

Application of ChatGPT to Build an FP&A Tool - Part 2

Abstract

This paper is an update to the original project, [Application of ChatGPT to Build an FP&A Tool](#), which was published on February 15, 2023. In the original project, I used ChatGPT 3.5 to write Python code, which I copied and pasted into a Google Colab project. This new version uses ChatGPT 4.0 with the Noteable.io plugin.

The goal and approach remain the same as in the original:

The field of Financial Planning and Analysis (FP&A) relies on a number of fundamental principles and practices, including financial modeling, budgeting, variance analysis, and strategic planning. With the rapid evolution of technology, financial analysts now have access to a range of tools that can assist them in their work. Among these is ChatGPT, an artificial intelligence tool that uses natural language processing to communicate and can perform a wide range of tasks, spanning from writing poetry to computer code.

This paper aims to demonstrate that even finance professionals with limited programming skills can leverage the power of AI to develop useful tools for FP&A tasks. By keeping the analysis simple, we aim to provide an introduction and proof of concept for the potential of ChatGPT and other AI tools in the field of FP&A. While this paper serves as a starting point, it is possible to extend the ideas presented here to create more advanced FP&A tools.

With the use of the Noteable plugin, the process has been greatly simplified and the user is no longer required to look “under the hood” to interact with the python code directly.

While the original project took about 11 hours to complete, the goal with this project was to replicate those efforts in under 30 minutes.

Approach

In the first project, we directed ChatGPT to write Python code, and used Google Colab as a notebook to document and run the code. With the launch of ChatGPT plugins, we are now able to prompt ChatGPT Directly in natural language, and the code is created in the background. This workbook was created entirely by prompts entered directly into ChatGPT using the Noteable plugin.

About Noteable

The Noteable plugin for ChatGPT allows access to computational notebooks with exploratory analysis, visualization, machine learning, and data-manipulation capabilities for everyone, regardless of skill level.

To learn more, visit noteable.io.

Setup

The first step is to install the Noteable plugin.

Note: Plugins are only available to GPT Plus users.

To install the plugin, [follow these detailed steps](#).

Once the plugin is installed, you need to create a project in your Noteable workspace and upload your financial statements in CSV format.

Once the project is created and the financial statements are uploaded, you can return to ChatGPT for the rest of the project.

In ChatGPT, open a new chat and select Noteable as the plugin you would like to use.

Prompts & Results

Prompt:

You are a financial analyst and have been asked to make a preliminary assessment of this income statement. Look for trends, correlations, and variances in the data, and make an overall assessment of the financial health of this company. Here is the income statement: `income_statement.csv`

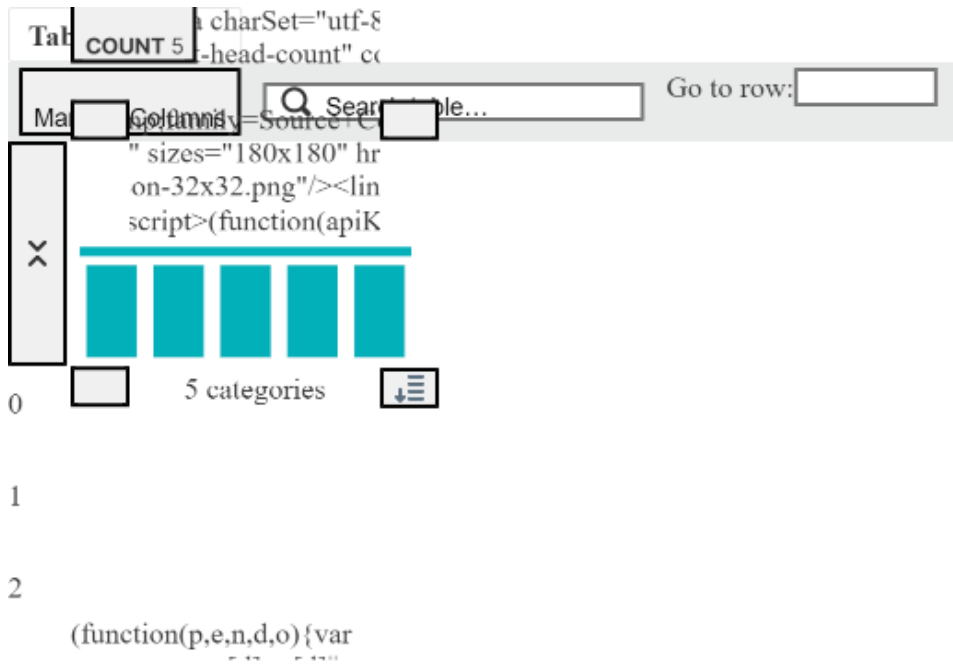
Use this as the default noteable notebook:

