In [24]:
```
import numpy as np
import pandas as pd
from datetime import datetime
import urllib3
import urllib.request
import lib
import zipfile
import zipfile2
from zipfile import ZipFile
import time
from urllib.request import urlretrieve, Request, FancyURLopener
import os
import os.path
import requests
import statsmodels.api as sm
import matplotlib.pyplot as plt
```

Assignment 12.1: STEP : 1

Downloading data via calling the API

In [17]:
```
headers = {"User-Agent": "Safari/15.1"}

downloadPath = os.getcwd()

for year in range(1995, 2020):
    quarters = ['QTR1', 'QTR2', 'QTR3', 'QTR4']
    # Download and extract each file
    for quarter in quarters:
        req_url = 'https://www.sec.gov/dera/data/edgar/full-index/' + str(year) + '/'+str(quarter)+ '/master' + '.zip'
        req = Request(req_url, headers=headers)
        response = urllib.request.urlopen(request)

        with open(downloadPath+"\\sec_fillings" + str(year) + "_" + str(quarter) + '.zip', "wb") as fo:
            fo.write(response.read())


        with zipfile2.ZipFile(downloadPath+"\\sec_fillings" + str(year) + "_" + str(quarter) + '.zip', 'r') as zip:
            zip.extractall(downloadPath+"\\sec_fillings" + str(year) + "_" + str(quarter))
```

Cleaning and taking random 50 lines as asked

In [21]:
```
final_data = np.empty((0, 5), str)

for year in range(1995, 2020):
    quarters = ['QTR1', 'QTR2', 'QTR3', 'QTR4']
    for quarter in quarters:
        with open(downloadPath+"\\sec_fillings" + str(year) + '_' + str(quarter) + '/master.idx', encoding='latin-1') as op:
            for i in range(11):
                op.readline()
            placeholder_list = []
            # Reading each line
            for line in op:
                    line = line[0:-1]
                    splits = list(line.split('|'))

                    if (splits[2] == '8-K'):
                        placeholder_list.append(splits)

        final_records = np.array(placeholder_list)
        indices = np.random.randint(np.size(final_records, 0), size = 50)
        final_data = np.append(final_data, final_records[indices, :], axis = 0)
```

Store into CSV File

In [23]:
```
sec_fillings = pd.DataFrame(final_data, columns = ['CIK', 'CompanyName', 'FormTypes', 'DATE', 'link'])
sec_fillings.to_csv(downloadPath+"\\sec_fillings.csv")
```

