Apple Inc - Machine Learning/ Fundamental / Technical

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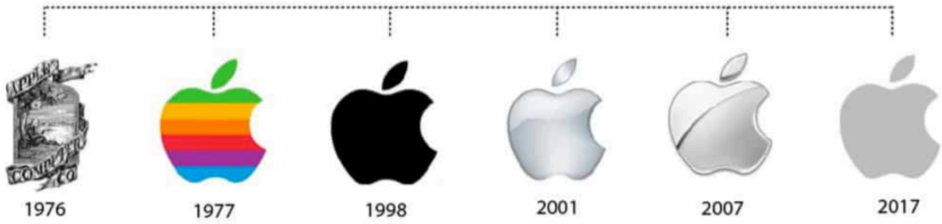


In [518…

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import pyttsx3
from sklearn.linear_model import LinearRegression
```

Apple Inc. is a multinational technology company that is best known for its innovative products, including the iPhone, iPad, and Mac computers. The company was founded in 1976 by Steve Jobs, Steve Wozniak, and Ronald Wayne, and it has since become one of the world's largest and most valuable companies. Apple has a strong brand image and is well-known for its sleek and user-friendly products, as well as its commitment to privacy and security. In addition to its consumer products, Apple also offers a range of services, including the App Store, Apple Music, and iCloud. The company's products and services are used by millions of people around the world, making Apple a leader in the technology industry.

Apple Inc. is one of the largest technology companies in the world, and has a market capitalization of over $2 trillion as of 2021. The company designs, develops, and sells consumer electronics, computer software, and online services. Apple's product line includes the iPhone smartphone, the iPad tablet computer, the Mac personal computer, the iPod portable media player, the Apple Watch smartwatch, the Apple TV digital media player, and the HomePod smart speaker.

Apple has retail stores in over 50 countries, including over 500 retail locations in the United States alone. The company's stores are designed to be a place for customers to try out and purchase Apple products, as well as receive support and training.

Apple's products are manufactured by a variety of companies, including Foxconn Technology Group, which is based in Taiwan. The company has faced criticism for the working conditions in its factories, and has taken steps to improve conditions and increase transparency. Despite these challenges, Apple remains one of the most valuable and influential companies in the world, and continues to push the boundaries of technology and design.

1. Creating dataset from apple financials.

https://investor.apple.com/investor-relations/default.aspx

In [406…

```
apple = [['Revenue', 170910, 182795, 233715, 215639, 229234, 265595, 2601
         ['Revenue Growth', 9.2, 7.0, 27.9, -7.7, 6.3, 15.9, -2.0, 5.5, 33
         ['Gross Profit', 64304, 70537, 93626, 84263, 88186, 101839, 98392
         ['Gross Margin %', 37.6, 38.6, 40.1, 39.1, 38.5, 38.3, 37.8, 38.2
         ['Operating Profit', 48999, 52503, 71230, 60024, 61344, 70898, 63
         ['Operating Margin %', 28.7, 28.7, 30.5, 27.8, 26.8, 26.7, 24.6,
         ['Earnings Per Share', 1.42, 1.61, 2.31, 2.08, 2.30, 2.98, 2.97,
         ['EPS Growth', -10.0, 13.6, 42.9, -9.8, 10.8, 29.4, -0.3, 10.4, 7
         ['Dividends Per Share', 0.41, 0.45, 0.50, 0.55, 0.60, 0.68, 0.75,
         ['Dividend Growth', 328.4, 11.3, 9.3, 10.1, 10.1, 13.3, 10.3, 6.0
         ['Return on Assets', 19.3, 18.0, 20.5, 14.9, 13.9, 16.1, 15.7, 17
         ['Return on Equity', 30.6, 33.6, 46.2, 36.9, 36.9, 49.4, 55.9, 73
         ['Return on Invested Capital', 28.6, 27.5, 32.3, 22.9, 20.8, 25.3
columns = ['Metric',
           '2013',
           '2014',
           '2015',
           '2016',
           '2017',
           '2018',
           '2019',
           '2020',
           '2021',
           '2022']
```

2. Creating dataframe

In [407…

```
df = pd.DataFrame(apple, columns=columns)
```

3. Return on Invested Capital

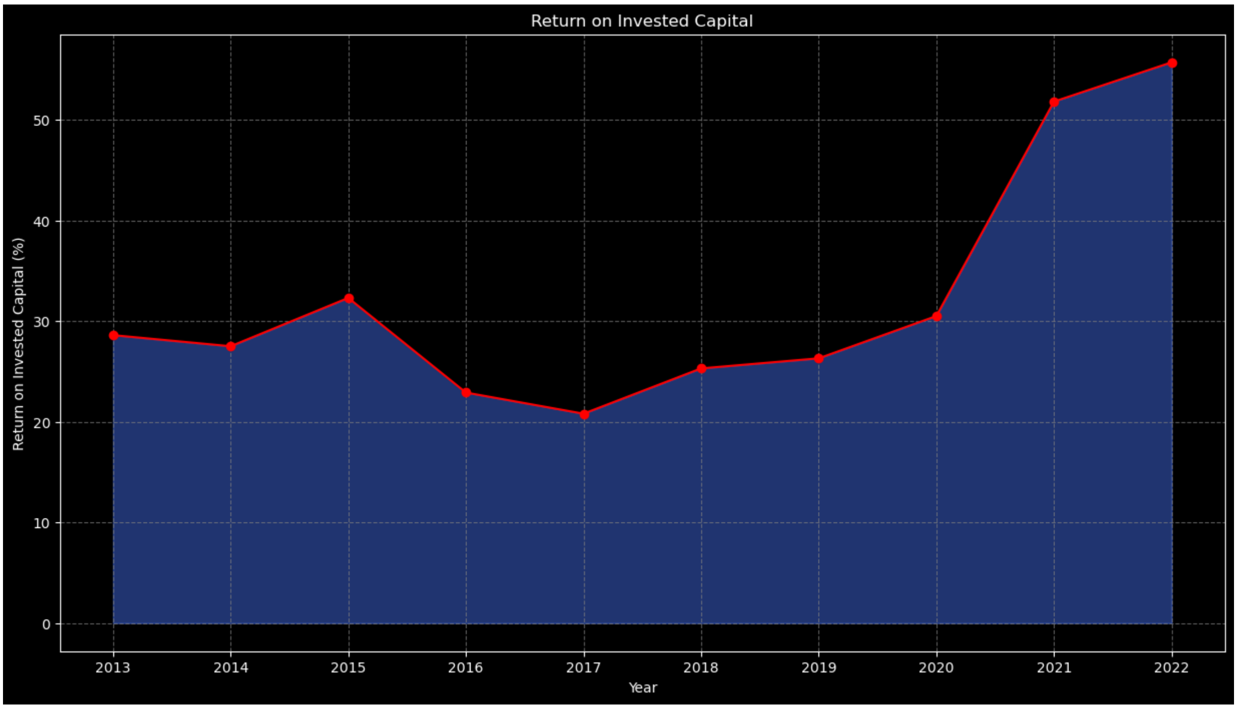
In [408...
```
roic_data = df[df['Metric'] == 'Return on Invested Capital'].iloc[0, 1:].
```

In [409...
```
roic_data
```

Out[409]:
```
[28.6, 27.5, 32.3, 22.9, 20.8, 25.3, 26.3, 30.5, 51.8, 55.7]
```

4. Ploting ROI with respect to time

In [366...
```
plt.style.use('dark_background')
plt.figure(figsize=(15,8))
plt.plot(columns[1:], roic_data, 'o-', color="red")
plt.fill_between(columns[1:], 0, roic_data, alpha=0.5, color="royalblue")
plt.title("Return on Invested Capital")
plt.xlabel("Year")
plt.ylabel("Return on Invested Capital (%)")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.show()
```



5. Machine Learning Model for performance analysis through trend

In [367...
```
from sklearn.linear_model import LinearRegression
```

In [368...
```
revenue = df[df['Metric'] == 'Revenue'].iloc[0, 1:].tolist()
gross_profit = df[df['Metric'] == 'Gross Profit'].iloc[0, 1:].tolist()
operating_profit = df[df['Metric'] == 'Operating Profit'].iloc[0, 1:].tol
earnings_per_share = df[df['Metric'] == 'Earnings Per Share'].iloc[0, 1:]
dividends_per_share = df[df['Metric'] == 'Dividends Per Share'].iloc[0, 1
```

In [369…