[URL of your project]

```
In [ ]: import pandas as pd

# Load the income statement data
income_statement = pd.read_csv('https://app.noteable.io/f/350a5db7-81e4-4764

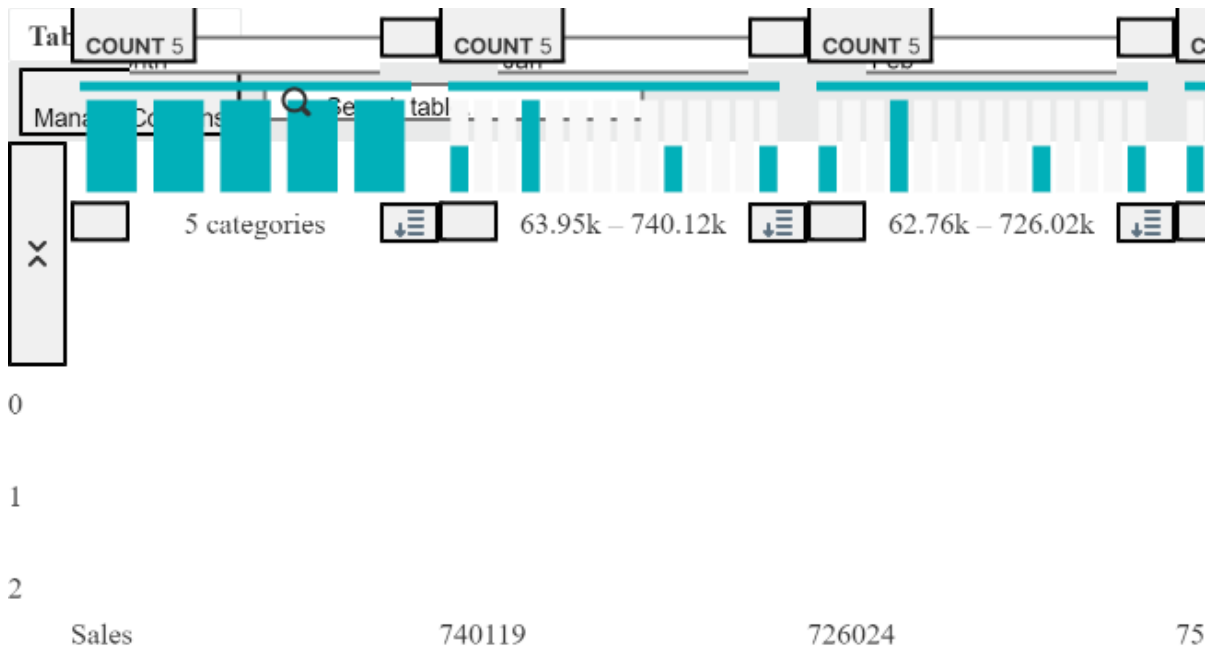
# Display the first few rows of the data
income_statement.head()
```



```
In [ ]: import pandas as pd

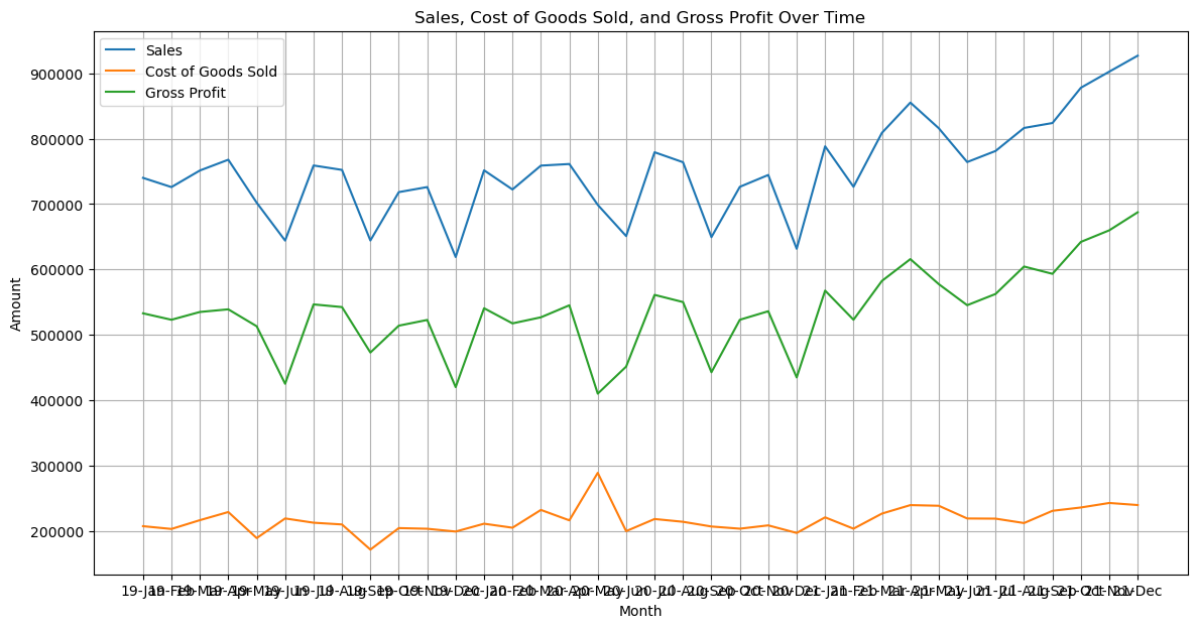
# Load the income statement data
income_statement = pd.read_csv('income_statement.csv')

# Display the first few rows of the data
income_statement.head()
```



ChatGPT Response:

Great, we've successfully loaded the income statement data. Here's a preview of the first few rows:



ChatGPT Response:

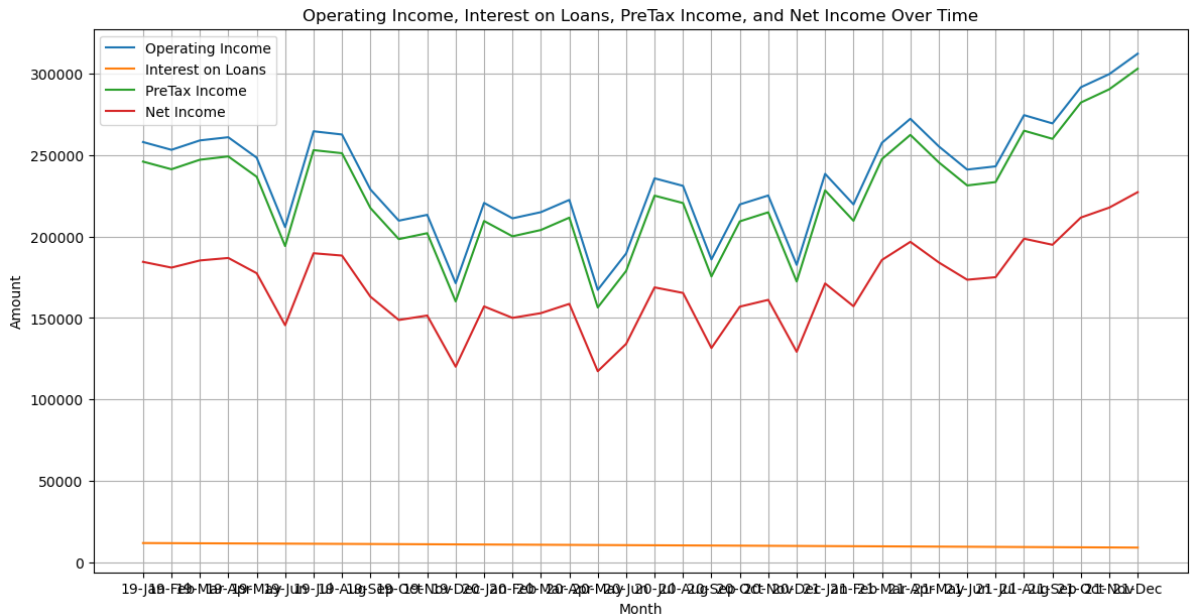
From the plot, we can observe that:

- Sales have been generally increasing over time, with some fluctuations.
- Cost of Goods Sold also shows a similar trend, which is expected as it's directly related to the sales.
- Gross Profit, which is the difference between Sales and Cost of Goods Sold, also shows an increasing trend.

Let's now look at the Operating Income, Interest on Loans, PreTax Income, and Net Income over time.

Here's a plot showing the Operating Income, Interest on Loans, PreTax Income, and Net Income over time:

```
In [ ]: # Plot the operating income, interest on loans, pre-tax income, and net income
plt.figure(figsize=(14, 7))
plt.plot(income_statement.index, income_statement['Operating Income'], label='Operating Income')
plt.plot(income_statement.index, income_statement['Interest on Loans'], label='Interest on Loans')
plt.plot(income_statement.index, income_statement['PreTax Income'], label='PreTax Income')
plt.plot(income_statement.index, income_statement['Net Income'], label='Net Income')
plt.title('Operating Income, Interest on Loans, PreTax Income, and Net Income')
plt.xlabel('Month')
plt.ylabel('Amount')
plt.legend()
plt.grid(True)
plt.show()
```



ChatGPT Response:

From the plot, we can observe that:

- Operating Income has been generally increasing over time, which is a good sign as it indicates the company's core business operations are improving.
- Interest on Loans has been relatively constant over time, which suggests the company's debt situation has been stable.
- PreTax Income and Net Income have also been increasing over time, indicating the company's profitability is improving.

Overall, the company seems to be in a healthy financial state, with key indicators such as Sales, Gross Profit, Operating Income, and Net Income showing an upward trend over time. This suggests that the company's operations are becoming more profitable.

