



IE423 Quality Engineering

PROJECT PART I

ANALYSIS REPORT

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Introduction:

The project is made for the analysis of the data of six stocks which are PGSUS, THYAO, BANVT, MGROS, ASELS, FROTO from 2015 to 2017 for two years. The main aim of the project is to detect outliers in the daily percent change of stock prices and understand the causes of the emergency of outliers. Furthermore, Google Trends is used for the detection of accuracy of outliers by comparing the line plot of monthly data of stock price and the line plot of the research about the stock in Google. Another usage of Google Trends is comparing the research about events which affect stock price like coup and election with stock price line plot. Other than that; KAP, Investing.com and newsletters are used for the news of the economy, the sector of stocks and the stock, and TradingView is used for obtaining an insight of BIST100 and stocks trends.

Data Retrieval & Manipulation:

At first, the data of six stocks is given at 15-minute intervals, then the data is prepared for daily analysis. The last data of each day is taken as the close price of each day. After that, the daily price change of close is calculated by the difference between the close prices of two consecutive days. Then, the data of each stock is separated for months and boxplots are made for each month to detect outliers. To detect outliers, boxplots of the daily data of stocks for each month are made based on Interquartile Range (IQR). In other words, 24 boxplots are made for each stock, and it is tried to find outliers for each month.

Interpretation:

A) Political & Economic Reasons :

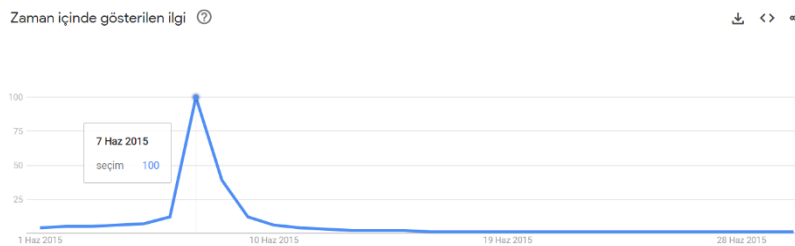
- **2015-06-08**

	Close	Month	Year	Symbol	Change
2015-06-08	6,2186	6	2015	ASELS	-8,36133
2015-06-08	8,42	6	2015	THYAO	-6,44444
2015-06-08	23,5	6	2015	PGSUS	-6,18762
2015-06-08	2,3	6	2015	BANVT	-10,8527
2015-06-08	20	6	2015	MGROS	-4,7619

In the election dated June 7, 2015, there was concern about stability in the country as no party could obtain the majority to establish power on its own. This caused a decline in BIST.



Google Trends chart for “bist” search



Google Trends chart for “seçim(election)” search

- **2016-07-18**

	Close	Month	Year	Symbol	Change
2016-07-18	8,9756	7	2016	ASELS	-8,74375
2016-07-18	12,55	7	2016	PGSUS	-10,1646
2016-07-18	5,21	7	2016	THYAO	-12,5839
2016-07-18	2,17	7	2016	BANVT	9,58333
2016-07-18	12,9	7	2016	MGROS	9,5048

There was a military coup attempt in Turkey between 15-16 July 2016 by a group of soldiers within the Turkish Armed Forces. That's why a big drop was observed in BIST on July 18, the first business day after these dates.

Zaman içinde gösterilen ilgi

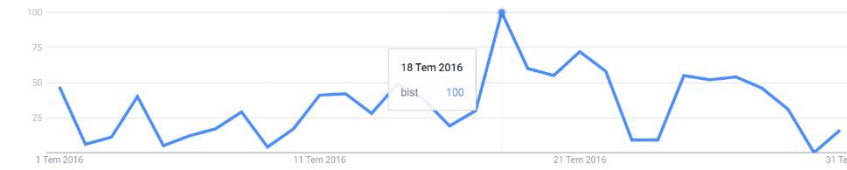
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Google Trends chart for "darbe(coup)" search

Zaman içinde gösterilen ilgi

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Google Trends chart for "BİST" search

• 2015-10-28

	Close	Month	Year	Symbol	Change
2015-10-28	6,9589	10	2015	ASELS	-4,40809
2015-10-28	8,3	10	2015	THYAO	-3,48837
2015-10-28	18,3	10	2015	PGSUS	-5,42636
2015-10-28	2,21	10	2015	BANVT	-5,55556
2015-10-28	17,45	10	2015	MGROS	-4,64481

On October 28, 2015, a trustee was appointed by the state to Koza Holding, one of the country's leading holding companies, and as a result, protests were held. As a result of the tension between the police and protesters during the protests, public unrest occurred, and a decline was observed in investment instruments such as BIST.

