Author: Ukanwa Prisca

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings .filterwarnings('ignore')

df=pd.read_csv(r'C:\Users\USER\Documents\dataset\Apple 2009-2024.csv')

df.head()
```

	year	EBITDA (millions)	Revenue (millions)	Gross Profit (millions)
0	2024	$134,661	$391,035	$180,683
1	2023	$125,820	$383,285	$169,148
2	2022	$130,541	$394,328	$170,782
3	2021	$120,233	$365,817	$152,836
4	2020	$77,344	$274,515	$104,956

	Op Income (millions)	Net Income (millions)	EPS	Shares Outstanding
0	$123,216	$93,736	$6.08	15,408
1	$114,301	$96,995	$6.13	15,813
2	$119,437	$99,803	$6.11	16,326
3	$108,949	$94,680	$5.61	16,865
4	$66,288	$57,411	$3.28	17,528

	Year Close Price	Total Assets (millions)	Cash on Hand (millions)
0	243.0400	$364,980	$65,171
1	191.5919	$352,583	$61,555
2	128.5816	$352,755	$48,304
3	174.7132	$351,002	$62,639
4	129.7556	$323,888	$90,943

	Long Term Debt (millions)	Total Liabilities (millions)	Gross Margin
0	$85,750	$308,030	46.21%

1	$95,281	$290,437	45.03%
2	$98,959	$302,083	43.06%
3	$109,106	$287,912	43.02%
4	$98,667	$258,549	38.78%

```
   PE ratio Employees
0     39.97   164,000
1     29.84   161,000
2     21.83   164,000
3     28.93   154,000
4     35.14   147,000
```

About the Dataset:

This dataset provides a deep dive into Apple's financials during one of the most iconic periods in corporate history—2009 to 2014. These were the years when Apple transformed from a tech leader into a global superpower, driven by groundbreaking innovations on a perpetual Cupertino conveyor belt. Explore key financial metrics that fuelled Apple's meteoric rise, from revenue and profits to product sales and market shifts. Perfect for anyone interested in analysing the financial backbone of a historic innovation run!

Source: kaggle.com

```
df.duplicated().sum()

0

# checking for null values
df.isnull().sum()
```

```
year                      0
EBITDA (millions)         0
Revenue (millions)        0
Gross Profit (millions)   0
Op Income (millions)      0
Net Income (millions)     0
EPS                       0
Shares Outstanding        0
```

```
Year Close Price               0
Total Assets (millions)        0
Cash on Hand (millions)        0
Long Term Debt (millions)      0
Total Liabilities (millions)   0
Gross Margin                   0
PE ratio                       0
Employees                      0
dtype: int64
```

Feature explanations:

1.Year: Represents the fiscal year of the data being reported.

2.EBITDA (millions): Earnings Before Interest, Taxes, Depreciation, and Amortization, measured in millions. It indicates a company's profitability from core operations.

3.Revenue (millions): Total income generated from sales or services, measured in millions.

4.Gross Profit (millions): Revenue minus the cost of goods sold (COGS), representing the profit before deducting operating expenses, measured in millions.

5.Op Income (millions): Operating Income, calculated as gross profit minus operating expenses, measured in millions. It reflects the profit from regular business operations.

6.Net Income (millions): Profit remaining after all expenses, taxes, and interest have been deducted from revenue, measured in millions.

EPS: Earnings Per Share, calculated as net income divided by the total number of shares outstanding. It indicates profitability per share of the company's stock.

7.Shares Outstanding: The total number of a company's shares currently held by all shareholders.

8.Year Close Price: The closing price of the company's stock at the end of the fiscal year.

9.Total Assets (millions): The total value of a company's assets (e.g., cash, inventory, property, equipment), measured in millions.

10.Cash on Hand (millions): The amount of cash and liquid assets the company has available, measured in millions.

11.Long Term Debt (millions): Total debt obligations that are due for repayment after one year, measured in millions.

12.Total Liabilities (millions): The sum of all financial obligations or debts of the company, measured in millions.

13.Gross Margin: The percentage of revenue remaining after deducting the cost of goods sold, calculated as (Gross Profit / Revenue) * 100.

14.PE Ratio: Price-to-Earnings Ratio, calculated as the market value per share divided by earnings per share (EPS). It indicates how much investors are willing to pay per dollar of earnings.

15.Employees: The total number of employees working for the company during the fiscal year.

Long Term Debt (millions)): Duplicate column; same as "Long Term Debt (millions)" but likely an error. This should be corrected or removed.

Data Cleaning:

```python
# removing special characters
df['EBITDA (millions)']=df['EBITDA (millions)'].str.replace('$','')
df['Revenue (millions)']=df['Revenue (millions)'].str.replace('$','')
df[ 'Gross Profit (millions)']=df[ 'Gross Profit
(millions)'].str.replace('$','')
df['Op Income (millions)']=df['Op Income
(millions)'].str.replace('$','')
df['Net Income (millions)']=df['Net Income
(millions)'].str.replace('$','')
df['EPS']=df['EPS'].str.replace('$','')
df['Long Term Debt (millions)']=df['Long Term Debt
(millions)'].str.replace('$','')
df['Cash on Hand (millions)']=df['Cash on Hand
(millions)'].str.replace('$','')
df['Total Liabilities (millions)']=df['Total Liabilities
(millions)'].str.replace('$','')
df['Gross Margin']=df['Gross Margin'].str.replace('%','')
df['Total Assets (millions)']=df['Total Assets
(millions)'].str.replace('$','')

df['EBITDA (millions)']=df['EBITDA (millions)'].str.replace(',','')
df['Revenue (millions)']=df['Revenue (millions)'].str.replace(',','')
df[ 'Gross Profit (millions)']=df[ 'Gross Profit
(millions)'].str.replace('$','')
df['Op Income (millions)']=df['Op Income
(millions)'].str.replace(',','')
df['Net Income (millions)']=df['Net Income
(millions)'].str.replace(',','')
df['EPS']=df['EPS'].str.replace('$','')
df['Long Term Debt (millions)']=df['Long Term Debt
(millions)'].str.replace(',','')
df['Cash on Hand (millions)']=df['Cash on Hand
(millions)'].str.replace(',','')
df['Total Liabilities (millions)']=df['Total Liabilities
(millions)'].str.replace(',','')
df['Employees']=df['Employees'].str.replace(',','')
df['Total Assets (millions)']=df['Total Assets
(millions)'].str.replace(',','')
df['Shares Outstanding']=df['Shares Outstanding'].str.replace(',','')
df['Gross Profit (millions)']=df['Gross Profit
(millions)'].str.replace(',','')
```

```python
# converting columns to numeric
df['EBITDA (millions)']=df['EBITDA (millions)'].astype(int)
df['Revenue (millions)']=df['Revenue (millions)'].astype(int)
df['Gross Profit (millions)']=df['Gross Profit
(millions)'].astype(float)
df['Op Income (millions)']=df['Op Income (millions)'].astype(int)
df['Net Income (millions)']=df['Net Income (millions)'].astype(int)
df['EPS']=df['EPS'].astype(float)
df['Shares Outstanding']=df['Shares Outstanding'].astype(int)
df['Total Liabilities (millions)']=df['Total Liabilities
(millions)'].astype(int)
df['Gross Margin']=df['Gross Margin'].astype(float)
df['Total Assets (millions)']=df['Total Assets
(millions)'].astype(int)
df['Cash on Hand (millions)']=df['Cash on Hand
(millions)'].astype(int)
df['Total Assets (millions)']=df['Total Liabilities
(millions)'].astype(int)
df['Long Term Debt (millions)']=df['Long Term Debt
(millions)'].astype(int)
df['Employees']=df['Employees'].astype(int)
```

Exploratory Analysis

1.How has revenue and net income trended over the years?

