. Beta      t        Sig             lower
## -----------------------------------------------------------------------------------------------------
## (Intercept)    2601886973.092    632832392.640                 4.111     0.000    1.360714e+09     3.8
## GrossProfit             2.461            0.041        0.817    59.813     0.000    2.380000e+00     2.542
## -----------------------------------------------------------------------------------------------------
##
```

```
##
##
## Forward Selection: Step 2
##
## - EarningsBeforeTax
##
##                              Model Summary
## -----------------------------------------------------------------------
## R                       0.823       RMSE              23290471047.694
## R-Squared               0.677       Coef. Var                 114.777
## Adj. R-Squared          0.677       MSE                   5.42446e+20
## Pred R-Squared          0.667       MAE               10486466038.792
## -----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                     ANOVA
## -----------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F          Sig.
## -----------------------------------------------------------------------------
## Regression    2.021619e+24          2    1.010809e+24    1863.428    0.0000
## Residual      9.644691e+23       1778     5.42446e+20
## Total         2.986088e+24       1780
## -----------------------------------------------------------------------------
##
##                                                  Parameter Estimates
## ----------------------------------------------------------------------------------------------------
##             model           Beta      Std. Error    Std. Beta      t        Sig            lower
## ----------------------------------------------------------------------------------------------------
##       (Intercept)    2619898243.177    624256476.310                 4.197    0.000    1.395545e+09
##       GrossProfit            2.089            0.066        0.694    31.492    0.000    1.959000e+00
## EarningsBeforeTax            1.118            0.158        0.156     7.088    0.000    8.090000e-01
## ----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 3
##
## - NetIncome
##
##                              Model Summary
## -----------------------------------------------------------------------
## R                       0.827       RMSE              23044392985.833
## R-Squared               0.684       Coef. Var                 113.564
## Adj. R-Squared          0.683       MSE                   5.31044e+20
## Pred R-Squared          0.673       MAE               10402770115.193
## -----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                     ANOVA
```

```
## ---------------------------------------------------------------------------
##                   Sum of
##                  Squares          DF     Mean Square       F          Sig.
## ---------------------------------------------------------------------------
## Regression    2.042422e+24           3    6.808074e+23    1282.017    0.0000
## Residual      9.436653e+23        1777     5.31044e+20
## Total         2.986088e+24        1780
## ---------------------------------------------------------------------------
##
##                                                 Parameter Estimates
## -----------------------------------------------------------------------------------------------------
##             model            Beta      Std. Error    Std. Beta      t        Sig             lower
## -----------------------------------------------------------------------------------------------------
##       (Intercept)    3060699488.416    621662934.562                 4.923    0.000      1.841432e+09
##       GrossProfit             2.055            0.066        0.682    31.194    0.000     1.925000e+00
## EarningsBeforeTax             4.092            0.500        0.572     8.182    0.000     3.111000e+00
##         NetIncome            -4.256            0.680       -0.415    -6.259    0.000    -5.589000e+00
## -----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 4
##
## - ProfitMargin
##
##                             Model Summary
## ---------------------------------------------------------------------
## R                         0.830       RMSE             22851728405.645
## R-Squared                 0.689       Coef. Var                112.615
## Adj. R-Squared            0.689       MSE                 5.222015e+20
## Pred R-Squared            0.677       MAE              10484832904.569
## ---------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                   ANOVA
## --------------------------------------------------------------------------
##                   Sum of
##                  Squares          DF    Mean Square       F         Sig.
## --------------------------------------------------------------------------
## Regression    2.058658e+24           4    5.146644e+23    985.567    0.0000
## Residual      9.274298e+23        1776    5.222015e+20
## Total         2.986088e+24        1780
## --------------------------------------------------------------------------
##
##                                                Parameter Estimates
## -----------------------------------------------------------------------------------------------------
##             model            Beta      Std. Error    Std. Beta      t        Sig            lower
## -----------------------------------------------------------------------------------------------------
##       (Intercept)    5537634397.295    759845018.103                 7.288    0.000      4.04735e+09
##       GrossProfit             2.065            0.065        0.686    31.598    0.000     1.93600e+00
## EarningsBeforeTax             3.878            0.497        0.542     7.795    0.000     2.90200e+00
##         NetIncome            -4.036            0.675       -0.394    -5.976    0.000    -5.36100e+00
```

```
##      ProfitMargin    -172961256.400    31019589.873       -0.074    -5.576    0.000    -2.33800e+08
## ----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 5
##
## - NetBorrowings
##
##                               Model Summary
## -------------------------------------------------------------------------
## R                         0.831       RMSE              22792620985.381
## R-Squared                 0.691       Coef. Var                 112.324
## Adj. R-Squared            0.690       MSE                  5.195036e+20
## Pred R-Squared            0.672       MAE               10489535061.472
## -------------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                    ANOVA
## ------------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F         Sig.
## ------------------------------------------------------------------------------
## Regression    2.063969e+24          5    4.127938e+23    794.593    0.0000
## Residual      9.221188e+23       1775    5.195036e+20
## Total         2.986088e+24       1780
## ------------------------------------------------------------------------------
##
##                                                 Parameter Estimates
## ----------------------------------------------------------------------------------------------------
##             model             Beta      Std. Error    Std. Beta      t        Sig           lower
## ----------------------------------------------------------------------------------------------------
##       (Intercept)    5431094652.444    758611772.794                7.159    0.000     3.943228e+09
##       GrossProfit             2.091            0.066        0.694   31.831    0.000     1.962000e+00
## EarningsBeforeTax             3.711            0.499        0.518    7.438    0.000     2.733000e+00
##         NetIncome            -3.936            0.674       -0.384   -5.837    0.000    -5.259000e+00
##      ProfitMargin    -174750092.175    30944413.733       -0.075   -5.647    0.000    -2.354414e+08
##     NetBorrowings             0.328            0.102        0.043    3.197    0.001     1.270000e-01
## ----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 6
##
## - Goodwill
##
##                               Model Summary
## -------------------------------------------------------------------------
## R                         0.832       RMSE              22784450969.368
## R-Squared                 0.692       Coef. Var                 112.283
## Adj. R-Squared            0.691       MSE                  5.191312e+20
## Pred R-Squared            0.669       MAE               10529120143.577
```

```
## ---------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## --------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F         Sig.
## --------------------------------------------------------------------------
## Regression    2.065149e+24           6    3.441915e+23    663.014    0.0000
## Residual      9.209388e+23        1774    5.191312e+20
## Total         2.986088e+24        1780
## --------------------------------------------------------------------------
##
##                                                Parameter Estimates
## ------------------------------------------------------------------------------------------------------
##             model             Beta      Std. Error    Std. Beta      t        Sig             lower
## ------------------------------------------------------------------------------------------------------
##       (Intercept)    5658504901.404    773194385.249                7.318    0.000     4.142037e+09
##       GrossProfit             2.120            0.069        0.704   30.933    0.000    1.986000e+00
## EarningsBeforeTax             3.599            0.504        0.503    7.139    0.000    2.611000e+00
##         NetIncome            -3.749            0.685       -0.366   -5.469    0.000   -5.094000e+00
##      ProfitMargin   -175388983.212     30936224.008       -0.075   -5.669    0.000   -2.360643e+08
##     NetBorrowings             0.306            0.103        0.040    2.960    0.003    1.030000e-01
##          Goodwill            -0.121            0.080       -0.023   -1.508    0.132   -2.780000e-01
## ------------------------------------------------------------------------------------------------------
##
##
##
## No more variables to be added.
##
## Variables Entered:
##
## + GrossProfit
## + EarningsBeforeTax
## + NetIncome
## + ProfitMargin
## + NetBorrowings
## + Goodwill
##
##
## Final Model Output
## ------------------
##
##                              Model Summary
## ---------------------------------------------------------------------
## R                        0.832       RMSE               22784450969.368
## R-Squared                0.692       Coef. Var                  112.283
## Adj. R-Squared           0.691       MSE                   5.191312e+20
## Pred R-Squared           0.669       MAE               10529120143.577
## ---------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
```

```
##  MAE: Mean Absolute Error
##
##                                    ANOVA
## ----------------------------------------------------------------------------
##                     Sum of
##                    Squares          DF     Mean Square       F         Sig.
## ----------------------------------------------------------------------------
## Regression    2.065149e+24           6    3.441915e+23    663.014    0.0000
## Residual      9.209388e+23        1774    5.191312e+20
## Total         2.986088e+24        1780
## ----------------------------------------------------------------------------
##
##                                                  Parameter Estimates
## ----------------------------------------------------------------------------------------------------
##             model             Beta      Std. Error    Std. Beta      t        Sig            lower
## ----------------------------------------------------------------------------------------------------
##       (Intercept)    5658504901.404    773194385.249                 7.318    0.000     4.142037e+0
##       GrossProfit             2.120            0.069        0.704    30.933    0.000     1.986000e+00
## EarningsBeforeTax             3.599            0.504        0.503     7.139    0.000     2.611000e+00
##         NetIncome            -3.749            0.685       -0.366    -5.469    0.000    -5.094000e+00
##      ProfitMargin    -175388983.212     30936224.008       -0.075    -5.669    0.000    -2.360643e+08
##     NetBorrowings             0.306            0.103        0.040     2.960    0.003     1.030000e-01
##          Goodwill            -0.121            0.080       -0.023    -1.508    0.132    -2.780000e-01
## ----------------------------------------------------------------------------------------------------
```

