**Service Level & Confidence Factor**

Task: Figure out how to test seasonal effect (and linear effect) in a time series.

The goal is to find the relationship between the selected confidence factor (CF) and how the outcome of the service level (SL) is. We should begin to define these two variables

Service Level: If we have stock for an item then SL = 1, if stockout then 0.

The confidence factor determines how much safety stock you will need for each order period. The safety stock (SS) is calculated as

Where is a function of the confidence factor ().

We can simulate the service level using different order periods and confidence factors. We simulate the results by generating 4 years of random time series data and fit models using the first 3 years of the data. We will do this for 3 different length order periods. Here is the result for 14-day order period.

Chart

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Similarly, we do this for 2- & 60- day order periods. We can see the results in the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| **CF/OP** | **Short** | **Medium** | **Long** |
|  |
| **50%** | 88.4% | 84.4% | 83.1% |  |
|  |
| **60%** | 92.2% | 85.7% | 83.7% |  |
|  |
| **70%** | 94.9% | 87.0% | 84.4% |  |
|  |
| **80%** | 97.1% | 88.4% | 85.2% |  |
|  |
| **90%** | 98.6% | 90.1% | 86.2% |  |
|  |
| **95%** | 99.1% | 91.4% | 87.0% |  |
|  |
| **99.5%** | 99.4% | 94.2% | 88.8% |  |
|  |

We can then define groups that would yield to the desired service level: “No safety stock”, “In stock” and “Never out of stock”.

**Simple example**

We can give a simple example of how the probability that the demand will be higher than the starting stock if we would not order anything.

Assume that we are looking at the demand for 1 month and assume we would have 1 sale each day on average. That means the expected demand is 30 for the month and this can be written as a Poisson distribution:

and for each day *i* we have the daily distribution of:

We can easily calculate the probability that the demand after each day is less than stock on hand after each day by having

So the probability that the demand is higher than the stock is

Chart

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From the graph above, we can see that if we start with 30 stock units, the probability of being in stockout after 15 days is 0.2% so without any safety stock and then we have already a service level of 50%. This supports the idea that even without any safety stock, we should still have more than 50% service level for this simple example.

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