```
revenue
```

Out[369]:

```
[170910.0,
 182795.0,
 233715.0,
 215639.0,
 229234.0,
 265595.0,
 260174.0,
 274515.0,
 365817.0,
 394328.0]
```

In [370…

```
gross_profit
```

Out[370]:

```
[64304.0,
 70537.0,
 93626.0,
 84263.0,
 88186.0,
 101839.0,
 98392.0,
 104956.0,
 152836.0,
 170782.0]
```

In [371…

```
operating_profit
```

Out[371]:

```
[48999.0,
 52503.0,
 71230.0,
 60024.0,
 61344.0,
 70898.0,
 63930.0,
 66288.0,
 108949.0,
 119437.0]
```

In [372…

```
earnings_per_share
```

Out[372]:

```
[1.42, 1.61, 2.31, 2.08, 2.3, 2.98, 2.97, 3.28, 5.61, 6.11]
```

In [373…

```
dividends_per_share
```

Out[373]:

```
[0.41, 0.45, 0.5, 0.55, 0.6, 0.68, 0.75, 0.8, 0.85, 0.9]
```

6. Features and target variables

In [374…

```
financial_data = np.array([revenue, gross_profit, operating_profit, earni
financial_data = financial_data.T
financial_data
```

Out[374]:
```
array([[1.70910e+05, 6.43040e+04, 4.89990e+04, 1.42000e+00, 4.10000e-01]
,
          [1.82795e+05, 7.05370e+04, 5.25030e+04, 1.61000e+00, 4.50000e-01]
,
          [2.33715e+05, 9.36260e+04, 7.12300e+04, 2.31000e+00, 5.00000e-01]
,
          [2.15639e+05, 8.42630e+04, 6.00240e+04, 2.08000e+00, 5.50000e-01]
,
          [2.29234e+05, 8.81860e+04, 6.13440e+04, 2.30000e+00, 6.00000e-01]
,
          [2.65595e+05, 1.01839e+05, 7.08980e+04, 2.98000e+00, 6.80000e-01]
,
          [2.60174e+05, 9.83920e+04, 6.39300e+04, 2.97000e+00, 7.50000e-01]
,
          [2.74515e+05, 1.04956e+05, 6.62880e+04, 3.28000e+00, 8.00000e-01]
,
          [3.65817e+05, 1.52836e+05, 1.08949e+05, 5.61000e+00, 8.50000e-01]
,
          [3.94328e+05, 1.70782e+05, 1.19437e+05, 6.11000e+00, 9.00000e-01]
])
```

In [375…
```
years = np.array([2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2
years
```

Out[375]:
```
array([[2013],
          [2014],
          [2015],
          [2016],
          [2017],
          [2018],
          [2019],
          [2020],
          [2021],
          [2022]])
```

y = β0 + β1 *Year + β2* Revenue + β3 *Gross Profit + β4* Operating Profit + β5 *Earnings Per Share + β6* Dividends Per Share

Here, y represents the financial metric, Year is the independent variable, and β0, β1, β2, β3, β4, β5, and β6 are the coefficients estimated by the linear regression model. The coefficients represent the change in the financial metric for each unit change in the year and the respective financial metric.

7. Trainning Model

In [376…
```
reg = LinearRegression().fit(years, financial_data)
reg
```

Out[376]:
```
▾ LinearRegression
LinearRegression()
```

In [377…
```
intercept = reg.intercept_
coefficients = reg.coef_