```python
yearly_revenue=df.groupby('year')['Revenue (millions)'].sum()

plt.plot(yearly_revenue,marker='o',markerfacecolor='skyblue')
plt.title('revenue and net income trend over the years')
plt.grid(True)
```

revenue and net income trend over the years
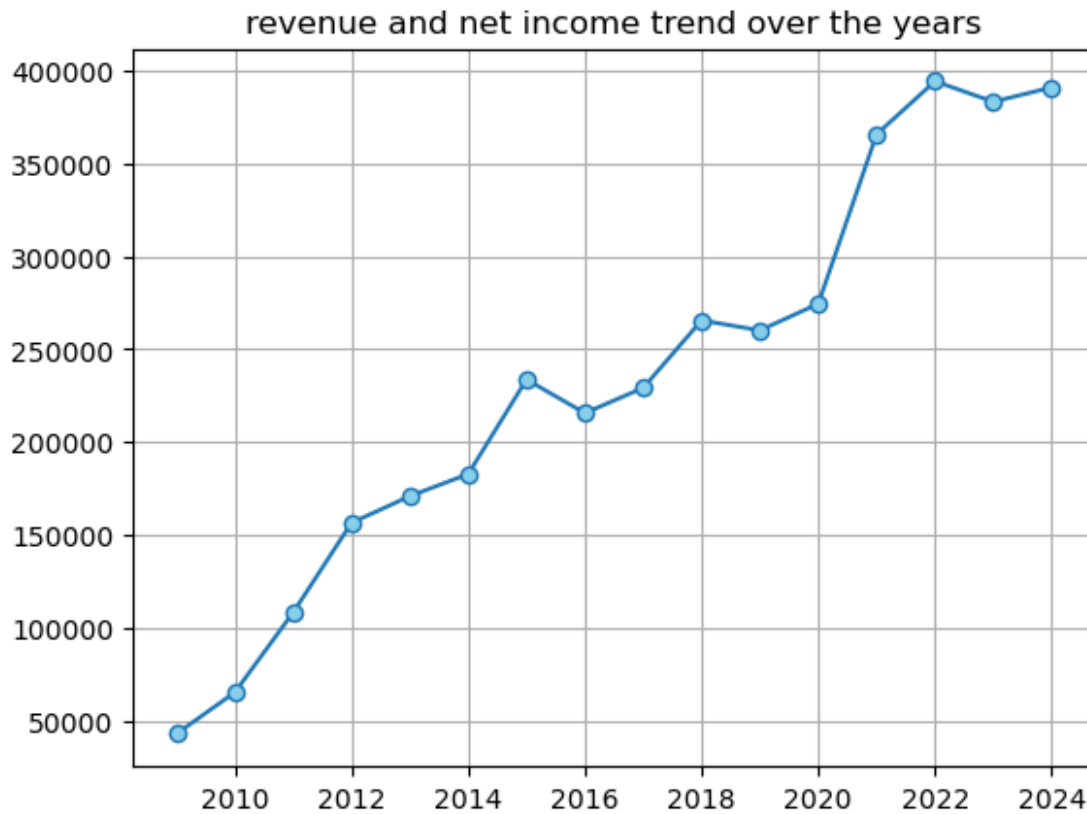
findings: revenue have been on high increase from 2010 till present

```
net_income=df.groupby('year')['Net Income (millions)'].sum()

plt.plot(net_income,marker='*')
plt.title('net income trend')
plt.xlabel('years')
plt.ylabel('net_income')

Text(0, 0.5, 'net_income')
```

net income trend
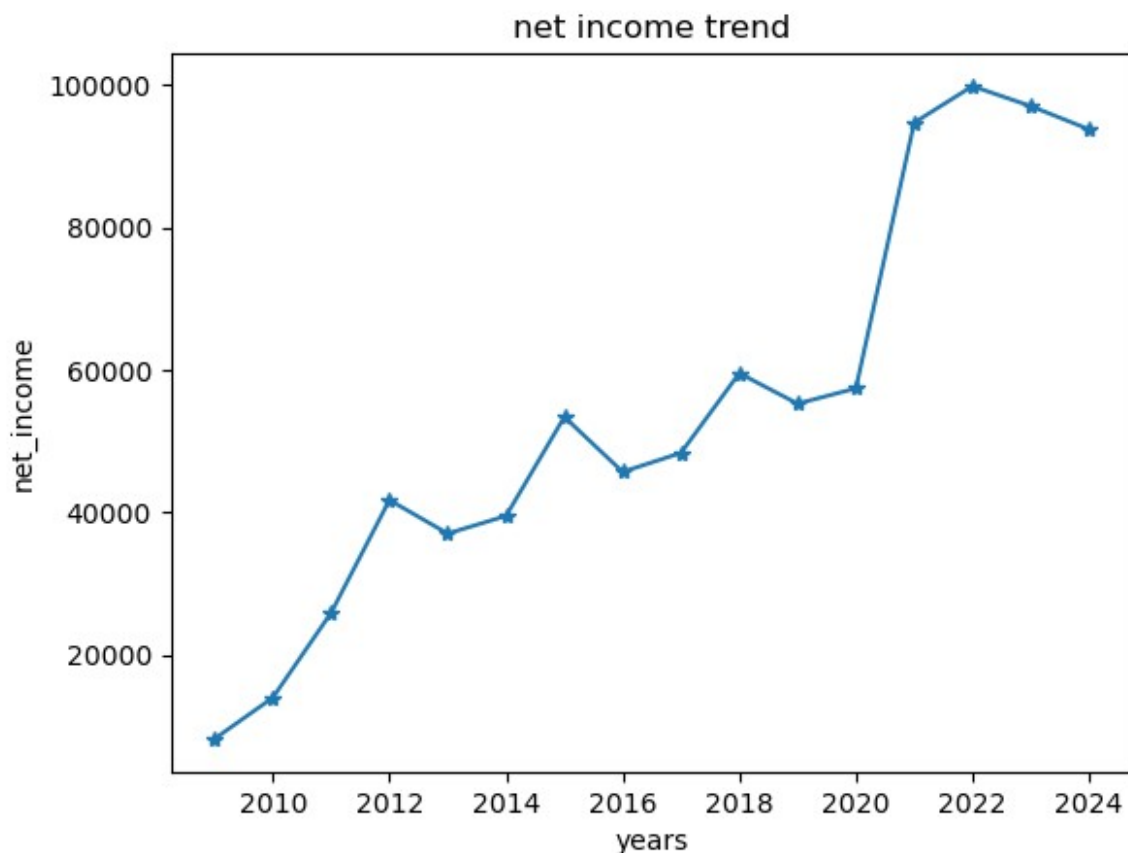
findings: the net income of the company has been on the rise from 2010 till present conclusion: over the years the net income and revenue have not declined

2.Is there a correlation between revenue growth and EBITDA?

