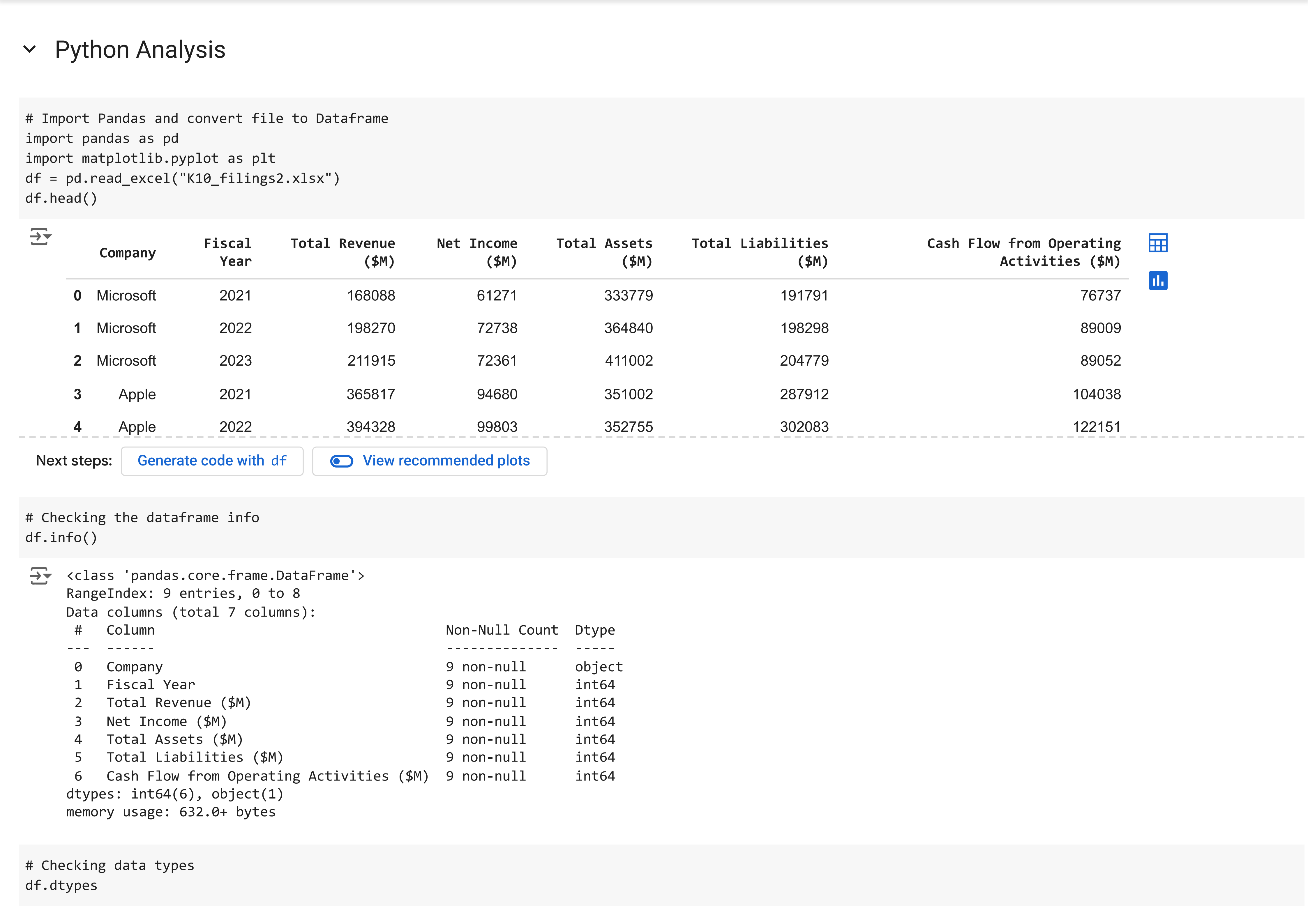


Python Analysis

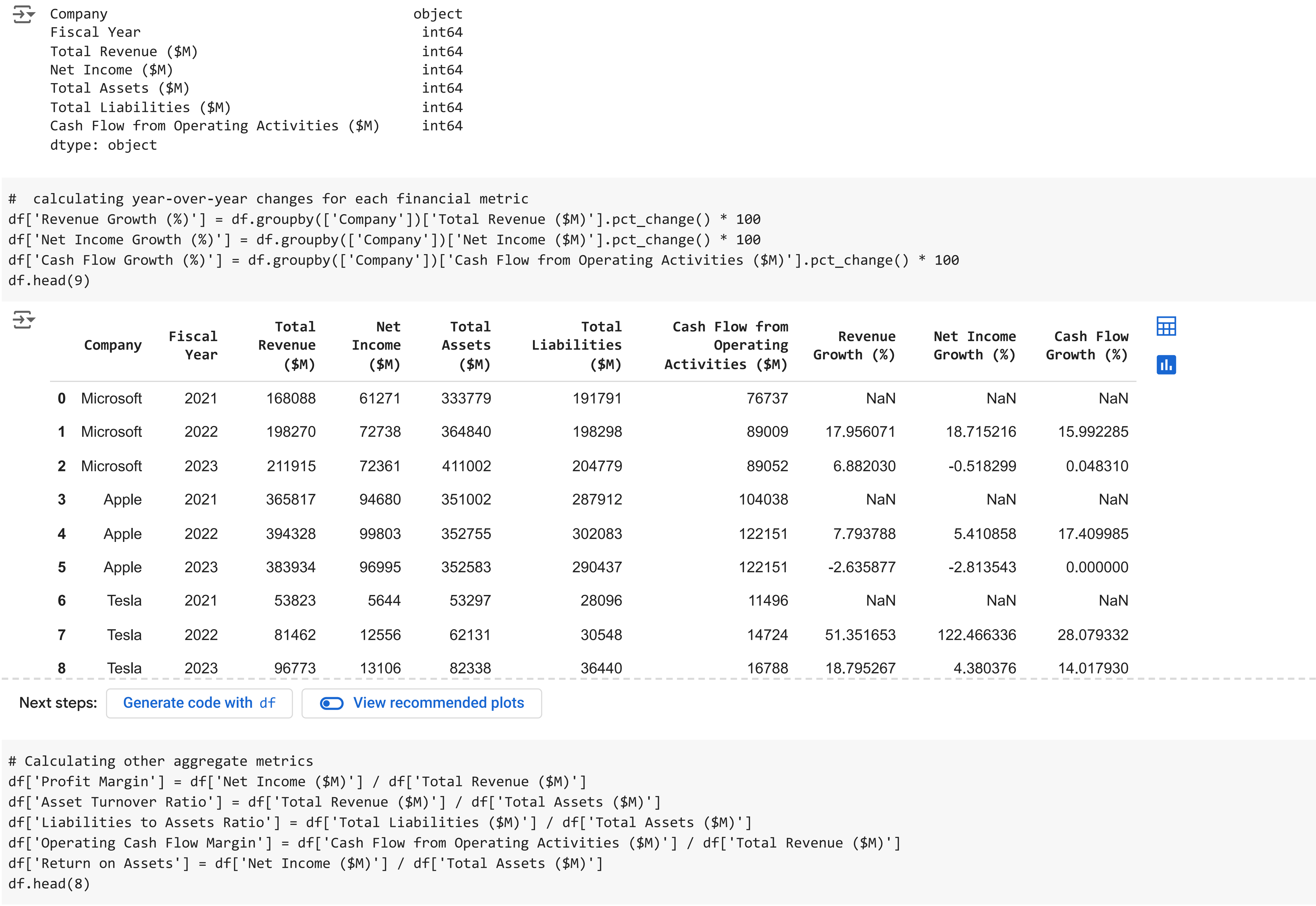
```
# Import Pandas and convert file to Dataframe
import pandas as pd
import matplotlib.pyplot as plt
df = pd.read_excel("K10_filings2.xlsx")
df.head()
```

	Company	Fiscal Year	Total Revenue ($M)	Net Income ($M)	Total Assets ($M)	Total Liabilities ($M)	Cash Flow from Operating Activities ($M)
0	Microsoft	2021	168088	61271	333779	191791	76737
1	Microsoft	2022	198270	72738	364840	198298	89009
2	Microsoft	2023	211915	72361	411002	204779	89052
3	Apple	2021	365817	94680	351002	287912	104038
4	Apple	2022	394328	99803	352755	302083	122151

```
# Checking the dataframe info
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9 entries, 0 to 8
Data columns (total 7 columns):
 #   Column                                   Non-Null Count  Dtype 
---  ------                                   --------------  ----- 
 0   Company                                  9 non-null      object
 1   Fiscal Year                              9 non-null      int64 
 2   Total Revenue ($M)                       9 non-null      int64 
 3   Net Income ($M)                          9 non-null      int64 
 4   Total Assets ($M)                        9 non-null      int64 
 5   Total Liabilities ($M)                   9 non-null      int64 
 6   Cash Flow from Operating Activities ($M)  9 non-null      int64 
dtypes: int64(6), object(1)
memory usage: 632.0+ bytes
```

```
# Checking data types
df.dtypes
```