print("Intercept:", intercept)
print("Coefficients:", coefficients)
```

```
Intercept: [-4.45644668e+07 -2.00363854e+07 -1.24682486e+07 -9.55673455e+
02
 -1.14165091e+02]
Coefficients: [[2.22174667e+04]
 [9.98233333e+03]
 [6.21591515e+03]
 [4.75212121e-01]
 [5.69090909e-02]]
```

8. Prediction

In [378…
```
predictions = reg.predict(years)
predictions
```

Out[378]:
```
array([[1.59293600e+05, 5.80516000e+04, 4.43885818e+04, 9.28545455e-01,
        3.92909091e-01],
       [1.81511067e+05, 6.80339333e+04, 5.06044970e+04, 1.40375758e+00,
        4.49818182e-01],
       [2.03728533e+05, 7.80162667e+04, 5.68204121e+04, 1.87896970e+00,
        5.06727273e-01],
       [2.25946000e+05, 8.79986000e+04, 6.30363273e+04, 2.35418182e+00,
        5.63636364e-01],
       [2.48163467e+05, 9.79809333e+04, 6.92522424e+04, 2.82939394e+00,
        6.20545455e-01],
       [2.70380933e+05, 1.07963267e+05, 7.54681576e+04, 3.30460606e+00,
        6.77454545e-01],
       [2.92598400e+05, 1.17945600e+05, 8.16840727e+04, 3.77981818e+00,
        7.34363636e-01],
       [3.14815867e+05, 1.27927933e+05, 8.78999879e+04, 4.25503030e+00,
        7.91272727e-01],
       [3.37033333e+05, 1.37910267e+05, 9.41159030e+04, 4.73024242e+00,
        8.48181818e-01],
       [3.59250800e+05, 1.47892600e+05, 1.00331818e+05, 5.20545455e+00,
        9.05090909e-01]])
```

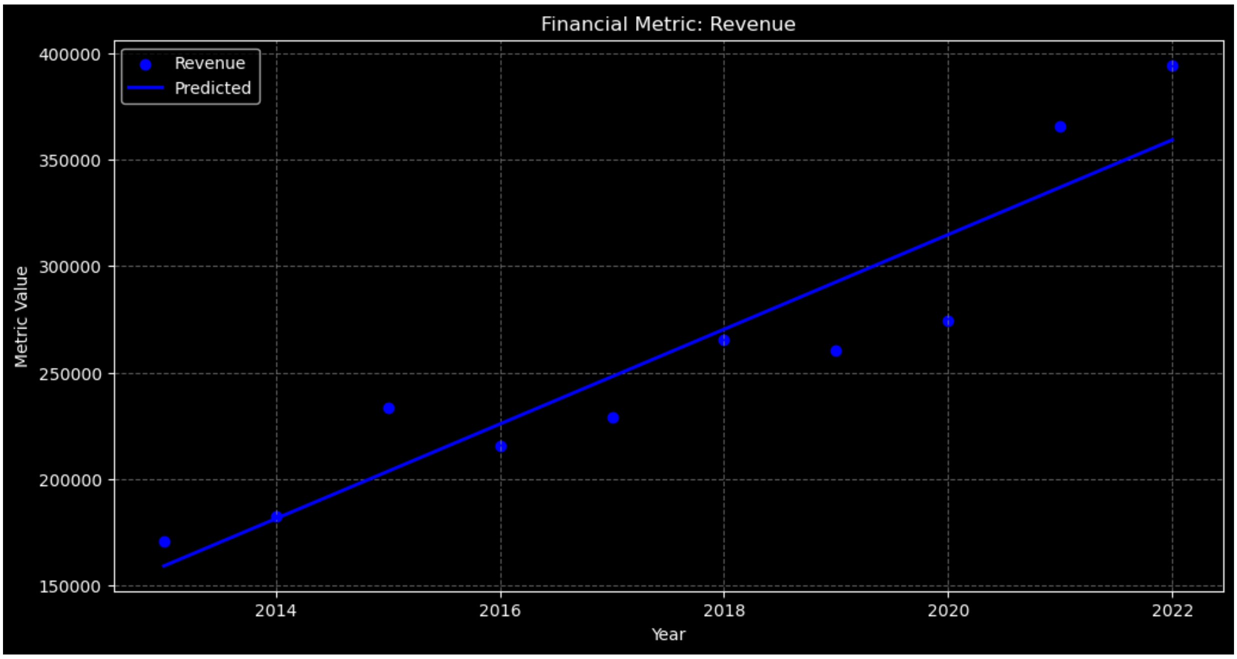
9. Plotting and checking performance

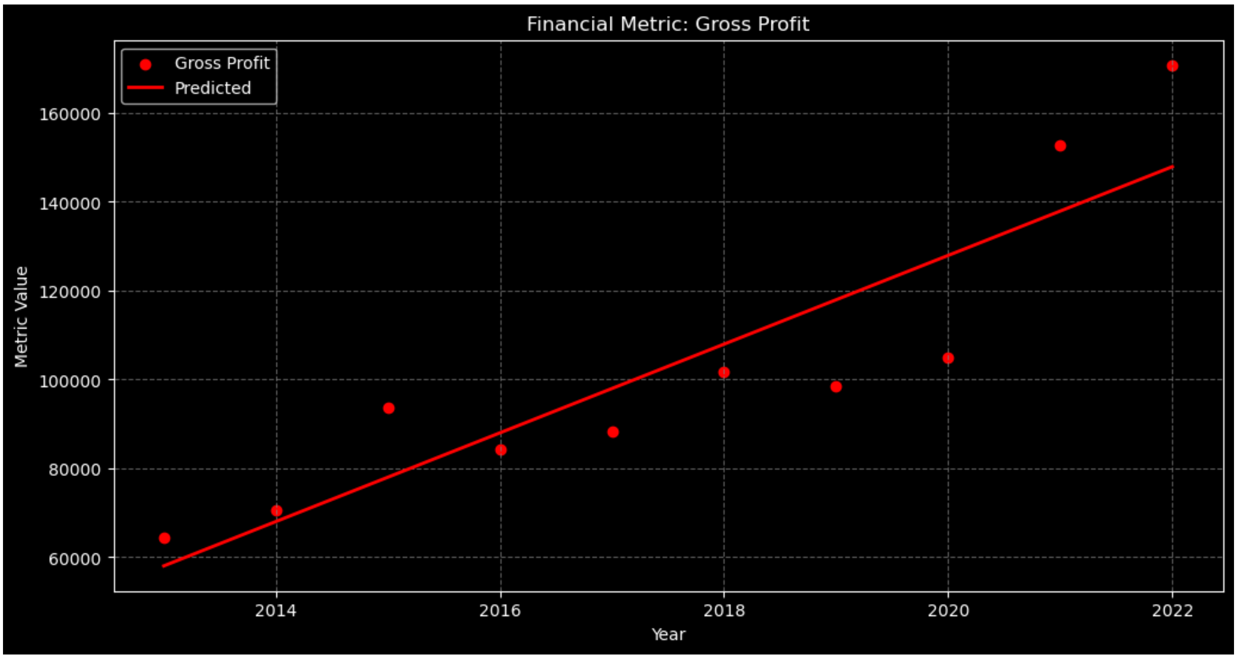
Plotting 'Revenue', 'Gross Profit', 'Operating Profit', 'Earnings Per Share', and 'Dividends Per Share'show psotive upward trend.

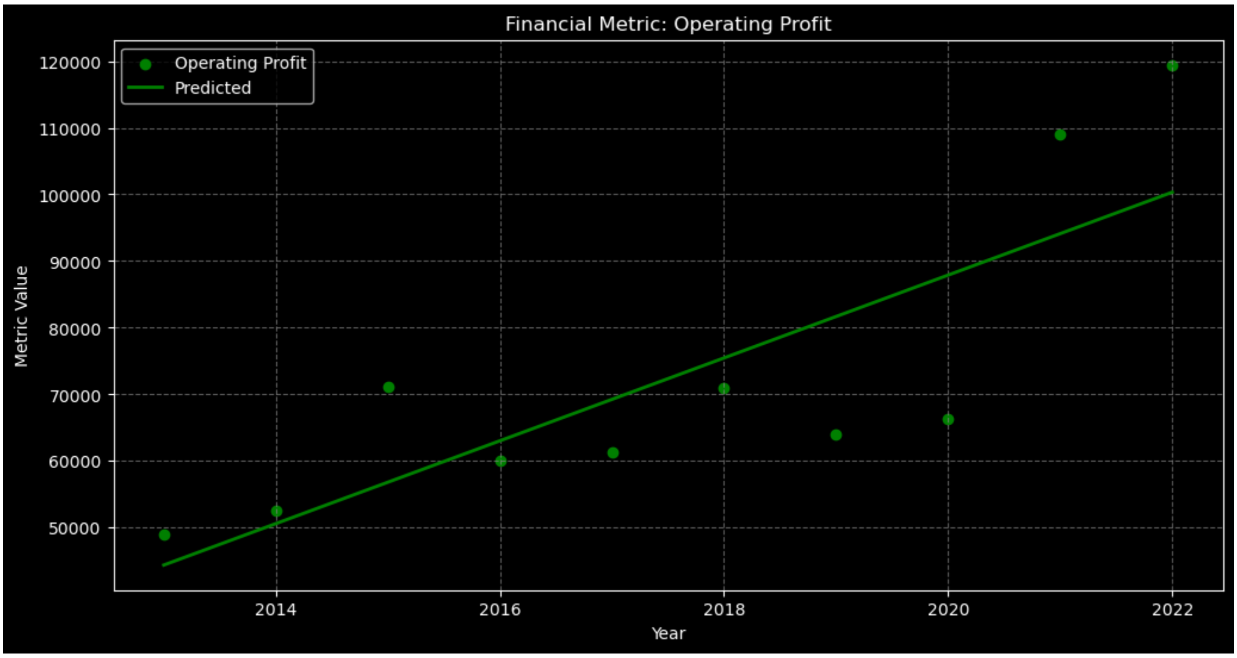
In [379…
```
colors = ['blue', 'red', 'green', 'white', 'purple']
metrics = ['Revenue', 'Gross Profit', 'Operating Profit', 'Earnings Per S
```

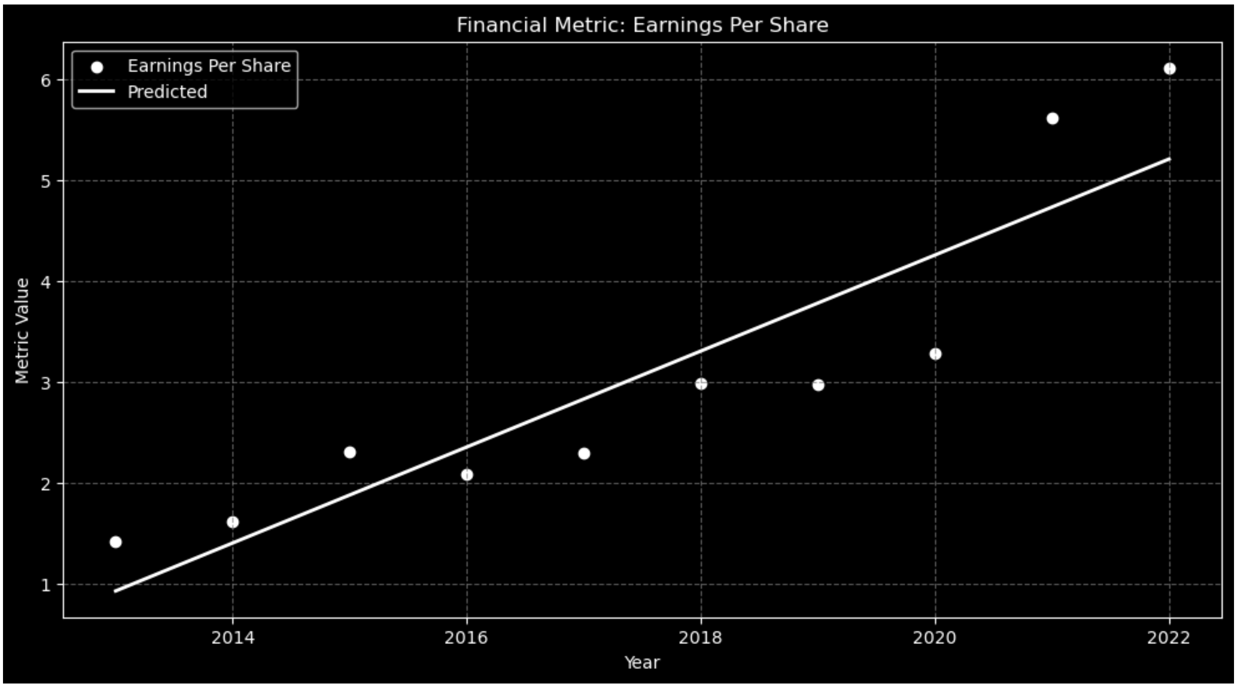
In [380…

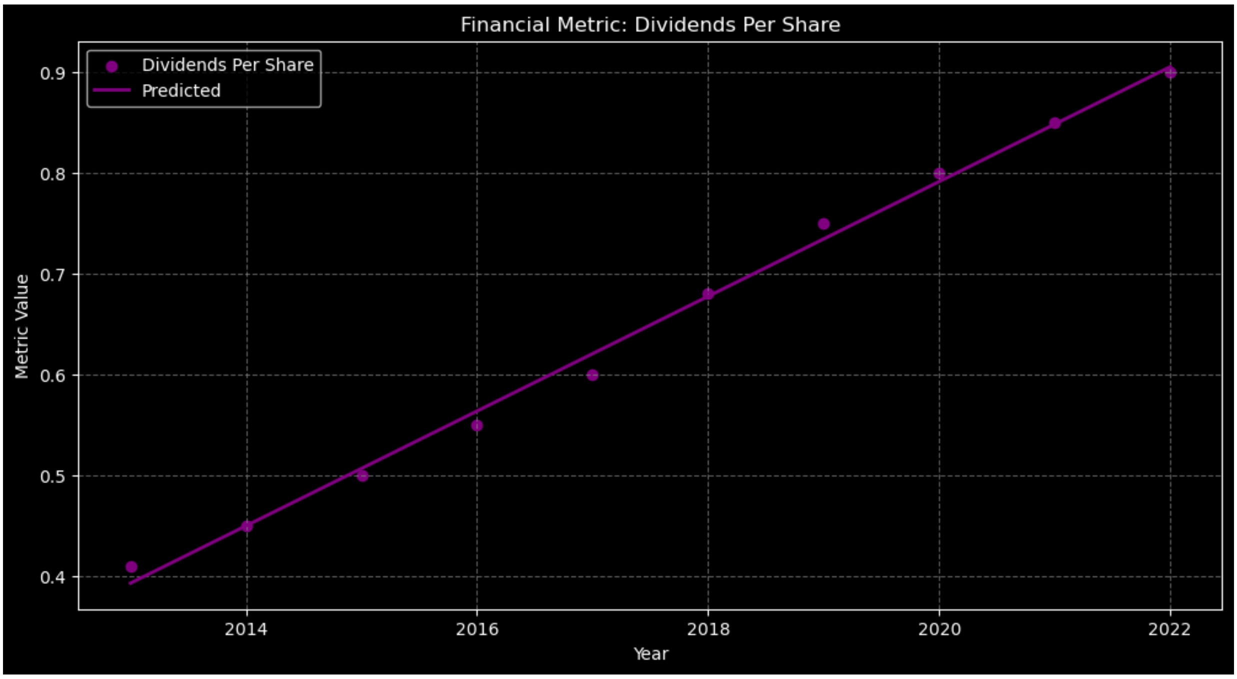
```
for i in range(financial_data.shape[1]):
    plt.figure(figsize=(12,6))