Assignment 12.1: STEP : 2 : Event Studies

Reading SEC, DAILY DATA and COMPUSTAT data for event studies

In [25]:
```
comp_data = pd.read_csv('Q:\\data-ReadOnly\\COMP\\funda.csv', header = 0)
```

```
C:\ProgramData\Anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3165: DtypeWarning: Columns (8,10,12,16,26,30,926,946,947) have mixed types.Specify dtype option on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

In [27]:
```
FUNDA = comp_data.copy()
FUNDA['cusip'] = FUNDA['cusip'].str[0:6]
FUNDA = FUNDA[['fyear', 'cusip', 'cik']]
FUNDA.head()
```

Out[27]:

	fyear	cusip	cik
0	1961.0	000032	NaN
1	1962.0	000032	NaN
2	1963.0	000032	NaN
3	1964.0	000032	NaN
4	1965.0	000032	NaN

In [28]:
```
SEC_FILLINGS = pd.read_csv(downloadPath+"\\sec_fillings.csv", header = 0)
SEC_FILLINGS = SEC_FILLINGS.iloc[:, 1:5]
SEC_FILLINGS['filingdate'] = pd.to_datetime(SEC_FILLINGS['DATE'], format='%Y/%m/%d')
SEC_FILLINGS['YEAR'] = pd.DatetimeIndex(SEC_FILLINGS['DATE']).year
SEC_FILLINGS[['CIK']] = SEC_FILLINGS[['CIK']].apply(pd.to_numeric, errors = 'coerce')
SEC_FILLINGS.head()
```

Out[28]:

	CIK	CompanyName	FormTypes	DATE	filingdate	YEAR
0	1296675	CubeSmart	8-K	2019-10-11	2019-10-11	2019
1	1493137	Lifeloc Technologies, Inc	8-K	2019-11-12	2019-11-12	2019
2	1557683	Oennea, Inc.	8-K	2019-11-13	2019-11-13	2019
3	1567523	Knowles Corp	8-K	2019-10-24	2019-10-24	2019
4	876378	TRANSENTERIX, INC	8-K	2019-11-13	2019-11-13	2019

In [33]:
```
FUNDA = FUNDA.rename(columns={'fyear': 'YEAR', 'cusip': 'CUSIP', 'cik' : 'CIK'})
FUNDA_SEC = pd.merge(FUNDA, SEC_FILLINGS, how = 'inner', on = ['YEAR', 'CIK'])
FUNDA_SEC = FUNDA_SEC[['CUSIP', 'YEAR', 'CIK', 'CompanyName', 'FormTypes', 'filingdate']]
FUNDA_SEC = FUNDA_SEC.drop_duplicates()
```

In [36]:
```
dsf_new = pd.read_csv('Q:\\data-ReadOnly\\CRSP\\dsf_new.csv')
DSF = dsf_new.copy()
DSF = DSF[['CUSIP', 'DATE', 'PRC', 'SHROUT', 'RET', 'VWRETD', 'VOL']]
DSF['YEAR'] = DSF['CUSIP'].str[0:8]
cols = DSF.columns.drop(['CUSIP', 'DATE'])
DSF[cols] = DSF[cols].apply(pd.to_numeric, errors='coerce')
DSF['DATE'] = DSF['DATE'].apply(str)
DSF['DATE'] = pd.to_datetime(DSF['DATE'])
DSF['YEAR'] = pd.DatetimeIndex(DSF['DATE']).year
DSF['PREV_YEAR'] = DSF['YEAR'] - 1
DSF.head()
```

Out[36]:

	CUSIP	DATE	PRC	SHROUT	RET	VWRETD	VOL	YEAR	PREV_YEAR
0	68391610	1986-01-06	NaN	NaN	NaN	-0.000138	NaN	1986	1985
1	68391610	1986-01-07	-2.5625	3680.0	NaN	0.013809	1000.0	1986	1985
2	68391610	1986-01-08	-2.5000	3680.0	-0.02439	-0.020744	12900.0	1986	1985
3	68391610	1986-01-09	-2.5000	3680.0	0.00000	-0.011219	1400.0	1986	1985
4	68391610	1986-01-10	-2.5000	3680.0	0.00000	0.000983	8500.0	1986	1985

Merge All datasets

In [41]:
```
FUNDA_SEC['YEAR'] = FUNDA_SEC['YEAR'].astype(int)
DSF['YEAR'] = DSF['YEAR'].astype(int)
master_dataset = pd.merge(DSF, FUNDA_SEC, how = 'inner', left_on = ['CUSIP', 'YEAR'], right_on = ['CUSIP', 'YEAR'])
master_dataset.head()
```

Out[41]:

	CUSIP	DATE	PRC	SHROUT	RET	VWRETD	VOL	YEAR	PREV_YEAR	CIK	CompanyName	FormTypes	filingdate
0	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	351034.0	AIR T INC	8-K	2019-12-19
1	NaN	2019-01-03	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	351034.0	AIR T INC	8-K	2019-11-14
2	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	5981.0	AMERICAN VANGUARD CORP	8-K	2019-11-06
3	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	1037868.0	AMETEK INC/	8-K	2019-10-31
4	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	316154.0	AMGEN INC	8-K	2019-10-29

Saving master dataset - to use in 12.2

In [47]:
```
master_dataset.to_csv(downloadPath+"\\master_dataset.csv")
```

Cleaning master dataset

In [48]:
```
ALL_DATA = master_dataset
CHECK = [(ALL_DATA['DATE'] == ALL_DATA['filingdate']), (ALL_DATA['DATE'] != ALL_DATA['filingdate'])]
ALL_DATA['filing_checker'] = np.select(CHECK, [1,0])
ALL_DATA['RET'] = ALL_DATA['RET'].apply(pd.to_numeric, errors = 'coerce')
ALL_DATA.dropna()
ALL_DATA['turnover'] = ALL_DATA['VOL']/ALL_DATA['SHROUT']
ALL_DATA['adjust'] = (np.log(ALL_DATA['turnover'] + (2.55 * (10 ** (-6)))))
ALL_DATA['regression'] = (ALL_DATA.groupby('CUSIP')['adjust'].shift(-11).rolling(60, min_periods = 1).sum())/60
ALL_DATA['ALPHA'] = ALL_DATA.groupby('CUSIP')['regression'].shift(-11)
ALL_DATA['std'] = ALL_DATA.groupby('CUSIP')['adj'].shift(-11).rolling(60, min_periods = 1).sum()
ALL_DATA['adj_std'] = np.sqrt(ALL_DATA['std']*60)
ALL_DATA['ATO'] = ((ALL_DATA['adjust'] - ALL_DATA['regression'])/(ALL_DATA['adj_std']))

