Daily Volatility Analysis

Project Luther

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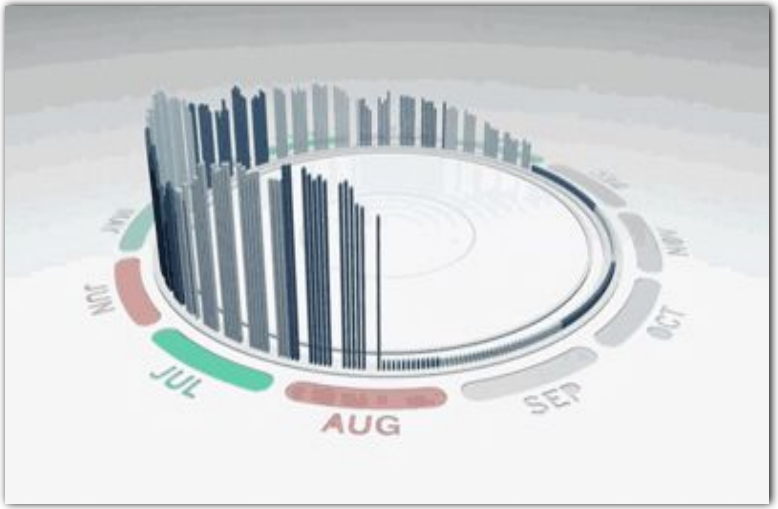
Amazon.com – 331$ billion powerhouse

Stock Prices has grown by a whopping 850%

$1.50 to $1300

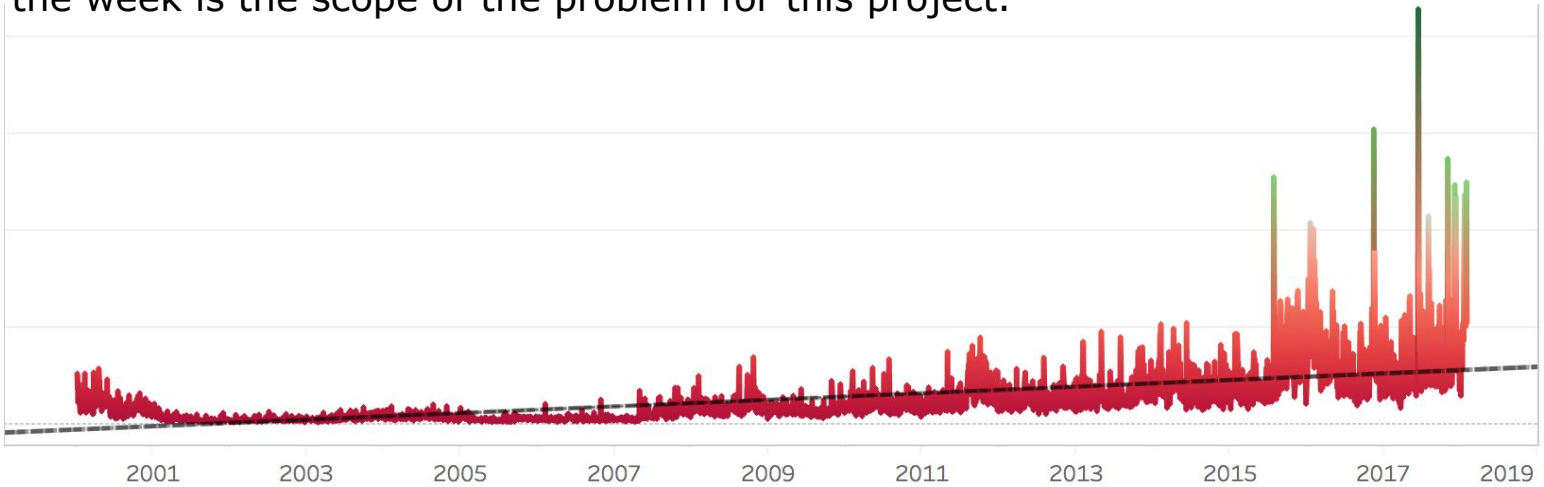
High degree of variation between High and Low share values across the period.

Has had towering P/E ratios throughout its history.