    plt.scatter(years, financial_data[:, i], color=colors[i], label=metri
    plt.plot(years, predictions[:, i], color=colors[i], linewidth=2, labe
    plt.title("Financial Metric: " + metrics[i])
    plt.xlabel("Year")
    plt.ylabel("Metric Value")
    plt.grid(linestyle='--', color='gray', alpha=0.7)
    plt.legend()
    plt.show()
```





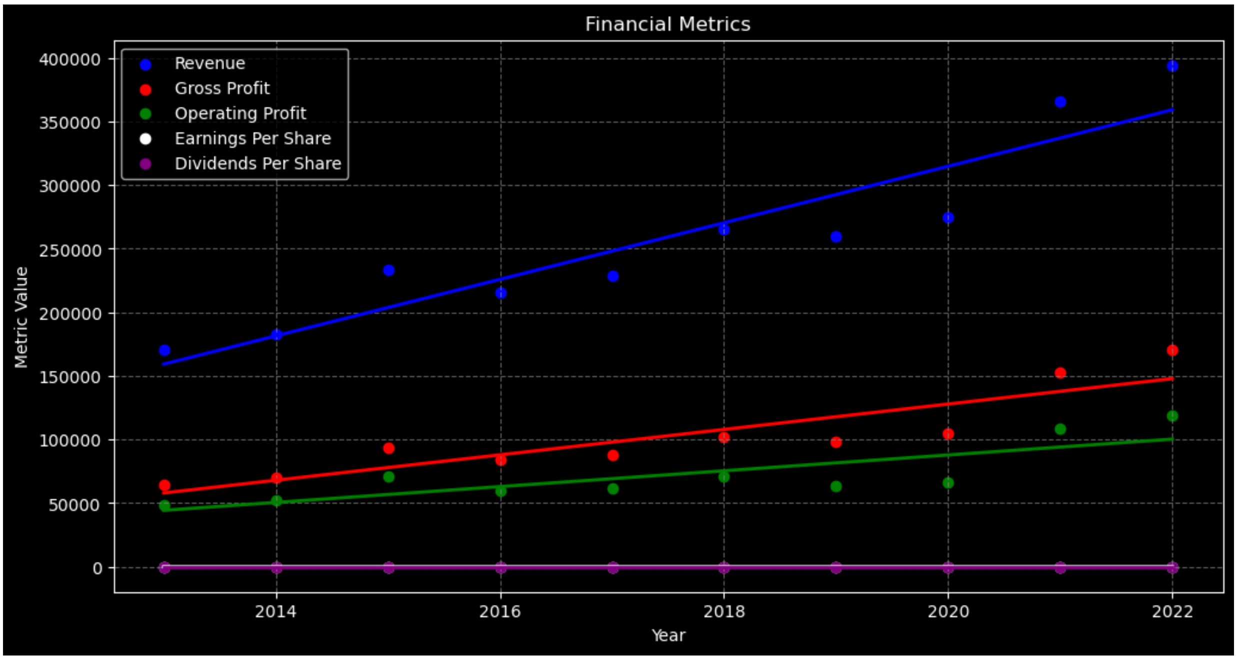

Financial Metric: Operating Profit
Operating Profit
Predicted
120000
110000
100000
90000
80000
70000
60000
50000
Metric Value
2014
2016
2018
2020
2022
Year


Financial Metric: Earnings Per Share
Earnings Per Share
Predicted
6
5
4
3
2
1
Metric Value
2014
2016
2018
2020
2022
Year


Financial Metric: Dividends Per Share
Dividends Per Share
Predicted
0.9
0.8
0.7
0.6
0.5
0.4
Metric Value
2014
2016
2018
2020
2022
Year

Plotting all dataset and trend into single chart

In [381…
```
plt.style.use('dark_background')
plt.figure(figsize=(12,6))
for i in range(financial_data.shape[1]):
    plt.scatter(years, financial_data[:, i], color=colors[i], label=metri
    plt.plot(years, predictions[:, i], color=colors[i], linewidth=2)
plt.title("Financial Metrics")
plt.xlabel("Year")
plt.ylabel("Metric Value")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend()
plt.show()
```



10. Analytical price target

In [382…
```
def stock(ticker, time):
    apple = yf.Ticker(ticker).history(period=time)
    close_price = apple['Close']
    return close_price
stock("AAPL","2y")
```

Out[382]:
```
Date
2021-05-05 00:00:00-04:00    126.576393
2021-05-06 00:00:00-04:00    128.196854
2021-05-07 00:00:00-04:00    128.879837
2021-05-10 00:00:00-04:00    125.554138
2021-05-11 00:00:00-04:00    124.623749
                                ...
2023-04-28 00:00:00-04:00    169.679993
2023-05-01 00:00:00-04:00    169.589996
2023-05-02 00:00:00-04:00    168.539993
2023-05-03 00:00:00-04:00    167.449997
2023-05-04 00:00:00-04:00    165.789993
Name: Close, Length: 504, dtype: float64
```

In [383…

