FUTURION

FUTURCAST

STAND ALONE MODULE

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1 Overview of the Forecast Methods

Can the future be predicted? Is it not futile to even try to forecast when we all know that the future is not deterministic? Why bother when so many forecasts go wrong? Is the cost of getting the forecasts worth the trouble? Is there anything more to forecasting than superstitious beliefs or fortune telling?

During the last forty years, forecasting has grown to become a well-respected managerial function. A solid body of scientific knowledge is now available to help business forecasters accurately and efficiently predict the future without relying on primitive and simplistic methods. It is our purpose to present the state of the art and science in the field of forecasting, its advantages and disadvantages, the benefits which can be derived while avoiding the problems and limitations of different forecasting methods.

Forecasting is needed for all types of planning and future oriented decision making (e.g. strategy). As such, it is an indispensable activity. The question is not whether to forecast, but what is the best way of obtaining forecasts about the future. In other words, planners and decision makers do not have a choice: they must forecast. The choice is to do it intuitively, or through a systematic formal procedure built upon knowledge, experience, and the most advanced objective methods available from the field of forecasting. A considerable amount of empirical findings and experimental work have shown that intuitive, ad hoc forecasting is less accurate than formal predictions based on data driven statistical forecasting methods when data is available. Furthermore, the cost of quantitative forecasting is less than people making similar predictions. In addition, quantitative forecasts can be obtained more quickly and consistently, which is not the case of judgmental forecasts.

Empirical work carried out since the early 1980s have greatly enriched our knowledge about forecasting, its advantages, and disadvantages. By studying and analyzing forecast made in the past, we are well aware that errors, sometimes large, are possible, and that some events that were predicted did not occur while others that were not predicted did occur. We now understand which method works and under what circumstances.

No doubt bad forecasts can and will be made. However, we cannot, judge the accuracy and usefulness of forecasting by a few incidents of bad or good forecasts. Instead, forecasting functions need to be evaluated from all aspects. Through empirical studies, it had been found that statistical forecasting methods improve forecasting accuracy, reduce the cost of predictions, and help us to more realistically assess future uncertainty. Quantitative forecasting provides us with objective information based on past data/information. The greatest contribution of quantitative forecasting methods is their ability to determine what data should be used to identify on these data, past patterns and/or relationships that are then extrapolated to predict the future.

Among those patterns, seasonality and trend are the most important. The seasonality of sales provides essential information for planning purposes; budgeting, production scheduling, inventories, cost management, buying of raw and other material, scheduling vacation and maintenance times, updating year end forecasts, and many other activities heavily depend on the seasonality of demand. These activities are greatly improved/facilitated when seasonality is known. Finding seasonality is a straightforward task which, with the aid of a computer, can be accomplished in less than a second. There is no reason not to estimate seasonality and to use it to improve planning and future oriented decision making. The benefits can be substantial.

What happens when seasonality changes? The answer is simple: the forecasts will be wrong. However, this does not often occur. Although there might be some changes in inherent seasonality from one year to another, the magnitude is small. Furthermore, such changes do not usually follow any regular pattern. Forecasting is based on the assumption that past patterns can be wrong. On the other hand, by having analyzed hundreds of thousands of past situations involving pattern changes, we know that changes in seasonality (and in particular big ones) do not often take place. Even if seasonal patterns do change, they change gradually or if they change, inherent seasonality can be estimated to reflect the most recent data.

A critical aspect of forecasting is to reduce the possibility of being caught by surprise. This requires analyzing and better understanding the past. In some cases, we might find out that forecasting is not possible (e.g. predicting the stock market), that no patterns can be identified in order to forecast. This is a part of forecasting. Knowing when we cannot forecast is as important since it helps us to better assess the future uncertainty and improve the planning process.

Looking at a series of values is similar to observing fluctuations around the trend (either exponential or linear). It is interesting to see how trends have been constant over time. This can again provide an indication on how the trend(s) in sales may change in the future. A change is possible and can occur because of a number of reasons. However, the consistency in the growth of sales over a long time period must be taken into account. Unless additional information is available, planners can assume that the established long-term trends will continue in the future.

There are many forecasting methods which look at the past history of a single series (e.g. sales) to discover patterns (e.g. seasonality, trend) which they subsequently extrapolate in order to forecast. Again, their purpose is to discover patterns in the retained historical data, then extrapolate them to predict the future. The methods we have found to be the most reliable have been selected for use are described in Section 5 of this handbook.

Most extrapolative forecasting methods assume that history repeats itself and that no outside factors affect the data to be forecasted. This obviously is not true. In fact, the effect of outside factors may be either temporary or permanent. For example, if a promotion is offered, sales will first increase, then decrease to finally return to the experienced trend. The effect is then temporary. New product launches, product lifecycle events, etc. affect data in more permanent ways. It is therefore essential to identify and quantify short and long term effects of various factors that have influenced sales in the past and to incorporate these effects if similar actions are contemplated in the future. This is the role of future assumptions. For instance, it is important to know for how many months and by how much in each month a promotion will change the sales figures from what would be forecasted if the product would not be promoted. To attempt to identify and extrapolate basic patterns found in historical sales data without accounting for the short and long term effects of marketing and product lifecycle events is a futile exercise which will only result in unreliable forecasts. In order to identify the true underlying patterns, the critical task of filtering data (auto removal and substitution of outliers) is performed before applying a forecasting method

The **FUTURCAST Stand Alone** module does not cover assumption/event-based forecasting, total market forecasting, replenishment forecasting nor does it cover population and patient-based approaches for new product forecasting.