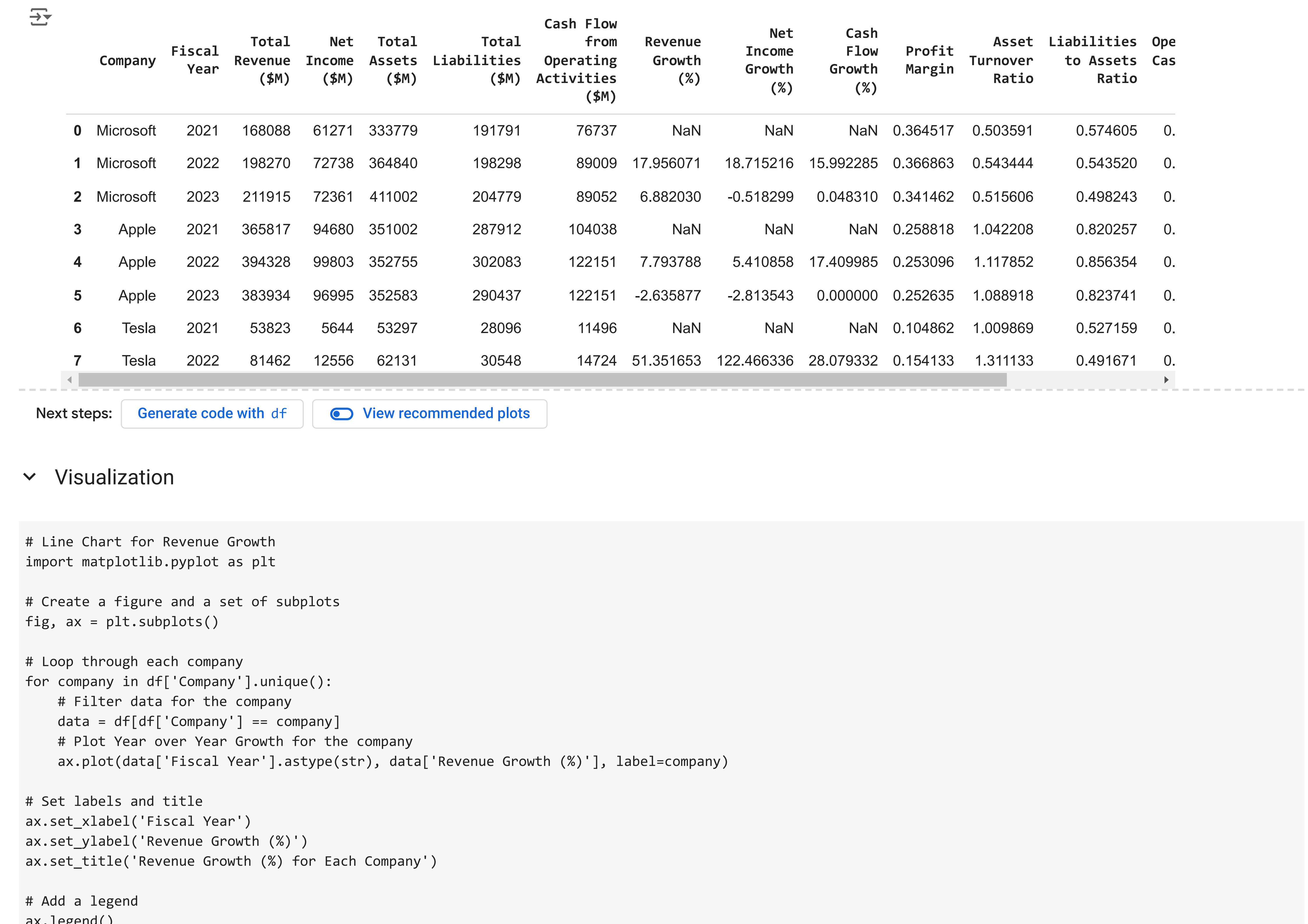


```
Company                                     object
Fiscal Year                                  int64
Total Revenue ($M)                           int64
Net Income ($M)                              int64
Total Assets ($M)                            int64
Total Liabilities ($M)                       int64
Cash Flow from Operating Activities ($M)     int64
dtype: object
```

```
#  calculating year-over-year changes for each financial metric
df['Revenue Growth (%)'] = df.groupby(['Company'])['Total Revenue ($M)'].pct_change() * 100
df['Net Income Growth (%)'] = df.groupby(['Company'])['Net Income ($M)'].pct_change() * 100
df['Cash Flow Growth (%)'] = df.groupby(['Company'])['Cash Flow from Operating Activities ($M)'].pct_change() * 100
df.head(9)
```

	Company	Fiscal Year	Total Revenue ($M)	Net Income ($M)	Total Assets ($M)	Total Liabilities ($M)	Cash Flow from Operating Activities ($M)	Revenue Growth (%)	Net Income Growth (%)	Cash Flow Growth (%)
0	Microsoft	2021	168088	61271	333779	191791	76737	NaN	NaN	NaN
1	Microsoft	2022	198270	72738	364840	198298	89009	17.956071	18.715216	15.992285
2	Microsoft	2023	211915	72361	411002	204779	89052	6.882030	-0.518299	0.048310
3	Apple	2021	365817	94680	351002	287912	104038	NaN	NaN	NaN
4	Apple	2022	394328	99803	352755	302083	122151	7.793788	5.410858	17.409985
5	Apple	2023	383934	96995	352583	290437	122151	-2.635877	-2.813543	0.000000
6	Tesla	2021	53823	5644	53297	28096	11496	NaN	NaN	NaN
7	Tesla	2022	81462	12556	62131	30548	14724	51.351653	122.466336	28.079332
8	Tesla	2023	96773	13106	82338	36440	16788	18.795267	4.380376	14.017930