Zaman içinde gösterilen ilgi

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Google Trends chart for "BİST" search

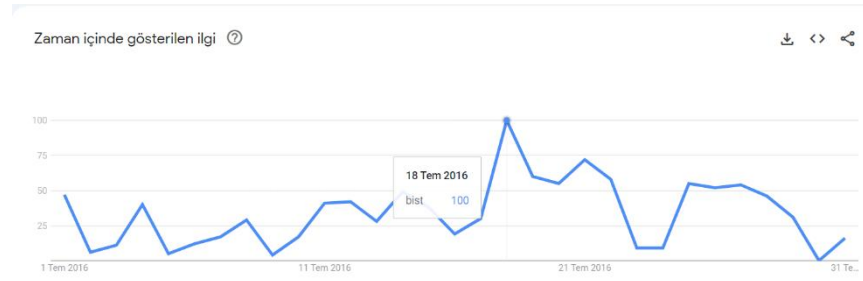


Google Trends chart for
“kayyum(trustee)” search

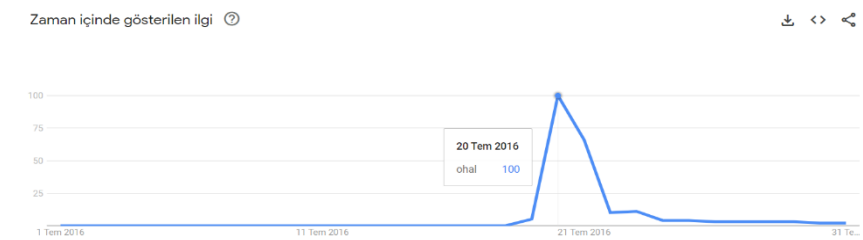
- **2016-07-21**

	Close	Month	Year	Symbol	Change
2016-07-21	8,9064	7	2016	AELS	-4,04758
2016-07-21	11,1	7	2016	PGSUS	-6,09137
2016-07-21	2	7	2016	BANVT	-6,10329
2016-07-21	15,11	7	2016	MGROS	-4,96855

After the coup attempt, a state of emergency was declared in the country for 3 months, and this caused a decline in investment instruments such as BIST.



Google Trends chart for
“BİST” search



Google Trends chart for
“OHAL(state of emergency)” search

- **2015-11-02**

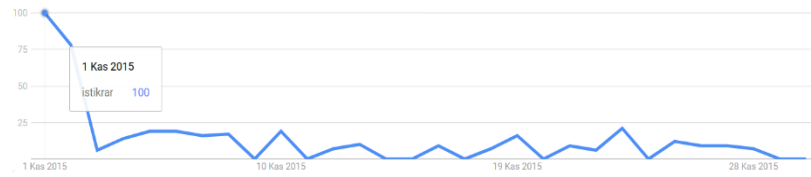
	Close	Month	Year	Symbol	Change
2015-11-02	7,3044	11	2015	AELS	6,093044
2015-11-02	9,2	11	2015	THYAO	6,852497
2015-11-02	19,55	11	2015	PGSUS	4,545455
2015-11-02	18,9	11	2015	MGROS	9,883721

Since a government could not be formed in the election on June 7, early elections were held on November 1, 2015. As a result of this election, the government was formed and

the atmosphere of uncertainty in the country was eliminated. As a result, a significant increase was seen in BIST.

Zaman içinde gösterilen ilgi ?

