▾ Import Library

```
from pandas_datareader import data
import matplotlib.pyplot as plt
import pandas as pd
import datetime
import numpy as np
import plotly.graph_objects as go
```

▾ Import Data

```
companies_dict = {
    'Ace Hardware Indonesia Tbk'  :'ACES.JK',
    'Adaro Energy Tbk':'ADRO.JK',
    'Aneka Tambang Tbk':'ANTM.JK',
    'Astra International Tbk':'ASII.JK',
    'Bank Central Asia Tbk':'BBCA.JK',
    'Bank Negara Indonesia (Persero) Tbk':'BBNI.JK',
    'Bank Rakyat Indonesia (Persero) Tbk':'BBRI.JK',
    'Bank Tabungan Negara (Persero) Tbk':'BBTN.JK',
    'Bank Mandiri (Persero) Tbk':'BMRI.JK',
    'Bank BTPN Syariah Tbk':'BTPS.JK',
    'Charoen Pokphand Indonesia Tbk':'CPIN.JK',
    'Erajaya Swasembada Tbk'  :'ERAA.JK',
    'XL Axiata Tbk':'EXCL.JK',
    'Gudang Garam Tbk':'GGRM.JK',
    'H.M. Sampoerna Tbk':'HMSP.JK',
    'Indofood CBP Sukses Makmur Tbk':'ICBP.JK',
    'Vale Indonesia Tbk':'INCO.JK',
    'Indofood Sukses Makmur Tbk':'INDF.JK',
    'Indah Kiat Pulp & Paper Tbk':'INKP.JK',
    'Indocement Tunggal Prakarsa Tbk':'INTP.JK',
    'Japfa Comfeed Indonesia Tbk':'JPFA.JK',
    'Kalbe Farma Tbk':'KLBF.JK',
    'Media Nusantara Citra Tbk':'MNCN.JK',
    'Perusahaan Gas Negara (Persero) Tbk':'PGAS.JK',
    'Bukit Asam Tbk':'PTBA.JK',
    'Semen Indonesia (Persero) Tbk' :'SMGR.JK',
    'Telekomunikasi Indonesia (Persero) Tbk'  :'TLKM.JK',
    'Sarana Menara Nusantara Tbk':'TOWR.JK',
    'United Tractors Tbk':'UNTR.JK',
    'Unilever Indonesia Tbk.':'UNVR.JK' }


companies_data = pd.DataFrame({'No':[1,
2,
3,
4,
5,
```

```
     5,
     6,
     7,
     8,
     9,
    10,
    11,
    12,
    13,
    14,
    15,
    16,
    17,
    18,
    19,
    20,
    21,
    22,
    23,
    24,
    25,
    26,
    27,
    28,
    29,
    30,
],'Company Name':['Ace Hardware Indonesia Tbk',
 'Adaro Energy Tbk',
 'Aneka Tambang Tbk',
 'Astra International Tbk',
 'Bank Central Asia Tbk',
 'Bank Negara Indonesia (Persero) Tbk',
 'Bank Rakyat Indonesia (Persero) Tbk',
 'Bank Tabungan Negara (Persero) Tbk',
 'Bank Mandiri (Persero) Tbk',
 'Bank BTPN Syariah Tbk',
 'Charoen Pokphand Indonesia Tbk',
 'Erajaya Swasembada Tbk',
 'XL Axiata Tbk',
 'Gudang Garam Tbk',
 'H.M. Sampoerna Tbk',
 'Indofood CBP Sukses Makmur Tbk',
 'Vale Indonesia Tbk',
 'Indofood Sukses Makmur Tbk',
 'Indah Kiat Pulp & Paper Tbk',
 'Indocement Tunggal Prakarsa Tbk',
 'Japfa Comfeed Indonesia Tbk',
 'Kalbe Farma Tbk',
 'Media Nusantara Citra Tbk',
 'Perusahaan Gas Negara (Persero) Tbk',
 'Bukit Asam Tbk',
 'Semen Indonesia (Persero) Tbk',
 'Telekomunikasi Indonesia (Persero) Tbk',
 'Sarana Menara Nusantara Tbk',
 'United Tractors Tbk',
 'Unilever Indonesia Tbk ',
```

```
  Unilever Indonesia Tbk.',
], 'Stock Code':['ACES.JK',
'ADRO.JK',
'ANTM.JK',
'ASII.JK',
'BBCA.JK',
'BBNI.JK',
'BBRI.JK',
'BBTN.JK',
'BMRI.JK',
'BTPS.JK',
'CPIN.JK',
'ERAA.JK',
'EXCL.JK',
'GGRM.JK',
'HMSP.JK',
'ICBP.JK',
'INCO.JK',
'INDF.JK',
'INKP.JK',
'INTP.JK',
'JPFA.JK',
'KLBF.JK',
'MNCN.JK',
'PGAS.JK',
'PTBA.JK',
'SMGR.JK',
'TLKM.JK',
'TOWR.JK',
'UNTR.JK',
'UNVR.JK'
]})
companies_data
```

3/16/2021Seminar2019.ipynb - Colaboratory

	No	Company Name	Stock Code
0	1	Ace Hardware Indonesia Tbk	ACES.JK
1	2	Adaro Energy Tbk	ADRO.JK
2	3	Aneka Tambang Tbk	ANTM.JK
3	4	Astra International Tbk	ASII.JK
4	5	Bank Central Asia Tbk	BBCA.JK
5	6	Bank Negara Indonesia (Persero) Tbk	BBNI.JK
6	7	Bank Rakyat Indonesia (Persero) Tbk	BBRI.JK
7	8	Bank Tabungan Negara (Persero) Tbk	BBTN.JK
8	9	Bank Mandiri (Persero) Tbk	BMRI.JK
9	10	Bank BTPN Syariah Tbk	BTPS.JK
10	11	Charoen Pokphand Indonesia Tbk	CPIN.JK
11	12	Erajaya Swasembada Tbk	ERAA.JK
12	13	XL Axiata Tbk	EXCL.JK
13	14	Gudang Garam Tbk	GGRM.JK
14	15	H.M. Sampoerna Tbk	HMSP.JK
15	16	Indofood CBP Sukses Makmur Tbk	ICBP.JK
16	17	Vale Indonesia Tbk	INCO.JK

```
data_source = 'yahoo'
start_date = '2019-1-1'
end_date = '2020-1-1'
data = data.DataReader(list(companies_dict.values()),
 data_source,start_date,end_date)


data
```

Attributes	Adj Close													
Symbols	ACES.JK	ADRO.JK	ANTM.JK	ASII.JK	BBCA.JK	BBNI.JK	BBRI.JK	BBTN.JK	BMRI.JK	BTPS.JK	CPIN.JK	ERAA.JK	EXCL.JK	GGRM.JK
Date														
2019-01-01	1448.801025	1068.733276	761.463440	7686.960449	25246.753906	8341.724609	3401.651367	2480.049072	6800.527832	1756.351685	6961.577637	2095.734619	1964.710449	80845.515625
2019-01-02	1468.248047	1077.529419	736.579041	7663.595703	25440.958984	8270.629883	3355.180908	2489.812744	6754.422852	1829.736816	6696.604004	2095.734619	1964.710449	81038.867188
2019-01-03	1536.312500	1081.927490	746.532776	7827.147949	25149.652344	8270.629883	3364.475098	2470.285156	6616.106934	1883.552612	6961.577637	2181.469238	2004.401489	80313.796875

```
data.describe()
```

