Novo Nordisk

Team 12: Aria, Leah, Helen, Nana Kofi

Novo Nordisk Introduction & Overview

Company Background

Novo Nordisk is a global pharmaceutical company that specializes in diabetes care medications and devices. Based out of Denmark, their main product and revenue driver are weight-loss drugs such as Ozempic and Rybelsus. Created after a merger between two Danish companies, they are now the highest valued company in all of Europe.

Industry

Novo Nordisk operates within the pharmaceutical industry, emphasizing disease management.. The company is a global leader in diabetes care but also has products in related areas such as obesity, hemophilia, and growth hormone disorders. The pharmaceutical industry is highly competitive and some of their key competitors include: Pfizer, Eli Lilly and Company, and Sanofi.

Mission

Novo Nordisk's mission is to focus on serious chronic diseases that are among the most urgent global health challenges by combining innovation and commercial usage. They want to turn ideas into better treatments for people living with serious chronic diseases.

Key Products & Services

Products

- Diabetes Medication
- Obesity Medication
- Hemophilia Medication
- Hormone Replacement Therapy

Services

- Diabetes Care Devices
- Medical Devices
- Savings, Coverage, Support

Motivation for Variables

Our team decided to use net profit and stock price as variables to assess Novo Nordisk. We chose these variables because, as a public company, we believe stock price and profit are reliable indicators of success.

Data and Key Insights

One data source we used was **Statista** to find the Net Profit of Novo Nordisk from 2009 to 2023 which was pulled from the Novo Nordisk website financial statements. This data shows a clear upward trend and a sharp increase in the year 2024.

The other data source we used was pulled from **Nasdaq** to find the stock prices of Novo Nordisk from 2010 to 2024. This data set shows the current market, and trends that can be anticipated. In the data set the weekends were unaccounted for due to the market being closed

Descriptive Statistics (Variable Analysis & Visualizations)

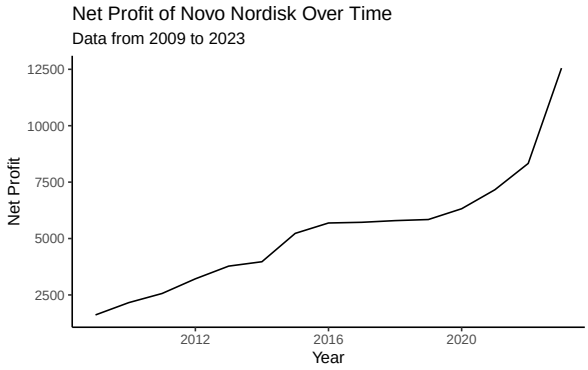
- Profit of Novo Nordisk

- Stock of Novo Nordisk

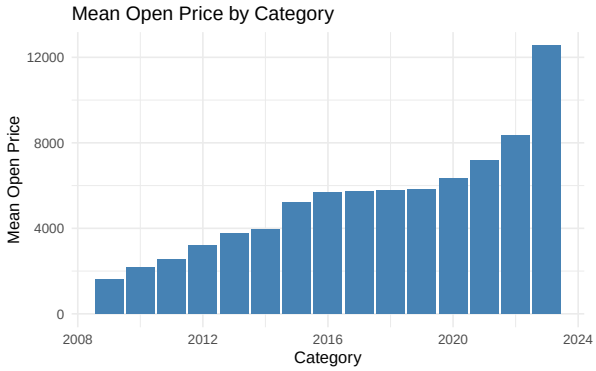
Summary Statistics for Net Profit of Novo Nordisk

Mean	Median (Q2)	1st Quartile (Q1)	3rd Quartile (Q3)	Max	Min
5329.62	5688.75	3496.2	6081.675	12552.45	1615.2