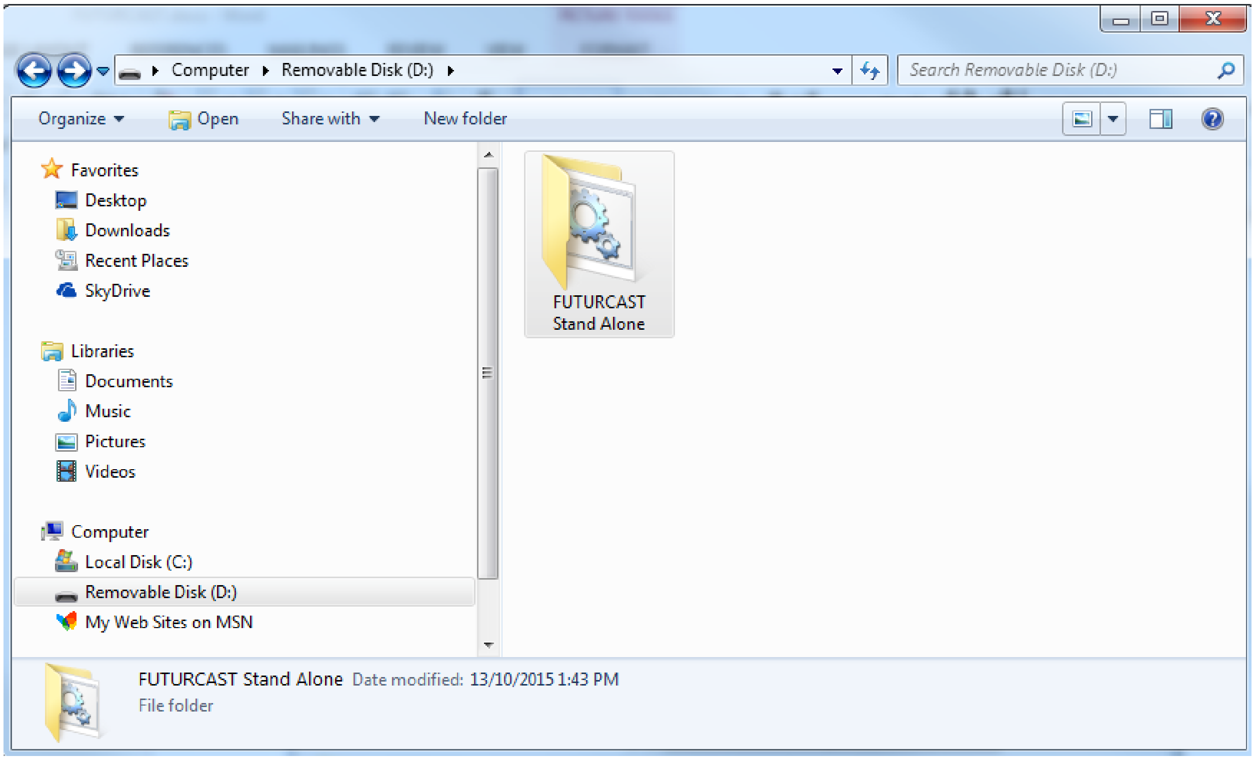
FUTURCAST Stand Alone is not a full blown forecasting system. The module does not rely on MS SQL or Oracle relational database. It does not offer a data management tool to restage, discontinue, classify in accordance to a product's ABC analysis or manage prices. Variance and accuracy analysis are not integrated. It does not provide a business intelligence application to summarize and analyze data. It is a small part of the **FUTURCAST** system. **A full comparison of the functionalities and capabilities of FUTURCAST Stand Alone versus the three main FUTURCAST system platforms is provided in the last section of this document (section 12)**

In summary, what it offers is the following:

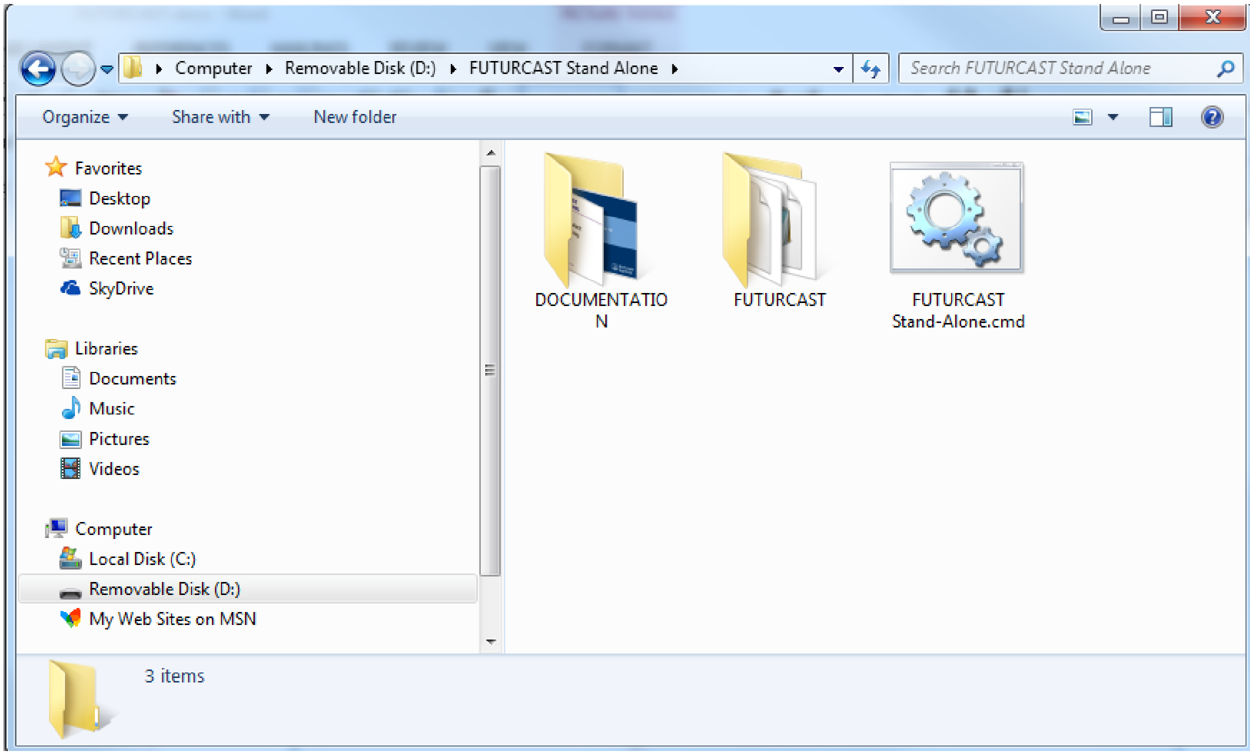
- The ability to forecast up to 30 time series with one click of the mouse in an auto-pilot mode.
- Access to the **FUTURCAST** Expert forecasting engine. The forecasting engine is the motor of a forecasting system. Its main purpose is to automatically analyze data in order to generate a reference or benchmark forecast that can be thereafter adjusted.
  The basic approach behind the **FUTURCAST** Expert system is to replicate how a person with great knowledge and skills in forecasting would go about making decisions on the approach to use. For example, an expert in statistical forecasting will first look at data after having filtered outliers and substituted values. The experts will then identify the date of the first observation to be used by isolating changing trends, focusing thereafter on choosing among a small set of methods the most appropriate one to apply. This selection will not be based on the method that best fit the data, but rather on the observed pattern; whether the trend is increasing, decreasing or leveling off. This process corresponds to the automatic **FUTURCAST** Expert System which has been refined over the last 20 years and is embedded in **FUTURCAST Stand Alone**.
- Aggregation to two levels
- Forecast modification at the lowest or at a higher level with proration to the lowest level
- Straightforward and advanced forecast modification formulas such as the Bass diffusion model.
- Computation of best-fit model (solver principle) for advanced forecast modification formulas.
- Ability to override the expert system selection and to apply a different forecast methodology, with or without seasonality given a selected first and last observation.
- Ability to evaluate the accuracy of a forecast obtained using a subset of the historical data.