Attributes	Adj Close													
Symbols	ACES.JK	ADRO.JK	ANTM.JK	ASII.JK	BBCA.JK	BBNI.JK	BBRI.JK	BBTN.JK	BMRI.JK	BTPS.JK	CPIN.JK	ERAA.JK	EXCL.JK	GGRM.JK
count	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000	259.000000
mean	1696.353597	1194.072208	896.319751	6810.982531	28688.078992	8076.612439	3916.155786	2302.326821	6922.481587	2891.318912	5932.663088	1730.733030	2933.962939	70726.844474
std	86.528277	99.006600	111.230702	469.061424	1875.819917	692.366344	253.252598	239.298268	367.784263	704.755992	1125.307839	334.383165	442.653903	12049.941724
min	1448.801025	938.379517	666.902649	6036.557617	25149.652344	6479.034180	3355.180908	1791.246582	6044.731445	1756.351685	4123.951660	957.369629	1964.710449	49225.000000
25%	1640.016296	1146.636902	816.209167	6410.931152	26800.400391	7449.676270	3706.904663	2145.504150	6663.483398	2172.200928	4921.811035	1531.966797	2629.536621	54637.500000
50%	1716.197144	1191.374023	890.862488	6752.375488	29078.699219	8177.657715	3974.938721	2323.825195	6869.686035	3043.038330	5805.329102	1743.270142	2907.374512	75987.539062
75%	1755.091309	1241.115601	982.934845	7110.253906	30156.593750	8614.446289	4090.433350	2464.835205	7154.781250	3444.210449	6937.488770	1973.447876	3324.131348	79492.050781
max	1869.077148	1522.566772	1164.591187	7920.607422	33201.046875	9337.043945	4379.169922	2734.270508	7758.198730	4217.201172	8286.444336	2429.146973	3592.046387	91262.382812

8 rows × 180 columns

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 259 entries, 2019-01-01 to 2020-01-02
Columns: 180 entries, ('Adj Close', 'ACES.JK') to ('Volume', 'UNVR.JK')
dtypes: float64(180)
memory usage: 366.2 KB
```

```
stock_open = np.array(data['Open']).T # stock_open is numpy array of transpose of df['Open']
stock_close = np.array(data['Close']).T # stock_close is numpy array of transpose of df['Close']
```

```
movements = stock_close - stock_open
```

```
sum_of_movement = np.sum(movements,1)
```

```
movements[0].size
```

```
259
```

```
plt.figure(figsize = (900,30))
```

```
<Figure size 64800x2160 with 0 Axes>
<Figure size 64800x2160 with 0 Axes>
```

```
j = 0
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
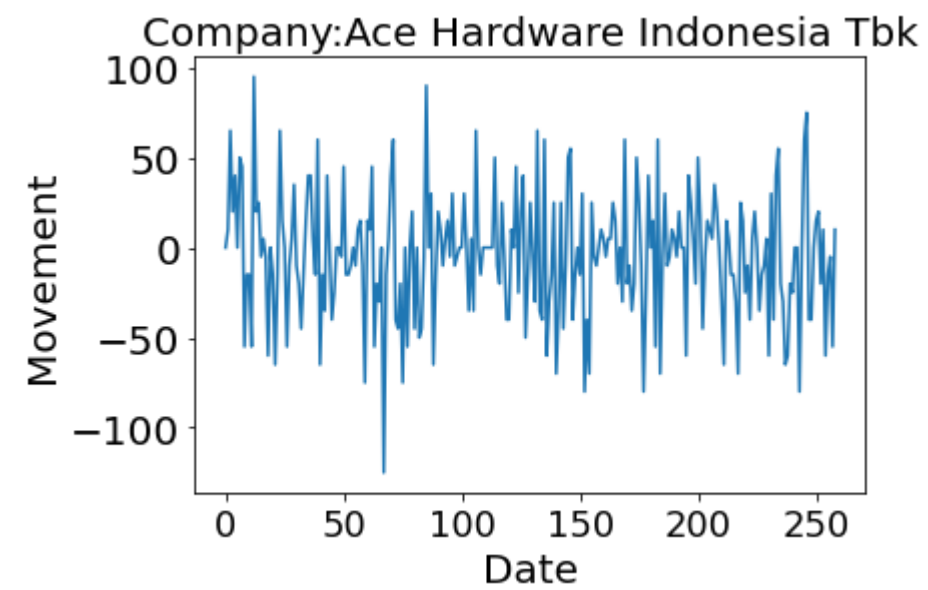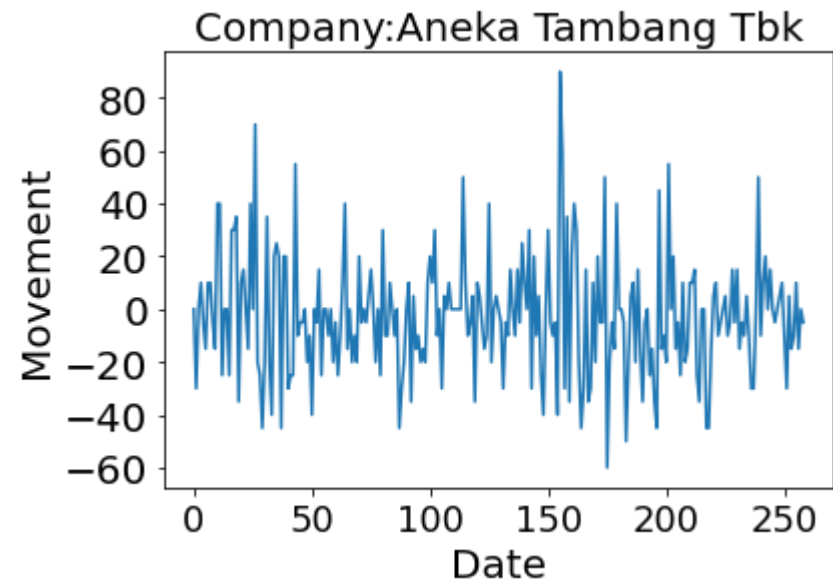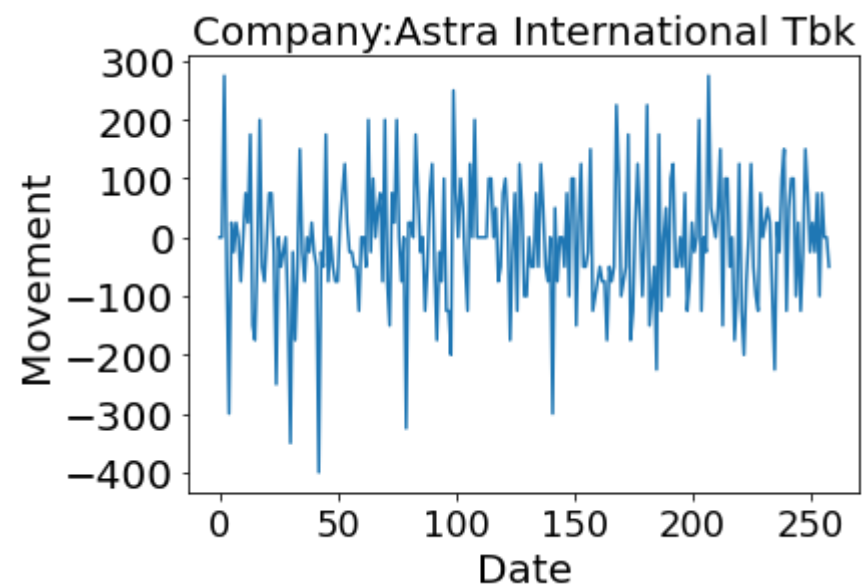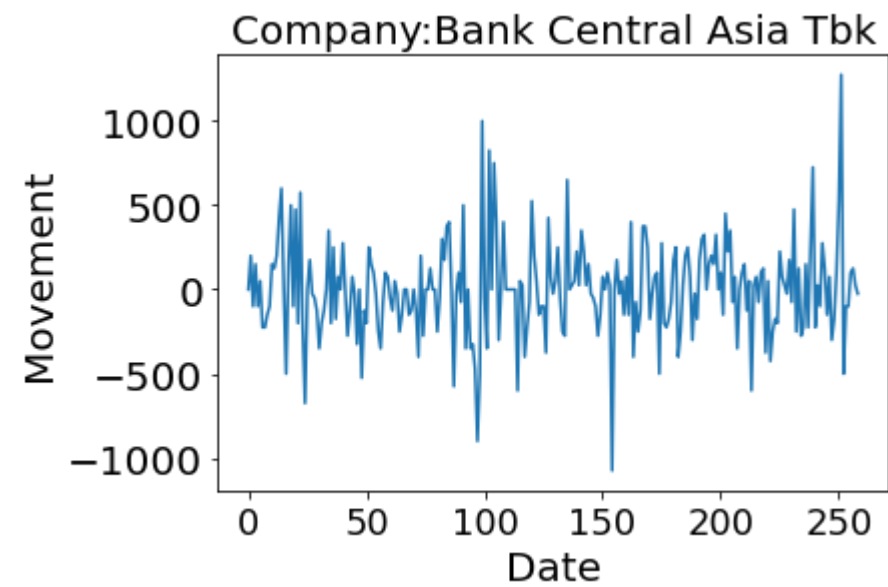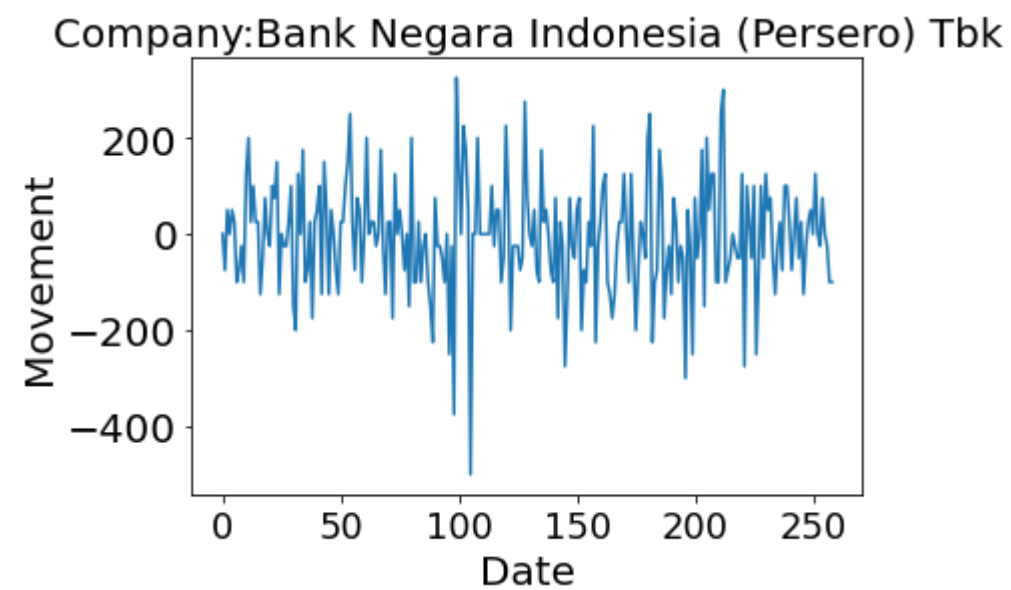