```
df.dtypes # checking for data types

year                          int64
EBITDA (millions)             int32
Revenue (millions)            int32
Gross Profit (millions)       float64
Op Income (millions)          int32
Net Income (millions)         int32
EPS                           float64
Shares Outstanding            int32
Year Close Price              float64
Total Assets (millions)       int32
Cash on Hand (millions)       int32
Long Term Debt (millions)     int32
Total Liabilities (millions)  int32
```

```
Gross Margin                       float64
PE ratio                           float64
Employees                            int32
dtype: object

df.dtypes
# reconfirming the data types

year                                 int64
EBITDA (millions)                    int32
Revenue (millions)                   int32
Gross Profit (millions)            float64
Op Income (millions)                 int32
Net Income (millions)                int32
EPS                                float64
Shares Outstanding                   int32
Year Close Price                   float64
Total Assets (millions)              int32
Cash on Hand (millions)              int32
Long Term Debt (millions)            int32
Total Liabilities (millions)         int32
Gross Margin                       float64
PE ratio                           float64
Employees                            int32
dtype: object


# to determine if the increase of EBITA leasde to increase in revenue
from scipy.stats import pearsonr

stats,p=pearsonr(df['EBITDA (millions)'],df['Revenue (millions)'])
stats,p
if p >0.05:
    print('there is a relationship')
else:
    print('no relationship')


no relationship
```

findings:

there is no relationship between EBITDA and revenue , meaning the increase in one does not lead to increase in the order

3.What percentage of gross profit is typically converted to net income?

```
percentage=df['Gross Profit (millions)']/df['Revenue (millions)']*100
percentage
# the following are percentage converted to net income

0     46.206350
1     44.131130
2     43.309631
3     41.779360
4     38.233248
5     37.817768
6     38.343719
7     38.469860
8     39.075956
9     40.059902
10    38.588036
11    37.624481
12    43.871240
13    40.478896
14    39.377539
15    40.139844
dtype: float64

plt.figure(figsize=(10,5))
sns.barplot(x=df['year'],y=percentage,palette='magma')
plt.xticks(rotation='vertical')
plt.title('% of gross profit converted to netincome')

Text(0.5, 1.0, '% of gross profit converted to netincome')
```

% of gross profit converted to netincome
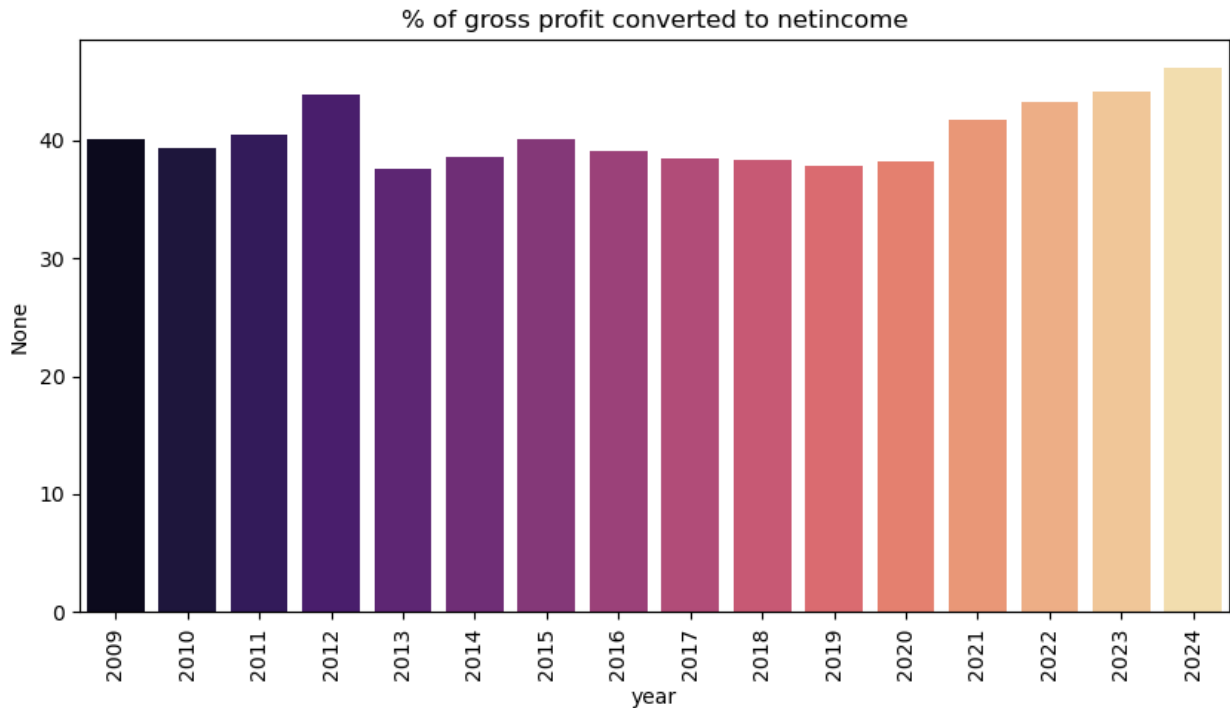
the percentage of gross profit converted to net income had a massive increase from 2021 till present, this indicates that the company revenue have massively increased.

4.How does the gross margin compare across different years, and what does it indicate about cost efficiency?

```
sns.lineplot(x=df['year'],y=df['Gross Margin'])
plt.grid(True)
plt.title(' Gross margin over the years')

Text(0.5, 1.0, ' Gross margin over the years')
```

Gross margin over the years
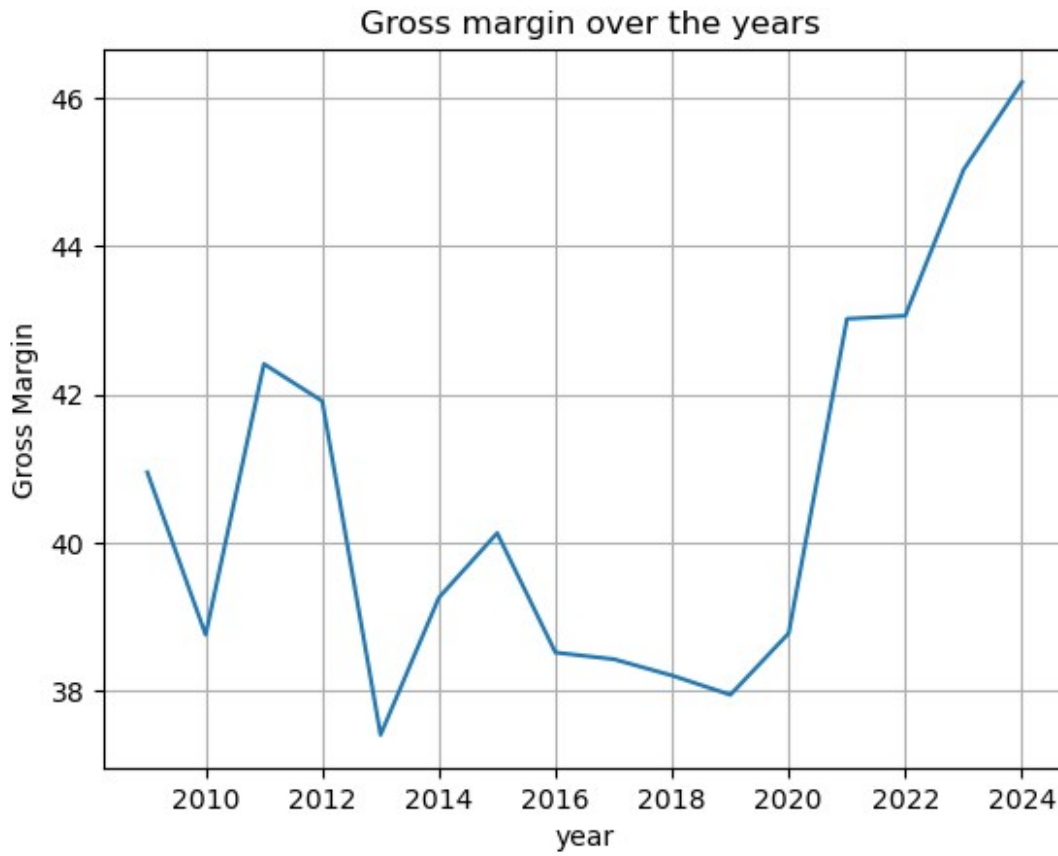
findings:

from 2010 gross margin has been on a decrease untill year 2020, their profit margin took a rise till present, indicating increase in revenue

5.How does operating income relate to gross profit and EBITDA?

