In [1]:

```
import pandas as pd
```

In [2]:

```
!pip install pandas-datareader
```

```
Requirement already satisfied: pandas-datareader in c:\users\proma.gupta\anacon
da3\lib\site-packages (0.10.0)
Requirement already satisfied: requests>=2.19.0 in c:\users\proma.gupta\anacond
a3\lib\site-packages (from pandas-datareader) (2.25.1)
Requirement already satisfied: lxml in c:\users\proma.gupta\anaconda3\lib\site-
packages (from pandas-datareader) (4.6.3)
Requirement already satisfied: pandas>=0.23 in c:\users\proma.gupta\anaconda3\l
ib\site-packages (from pandas-datareader) (1.2.4)
Requirement already satisfied: python-dateutil>=2.7.3 in c:\users\proma.gupta\a
naconda3\lib\site-packages (from pandas>=0.23->pandas-datareader) (2.8.1)
Requirement already satisfied: numpy>=1.16.5 in c:\users\proma.gupta\anaconda3
\lib\site-packages (from pandas>=0.23->pandas-datareader) (1.20.1)
Requirement already satisfied: pytz>=2017.3 in c:\users\proma.gupta\anaconda3\l
ib\site-packages (from pandas>=0.23->pandas-datareader) (2021.1)
Requirement already satisfied: six>=1.5 in c:\users\proma.gupta\anaconda3\lib\s
ite-packages (from python-dateutil>=2.7.3->pandas>=0.23->pandas-datareader) (1.
15.0)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\proma.gupta\an
aconda3\lib\site-packages (from requests>=2.19.0->pandas-datareader) (1.26.4)
Requirement already satisfied: idna<3,>=2.5 in c:\users\proma.gupta\anaconda3\l
ib\site-packages (from requests>=2.19.0->pandas-datareader) (2.10)
Requirement already satisfied: chardet<5,>=3.0.2 in c:\users\proma.gupta\anacon
da3\lib\site-packages (from requests>=2.19.0->pandas-datareader) (4.0.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\proma.gupta\anaco
nda3\lib\site-packages (from requests>=2.19.0->pandas-datareader) (2020.12.5)
```

In [3]:

```
import pandas_datareader.data as web
import datetime
start = datetime.datetime(2012, 1, 1)
end = datetime.datetime.today()
print(start, end)
```

```
2012-01-01 00:00:00 2021-09-29 12:12:14.178876
```

In [8]:

```
data_dict = {}
stocks = ["MSFT", "AAPL", "FB", "TSLA", "GOOGL", "AMZN", "NFLX", "WMT", "TGT" ]
for key in stocks:
 data_dict[key] = web.DataReader(key, 'yahoo', start, end)
data_dict
```

Out[8]:

```
{'MSFT':                   High         Low        Open       Close       Volu
me  \
 Date
 2012-01-03   26.959999   26.389999   26.549999   26.770000  64731500.0
 2012-01-04   27.469999   26.780001   26.820000   27.400000  80516100.0
 2012-01-05   27.730000   27.290001   27.379999   27.680000  56081400.0
 2012-01-06   28.190001   27.530001   27.530001   28.110001  99455500.0
 2012-01-09   28.100000   27.719999   28.049999   27.740000  59706800.0
 ...                ...         ...         ...         ...         ...
 2021-09-23  300.899994  297.529999  298.850006  299.559998  18604600.0
 2021-09-24  299.799988  296.929993  298.230011  299.350006  14994200.0
 2021-09-27  296.470001  292.940002  296.140015  294.170013  23571700.0
 2021-09-28  290.779999  282.750000  289.799988  283.519989  43139400.0
 2021-09-29  286.679993  283.010010  285.100006  284.309998  14958083.0

              Adj Close
 Date
 2012-01-03   21.707487
 2012-01-04   22.218348
 2012-01-05   22.445306
```

In [11]:

```
print(key +" Closing Price")
data_dict[key]
```

```
TGT Closing Price
```

Out[11]:

Date	High	Low	Open	Close	Volume	Adj Close
2012-01-03	51.910000	50.770000	51.889999	51.119999	7627900.0	38.849899
2012-01-04	51.230000	49.549999	51.049999	50.000000	14091600.0	37.998726
2012-01-05	48.779999	47.250000	48.000000	48.509998	19509400.0	36.866352
2012-01-06	49.560001	48.480000	48.810001	48.950001	12595700.0	37.200741
2012-01-09	49.020000	48.279999	49.020000	48.570000	6795300.0	36.911964
...	...	...	...	...	...	...
2021-09-23	245.169998	242.440002	243.500000	242.669998	2038600.0	242.669998
2021-09-24	242.809998	240.380005	241.330002	241.440002	1900400.0	241.440002
2021-09-27	242.339996	237.869995	240.250000	238.580002	2588400.0	238.580002
2021-09-28	237.360001	232.860001	236.899994	233.440002	3172400.0	233.440002
2021-09-29	237.619995	233.839996	234.570007	236.210007	1294040.0	236.210007

2452 rows × 6 columns

In [12]:
```
data_dict.keys()
```

Out[12]:
```
dict_keys(['MSFT', 'AAPL', 'FB', 'TSLA', 'GOOGL', 'AMZN', 'NFLX', 'WMT', 'TG
T'])
```

In [13]:
```

close_data = pd.concat((df["Close"] for df in data_dict.values()),
                       keys = data_dict.keys(),
                        axis = 1)
close_data
```

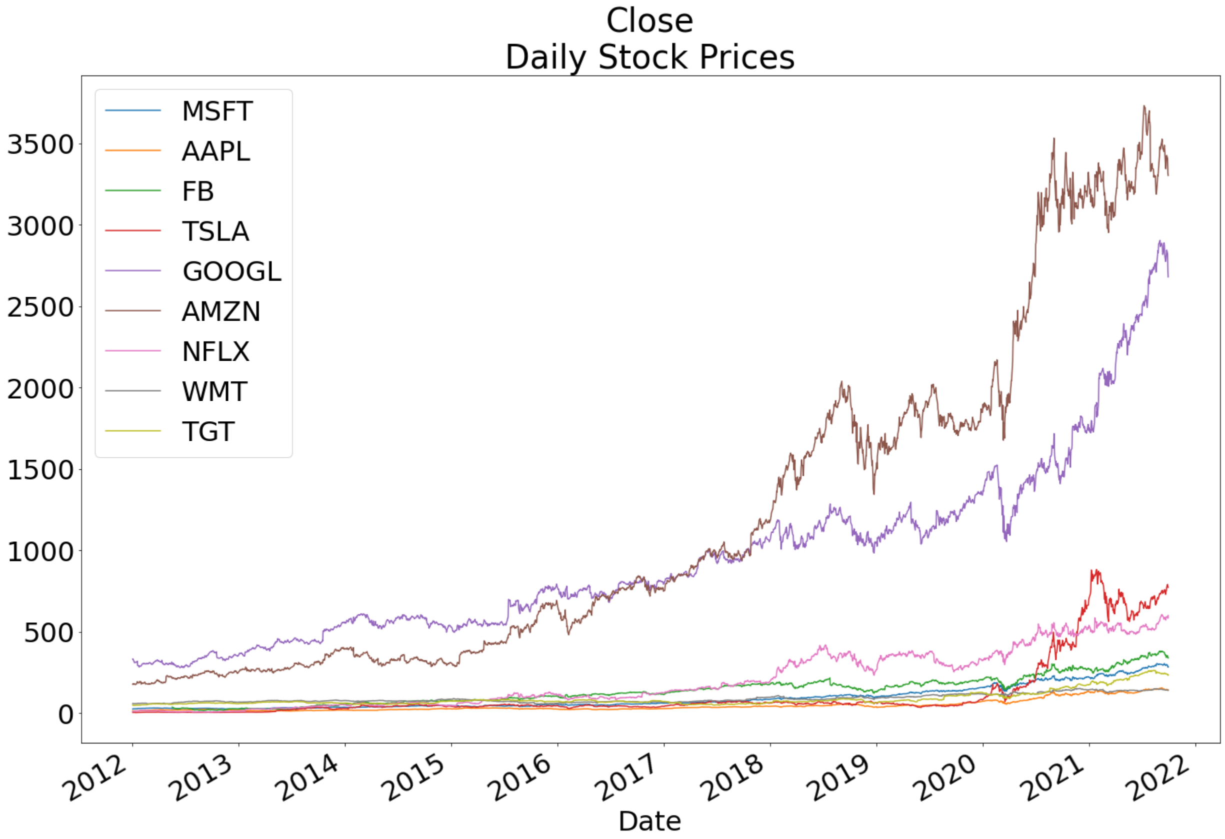
Out[13]:

	MSFT	AAPL	FB	TSLA	GOOGL	AMZN	NFLX	
Date								
2012-01-03	26.770000	14.686786	NaN	5.616000	333.038025	179.029999	10.320000	60.
2012-01-04	27.400000	14.765714	NaN	5.542000	334.474487	177.509995	11.492857	59.
2012-01-05	27.680000	14.929643	NaN	5.424000	329.834839	177.610001	11.328571	59.
2012-01-06	28.110001	15.085714	NaN	5.382000	325.335327	182.610001	12.327143	59.
2012-01-09	27.740000	15.061786	NaN	5.450000	311.541534	178.559998	14.025714	59.
...	...	...	...	...	...	...	...	
2021-09-23	299.559998	146.830002	345.959991	753.640015	2824.320068	3416.000000	593.260010	142.
2021-09-24	299.350006	146.919998	352.959991	774.390015	2844.300049	3425.520020	592.390015	143.
2021-09-27	294.170013	145.369995	353.579987	791.359985	2821.439941	3405.800049	592.640015	142.
2021-09-28	283.519989	141.910004	340.649994	777.559998	2716.600098	3315.959961	583.849976	140.
2021-09-29	284.309998	142.789993	340.109985	773.210022	2679.429932	3302.135010	601.059998	140.

2452 rows × 9 columns

In [14]:
```
import matplotlib.pyplot as plt

plt.rcParams.update({"font.size":32})
fig, ax = plt.subplots(figsize = (24,16))
close_data.plot.line(ax = ax, legend = True)
plt.title("Close\nDaily Stock Prices")
```

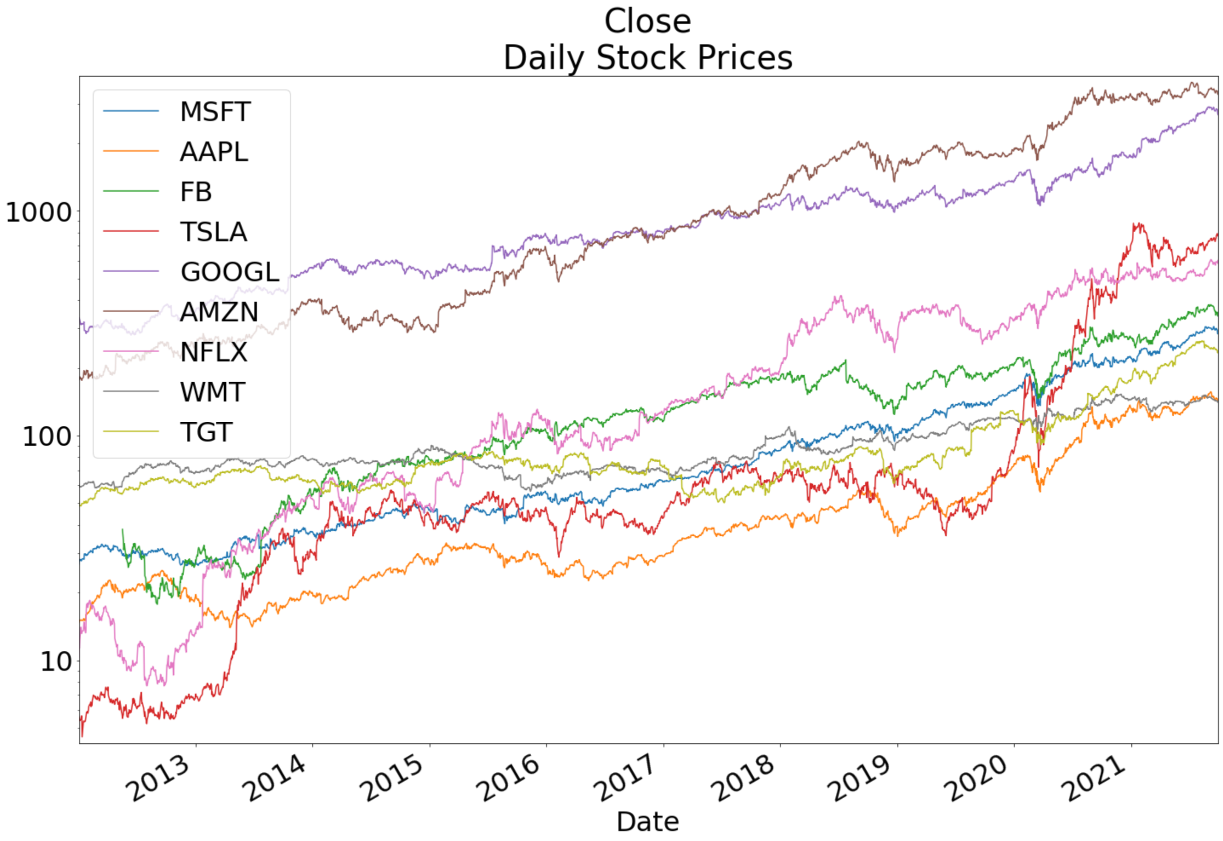
Out[14]:
```
Text(0.5, 1.0, 'Close\nDaily Stock Prices')
```