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
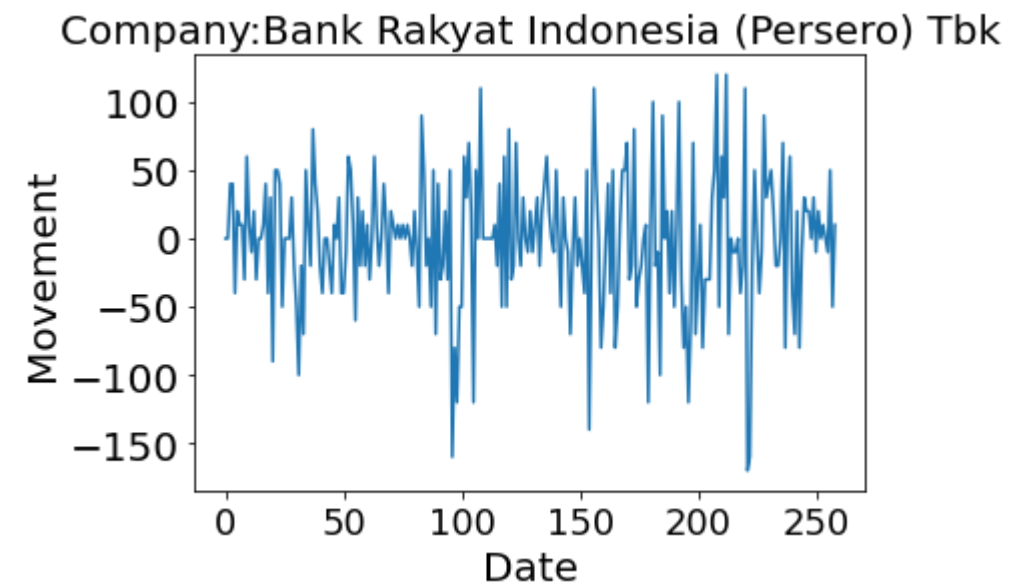
Company:Adaro Energy Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```


Company:Aneka Tambang Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
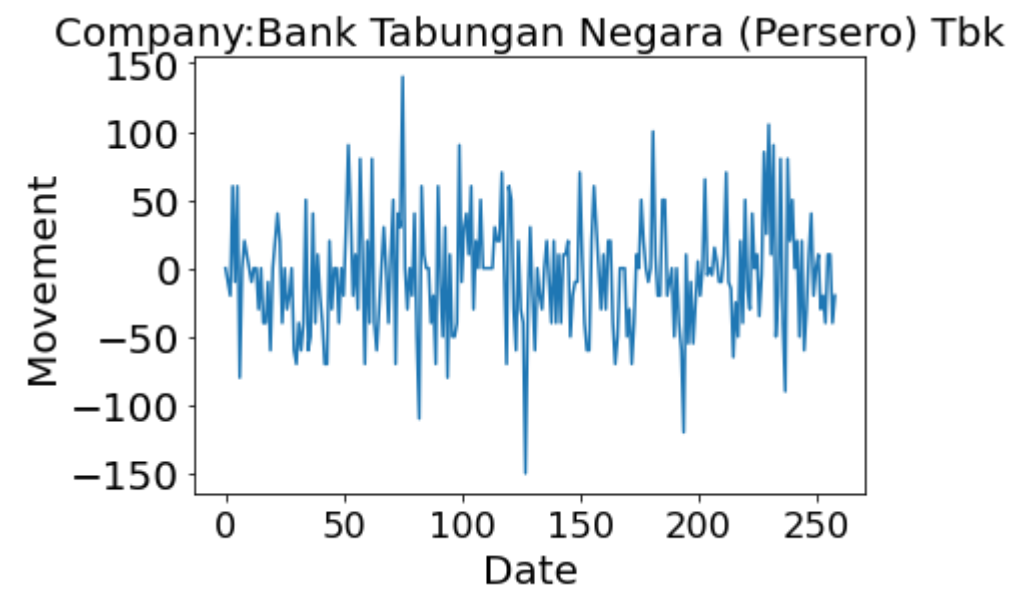

Company:Astra International Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
```

