The Effects of GDP on Apple Inc.’s Net Sales

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Apple Inc. is a multinational technology company that has become a household name and has had a significant impact on the global technology industry. With a portfolio of products and services that includes iPhones, Macs, iPads, Apple Watches, and Apple Music, the company has become a dominant player in the technology industry. This paper will use regression analysis to analyze the demand for Apple's products and services, with a particular focus on the company's pricing strategies. Additionally, this paper will explore the impact of a leading economic indicator on Apple's sales and services, Gross Domestic Product (GDP), and offer recommendations for future pricing strategies based on the analysis. The research question guiding this paper is: how does a change in GDP impact the demand for Apple products and services, and how can regression analysis be used to estimate this impact and inform pricing strategies in light of the changing economic conditions?

According to various scholarly sources, there is a significant correlation between the state of the economy and the demand for Apple products. For example, according to Jana Kasperkevic from The Guardian, "The state of the economy can often determine whether consumers buy a new iPhone or delay their purchase". This quote highlights the importance of the GDP, as it is a measure of the overall health of the economy. Thus, changes in the GDP can greatly affect consumer behavior and purchasing decisions for Apple products.

Similarly, a study by Chen, Lee, and Tsai (2012) found that GDP growth had a significant positive effect on sales in the technology industry. They note that "when the GDP grows, consumers’ income and purchasing power increase, and consumers have more disposable income to spend on technology products". This insight supports the idea that GDP growth can lead to an increase in demand for Apple products and ultimately higher net sales.

In the case of Apple, a higher GDP could result in increased demand for its products and services, particularly as consumers regain confidence in their financial situation and feel more comfortable making purchases. A report by Statista shows that the growth of the global GDP has a strong positive correlation with the net sales of the technology industry, which is being covered in this paper. The report states that "the technology sector is one of the key drivers of global GDP growth, accounting for a significant share of the world's economic activity." This means that changes in the GDP, both positive and negative, can have a significant impact on the demand for Apple's products and services. This insight is important to consider when analyzing the effect of GDP on the demand for Apple products, as changes in the global economy can have a significant impact on consumer behavior and purchasing patterns. By including GDP as an independent variable in the regression analysis, there will be a better understanding of the relationship between GDP and Apple's net sales.

Now by looking at Apple Inc.'s quarterly financial data from 2018 to 2022, presented in their annual 10-K reports, they provide a relevant information. The 10-K report is a reliable and valid source of information, as it is required by the United States Securities and Exchange Commission (SEC) for publicly traded companies to file yearly reports that provide a comprehensive overview of their financial performance.

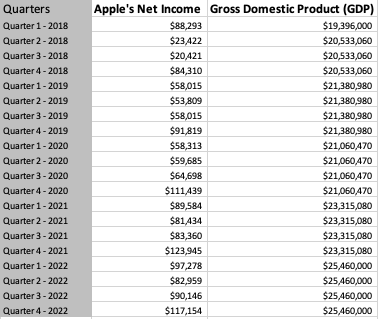
The selected financial data section of the 10-K report provides a summary of key financial metrics for Apple Inc. over the past years. This information can be used to gain a high-level view of the company's financial performance and to identify trends or patterns that may be relevant. The dependent variable that will be used for the regression analysis in the case to examine the effect that the GDP has on the demand for Apple products and services, is their quarterly net sales, because it provides a measure of Apple's revenue generated from the sales of its products and services.

By using net sales as the dependent variable, the analysis can capture the effect of changes in GDP on Apple's actual revenue earned. This is a more direct measure of the impact of changes in GDP on Apple's financial performance compared to using other measures. Additionally, using net sales allows for the evaluation of the relationship between GDP and Apple’s demand. Therefore, using net sales as the dependent variable is crucial for the accurate and relevant analysis of the relationship.

Now to gather GDP data, the The Bureau of Labor Statistics (BLS) website was consulted. The BLS provides quarterly and annual GDP data, which is measured in billions of dollars. These data are derived from multiple sources, including the U.S. Department of Commerce's Bureau of Economic Analysis, and are subject to rigorous quality control and analysis to ensure accuracy.

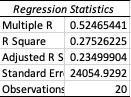
When conducting a regression analysis, it is important to ensure that the variables being compared are in the same units to avoid misleading results. In this study, the GDP data from the BLS were originally reported in trillions of dollars, while Apple's net sales were reported in billions of dollars. As a result, an adjustment was made to the GDP data to ensure that both variables were in the same units.

Specifically, the GDP data were converted from trillions of dollars to billions of dollars by multiplying the original values by 1,000. This adjustment ensured that the GDP and net sales variables were in the same units and could be accurately compared in the regression analysis. Without this adjustment, the results of the analysis may have been biased or incorrect. Here is the table that was created to show both corresponding net sales and GDP by quarter and years.



To understand the relationship between GDP and net sales of Apple products, a demand equation is necessary. The demand equation is a mathematical expression that shows how the quantity demanded of a product or service is related to its price and other variables. In this case, we are using a simple linear demand equation, y=mx+b, where y represents the net sales of Apple products, m represents the slope of the line or the change in net sales per unit change in GDP, b represents the y-intercept or the net sales when GDP is zero, and x represents the GDP. By formulating a demand equation, we can quantitatively analyze the impact of changes in GDP on the net sales of Apple products.

The y=mx+b demand equation assumes that the demand for Apple's products is linearly related to changes in GDP. However, it is important to note that demand can be affected by various other economic indicators. Therefore, the equation may not accurately capture the complexity of real-world demand for Apple's products. Another limitation of the equation is that it assumes a constant value for the slope of the equation (m), indicating that the marginal effect of changes in GDP on demand remains constant over time. However, this may not be the case, as consumer behavior can change over time due to various economic and social factors.

A regression analysis was conducted using the data and the demand equation y = mx + b, where y represents Apple's net sales, m is the GDP coefficient, x is the GDP, and b is the intercept coefficient. The regression analysis produced the following results

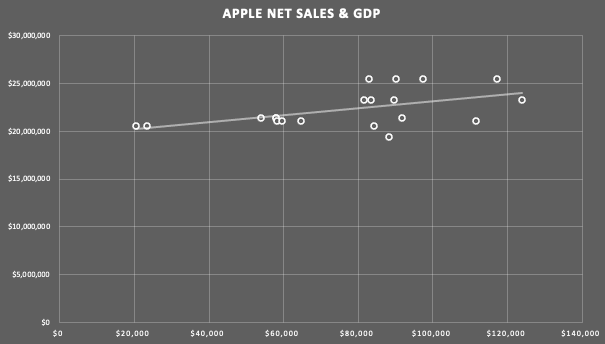


The ANOVA regression significance F-value is 0.01754876, indicating that the regression model is statistically significant at the 5% level. The significance of the F-value is important as it demonstrates that the model is useful for predicting the net sales of Apple products based on changes in GDP. This means that the independent variable (GDP) has a significant impact on the dependent variable (net sales), and the overall model is statistically significant. It adds credibility to the analysis and shows that the regression model is a reliable tool for predicting the impact of GDP on the net sales of Apple products.

The results of the regression analysis provide valuable insight into the relationship between Apple's net sales and GDP. The multiple R value of 0.52 indicates a moderate positive correlation between the two variables. This means that as GDP increases, so does Apple's net sales. The multiple R value is an important statistic as it provides an overall measure of the strength and direction of the relationship between the independent variable and the dependent variable. In this case, the moderate positive correlation suggests that GDP is a significant predictor of net sales, but there may be other factors that influence the relationship as well.

Furthermore, the multiple R value strengthens the original stance of the paper that GDP is a major determinant of Apple's net sales. The moderate positive correlation between the two variables suggests that there is a significant relationship between them, and this supports the idea that Apple's net sales are heavily influenced by macroeconomic factors such as GDP. However, it is important to note that the multiple R value does not provide information about causality or the direction of the relationship. It simply measures the strength and direction of the correlation between the two variables.

To provide a visual representation of the relationship between GDP and Apple net sales, a scatterplot can be included.



The scatterplot can help to further illustrate the moderate positive correlation between the two variables and demonstrate any potential outliers or patterns in the data. There is also evidence that with higher GDP values correspond to higher net sales values. However, the relationship is not perfectly linear, meaning there is some variability in the data points around the trend line.

The R-squared value for our regression analysis is 0.275, which means that approximately 27.5% of the variation in Apple net sales can be explained by changes in GDP. This indicates that our demand equation and regression analysis can provide a moderate level of explanation for the changes in both the variables. Although the R-squared value is not particularly high, it is still meaningful because it tells us that there is a relationship between the variables, and that our demand equation is a valid representation of this relationship. It is important to keep in mind that R-squared values can range from 0 to 1, with higher values indicating a stronger relationship between the variables. While the R-squared value is not particularly high, it is not uncommon to have a low R-squared value in real-world data analysis, especially in cases where there are many factors that can influence the dependent variable. Overall, the R-squared value of our regression analysis supports the idea that changes in GDP have an impact on Apple net sales and justifies the inclusion of GDP as an independent variable in our demand equation.

The F-value, which measures the significance of the overall regression model, is also a crucial statistic in this analysis. The F-value for this regression model is 0.0175, which is below the critical value of 0.05, indicating that the regression model is statistically significant. This means that there is a strong relationship between the independent and the dependent variable, and the model as a whole is a good fit for the data. The F-value also suggests that the independent variable has a statistically significant impact on the dependent variable. In other words, changes in GDP can be used to predict changes in Apple net sales with a reasonable degree of accuracy. This will help later in the paper when trying to develop pricing strategies to help Apple combat changing economic conditions.

The intercept coefficient for the demand equation is -89047.917, which represents the value of net sales when GDP is equal to zero. This value is not meaningful in the context of the model since GDP can never be zero. The t-value for the intercept coefficient is -1.398, which indicates that the coefficient is not statistically significant at the 95% confidence level. Therefore, we cannot conclude that the intercept has a significant impact on Apple's net sales.

The estimated coefficient value of 0.0074 indicates that for a one unit increase in GDP, the net sales of Apple products are expected to increase by 0.0074 units, all other variables held constant. The positive coefficient suggests a positive relationship between GDP and Apple net sales, meaning that as GDP increases, the demand for Apple products increases as well.

The GDP coefficient's t-value of 2.614 and p-value of 0.018 indicate that the coefficient is statistically significant at the 95% confidence level. This means that we can be reasonably confident that the true population coefficient lies within a certain range and is not zero, indicating that there is a real relationship between GDP and Apple net sales. This further supports the hypothesis that GDP is a significant factor in determining the demand for Apple products.

The standard error for the intercept and GDP coefficient can be interpreted as the average amount of error associated with predicting the demand for Apple products based on changes in GDP. In the regression analysis provided earlier, the standard error for the intercept was 63,697.0924 and for the GDP coefficient was 0.0028. These values suggest that the estimated coefficients may be subject to some degree of error or uncertainty, especially for the intercept. Nonetheless, the standard errors are relatively small compared to the magnitudes of the estimated coefficients, indicating that the demand equation still may be a good fit for the data.

It's important to note that the coefficients only provide information about the strength and direction of the relationship between the independent variable and the dependent variable in this specific model. Other factors, like stated earlier, could also influence Apple's net sales. However, the regression analysis provides valuable insight into the relationship between the variables, and can be used as a tool to inform business decisions and future predictions. Overall, the regression analysis provides strong evidence to support our original hypothesis that there is a positive relationship between GDP and Apple's net sales.

Calculating the elasticity of demand is a crucial aspect of understanding the behavior of markets and consumers. By knowing the elasticity, Apple can make informed decisions about pricing and production to maximize profits and meet consumer demand. Additionally, understanding the elasticity of demand can provide insights into the level of competition in the market and the potential impact of external factors, such as changes in consumer preferences or the introduction of new technology. With this information, Apple can adjust their strategies accordingly and remain competitive in the market.

In order to calculate the elasticity of demand, we must first obtain the values for price and quantity demanded at two different points. Using the demand equation y = mx + b, the slope (m) of the demand curve can be obtained, which represents the change in quantity demanded for a one-unit change in price. Then, the following formula to calculate the elasticity of demand can be used:

Elasticity of Demand = (% Change in Quantity Demanded) / (% Change in Price)

In this case, Apple’s net sales data and the GDP will be used for the price and quantity demanded, respectively. With the regression coefficients, the change in quantity demanded can be estimated for a one percent change in GDP. Using this estimate and the average GDP growth rate, the percentage change in quantity demanded can be calculated over a given period of time. Similarly, the percentage change in price can be calculate using the average growth rate of net sales.

If the elasticity of demand is greater than one, the product is considered elastic, meaning that a change in price will have a significant impact on the quantity demanded. If the elasticity of demand is less than one, the product is considered inelastic, meaning that a change in price will have a minimal impact on the quantity demanded. If the elasticity of demand is equal to one, the product is considered unit elastic, meaning that a change in price will have a proportional impact on the quantity demanded.

Overall, the calculation of elasticity of demand provides valuable insight into Apple's pricing and production decisions. Understanding the responsiveness of quantity demanded to changes in price is crucial for firms, especially in a competitive market. By applying the concept of elasticity of demand, Apple can gain a competitive edge and make informed decisions that will optimize their profits and market position.

By using the formula above, the percent change in quantity demanded can be calculated by using the following formula:

% Change in Quantity Demanded = ((New Quantity Demanded - Old Quantity Demanded) / Old Quantity Demanded) x 100

And to calculate the percentage change in price, we can use the following formula:

% Change in Price = ((New Price - Old Price) / Old Price) x 100

If Apple increases the price of their products by 10%, from $1,000 to $1,100, we can calculate the new quantity demanded using the demand equation. The new quantity demanded is 77.48 million units, while the original quantity demanded is 83.18 million units. Therefore, the percentage change in quantity demanded is -6.84%.

The percentage change in price is 10%, and using these values, the elasticity of demand was calculated to be -0.684. This suggests that the elasticity of demand for Apple products is inelastic, which means that a 10% increase in price would lead to a decrease in quantity demanded of only 6.84%. This indicates that Apple has some pricing power in the market and could potentially increase their prices without experiencing a significant decrease in sales.

For instance, Apple could increase the price of their products to increase their revenue and profits. However, this approach needs to be carefully implemented as an excessive price increase could lead to a decrease in sales, particularly if the company's products face stiff competition from substitutes. Moreover, if the price increase is too high, it could lead to negative customer feedback, which could damage the brand's reputation.

Moreover, since the elasticity of demand for Apple products is affected by factors such as consumer preferences and availability of substitutes, the company needs to monitor these factors closely to ensure that they remain competitive in the market. Apple could also use the information obtained from the elasticity calculation to adjust their marketing strategies, such as offering discounts during periods of low demand to encourage sales.

In order to protect Apple from losing sales, and facilitating appropriate pricing strategies with changing economic indicators, price forecasting is important. According to the Economic Forecast for the U.S. Economy posted by the Conference Board, the projected GDP growth rate for the U.S. economy is expected to fall soon. To maximize profits, Apple may consider adjusting their prices accordingly. Based on the regression analysis conducted earlier, we know that the demand for Apple products is affected by changes in GDP.

It was calculated that the GDP is expected to fall by .3% in the first quarter of 2023. By using the demand equation used earlier, it was found that a .3% decrease in demand will trigger a significant decrease in units, 83 million to be exact. This was able to be done by substituting a .3% change in GDP in the original demand equation to forecast the demand given these circumstances.

To counteract this, Apple can consider adjusting its pricing strategy. Specifically, if the demand for Apple products decreases due to a fall in expected GDP, then Apple can consider decreasing its prices in order to stimulate demand and maintain market share.

However, it is important to note that this strategy has its limitations. The elasticity of demand for Apple products is inelastic, meaning that a price decrease may not necessarily lead to a significant increase in demand. Additionally, price cuts could negatively impact Apple's profit margins. Therefore, Apple must carefully consider the potential impact of a price cut on its bottom line before implementing such a strategy. Also, the regression analysis and demand equation are based on historical data, which may not necessarily reflect future trends. Economic conditions can shift rapidly, and unforeseen events such as global pandemics can significantly impact demand for Apple products.

Other possible strategies for Apple to protect against losing sales and maximize prices could include diversifying its product line to appeal to a wider range of consumers, investing in research and development to stay ahead of competitors, and improving customer service and support to increase customer loyalty. Overall, Apple must carefully analyze the market conditions and its own capabilities in order to make strategic decisions that will maximize its profits and improve its market position.

Another way to help determine the optimal pricing and production levels for Apple products and services, given that there is a .3% expected decrease in GDP in the near future, a marginal analysis of the demand for their products and services can be conducted. This is used to identify the point at which the marginal revenue equals the marginal cost. This point is known as the profit-maximizing point and helps the firm to determine the optimal price to charge for its products. By conducting marginal analysis, Apple can also determine the elasticity of demand for its products and services, which is critical in predicting the effect of a change in price on sales. This information is particularly important when there is an expected .3% decline in GDP, as Apple can use this information to determine the optimal price level that maximizes revenue while minimizing the impact of the decline in GDP on demand.

So, by looking at a current Apple product, iPhone, we can conduct a marginal analysis to hopefully maximize profits when faced with a drop in GDP. By looking at the production costs ($501), the current price ($899), and the demand equation, there is a way that Apple should maximize their profit. By finding the marginal revenue and comparing that to the marginal costs, in respect to the .3% drop in GDP, the new price of the iPhone should be dropped approximately $40 to $859 to maximize sales revenue. By doing so,, Apple should produce and sell 11.08 million units to optimize its profit and potentially mitigate the negative impact of the GDP decline on its sales revenue and maintain its competitiveness in the market.

When faced with a drop in GDP, Apple must consider the trade-offs involved in adjusting their pricing strategy. If they lower their prices, they may be able to maintain sales and market share, but they will also face lower profit margins due to reduced revenue per unit sold. On the other hand, if they maintain their current prices, they may be able to preserve their profit margins, but they may also lose customers who are seeking more affordable options during an economic downturn.

Additionally, Apple must also consider the potential long-term effects of any pricing decisions made during this time. Lowering prices may cause customers to become accustomed to the lower prices, making it difficult to increase prices again once the economy recovers. Similarly, maintaining high prices may make it difficult to attract customers who have become more price-sensitive during the economic downturn. Therefore, Apple should carefully consider the trade-offs involved in any pricing decisions made during this time. They may also want to consider alternative strategies.

One strategy that Apple could use to maintain sales and market share without reducing their prices is to offer financing options. This would allow customers to purchase Apple products and services without having to pay the full amount upfront. By offering financing options, Apple can make their products more accessible to customers who may not have the financial means to make a full purchase at once. Additionally, offering financing options may encourage customers to purchase more expensive products, such as the iPhone 14 Plus, by spreading the cost out over a longer period. However, offering financing options can result in higher costs for Apple, as they may need to pay interest on the financing or assume the risk of customers defaulting on payments. So, by taking a thoughtful and strategic approach to their pricing during an economic downturn, Apple can maximize their long-term success and profitability.

Based on the analysis conducted in this paper, it is evident that will be able to Apple to maintain its market share and pricing power despite the challenges posed by the expected .3% decline in GDP. The regression analysis revealed that Apple's products and services are relatively price inelastic, indicating that changes in price do not significantly affect consumer demand. However, the marginal analysis showed that a decline in GDP may lead to a decrease in revenue for Apple. To mitigate this, Apple could consider implementing strategies such as offering financing options or discounts on bundles of products or services, rather than reducing prices. And all of that put the research question of this paper into perspective.

In conclusion, Apple's strong brand image, loyal customer base, and innovative products have allowed the company to maintain its market share and pricing power. The findings of this paper suggest that Apple should continue to focus on innovation and product differentiation to maintain its competitive edge. Future research could explore the impact of external factors, such as changing consumer preferences or economic conditions, on Apple's pricing strategy. Furthermore, future research could explore the impact of different marketing and advertising strategies on the demand for Apple products and services. This could include examining the effectiveness of social media campaigns, influencer marketing, and other forms of digital marketing.

Possible improvements to the analysis could include gathering more data on consumer behavior and preferences and conducting a more in-depth analysis of Apple's cost structure. Overall, this paper provides valuable insights into the pricing strategy of one of the world's most successful technology companies and highlights the importance of understanding market demand and conducting marginal analysis in making pricing decisions.

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