```
close_price_2year = stock("AAPL","2y")
close_price_1year = stock("AAPL","1y")
close_price_6m = stock("AAPL","126d")
close_price_3m = stock("AAPL","90d")
```

In [389…

```
close_price_2year.max()
```

Out[389]:

```
180.68386840820312
```

While taking 2 year chart 180.68386840820312 is the highest resistance in this stock

In [384…

```
plt.figure(figsize=(12,6))
plt.plot(close_price_2year)
plt.axhline(close_price_2year.max(), color='red', label='Analyst Price Ta
plt.title("Apple Stock Price 2 year")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend()
plt.show()
```

In [390…

```
close_price_1year.max()
```

Out[390]:

```
173.99526977539062
```

While considering 1 year chart, highest price is around 173.99526977539062

In [385…

```
plt.figure(figsize=(12,6))
plt.plot(close_price_1year)
plt.axhline(close_price_1year.max(), color='red', label='Analyst Price Ta
plt.title("Apple Stock Price 1 year")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend()
plt.show()
```

In [391…

```
close_price_6m.max()
```

Out[391]:

```
169.67999267578125
```

While considering 6 month chart, highest price is around 169.67999267578125

In [386…

```
plt.figure(figsize=(12,6))
plt.plot(close_price_6m)
plt.axhline(close_price_6m.max(), color='red', label='Analyst Price Targe
plt.title("Apple Stock Price 6 months")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend()
plt.show()
```

In [392…
```
close_price_3m.max()
```

Out[392]:
```
169.67999267578125
```

While considering 3 month chart, highest price is around 169.67999267578125 which stay same

In [387…
```
plt.figure(figsize=(12,6))
plt.plot(close_price_3m)
plt.axhline(close_price_3m.max(), color='red', label='Analyst Price Targe
plt.title("Apple Stock Price 3 months")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend()
plt.show()
```

Overall present of resistance on apple stock

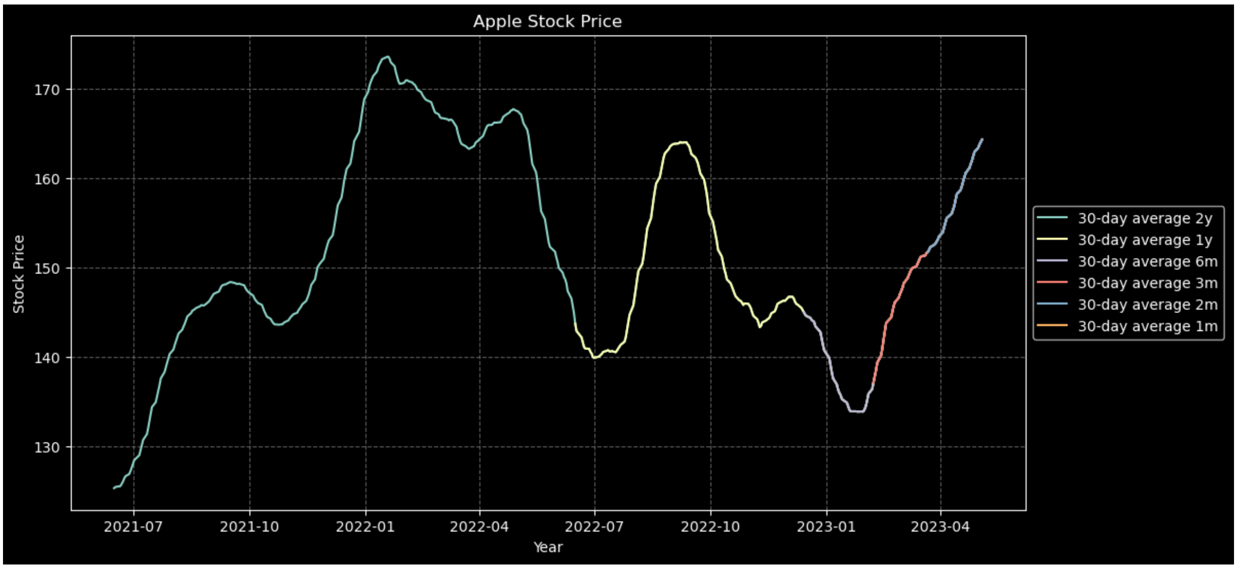
In [388…

```
plt.figure(figsize=(12,6))
plt.plot(close_price_2year)
plt.axhline(close_price_2year.max(), color='red', label='resistance 2y')
plt.plot(close_price_1year)
plt.axhline(close_price_1year.max(), color='yellow', label='resistance 1y
plt.plot(close_price_6m)
plt.axhline(close_price_6m.max(), color='green', label='resistance 6m')
plt.plot(close_price_3m)
plt.axhline(close_price_3m.max(), color='green', label='resistance 3m')
plt.title("Apple Stock Price")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
plt.show()
```

Creating 30 days moving average interval from 2 year chart

In [308…

```
plt.figure(figsize=(12,6))
plt.plot(close_price_2year.rolling(30).mean(), label='30-day average 2y')
plt.plot(close_price_1year.rolling(30).mean(), label='30-day average 1y')
plt.plot(close_price_6m.rolling(30).mean(), label='30-day average 6m')
plt.plot(close_price_3m.rolling(30).mean(), label='30-day average 3m')
plt.plot(close_price_2m.rolling(30).mean(), label='30-day average 2m')
plt.plot(close_price_1m.rolling(30).mean(), label='30-day average 1m')
plt.title("Apple Stock Price")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
plt.show()
```



Projecting 30 days interval of 2 year chart and original 2 year chart

In [309…

```
plt.figure(figsize=(12,6))
plt.plot(close_price_2year)
plt.plot(close_price_2year.rolling(30).mean(), label='30-day average 2y')
plt.plot(close_price_1year.rolling(30).mean(), label='30-day average 1y')
plt.plot(close_price_6m.rolling(30).mean(), label='30-day average 6m')
plt.plot(close_price_3m.rolling(30).mean(), label='30-day average 3m')
plt.plot(close_price_2m.rolling(30).mean(), label='30-day average 2m')
plt.plot(close_price_1m.rolling(30).mean(), label='30-day average 1m')
plt.title("Apple Stock Price")
plt.xlabel("Year")
plt.ylabel("Stock Price")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
plt.show()
```

11. Fundamental analysis

In [418…

```
df.transpose()
```

Out[418]:

	0	1	2	3	4	5	6	7
Metric	Revenue	Revenue Growth	Gross Profit	Gross Margin %	Operating Profit	Operating Margin %	Earnings Per Share	EPS Growth	Div Per
2013	170910.0	9.2	64304.0	37.6	48999.0	28.7	1.42	-10.0
2014	182795.0	7.0	70537.0	38.6	52503.0	28.7	1.61	13.6
2015	233715.0	27.9	93626.0	40.1	71230.0	30.5	2.31	42.9
2016	215639.0	-7.7	84263.0	39.1	60024.0	27.8	2.08	-9.8
2017	229234.0	6.3	88186.0	38.5	61344.0	26.8	2.3	10.8
2018	265595.0	15.9	101839.0	38.3	70898.0	26.7	2.98	29.4
2019	260174.0	-2.0	98392.0	37.8	63930.0	24.6	2.97	-0.3
2020	274515.0	5.5	104956.0	38.2	66288.0	24.1	3.28	10.4
2021	365817.0	33.3	152836.0	41.8	108949.0	29.8	5.61	71.0
2022	394328.0	7.8	170782.0	43.3	119437.0	30.3	6.11	8.9

In [423…

```
df = pd.DataFrame(apple, columns=columns)
df = df.set_index('Metric')
df = df.transpose()
```

In [424…

```
df
```

Out[424]:

Metric	Revenue	Revenue Growth	Gross Profit	Gross Margin %	Operating Profit	Operating Margin %	Earnings Per Share	EPS Growth
2013	170910.0	9.2	64304.0	37.6	48999.0	28.7	1.42	-10.0
2014	182795.0	7.0	70537.0	38.6	52503.0	28.7	1.61	13.6
2015	233715.0	27.9	93626.0	40.1	71230.0	30.5	2.31	42.9
2016	215639.0	-7.7	84263.0	39.1	60024.0	27.8	2.08	-9.8
2017	229234.0	6.3	88186.0	38.5	61344.0	26.8	2.30	10.8
2018	265595.0	15.9	101839.0	38.3	70898.0	26.7	2.98	29.4
2019	260174.0	-2.0	98392.0	37.8	63930.0	24.6	2.97	-0.3
2020	274515.0	5.5	104956.0	38.2	66288.0	24.1	3.28	10.4
2021	365817.0	33.3	152836.0	41.8	108949.0	29.8	5.61	71.0
2022	394328.0	7.8	170782.0	43.3	119437.0	30.3	6.11	8.9

In [431…