```
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
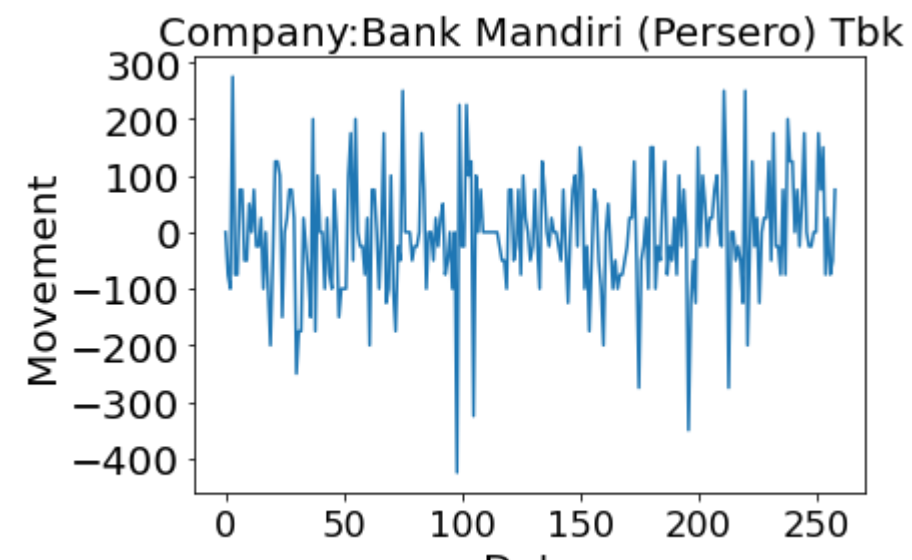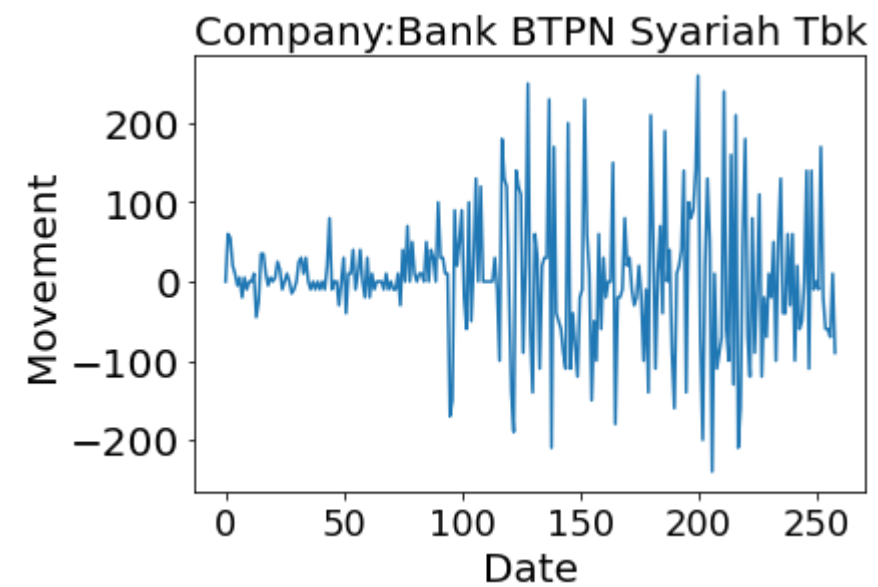


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
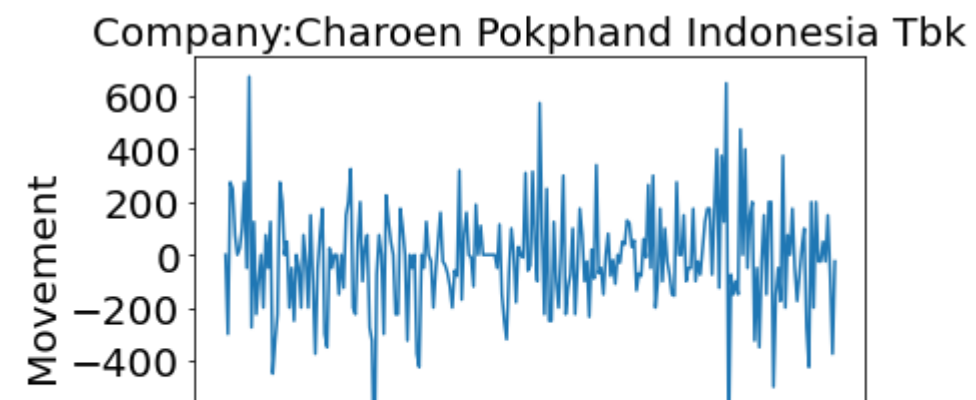


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
```

```
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
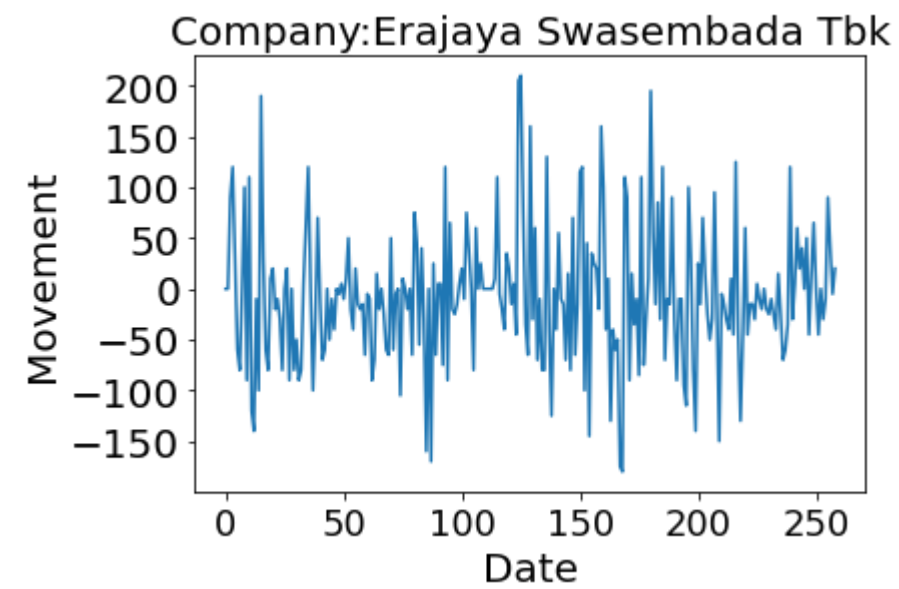