```
##
##                                        Selection Summary
## -----------------------------------------------------------------------------------------------
##         Variable                          Adj.
## Step         Entered           R-Square    R-Square      C(p)          AIC              RMSE
## -----------------------------------------------------------------------------------------------
##    1    GrossProfit              0.6679      0.6677     45.1252    90136.4952    23610626684.3418
##    2    EarningsBeforeTax        0.6770      0.6766     -2.9518    90088.8633    23290471047.6940
##    3    NetIncome                0.6840      0.6834    -39.1752    90052.0264    23044392985.8326
##    4    ProfitMargin             0.6894      0.6887    -67.0051    90023.1182    22851728405.6446
##    5    NetBorrowings            0.6912      0.6903    -74.7632    90014.8899    22792620985.3809
##    6    Goodwill                 0.6916      0.6905    -74.9314    90014.6092    22784450969.3684
## -----------------------------------------------------------------------------------------------
```

```r
ols_step_forward_p(fit2, details = TRUE)
```

```
## Forward Selection Method
## ---------------------------
##
## Candidate Terms:
##
## 1. TotalAssets
## 2. TotalCurrentAssets
## 3. OtherEquity
## 4. Investments
## 5. LongTermDebt
## 6. OtherLiabilities
## 7. OtherCurrentLiabilities
```

```
## 8. IncomeTax
## 9. TotalCurrentLiabilities
##
## We are selecting variables based on p value...
##
##
## Forward Selection: Step 1
##
## - IncomeTax
##
##                          Model Summary
## ----------------------------------------------------------------------
## R                        0.622       RMSE              2334342817.801
## R-Squared                0.387       Coef. Var               -186.460
## Adj. R-Squared           0.386       MSE                 5.449156e+18
## Pred R-Squared           0.375       MAE               1187916830.420
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## -----------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F          Sig.
## -----------------------------------------------------------------------------
## Regression     6.11267e+21          1     6.11267e+21    1121.764    0.0000
## Residual      9.694049e+21       1779    5.449156e+18
## Total         1.580672e+22       1780
## -----------------------------------------------------------------------------
##
##                                            Parameter Estimates
## --------------------------------------------------------------------------------------------------------------
##       model             Beta      Std. Error    Std. Beta       t        Sig             lower
## --------------------------------------------------------------------------------------------------------------
## (Intercept)    -574126159.154    58899473.429                 -9.748    0.000    -6.896456e+08    -4
##   IncomeTax            -1.013           0.030      -0.622    -33.493    0.000    -1.072000e+00    -9
## --------------------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 2
##
## - TotalCurrentLiabilities
##
##                          Model Summary
## ----------------------------------------------------------------------
## R                        0.696       RMSE              2141166541.505
## R-Squared                0.484       Coef. Var               -171.030
## Adj. R-Squared           0.484       MSE                 4.584594e+18
## Pred R-Squared           0.469       MAE               1049366288.146
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
```

```
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## --------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F         Sig.
## --------------------------------------------------------------------------
## Regression    7.655311e+21          2    3.827655e+21    834.895    0.0000
## Residual      8.151408e+21       1778    4.584594e+18
## Total         1.580672e+22       1780
## --------------------------------------------------------------------------
##
##                                                   Parameter Estimates
## ----------------------------------------------------------------------------------------------------
##                   model            Beta     Std. Error    Std. Beta       t        Sig
## ----------------------------------------------------------------------------------------------------
##             (Intercept)    -248639588.125    56864597.744                  -4.372    0.000    -3.601
##               IncomeTax            -0.680           0.033       -0.418    -20.547    0.000    -7.45000
## TotalCurrentLiabilities            -0.117           0.006       -0.373    -18.343    0.000    -1.29000
## ----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 3
##
## - Investments
##
##                           Model Summary
## --------------------------------------------------------------------
## R                        0.715       RMSE              2086062730.007
## R-Squared                0.511       Coef. Var               -166.628
## Adj. R-Squared           0.510       MSE                 4.351658e+18
## Pred R-Squared           0.496       MAE               1049410662.934
## --------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## --------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F         Sig.
## --------------------------------------------------------------------------
## Regression    8.073823e+21          3    2.691274e+21    618.448    0.0000
## Residual      7.732896e+21       1777    4.351658e+18
## Total         1.580672e+22       1780
## --------------------------------------------------------------------------
##
##                                                   Parameter Estimates
## ----------------------------------------------------------------------------------------------------
##                   model            Beta      Std. Error    Std. Beta       t        Sig
## ----------------------------------------------------------------------------------------------------
##             (Intercept)    -286287555.427    55534013.167                  -5.155    0.000    -3.952
##               IncomeTax            -0.814           0.035       -0.500    -23.244    0.000    -8.8300
```

```
## TotalCurrentLiabilities           -0.103           0.006       -0.330    -16.262    0.000    -1.1600
##            Investments            -0.066           0.007       -0.177     -9.807    0.000    -7.9000
## ----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 4
##
## - TotalCurrentAssets
##
##                            Model Summary
## ---------------------------------------------------------------------
## R                       0.721       RMSE              2066785632.914
## R-Squared               0.520       Coef. Var               -165.089
## Adj. R-Squared          0.519       MSE                 4.271603e+18
## Pred R-Squared          0.502       MAE               1036105578.916
## ---------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## ---------------------------------------------------------------------------
##                   Sum of
##                  Squares          DF     Mean Square       F         Sig.
## ---------------------------------------------------------------------------
## Regression    8.220352e+21           4    2.055088e+21    481.105    0.0000
## Residual      7.586367e+21        1776    4.271603e+18
## Total         1.580672e+22        1780
## ---------------------------------------------------------------------------
##
##                                                  Parameter Estimates
## ----------------------------------------------------------------------------------------------------
##                  model             Beta      Std. Error    Std. Beta       t        Sig
## ----------------------------------------------------------------------------------------------------
##            (Intercept)    -328435149.392    55489437.190                 -5.919    0.000    -4.372
##              IncomeTax            -0.813           0.035       -0.499    -23.424    0.000    -8.8100
## TotalCurrentLiabilities           -0.159           0.011       -0.508    -13.946    0.000    -1.8100
##            Investments            -0.068           0.007       -0.181    -10.136    0.000    -8.1000
##     TotalCurrentAssets             0.045           0.008        0.202      5.857    0.000     3.0000
## ----------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 5
##
## - OtherCurrentLiabilities
##
##                            Model Summary
## ---------------------------------------------------------------------
## R                       0.724       RMSE              2057549801.915
## R-Squared               0.525       Coef. Var               -164.351
## Adj. R-Squared          0.523       MSE                 4.233511e+18
## Pred R-Squared          0.505       MAE               1035139307.812
```

```
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## ----------------------------------------------------------------------------
##                    Sum of
##                   Squares         DF     Mean Square       F         Sig.
## ----------------------------------------------------------------------------
## Regression    8.292237e+21         5    1.658447e+21    391.743    0.0000
## Residual      7.514482e+21      1775    4.233511e+18
## Total         1.580672e+22      1780
## ----------------------------------------------------------------------------
##
##                                                    Parameter Estimates
## ---------------------------------------------------------------------------------------------------
##                  model            Beta     Std. Error    Std. Beta       t        Sig
## ---------------------------------------------------------------------------------------------------
##            (Intercept)    -348487537.167    55455397.863                 -6.284    0.000    -4.5725
##              IncomeTax          -0.846          0.035       -0.520    -23.848    0.000    -9.16000
## TotalCurrentLiabilities          -0.152          0.011       -0.488    -13.347    0.000    -1.75000
##            Investments          -0.050          0.008       -0.132     -6.206    0.000    -6.50000
##      TotalCurrentAssets           0.044          0.008        0.198      5.773    0.000     2.90000
## OtherCurrentLiabilities           0.002          0.001        0.089      4.121    0.000     1.00000
## ---------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 6
##
## - LongTermDebt
##
##                              Model Summary
## ----------------------------------------------------------------------
## R                          0.732       RMSE              2032101942.489
## R-Squared                  0.537       Coef. Var               -162.318
## Adj. R-Squared             0.535       MSE                 4.129438e+18
## Pred R-Squared             0.512       MAE               1006766529.173
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                  ANOVA
## ----------------------------------------------------------------------------
##                    Sum of
##                   Squares         DF     Mean Square       F         Sig.
## ----------------------------------------------------------------------------
## Regression    8.481096e+21         6    1.413516e+21    342.302    0.0000
## Residual      7.325624e+21      1774    4.129438e+18
## Total         1.580672e+22      1780
## ----------------------------------------------------------------------------
##
```