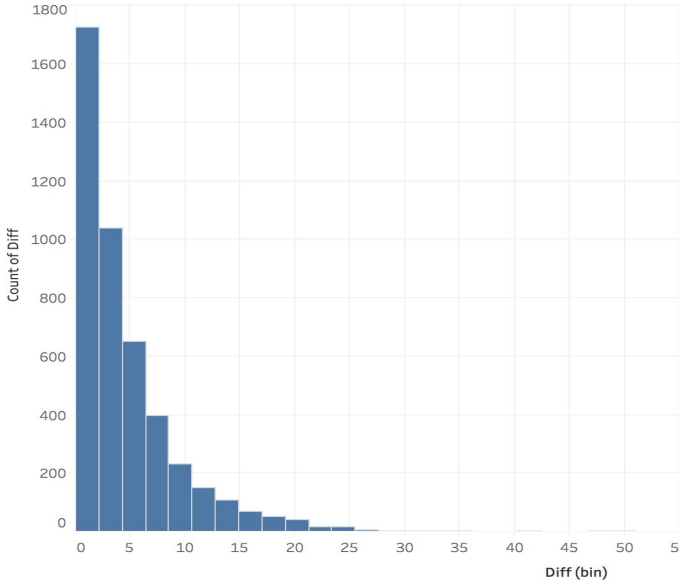
Problem Statement

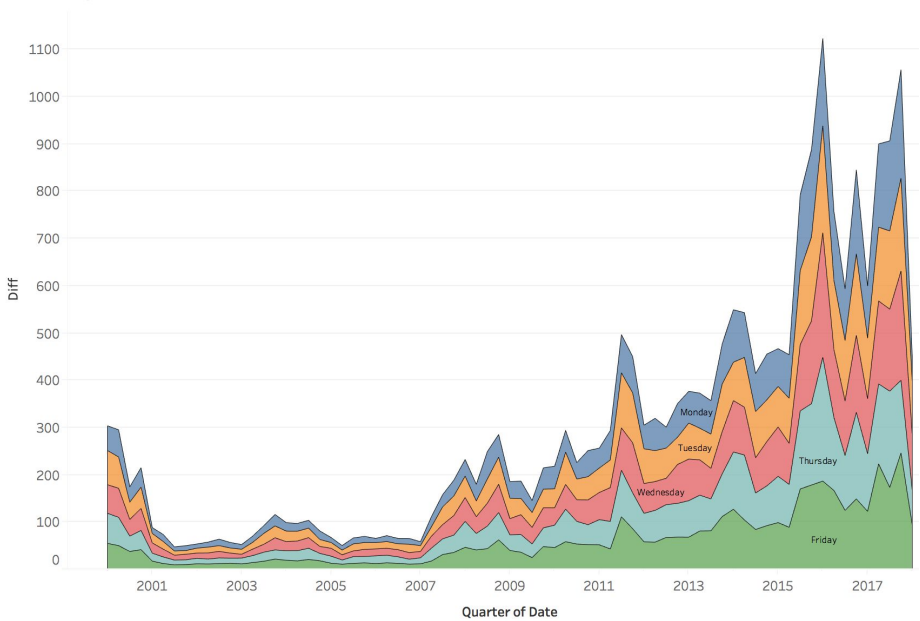
There is an increasing trend in the difference between the high and low of the Amazon stock price.
Predicting this change in volatility and determining the relation with the day of the week is the scope of the problem for this project.