Profit of Novo Nordisk



(a) Line Graph



(a) Bar Graph

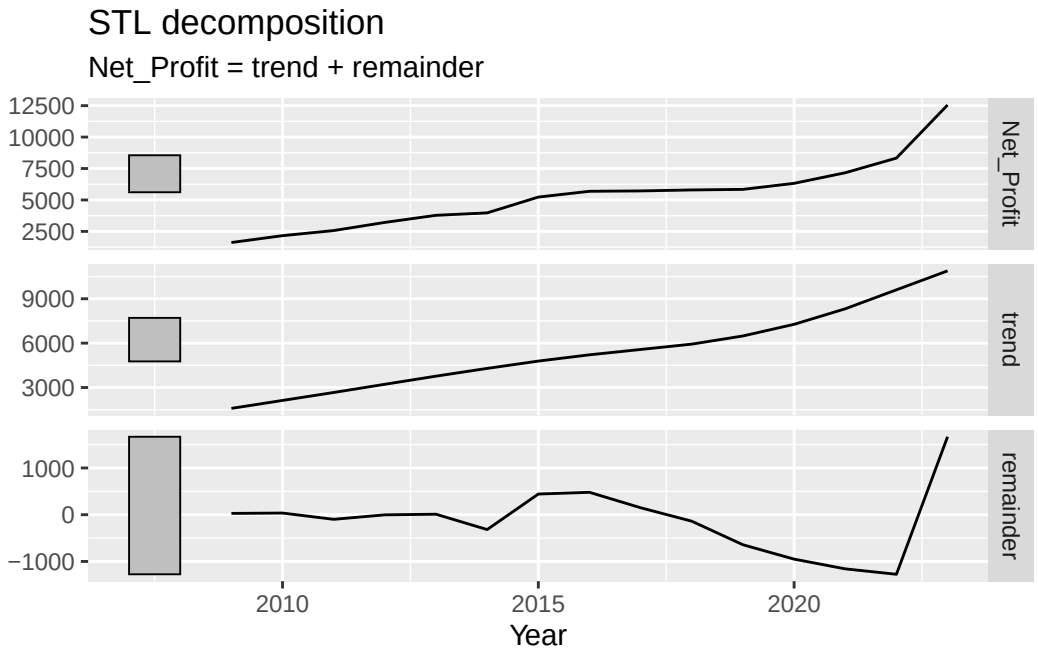
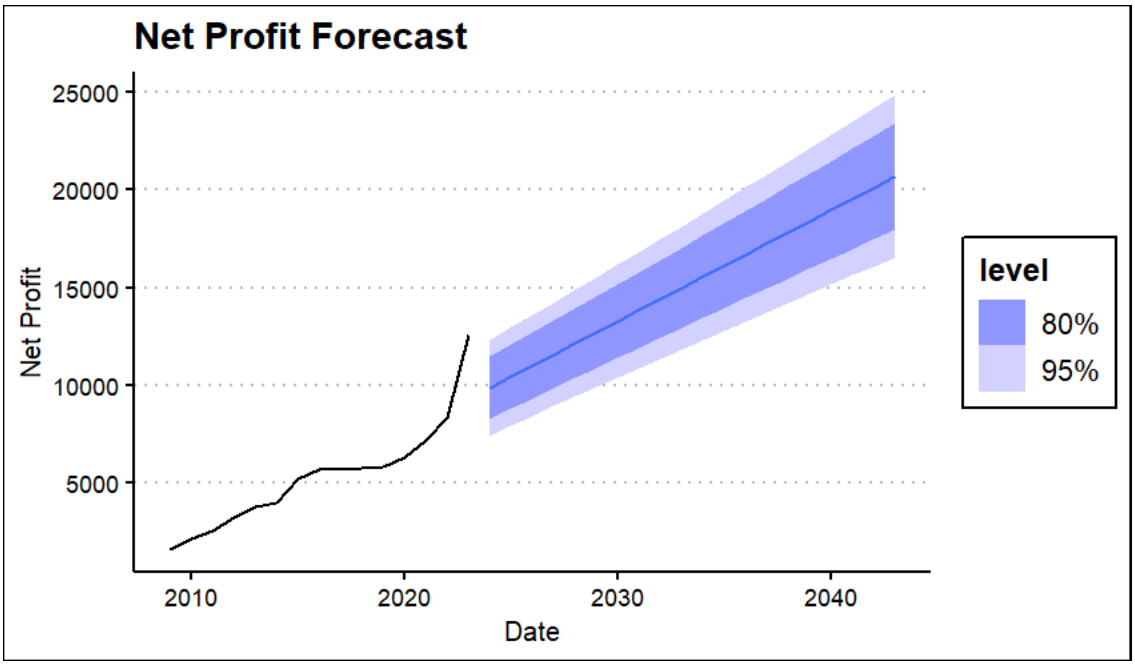