In [15]:
```
import matplotlib.pyplot as plt

plt.rcParams.update({"font.size":32})
plt.rcParams['axes.xmargin'] = 0
plt.rcParams['axes.ymargin'] = .01

fig, ax = plt.subplots(figsize = (24,16))
close_data.plot.line(ax = ax, legend = True)

plt.title("Close\nDaily Stock Prices")
ax.set_yscale("log")
# reset y-ticklabels so that they are not in
# scientific notation
y_vals = ax.get_yticks()
ax.set_yticklabels([int(y) if y >= 1 else round(y, 1) for y in y_vals])
```

```
<ipython-input-15-0eb7047172d3>:15: UserWarning: FixedFormatter should only be
used together with FixedLocator
  ax.set_yticklabels([int(y) if y >= 1 else round(y, 1) for y in y_vals])
```

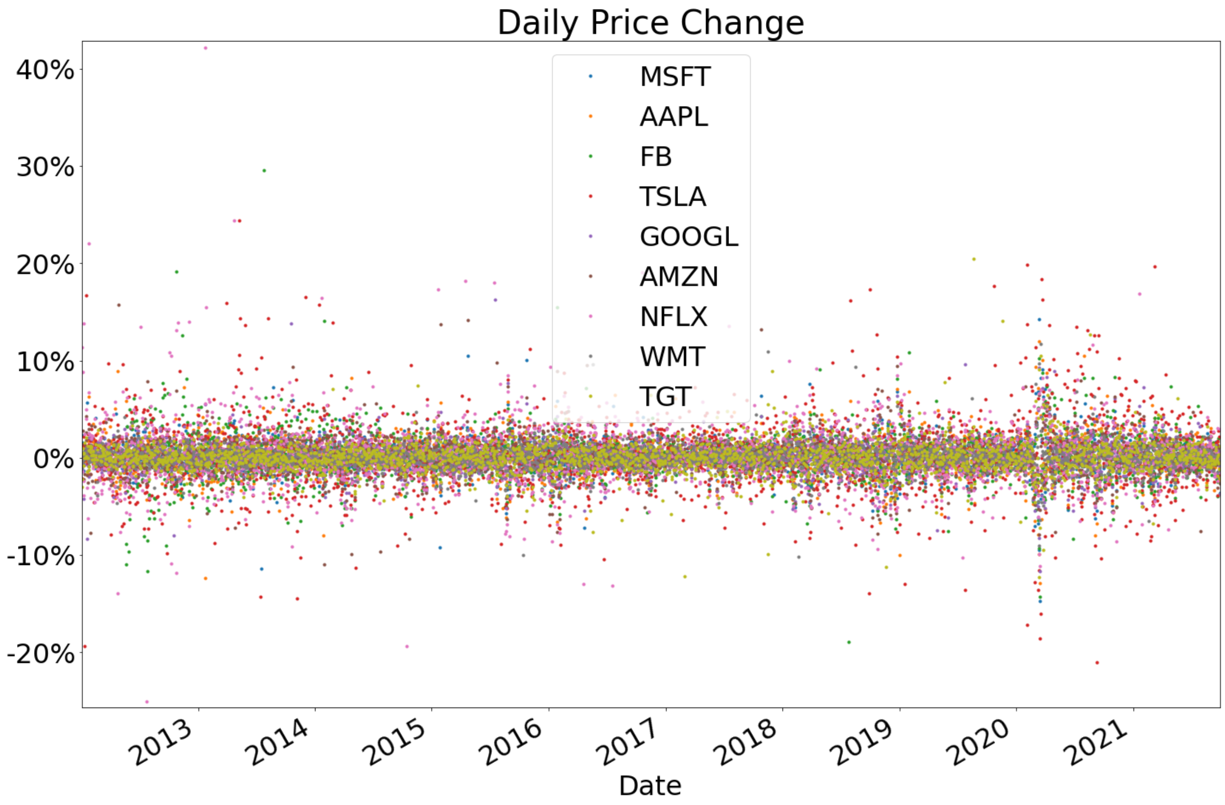
Out[15]:
```
[Text(0, 0.1, '0.1'),
 Text(0, 1.0, '1'),
 Text(0, 10.0, '10'),
 Text(0, 100.0, '100'),
 Text(0, 1000.0, '1000'),
 Text(0, 10000.0, '10000'),
 Text(0, 100000.0, '100000')]
```