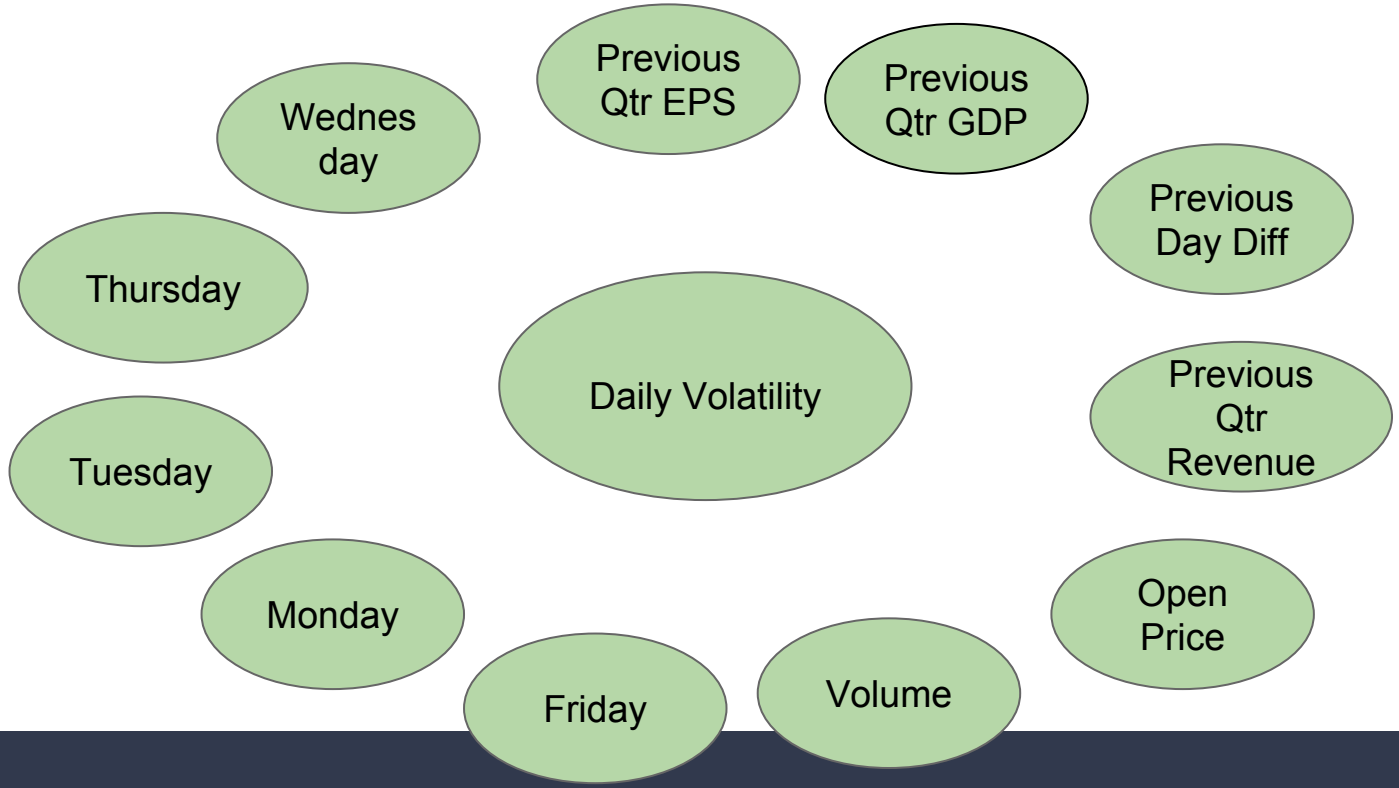
Design Strategy

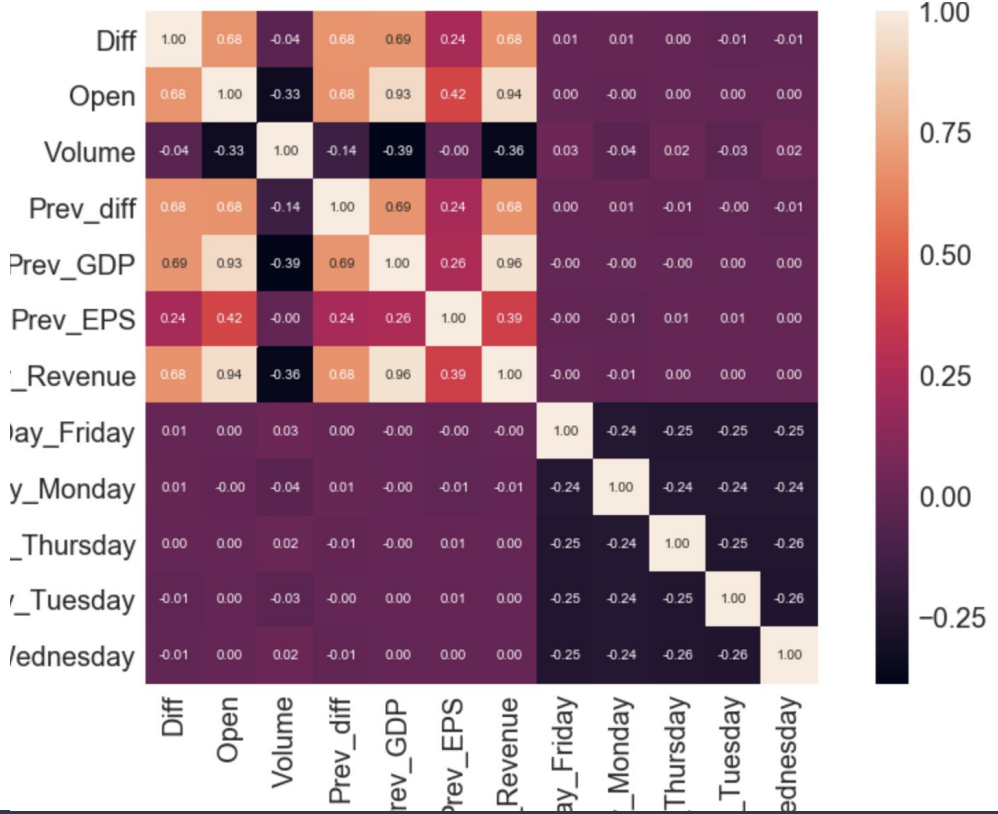
- ➔ Data Collection
- ➔ Exploratory Analysis





Feature engineering





OLS Regression Results

Dep. Variable:	Diff	**R-squared:**	0.525
Model:	OLS	**Adj. R-squared:**	0.525
Method:	Least Squares	**F-statistic:**	2285.
Date:	Wed, 31 Jan 2018	**Prob (F-statistic):**	0.00
Time:	21:06:22	**Log-Likelihood:**	-5619.6
No. Observations:	2070	**AIC:**	1.124e+04