```
from scipy .stats import f_oneway
```

h1:is there relationship between operating system,gross profit and EBITDA

h0:there is no relationship between operating system,gross profit and EBITDA

```
stat,p=f_oneway(df['Op Income (millions)'],df['EBITDA
(millions)'],df['Gross Profit (millions)'])
print(stat,p)
```

```
if p>0.05:
    print('there is relationship')
else:
    print('no relationship')

2.022272085574816 0.14420846503195542
there is relationship
```

conclusion: from the hypothesis testing, it is discovered that there is a relationship between operation income,gross income and EBITDA. which simply means that an increase or decrease of one will affect the others.

6.Is the company's gross profit margin improving or declining over time?

from the chart from number 4, the gross margin is increasing over time

7.What is the relationship between EPS (Earnings Per Share) and shares outstanding?

```
from scipy.stats import spearmanr

stat,p=spearmanr(df['EPS'],df['Shares Outstanding'])
print(stat,p)
if p>0.05:
    print('there is relationship')
else:
    print('no relationship')

-0.9235294117647058 3.3439000100406954e-07
no relationship
```

finding: there is no relationship between EPS and outstanding share

Financial Health

7.How has the company's long-term debt and total liabilities changed over time?

```
plt.plot(df['year'],df['Long Term Debt
(millions)'],color='yellow',marker='d',markerfacecolor='purple')
plt.title('long term debt over the years')
plt.grid(True)
```


long term debt over the years

finding : long term debt have been on increase until 2018, it started it's decrease from 2018 till present

```
plt.plot(df['year'],df['Total Liabilities (millions)'],color='Red')
plt.title('liablilites over the years')

Text(0.5, 1.0, 'liablilites over the years')
```

liablilites over the years
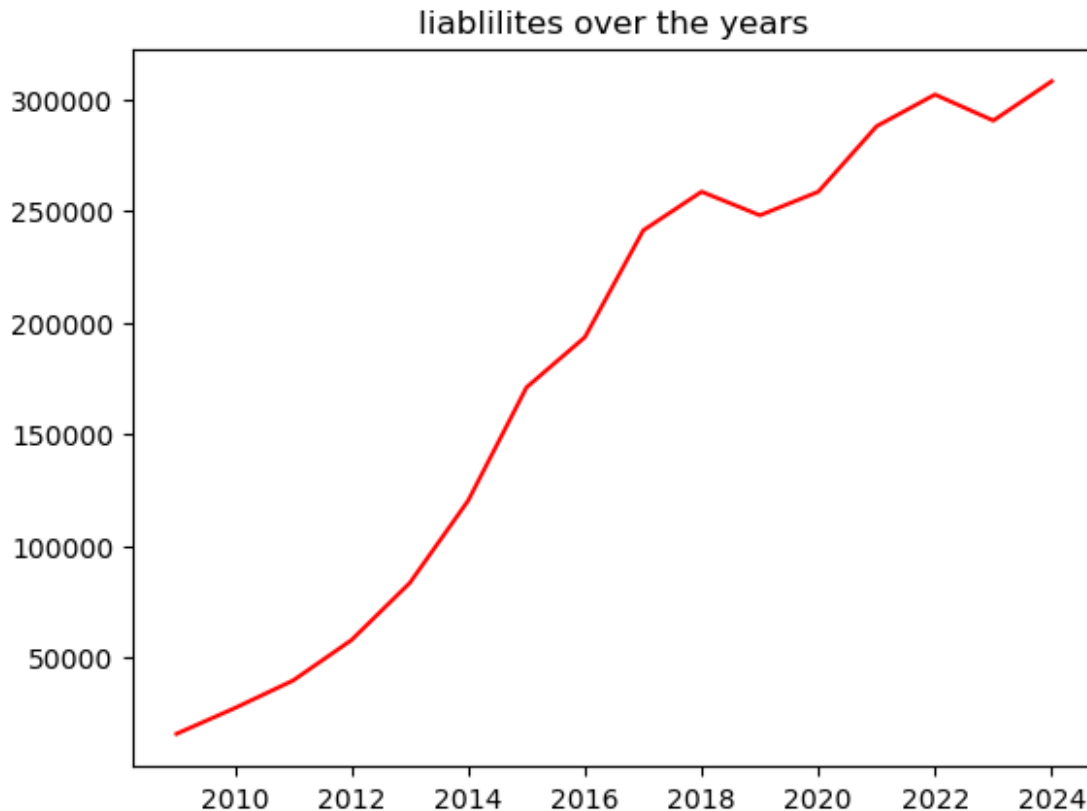
findings: liabilites have been increasing till present

8.What is the ratio of cash on hand to long-term debt, and how has it evolved?

```
df['Cash_Ratio'] = df['Cash on Hand (millions)'] / df['Long Term Debt
(millions)']

plt.plot(df['year'],df['Cash_Ratio'],color='green',marker='o',markerfa
cecolor='red')
plt.title('ratio of cash over time')

Text(0.5, 1.0, 'ratio of cash over time')
```

ratio of cash over time
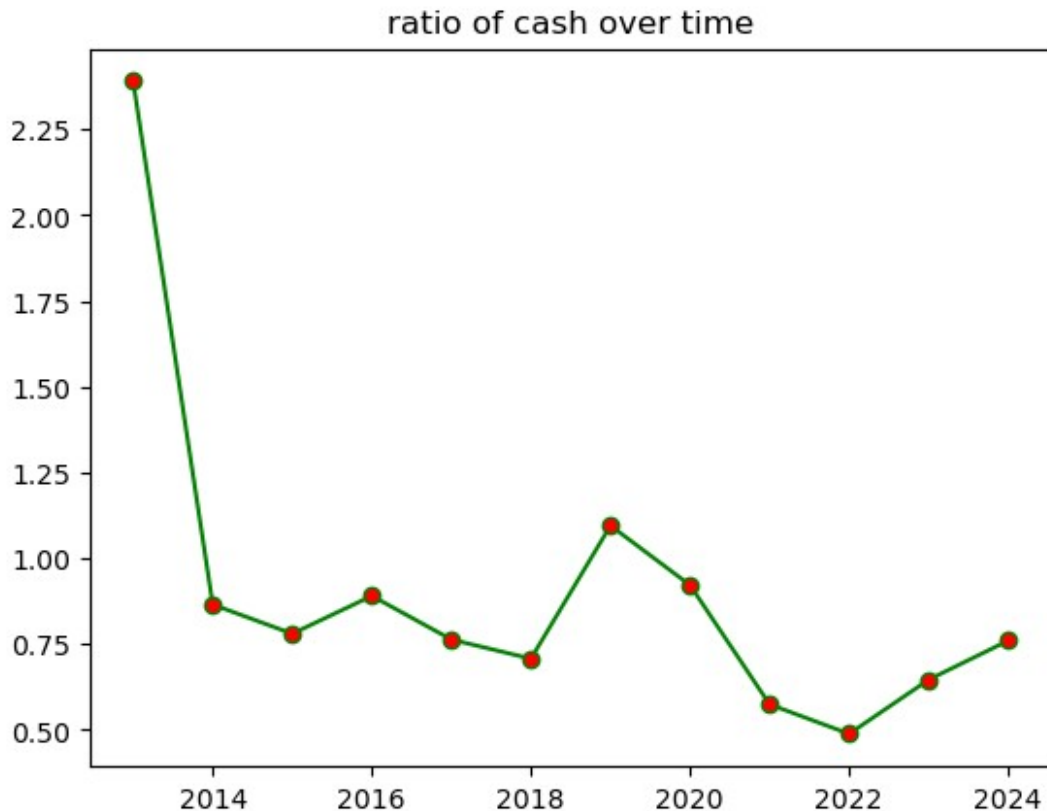
An increasing ratio indicates improved financial liquidity and reduced dependency on long-term debt. but in this case, the ratio has been decreasing over time.

9.Does the company's total assets sufficiently cover its total liabilities?