```
df.columns
```

Out[431]:
```
Index(['Revenue', 'Revenue Growth', 'Gross Profit', 'Gross Margin %',
       'Operating Profit', 'Operating Margin %', 'Earnings Per Share',
       'EPS Growth', 'Dividends Per Share', 'Dividend Growth',
       'Return on Assets', 'Return on Equity', 'Return on Invested Capit
al'],
      dtype='object', name='Metric')
```

In [452…
```
df.columns.str.replace(' ','_')
```

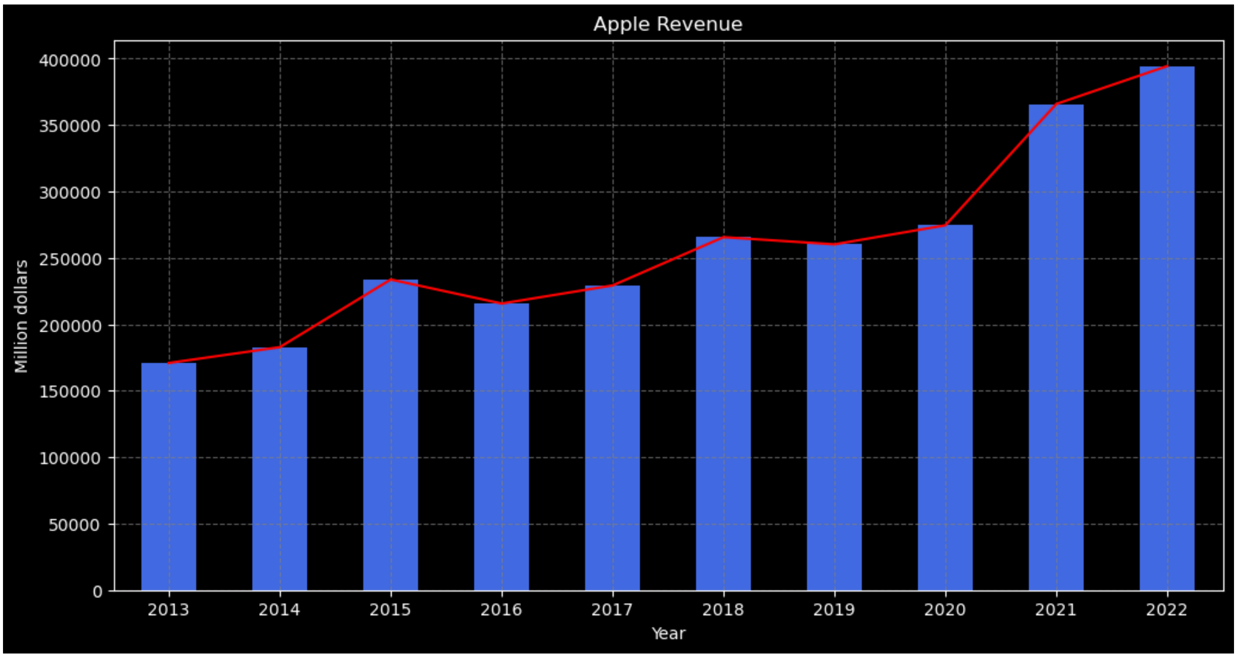
Out[452]:
```
Index(['Revenue', 'Revenue_Growth', 'Gross_Profit', 'Gross_Margin_%',
       'Operating_Profit', 'Operating_Margin_%', 'Earnings_Per_Share',
       'EPS_Growth', 'Dividends_Per_Share', 'Dividend_Growth',
       'Return_on_Assets', 'Return_on_Equity', 'Return_on_Invested_Capit
al'],
      dtype='object', name='Metric')
```

Apple Revenue since 2013 to 2022 is growing and look like company is innovating

In [476…
```
df.Revenue
```

Out[476]:
```
2013    170910.0
2014    182795.0
2015    233715.0
2016    215639.0
2017    229234.0
2018    265595.0
2019    260174.0
2020    274515.0
2021    365817.0
2022    394328.0
Name: Revenue, dtype: float64
```

In [453…
```
plt.figure(figsize=(12,6))
df.Revenue.plot.bar(color="royalblue")
df.Revenue.plot(color="red")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.title("Apple Revenue")
plt.xlabel("Year")
plt.ylabel("Million dollars");
```



Revenue growth is bit up and down as comapre to revenue generated.

In [473…

```
plt.figure(figsize=(12,6))
df['Revenue Growth'].plot.bar(color=["red" if x < 0 else "green" for x in
df['Revenue Growth'].plot(color="royalblue")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.title("Revenue Growth")
plt.xlabel("Year")
plt.ylabel("Percentage")
plt.show()
```

In [475…

```
df['Gross Profit']
```

Out[475]:

```
2013     64304.0
2014     70537.0
2015     93626.0
2016     84263.0
2017     88186.0
2018    101839.0
2019     98392.0
2020    104956.0
2021    152836.0
2022    170782.0
Name: Gross Profit, dtype: float64
```

Gross profit is positive and look like operation is in good shape

In [480…

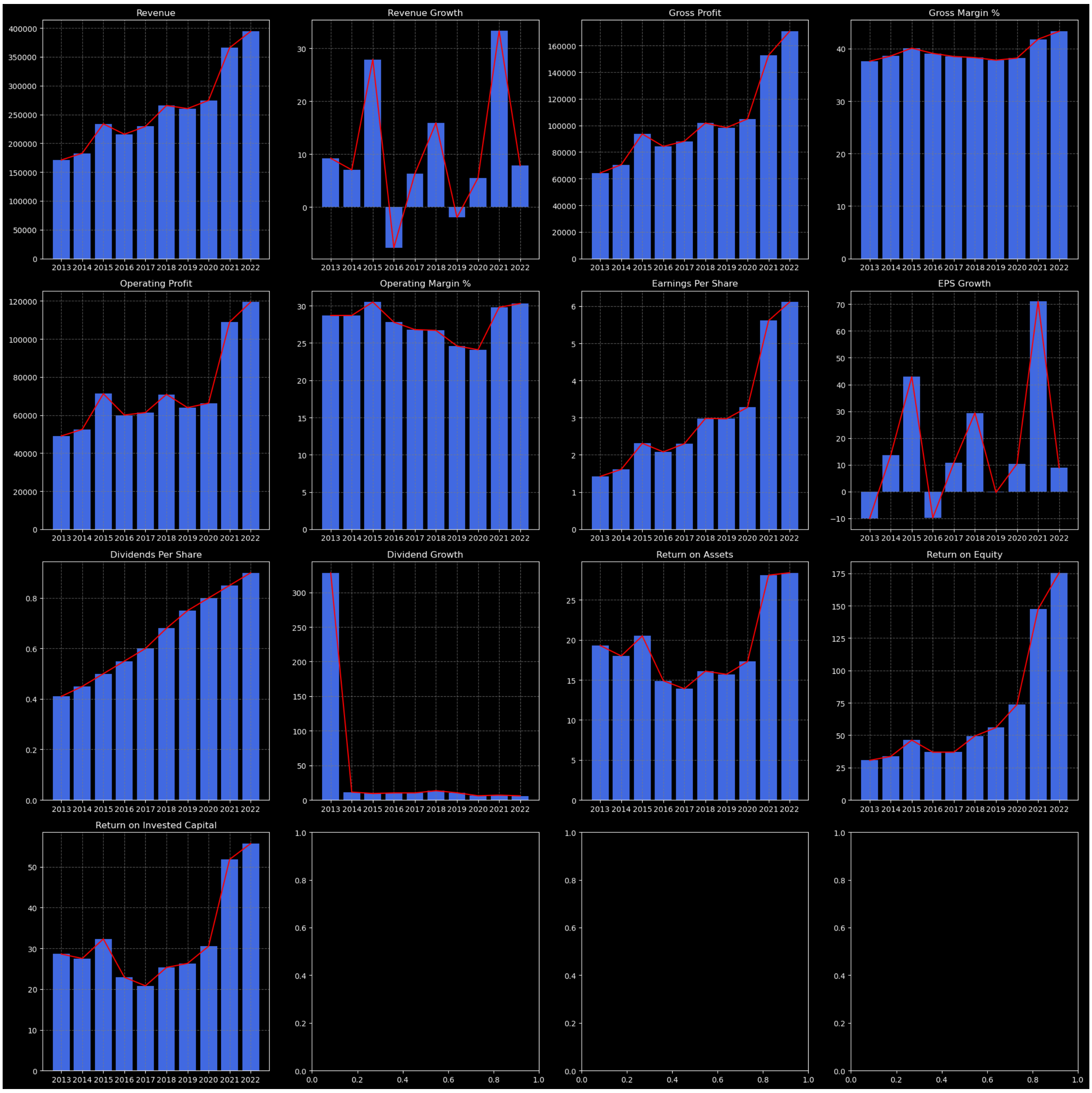
```
plt.figure(figsize=(12,6))
df['Gross Profit'].plot.bar(color="royalblue")
df['Gross Profit'].plot(color="red")
plt.grid(linestyle='--', color='gray', alpha=0.7)
plt.title("Gross Profit")
plt.xlabel("Year")
plt.ylabel("Million dollars")
plt.show()
```

Multiple Chart for understanding relationship

In [506…