2 Launching the FUTURCAST Stand Alone module

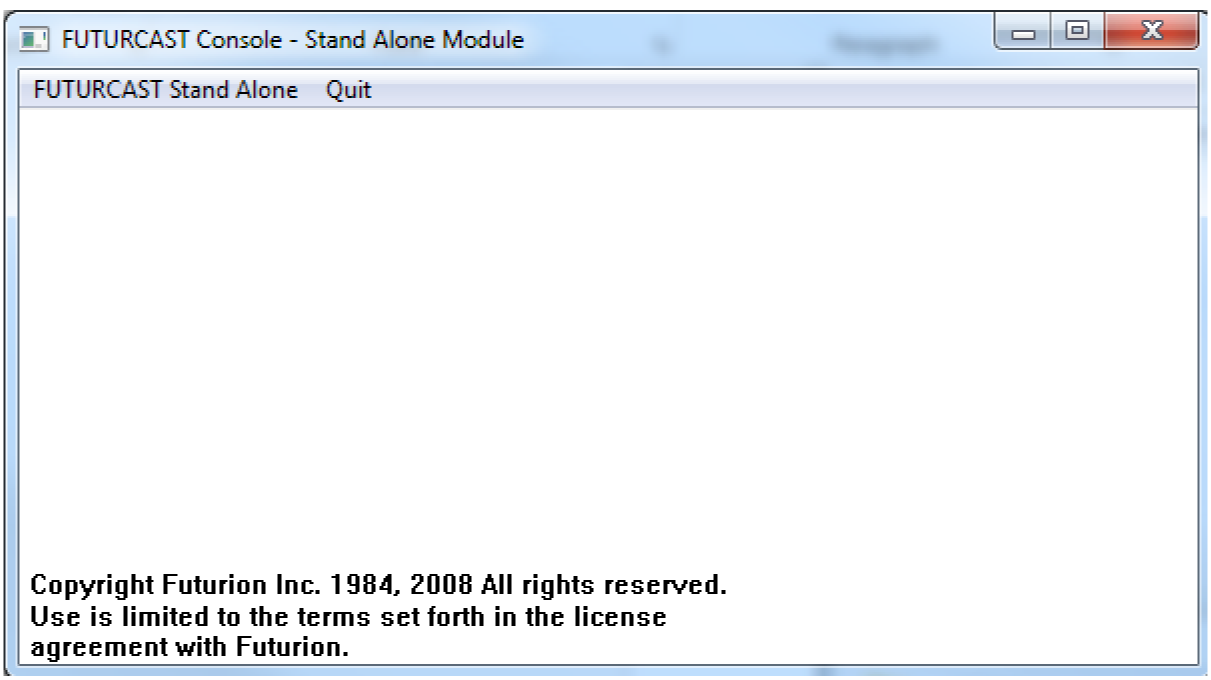
Insert the USB key containing the **FUTURCAST Stand Alone** module into your computer/laptop and access the following folder off the correct drive (Removable Disk drive): **FUTURCAST Stand Alone.**



Once the **FUTURCAST Stand Alone** folder has been located double click on to the **FUTURCAST Stand Alone** icon to access the console of **FUTURCAST Stand Alone Module:**