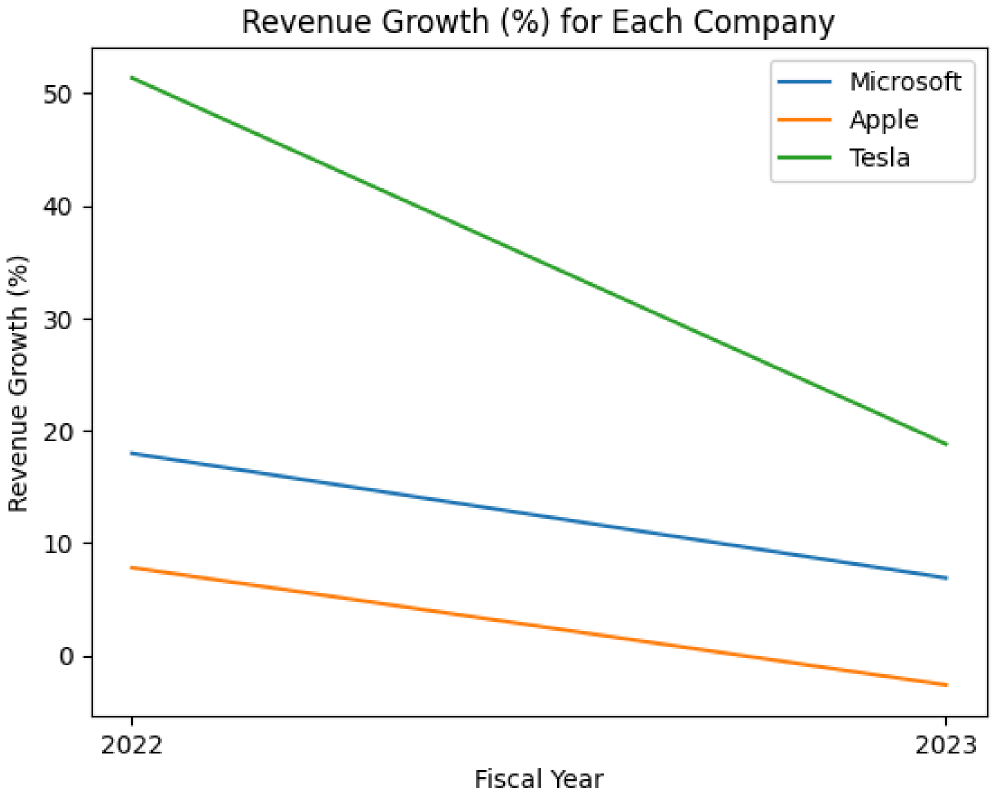
```
# Calculating other aggregate metrics
df['Profit Margin'] = df['Net Income ($M)'] / df['Total Revenue ($M)']
df['Asset Turnover Ratio'] = df['Total Revenue ($M)'] / df['Total Assets ($M)']
df['Liabilities to Assets Ratio'] = df['Total Liabilities ($M)'] / df['Total Assets ($M)']
df['Operating Cash Flow Margin'] = df['Cash Flow from Operating Activities ($M)'] / df['Total Revenue ($M)']
df['Return on Assets'] = df['Net Income ($M)'] / df['Total Assets ($M)']
df.head(8)
```



	Company	Fiscal Year	Total Revenue ($M)	Net Income ($M)	Total Assets ($M)	Total Liabilities ($M)	Cash Flow from Operating Activities ($M)	Revenue Growth (%)	Net Income Growth (%)	Cash Flow Growth (%)	Profit Margin	Asset Turnover Ratio	Liabilities to Assets Ratio	Ope Cas
0	Microsoft	2021	168088	61271	333779	191791	76737	NaN	NaN	NaN	0.364517	0.503591	0.574605	0.
1	Microsoft	2022	198270	72738	364840	198298	89009	17.956071	18.715216	15.992285	0.366863	0.543444	0.543520	0.
2	Microsoft	2023	211915	72361	411002	204779	89052	6.882030	-0.518299	0.048310	0.341462	0.515606	0.498243	0.
3	Apple	2021	365817	94680	351002	287912	104038	NaN	NaN	NaN	0.258818	1.042208	0.820257	0.
4	Apple	2022	394328	99803	352755	302083	122151	7.793788	5.410858	17.409985	0.253096	1.117852	0.856354	0.
5	Apple	2023	383934	96995	352583	290437	122151	-2.635877	-2.813543	0.000000	0.252635	1.088918	0.823741	0.
6	Tesla	2021	53823	5644	53297	28096	11496	NaN	NaN	NaN	0.104862	1.009869	0.527159	0.
7	Tesla	2022	81462	12556	62131	30548	14724	51.351653	122.466336	28.079332	0.154133	1.311133	0.491671	0.