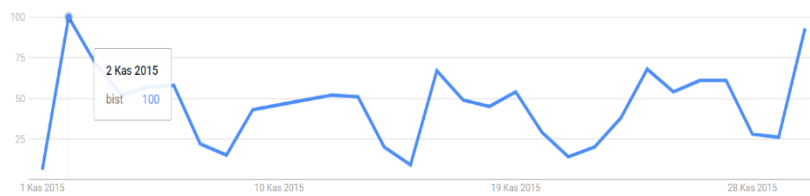
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Google Trends chart for "istikrar (stability)" search

Zaman içinde gösterilen ilgi ?

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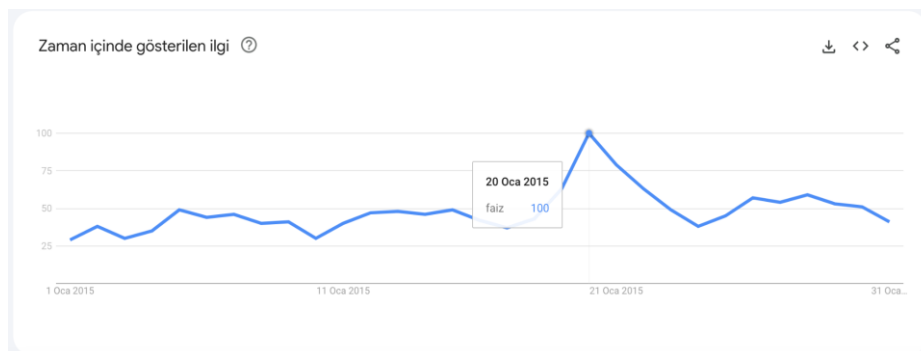


Google Trends chart for "BIST" search

● 2015-01-20

	Close	Month	Year	Symbol	Change
2015-01-21	24,6318	1	2015	FROTO	3,408929
2015-01-20	32,4	1	2015	PGSUS	4,854369
2015-01-20	9,65	1	2015	THYAO	7,222222

The Central Bank of Turkey's decision to reduce the policy interest rate by 50 basis points on January 20, 2015 was positively received by the markets, and the BIST 100 index showed an increase. As a result of this decision, an increase was observed in the shares of FROTO, PGSUS, and THYAO.