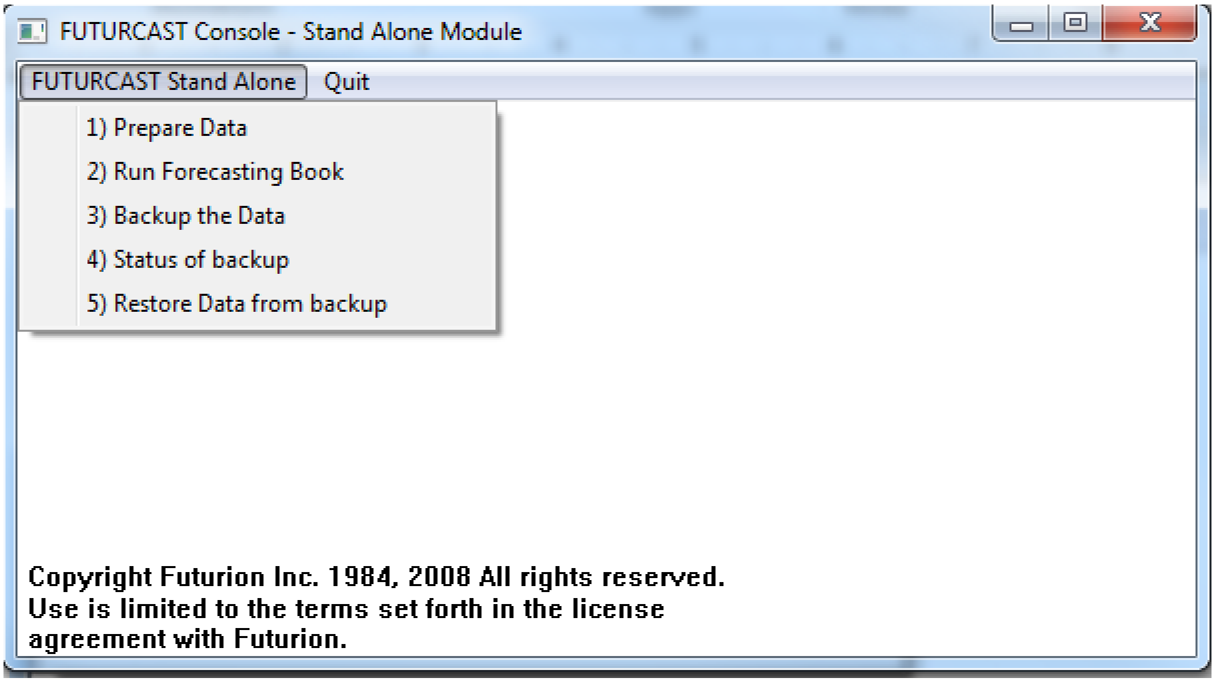


The Console for the **FUTURCAST Stand Alone** Module will automatically launch in a new window



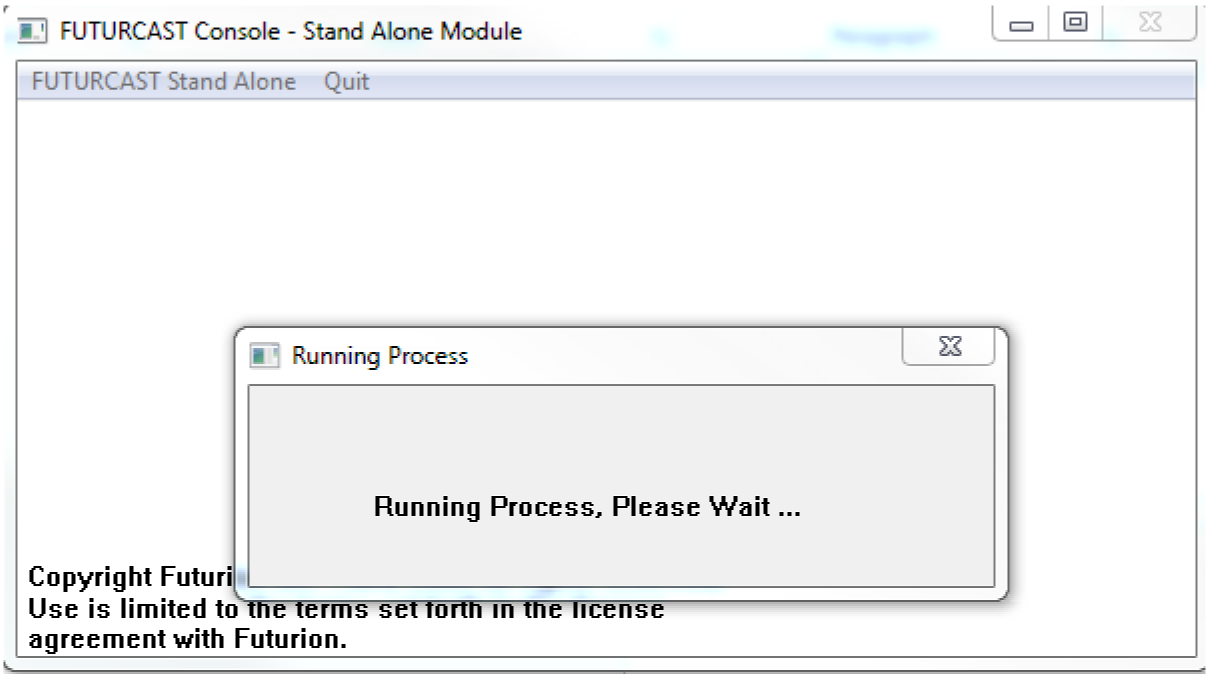
3 Preparing the Data

From the menu bar, select **FUTURCAST Stand Alone** to access the following drop window to either prepare or store the desired data you would like to forecast or run Forecasting Book application or backup and restore your data.