In [16]:
```
price_change_data = close_data.pct_change() * 100
```

In [17]:
```
# set default font size
plt.rcParams.update({'font.size': 32})
fig, ax = plt.subplots(figsize = (24,16))
for key in price_change_data:
    # plot as scatter plot over time by setting marker to "." and ls to "" (blank
    #price_change_data[key].scatter()
    price_change_data[key].plot.line(marker = ".", ls="", ax = ax)
plt.legend()
plt.title("Daily Price Change")
# set y labels to integer include %
y_vals = ax.get_yticks()
ax.set_yticklabels([str(int(y))+ "%" for y in y_vals])

plt.show()
plt.close()
```

```
<ipython-input-17-58c58f1ee5c9>:12: UserWarning: FixedFormatter should only be
used together with FixedLocator
  ax.set_yticklabels([str(int(y))+ "%" for y in y_vals])
```



In [18]:

```
stats_df = gather_statistics(price_change_data, sample = True)
stats_df
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-18-b1992bf4ceca> in <module>
----> 1 stats_df = gather_statistics(price_change_data, sample = True)
      2 stats_df

NameError: name 'gather_statistics' is not defined
```

In [19]:

```
def gather_statistics(df, sample = False):
    dct = {key:{} for key in df}
    for key, val in df.items():
        # drop any missing observations from dataframe
        val = val.dropna(axis=0)
        dct[key]["mean"] = round(mean(val),3)
        dct[key]["median"] = round(median(val),3)
        # skip mode. . .          dct[key]["mode"] = mode(val)
        dct[key]["variance"] = round(variance(val, sample),3)
        dct[key]["S.D."] = round(SD(val, sample) ,3)
        dct[key]["skewness"] = round(skewness(val, sample),3)
        dct[key]["kurtosis"] = round(kurtosis(val, sample),3)
    stats_df = pd.DataFrame(dct)
    return stats_df
```

In [ ]:

In [21]:

```
def total(list_obj):
    total = 0
    n = len(list_obj)
    for i in range(n):
        total += list_obj[i]
    return total

def mean(list_obj):
    n = len(list_obj)
    mean_ = total(list_obj) / n
    return mean_

def median(list_obj):
    n = len(list_obj)
    list_obj = sorted(list_obj)
    #lists of even length divided by 2 have reminder 0
    if n % 2 != 0:
        #list length is odd
        middle_index = int((n - 1) / 2)
        median_ = list_obj[middle_index]
    else:
        upper_middle_index = int(n / 2)
        lower_middle_index = upper_middle_index - 1
        # pass slice with two middle values to mean()
        median_ = mean(list_obj[lower_middle_index : upper_middle_index + 1])

    return median_

def mode(list_obj):
    # use to record value(s) that appear most times
    max_count = 0
    # use to count occurrences of each value in list
    counter_dict = {}
    for value in list_obj:
        # count for each value should start at 0
        counter_dict[value] = 0
    for value in list_obj:
        # add on to the count of the value for each occurrence in list_obj
        counter_dict[value] += 1
    # make a list of the value (not keys) from the dictionary
    count_list = list(counter_dict.values())
    # and find the max value
    max_count = max(count_list)
    # use a generator to make a list of the values (keys) whose number of
    # occurences in the list match max_count
    mode_ = [key for key in counter_dict if counter_dict[key] == max_count]

    return mode_

def variance(list_obj, sample = False):
    # popvar(list) = sum((xi - list_mean)**2) / n for all xi in list
    # save mean value of list
    list_mean = mean(list_obj)
    # use n to calculate average of sum squared diffs
    n = len(list_obj)
    # create value we can add squared diffs to
    sum_sq_diff = 0
    for val in list_obj:
        # adds each squared diff to sum_sq_diff
        sum_sq_diff += (val - list_mean) ** 2
    if sample == False:
        # normalize result by dividing by n
        variance_ = sum_sq_diff / n
    else:
        # for samples, normalize by dividing by (n-1)
        variance_ = sum_sq_diff / (n - 1)

    return variance_

def SD(list_obj, sample = False):
    # Standard deviation is the square root of variance
    SD_ = variance(list_obj, sample) ** (1/2)

    return SD_

def covariance(list_obj1, list_obj2, sample = False):
    # determine the mean of each list
    mean1 = mean(list_obj1)
    mean2 = mean(list_obj2)
    # instantiate a variable holding the value of 0; this will be used to
    # sum the values generated in the for loop below
    cov = 0
    n1 = len(list_obj1)
    n2 = len(list_obj2)
    # check list lengths are equal
    if n1 == n2:
        n = n1
        # sum the product of the differences
        for i in range(n1):
            cov += (list_obj1[i] - mean1) * (list_obj2[i] - mean2)
        if sample == False:
            cov = cov / n
        # account for sample by dividing by one less than number of elements in l
        else:
            cov = cov / (n - 1)
        # return covariance
        return cov
    else:
        print("List lengths are not equal")
        print("List1:", n1)
        print("List2:", n2)


def correlation(list_obj1, list_obj2):
    # corr(x,y) = cov(x, y) / (SD(x) * SD(y))
    cov = covariance(list_obj1, list_obj2)
    SD1 = SD(list_obj1)
    SD2 = SD(list_obj2)
    corr = cov / (SD1 * SD2)
    return corr

def skewness(list_obj, sample = False):
    mean_ = mean(list_obj)
    SD_ = SD(list_obj, sample)
    skew = 0
    n = len(list_obj)
    for val in list_obj:
        skew += (val - mean_) ** 3
    skew = skew / (n * SD_ **3) if not sample else n * skew / ((n - 1)*(n - 2) *

    return skew

def kurtosis(list_obj, sample = False):
    mean_ = mean(list_obj)
    kurt = 0
    SD_ = SD(list_obj, sample)
    n = len(list_obj)
    for val in list_obj:
        kurt += (val - mean_) ** 4
    kurt = kurt / (n * SD_ ** 4) if sample == False else  n * (n + 1) * kurt / \
    ( (n - 1) * (n - 2) *(n - 3) * (SD_ ** 4)) - (3 *(n - 1) ** 2) / ((n - 2) * (

    return kurt
```

In [22]:

```
stats_df = gather_statistics(price_change_data, sample = True)
stats_df
```

Out[22]:

	MSFT	AAPL	FB	TSLA	GOOGL	AMZN	NFLX	WMT	TGT
mean	0.109	0.109	0.119	0.262	0.098	0.137	0.210	0.042	0.076
median	0.069	0.081	0.105	0.131	0.094	0.114	0.061	0.039	0.079
variance	2.597	3.220	5.378	12.267	2.527	3.648	9.109	1.512	2.650
S.D.	1.612	1.794	2.319	3.502	1.590	1.910	3.018	1.229	1.628
skewness	0.045	-0.120	0.945	0.432	0.512	0.552	1.722	0.606	0.795
kurtosis	10.759	6.442	18.582	6.246	11.409	8.212	24.779	17.359	20.559