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```



```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
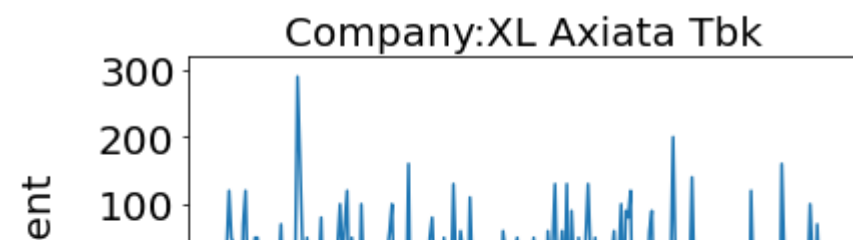
Company:Bank Mandiri (Persero) Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```


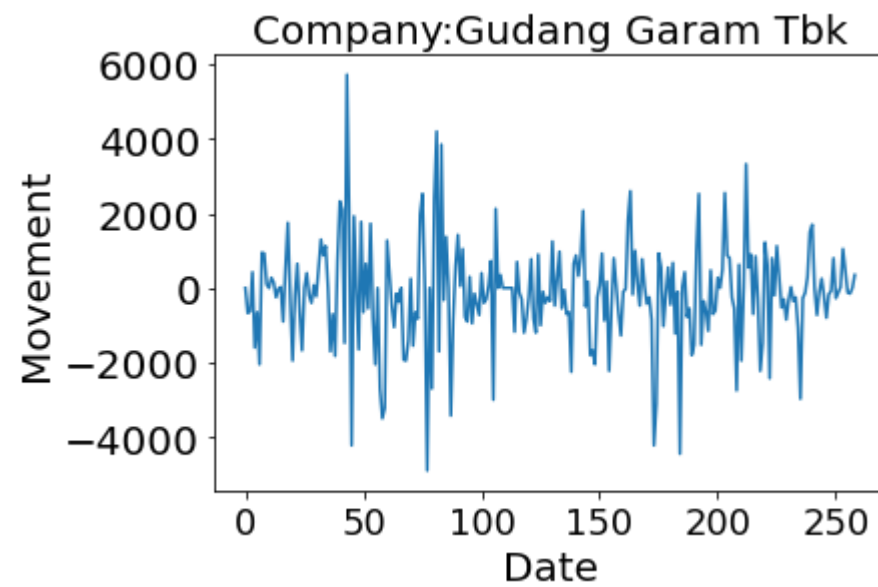Company:Bank BTPN Syariah Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

Company:Charoen Pokphand Indonesia Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```


Company:Erajaya Swasembada Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
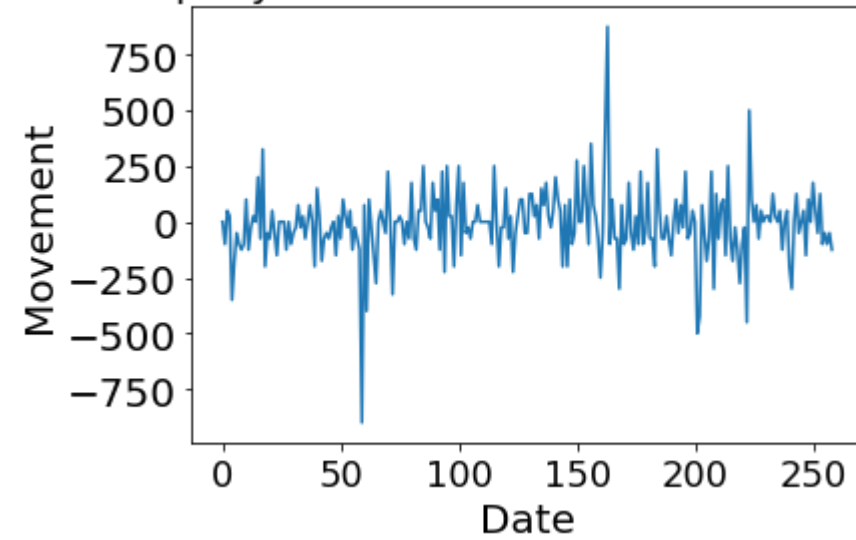


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
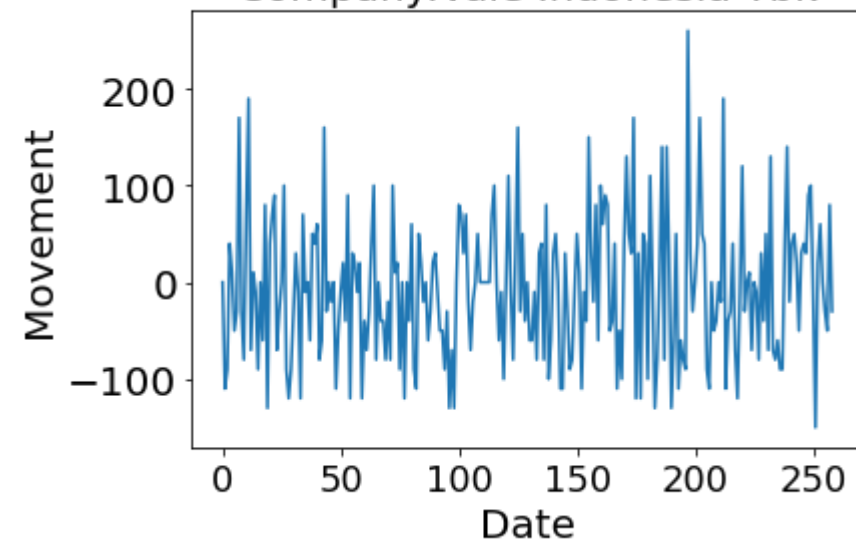
Company:H.M. Sampoerna Tbk

150

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```


Company:Indofood CBP Sukses Makmur Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
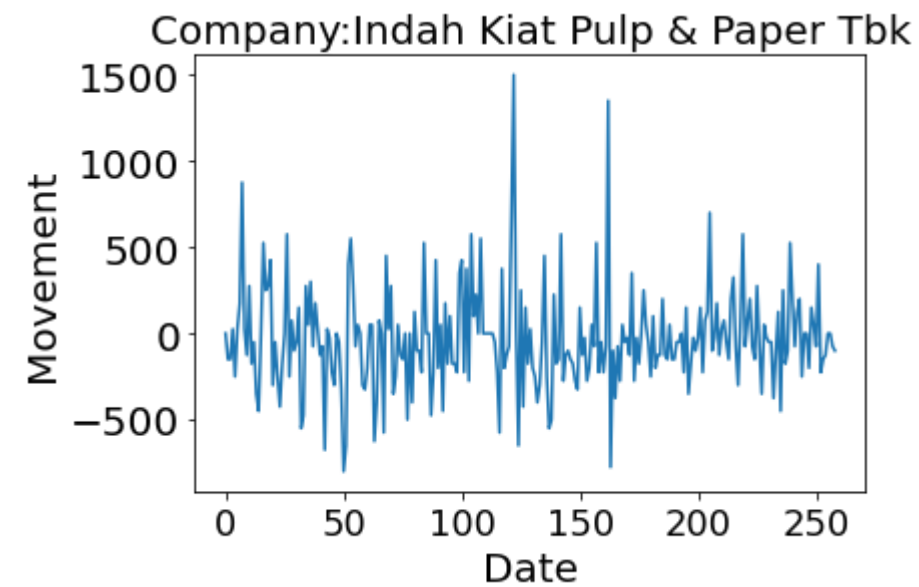

Company:Vale Indonesia Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
```

```
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
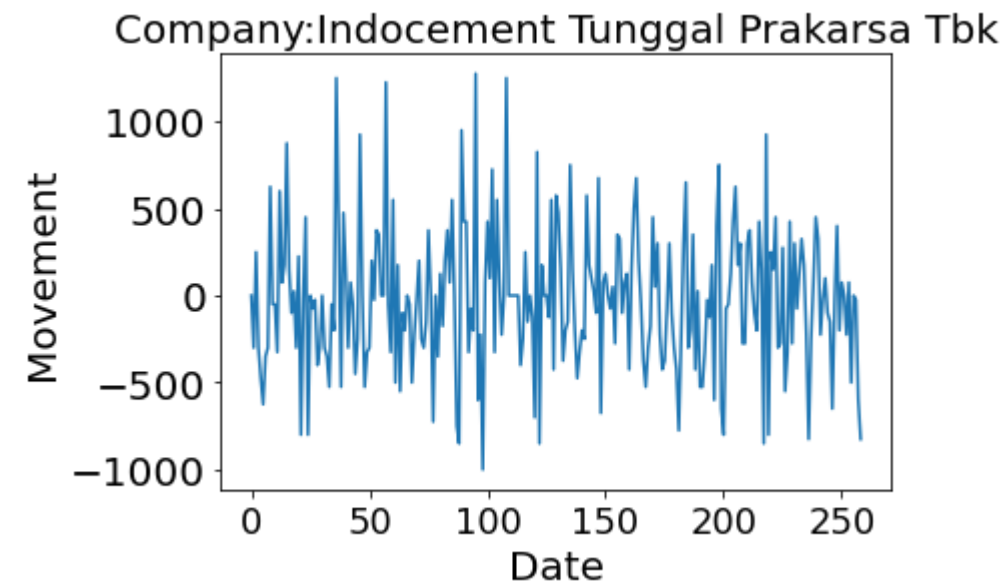


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
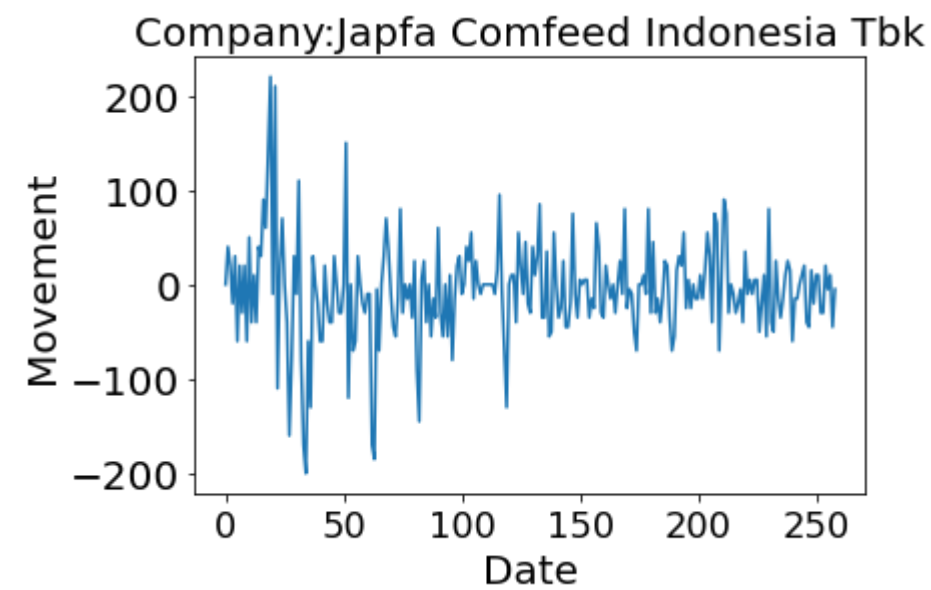


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
```

```
plt.plot(movements[j][0:movements[j].size])
j = j+1
```



```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
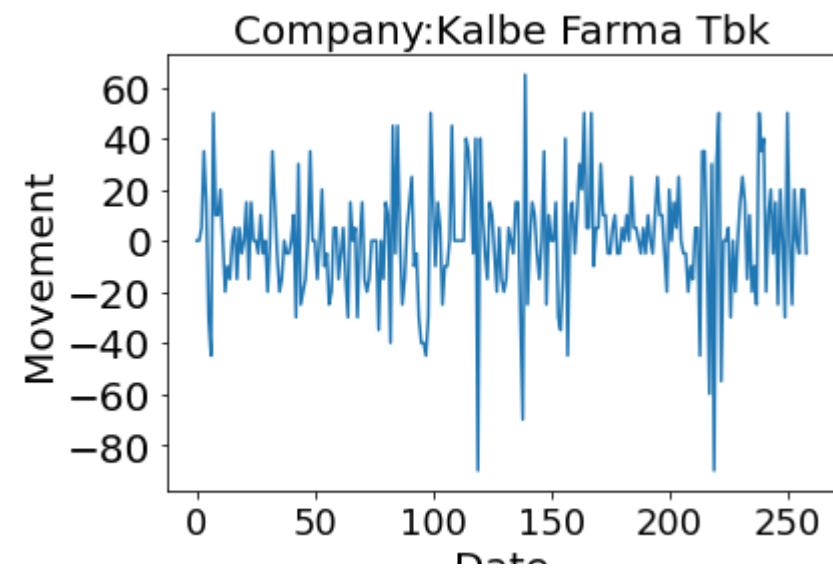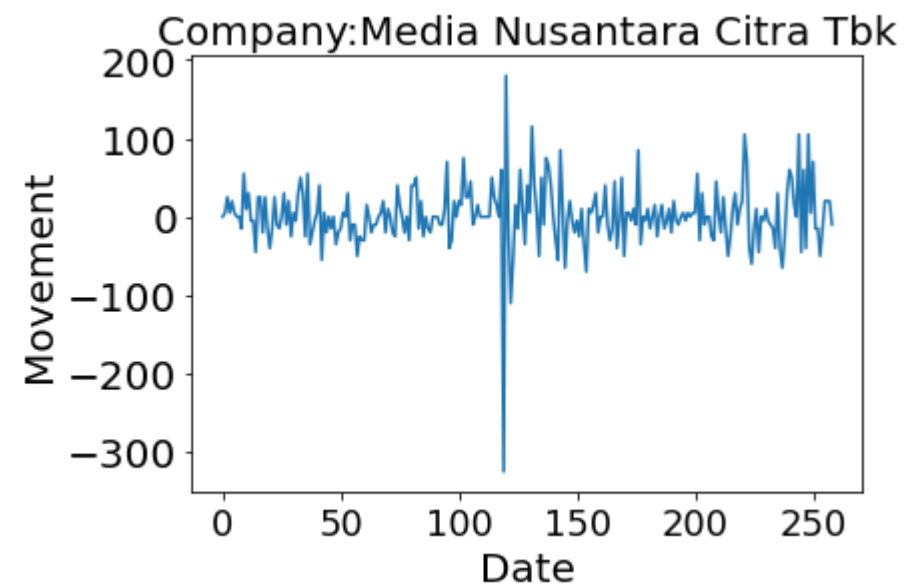


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

Company:Kalbe Farma Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
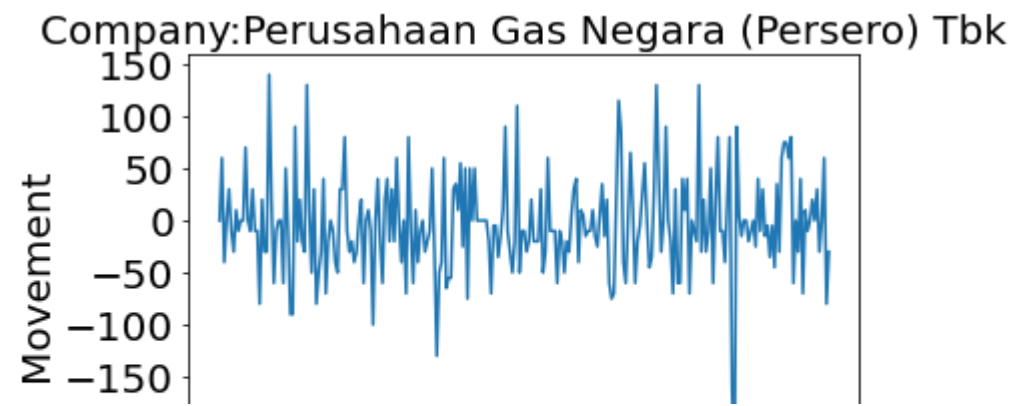

Company:Media Nusantara Citra Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

Company:Perusahaan Gas Negara (Persero) Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
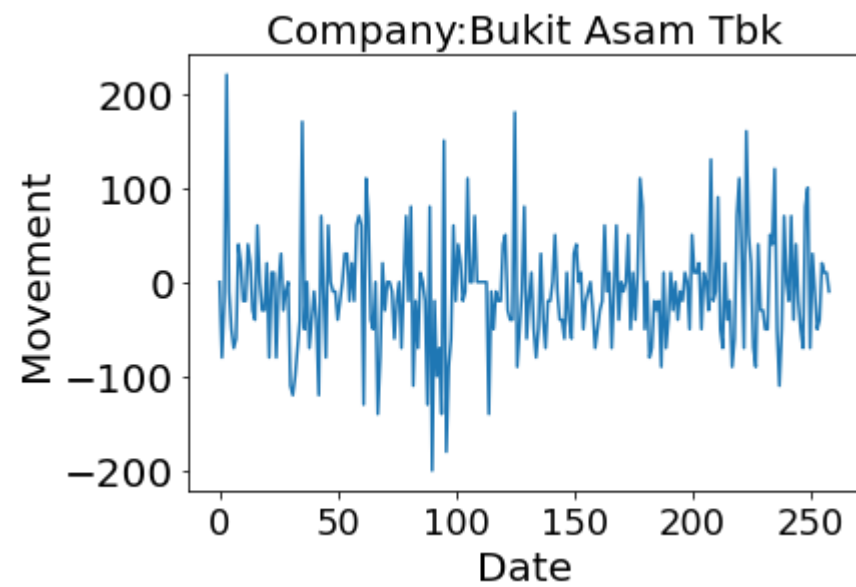

Company:Bukit Asam Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

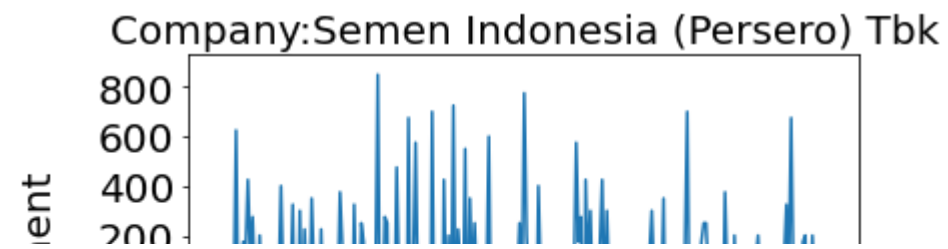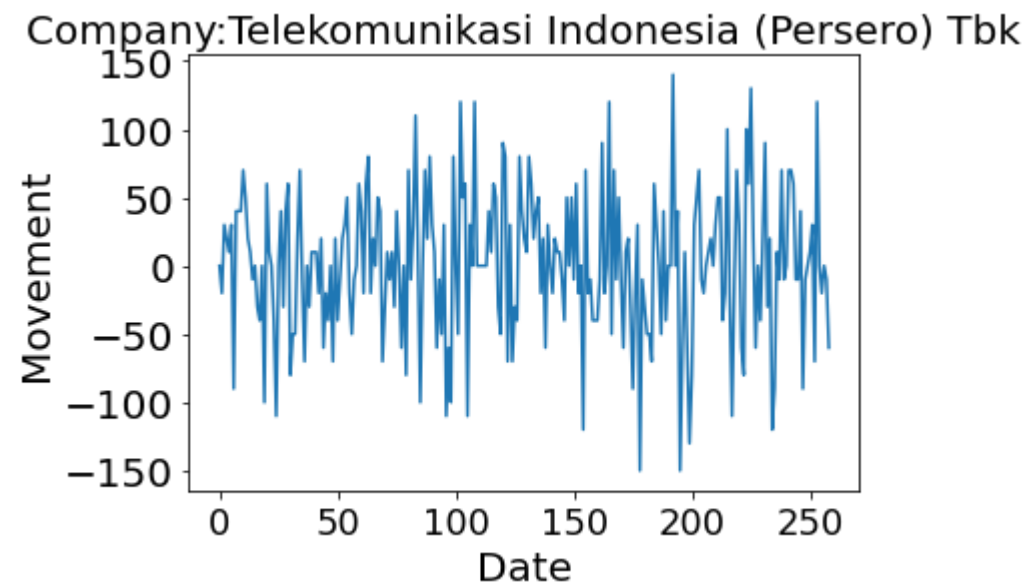## Company:Semen Indonesia (Persero) Tbk


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

Company:Telekomunikasi Indonesia (Persero) Tbk