```
plt.plot(df['Total Assets (millions)'],df['Total Liabilities
(millions)'],marker='o',markerfacecolor='yellow')
plt.title(' total asset vs total liabilities')
plt.xlabel('total asset')
plt.ylabel('total liabilities')

Text(0, 0.5, 'total liabilities')
```

total asset vs total liabilities
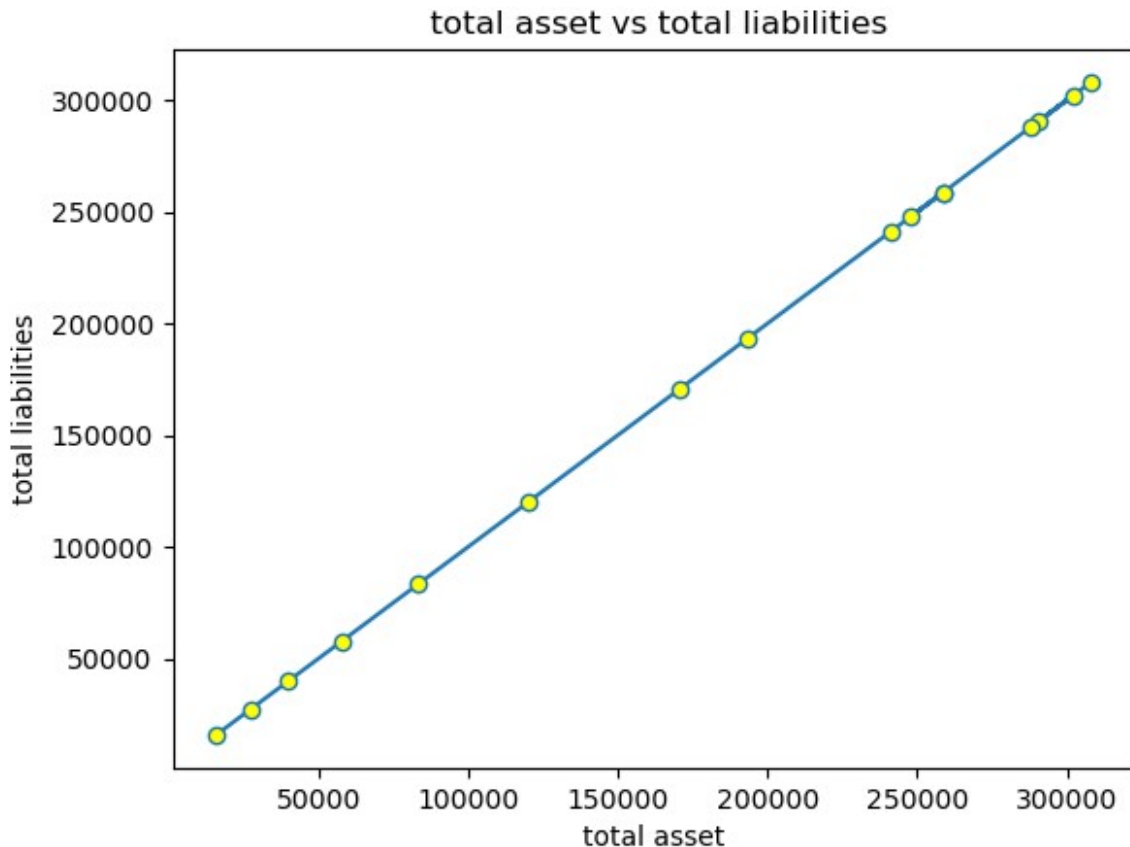
the chart shows that the company total asset covers its liablities

10.How does the company's PE ratio (Price-to-Earnings ratio) compare over the years, and does it align with market expectations?

```
plt.plot(df['year'],df['PE ratio'],marker='d',markerfacecolor='green')
plt.title('Price-to-Earnings ratio')
plt.xlabel('Year')
plt.ylabel('PE ratio')

Text(0, 0.5, 'PE ratio')
```

Price-to-Earnings ratio

findings: from 2018, the earning per ratio spike to an increase , a little decline in 2022 and recovered it strenght till present 2024

Market and Shareholder Insights

11.How does the year close price correlate with EPS and PE ratio?

```
plt.plot(df['EPS'],df['Year Close
Price'],marker='d',markerfacecolor='yellow',color='blue')
plt.title('EPS vs year close price')
plt.xlabel('eps')
plt.ylabel('year close price')

Text(0, 0.5, 'year close price')
```

EPS vs year close price
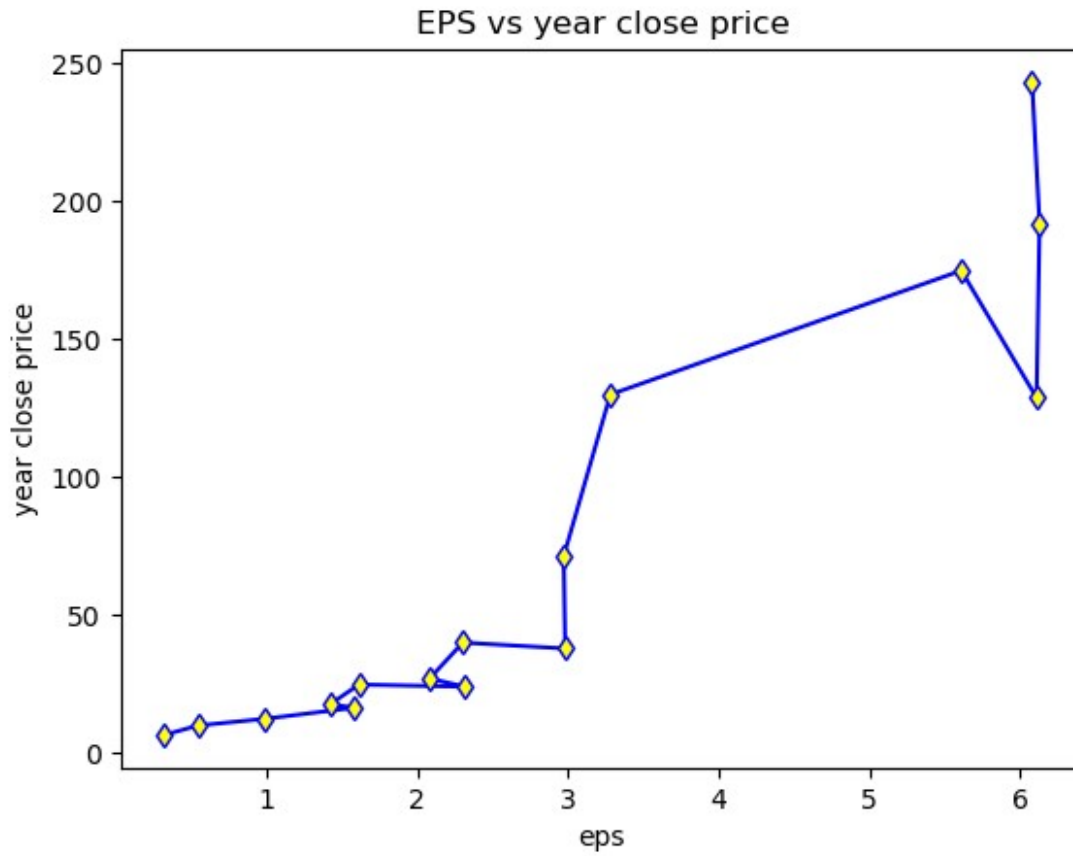

```
stat,p=pearsonr(df['EPS'],df['Year Close Price'])
print(stat,p)
if p>0.05:
    print('relationship')
else:
    print('no relationshp')

0.9258043011249284 2.723438684081881e-07
no relationshp
```
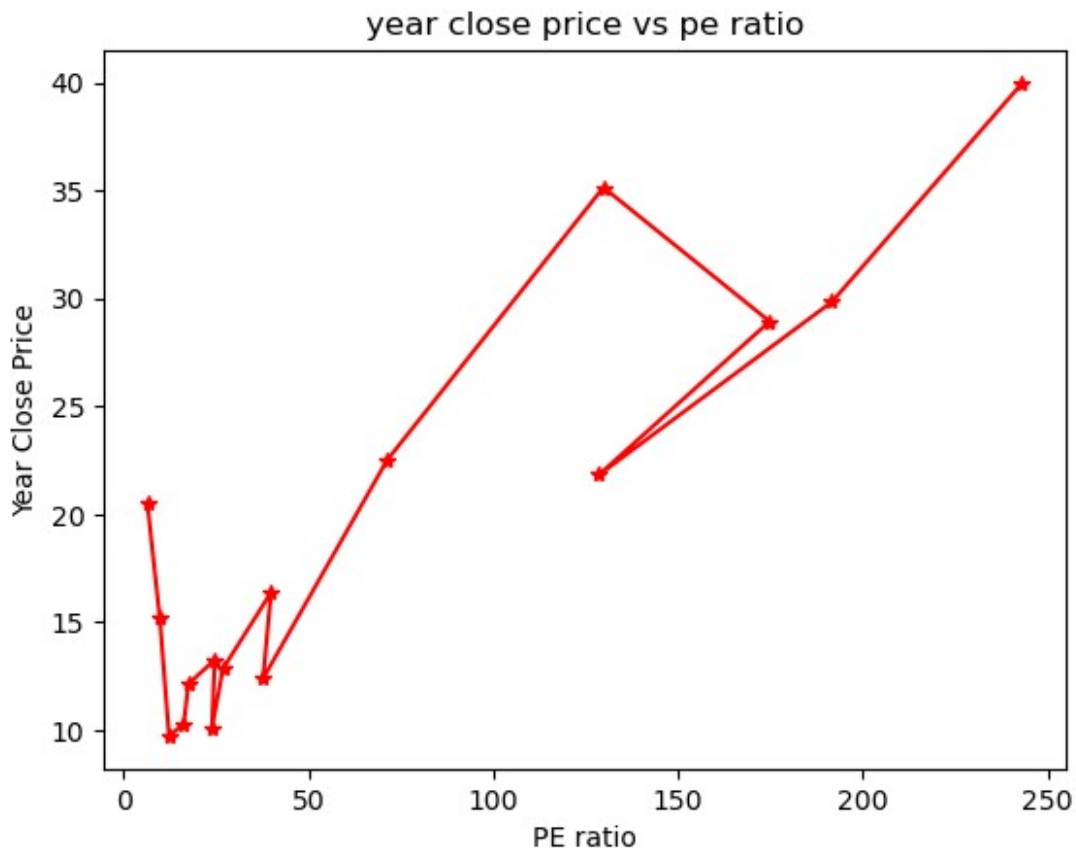
findings: year open price and EPS has no correlation, which means that the year open price doesnt affeect earnings per share

```
stat,p=pearsonr(df['Year Close Price'],df['PE ratio'])
print(stat,p)
if p>0.05:
    print('relationship')
else:
    print('no relationshp')

0.9025217014987506 1.727163432750961e-06
no relationshp
```

```
plt.plot(df['Year Close Price'],df['PE ratio'],color='red',marker='*')
plt.title('year close price vs pe ratio')
plt.xlabel('PE ratio')
plt.ylabel('Year Close Price')

Text(0, 0.5, 'Year Close Price')
```


findings: year open price and PE ratio has no correlation, which means that the year open price doesnt affect earning ratio

12. Is there a relationship between net income and the number of shares outstanding?

```
plt.plot(df['Shares Outstanding'],df['Net Income
(millions)'],color='red')
plt.title('Shares Outstanding vs Net Income ')
plt.xlabel('share outstanding')
plt.ylabel('net income')

Text(0, 0.5, 'net income')
```

Shares Outstanding vs Net Income
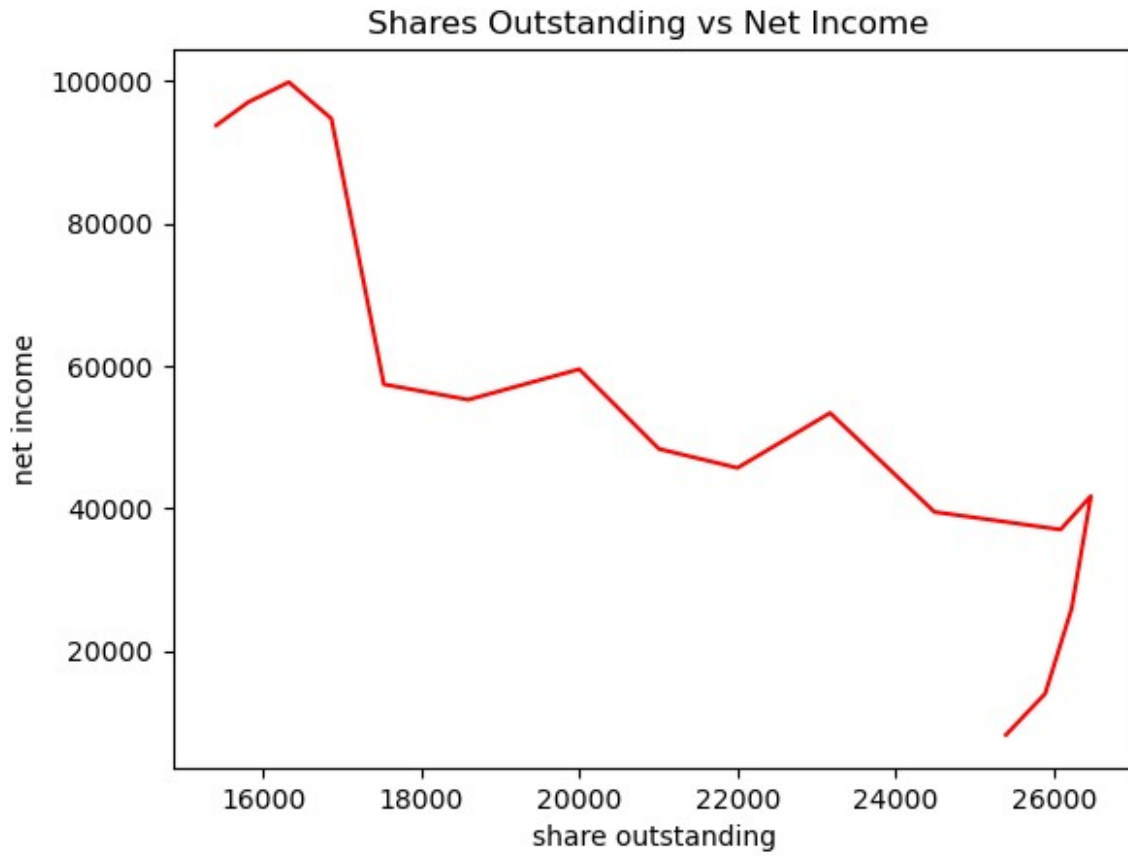