Click on **Prepare Data**

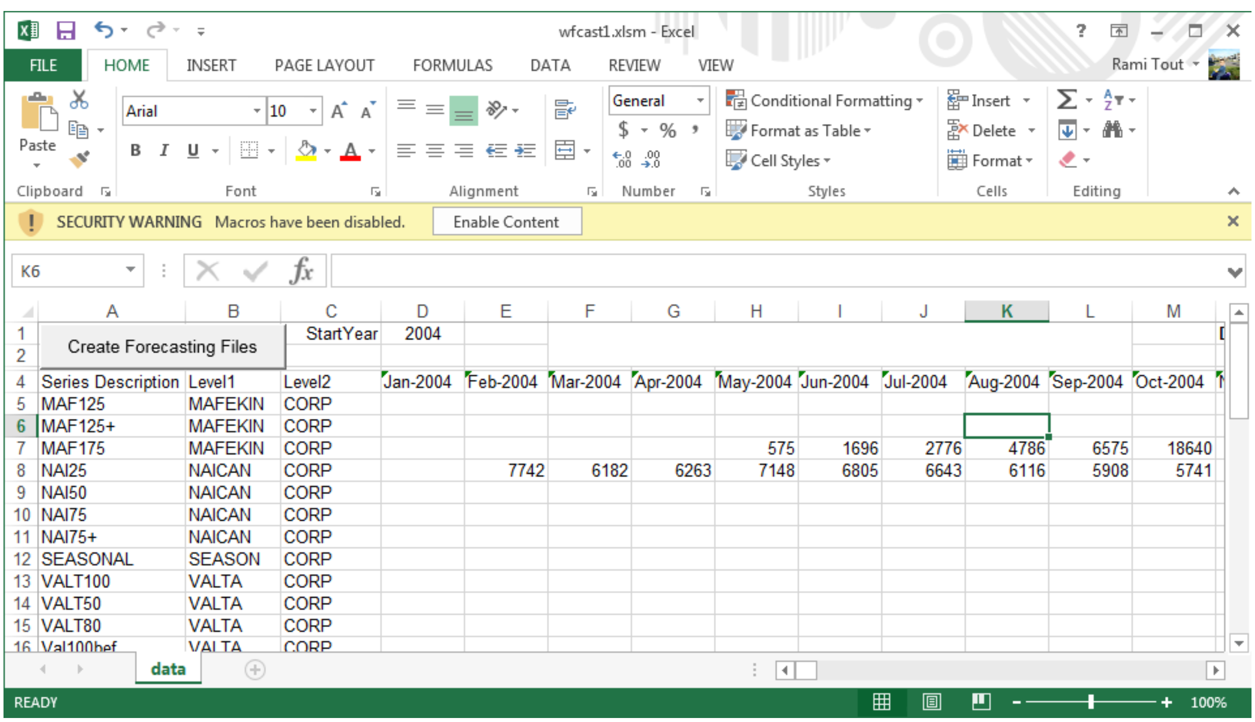
The following window will appear as the application processes an associated Excel file to enter/modify your desired data sets to forecast.



An Excel Spreadsheet will then be launched

Note:

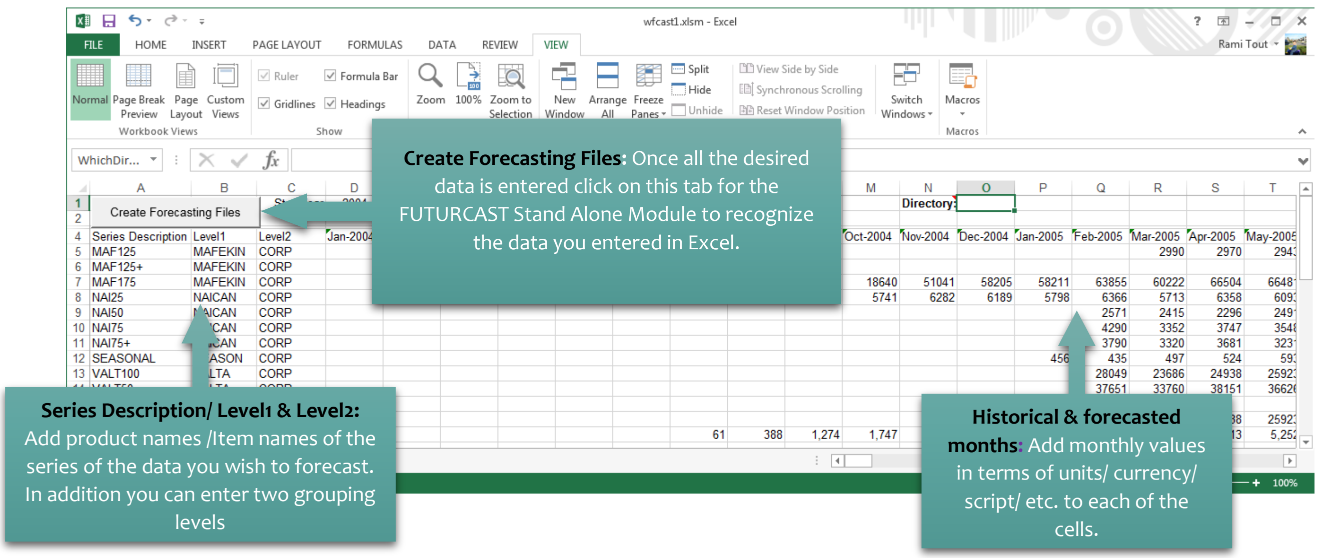
You must enable the Content in order for the enbedded Macro to run properly. To do so you need to click on Enable Content.



3.1 WFCAST.xlsm: An Overview

The following **WFCAST** Excel window will appear. In this file you can add, modify, and remove the desired data sets of monthly values you wish to forecast via the **FUTURCAST Stand Alone** module.

- The following spreadsheet displays by default a historical horizon spanning from January 2004 up to March 2025.
- Monthly values can easily be entered, modified, added; and removed on this data storage spreadsheet.
- The total number of data series may not exceed 30.