Df Residuals:	2068	**BIC:**	1.125e+04
Df Model:	1		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	-29.6595	0.757	-39.172	0.000	-31.144	-28.175
Prev_GDP	2.237e-12	4.68e-14	47.800	0.000	2.15e-12	2.33e-12

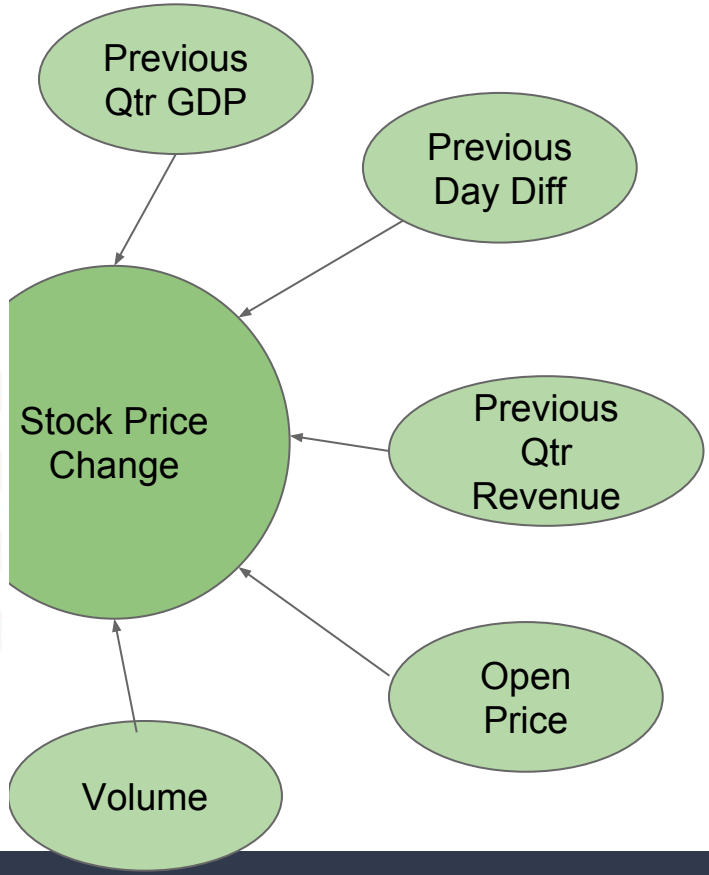
Omnibus:	1427.794	**Durbin-Watson:**	2.034
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	44731.669
Skew:	2.814	**Prob(JB):**	0.00
Kurtosis:	25.067	**Cond. No.**	1.52e+14