```
stat,p=pearsonr(df['Shares Outstanding'],df['Net Income (millions)'])
print(stat,p)
if p>0.05:
    print('relationship')
else:
    print('no relationshp')
```

```
-0.8960074532878819 2.6684236047308685e-06
no relationshp
```

findings: there is no relationship between share outstanding and net come, that means the increase or decrease of one does not affect the other

Employee and Operational Efficiency

13.How has the number of employees affected profitability metrics like EBITDA and Op Income?

```
plt.plot(df['Employees'],df['Op Income (millions)'])
plt.title('employees vs op income')

Text(0.5, 1.0, 'employees vs op income')
```


employees vs op income
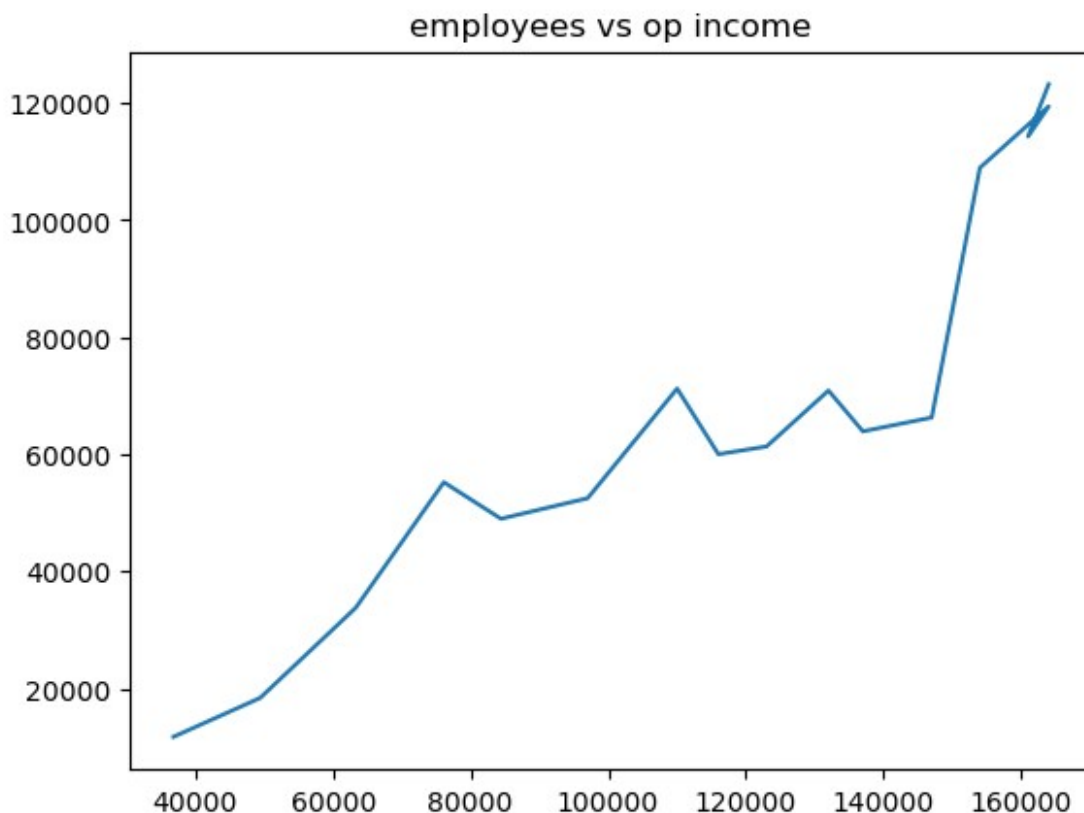
findings: the employees does not affect the operating income from the chart above

14. What is the revenue or profit generated per employee, and has this changed over time?

```
Revenue_per_Employee = df['Revenue (millions)']/ df['Employees']
Profit_per_Employee = df['Net Income (millions)'] / df['Employees']
```

```
plt.plot(df['year'],Revenue_per_Employee,marker='*',color='purple')
plt.title('year vs revenue')

Text(0.5, 1.0, 'year vs revenue')
```


A consistent increase in revenue or profit per employee over time signal that the company is becoming more efficient, growing, or leveraging its workforce better.

Comparative Ratios

15.Are there specific years where cash on hand relative to gross profit or net income significantly deviates?

```
plt.plot(df['year'],df['Cash on Hand
(millions)'],marker='*',markerfacecolor='black',color='orange')
plt.grid(True)
plt.title('year vs cash on hand')
plt.xlabel('year')
plt.ylabel('cash on hand')
```