```
fig, ax = plt.subplots(4, 4, figsize=(20, 20))
metrics = ['Revenue',
           'Revenue Growth',
           'Gross Profit',
           'Gross Margin %',
           'Operating Profit',
           'Operating Margin %',
           'Earnings Per Share',
           'EPS Growth',
           'Dividends Per Share',
           'Dividend Growth',
           'Return on Assets',
           'Return on Equity',
           'Return on Invested Capital']
for i, metric in enumerate(metrics):
    row = i // 4
    col = i % 4
    ax[row][col].plot(df[metric], color='red')
    ax[row][col].bar(df.index, df[metric], color='royalblue')
    ax[row][col].set_title(metric)
    ax[row][col].grid(linestyle='--', color='gray', alpha=0.7)

plt.tight_layout()
plt.show()
```

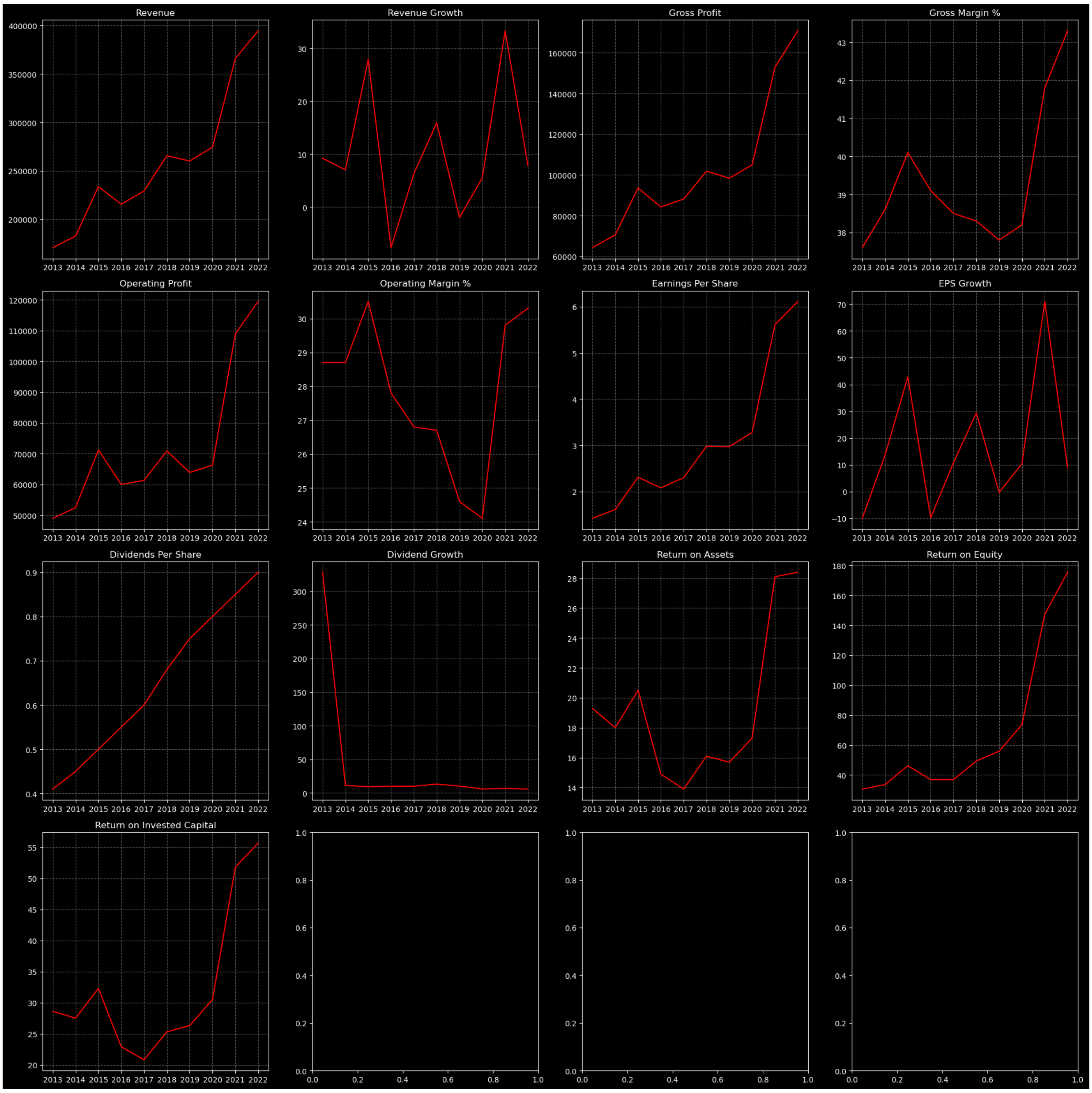

Revenue
Revenue Growth
Gross Profit
Gross Margin %
Operating Profit
Operating Margin %
Earnings Per Share
EPS Growth
Dividends Per Share
Dividend Growth
Return on Assets
Return on Equity
Return on Invested Capital

In [507…

```
fig, ax = plt.subplots(4, 4, figsize=(20, 20))
metrics = ['Revenue',
           'Revenue Growth',
           'Gross Profit',
           'Gross Margin %',
           'Operating Profit',
           'Operating Margin %',
           'Earnings Per Share',
           'EPS Growth',
           'Dividends Per Share',
           'Dividend Growth',
           'Return on Assets',
           'Return on Equity',
           'Return on Invested Capital']

for i, metric in enumerate(metrics):
    row = i // 4
    col = i % 4
    ax[row][col].plot(df[metric], color='red')
    ax[row][col].set_title(metric)
    ax[row][col].grid(linestyle='--', color='gray', alpha=0.7)