```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
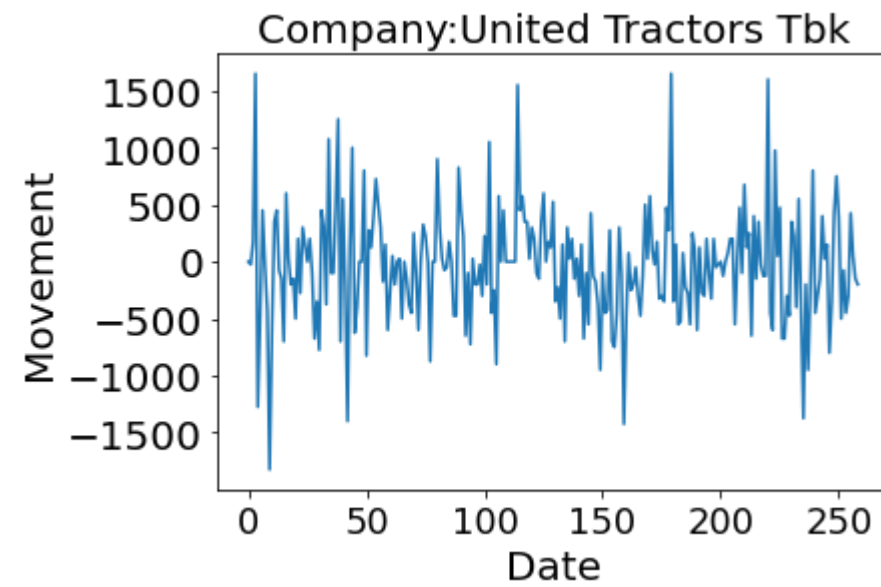
Company:Sarana Menara Nusantara Tbk
60