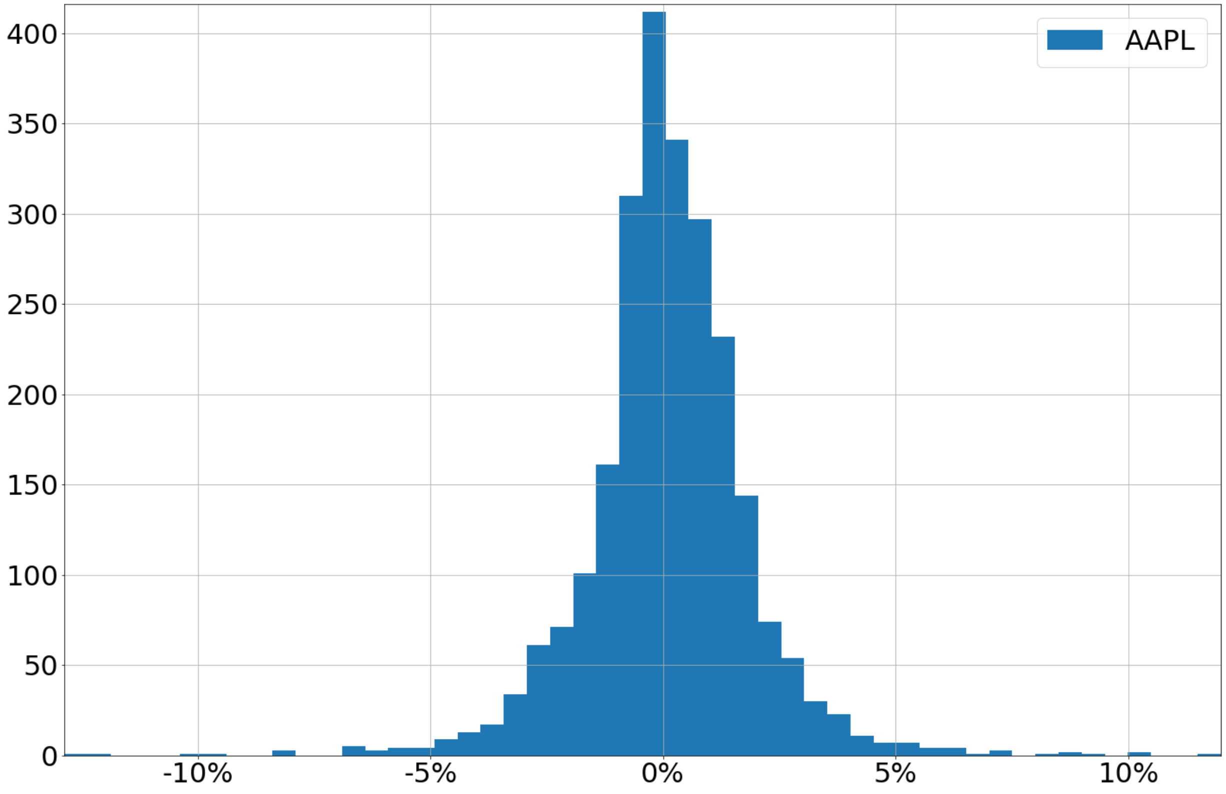
In [23]:

```
fig, ax = plt.subplots(figsize = (24, 16))
price_change_data["AAPL"].hist(bins = 50, label = "AAPL")
# set horizontal axis values as percent
x_vals = ax.get_xticks()
ax.set_xticklabels([str(int(x))+ "%" for x in x_vals])
plt.legend()
```

```
<ipython-input-23-0571c30e9031>:5: UserWarning: FixedFormatter should only be u
sed together with FixedLocator
  ax.set_xticklabels([str(int(x))+ "%" for x in x_vals])
```

Out[23]:

```
<matplotlib.legend.Legend at 0x235e1cacdc0>
```



In [ ]:

In [ ]: