



Time Series and Experimental Design

Final Project Presentation

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Project Summary

- Objective: Fit time series models on Apple, Amazon, and Google stock data
- Data:
 - Historical stock data for DJIA 30 companies from 2006-01-01 to 2018-01-01⁽¹⁾

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Date	Open	High	Low	Close	Volume	Name
1/3/2006	211.47	218.05	209.32	217.83	13137450	GOOGL
1/4/2006	222.17	224.7	220.09	222.84	15292353	GOOGL
1/5/2006	223.22	226	220.97	225.85	10815661	GOOGL
1/6/2006	228.66	235.49	226.85	233.06	17759521	GOOGL
1/9/2006	233.44	236.94	230.7	233.68	12795837	GOOGL
1/10/2006	232.44	235.36	231.25	235.11	9104719	GOOGL
1/11/2006	235.87	237.79	234.82	236.05	9008664	GOOGL

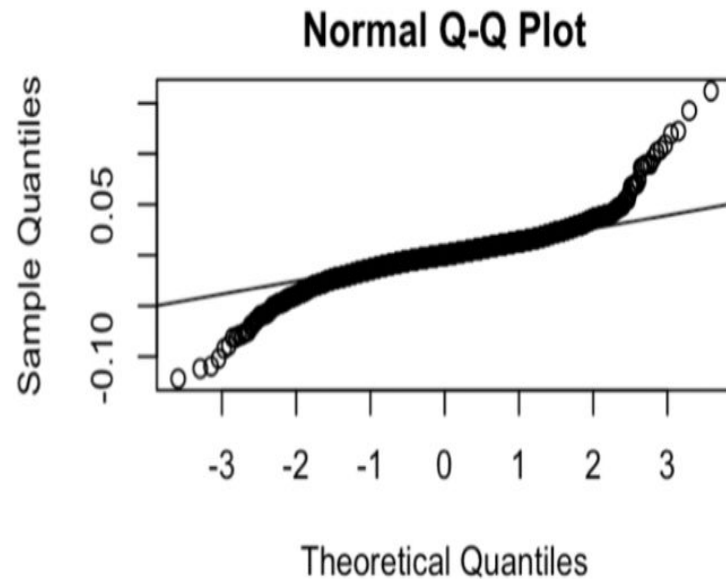
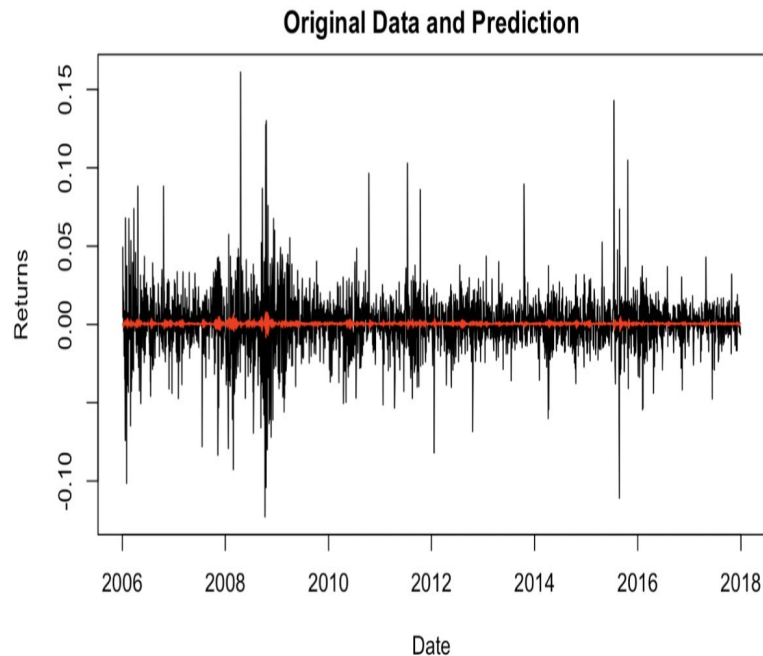
(1). <https://www.kaggle.com/datasets/szrlee/stock-time-series-20050101-to-201712311>