```
##                                                     Parameter Estimates
## -------------------------------------------------------------------------------------------------------------
##                     model             Beta      Std. Error    Std. Beta       t        Sig
## -------------------------------------------------------------------------------------------------------------
##             (Intercept)    -296180514.233    55312968.131                  -5.355    0.000    -4.046
##               IncomeTax            -0.825           0.035        -0.506    -23.431    0.000    -8.9400
## TotalCurrentLiabilities            -0.145           0.011        -0.463    -12.754    0.000    -1.6700
##             Investments            -0.018           0.009        -0.047     -1.931    0.054    -3.6000
##      TotalCurrentAssets             0.048           0.008         0.215      6.330    0.000     3.3000
## OtherCurrentLiabilities             0.007           0.001         0.272      7.896    0.000     6.0000
##            LongTermDebt            -0.020           0.003        -0.189     -6.763    0.000    -2.6000
## -------------------------------------------------------------------------------------------------------------
##
##
##
## Forward Selection: Step 7
##
## - TotalAssets
##
##                            Model Summary
## ----------------------------------------------------------------------
## R                        0.735       RMSE              2024346966.558
## R-Squared                0.540       Coef. Var               -161.699
## Adj. R-Squared           0.539       MSE                 4.097981e+18
## Pred R-Squared           0.514       MAE               1007902743.662
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                    ANOVA
## ----------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F         Sig.
## ----------------------------------------------------------------------------
## Regression    8.540999e+21          7    1.220143e+21    297.742    0.0000
## Residual       7.26572e+21       1773    4.097981e+18
## Total         1.580672e+22       1780
## ----------------------------------------------------------------------------
##
##                                                     Parameter Estimates
## -------------------------------------------------------------------------------------------------------------
##                     model             Beta      Std. Error    Std. Beta       t        Sig
## -------------------------------------------------------------------------------------------------------------
##             (Intercept)    -265719586.929    55674878.202                  -4.773    0.000    -3.749
##               IncomeTax            -0.801           0.036        -0.492    -22.520    0.000    -8.7100
## TotalCurrentLiabilities            -0.141           0.011        -0.452    -12.465    0.000    -1.6400
##             Investments            -0.020           0.009        -0.054     -2.194    0.028    -3.8000
##      TotalCurrentAssets             0.047           0.008         0.211      6.226    0.000     3.2000
## OtherCurrentLiabilities             0.011           0.001         0.416      8.164    0.000     9.0000
##            LongTermDebt            -0.014           0.003        -0.134     -4.262    0.000    -2.1000
##             TotalAssets            -0.003           0.001        -0.206     -3.823    0.000    -5.0000
## -------------------------------------------------------------------------------------------------------------
##
```

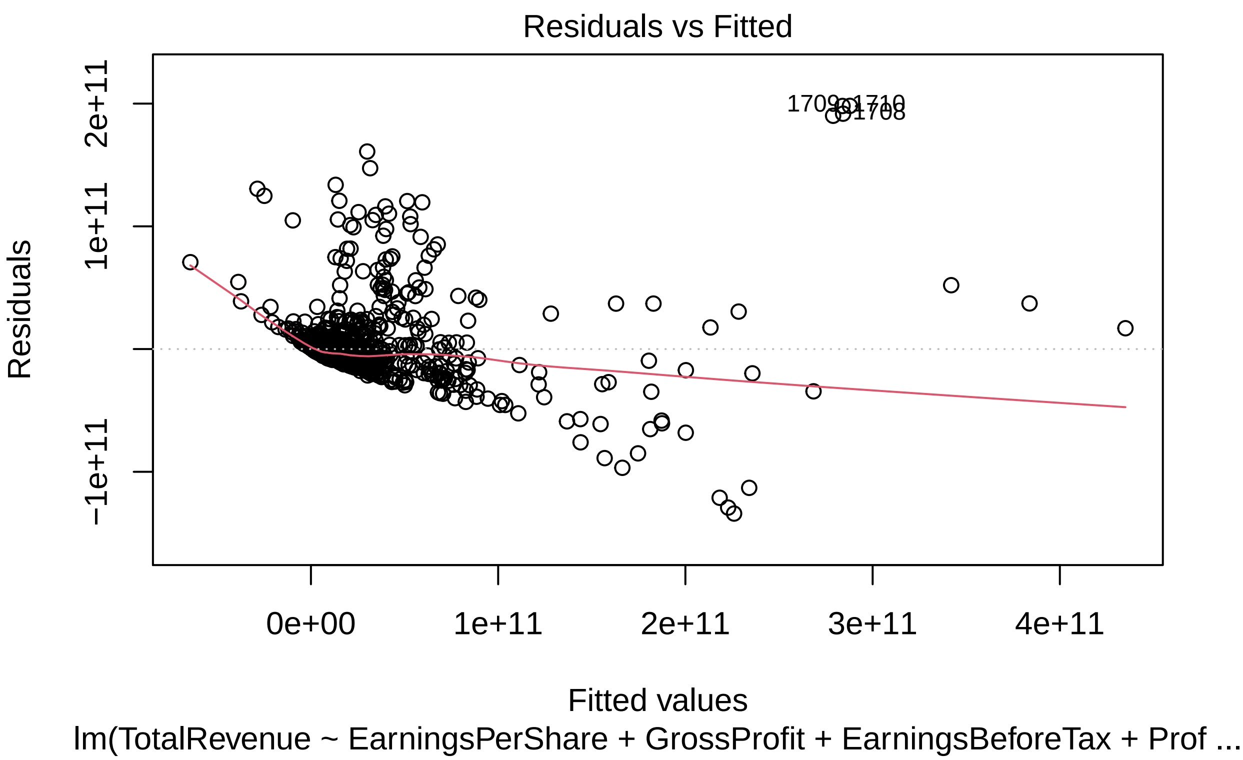
```
##
##
## Forward Selection: Step 8
##
## - OtherLiabilities
##
##                            Model Summary
## ----------------------------------------------------------------------
## R                       0.792       RMSE              1824737497.184
## R-Squared               0.627       Coef. Var               -145.755
## Adj. R-Squared          0.625       MSE                 3.329667e+18
## Pred R-Squared          0.593       MAE                938098195.926
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                   ANOVA
## ----------------------------------------------------------------------------
##                    Sum of
##                   Squares          DF     Mean Square       F         Sig.
## ----------------------------------------------------------------------------
## Regression    9.906549e+21           8    1.238319e+21    371.905    0.0000
## Residual       5.90017e+21        1772    3.329667e+18
## Total         1.580672e+22        1780
## ----------------------------------------------------------------------------
##
##                                                     Parameter Estimates
## ------------------------------------------------------------------------------------------------------
##                    model            Beta      Std. Error    Std. Beta       t       Sig           l
## ------------------------------------------------------------------------------------------------------
##             (Intercept)    -171252545.109    50401420.266                  -3.398    0.001    -2.701
##               IncomeTax            -0.549           0.034       -0.337    -15.963    0.000    -6.1700
## TotalCurrentLiabilities            -0.074           0.011       -0.237     -6.902    0.000    -9.5000
##             Investments             0.053           0.009        0.142      5.883    0.000     3.5000
##       TotalCurrentAssets            0.048           0.007        0.215      7.030    0.000     3.4000
## OtherCurrentLiabilities             0.078           0.004        2.851     22.150    0.000     7.1000
##            LongTermDebt             0.018           0.003        0.168      5.241    0.000     1.1000
##             TotalAssets            -0.044           0.002       -2.972    -20.502    0.000    -4.8000
##        OtherLiabilities             0.051           0.003        0.918     20.251    0.000     4.6000
## ------------------------------------------------------------------------------------------------------
##
##
##
## No more variables to be added.
##
## Variables Entered:
##
## + IncomeTax
## + TotalCurrentLiabilities
## + Investments
## + TotalCurrentAssets
## + OtherCurrentLiabilities
## + LongTermDebt
```

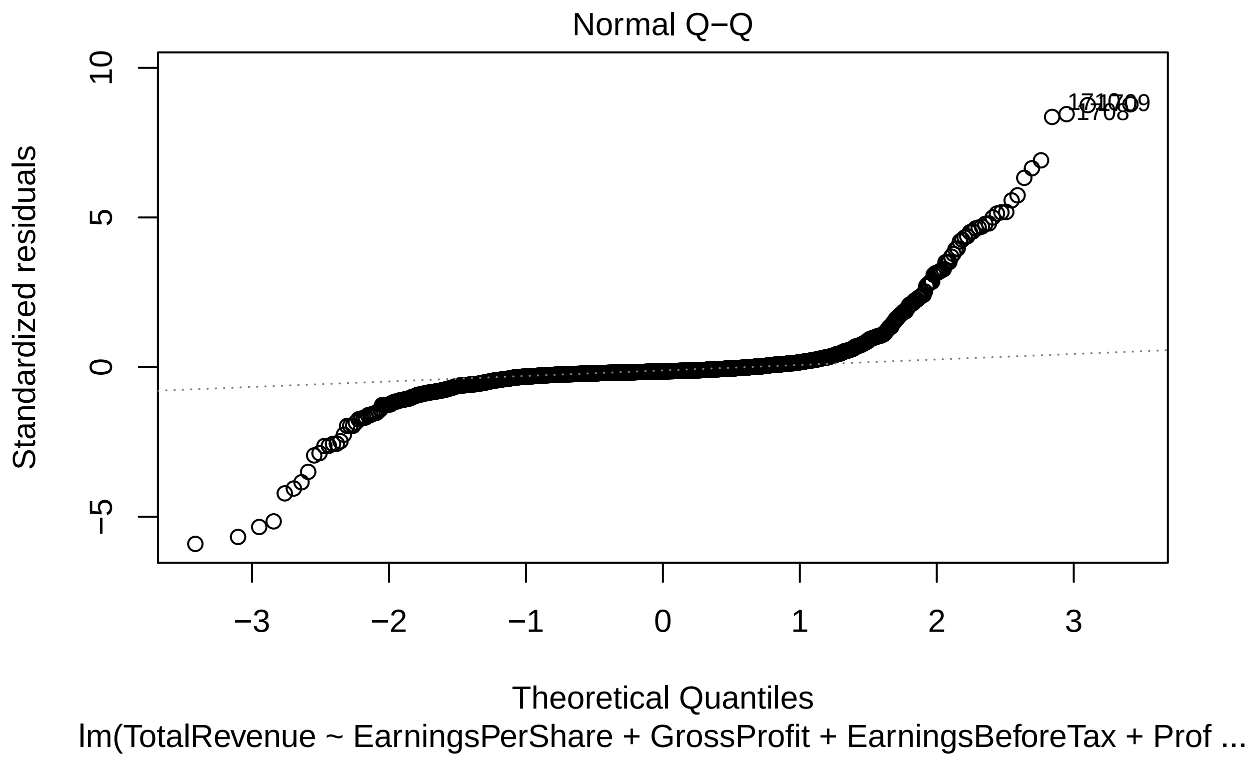
```
## + TotalAssets
## + OtherLiabilities
##
##
## Final Model Output
## ------------------
##
##                              Model Summary
## ----------------------------------------------------------------------
## R                        0.792       RMSE               1824737497.184
## R-Squared                0.627       Coef. Var                -145.755
## Adj. R-Squared           0.625       MSE                  3.329667e+18
## Pred R-Squared           0.593       MAE                938098195.926
## ----------------------------------------------------------------------
##  RMSE: Root Mean Square Error
##  MSE: Mean Square Error
##  MAE: Mean Absolute Error
##
##                                     ANOVA
## ----------------------------------------------------------------------------
##                     Sum of
##                    Squares          DF     Mean Square       F         Sig.
## ----------------------------------------------------------------------------
## Regression    9.906549e+21           8    1.238319e+21    371.905    0.0000
## Residual       5.90017e+21        1772    3.329667e+18
## Total         1.580672e+22        1780
## ----------------------------------------------------------------------------
##
##                                                  Parameter Estimates
## -----------------------------------------------------------------------------------------------------
##                    model             Beta      Std. Error    Std. Beta       t        Sig           l
## -----------------------------------------------------------------------------------------------------
##            (Intercept)    -171252545.109    50401420.266                 -3.398    0.001    -2.701
##              IncomeTax            -0.549           0.034       -0.337   -15.963    0.000    -6.1700
## TotalCurrentLiabilities           -0.074           0.011       -0.237    -6.902    0.000    -9.5000
##            Investments             0.053           0.009        0.142     5.883    0.000     3.5000
##      TotalCurrentAssets            0.048           0.007        0.215     7.030    0.000     3.4000
## OtherCurrentLiabilities            0.078           0.004        2.851    22.150    0.000     7.1000
##           LongTermDebt             0.018           0.003        0.168     5.241    0.000     1.1000
##            TotalAssets            -0.044           0.002       -2.972   -20.502    0.000    -4.8000
##       OtherLiabilities             0.051           0.003        0.918    20.251    0.000     4.6000
## -----------------------------------------------------------------------------------------------------