Google Trends chart for "Faiz" search

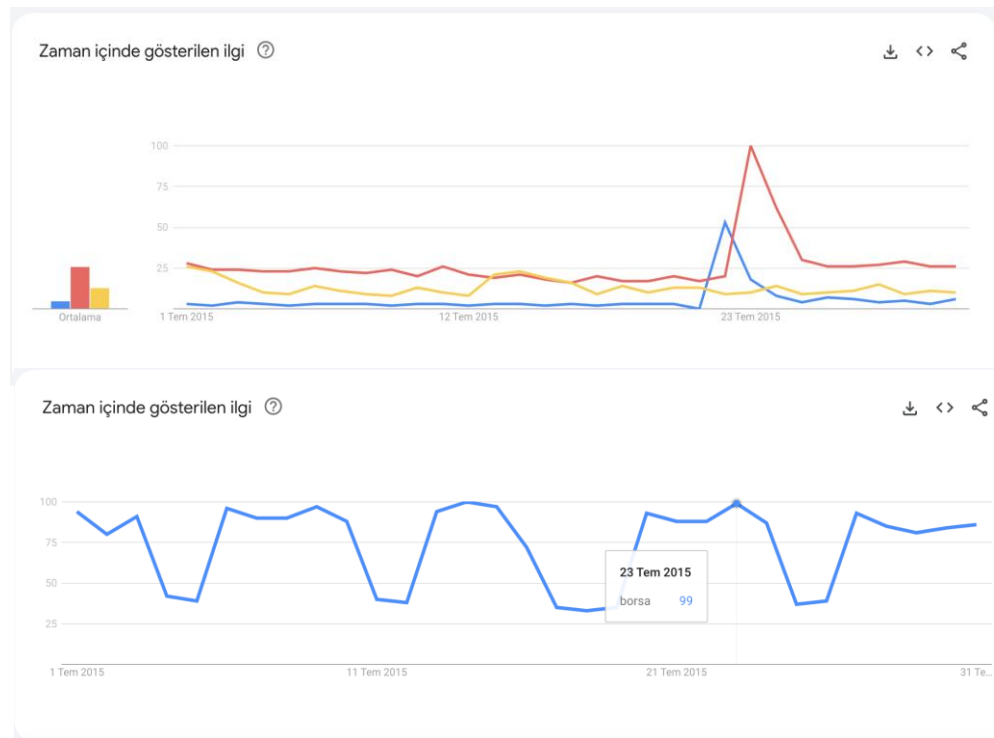


Google Trends chart for “Borsa” search

- **2015-07-23**

	Close	Month	Year	Symbol	Change
2015-07-23	26,0069	7	2015	FROTO	-3,92474
2015-07-23	20,35	7	2015	MGROS	-4,23529
2015-07-23	2,35	7	2015	BANVT	-5,62249
2015-07-23	23,6	7	2015	PGSUS	-5,78842
2015-07-23	8,82	7	2015	THYAO	-4,75162

The uncertainty created by politicians' coalition statements and terrorist attacks, especially in Kilis and Ceylanpınar, led to a decline in the stock market index. In parallel, a decrease was observed in the shares of PGSUS, THYAO, BANVT, MGROS, ASELS, and FROTO.



Google Trends chart for “Kilis, Ceylanpınar, Koalisyon” search

Google Trends chart for “Borsa” search

- **2016-12-01**

	Close	Month	Year	Symbol	Change
2016-12-01	23,5737	12	2016	FROTO	-3,7427
2016-12-01	16,61	12	2016	MGROS	-4,0439
2016-12-01	4,63	12	2016	THYAO	-3,7422
2016-12-01	12,12	12	2016	PGSUS	-3,04

The tensions with the EU and Russia, along with constitutional debates, have resulted in an uncertain environment, causing a decline in the stock market index.. In parallel, a decrease was observed in the shares of PGSUS, THYAO, BANVT, MGROS, ASELS, and FROTO.

Gündem

AK Parti'nin "Cumhurbaşkanlığı sistemi" ile ilgili TBMM Başkanlığına sunacağı, "Türkiye Cumhuriyeti Anayasasında Değişiklik Yapılması Hakkında Kanun Teklifi", AK Parti milletvekillerinin imzasına açıldı. Teklifin, imzalar tamamlandıktan sonra en kısa sürede Meclis Başkanlığına sunulması bekleniyor. Anayasanın değiştirilmesi, TBMM üye tamsayısının en az üçte biri (184) tarafından teklif edilebiliyor. Teklifin kabul edilmesi, en az 330 milletvekilinin kabul oyuyla mümkün olabiliyor. Anayasanın değiştirilmesi hakkındaki teklifler Genel Kurulda iki defa görüşülüyor. Değiştirme teklifinin kabulü, Meclisin üye tamsayısının beşte üç çoğunluğunun (330) gizli oyuyla mümkün oluyor. Meclisçe üye tamsayısının beşte üçü (330) ile veya üçte ikisinden az oyla (367) kabul edilen Anayasa değişikliği hakkındaki kanun, Cumhurbaşkanı tarafından Meclise iade edilmediği takdirde halkoyuna sunulmak üzere Resmi Gazete'de yayımlanıyor. Halkoyuna sunulan anayasa değişikliklerine ilişkin kanunların yürürlüğe girmesi için, halkoylamasında kullanılan geçerli oyların yarısından çoğunun kabul oyu olması gerekiyor.

“TSKB daily analysis of BIST100 index “

B) Sectoral Reasons :

- **2015-11-24**

	Close	Month	Year	Symbol	Change
2015-11-24	7,92	11	2015	THYAO	-7,15123
2015-11-24	18,25	11	2015	PGSUS	-5,44041

On November 24, 2015, the Suhoi Su-24 type aircraft belonging to the Russian Air Force committed a border violation and was shot down by the Turkish Air Force. As a result, Russia-Türkiye relations have almost come to a complete end. Considering that Russian citizens are one of the biggest sources of tourism for Turkey, it is normal that the share value of companies operating in the field of aviation will decrease as a result of this incident.