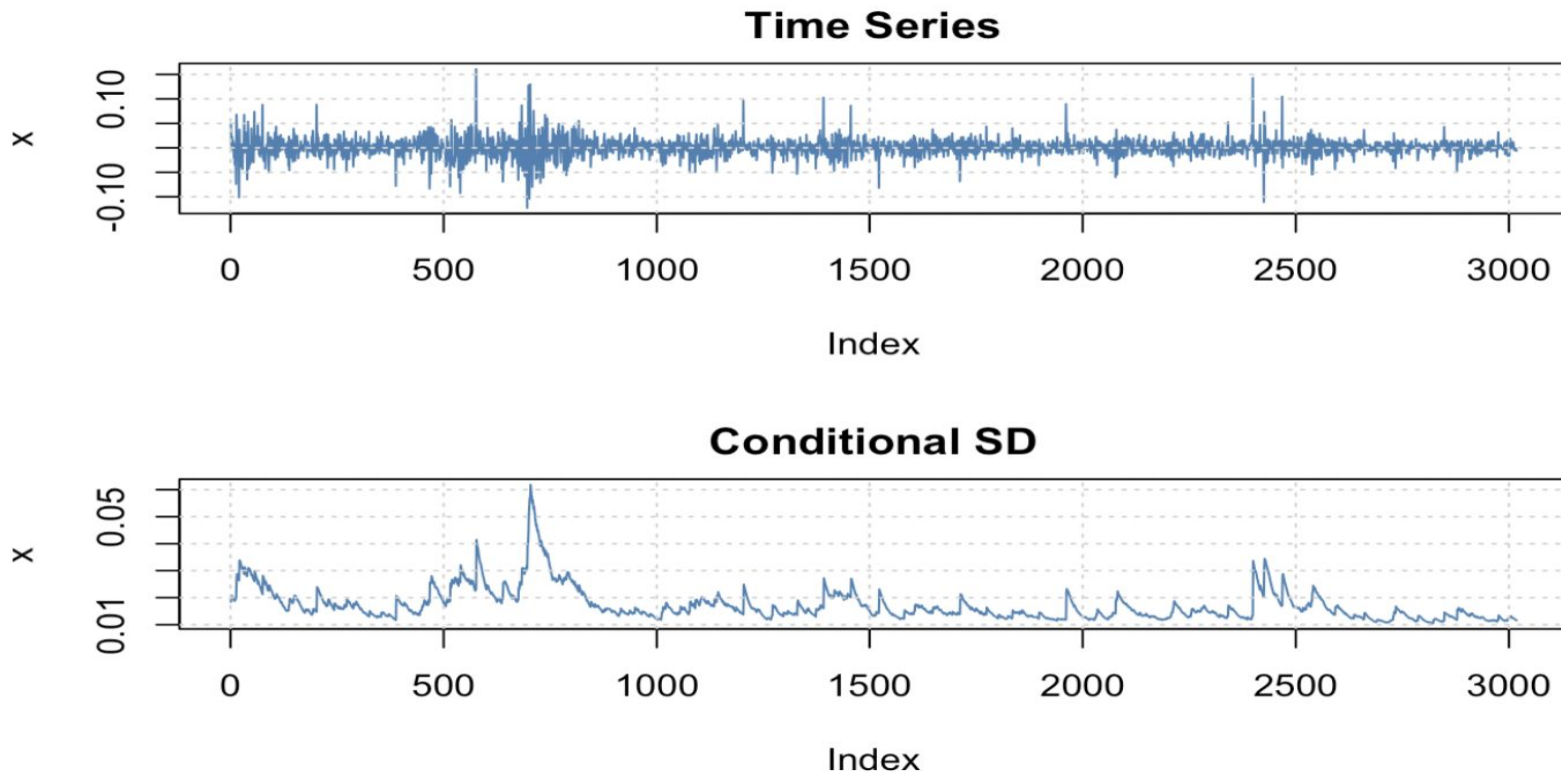
Methodology

- Take log to avoid exponential trend of open price and detrend the linear trend by differencing to get the returns
- Evaluate the ACF and PACF of the returns to find out the autocorrelation
- Apply `auto.arima()` in the package forecast and choose the best model by evaluating the AIC criterion
- Fit GARCH model to fit the volatility of the three stocks

Actual and predicted returns of Google after fitting ARIMA(1,0,3)



Conditional standard deviation of Google after fitting GARCH(1,1)