##
##                                          Selection Summary
## -----------------------------------------------------------------------------------------------------
##         Variable                                  Adj.
## Step            Entered             R-Square    R-Square      C(p)          AIC             RMSE
## -----------------------------------------------------------------------------------------------------
##    1    IncomeTax                     0.3867      0.3864    1133.8143    81894.1465    2334342817.801
##    2    TotalCurrentLiabilities       0.4843      0.4837     672.6084    81587.4610    2141166541.505
##    3    Investments                   0.5108      0.5100     548.9423    81495.5892    2086062730.006
##    4    TotalCurrentAssets            0.5201      0.5190     506.9443    81463.5176    2066785632.913
##    5    OtherCurrentLiabilities       0.5246      0.5233     487.3598    81448.5613    2057549801.915
```

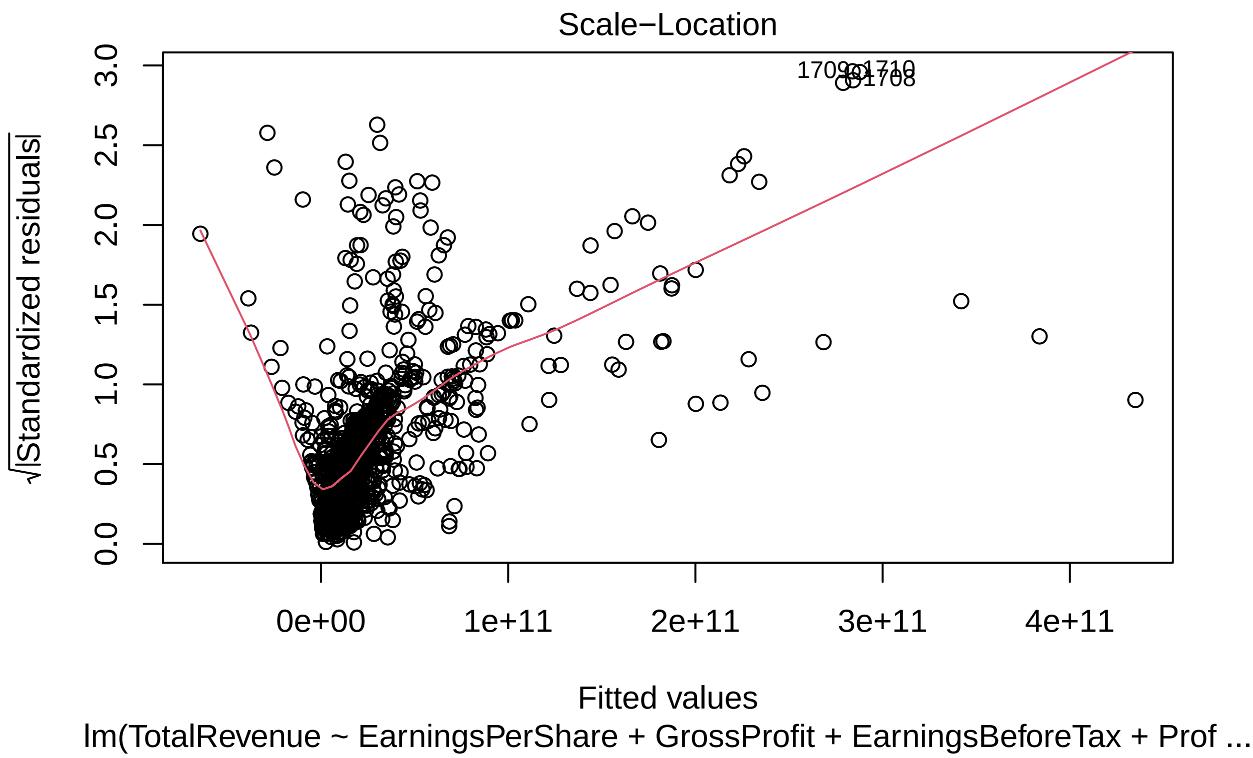
```
## 6 LongTermDebt 0.5366 0.5350 432.6515 81405.2280 2032101942.489
## 7 TotalAssets 0.5403 0.5385 416.6642 81392.6043 2024346966.557
## 8 OtherLiabilities 0.6267 0.6250 8.6331 81023.8247 1824737497.184
## -----------------------------------------------------------------------------------------
```

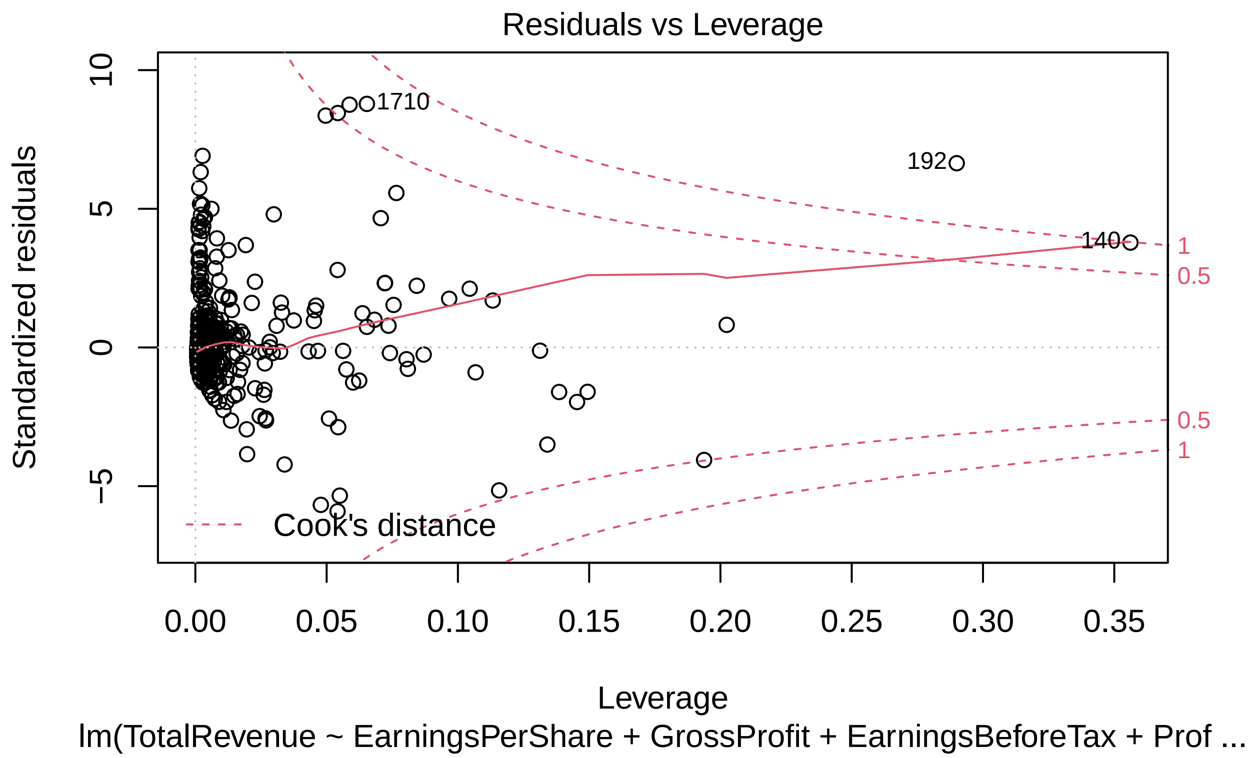
We finally begin to generate our regression models. We utilize the forward selection process (utilizing p-values) to help us construct our model. We are able to have minimal error within the parameters, meaning that we are able to get somewhat good fits, even though R^2 value isn't too high. MSE is very high due to extremely high values of the individual data points.