plt.tight_layout()
plt.show()
```



12. NALYST

In [4]:
```
from nalyst.CorrelationAnalysis import LinearCorrelationVisualizer
```

In [5]:
```
help(LinearCorrelationVisualizer)
```

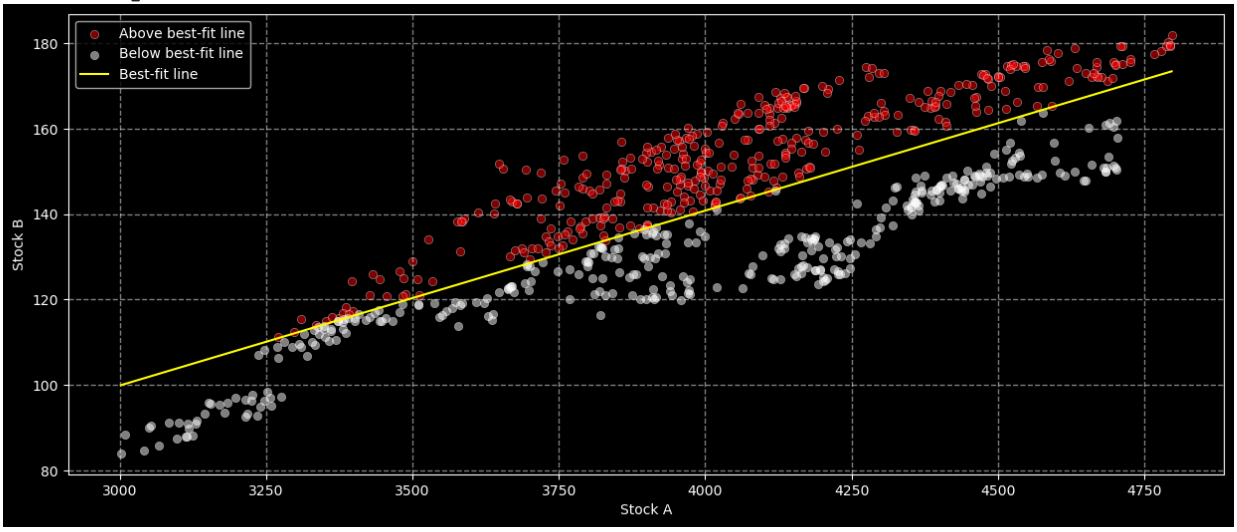
```
Help on class LinearCorrelationVisualizer in module nalyst.CorrelationAna
lysis:

class LinearCorrelationVisualizer(builtins.object)
 |  LinearCorrelationVisualizer(stock_a, stock_b)
 |
 |  Methods defined here:
 |
 |  __init__(self, stock_a, stock_b)
 |      Initialize self.  See help(type(self)) for accurate signature.
 |
 |  visualize(self)
 |
 |  ----------------------------------------------------------------------
-
 |  Data descriptors defined here:
 |
 |  __dict__
 |      dictionary for instance variables (if defined)
 |
 |  __weakref__
 |      list of weak references to the object (if defined)
```

SNP500 AND APPLE has strong correlation.

In [ ]:
```
correlation_analysis = LinearCorrelationVisualizer("^GSPC", "AAPL")
correlation_analysis.visualize()
```

```
[*********************100%***********************]  1 of 1 completed
[*********************100%***********************]  1 of 1 completed
Trend: Upward Trend
Slope: 0.04097812888380323
Intercept: -23.091411778031034
```



In [6]:
```
from nalyst.TrendAnalyst import LinearRegressionVisualizer
```

In [7]:
```
help(LinearRegressionVisualizer)
```

```
Help on class LinearRegressionVisualizer in module nalyst.TrendAnalyst:

class LinearRegressionVisualizer(builtins.object)
 |  LinearRegressionVisualizer(stock, start_date, end_date)
 |
 |  Methods defined here:
 |
 |  __init__(self, stock, start_date, end_date)
 |      Initialize self.  See help(type(self)) for accurate signature.
 |
 |  visualize(self)
 |
 |  ----------------------------------------------------------------------
-
 |  Data descriptors defined here:
 |
 |  __dict__
 |      dictionary for instance variables (if defined)
 |
 |  __weakref__
 |      list of weak references to the object (if defined)
```

Apple since 2013 to 2023 is positive and showing good return

In [ ]:

```python
trend_analysis = LinearRegressionVisualizer("AAPL", "2013-01-01", "2023-0
trend_analysis.visualize()
```

```
[*********************100%***********************]  1 of 1 completed
Slope: 0.05286231890546993
Intercept: -38877.89419420266
Trend: Upward Trend
```

In [8]:

```python
from nalyst.BetaFive import calculate_beta_five
```

In [9]:

```python
help(calculate_beta_five)
```

```
Help on function calculate_beta_five in module nalyst.BetaFive:

calculate_beta_five(ticker, benchmark)
```

Beta of Apple is above 1 which is bit volatile

In [10]:
```
calculate_beta_five("AAPL", "^GSPC")
```

Out[10]:
```
1.3101840892535732
```

In [11]:
```
from nalyst.MonteCarloSimulator import MonteCarloSimulator
```

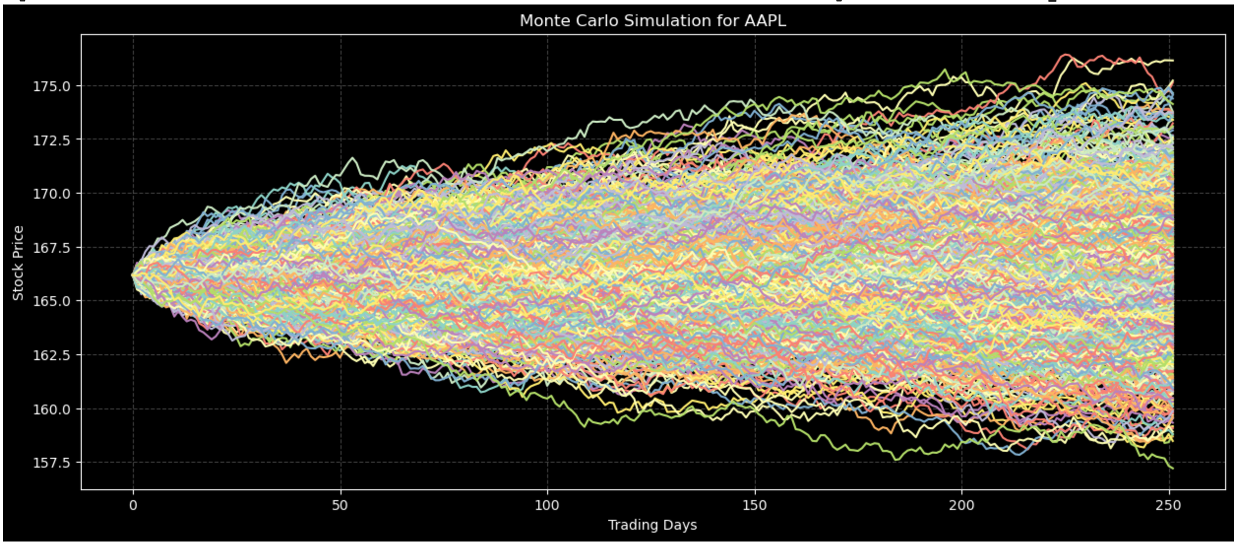
In [12]:
```
help(MonteCarloSimulator)
```

```
Help on class MonteCarloSimulator in module nalyst.MonteCarloSimulator:

class MonteCarloSimulator(builtins.object)
 |  MonteCarloSimulator(symbol, start_date, end_date)
 |
 |  Methods defined here:
 |
 |  __init__(self, symbol, start_date, end_date)
 |      Initialize self.  See help(type(self)) for accurate signature.
 |
 |  generate_paths(self, num_paths, num_days)
 |
 |  plot_paths(self, num_paths, num_days)
 |
 |  ----------------------------------------------------------------------
-
 |  Data descriptors defined here:
 |
 |  __dict__
 |      dictionary for instance variables (if defined)
 |
 |  __weakref__
 |      list of weak references to the object (if defined)
```

In [16]:
```
simulator = MonteCarloSimulator("AAPL","2013-01-01", "2023-04-04")
simulator.plot_paths(num_paths=1000, num_days=252)
```

```
[*********************100%***********************]  1 of 1 completed
```



Apple is one of the largest technology companies in the world, employing over 120,000 workers globally. The company has a significant impact on the modern society in several ways.

First, Apple is known for its innovative products and services that have transformed the way people communicate, consume media, and interact with technology. The company has a reputation for producing high-quality, user-friendly products that have become an integral part of people's daily lives.

Second, Apple's products are manufactured in modern, state-of-the-art facilities that use cutting-edge technology and robotics to produce millions of products each year. The company's manufacturing process is highly automated, making it one of the most efficient in the world. This helps to ensure that products are produced quickly, accurately, and to a high standard, which is essential for meeting the needs of customers.

Finally, Apple's workers are highly skilled and trained professionals who play a critical role in the company's success. They work in a wide range of roles, including research and development, manufacturing, marketing, and sales. By contributing their skills and expertise, Apple's workers help the company to create innovative products and services that have a positive impact on the world.

Reference

https://mytradingskills.com/support-resistance-levels

https://investor.apple.com/investor-relations/default.aspx

https://pypi.org/project/nalyst/