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```
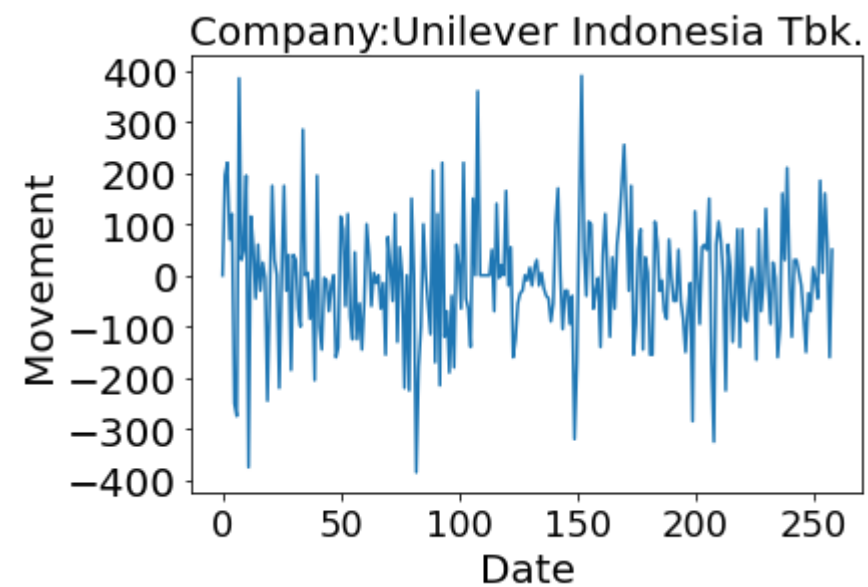
Company:United Tractors Tbk

```
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
j = j+1
```