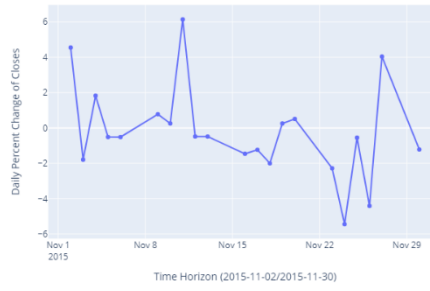


Google Trends chart for
“uçak(aircraft)” search

THYAO



PGSUS

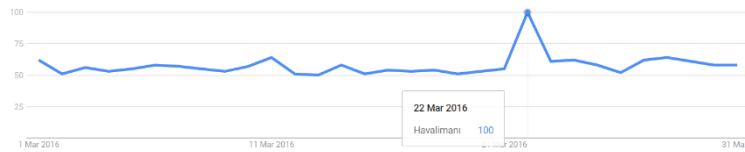


● 2016-03-22

	Close	Month	Year	Symbol	Change
2016-03-22	7,58	3	2016	THYAO	-4,77387
2016-03-22	16,91	3	2016	PGSUS	-3,15006

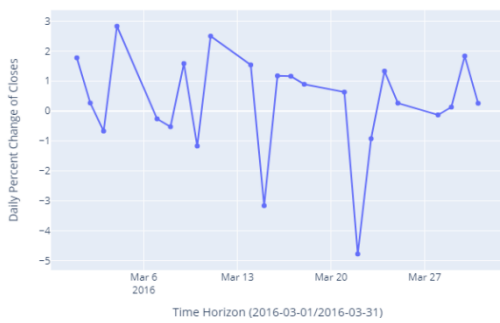
On 22 March 2016, between 08:00 and 09:11 local time, a series of armed attacks and suicide bomb attacks took place at the Maelbeek metro station and Brussels Airport in Brussels, Belgium. The fact that such an attack took place in Europe and one of these attacks was at the airport caused a decline in the shares of two airline companies serving in Europe.

Zaman içinde gösterilen ilgi

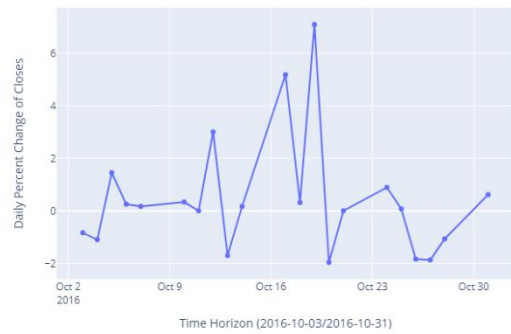


Google Trends chart for
“havalimani(airport)” search

THYAO



PGSUS



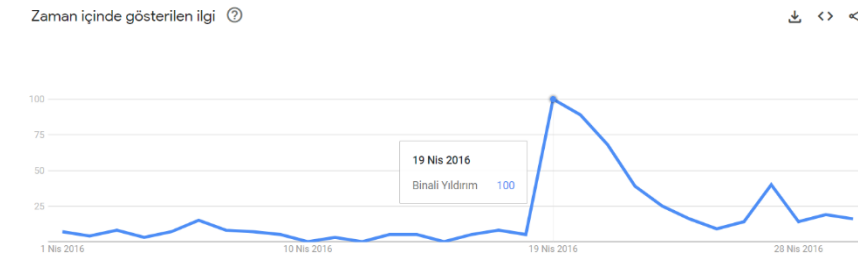
● 2016-04-20

	Close	Month	Year	Symbol	Change
2016-04-20	6,99	4	2016	THYAO	-6,8
2016-04-20	16,7	4	2016	PGSUS	-6,54729

Shares of companies serving in the transportation sector decreased after the rumor spread that the minister could be dismissed because the son of the then minister of transportation was seen in a casino abroad.