ALL_DATA.head()
```

Out[48]:

	CUSIP	DATE	PRC	SHROUT	RET	VWRETD	VOL	YEAR	PREV_YEAR	CIK	...	FormTypes	filingdate	filing_checker	turnover	adjust	regression	val	std	adj_std	ATO
0	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	351034.0	...	8-K	2019-12-19	0	0.009641	1.793365	NaN	NaN	NaN	NaN	NaN
1	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	351034.0	...	8-K	2019-11-14	0	0.009641	1.793365	NaN	NaN	NaN	NaN	NaN
2	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	5981.0	...	8-K	2019-11-06	0	0.009641	1.793365	NaN	NaN	NaN	NaN	NaN
3	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	1037868.0	...	8-K	2019-10-31	0	0.009641	1.793365	NaN	NaN	NaN	NaN	NaN
4	NaN	2019-01-02	141.0	18774.0	-0.024829	0.001791	112825.0	2019	2018	316154.0	...	8-K	2019-10-29	0	0.009641	1.793365	NaN	NaN	NaN	NaN	NaN

5 rows × 21 columns

In [57]:
```
def myfunc(df, a, b):
    return sm.OLS(df[b], df[a]).fit().predict()

capm = ALL_DATA.groupby('CUSIP').apply(myfunc, 'VWRETD', 'RET')
capm_c = capm.copy()
capm_c = capm_c.to_frame(capm_c)
final_list = capm_c.iloc[:, 0:1]
final_list = final_list.reset_index()
final_list = final_list.iloc[:, 0:1]
final_list = final_list.set_axis(['CUSIP'], axis = 1,inplace = False)
total_cusips = final_list['CUSIP'].count()
```

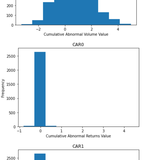
Calculating Alpha and Beta Values

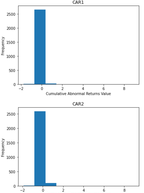
In [58]:
```
coe_array = np.array(capm)
coe_list = coe_array.tolist()
index_list = list(capm.index)
coe_val = pd.DataFrame(np.concatenate(coe_list))


alpha = coe_val.iloc[0:total_cusips, 0:1]
alpha['CUSIP'] = index_list
alpha = alpha.rename(columns={alpha.columns[0]: 'ALPHA'})

beta = coe_val.iloc[total_cusips:2*total_cusips, 0:1]
beta['CUSIP'] = index_list
beta = beta.rename(columns={beta.columns[0]: 'BETA'})


alpha_beta = pd.merge(alpha, beta, how = 'inner', on = ['CUSIP'])
ALL_DATA_betas = pd.merge(ALL_DATA, alpha_beta, how = 'inner', on = 'CUSIP')