```
Text(0, 0.5, 'cash on hand')
```


year vs cash on hand
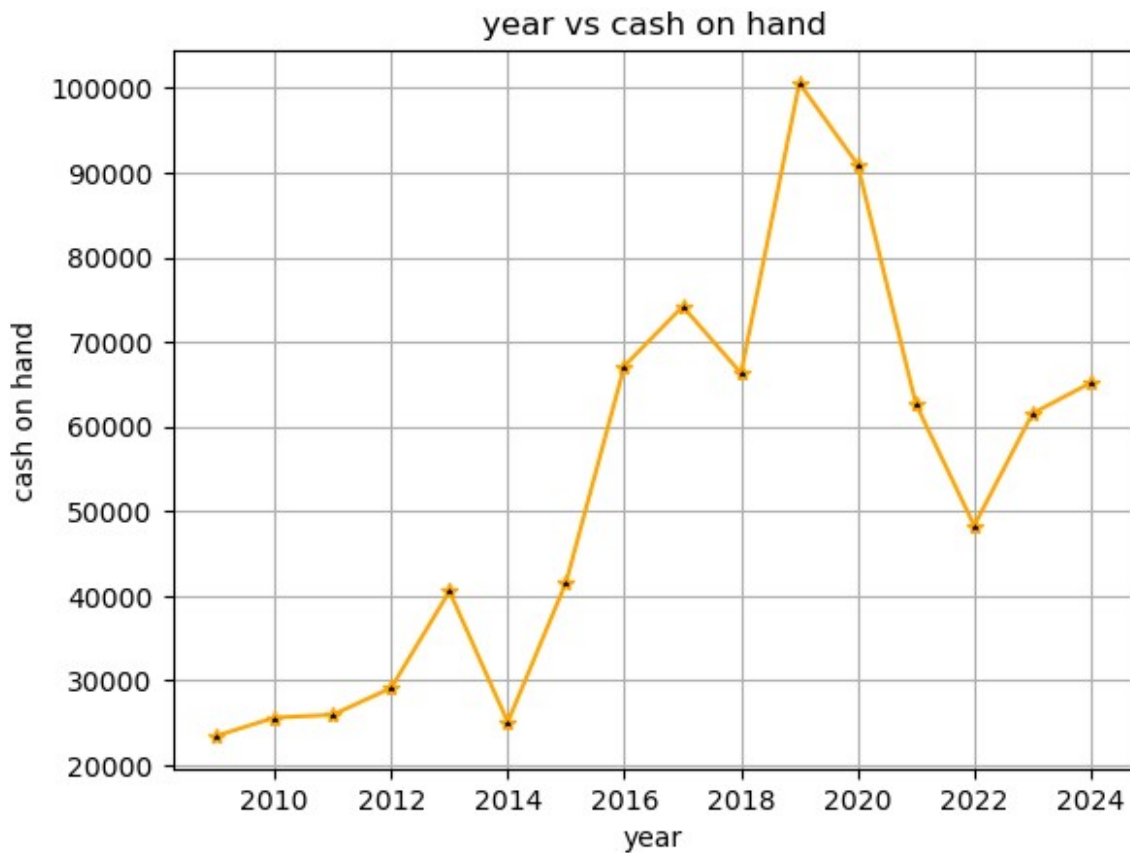
findings: from 2018 to 2024, the cash on hand have been declining massively. A decline in cash on hand can signal financial distress, limit growth potential, and reduce operational flexibility

16.What is the trend of long-term debt as a percentage of total liabilities, and does it indicate improving or worsening debt structure?

```python
Total_Liabilities = (df['Long Term Debt (millions)'] / df['Total
Liabilities (millions)']) * 100

plt.plot(df['year'],Total_Liabilities,marker='o',markerfacecolor='grey
',color='red')
plt.title('percentage liabilities')
plt.grid(True)
plt.ylabel('liablities')
plt.xlabel('year')
```

```
Text(0.5, 0, 'year')
```

percentage liabilities
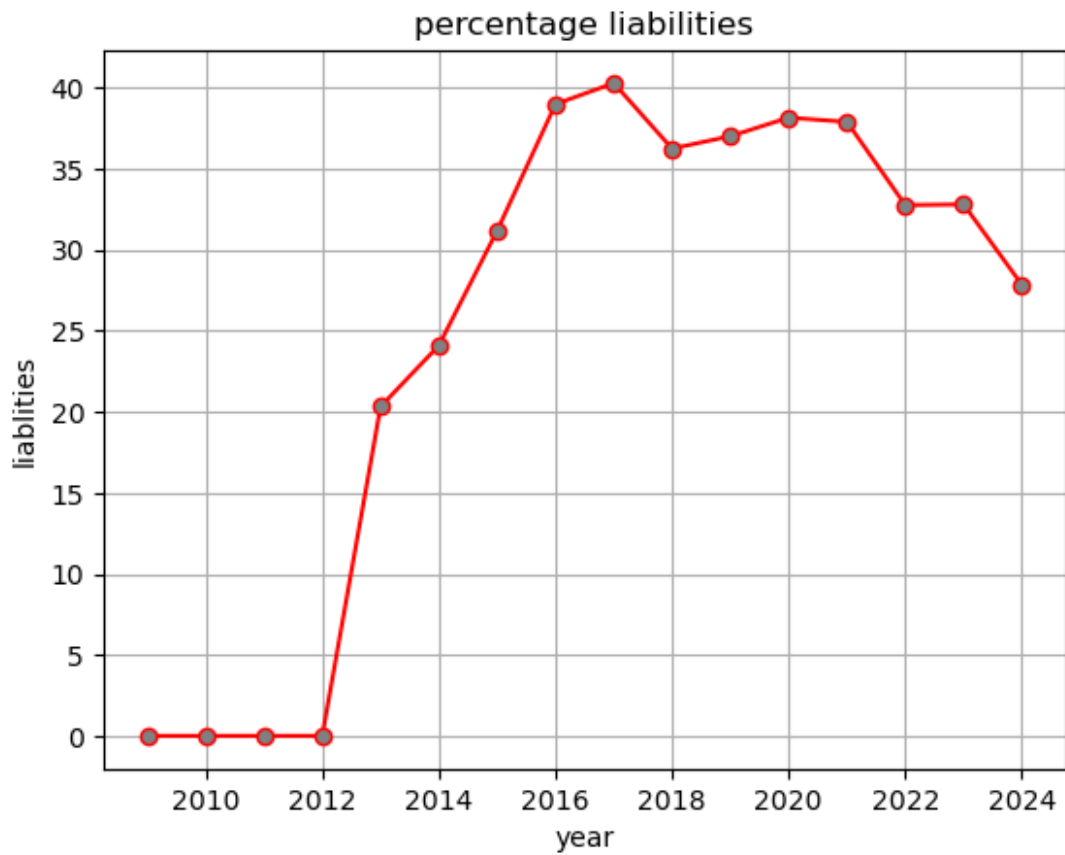
the ratio have started decreasing from 2018, suggesting that the company is reducing its reliance on long-term debt relative to total liabilities, which could indicate an improvement in financial stability. It may be paying down long-term debt or using other financing sources, such as equity or short-term debt, to cover liabilities.

Conclusions:

Revenue and Profitability: Apple's revenue and net income have consistently grown since 2010, with no significant declines, showcasing strong financial performance.Gross profit margins have improved since 2021, indicating better cost efficiency and profitability.

Financial Relationships: Operating income, gross profit, and EBITDA are strongly correlated, meaning changes in one metric directly impact the others.There is no significant relationship between EPS, shares outstanding, or year-close price, suggesting stock performance is influenced by broader market factors.

Debt and Liquidity: Long-term debt has been decreasing since 2018, but total liabilities have been increasing, requiring careful monitoring.The cash-to-debt ratio has been declining, signaling reduced liquidity and increased reliance on liabilities.

Employee Efficiency: Revenue and profit per employee have been increasing, indicating improved workforce productivity.

Market and Shareholder Insights: The PE ratio has shown a positive trend since 2018, reflecting investor confidence. Cash on hand has been declining significantly since 2018, which could limit operational flexibility.

Recommendations:

Improve Liquidity: Address the declining cash reserves by improving operational cash flow or reducing unnecessary expenditures.

Monitor Liabilities: While long-term debt is decreasing, the increase in total liabilities should be managed to maintain financial stability.

Leverage Workforce Productivity:Continue investing in employee training and development to sustain the increasing revenue and profit per employee.

Enhance Shareholder Value: Consider strategies like share buybacks or dividend increases to align EPS and share performance with market expectations.

Focus on Cost Efficiency: Maintain the upward trend in gross margins by optimizing production costs and operational expenses.

Invest in Innovation: Continue investing in new products and services to sustain revenue growth and market leadership.

By addressing liquidity concerns, managing liabilities, and leveraging operational efficiency, Apple can maintain its financial health and continue its trajectory of success.