```r
plot(fit)
```



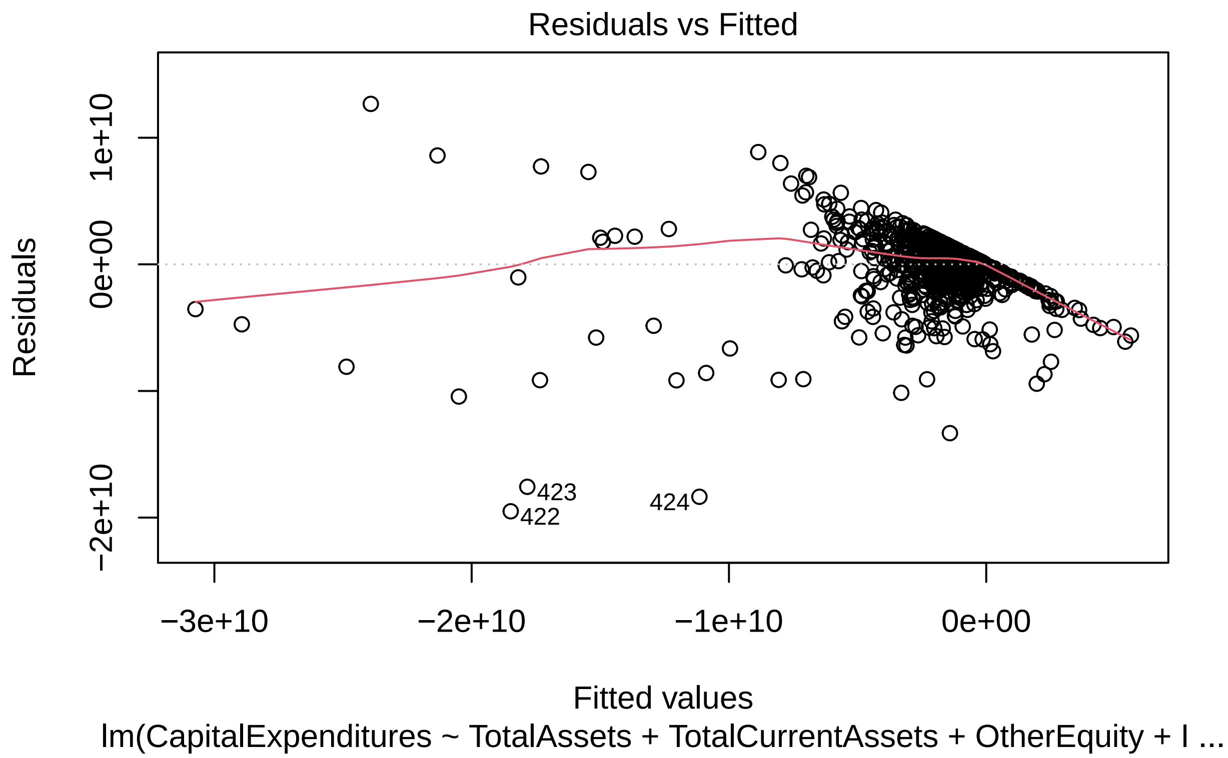

Normal Q−Q
Standardized residuals
10
5
0
−5
−3
−2
−1
0
1
2
3
1708
Theoretical Quantiles
lm(TotalRevenue ~ EarningsPerShare + GrossProfit + EarningsBeforeTax + Prof ...

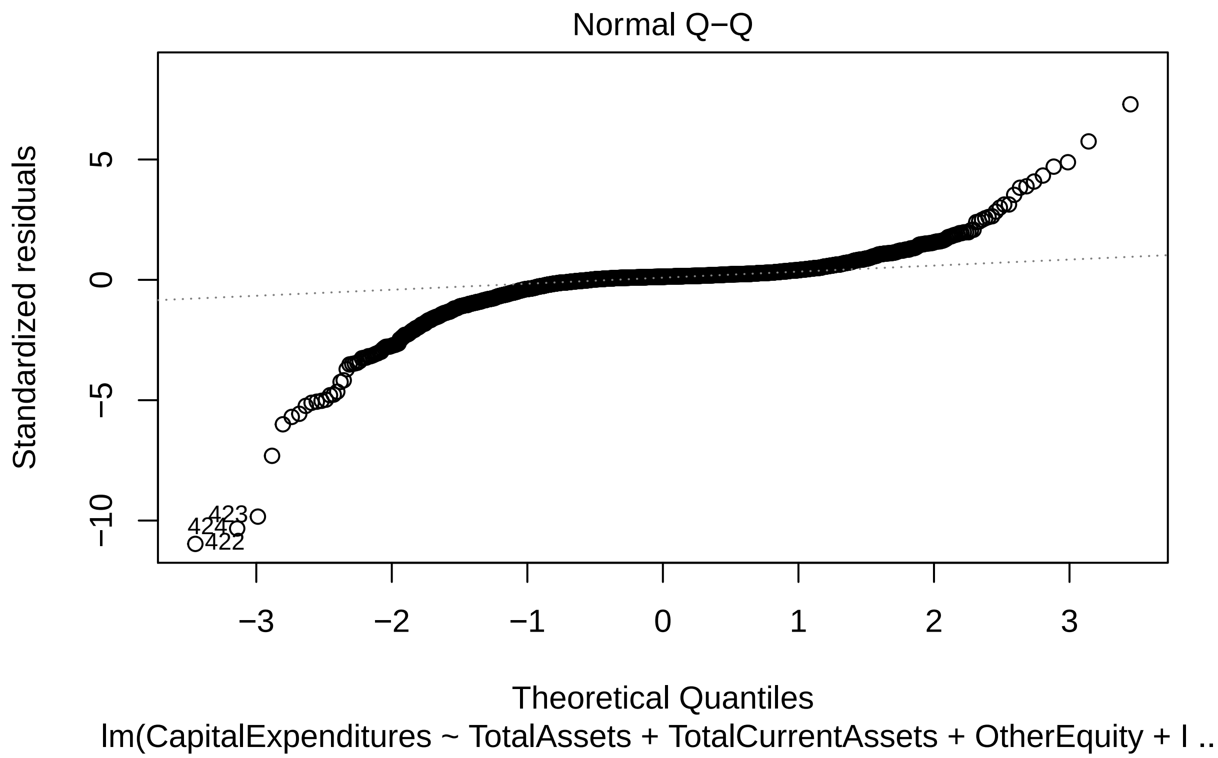

Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0e+00
1e+11
2e+11
3e+11
4e+11
Fitted values
lm(TotalRevenue ~ EarningsPerShare + GrossProfit + EarningsBeforeTax + Prof ...
1709
1710
1708

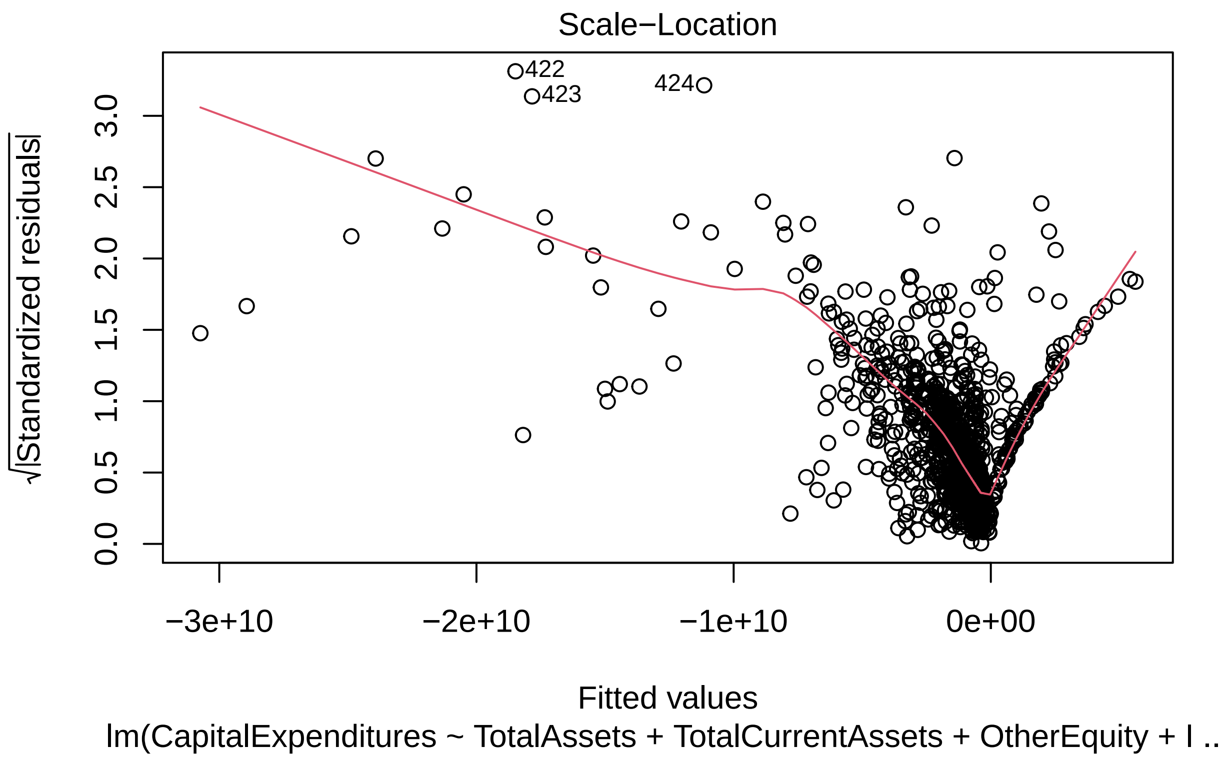


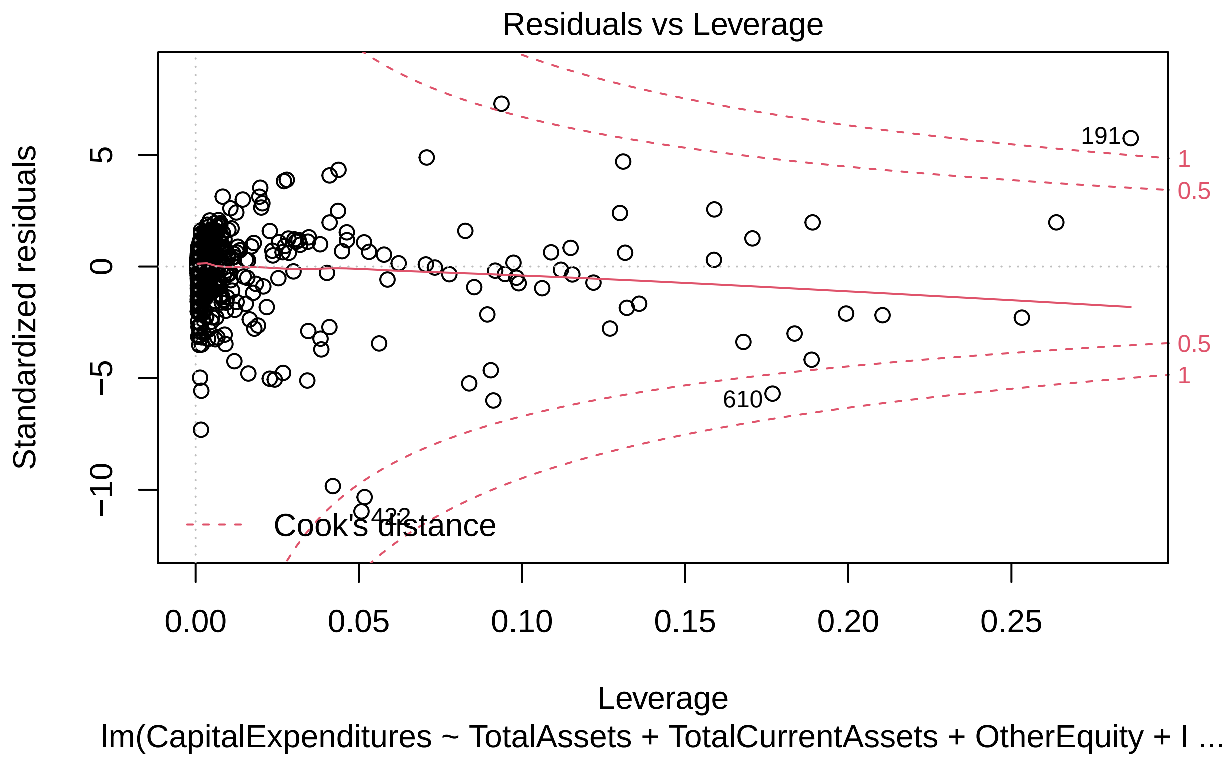
Residuals vs Leverage
Standardized residuals
10
5
0
−5
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
1710
192
140
1
0.5
0.5
1
Cook's distance
Leverage
lm(TotalRevenue ~ EarningsPerShare + GrossProfit + EarningsBeforeTax + Prof ...