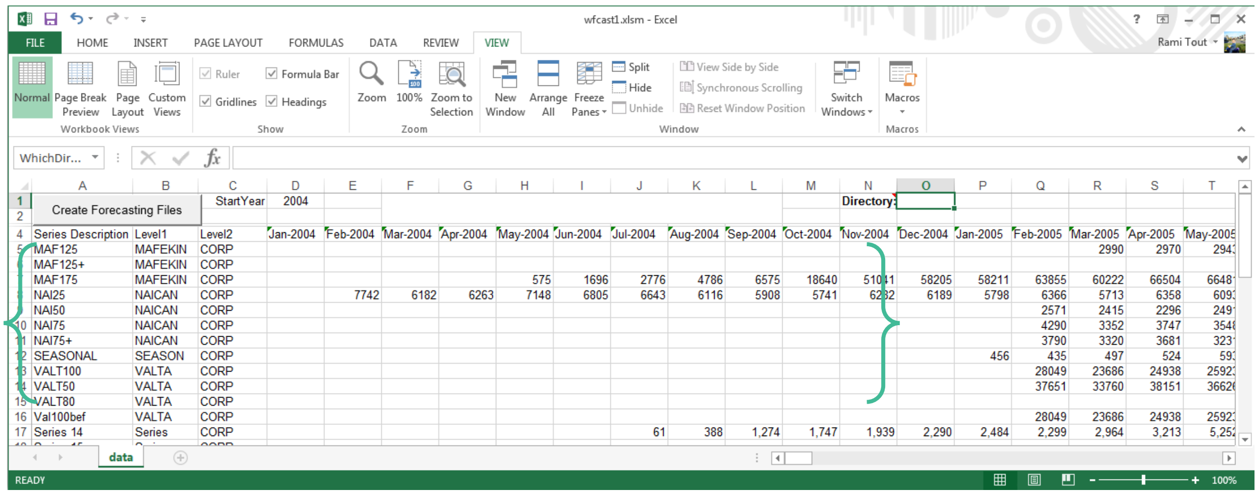
Note:

Create Forecasting Files: This function must be executed before exiting the WFCAST spreadsheet and whenever changes are made to the stored data.

The following series of data have been inputted for example purposes:

Series Description:

MAF 125
MAF 125+
MAF 175
NAI25
NAI50
NAI75
NAI75+
SEASONAL
VALT100
VALT50
VALT80

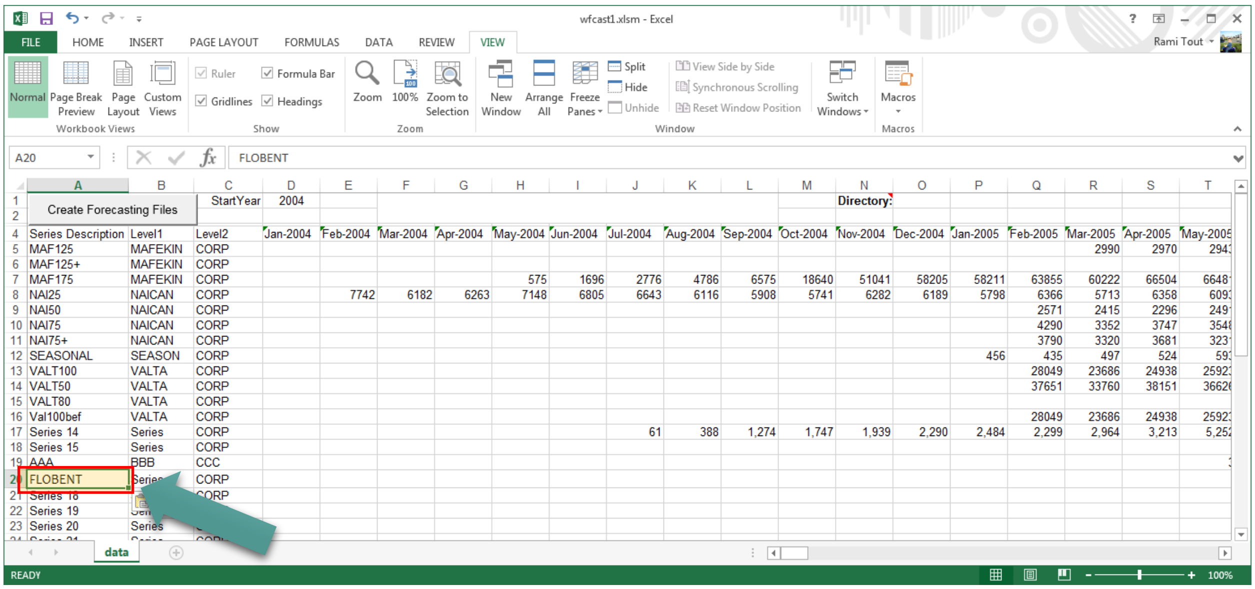


3.2 Inputting and Editing Historical Data

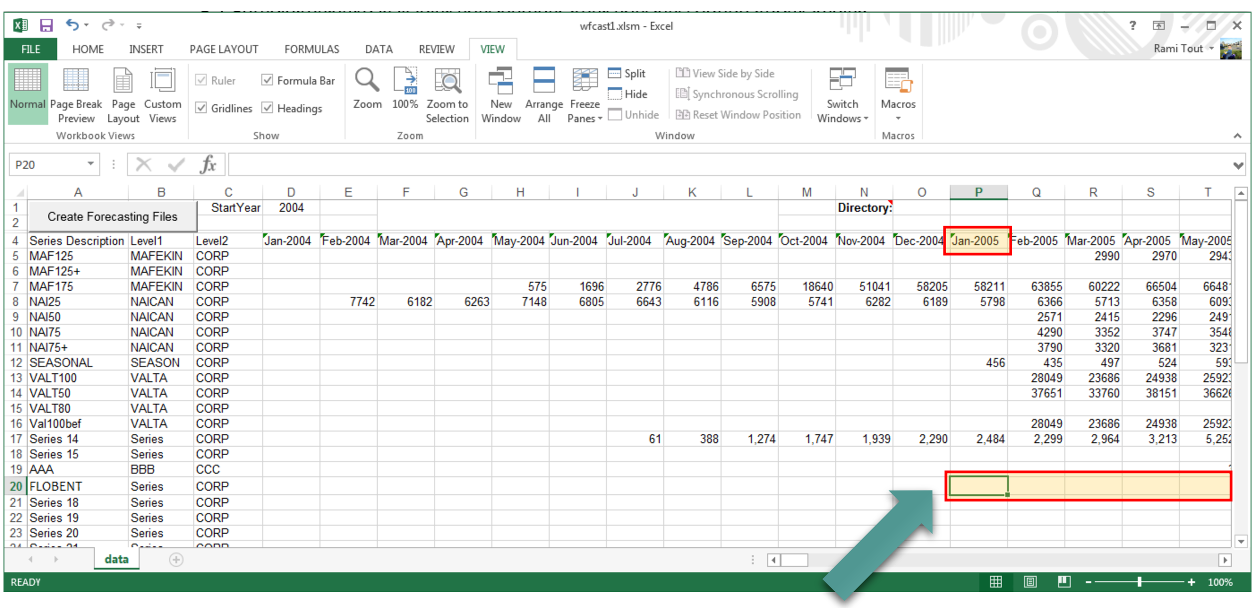
3.2.1 Entering a Set of Data Values

To enter a new series of data on which you wish to run different forecasting methods;

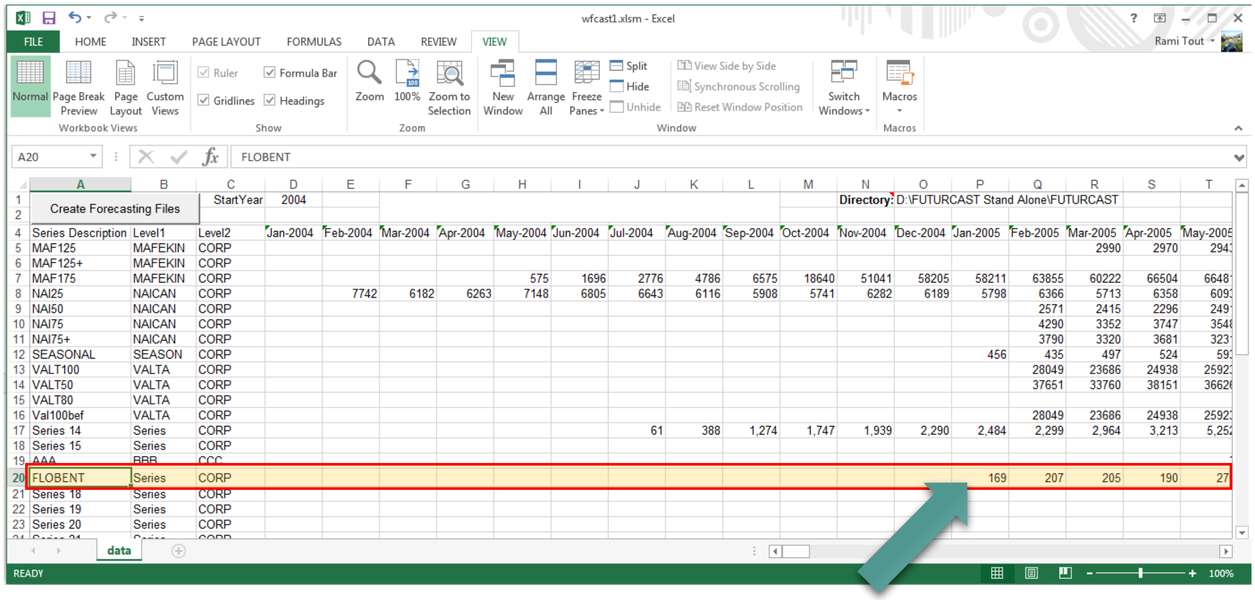
- Enter in the next available series number, the series description, for example: FLOBENT.



- Go to the corresponding cell of the month and year of the first historical value of the FLOBENT series to be entered on that row (i.e. January 2005 for the FLOBENT data series).



- Type in the January historical value and the subsequent monthly values in the appropriate monthly cell on that row (copy/paste may be used for this purpose).

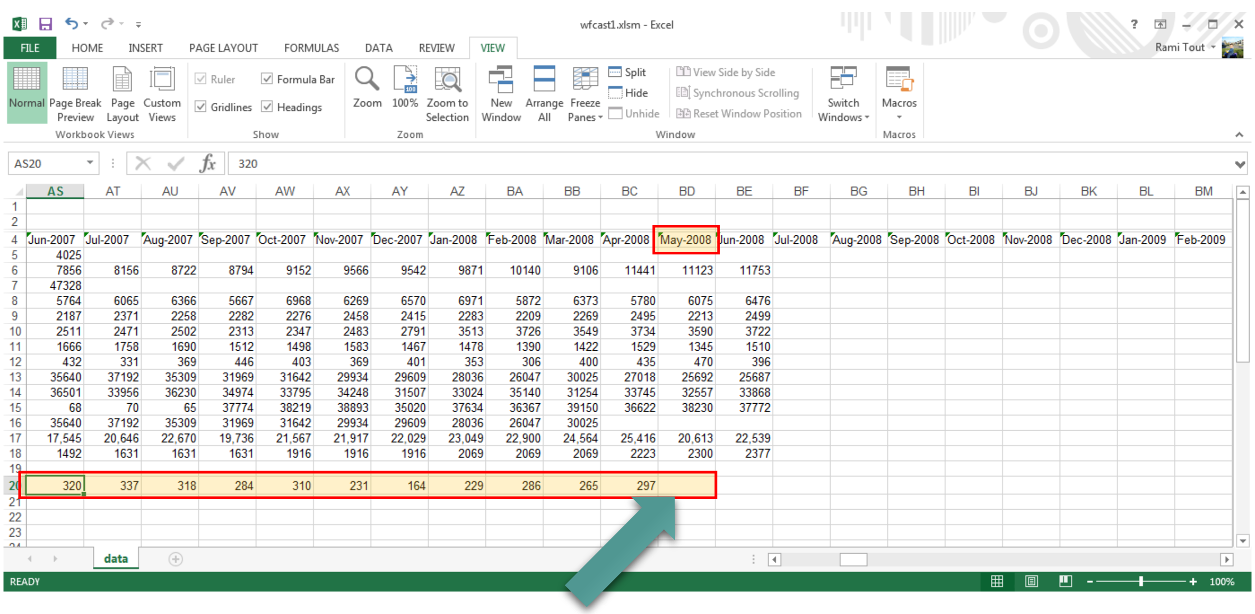


3.2.2 Editing Historical Values

- Editing historical values is as simple as going to the desired cell and re-typing a value.