OLS Regression Results

Dep. Variable:	Diff	**R-squared:**	0.655
Model:	OLS	**Adj. R-squared:**	0.654
Method:	Least Squares	**F-statistic:**	782.6
Date:	Wed, 31 Jan 2018	**Prob (F-statistic):**	0.00
Time:	21:06:37	**Log-Likelihood:**	-5289.4
No. Observations:	2070	**AIC:**	1.059e+04
Df Residuals:	2064	**BIC:**	1.062e+04
Df Model:	5		
Covariance Type:	nonrobust		

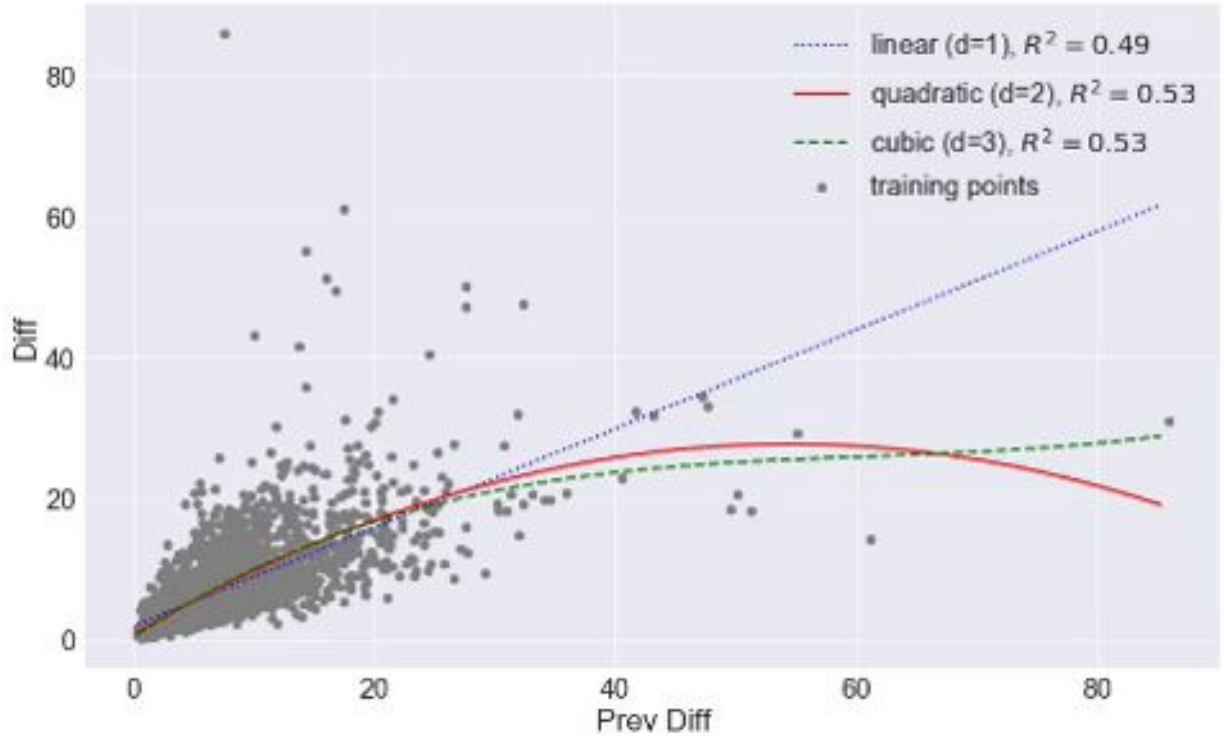
	coef	std err	t	P>|t|	[0.025	0.975]
const	-15.6135	2.281	-6.844	0.000	-20.087	-11.140
Prev_diff	0.3576	0.017	21.523	0.000	0.325	0.390
Prev_GDP	1.084e-12	1.62e-13	6.707	0.000	7.67e-13	1.4e-12
Open	0.0006	0.001	0.753	0.451	-0.001	0.002
Volume	1.711e-07	1.38e-08	12.371	0.000	1.44e-07	1.98e-07
Prev_Revenue	6.631e-11	2.43e-11	2.733	0.006	1.87e-11	1.14e-10