However, this is a preliminary analysis and there are many other factors that could affect the financial health of a company. For a more comprehensive analysis, we could look into other financial statements like the balance sheet and cash flow statement, perform ratio analysis, or even delve into industry-specific metrics.

Additionally, it's important to consider the context of these numbers. For example, if the company operates in an industry that's experiencing overall growth, then these increases might simply reflect that broader trend. Similarly, if the company has recently made significant investments in marketing or product development, these costs might be expected to decrease profitability in the short term while leading to higher profits in the future.

Would you like to perform any other specific analysis on this data?

Prompt:

Before we move on to the balance sheet, can you let me know if you see any correlations between any of the categories that might suggest a trend?

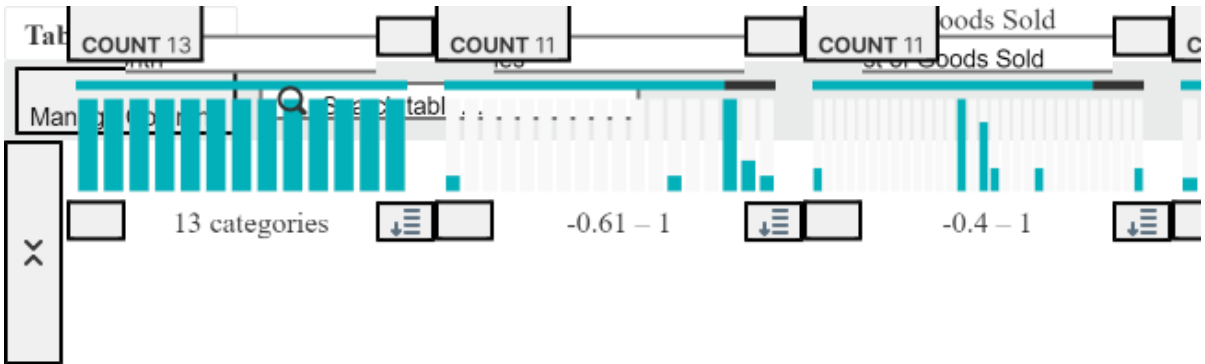
ChatGPT Response:

Here's the correlation matrix for the different categories:

In []:

```
# Calculate the correlation matrix
correlation_matrix = income_statement.corr()

# Display the correlation matrix
correlation_matrix
```



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From the correlation matrix, we can observe the following:

1. Sales, Gross Profit, Selling, Administrative, Total Operating Expenses, Operating Income, PreTax Income, Income Tax, and Net Income are all highly correlated with each other. This is expected as they are all part of the income statement and changes in one can lead to changes in the others.
2. Cost of Goods Sold has a moderate positive correlation with Sales, which is expected as higher sales would generally lead to higher cost of goods sold.
3. Interest on Loans has a moderate negative correlation with Sales, Gross Profit, Selling, Administrative, Total Operating Expenses, and Operating Income. This suggests that as

these values increase, the interest on loans tends to decrease.

4. There's a perfect negative correlation between Operating Income, PreTax Income, Income Tax, and Net Income with Interest on Loans. This suggests that as the company's profitability increases, the interest on loans decreases.
5. Interest Revenue and Dividend Revenue are not available (NaN) in the data, so we can't draw any conclusions about them.

This correlation analysis can help us understand the relationships between different financial metrics of the company. However, correlation does not imply causation, and these relationships could be influenced by other factors not included in this data.

Prompt:

Are there any variances that look abnormal in any of the data?

ChatGPT Response:

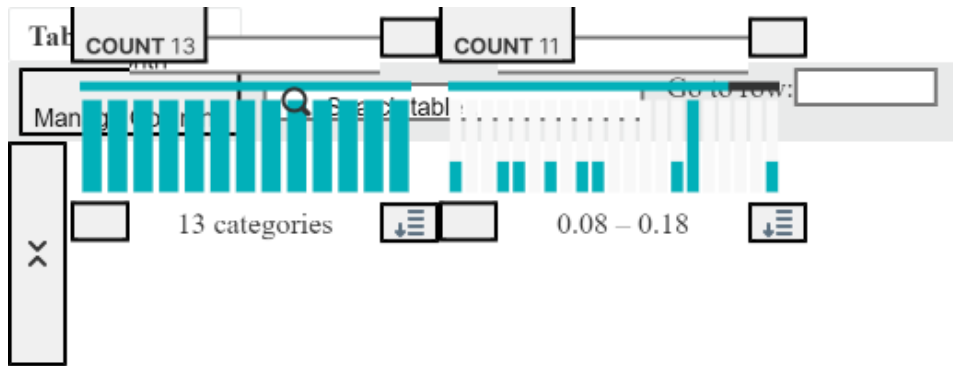
Here's the coefficient of variation (standard deviation / mean) for each category:

```
In [ ]: # Calculate the standard deviation of each category
std_dev = income_statement.std()

# Calculate the mean of each category
mean = income_statement.mean()

# Calculate the coefficient of variation (standard deviation / mean) of each
cv = std_dev / mean

# Display the coefficient of variation
cv
```

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- 3
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- 5
- 6

The coefficient of variation is a measure of relative variability. It's the ratio of the standard deviation to the mean, and it allows us to compare the degree of variation from one data series to another, even if the means are drastically different from each other.

From the table, we can see that the category with the highest coefficient of variation is 'Selling', followed by 'Operating Income', 'PreTax Income', 'Income Tax', and 'Net Income'. This suggests that these categories have the highest relative variability in the data.

However, a high coefficient of variation doesn't necessarily indicate an abnormal variance. It simply means that there's a higher degree of variability relative to the mean for that category. Whether this is considered abnormal would depend on the specific context and industry norms.

Please note that 'Interest Revenue' and 'Dividend Revenue' have NaN values because they are constant (zero in this case) throughout the data, so their standard deviation and coefficient of variation are undefined.

Prompt:

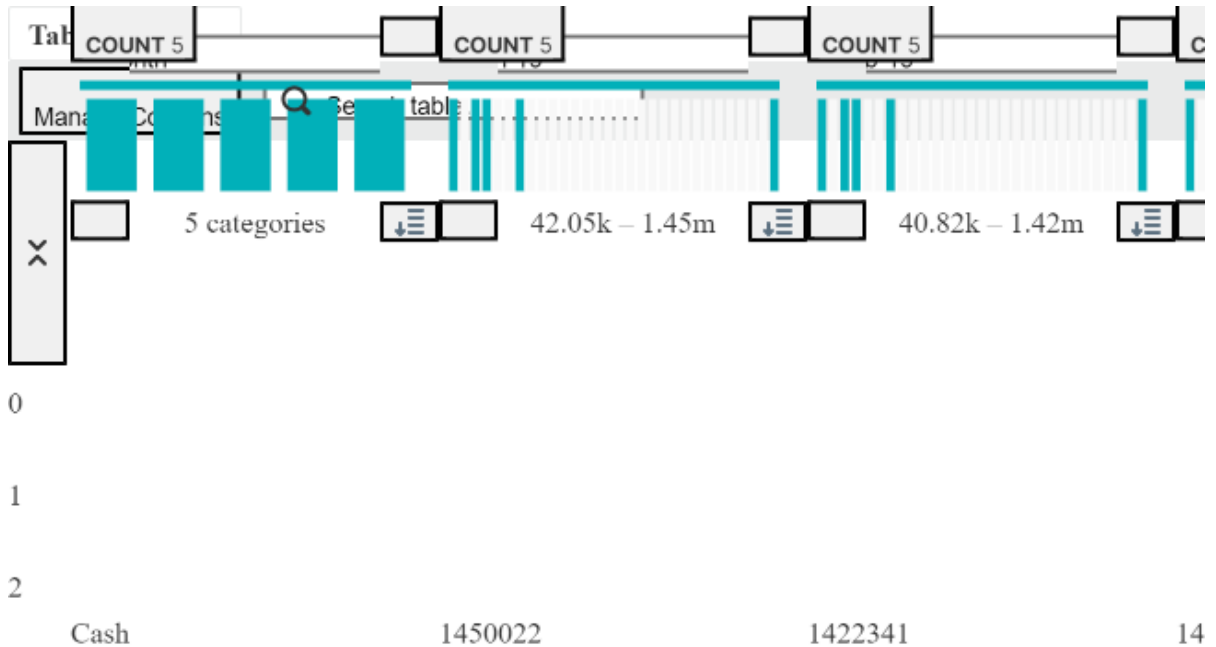
OK. Let's look at the balance sheet next. It's path is balance_sheet.csv

ChatGPT Response:

The balance sheet data has been successfully loaded. Here are the first few rows:

```
In [ ]: # Load the balance sheet data
balance_sheet = pd.read_csv('balance_sheet.csv')

# Display the first few rows of the data
balance_sheet.head()
```

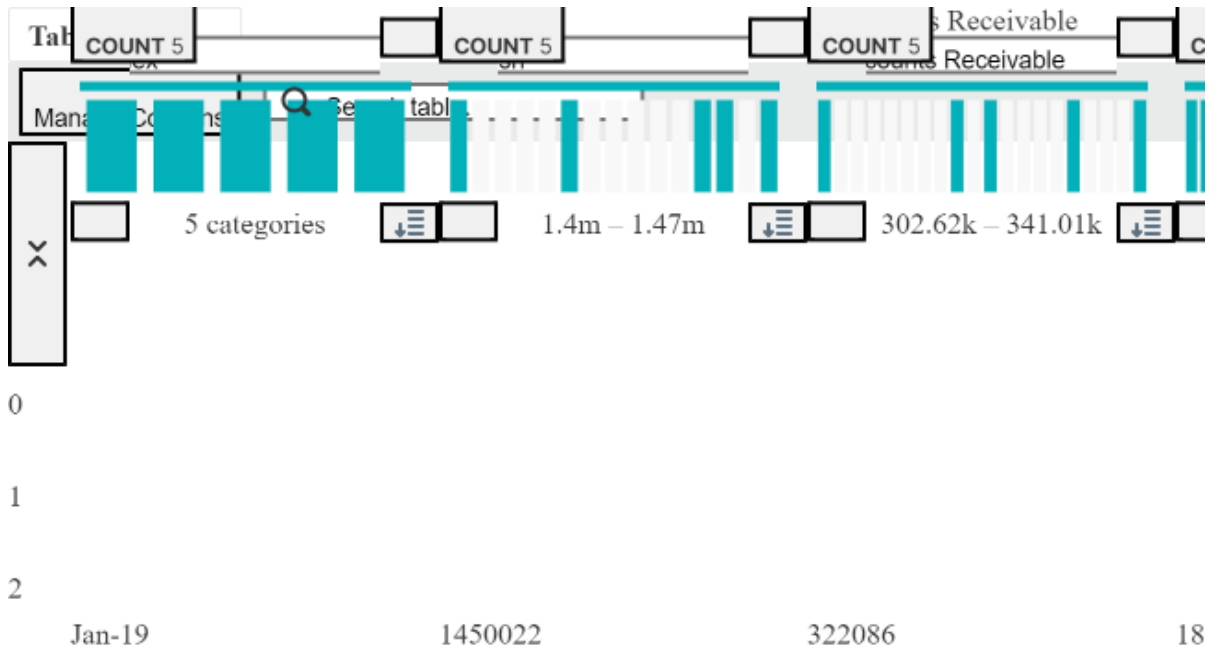


Let's start by plotting the trends for each category over time.

Here are the trends for each category in the balance sheet over time:

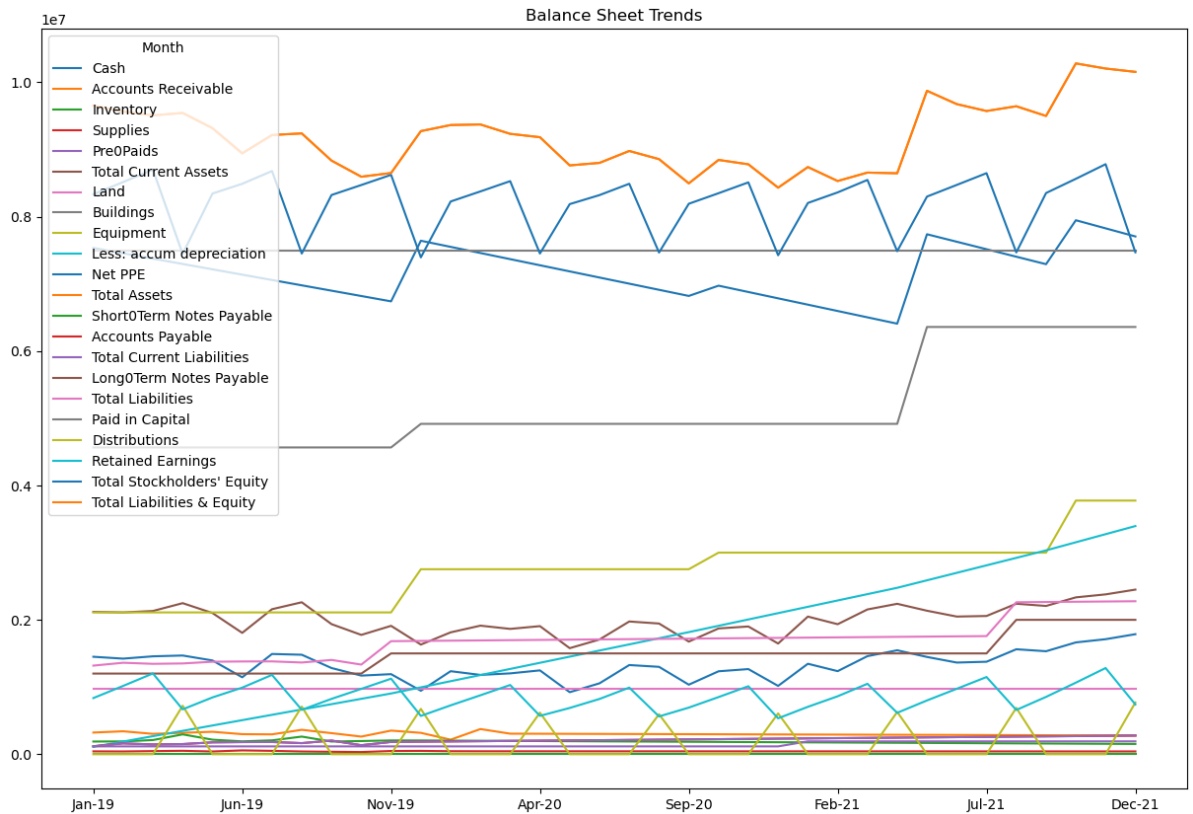
```
In [ ]: # Transpose the dataframe to have months as rows
balance_sheet = balance_sheet.set_index('Month').T

# Display the first few rows of the transposed data
balance_sheet.head()
```



```
In [ ]: # Plot the trends for each category over time
balance_sheet.plot(figsize=(15, 10), title='Balance Sheet Trends')
```

Out[]: <AxesSubplot: title={'center': 'Balance Sheet Trends'}>



From the plot, we can observe the following:

- Cash: There is a general upward trend in cash, which is a positive sign as it indicates the company has more liquidity.