```r
plot(fit2)
```


Residuals vs Fitted
Residuals
1e+10
0e+00
−2e+10
−3e+10
−2e+10
−1e+10
0e+00
Fitted values
lm(CapitalExpenditures ~ TotalAssets + TotalCurrentAssets + OtherEquity + I ...
423
422
424

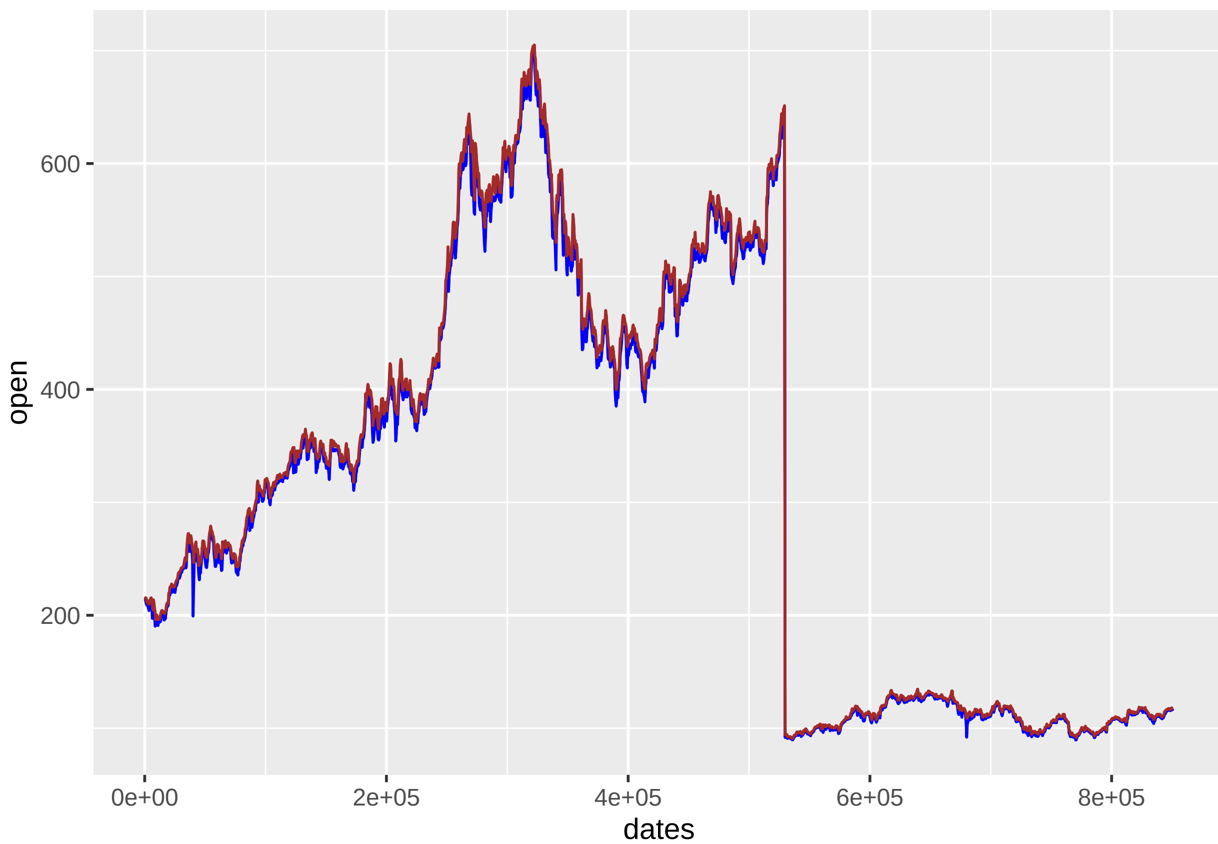

Normal Q−Q
Standardized residuals
5
0
−5
−10
423
424
422
−3
−2
−1
0
1
2
3
Theoretical Quantiles
lm(CapitalExpenditures ~ TotalAssets + TotalCurrentAssets + OtherEquity + I ...


Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
2.5
3.0
422
423
424
−3e+10
−2e+10
−1e+10
0e+00
Fitted values
lm(CapitalExpenditures ~ TotalAssets + TotalCurrentAssets + OtherEquity + I ...

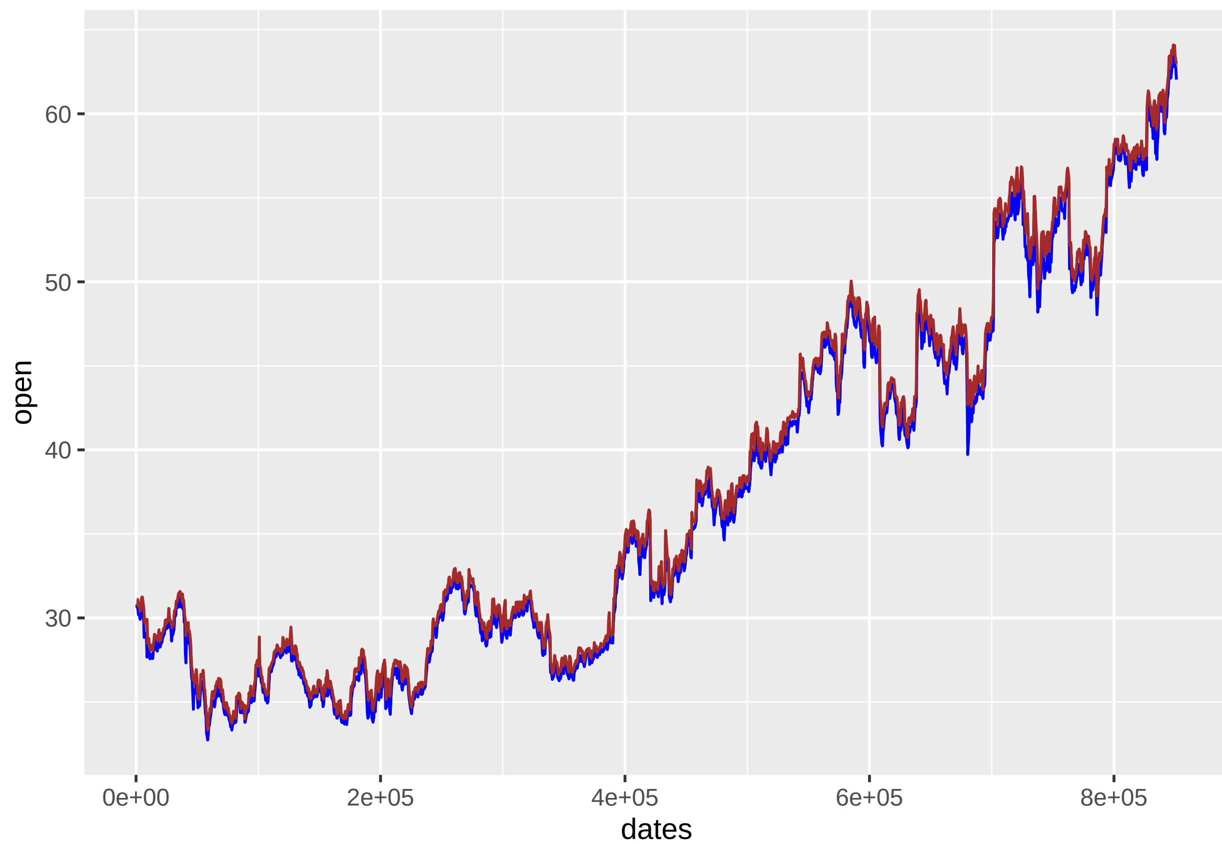


We check the various plots provided by R's plot function to see whether our models are effective in prediction.

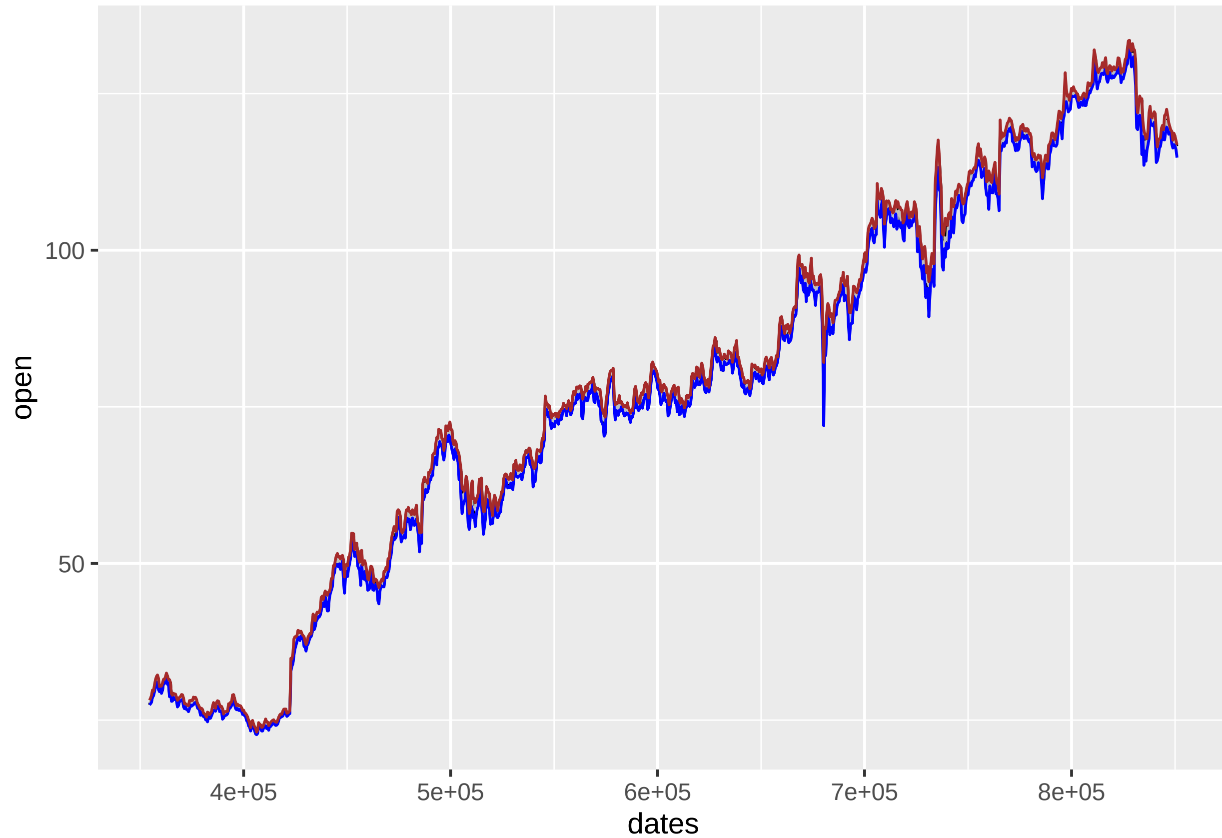
```
ggplot(data = appleprice)+
  geom_line(mapping = aes(x = dates, y = open), color = "black")+
  geom_line(mapping = aes(x = dates, y = close), color = "gray")+
  geom_line(mapping = aes(x = dates, y = low), color = "blue")+
  geom_line(mapping = aes(x = dates, y = high), color = "brown")
```



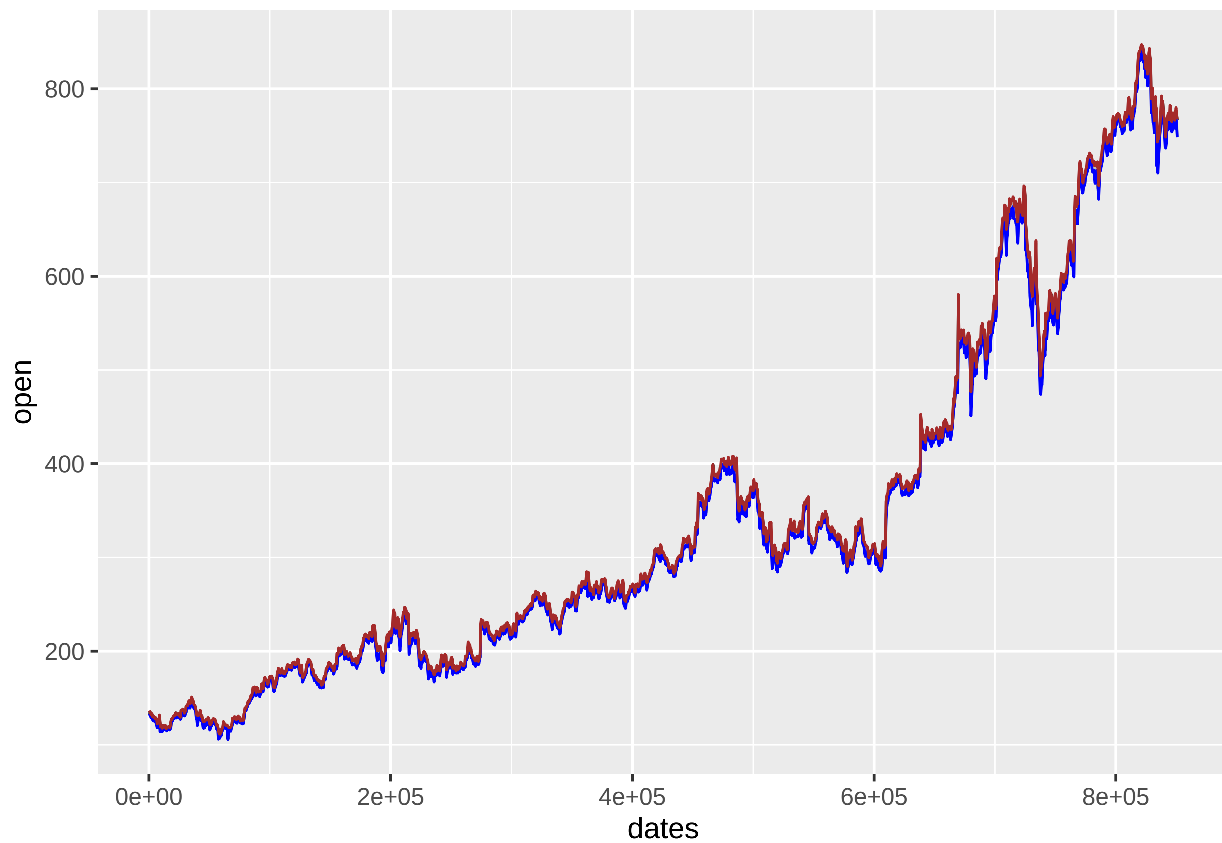