Omnibus:	1472.764	**Durbin-Watson:**	2.053
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	74193.310
Skew:	2.777	**Prob(JB):**	0.00
Kurtosis:	31.799	**Cond. No.**	5.38e+14

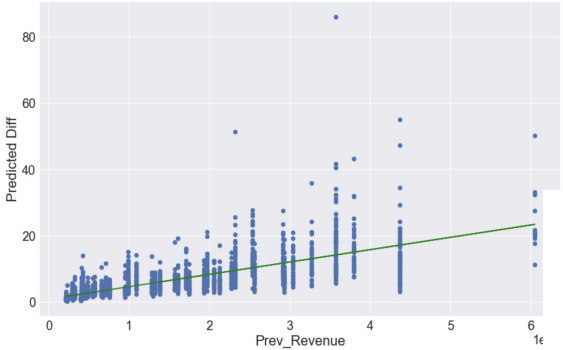


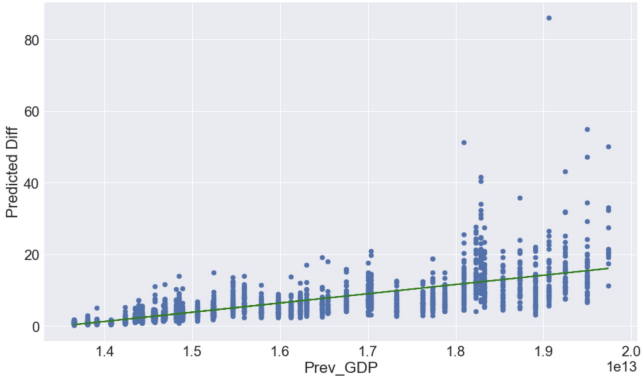
Feature engineering

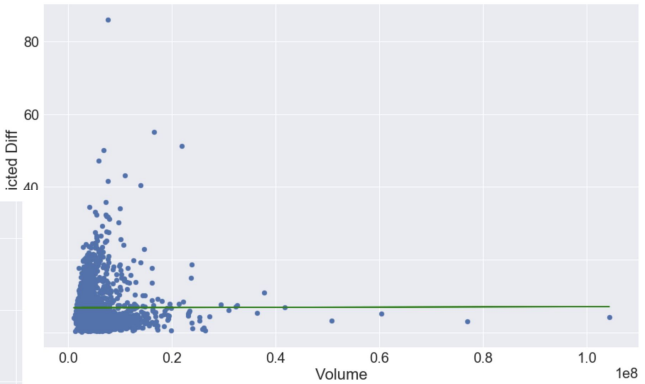
Regression Model selection

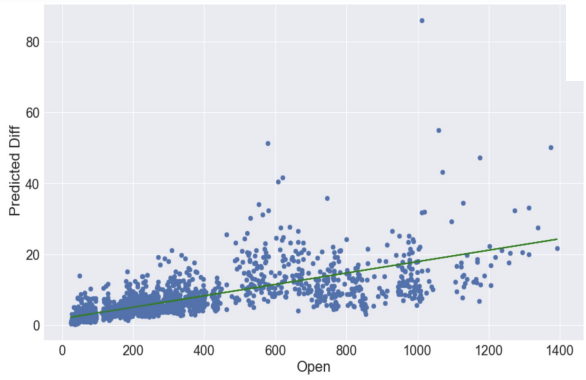


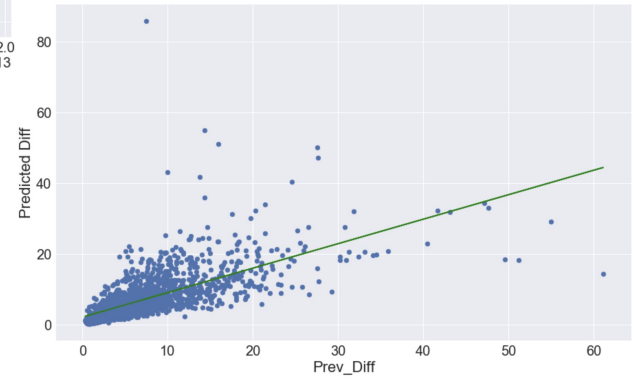