Google Trends chart for “kumar (gamble)” search

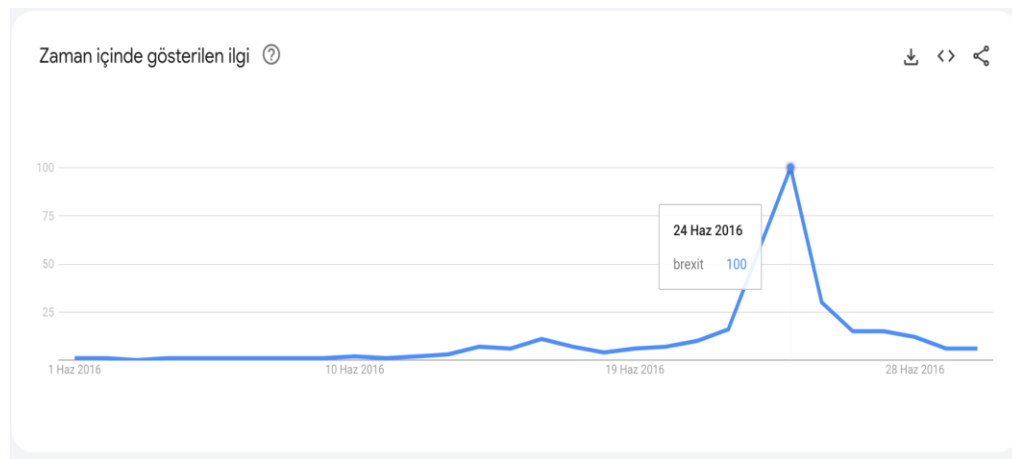


Google Trends chart for “Binali Yıldırım (minister of transportation)” search

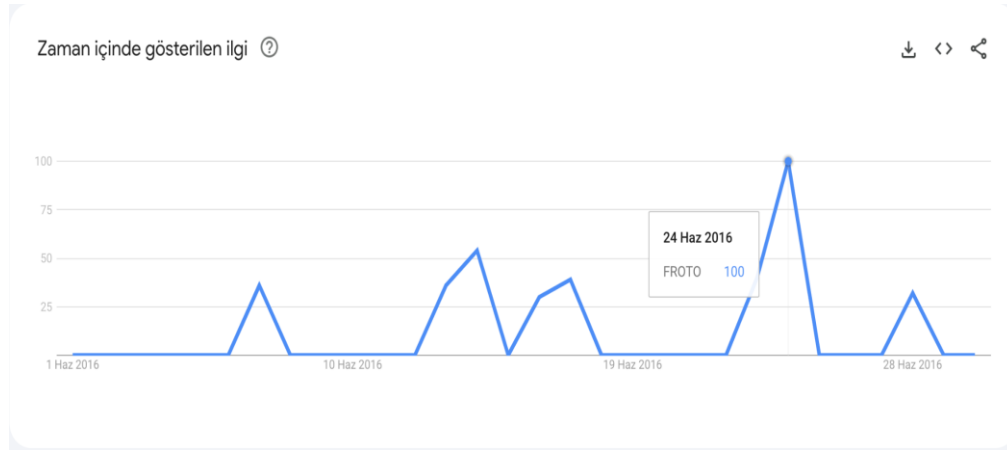
- **2016-06-24**

	Close	Month	Year	Symbol	Change
2016-04-20	26,2626	6	2016	FROTO	-7,6386

Ford Otosan, which exports nearly 20% of its products to the United Kingdom, experienced a significant drop in its shares due to the possibility of new regulations and agreements being required to continue sales in this country following the Brexit event, which was brought up with the UK's separation from the European Union.



Google Trends chart for “Brexit”



*Google
Trends chart
for "FROTO"*

C) Company-Specific Reasons :

The aim of the part is to understand the effects of announcements of companies on stock price, and the relationship between outliers and important announcements.

KAP Announcements about New Deals:

The revenue and profit of companies have significant effects on stock prices and stock prices increase when a new deal increases the revenue is made. Other than that, there are many announcement types which positively affect prices like the capital increase, the acquisition of another company and so on. Another type of announcements positively affects price is the purchasing of stocks from the boss or shareholder of the company. Lastly, the most important thing related to KAP is the quarterly balance sheet announcement. If it is positive, the stock price will be positive. The table of outliers related to these positive announcements are below:

	Close	Month	Year	Symbol	Change
2015-06-24	7.181	6	2015	ASELS	5.054495
2015-09-15	6.8355	9	2015	ASELS	4.922638
2016-03-24	8.8246	3	2016	ASELS	3.057411
2016-04-04	9.1995	Z4	2016	ASELS	1.969673
2016-04-12	9.7966	4	2016	ASELS	3.329853