Company:Unilever Indonesia Tbk.

```
from sklearn.preprocessing import Normalizer
```

```
normalizer = Normalizer() # Define a Normalizer
movements = normalizer.fit_transform(movements)


from sklearn.cluster import KMeans


# function returns WSS score for k values from 1 to kmax
def calculate_WSS(points, kmax):
  sse = []
  for k in range(1, kmax+1):
    kmeans = KMeans(n_clusters = k).fit(points)
    centroids = kmeans.cluster_centers_
    pred_clusters = kmeans.predict(points)
    curr_sse = 0

    # calculate square of Euclidean distance of each point from its cluster center and add to current WSS
    for i in range(len(points)):
      curr_center = centroids[pred_clusters[i]]
      curr_sse += (points[i, 0] - curr_center[0]) ** 2 + (points[i, 1] - curr_center[1]) ** 2

    sse.append(curr_sse)
  return sse



plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('K',fontsize = 20)
plt.ylabel('WSS',fontsize = 20)
plt.plot(calculate_WSS(movements,30))
```
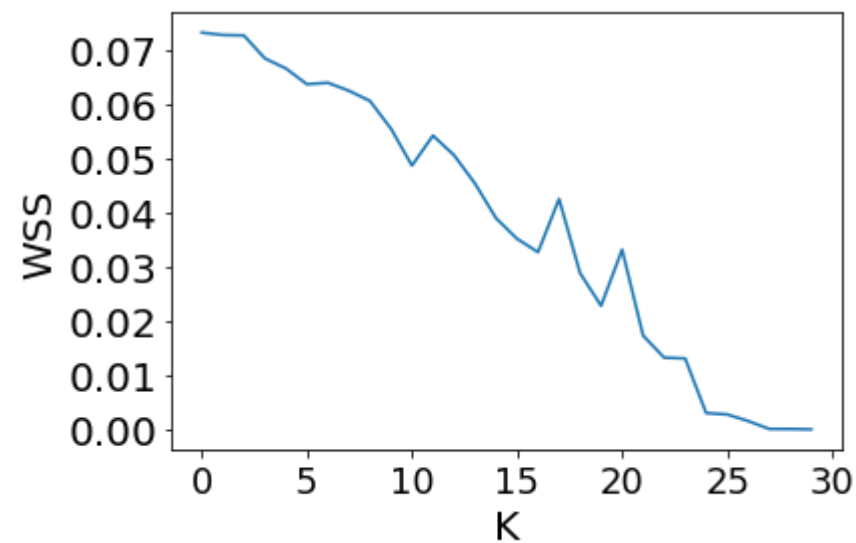
      [<matplotlib.lines.Line2D at 0x7f5ee44c57b8>]


```
from sklearn.metrics import silhouette_score


sil = []
kmax =29


# dissimilarity would not be defined for a single cluster, thus, minimum number of clusters should be 2
for k in range(2, kmax+1):
  kmeans = KMeans(n_clusters = k).fit(movements)
```

```
kmeans = KMeans(n_clusters = K).fit(movements)
labels = kmeans.labels_
sil.append(silhouette_score(movements, labels, metric = 'euclidean'))


sil
```

```
[0.027774913725341355,
 0.027159244235291605,
 0.03222137223954565,
 0.04044292090040227,
 0.04457571908486671,
 0.05040356167750475,
 0.05026193543718242,
 0.06268019621715502,
 0.06045342323649591,
 0.07171271959043538,
 0.07838883380774533,
 0.07457313527573459,
 0.07593310701756238,
 0.08345785556596799,
 0.07101204691289814,
 0.07388485108065544,
 0.07378356875854421,
 0.06544916604800446,
 0.06706989967283902,
 0.06383496208891538,
 0.060275347679000314,
 0.05886064440119912,
 0.05366367543626883,
 0.04420383548768357,
 0.042217813884549336,
 0.04105726981945183,
 0.02688459955520304,
 0.020327836244087866]
```

```
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('K',fontsize = 20)
plt.ylabel('Silhouette Score',fontsize = 20)
plt.plot(sil)
```

```
        [<matplotlib.lines.Line2D at 0x7f5ed50a0940>]
```

```python
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import Normalizer
from sklearn.cluster import KMeans
# Define a normalizer
normalizer = Normalizer()
# Create Kmeans model
kmeans = KMeans(n_clusters = 13,max_iter = 1000)
# Make a pipeline chaining normalizer and kmeans
pipeline = make_pipeline(normalizer,kmeans)
# Fit pipeline to daily stock movements
pipeline.fit(movements)
labels = pipeline.predict(movements)
```

```python
df1 = pd.DataFrame({'labels':labels+1,'companies':list(companies_data['Company Name'])}).sort_values(by=['labels'],axis = 0)
```
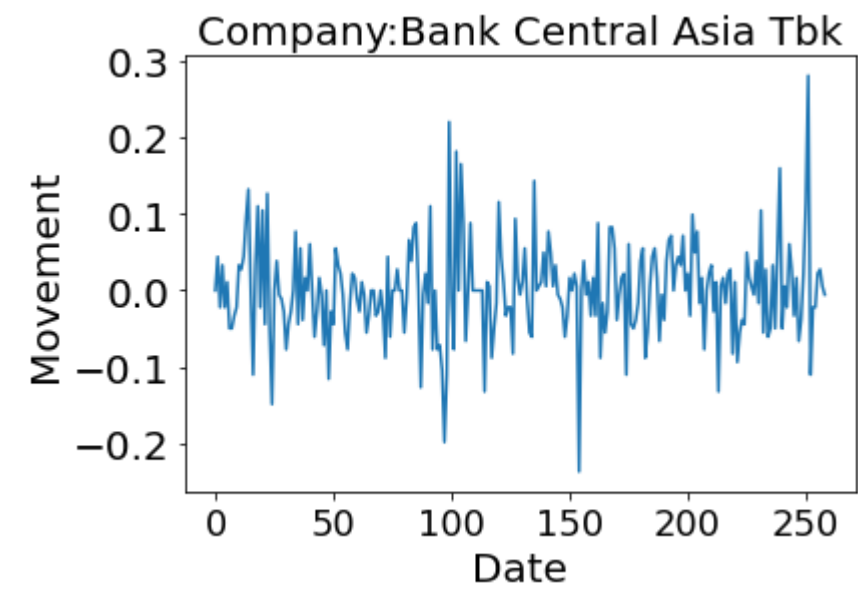
```python
df1
```

	labels	companies
9	1	Bank BTPN Syariah Tbk
15	2	Indofood CBP Sukses Makmur Tbk
17	2	Indofood Sukses Makmur Tbk
29	2	Unilever Indonesia Tbk.
7	3	Bank Tabungan Negara (Persero) Tbk
21	3	Kalbe Farma Tbk
4	4	Bank Central Asia Tbk
5	4	Bank Negara Indonesia (Persero) Tbk
6	4	Bank Rakyat Indonesia (Persero) Tbk

```
j = 4
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
```
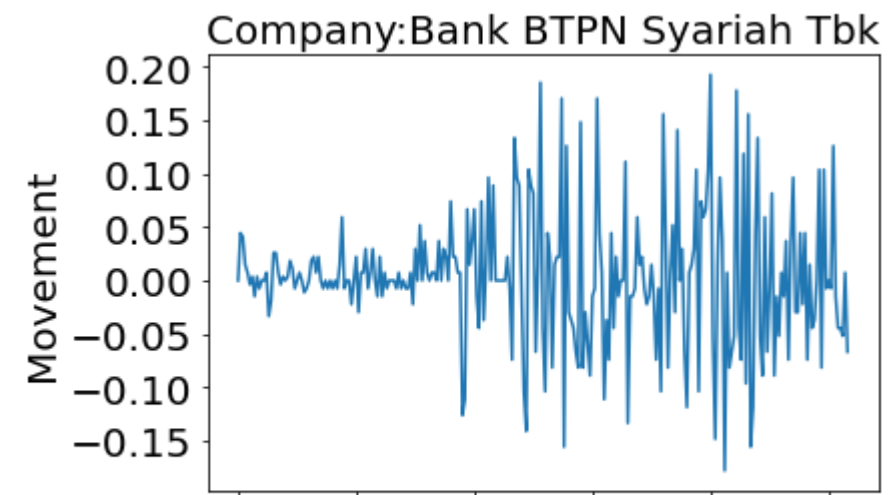
```
[<matplotlib.lines.Line2D at 0x7f5ed505c7b8>]
```



```
j = 9
plt.title('Company:'+companies_data['Company Name'][j],fontsize = 20)
plt.xticks(fontsize = 18)
plt.yticks(fontsize = 20)
plt.xlabel('Date',fontsize = 20)
plt.ylabel('Movement',fontsize = 20)
plt.plot(movements[j][0:movements[j].size])
```

```
[<matplotlib.lines.Line2D at 0x7f5ed502abe0>]
```


Company:Bank BTPN Syariah Tbk

```python
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import Normalizer
from sklearn.cluster import KMeans
# Define a normalizer
normalizer = Normalizer()
# Create Kmeans model
kmeans = KMeans(n_clusters = 2,max_iter = 1000)
# Make a pipeline chaining normalizer and kmeans
pipeline = make_pipeline(normalizer,kmeans)
# Fit pipeline to daily stock movements
pipeline.fit(movements)
labels = pipeline.predict(movements)
df1 = pd.DataFrame({'labels':labels+1,'companies':list(companies_data['Company Name'])}).sort_values(by=['labels'],axis = 0)
df1
```

	labels	companies
0	1	Ace Hardware Indonesia Tbk
27	1	Sarana Menara Nusantara Tbk
25	1	Semen Indonesia (Persero) Tbk
24	1	Bukit Asam Tbk
21	1	Kalbe Farma Tbk
20	1	Japfa Comfeed Indonesia Tbk
19	1	Indocement Tunggal Prakarsa Tbk
18	1	Indah Kiat Pulp & Paper Tbk
17	1	Indofood Sukses Makmur Tbk
15	1	Indofood CBP Sukses Makmur Tbk
28	1	United Tractors Tbk
13	1	Gudang Garam Tbk
14	1	H.M. Sampoerna Tbk
29	1	Unilever Indonesia Tbk.
10	1	Charoen Pokphand Indonesia Tbk
26	2	Telekomunikasi Indonesia (Persero) Tbk
2	2	Aneka Tambang Tbk
3	2	Astra International Tbk
23	2	Perusahaan Gas Negara (Persero) Tbk
22	2	Media Nusantara Citra Tbk
11	2	Erajaya Swasembada Tbk
5	2	Bank Negara Indonesia (Persero) Tbk
6	2	Bank Rakyat Indonesia (Persero) Tbk
7	2	Bank Tabungan Negara (Persero) Tbk
8	2	Bank Mandiri (Persero) Tbk
16	2	Vale Indonesia Tbk
9	2	Bank BTPN Syariah Tbk
12	2	XL Axiata Tbk
4	2	Bank Central Asia Tbk