Figure 3: For our Profit Decomposition, there is a steady upward trend shown

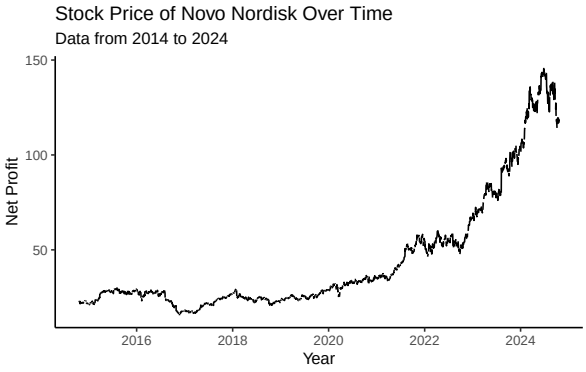
```
# A tibble: 5 x 10
  .model .type    ME  RMSE   MAE    MPE   MAPE   MASE  RMSSE   ACF1
  <chr>  <chr> <dbl> <dbl> <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
1 ARIMA  Test    NaN   NaN   NaN  NaN     NaN    NaN    NaN     NA
2 ETS    Test    552. 2208. 1526.   1.40  17.7    3.57   4.05  0.325
3 ETS2   Test    973. 1811.  973.   9.64   9.64   2.27   3.32  0.119
4 TSLM   Test    176. 2823. 2272.  -6.07  28.9    5.31   5.18  0.395
5 TSLM2  Test    106. 1920. 1358.  -4.22  16.7    3.17   3.52  0.285
```



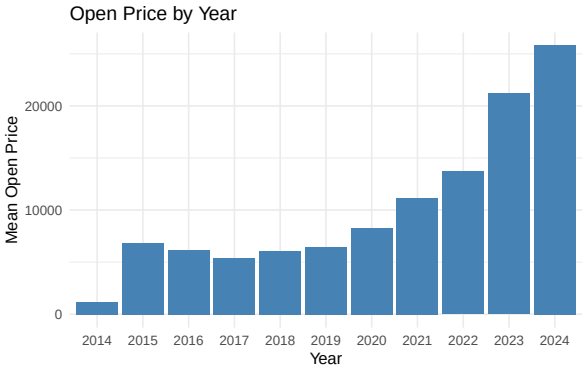
Summary Statistics

Mean	Median	1st Quartile (Q1)	3rd Quartile (Q3)	Max	Min
44.49616	28.6475	24.49375	53.64375	145.56	15.535

Stock of Novo Nordisk

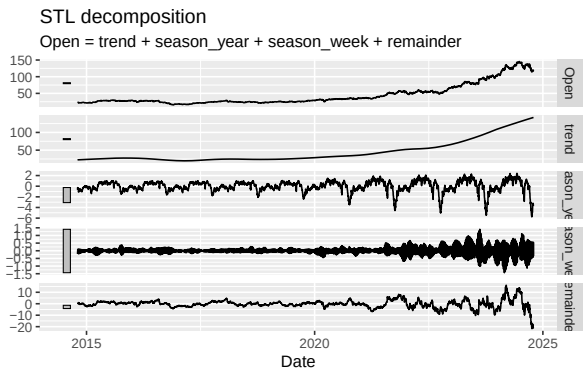


(a) Line Graph

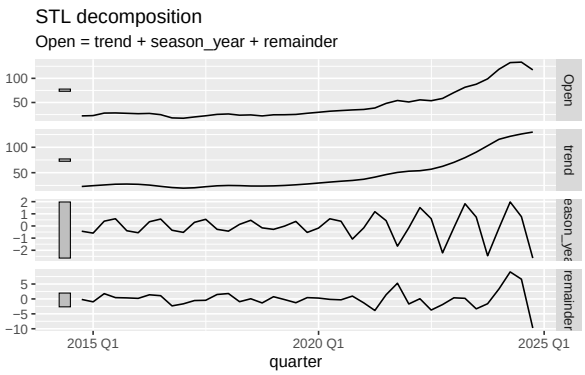


(a) Bar Graph

Stock Time Series and Decomposition



(a) Daily Decomposition



(a) Quarterly Decomposition

```
# A tibble: 4 x 10
  .model .type    ME  RMSE   MAE    MPE  MAPE  MASE RMSSE  ACF1
  <chr>  <chr> <dbl> <dbl> <dbl>  <dbl> <dbl> <dbl> <dbl> <dbl>
1 ETS    Test   3.11  11.7  8.34  0.828  16.8 0.657 0.622 0.436
2 ETS2   Test   7.73  15.9 10.1   8.55   16.8 0.796 0.844 0.503
3 TSLM   Test   8.11  13.3  9.28 16.3    19.2 0.730 0.707 0.501
4 TSLM2  Test  15.7   25.5 17.9  19.1    30.7 1.41  1.35  0.868
```