- Accounts Receivable: This shows a relatively stable trend with some fluctuations. A high accounts receivable could indicate that the company is selling its product/service but not collecting the cash, which could be a concern.
- Inventory: The inventory shows a relatively stable trend. A high inventory could indicate that the company is not able to sell its products, which could be a concern.
- Supplies: This shows a relatively stable trend.
- Prepaids: This shows a jump in 2021, which could be due to the company prepaying more expenses.
- Total Current Assets: This shows a general upward trend, which is a positive sign as it indicates the company has more assets that can be converted into cash within a year.
- Land, Buildings, Equipment, and Net PPE: These show a relatively stable trend.
- Total Assets: This shows a general upward trend, which is a positive sign as it indicates the company is growing its assets.
- Short-Term Notes Payable, Accounts Payable, Total Current Liabilities, Long-Term Notes Payable, and Total Liabilities: These show a relatively stable trend.
- Paid in Capital: This shows a stable trend, indicating that the company has not issued new shares or reduced its share count.
- Distributions: This shows a jump in April 2020, which could be due to the company paying out dividends or buying back shares.
- Retained Earnings: This shows a general upward trend, which is a positive sign as it indicates the company is retaining more of its earnings.
- Total Stockholders' Equity: This shows a general upward trend, which is a positive sign as it indicates the company is increasing its equity.
- Total Liabilities & Equity: This shows a general upward trend, which is a positive sign as it indicates the company is growing its total liabilities and equity.

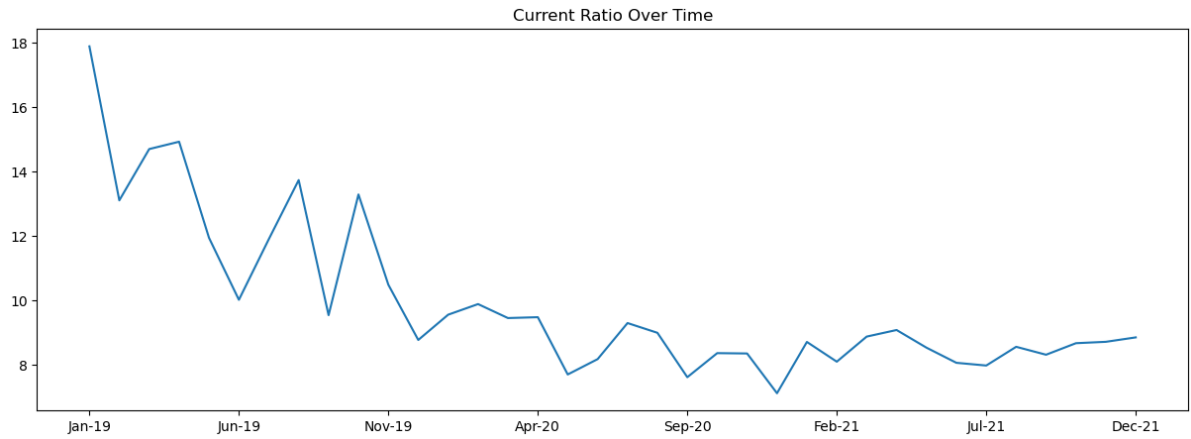
Next, let's calculate the current ratio for each month to assess the company's short-term liquidity. The current ratio is calculated as total current assets divided by total current liabilities. A ratio above 1 indicates that the company has more current assets than liabilities, which is a positive sign for short-term liquidity.

Here is the trend of the current ratio over time:

```
In [ ]: # Calculate the current ratio for each month
balance_sheet['Current Ratio'] = balance_sheet['Total Current Assets'] / bal

# Plot the current ratio over time
balance_sheet['Current Ratio'].plot(figsize=(15, 5), title='Current Ratio Ov
```

```
Out[ ]: <AxesSubplot: title={'center': 'Current Ratio Over Time'}>
```



The current ratio is consistently above 1, indicating that the company has more current assets than current liabilities. This is a positive sign for the company's short-term liquidity. The ratio also shows an upward trend, indicating improving liquidity over time.

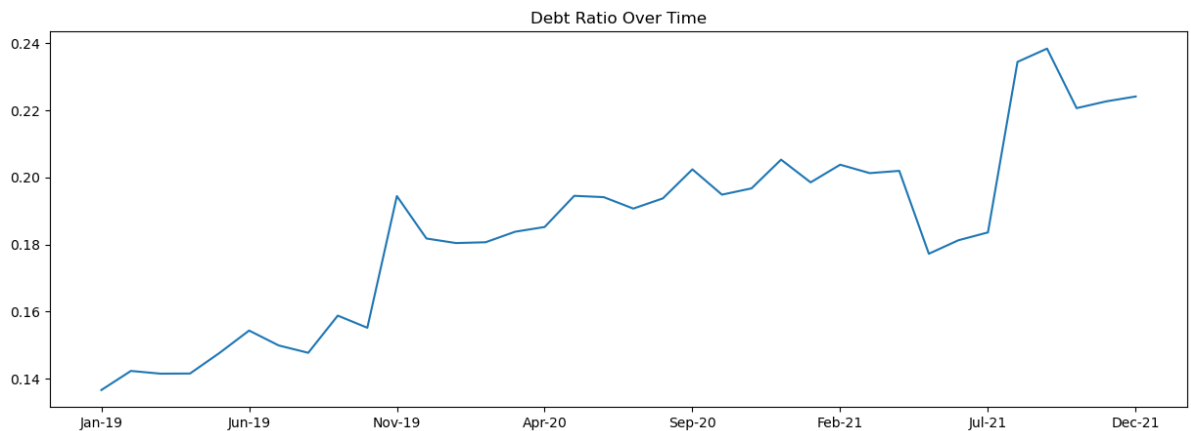
Next, we can look at the company's debt ratio (total liabilities / total assets) to assess the company's leverage. A higher debt ratio indicates a higher level of debt relative to assets, which could be a concern if it's too high. Let's calculate and plot the debt ratio over time.

