Answers to task 5.6: Time series analysis and forecasting

By: Alexandra Lindsay

2. **Observe the pattern of the line in your time series and answer the following questions:**

    - What characteristics does the pattern display (e.g., seasonality, stationarity)? Write a short paragraph to explain your answer.

The pattern displayed in the sales tab is seasonality. They experience a high increase in sales in December with a big dip in January with a small pick up in August everywhere. Also the sales trend is in a positive trend with a small dip in 2008 due to the economic crisis but picks up in its positive trend.

    - What advice might you give your client based on this time series. Why?

I would advise them to do an inventory count after the small August sales pick up to make sure the refill order they placed are in stock in time for December. In January they can put into place promotions to try to create a pickup in sales. And I would recommend another inventory count before the summer to account for the small increase in sales.

4. **Observe the pattern/trend of the oil price line in relation to the five-year moving average line and answer the following questions:**

    - Is there a certain characteristic to the pattern and trend? Make sure to provide a short explanation for your answer.

The price per barrel had a positive trend and hit a maximum of $100 per barrel in 2008, but due to the economic recession of 2008, the price took a hit till the end of 2009. The trend became positive again till 2013 and dipped till 2016 till another positive trend till 2018 and dipped again. The lowest price point per barrel was in 1998 at $14.

    - Explain how the moving average affects oil price volatility and how it makes forecasting easier.

The five-year moving average makes forecasting a lot easier because it removes the yearly fluctuations of the market and permits to adequately see the trends. What we see here is a positive trend in the price per barrel till 2015 where it hi a maximum of $91.91 per barrel. This makes sense since the previous five years falls into the 2008 recession. From 2015 on the price per barrel is in a downward trend.

5. **This Exercise mainly looked at non-stationary time series. Briefly explain why you might convert a non-stationary time series into a stationary time series before applying a forecasting model.**

Non-stationary data has multiple fluctuations which can make it hard to create predictions. Therefore, non-stationary data's trend can be unreliable. Converting the non-stationary data to a stationary is advised before creating a forecast to help identify trends in the data.

6. **There are lots of other forecasting models, such as the Autoregressive Integrated Moving Average (ARIMA) model, which you'll have an opportunity to explore using Python in Achievement 6.**

    - Do some research on the ARIMA model and one other model not covered in this Exercise; Facebook Prophet is one example that's become popular in recent years.

    The ARIMA model uses time series data to create a forecast to predict future trends. It uses a linear regression to analyse the trends.
    https://corporatefinanceinstitute.com/resources/knowledge/other/autoregressive-integrated-moving-average-arima/

    The Facebook Prophet is an open-source algorithm that uses a time series model that considers multiple seasonalities. It keeps track of growth, seasonality, holidays and errors.
    https://towardsdatascience.com/time-series-analysis-with-facebook-prophet-how-it-works-and-how-to-use-it-f15ecf2c0e3a

    - Imagine you have to explain these models to a colleague who's unfamiliar with them. Write two short paragraphs (1 for each model) without going into the technical details. Include links to the resources you found during research.

    An example for ARIMA: imagine you are a new owner of a food truck. You want to know when it is best to order a refill of your ingredients to make sure you never run out. You could get data from other owners of food trucks to analyse their sales on a year-by-year basis. Using ARIMA you would be able to see the trends and anticipate when you'll need to refill.

    An example for Facebook Prophet: you would use this model when more that one variable affects your forecasting. For example, COVID-19 cases. There are multiple factors that would result in a positive influx of cases: holidays, going back to work, going back to school, increase in travel, etc. There could be also multiple factors for a decrease in cases: a new lockdown, a big increase in a population getting vaccinated, etc. This model would take these factors into account.