Forecasting

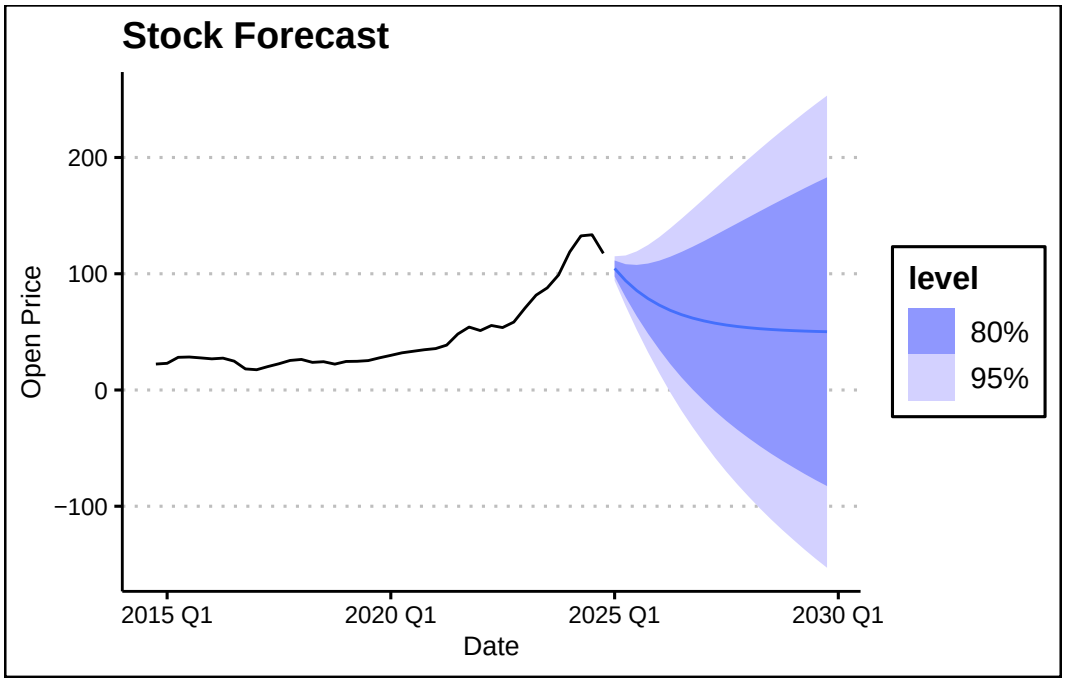


Figure 8: Best Model Forecast

Forecasting Methodology

Model Selection

- For our **Net Profit** model, we used ETS with additive error and additive trend, ETS with no arguments, TSLM with trend and trend squared, TSLM with only trend, and ARIMA. We selected the TSLM with trend due to the fact that it generally produced the lowest error metric. However, we also found that ETS with no arguments could be a valid model to use as it scored similarly when comparing error metrics.
- For our **Stock Price** Model, we made the same models used in the Net Profit analysis and found that the ETS model with additive error and additive trend scored the lowest of every single error metric.

Process Overview

- We first read the Net Profit data and converted it to a tsibble. Within our model creation, we then used the function stretch_tsibble and set .init=8 and .step which we found produced the lowest error metric and created all four models within that code. We then did a forecast of h=4 to forecast for 4 time periods. We then ran an accuracy function to test the model and compared each model by the different error metrics.
- For the Stock Data, we read in the data and converted the Open prices to a numeric data type as well as removed the dollar sign so the data could be used for analysis. Since the stock open prices are only listed for the weekdays, we filled the missing dates in the data for the weekends. We then converted the data to a tsibble and carried the Friday Open price to the next Saturday and Sunday date to replace the NA values. Within our model creation, we then used the function stretch_tsibble and set .init=8 and .step which we found produced the lowest error metric and created all four models within that code. We then did a forecast of h=4 to forecast for 4 time periods. We then ran an accuracy function to test the model and compared each model by the different error metrics.

Results and Business Impact

Forecasting Results

We found that within our forecasted results, Novo Nordisk Stock Prices operate with seasonal trends, as profit drops during the winter and rises during the summer. This is possibly due to several different factors, such as how warmer temperatures can affect diabetic patients and how they absorb insulin. Additionally, year end supply constraints have affected Novo Nordisk since the recent spike in Ozempic sales.

Implications for the Company

- Scenarios
  - In a Bear market, Novo Nordisk may see drops in stock price due to missed earnings, increased competition for weight loss drugs, and supply chain issues.
  - In a Bull Market, Novo Nordisk could benefit from the rising obesity crisis as weight loss products increase in demand. Novo Nordisk is also continuing to expand into new markets and as it develops new R&D innovations that can drive future growth.
- Business Strategy
  - For Novo Nordisk's strategy, when continuing to gain more net profit, it would be best for them to keep their supply constant and continue to standardize their prices for customer retention. In addition, as competition in the market continues to grow, increasing investment in R&D would be highly recommended to ensure that they maintain their large market share in the obesity drugs market.