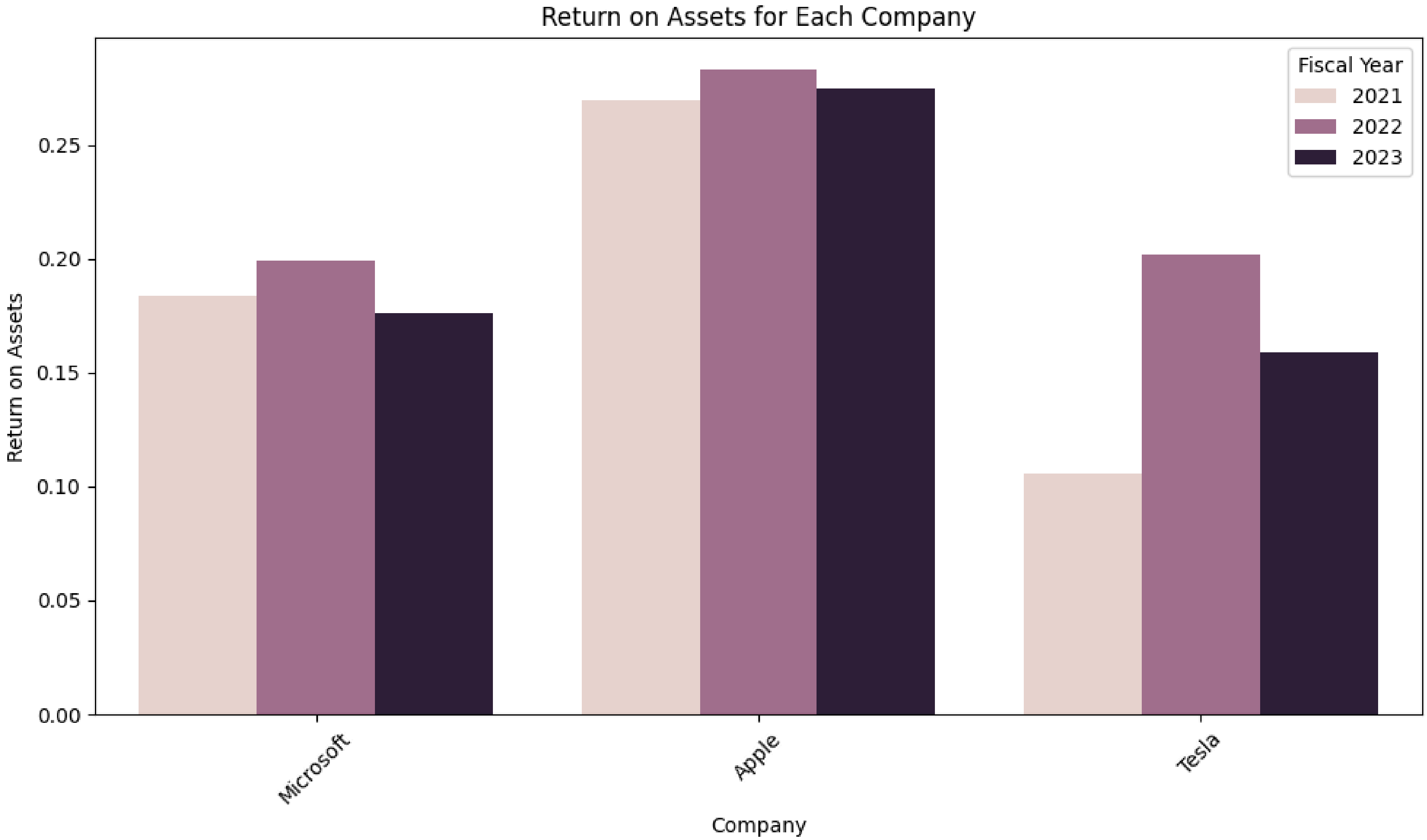
Visualization

```
# Line Chart for Revenue Growth
import matplotlib.pyplot as plt

# Create a figure and a set of subplots
fig, ax = plt.subplots()

# Loop through each company
for company in df['Company'].unique():
    # Filter data for the company
    data = df[df['Company'] == company]
    # Plot Year over Year Growth for the company
    ax.plot(data['Fiscal Year'].astype(str), data['Revenue Growth (%)'], label=company)

# Set labels and title
ax.set_xlabel('Fiscal Year')
ax.set_ylabel('Revenue Growth (%)')
ax.set_title('Revenue Growth (%) for Each Company')

# Add a legend
ax.legend()
ax.legend()


# Save the figure
plt.show()
```

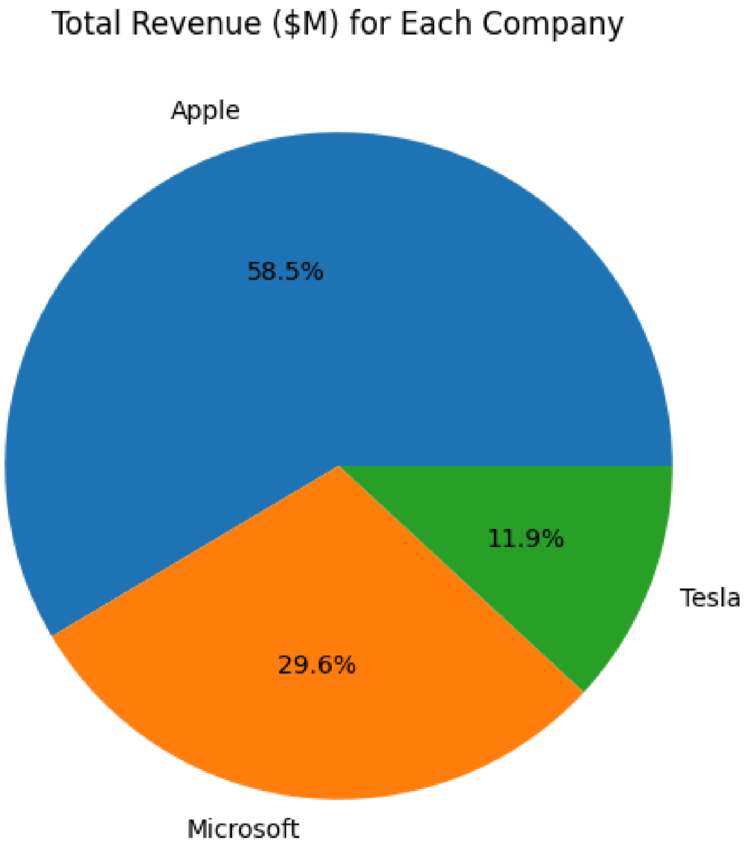


```
# Bar Chart for Return on Assets
import seaborn as sns

plt.figure(figsize=(10,6))
sns.barplot(x='Company', y='Return on Assets', hue='Fiscal Year', data=df, ci=None)
plt.title('Return on Assets for Each Company')
plt.ylabel('Return on Assets')
plt.xlabel('Company')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
plt.close()
```