Regression Model selection

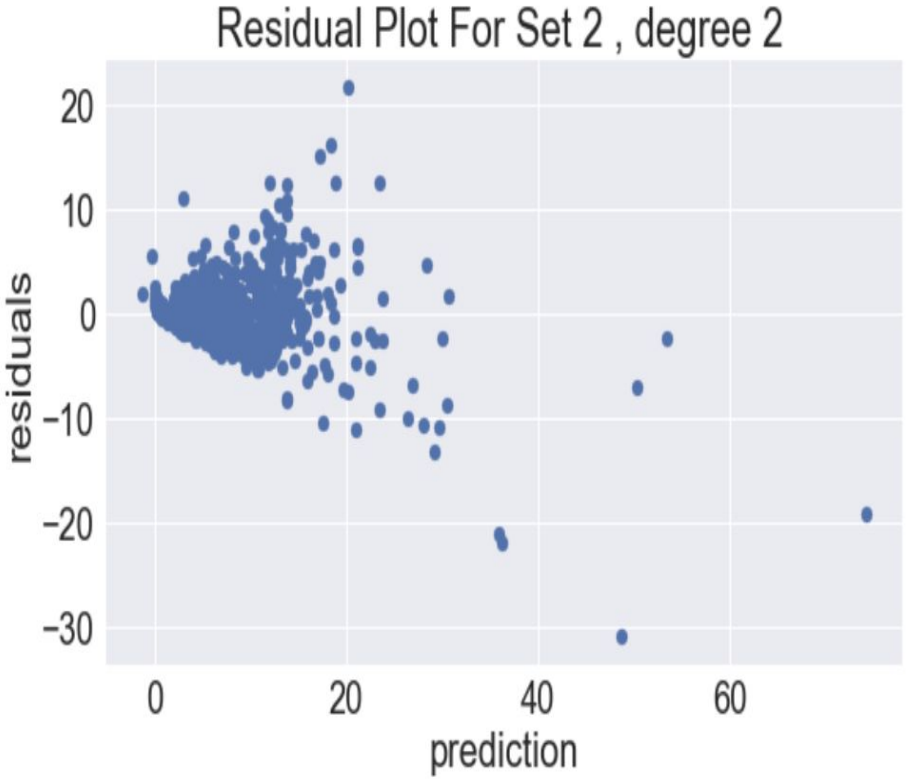


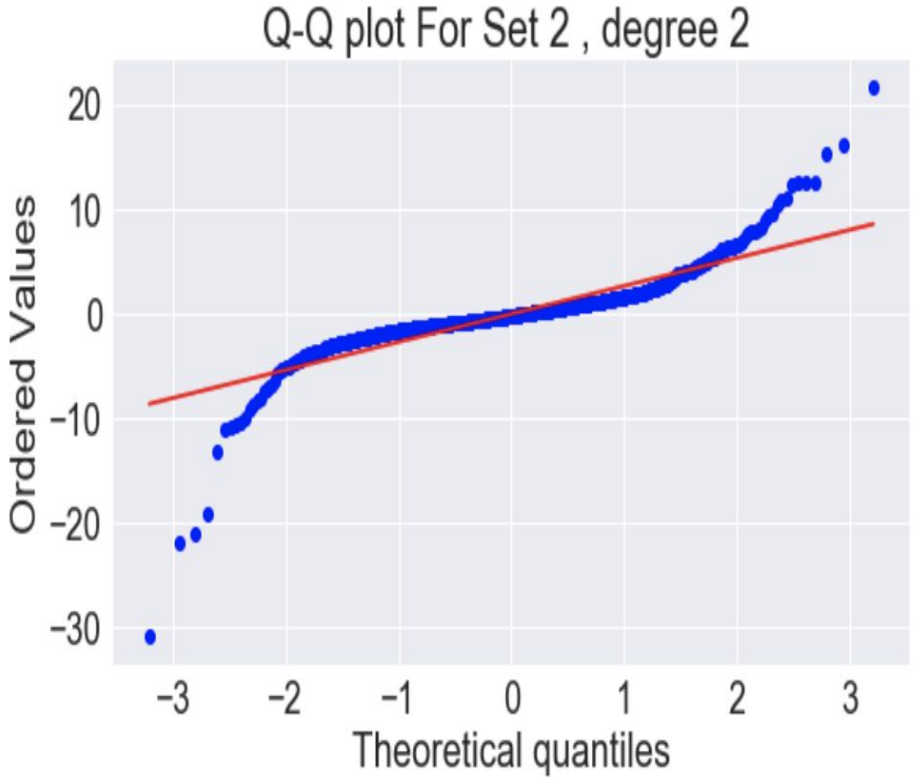


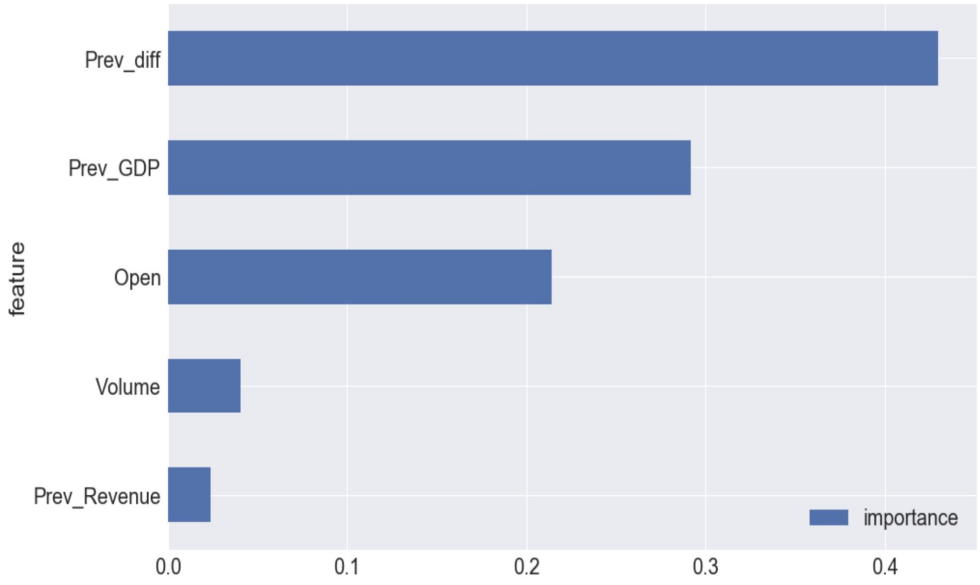




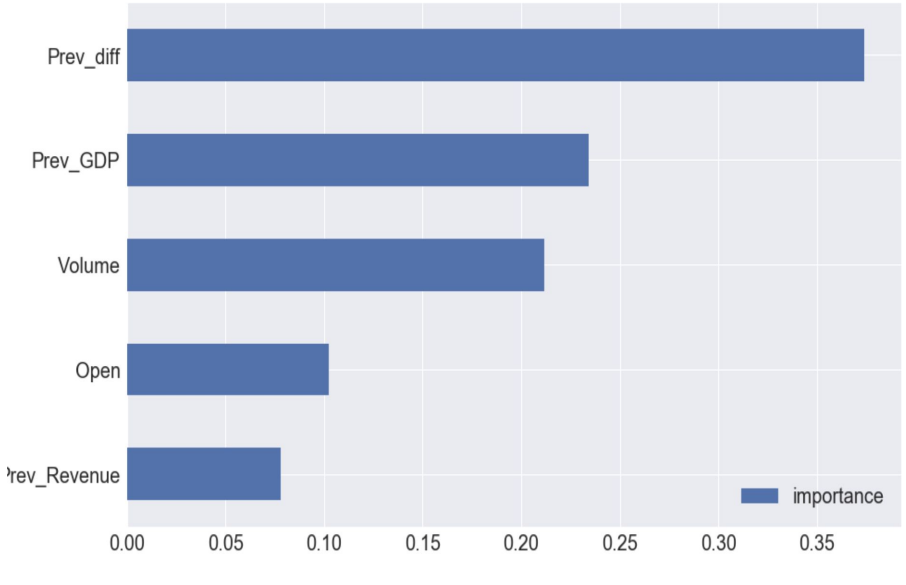



Residual Plot For Set 2 , degree 2
residuals
prediction
20
10
0
−10
−20
−30
0
20
40
60


Q-Q plot For Set 2 , degree 2
Ordered Values
Theoretical quantiles
20
10
0
−10
−20
−30
−3
−2
−1
0
1
2
3



