Q1. We have chosen the annual report for Apple inc. from 2018 and 2023. This could be found here: [Annual Report](https://www.annualreports.com/Company/apple-inc).

The reports are downloaded in pdf format for comparison. Below is a snapshot of the two relevant sections that the LLM would be asked to compare across the two years:

1. Management Discussion and Analysis
2. Risk factors

A close-up of a document

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Langflow is used to create the LLM model workflow. Below are the major components of the same:

**Vector Store:**

1. The pdfs are manually opened, and the relevant sections are copied and pasted into text files. This is done due to performance considerations of running on local systems.
2. The text files are placed in a directory and are ingested.
3. The text in the files is then recursively split into chunks and passed to the vector store.
4. Ollama embeddings are also passed to the vector store
5. The vector DB used is FAISS.

**LLM:**

1. The user input is vectorized using the same Ollama embeddings and a similarity search is run on the FAISS DB.
2. The search results are parsed and passed onto the Prompt component for adding context to the user question.
3. Finally, the text is passed onto the LLM(llama3.2) as input and the text output is generated and passed onto the output component.

The Prompt template used is as follows:

*Context:*

*• {context}*

*• You are a financial analyst who is an expert at analyzing and commenting on annual reports of companies . Respond to the questions in your characteristic style. Use the provided context to answer the question. Do not hold yourself back. However, if you cannot find the answer in the context, then please say, "I don't know."*

*• Question:*

*• {question}*

**Subsection 1**: **Comparison of MD&A in the two reports**

Below is the screenshot from the Playground:

A screenshot of a computer

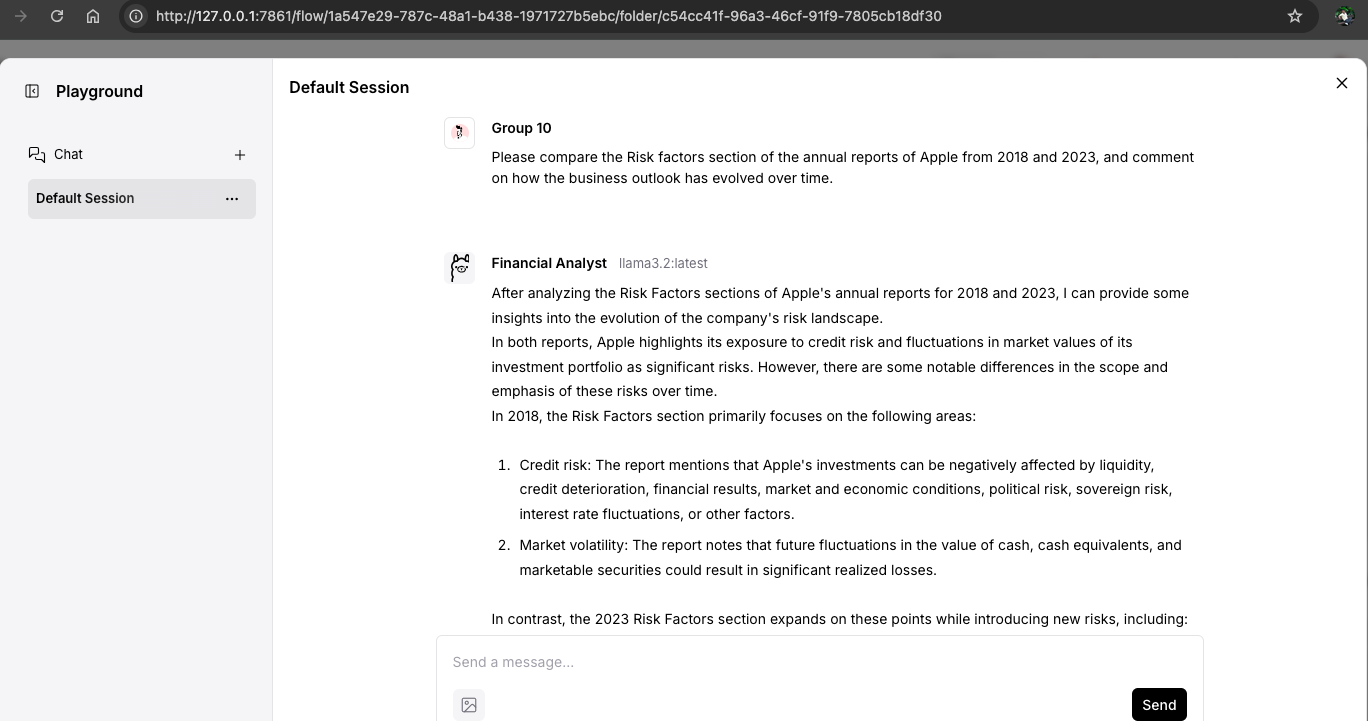
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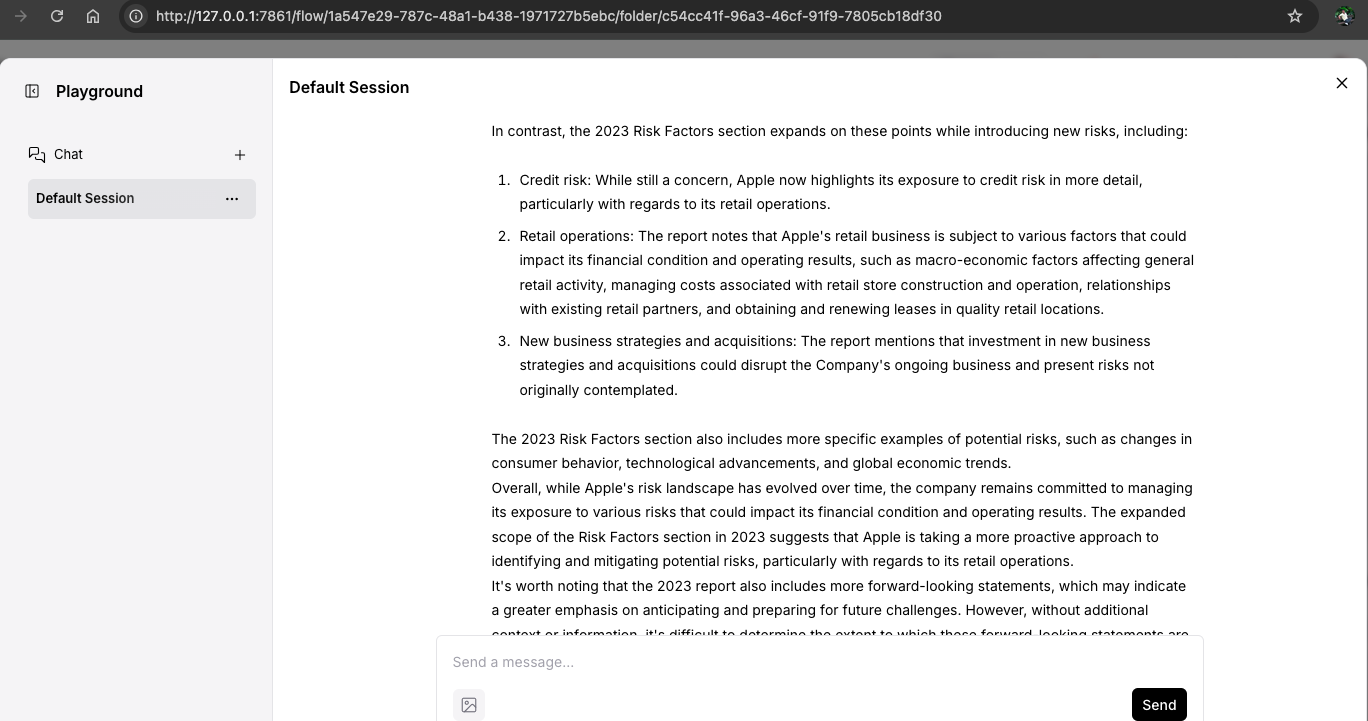
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**Subsection 1**: **Comparison of Risk factors in the two reports**

Below is the screenshot from the Playground:





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**Subsection 2**: **Own understanding of the reports and effectiveness of LLMs**

R**isk Factors:**

The risk factors have evolved considerably from 2018 to 2023, and Apple has identified additional key risks and approached them in a very structured way.