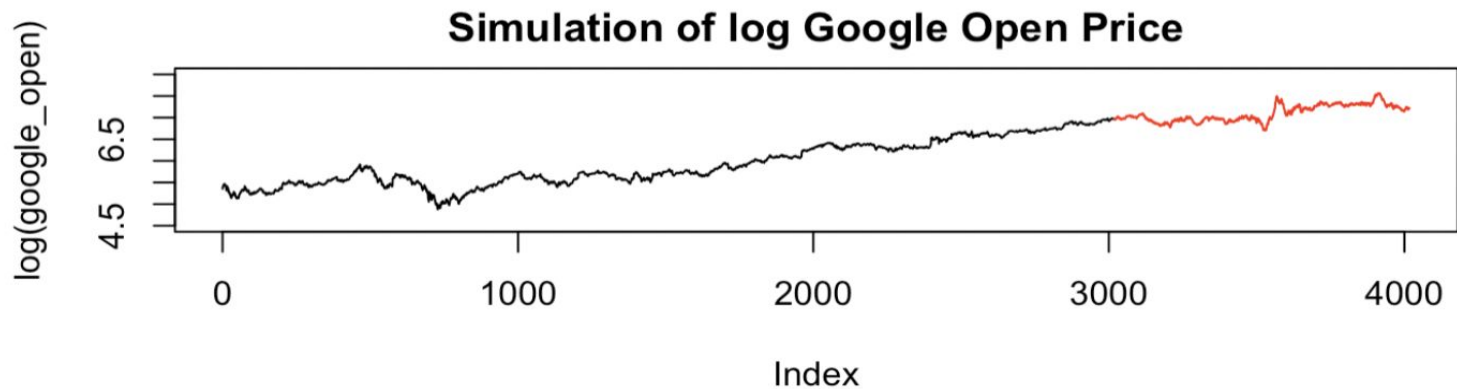
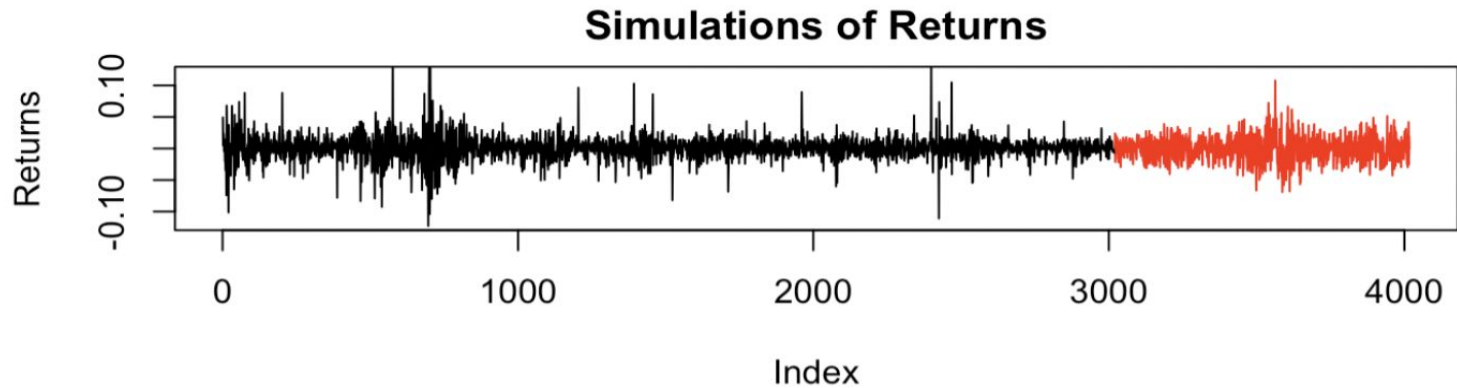
Summary statistics of GARCH(1,1) for Google

Error Analysis:

	Estimate	Std. Error	t value	Pr(> t)	
mu	6.797e-04	2.795e-04	2.432	0.015009	*
omega	5.700e-06	1.598e-06	3.566	0.000363	***
alpha1	4.754e-02	1.087e-02	4.374	1.22e-05	***
beta1	9.346e-01	1.448e-02	64.528	< 2e-16	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Simulation



All open prices for companies show the increase trend over the year