Gradient Boosting Regressor



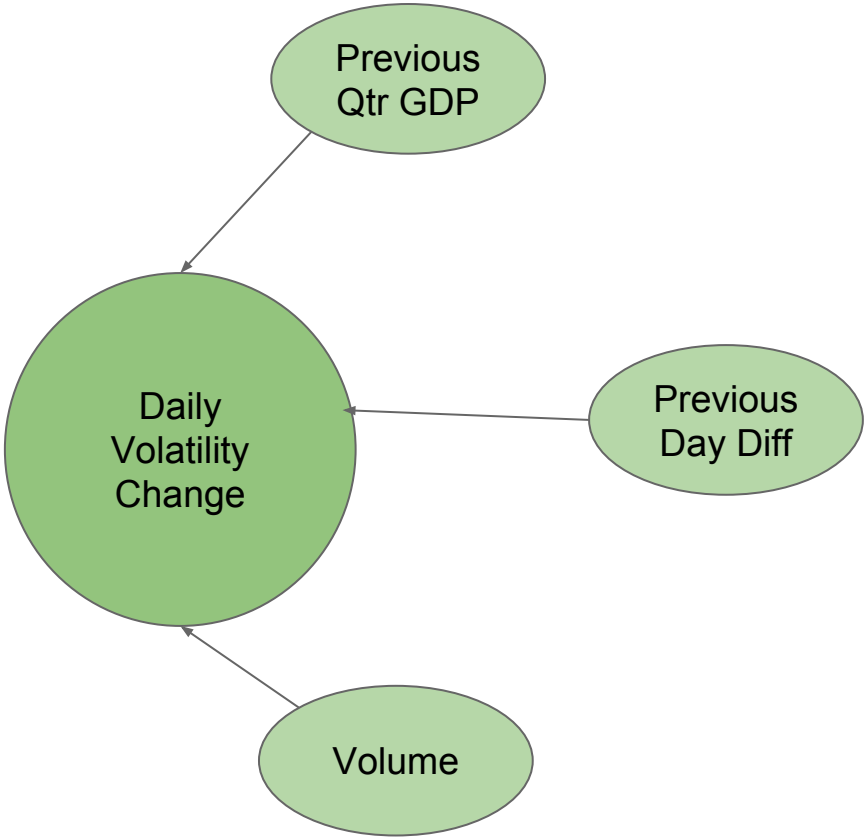
Random Forest Regressor

OLS Regression Results

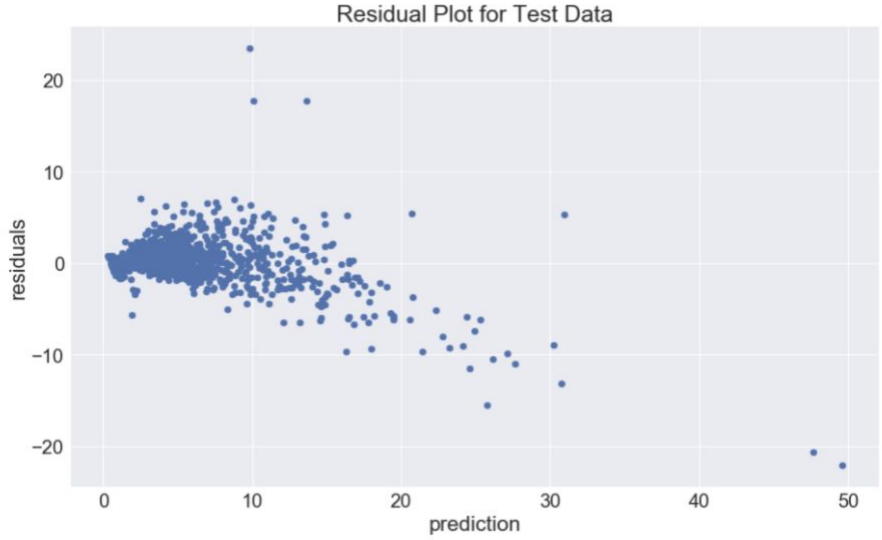
Dep. Variable:	y	**R-squared:**	0.605
Model:	OLS	**Adj. R-squared:**	0.604
Method:	Least Squares	**F-statistic:**	1061.
Date:	Thu, 01 Feb 2018	**Prob (F-statistic):**	0.00
Time:	20:40:34	**Log-Likelihood:**	-5726.4
No. Observations:	2082	**AIC:**	1.146e+04
Df Residuals:	2078	**BIC:**	1.148e+04
Df Model:	3		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-26.6032	1.146	-23.212	0.000	-28.851	-24.356
x1	0.3630	0.020	18.211	0.000	0.324	0.402
x2	1.825e-12	7.34e-14	24.864	0.000	1.68e-12	1.97e-12
x3	2.336e-07	1.82e-08	12.850	0.000	1.98e-07	2.69e-07

Omnibus:	2389.025	**Durbin-Watson:**	2.036
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	589761.028
Skew:	5.460	**Prob(JB):**	0.00
Kurtosis:	84.726	**Cond. No.**	2.24e+14



Residual Plots & Error Difference



```
Mean of Error for Test Data :7.805509267545955
Mean of Error for Training Data:8.398808077540318
Alpha: 0.1
Alpha : 0.1
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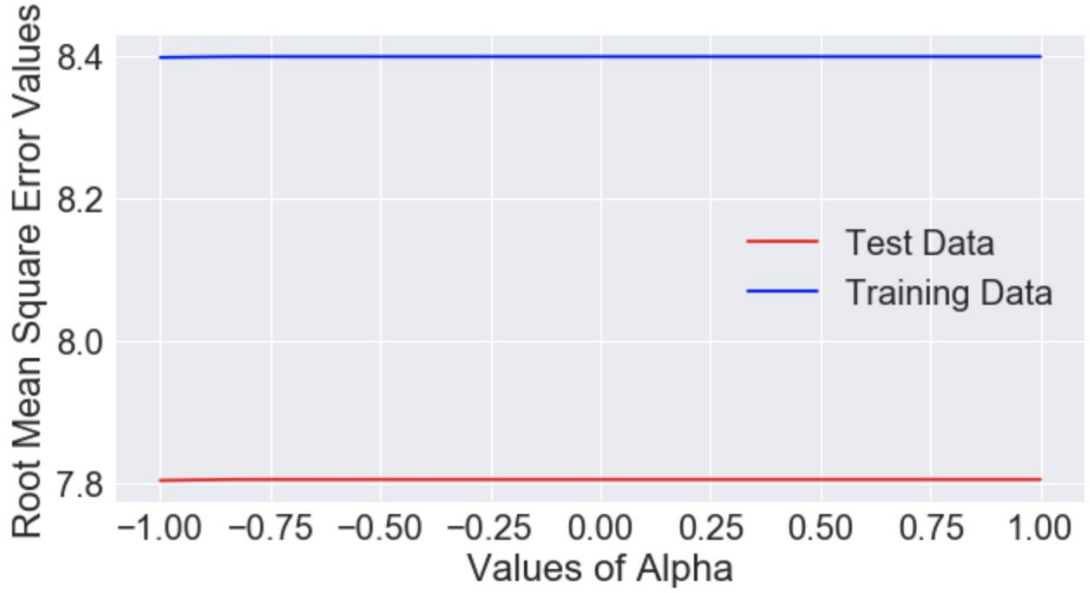
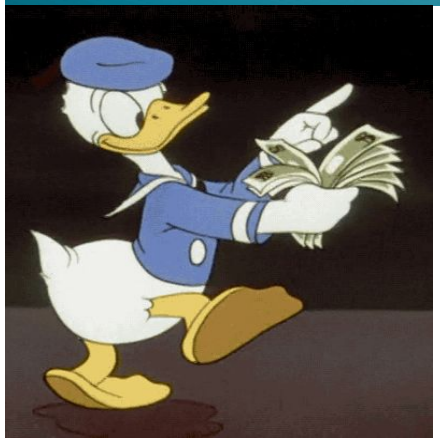


Summary & Observations

- ➔ Data is skewed
- ➔ Time Based Variance not visible in day of the week
- ➔ Various other features are needed



- http://www.nasdaq.com/symbol/amzn/revenue-eps
- https://finance.yahoo.com/quote/AMZN/history?p=AMZN
- https://data.worldbank.org/indicator/NY.GDP.MKTP.CD
- https://fred.stlouisfed.org/series/GDP