2016-11-09	9.8003	11	2016	ASELS	3.991893
2016-12-30	12.598	12	2016	ASELS	5.127884
2015-11-11	20.75	11	2015	PGSUS	6.138107
2016-10-17	12.8	10	2016	PGSUS	5.176664
2016-11-07	5.3	11	2016	THYAO	4.330709
2015-04-29	3.05	4	2015	BANVT	3.040541
2015-05-04	2.85	5	2015	BANVT	-3.38983
2015-05-06	2.72	5	2015	BANVT	-3.88693
2016-03-24	2.62	3	2016	BANVT	19.6347
2016-08-16	2.91	8	2016	BANVT	15.93625
2015-04-21	22.4	4	2015	MGROS	4.186047
2015-01-27	25.4437	1	2015	FROTO	2.014739
2015-03-11	25.7145	3	2015	FROTO	3.260717

There are also negative effects of KAP announcements like selling stocks from shareholders or a bad situation related to deals, investments of companies or negative quarterly balance sheet. The table of outliers related to these positive announcements is below:

	Close	Month	Year	Symbol	Change
2016-03-08	8.4643	3	2016	ASELS	-5.29878
2016-09-26	9.2558	9	2016	ASELS	-3.57035
2015-08-13	21.6	8	2015	PGSUS	-7.09677
2016-03-04	17.23	3	2016	PGSUS	-3.47339
2015-04-30	2.95	4	2015	BANVT	-3.27869
2016-05-03	2.34	5	2016	BANVT	-5.64516

2016-06-24	2.2	6	2016	BANVT	-3.93013
2015-04-30	21.4	4	2015	MGROS	-4.67706
2016-10-04	17.76	10	2016	MGROS	-3.84407
2015-01-07	24.6704	1	2015	FROTO	-2.59595

However, there are no correlation between these increases or decreases in stock prices and Google Trends because in stock industry these are followed by few people and it does not cause the significant increase in the research in Google Trends.

D) Other Reasons :

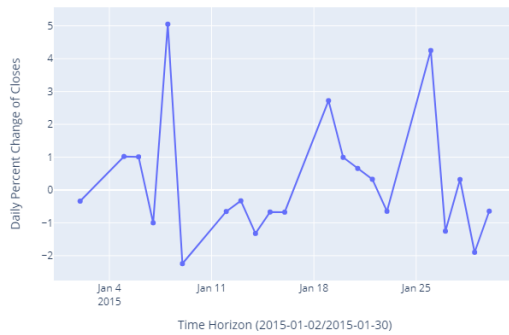
Other 3 main reasons are significant for the stock price but there are many movements of stock prices that can not be explained by these reasons. It is related to the stochastic nature of stock prices. In other words, the previous 3 reasons are related to fundamental analysis of stocks but there is another important thing is technical analysis of stocks.

The movements due to technical analysis are not explained with specific reasons therefore there is no pattern in Google Trends or news about stocks. These are understood by analyzing stock prices with indicators and formations. Furthermore, some outliers are just response increases against low prices and movements against low volatility.

As examples of these situations, BANVT and ASELS may be considered because there are big differences between the change in stock plot and Google Trends plot at the same time. Although there are big changes in stock, there are no significant changes in Google Trends.

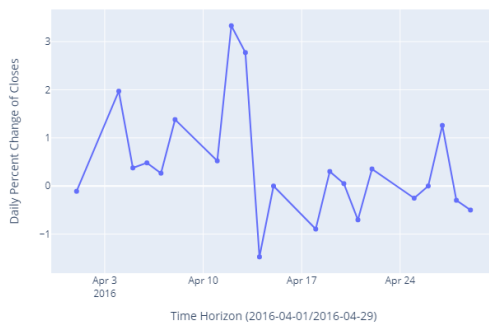
	Close	Month	Year	Symbol	Change
2015-01-08	3.12	1	2015	BANVT	5.050505
2015-01-26	3.19	1	2015	BANVT	4.248366

BANVT



	Close	Month	Year	Symbol	Change
2016-04-13	10.0682	4	2016	ASELS	2.77239
2016-04-14	9.92	4	2016	ASELS	-1.47196

ASELS



Conclusion:

The stock prices depend on many things like political-economic reasons, sectoral developments of companies, company related news and the stochastic nature of stock market. To detect significant daily change of stock prices and analyze stocks, many methods can be used like boxplots. Boxplots represent outliers which means extreme events, and these outliers can be used for understanding what is going on at the time of emergence of outliers. Therefore, outliers are used in the project and significant results are made with some significant problems.