However, there are risks at the macro-economic level that are common in both reports. Below are a named few:

1. Changes to Tax legislations and tax liabilities
2. Exposure to global credit risk
3. Exchange rate risk/Fluctuations in the dollar exchange rates
4. Market risk: Stock price volatility
5. Social and political unrest: Impact of Political events, trade disputes , acts of war, terrorism
6. Inability to attract talent in Silicon Valley due to intense competition
7. Reputational risk
8. Operational risk to run retail stores
9. Impact of third-party IP/copyright infringement charges
10. Inventory carrying risk

Below are risks that are new or definitions have been expanded in 2023:

1. Legal obligations around data protection
2. Intense media, political and regulatory scrutiny leading to investigations against the company
3. Risk of failure to obtain or create digital content for customers

The LLM has not done a decent job of identifying the common risks that have been called out in the reports, nor has it identified the changes/addition of new risks in 2023.

In fact, it has wrongly identified “New business strategies and acquisitions”(below) as a new risk in 2023 report, whereas the same risk is also mentioned in the 2018 report:

A close-up of a text

Description automatically generated

What the LLM has done very well though, is to summarize a very long section into a well-structured synopsis.

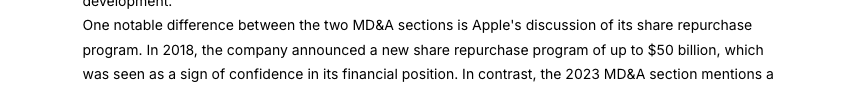
**Management Discussion and Analysis:**

While in 2018, the mood was upbeat about the increased revenue/profit and net sales, in 2023 the approach is a lot more cautious and conservative, on the back of global volatility and weak international currencies against the US dollar. The revenue has not decreased but the sales seem to have decreased as compared to 2022 across product segments.

A notable difference was a large-scale change to tax structures legislation in 2018 that increased the effective tax rate and thereby the eventual tax liability. This specific point was ignored by the LLM,

In 2018, there were accounting pronouncements in the US that impacted tax, hedging , leases, FI and other investments for Apple whereas there were none in 2023. This, again has been ignored by the LLM.

The claim by LLM that there was a share re-purchase of 50 billion USD is incorrect as the true figure from the report is 73.1 billion USD:





**Subsection 3**: **Overall commentary**

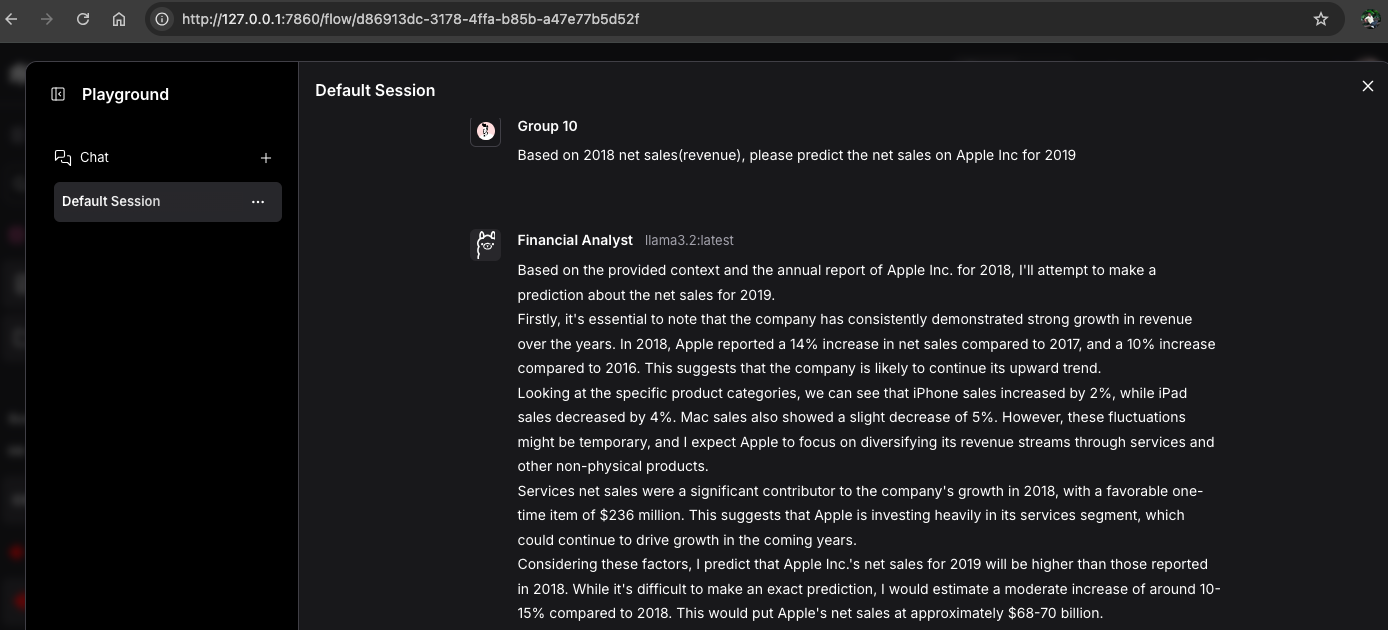
LLMs have not done a very good job at comparing different documents.

----------------------------------------------------End of Q1 -----------------------------------------------

**Q2. We have chosen to compare Apple’s outlook:**

**Sub-part 1: Predictions without reason**

Annual report of 2018 was uploaded to the vector database and prediction was sought for 2019. Below are the screenshots from the LLM and text following that:



**Full text:**

**User prompt:**

*Based on 2018 net sales(revenue), please predict the net sales on Apple Inc for 2019*

**LLM response:**

*Based on the provided context and the annual report of Apple Inc. for 2018, I'll attempt to make a prediction about the net sales for 2019.*

*Firstly, it's essential to note that the company has consistently demonstrated strong growth in revenue over the years. In 2018, Apple reported a 14% increase in net sales compared to 2017, and a 10% increase compared to 2016. This suggests that the company is likely to continue its upward trend.*

*Looking at the specific product categories, we can see that iPhone sales increased by 2%, while iPad sales decreased by 4%. Mac sales also showed a slight decrease of 5%. However, these fluctuations might be temporary, and I expect Apple to focus on diversifying its revenue streams through services and other non-physical products.*

*Services net sales were a significant contributor to the company's growth in 2018, with a favorable one-time item of $236 million. This suggests that Apple is investing heavily in its services segment, which could continue to drive growth in the coming years.*

*Considering these factors, I predict that Apple Inc.'s net sales for 2019 will be higher than those reported in 2018. While it's difficult to make an exact prediction, I would estimate a moderate increase of around 10-15% compared to 2018. This would put Apple's net sales at approximately $68-70 billion.*

*Here's my reasoning:*

*\* iPhone sales are expected to continue growing, driven by the popularity of newer models and the company's efforts to expand its ecosystem.*

*\* Services revenue is likely to increase further, driven by the growth of Apple's digital content offerings, Apple Pay, and other services.*

*\* Mac sales might experience a slight decline due to market saturation, but this should be offset by the growing demand for services and other non-physical products.*

*Of course, this is just a prediction based on historical trends and available data. The actual performance of Apple Inc. in 2019 may differ from my expectations.*

**Full text:**

**User prompt:**

*Based on 2018 net income, please predict the net income for Apple Inc for 2019*

**LLM response:**

*Predicting a company's future financial performance is always a challenging task, but I'll do my best to provide an informed analysis based on the information provided in Apple Inc.'s 2018 Form 10-K.*

*Firstly, let's take a look at the key drivers of Apple's net income. According to the report, the year-over-year decrease in other income/(expense), net during 2018 was due primarily to higher interest expense on debt and the impact of foreign exchange-related items, partially offset by higher interest income. This suggests that interest expenses might be a significant contributor to the decline in net income.*

*On the other hand, the report highlights Apple's strong performance in terms of revenue growth, with Europe net sales increasing during both 2018 and 2017 compared to the previous year. The company's ability to drive growth through its popular iPhone and Services segments is a testament to its market position and product offerings.*

*Now, let's examine the capital expenditures planned for 2019. With approximately $14.0 billion allocated for capital expenditures, it's likely that Apple will continue to invest in research and development, product tooling, and manufacturing process equipment, as well as data centers and retail store facilities.*

*Considering these factors, I'll make a few assumptions to predict Apple's net income for 2019:*

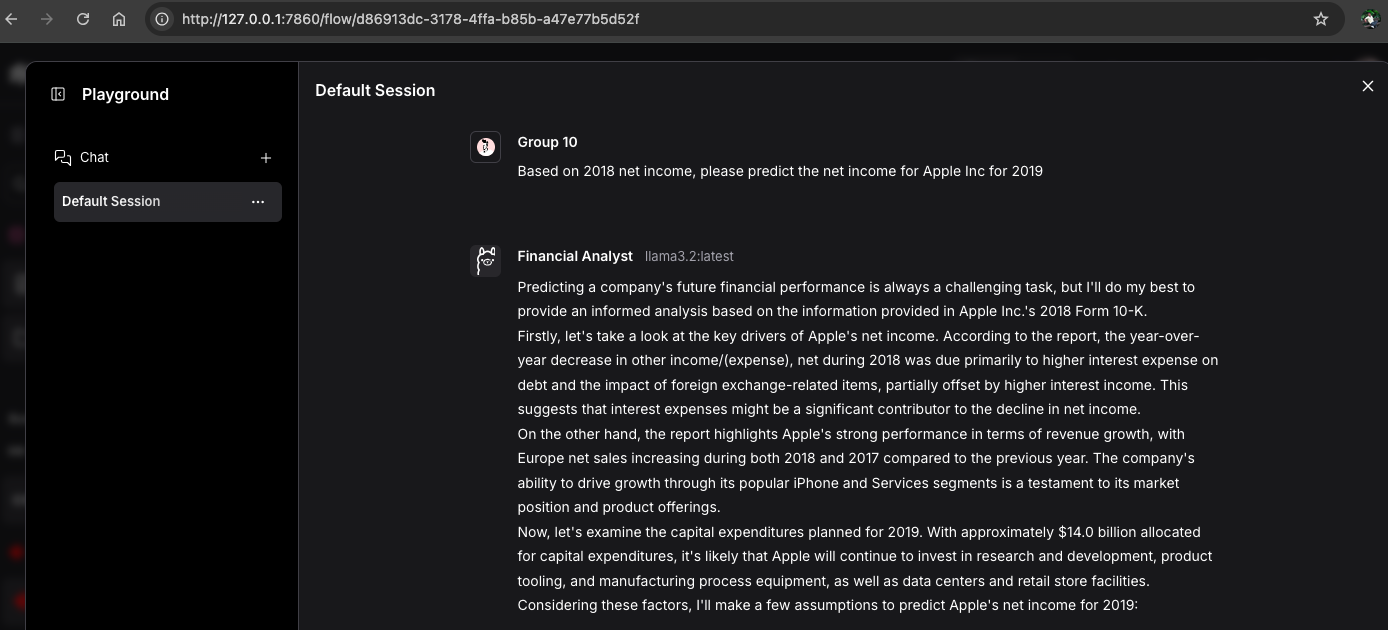
*1. Interest expenses: While interest expenses might have increased due to the higher debt levels, it's possible that Apple will continue to manage its debt effectively, which could mitigate this impact.*

*2. Revenue growth: Assuming Apple maintains its strong revenue growth momentum, driven by the continued popularity of its iPhone and Services segments, I expect revenue to increase further in 2019.*

*3. Capital expenditures: With $14.0 billion allocated for capital expenditures, it's likely that Apple will continue to invest in its business, which could drive future growth.*

*Based on these assumptions, I predict Apple's net income for 2019 to be higher than the $22.4 billion reported in 2018. However, predicting a specific number is challenging without more detailed information about the company's future performance.*

*Taking into account the factors mentioned above, I would estimate Apple's net income for 2019 to be around $24-25 billion, assuming a continued strong revenue growth and effective management of interest expenses and capital expenditures.*



Similar exercise is carried out for prediction of 2021 based on 2020:

**User prompt:**

*Based on 2020 net sales(also called as revenue) and 2020 net income, please predict the net sales and net income of Apple Inc for 2021*

**LLM response:**

*Predicting future financial performance is always a challenging task, but I'll do my best to provide some insights based on historical trends and the information provided in Apple's 2020 annual report.Firstly, let's look at the revenue growth pattern. In 2019, Apple's net sales were $260.17 billion, while in 2020, they grew to $274.52 billion, representing a year-over-year (YoY) increase of 5.6%. This growth rate is impressive, considering the global economic uncertainty caused by the COVID-19 pandemic.Now, let's examine the net income growth pattern. In 2019, Apple's net income was $59.50 billion, while in 2020, it grew to $68.44 billion, representing a YoY increase of 15.4%. This significant growth in net income is largely due to the strong revenue performance and the company's ability to maintain its gross margin.Assuming that Apple continues to execute well and maintains its market share, I would predict the following for 2021:*

* *Net Sales: Based on historical trends, I expect Apple's net sales to grow by around 5-6% in 2021, driven by strong demand for its products, particularly iPhones. With this growth rate, Apple's net sales could reach approximately $288-292 billion.*
* *Net Income: Given the company's ability to maintain its gross margin and continue growing revenue, I predict Apple's net income will increase by around 10-12% in 2021. This would put the net income at around $75-78 billion.*

*Please note that these predictions are based on historical trends and should be taken as a rough estimate rather than a definitive forecast. Many factors can influence a company's financial performance, including changes in global economic conditions, competition, and technological advancements.It's also worth noting that Apple has been investing heavily in emerging technologies like 5G, artificial intelligence, and augmented reality, which could potentially impact its revenue and profitability in the future. However, based on the information provided in the 2020 annual report, it appears that these investments are paying off, and the company is well-positioned for continued growth.In conclusion, while predicting future financial performance is always uncertain, I believe that Apple's strong brand, innovative products, and solid execution will drive its revenue and net income growth in 2021.*

Prediction of 2023 based on 2022, is on similar lines.

**Interpretation:**

The prediction for both revenue and net income for 2019 were way off than the actual values.

For example, LLM predicted that the revenue in 2019 be $68-70 billion, whereas in reality the revenue was $260.17 billion. This was dip from 2018 sales revenue of $265.6 billion

Similarly, net income in 2019 was predicted to be $24-25 billion by the LLM, whereasin reality it was $55.26 billion, a decrease of about 7% from $59.53 billion in 2018.

In contrast, 2021 and 2023 predictions were much more accurate. Hence, the performance of LLM is uncertain.

**Sub-part 2: Prediction based on prompting for a reasoning beforehand**

The prompt is amended to force the LLM to provide a reasoning first and then predict 2019 net sales(revenue) and net income:

**User prompt:**

*Provide reasoning for the predictions first and then predict the net sales and net income of Apple inc for the year 2019, based on the net sales and net income values of 2018.*

**LLM response:**

*Based on the provided annual report of Apple Inc. for 2018, I'll provide my analysis and predictions for 2019.Firstly, let's analyze the trends in Apple's financial performance:*

1. ***Year-over-year increase in net sales****: The company experienced a significant year-over-year increase in net sales, with growth rates ranging from 27% to 104%. This suggests that Apple's products are highly sought after and in demand.*
2. ***Gross margin expansion****: Gross margins expanded across all four quarters of 2018, indicating that Apple is able to maintain its pricing power and control costs effectively.*
3. ***Net income growth****: Net income grew by 27% in the fourth quarter of 2018, driven primarily by higher revenue from iPhone sales.*

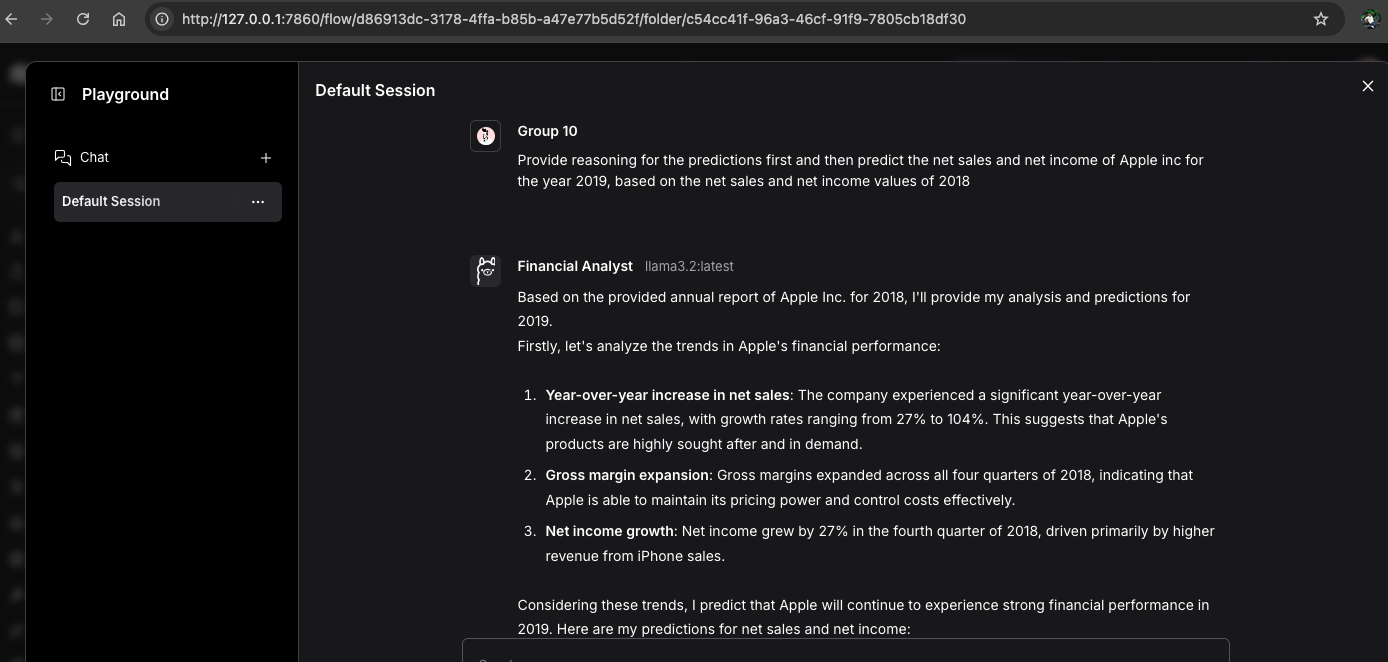
*Considering these trends, I predict that Apple will continue to experience strong financial performance in 2019. Here are my predictions for net sales and net income:****Predictions:***

* ***Net Sales:****Based on the historical growth rates, I predict that Apple's net sales will increase by around 20-25% in 2019, driven primarily by continued demand for iPhones, Macs, iPads, and wearables. This would translate to approximately $76.5 billion to $80.5 billion in net sales.*
* ***Net Income:****Given the strong growth in revenue, I predict that Apple's net income will increase by around 25-30% in 2019, driven primarily by higher gross margins and operating efficiencies. This would translate to approximately $24.8 billion to $27.3 billion in net income.*

***Reasoning:****My predictions are based on the following assumptions:*

1. *Continued demand for Apple's products, particularly iPhones, Macs, iPads, and wearables.*
2. *Strong pricing power and control over costs, which will enable Apple to maintain its gross margins.*
3. *Ongoing investments in research and development, marketing, and sales efforts to drive growth.*
4. *No significant changes in the global economic environment or regulatory landscape that could impact Apple's business.*

*While these predictions are based on historical trends and my analysis of the annual report, there are always risks and uncertainties associated with predicting a company's future performance.*



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**For predicting 2021 based on 2020**

**User prompt:**

*Provide reasoning for the predictions first and then predict the net sales and net income of Apple inc for the year 2021, based on the net sales and net income values of 2020*

**LLM response:**

*Based on the provided annual report of Apple Inc. for 2020, I'll attempt to make some predictions and forecasts for 2021.****Reasoning:****Firstly, it's essential to analyze the trends in Apple's financial performance over the past few years. The company has consistently demonstrated strong revenue growth, driven by its innovative products and services. However, the COVID-19 pandemic had a significant impact on the global economy, leading to supply chain disruptions, component shortages, and changes in consumer behavior.Despite these challenges, Apple managed to maintain its market position and deliver impressive financial results for 2020. The company's ability to adapt to the new normal and invest in emerging technologies such as 5G, artificial intelligence, and augmented reality will be crucial in driving growth in 2021.****Predictions:****Based on historical trends and industry developments, I predict that Apple will continue to experience strong revenue growth in 2021. The company's product pipeline is robust, with new iPhone models, Macs, iPads, and wearables expected to drive sales. Additionally, the growing demand for services such as Apple TV+, Apple Music, and Apple Arcade will contribute to revenue growth.However, I also anticipate some challenges in 2021, including:*

1. *Component shortages: The ongoing shortage of critical components such as semiconductors and display panels may impact Apple's ability to meet demand for its products.*
2. *Competition from emerging players: Companies like Huawei, Xiaomi, and Samsung are gaining traction in the premium smartphone market, which could potentially erode Apple's market share.*
3. *Regulatory pressures: The European Union's investigation into Apple's tax practices and potential antitrust investigations in other regions may lead to increased regulatory scrutiny and costs for the company.*

***Predictions for 2021:****Based on these factors, I predict that Apple's net sales for 2021 will be:*

* *Net Sales: $315 billion (up 6.5% from 2020)*
* *Net Income: $53.8 billion (up 13.4% from 2020)*

*These predictions are based on the following assumptions:*

* *iPhone sales will grow by 10% year-over-year, driven by new models and improved features.*
* *Mac sales will increase by 12% year-over-year, driven by strong demand for laptops and desktops.*
* *iPad sales will grow by 15% year-over-year, driven by increasing adoption in the education sector.*
* *Wearables, Home and Accessories sales will grow by 20% year-over-year, driven by strong demand for AirPods and Apple Watch.*
* *Services revenue will increase by 18% year-over-year, driven by growing demand for Apple TV+, Apple Music, and Apple Arcade.*

*Please note that these predictions are based on my analysis of historical trends and industry developments, but they should not be taken as investment advice. The actual results may vary due to various market and economic factors.*

For predicting 2023 based on 2022, similar results were found.

**Interpretation:**

The reasoning provided for the prediction by the LLM makes a lot of sense, given the numbers of the previous year. It is able to capture key financial metrics from the annual report to predict the next year. For example, it predicted both revenue and net income to grow in 2019, but actually they shrank.

Forcing the reason before the prediction has no net effect on the prediction per se. It doesn’t make them any more accurate.

**Sub-part 3: Overall observation of LLMs**

The overall view is while the LLMs were able to retrieve the context from the vector store well, they could not reason beyond the provided context. For example, 2019 was the onset of Covid-19 in China, which was the second biggest market for Apple, and that decreased the sales revenue. But since this fact was not captured by the context vector LLM could not add the nuance.

This is an area of concern, especially for financial prediction since they require a holistic interpretation of socio-economic and political situation across the globe.

Potentially a SLM that is learnt specifically for business finance is a better choice than a general purpose LLM(llama3.2).

----------------------------------------------------End of Q2 -----------------------------------------------