```r
ggplot(data = microprice)+
  geom_line(mapping = aes(x = dates, y = open), color = "black")+
  geom_line(mapping = aes(x = dates, y = close), color = "gray")+
  geom_line(mapping = aes(x = dates, y = low), color = "blue")+
  geom_line(mapping = aes(x = dates, y = high), color = "brown")
```




```r
ggplot(data = fbprice)+
  geom_line(mapping = aes(x = dates, y = open), color = "black")+
  geom_line(mapping = aes(x = dates, y = close), color = "gray")+
  geom_line(mapping = aes(x = dates, y = low), color = "blue")+
  geom_line(mapping = aes(x = dates, y = high), color = "brown")
```




```
ggplot(data = amazonprice)+
  geom_line(mapping = aes(x = dates, y = open), color = "black")+
  geom_line(mapping = aes(x = dates, y = close), color = "gray")+
  geom_line(mapping = aes(x = dates, y = low), color = "blue")+
  geom_line(mapping = aes(x = dates, y = high), color = "brown")
```



We now begin our time series analysis of the 4 really profitable companies, Apple, Google, Microsoft, and Facebook. We first generate the time series plots of each of the 4 companies' opening stock values, closing stock values, and high and low values per day. I converted the date objects into integers to be able to get the time series plots.