When detecting outliers, interquartile range is used and 174 outliers are captured for 6 stocks and 24 months. The most of outliers represent important events about the politics, economics, sectoral events and companies' news. Furthermore, dates of these outliers represent significant changes in Google Trends and the correlation between Google Trends plot line and the change of stock price plot line can be seen exactly. However, some part of outliers does not represent the same thing and can not also seen in Google Trends. These can be explained with the stochastic nature of the stock market and the structure of actors in the stock market.

Code:

```
import pandas as pd
import plotly as plt
import numpy as np
import plotly.express as px

data = pd.read_csv('all_ticks_wide.csv')
data['timestamp'] = pd.to_datetime(data['timestamp'])
data['timestamp'] = data['timestamp'].dt.tz_convert('Europe/Istanbul')
data.set_index('timestamp', inplace=True)
data.index = data.index.tz_localize(None)
stocks = ['ASELS', 'THYAO', 'PGSUS', 'BANVT', 'MGROS', 'FROTO']

#function gives data between 2015-2017
def data_preparation(data, stocks):
    first_day = '2014-12-31'
    last_day = '2017-01-01'
    two_years_data = data[(data.index > first_day) & (data.index < last_day)]
    two_years_data = two_years_data[stocks]
    return two_years_data

#function gives daily change of price for each stock
def stocks_data(symbol, data):
    #find close values of stocks
    stock = data[symbol]
    stock_close = data.groupby([data.index.date])[symbol].agg('last')

    #creating dataframe
    frame = {'Close': stock_close}
    df = pd.DataFrame(frame)

    #grouping by months and creating a month and a year column
    stock_close.index = pd.to_datetime(stock_close.index)
    stock_close_monthly = stock_close.groupby([stock_close.index.month])

    df['Month'] = stock_close.index.month
    df['Year'] = stock_close.index.year
    df['Symbol'] = [symbol for i in range(len(df))]

    df['Change'] = (df['Close']-df['Close'].shift(1))/df['Close'].shift(1)*100
    return df
```

```

#outliers detection with IQR and plot each monthly data
def outliers(outliers_df, data, i, j, symbol_name):
    if j == 2017:
        return outliers_df

    monthly_df = data[(data['Month']==i) & (data['Year']==j)]
    #interquartilerange
    Q1 = monthly_df['Change'].quantile(0.25)
    Q3 = monthly_df['Change'].quantile(0.75)
    IQR = Q3 - Q1
    up = Q3 + 1.5 * IQR
    low = Q1 - 1.5 * IQR

    outli = monthly_df[(monthly_df['Change']>up) | (monthly_df['Change']<low)]
    outliers_df = outliers_df.append(outli)

    #because data split for months in that function we have to call plot function here
    plot(monthly_df, symbol_name)

    if i == 12:
        j = j+1
        i = 0

    return outliers(outliers_df, data, i+1, j, symbol_name)

#plot function
def plot(data, symbol_name):
    fig = px.line(x = data.index, y = data['Change'], title=symbol_name, markers= True)
    fig.update_layout(
        xaxis_title="Time Horizon" + ' (' + str(data.index[0]) + '/' + str(data.index[-1]) + ')',
        yaxis_title="Daily Percent Change of Closes"
    )

six_stocks_data = data_preparation(data, stocks)

#each outlier is stored in that dataframe
outliers_df = pd.DataFrame()
for k in stocks:
    last_data = stocks_data(k, six_stocks_data)
    outliers_df = outliers(outliers_df, last_data, 1, 2015, k)
outliers_df

```