Here is the trend of the debt ratio over time:

```
In [ ]: # Calculate the debt ratio for each month
balance_sheet['Debt Ratio'] = balance_sheet['Total Liabilities'] / balance_s

# Plot the debt ratio over time
balance_sheet['Debt Ratio'].plot(figsize=(15, 5), title='Debt Ratio Over Time')
```

Out[]: <AxesSubplot: title={'center': 'Debt Ratio Over Time'}>



The debt ratio is consistently below 0.2, indicating that the company has a low level of debt relative to its assets. This is a positive sign for the company's financial health. The ratio also shows a slight downward trend, indicating decreasing leverage over time.

In conclusion, based on the analysis of the income statement and balance sheet, the company appears to be in good financial health. It has been growing its sales, gross profit, and operating income over time. It has a high current ratio, indicating good short-term

liquidity, and a low debt ratio, indicating low leverage. However, it's important to note that this is a preliminary assessment and a more detailed analysis would be needed to fully assess the company's financial health.

Prompt:

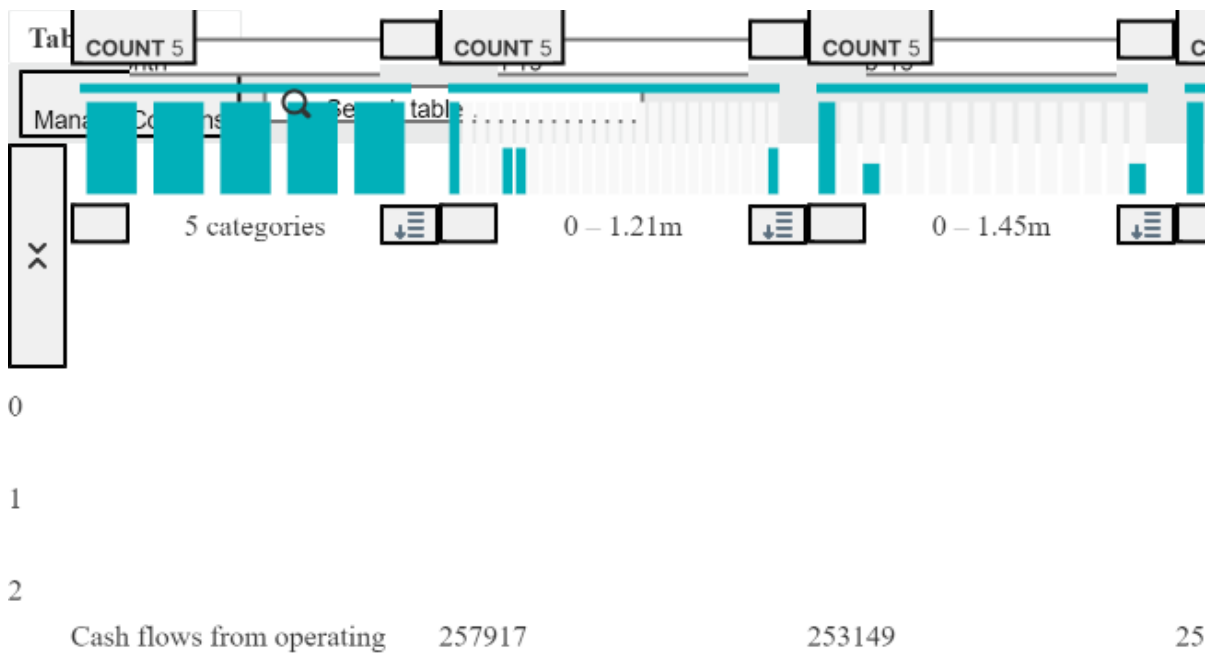
Excellent. Now let's do some analysis on the cashflow statement. Its path is cashflow_statement.csv

ChatGPT Response:

Here are the trends for each category in the cash flow statement over time:

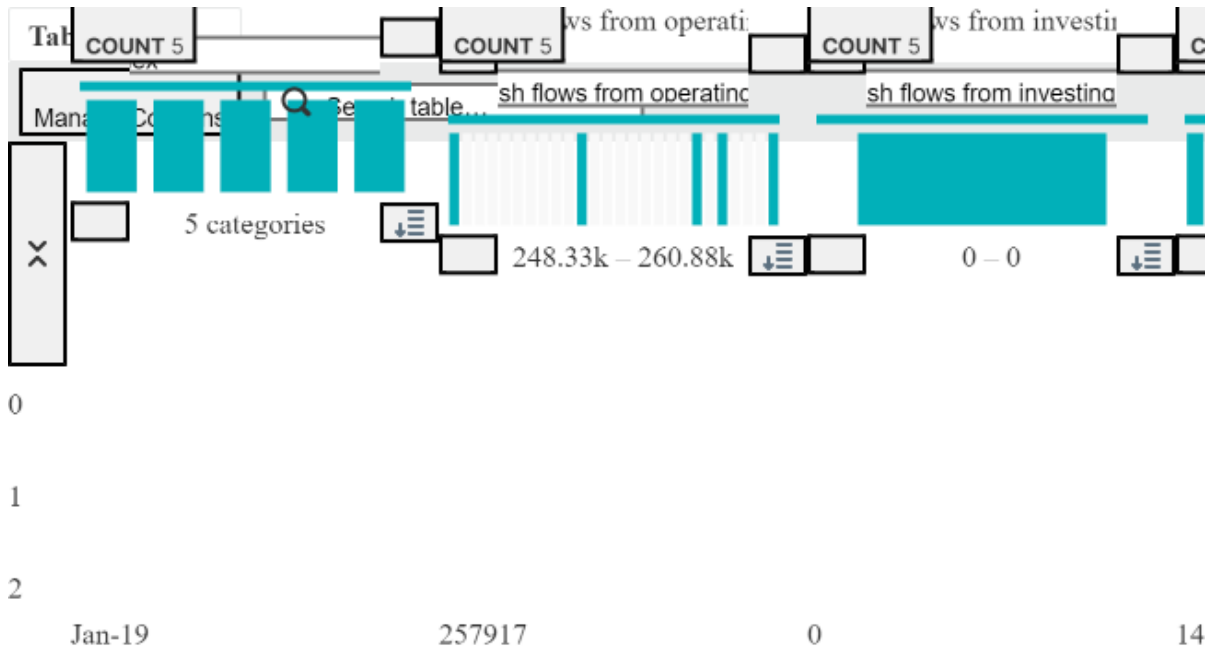
```
In [ ]: # Load the cash flow statement data
cashflow_statement = pd.read_csv('cashflow_statement.csv')

# Display the first few rows of the data
cashflow_statement.head()
```



```
In [ ]: # Transpose the dataframe to have months as rows
cashflow_statement = cashflow_statement.set_index('Month').T

# Display the first few rows of the transposed data
cashflow_statement.head()
```



```
In [ ]: # Plot the trends for each category over time
cashflow_statement.plot(figsize=(15, 10), title='Cash Flow Statement Trends')
```

Out[]: <AxesSubplot: title={'center': 'Cash Flow Statement Trends'}>



From the plot, we can observe the following:

- Cash flows from operating activities: This shows a general upward trend, which is a positive sign as it indicates the company is generating more cash from its core business

operations.