```
trendapcl <- lm(close ~ dates, data = appleprice)
summary(trendapcl)
```

```
##
## Call:
## lm(formula = close ~ dates, data = appleprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -271.60 -108.95  -66.17  147.34  374.53
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.668e+02  7.632e+00   61.17   <2e-16 ***
## dates       -3.668e-04  1.570e-05  -23.37   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 161.8 on 1760 degrees of freedom
## Multiple R-squared:  0.2368, Adjusted R-squared:  0.2363
## F-statistic:   546 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendapo <- lm(open ~ dates, data = appleprice)
summary(trendapo)
```

```
##
## Call:
## lm(formula = open ~ dates, data = appleprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -271.41 -108.83  -66.01  146.73  377.15
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.671e+02  7.637e+00   61.16   <2e-16 ***
## dates       -3.672e-04  1.571e-05  -23.37   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 161.9 on 1760 degrees of freedom
## Multiple R-squared:  0.2369, Adjusted R-squared:  0.2364
## F-statistic: 546.3 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendaphigh <- lm(high ~ dates, data = appleprice)
summary(trendaphigh)
```

```
##
## Call:
## lm(formula = high ~ dates, data = appleprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -272.07 -110.02  -66.37  148.84  376.06
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.715e+02  7.701e+00   61.22   <2e-16 ***
## dates       -3.707e-04  1.584e-05  -23.40   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 163.3 on 1760 degrees of freedom
## Multiple R-squared:  0.2373, Adjusted R-squared:  0.2369
## F-statistic: 547.7 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendaplow <- lm(low ~ dates, data = appleprice)
summary(trendaplow)
```

```
##
## Call:
## lm(formula = low ~ dates, data = appleprice)
##
```

```
## Residuals:
##     Min      1Q  Median      3Q     Max
## -268.47 -107.79  -64.67  145.41  374.43
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.619e+02  7.565e+00   61.05   <2e-16 ***
## dates       -3.624e-04  1.556e-05  -23.29   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 160.4 on 1760 degrees of freedom
## Multiple R-squared:  0.2355, Adjusted R-squared:  0.2351
## F-statistic: 542.2 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendmsftcl <- lm(close ~ dates, data = microprice)
summary(trendmsftcl)
```

```
##
## Call:
## lm(formula = close ~ dates, data = microprice)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.118 -2.627 -0.495  2.705 10.982
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.995e+01  1.878e-01   106.2   <2e-16 ***
## dates       4.093e-05  3.862e-07   106.0   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.98 on 1760 degrees of freedom
## Multiple R-squared:  0.8645, Adjusted R-squared:  0.8644
## F-statistic: 1.123e+04 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendmsftop <- lm(open ~ dates, data = microprice)
summary(trendmsftop)
```

```
##
## Call:
## lm(formula = open ~ dates, data = microprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.0936 -2.6320 -0.5854  2.7389 10.9278
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.996e+01  1.881e-01   106.1   <2e-16 ***
## dates       4.085e-05  3.868e-07   105.6   <2e-16 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.986 on 1760 degrees of freedom
## Multiple R-squared:  0.8637, Adjusted R-squared:  0.8637
## F-statistic: 1.116e+04 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendmsfthigh <- lm(high ~ dates, data = microprice)
summary(trendmsfthigh)
```

```
##
## Call:
## lm(formula = high ~ dates, data = microprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.0991 -2.6508 -0.5133  2.7956 10.9344
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 2.014e+01  1.891e-01   106.5   <2e-16 ***
## dates       4.119e-05  3.887e-07   106.0   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.006 on 1760 degrees of freedom
## Multiple R-squared:  0.8645, Adjusted R-squared:  0.8644
## F-statistic: 1.123e+04 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendmsftlow <- lm(low ~ dates, data = microprice)
summary(trendmsftlow)
```

```
##
## Call:
## lm(formula = low ~ dates, data = microprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.9975 -2.6146 -0.5386  2.7085 10.8544
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.974e+01  1.867e-01   105.8   <2e-16 ***
## dates       4.059e-05  3.838e-07   105.8   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.955 on 1760 degrees of freedom
## Multiple R-squared:  0.8641, Adjusted R-squared:  0.864
## F-statistic: 1.119e+04 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendfbcl <- lm(close ~ dates, data = fbprice)
summary(trendfbcl)
```

```
##
## Call:
## lm(formula = close ~ dates, data = fbprice)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -15.721  -3.598   0.646   4.120  16.285
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.072e+01  7.958e-01  -63.74   <2e-16 ***
## dates        2.133e-04  1.287e-06  165.66   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.865 on 1006 degrees of freedom
## Multiple R-squared:  0.9646, Adjusted R-squared:  0.9646
## F-statistic: 2.744e+04 on 1 and 1006 DF,  p-value: < 2.2e-16
```

```
trendfbop <- lm(open ~ dates, data = fbprice)
summary(trendfbop)
```

```
##
## Call:
## lm(formula = open ~ dates, data = fbprice)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.3442  -3.7345   0.5191   4.1275  16.6496
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.074e+01  7.957e-01  -63.77   <2e-16 ***
## dates        2.133e-04  1.287e-06  165.71   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.864 on 1006 degrees of freedom
## Multiple R-squared:  0.9647, Adjusted R-squared:  0.9646
## F-statistic: 2.746e+04 on 1 and 1006 DF,  p-value: < 2.2e-16
```

```
trendfbhigh <- lm(high ~ dates, data = fbprice)
summary(trendfbhigh)
```

```
##
## Call:
## lm(formula = high ~ dates, data = fbprice)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.0738  -3.7389   0.6507   4.0182  16.0082
##
## Coefficients:
```

```
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.055e+01  7.980e-01  -63.34   <2e-16 ***
## dates        2.144e-04  1.291e-06  166.08   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.881 on 1006 degrees of freedom
## Multiple R-squared:  0.9648, Adjusted R-squared:  0.9648
## F-statistic: 2.758e+04 on 1 and 1006 DF,  p-value: < 2.2e-16
```

```
trendfblow <- lm(low ~ dates, data = fbprice)
summary(trendfblow)
```

```
##
## Call:
## lm(formula = low ~ dates, data = fbprice)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.3339  -3.6426   0.5483   4.2687  15.5298
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.075e+01  7.919e-01  -64.09   <2e-16 ***
## dates        2.118e-04  1.281e-06  165.34   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.836 on 1006 degrees of freedom
## Multiple R-squared:  0.9645, Adjusted R-squared:  0.9645
## F-statistic: 2.734e+04 on 1 and 1006 DF,  p-value: < 2.2e-16
```

```
trendamzncl <- lm(close ~ dates, data = amazonprice)
summary(trendamzncl)
```

```
##
## Call:
## lm(formula = close ~ dates, data = amazonprice)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -181.212  -49.320   -9.105   47.411  224.442
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.294e+01  3.641e+00   11.79   <2e-16 ***
## dates       7.030e-04  7.490e-06   93.85   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 77.2 on 1760 degrees of freedom
## Multiple R-squared:  0.8335, Adjusted R-squared:  0.8334
## F-statistic:  8808 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendamznop <- lm(open ~ dates, data = amazonprice)
summary(trendamznop)
```

```
##
## Call:
## lm(formula = open ~ dates, data = amazonprice)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -182.309  -49.132   -9.424   47.496  224.970
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.268e+01  3.648e+00   11.70   <2e-16 ***
## dates       7.035e-04  7.504e-06   93.75   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 77.34 on 1760 degrees of freedom
## Multiple R-squared:  0.8331, Adjusted R-squared:  0.8331
## F-statistic:  8788 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendamznhigh <- lm(high ~ dates, data = amazonprice)
summary(trendamznhigh)
```

```
##
## Call:
## lm(formula = high ~ dates, data = amazonprice)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -182.339  -49.758   -9.007   47.983  221.095
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.412e+01  3.658e+00   12.06   <2e-16 ***
## dates       7.086e-04  7.524e-06   94.18   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 77.55 on 1760 degrees of freedom
## Multiple R-squared:  0.8344, Adjusted R-squared:  0.8343
## F-statistic:  8870 on 1 and 1760 DF,  p-value: < 2.2e-16
```

```r
trendamznlow <- lm(low ~ dates, data = amazonprice)
summary(trendamznlow)
```

```
##
## Call:
## lm(formula = low ~ dates, data = amazonprice)
##
```

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -178.259  -49.130   -9.689   46.385  226.574
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.143e+01  3.623e+00   11.44   <2e-16 ***
## dates       6.972e-04  7.451e-06   93.57   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 76.8 on 1760 degrees of freedom
## Multiple R-squared:  0.8326, Adjusted R-squared:  0.8325
## F-statistic:  8755 on 1 and 1760 DF,  p-value: < 2.2e-16
```

Here we generate the trend predictors for each of the various vlaues. We can use these values to find the opening, closing, high, and low values for each of these 4 stocks.