ALL_DATA_betas.drop_duplicates()
ALL_DATA_betas['VAR'] = ALL_DATA_betas['RET'] - (ALL_DATA_betas['ALPHA'] + ALL_DATA_betas['BETA'] * ALL_DATA_betas['VWRETD'])
ALL_DATA_betas['CAR3'] = ALL_DATA_betas['AR']
ALL_DATA_betas['CAR1'] = ALL_DATA_betas.groupby(['CUSIP'])['AR'].shift(1).rolling(3, min_periods = 1).sum().shift(-1)
ALL_DATA_betas['CAR2'] = ALL_DATA_betas.groupby(['CUSIP'])['AR'].shift(2).rolling(5, min_periods = 1).sum().shift(-2)
ALL_DATA_betas['CAR3'] = ALL_DATA_betas.groupby(['CUSIP'])['AR'].shift(3).rolling(7, min_periods = 1).sum().shift(-3)
ALL_DATA_betas['CAR5'] = ALL_DATA_betas.groupby(['CUSIP'])['AR'].shift(5).rolling(11, min_periods = 1).sum().shift(-5)


selected_data = ALL_DATA_betas.loc[ALL_DATA_betas['filing_checker'] == 1]
CAR = selected_data[['CIK'] + ['ATO'] + ['CAR0'] + ['CAR1'] + ['CAR2'] + ['CAR3'] + ['CAR5']]
CAR_DESC = CAR[['ATO'] + ['CAR0'] + ['CAR1'] + ['CAR2'] + ['CAR3'] + ['CAR5']]
CAR_DESC.describe()
```

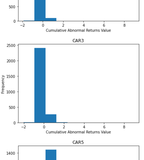
Out[58]:

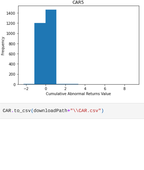
	ATO	CAR0	CAR1	CAR2	CAR3	CAR5
count	2691.000000	2691.000000	2691.000000	2691.000000	2691.000000	2691.000000
mean	0.578485	0.002964	0.006950	0.007333	0.004617	0.001829
std	1.220596	0.122061	0.241546	0.274950	0.296104	0.333067
min	-3.282840	-0.905788	-1.701484	-1.894613	-2.029142	-2.253025
25%	-0.278597	-0.017414	-0.039778	-0.056914	-0.072573	-0.104512
50%	0.442220	-0.000554	-0.001187	-0.000890	-0.002066	-0.005401
75%	1.317576	0.017114	0.035686	0.051873	0.067376	0.089468
max	4.970397	4.432156	8.883267	8.889782	8.917258	8.905870

In [59]:
```
ATOplot = CAR['ATO'].plot.hist()
plt.xlabel('Cumulative Abnormal Volume Value')
plt.title('ATO')
plt.show()

CAR0plot = CAR['CAR0'].plot.hist()
plt.xlabel('Cumulative Abnormal Returns Value')
plt.title('CAR0')
plt.show()

CAR1plot = CAR['CAR1'].plot.hist()
plt.xlabel('Cumulative Abnormal Returns Value')
plt.title('CAR1')
plt.show()

CAR2plot = CAR['CAR2'].plot.hist()
plt.xlabel('Cumulative Abnormal Returns Value')
plt.title('CAR2')
plt.show()

CAR3plot = CAR['CAR3'].plot.hist()
plt.xlabel('Cumulative Abnormal Returns Value')
plt.title('CAR3')
plt.show()

CAR5plot = CAR['CAR5'].plot.hist()
plt.xlabel('Cumulative Abnormal Returns Value')
plt.title('CAR5')
plt.show()
```









In [62]:
```
CAR.to_csv(downloadPath+"\\CAR.csv")
```