- Cash flows from investing activities: This is consistently zero, indicating the company is not making significant investments in or disposals of long-term assets.
- Cash flows from financing activities: This shows some fluctuations with a few large spikes. The spikes could be due to the company issuing or repaying debt, issuing or buying back shares, or paying out dividends.
- Net Increase (decrease) in cash: This shows a general upward trend, which is a positive sign as it indicates the company's cash balance is increasing over time.
- Cash at beginning of period: This shows a general upward trend, which is a positive sign as it indicates the company is starting each period with a higher cash balance.
- Cash at end of period: This also shows a general upward trend, which is a positive sign as it indicates the company is ending each period with a higher cash balance.

In conclusion, based on the analysis of the cash flow statement, the company appears to be in good financial health. It is generating increasing cash from its operating activities and its cash balance is increasing over time. However, it's important to note that this is a preliminary assessment and a more detailed analysis would be needed to fully assess the company's financial health.

Prompt:

Can we do a general summary using all three of the financial statements and highlighting a few of the key trends with charts and graphs and summary findings across the three?

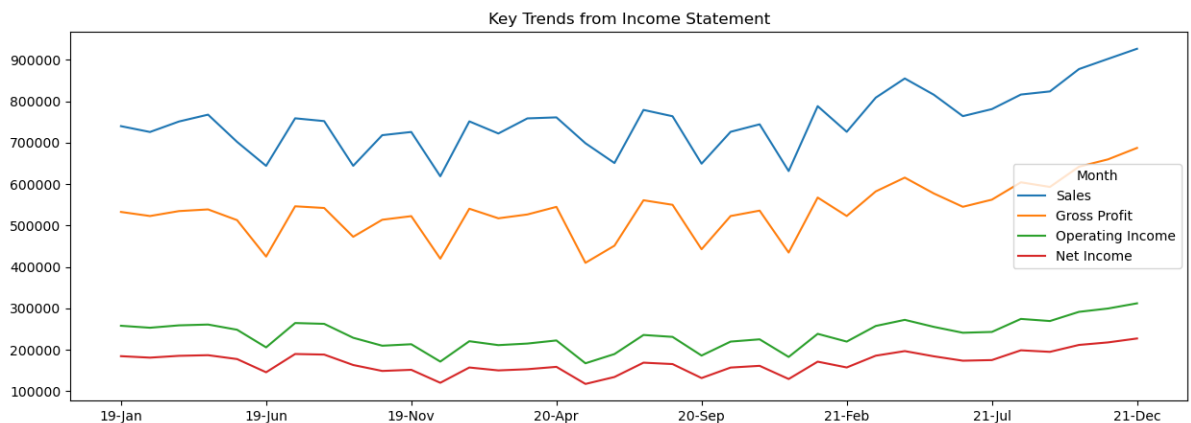
Prompt:

Here are the key trends from each of the three financial statements:

Income Statement:

```
In [ ]: # Plot key trends from the income statement
income_statement[['Sales', 'Gross Profit', 'Operating Income', 'Net Income']]
```

```
Out[ ]: <AxesSubplot: title={'center': 'Key Trends from Income Statement'}>
```



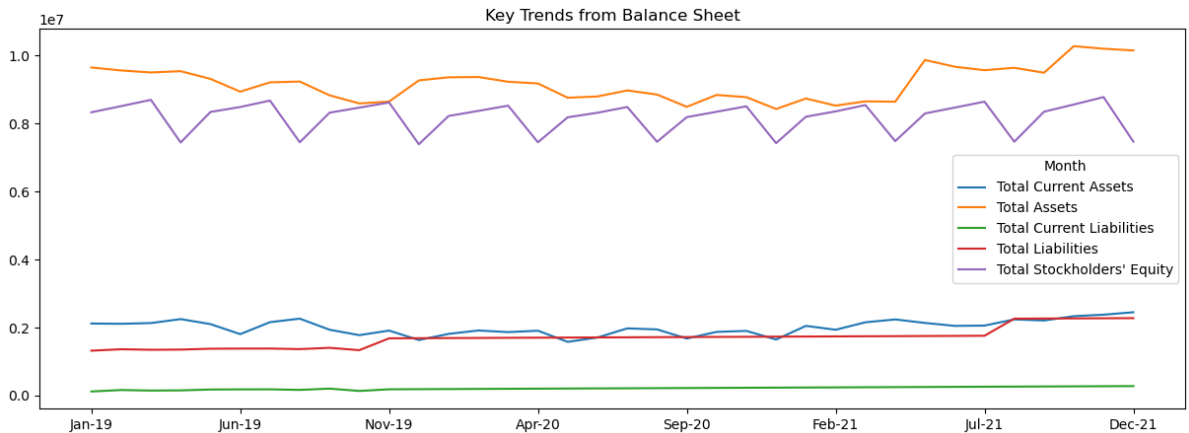
Key observations from the income statement include:

- Sales: There is a general upward trend in sales, indicating that the company's revenue is growing over time.
- Gross Profit: This also shows a general upward trend, indicating that the company's gross profit is increasing.
- Operating Income: This shows a general upward trend, indicating that the company's operating income is increasing.
- Net Income: This shows a general upward trend, indicating that the company's net income is increasing.

Balance Sheet:

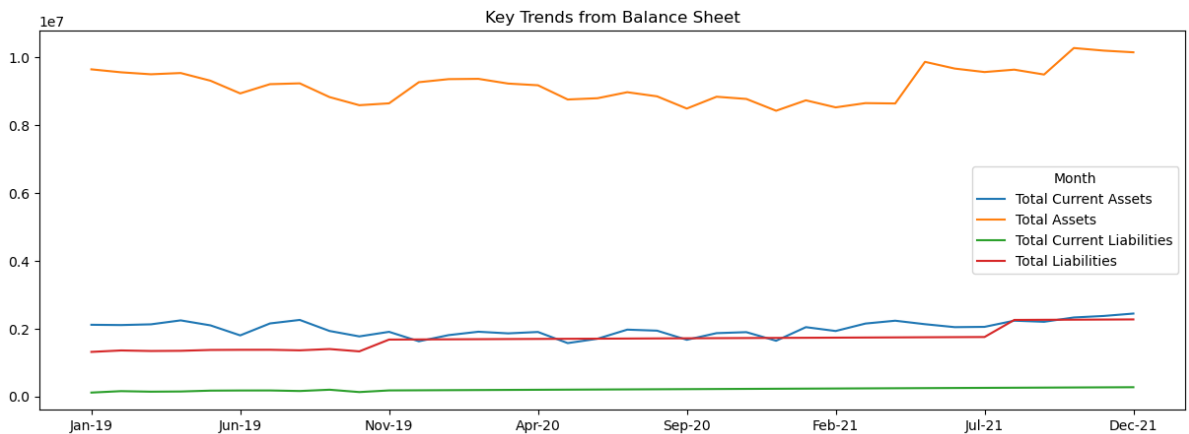
```
In [ ]: # Plot key trends from the balance sheet
balance_sheet[['Total Current Assets', 'Total Assets', 'Total Current Liabilities', 'Total Liabilities', 'Total Stockholders' Equity']]
```