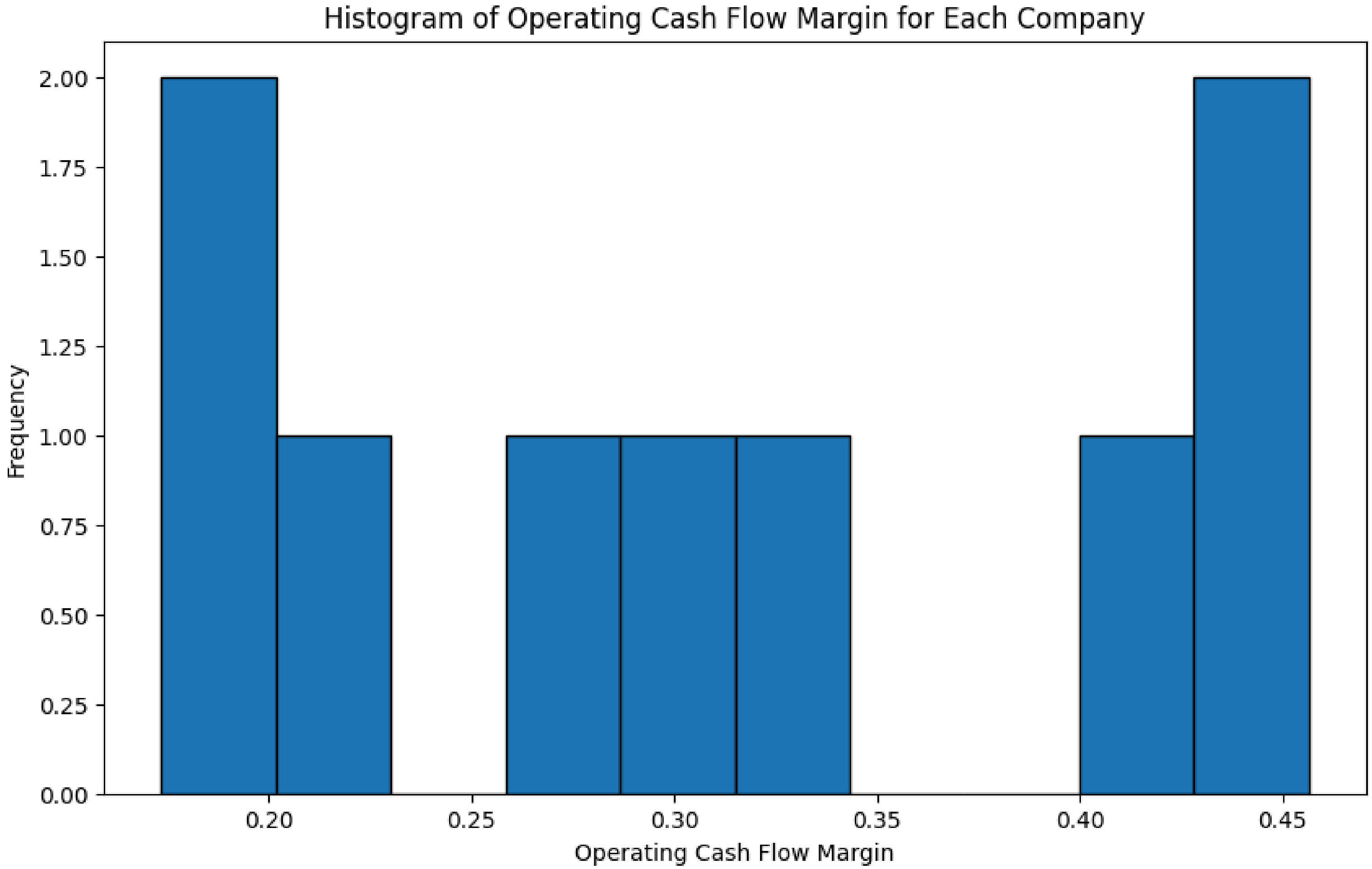
```
<ipython-input-41-dcf589915ac1>:5: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=None` for the same effect.

  sns.barplot(x='Company', y='Return on Assets', hue='Fiscal Year', data=df, ci=None)
```



