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## Understanding and Identifying Causal Factors An Oracle Demantra White Paper

Created by Optimum Solutions

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## **Introduction**

Planners and forecasters have struggled for years trying to improve on the accuracy of their forecasts. ERP software packages have provided tools to assist those people in their quest for a more accurate forecast. They have provided them not only with the tools to develop those forecasts but they have given them many different methods to generate them. Some of these methods typically include curve fitting (regression) methods or exponential smoothing methods such as moving average and Holt-Winters exponential smoothing method. Some of them even give them the capability of adding in seasonality. Seasonality in these cases usually is defined by identifying a multiplier or a percentage to be applied to one of the other forecasting methods. Unfortunately these traditional forecasting methods either do not offer the capability to introduce in other causal factors outside of seasonality or they will reject the causal factor as not having a large enough impact. This can be terribly frustrating to the users who know from experience or common sense that these causal factors need to be introduced in order to improve on the forecasts. Many users will take the forecasts generated by the tools and manually add the casual factors as best they can or, even worse, not even add in the causal factors. They will justify this to themselves that it is not worth investing the time to account for the causal factors when they might not have a big impact on the forecast anyway. Due to the lack of time or lack of sophisticated forecasting tools, they will just accept the forecasts as they are even when know they can be improved upon. In order to improve the accuracy of one's forecasts, relevant causal factors need to be introduced into the forecasting process.

## **Oracle's DEMANTRA BAYESIAN MODELING**

Oracle's Demantra application utilizes a more sophisticated modeling technique called Bayesian Modeling. Bayesian modeling allows the user to introduce as many causal factors as they deem important or relevant. There are guidelines to the number of causal factors that should be introduced into the generation of any forecast. The best guideline to follow is that you should have at least 2-4 points of demand history per causal factor. For example, if you have two years of history broken out into monthly buckets that you will be using to generate your forecast, you will have 24 points of demand history and you should not use more than 6-12 different causal factors. Using more than 12 causal factors in this example will actually decrease the accuracy of the forecast as the Analytical Engine, the engine that works thru all of the different forecasting equations and causal factors, will have trouble deciphering the true impact of each causal factor. It is also not recommended to include two or more causal factors that have a high degree dependence upon each other. In those cases, you are essentially introducing the same causal factor more than once to the Analytical Engine and this can cause less reliable forecasts. And lastly any causal factor that is not deemed relevant should not be used as it will just slow down the processing time as it would be unnecessarily used in the calculations.

## **Identifying causal factors**

Since Oracle's Demantra applications allows for the introduction of causal factors, it is important to be able identify what constitutes a causal factor. After many years of working with traditional forecasting methods, it may be difficult in the beginning to shift gears and think about identifying the causal factors. The most simplistic approach is to just think about what can affect the forecast or have an impact on the sales of that item. Any effect that can be quantified can also be used as a causal factor. The two most common causal factors are price and seasonality.

### **Price**

Price is an obvious causal factor as it usually has the biggest impact on how well a product sells. Thus it makes sense that the price of an item should be "factored" in when developing the forecast for that item. Price is one of the default casual factors supplied by Oracle's Demantra applications. Staying within the context of price, a less obvious and in some cases no less important factor is the price of a competitive product. When identifying causal factors many users will focus on what they can control and or accurately predict. Even though a competitor's price is out of the user's control, it can have an impact on the demand of their product. Another deterrent to using a competitor's price usually is the lack of history.

### **Seasonality**

Seasonality is probably the most used causal factor when forecasting. This can be attributed to the traditional forecasting methods utilizing seasonality even if it is only as a percentage or multiplier. However, taking a deeper look at seasonality can lead to identifying more detailed causal factors which leads to improved forecasts. For instance, every one will agree that ear muffs have a seasonality factor tied to its demand. With no other factors involved such as temporary price reductions, the sales of ear muffs tend to increase in the fall as people prepare for the winter season and they decrease in the spring as the warmer weather approaches. Seasonality is usually derived by looking at the sales history of this item and determining the multiplier by month. A more accurate forecast could probably be created by looking back at the temperature and determining the correlation of the sales of ear muffs to the actual temperature. Other examples of items that are viewed as having seasonality that other causal factors could be used instead include snow blowers / shovels and snow fall (first snow fall, number inches, etc) and jewelry and dates (Christmas, Valentine's Day).

### **Regionalization**

Regionalization is another very common area to explore when determining causal factors. Regionalization can be utilized when a user actually breaks the forecasts down to what region or more specifically what store they are selling an item to. Downhill skis will sell better in stores closer to the mountains. Surfboards will sell better near the ocean. Sun tan lotion will sell better in the southern states. Allowing a user to identify causal factors to a specific region will only increase the accuracy of the forecast on a national level.

### **Promotional**

The goal of promotions is to lift the sales of a product. Traditionally many promotions are handled outside of the forecasting process due to the inability of traditional forecasting models to accommodate the promotional information thus causing problems for the user when trying to identify past spikes in demand and predicting future spikes. Creating a causal factor based upon a promotion should result in the desired effect of identifying the cause of past increases in demand and improving the forecast accuracy in the future. Oracle's Demantra application also provides extra functionality with promotional causal factors such as identifying the difference between base demand and lift.

### **Other types of causal factors**

Other causal factors may not be as obvious as those described previously. Talking to others is a great source for identifying causal factors. For example a theatre group noticed large drops in attendance on several Fridays throughout the year that they could not account for. After talking with their marketing department, they discovered that those dates corresponded to key events at the local opera house and orchestral hall. They now use the opera and symphony schedules as causal factors (in addition to cross-marketing with the opera house and orchestral hall) when generating their forecasts. Oracle's Demantra applications have simulation capabilities which will allow the user to try different possible causal factors to determine its relevance when the causal factor may not seem as intuitive as other causal factors.

## **Conclusion**

For years users lacked the tools necessary to measure and predict the impact of causal factors such as price, seasonality, promotions, location, and competitive pricing on a forecast. Using a sophisticated forecasting method such as the Bayesian Modeling that is utilized by Oracle's Demantra applications, it is important to be able to understand and identify the relevant and important causal factors. The introduction of causal factors to the forecasting process and determine their relevance will vastly improve on one of the goals of all demand planners; to improve their forecast accuracy.