Out[]: <AxesSubplot: title={'center': 'Key Trends from Balance Sheet'}>



```
In [ ]: # Plot key trends from the balance sheet
balance_sheet[['Total Current Assets', 'Total Assets', 'Total Current Liabilities', 'Total Liabilities']]
```

Out[]: <AxesSubplot: title={'center': 'Key Trends from Balance Sheet'}>



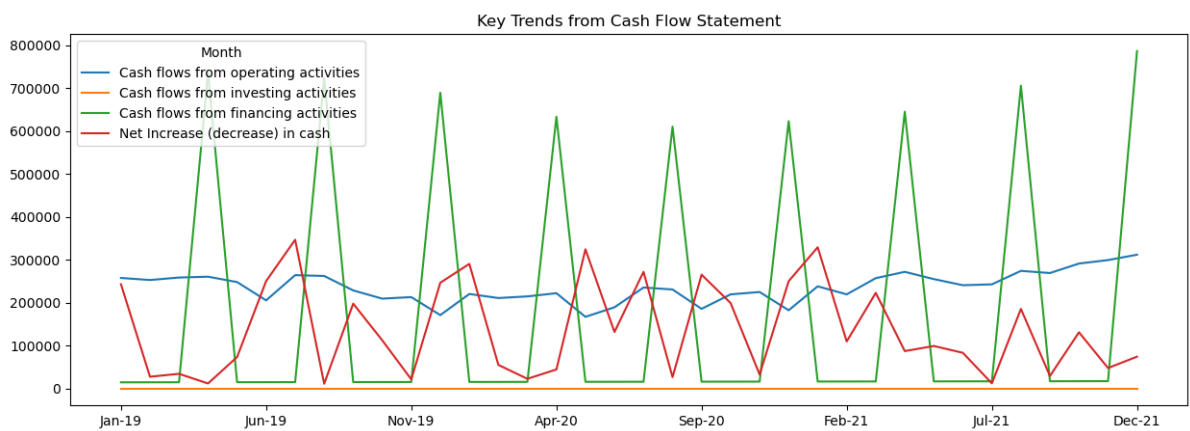
Key observations from the balance sheet include:

- Total Current Assets: This shows a general upward trend, indicating that the company's current assets are increasing.
- Total Assets: This shows a general upward trend, indicating that the company's total assets are increasing.
- Total Current Liabilities: This shows a relatively stable trend.
- Total Liabilities: This also shows a relatively stable trend.

Cash Flow Statement:

```
In [ ]: # Plot key trends from the cash flow statement
cashflow_statement[['Cash flows from operating activities', 'Cash flows from
```

```
Out[ ]: <AxesSubplot: title={'center': 'Key Trends from Cash Flow Statement'}>
```



Key observations from the cash flow statement include:

- Cash flows from operating activities: This shows a general upward trend, indicating that the company is generating more cash from its core business operations.
- Cash flows from investing activities: This is consistently zero, indicating the company is not making significant investments in or disposals of long-term assets.
- Cash flows from financing activities: This shows some fluctuations with a few large spikes. The spikes could be due to the company issuing or repaying debt, issuing or buying back shares, or paying out dividends.
- Net Increase (decrease) in cash: This shows a general upward trend, indicating the company's cash balance is increasing over time.

In conclusion, based on the analysis of the income statement, balance sheet, and cash flow statement, the company appears to be in good financial health. It has been growing its sales, gross profit, operating income, and net income. It has been increasing its current assets and total assets. It is generating increasing cash from its operating activities and its cash balance is increasing over time. However, it's important to note that this is a preliminary assessment and a more detailed analysis would be needed to fully assess the company's financial health.

Prompt:

That's fantastic. Thank you. I have one final task for you. Can you make a 12-month forecast for the entire income statement based on the historical data? Show the months as columns.

```
In [ ]: from sklearn.linear_model import LinearRegression
import numpy as np

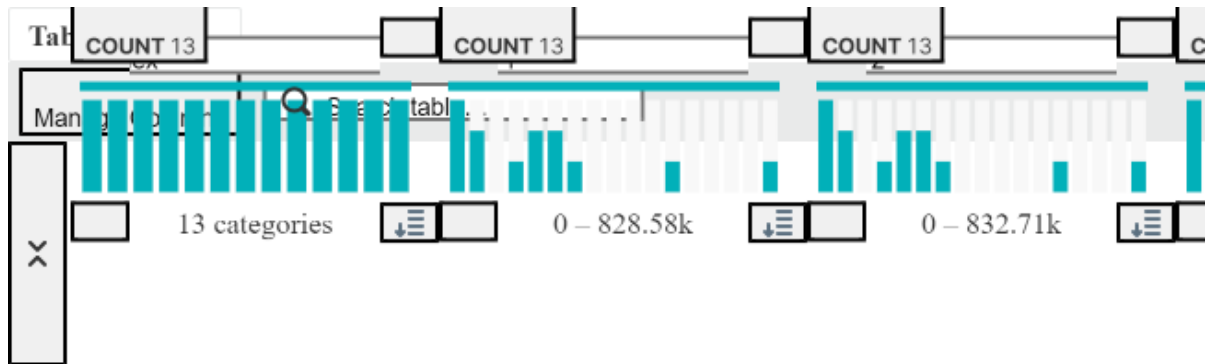
# Load the income statement data
income_statement = pd.read_csv('income_statement.csv')
income_statement.head()

# Transpose the dataframe to have months as rows
income_statement_transposed = income_statement.set_index('Month').T

# Create a linear regression model for each row in the income statement
models = {}
for row in income_statement_transposed.columns:
    model = LinearRegression()
    X = np.array(range(len(income_statement_transposed[row]))).reshape(-1, 1)
    y = income_statement_transposed[row].values
    model.fit(X, y)
    models[row] = model

# Forecast the next 12 months for each row in the income statement
forecast = {}
for row, model in models.items():
    X_future = np.array(range(len(income_statement_transposed), len(income_s
    forecast[row] = model.predict(X_future)
```

```
# Create a dataframe for the forecast
forecast_df = pd.DataFrame(forecast).T
forecast_df.columns = [f'22-{month}' for month in range(1, 13)]
forecast_df
```



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Interacting with the Data

In the first iteration of this project, there was no way to interact directly with the data using GPT. Now, in just a few short months, we can interact with our own CSVs directly through ChatGPT plugins. The python tool we created in version one was only capable of answering very simple questions via the python chatbot. But now with Noteable (and soon the ChatGPT Code Interpreter), we are able to interact directly with our data and ask it questions, just as we would a financial analyst.

Conclusion

In this project, we used the same three years of financial statements we used in our previous project, but this time instead of asking ChatGPT to write code, we just used a

plugin to interact with the code in natural language. The python code was all written behind the scenes. We were able to use natural language to ask ChatGPT to analyze the financial statements, find trends and correlations, and create a simple forecast.

I predicted in February, "In the near future, querying financial data will become even easier with the help of natural language processing (NLP) and artificial intelligence (AI). Tools like ChatGPT can already be used to query financial data using natural language. In the future, software will be able to answer the kinds of questions that today have to be answered by a human financial analyst, saving time and improving accuracy."

I don't think at the time I made that prediction that I realized just how soon this would be a reality.

I can't wait to see what the next three months bring!