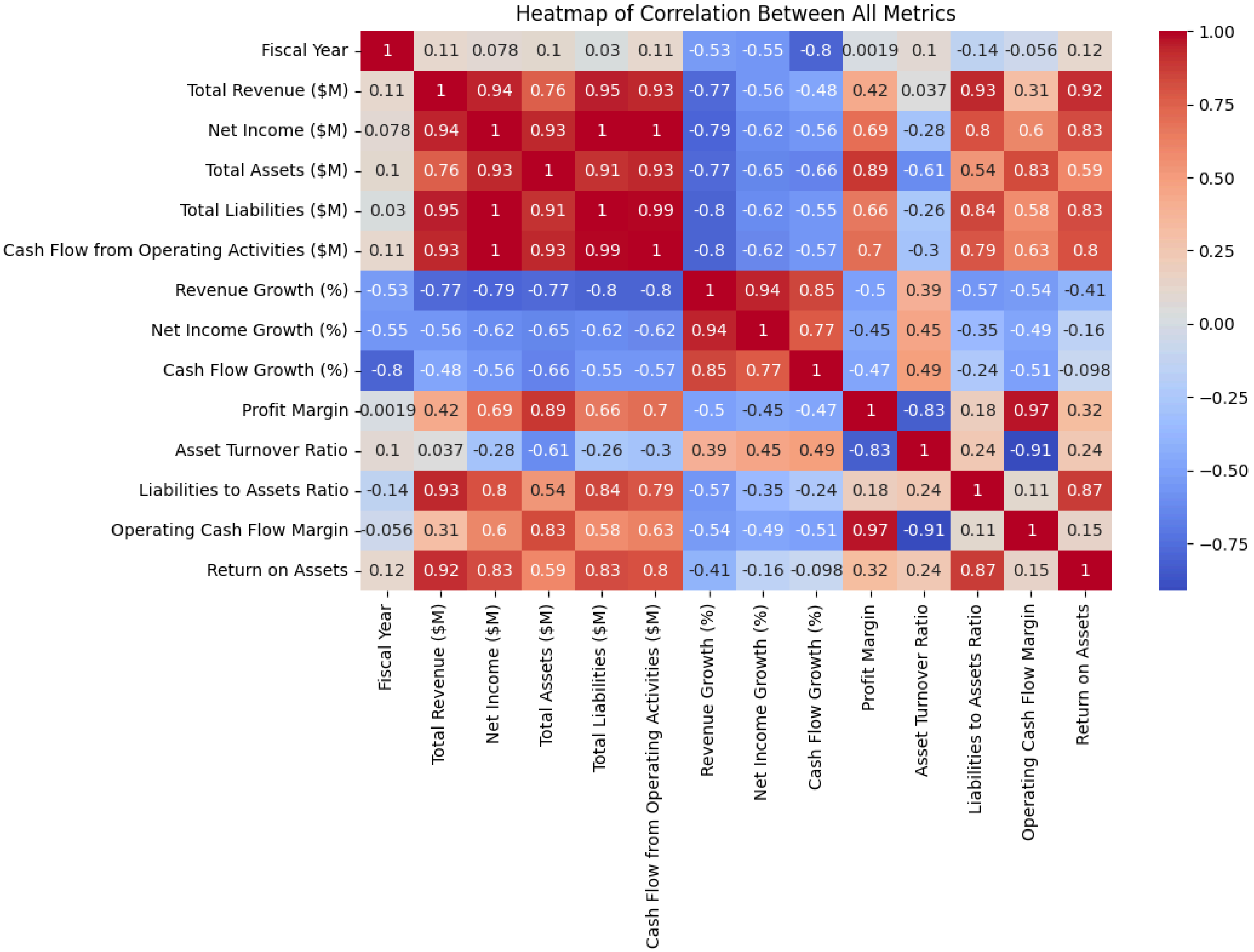
```
# Pie Chart for Total Revenue ($M)
# Group by 'Company' and sum 'Total Revenue ($M)'
revenue_sum = df.groupby('Company')['Total Revenue ($M)'].sum()

# Plotting
plt.figure(figsize=(10,6))
plt.pie(revenue_sum, labels=revenue_sum.index, autopct='%1.1f%%')
plt.title('Total Revenue ($M) for Each Company')
plt.show()
plt.show()
plt.close()
```



```
# Histogram for Operating Cash Flow Margin
plt.figure(figsize=(10,6))
plt.hist(df['Operating Cash Flow Margin'], bins=10, edgecolor='black')
plt.title('Histogram of Operating Cash Flow Margin for Each Company')
plt.xlabel('Operating Cash Flow Margin')
plt.ylabel('Frequency')
plt.show()
plt.close()
```



```
# Heatmap for correlation between all metrics
# Calculate correlation matrix
corr = df.select_dtypes(include=['float64', 'int64']).corr()

# Plotting
plt.figure(figsize=(10,6))
sns.heatmap(corr, annot=True, cmap='coolwarm')
plt.title('Heatmap of Correlation Between All Metrics')
plt.show()
plt.close()
```


Heatmap of Correlation Between All Metrics
Fiscal Year 1 0.11 0.078 0.1 0.03 0.11 -0.53 -0.55 -0.8 0.0019 0.1 -0.14 -0.056 0.12
Total Revenue ($M) 0.11 1 0.94 0.76 0.95 0.93 -0.77 -0.56 -0.48 0.42 0.037 0.93 0.31 0.92
Net Income ($M) 0.078 0.94 1 0.93 1 1 -0.79 -0.62 -0.56 0.69 -0.28 0.8 0.6 0.83
Total Assets ($M) 0.1 0.76 0.93 1 0.91 0.93 -0.77 -0.65 -0.66 0.89 -0.61 0.54 0.83 0.59
Total Liabilities ($M) 0.03 0.95 1 0.91 1 0.99 -0.8 -0.62 -0.55 0.66 -0.26 0.84 0.58 0.83
Cash Flow from Operating Activities ($M) 0.11 0.93 1 0.93 0.99 1 -0.8 -0.62 -0.57 0.7 -0.3 0.79 0.63 0.8
Revenue Growth (%) -0.53 -0.77 -0.79 -0.77 -0.8 -0.8 1 0.94 0.85 -0.5 0.39 -0.57 -0.54 -0.41
Net Income Growth (%) -0.55 -0.56 -0.62 -0.65 -0.62 -0.62 0.94 1 0.77 -0.45 0.45 -0.35 -0.49 -0.16
Cash Flow Growth (%) -0.8 -0.48 -0.56 -0.66 -0.55 -0.57 0.85 0.77 1 -0.47 0.49 -0.24 -0.51 -0.098
Profit Margin 0.0019 0.42 0.69 0.89 0.66 0.7 -0.5 -0.45 -0.47 1 -0.83 0.18 0.97 0.32
Asset Turnover Ratio 0.1 0.037 -0.28 -0.61 -0.26 -0.3 0.39 0.45 0.49 -0.83 1 0.24 -0.91 0.24
Liabilities to Assets Ratio -0.14 0.93 0.8 0.54 0.84 0.79 -0.57 -0.35 -0.24 0.18 0.24 1 0.11 0.87
Operating Cash Flow Margin -0.056 0.31 0.6 0.83 0.58 0.63 -0.54 -0.49 -0.51 0.97 -0.91 0.11 1 0.15
Return on Assets 0.12 0.92 0.83 0.59 0.83 0.8 -0.41 -0.16 -0.098 0.32 0.24 0.87 0.15 1
Fiscal Year
Total Revenue ($M)
Net Income ($M)
Total Assets ($M)
Total Liabilities ($M)
Cash Flow from Operating Activities ($M)
Revenue Growth (%)
Net Income Growth (%)
Cash Flow Growth (%)
Profit Margin
Asset Turnover Ratio
Liabilities to Assets Ratio
Operating Cash Flow Margin
Return on Assets
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75

```
# Statistical Analysis
df.describe()
```

	Fiscal Year	Total Revenue ($M)	Net Income ($M)	Total Assets ($M)	Total Liabilities ($M)	Cash Flow from Operating Activities ($M)	Revenue Growth (%)	Net Income Growth (%)	Cash Flow Growth (%)	Profit Margin	A Turn R
count	9.000000	9.000000	9.000000	9.000000	9.000000	9.000000	6.000000	6.000000	6.000000	9.000000	9.00
mean	2022.000000	217156.666667	58794.888889	262636.333333	174487.111111	71794.000000	16.690488	24.606824	12.591307	0.247980	0.92
std	0.866025	134014.610537	38509.352943	149194.647062	114880.429443	45618.598471	18.741898	48.522032	10.886398	0.099106	0.31
min	2021.000000	53823.000000	5644.000000	53297.000000	28096.000000	11496.000000	-2.635877	-2.813543	0.000000	0.104862	0.50
25%	2021.000000	96773.000000	13106.000000	82338.000000	36440.000000	16788.000000	7.109969	0.706370	3.540715	0.154133	0.54
50%	2022.000000	198270.000000	72361.000000	351002.000000	198298.000000	89009.000000	12.874929	4.895617	15.005108	0.253096	1.04
75%	2023.000000	365817.000000	94680.000000	352755.000000	287912.000000	104038.000000	18.585468	15.389126	17.055560	0.341462	1.11
max	2023.000000	394328.000000	99803.000000	411002.000000	302083.000000	122151.000000	51.351653	122.466336	28.079332	0.366863	1.31

```
# Saving the dataframe to excel spreadsheet
df.to_excel("K10_filings3.xlsx", index=False)
```

Summary of Analysis

From the analysis, Microsoft and Apple have demonstrated a strong financial performance and consistent revenue growth. Microsoft in 2022 showed a significant growth in their net income and in their operating cash flow but seemed to face a slight decline in 2023. Apple's financial performance on the other hand has indicated robust growth, this can be seen in their operating cash flow and there they have also maintained a high efficiency in asset utilization. However, it will be good to note that Apple's liabilities have increased relative to its assets, and this can be a point of concern.

Lastly, Tesla has also demonstrated a strong financial growth with substantial increase in their revenue and net income especially in 2022. Tesla has also been able to improve on its balance sheet by decreasing their liabilities-to-asset ratio and a strong cash flow growth. Even though Tesla had a slight decline in their profit margin and operating cash flow margin in 2023, they were still able to maintain a high efficiency in their asset utilization and profitability.

Overall, All the three companies have demonstrated a robust financial health and a strong growth trajectory.