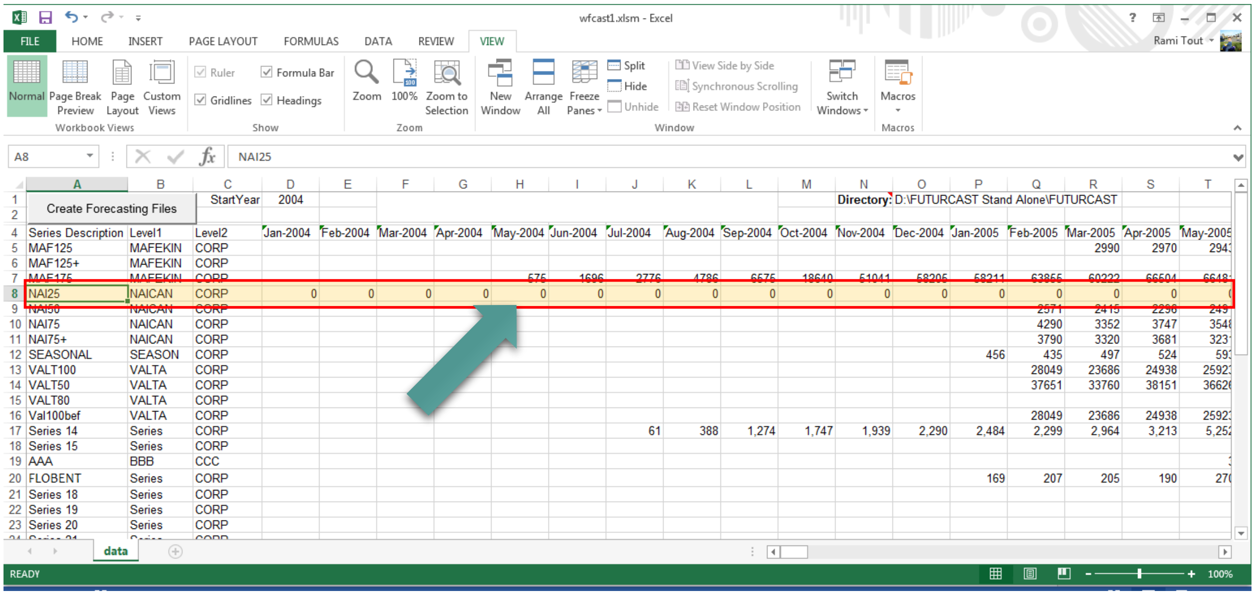
3.2.3 Adding Historical Values

- Beginning and ending new historical values may be entered for any defined data series. These values must either come just before or after the first or last observation.



3.2.4 Deleting Historical Values

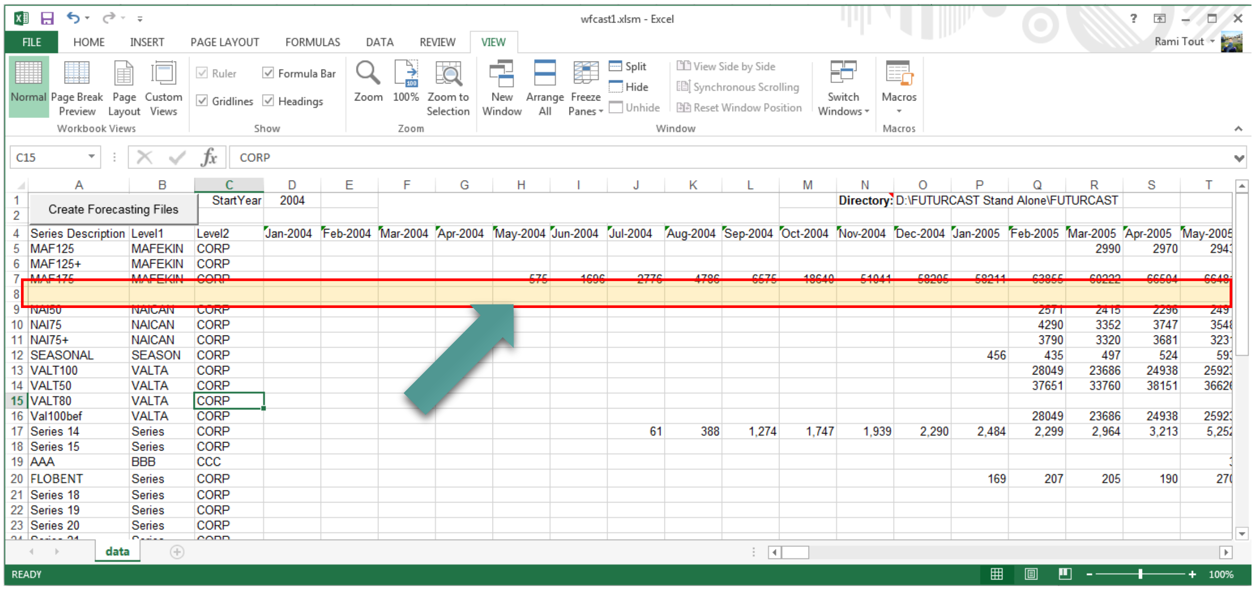
- To delete a data series from the WFCAST Excel data storage sheet go to the row of that data series (example: NAI25).
- Change all monthly values to “0”. WFCAST will not create a forecasting file for that series.



Important Note:

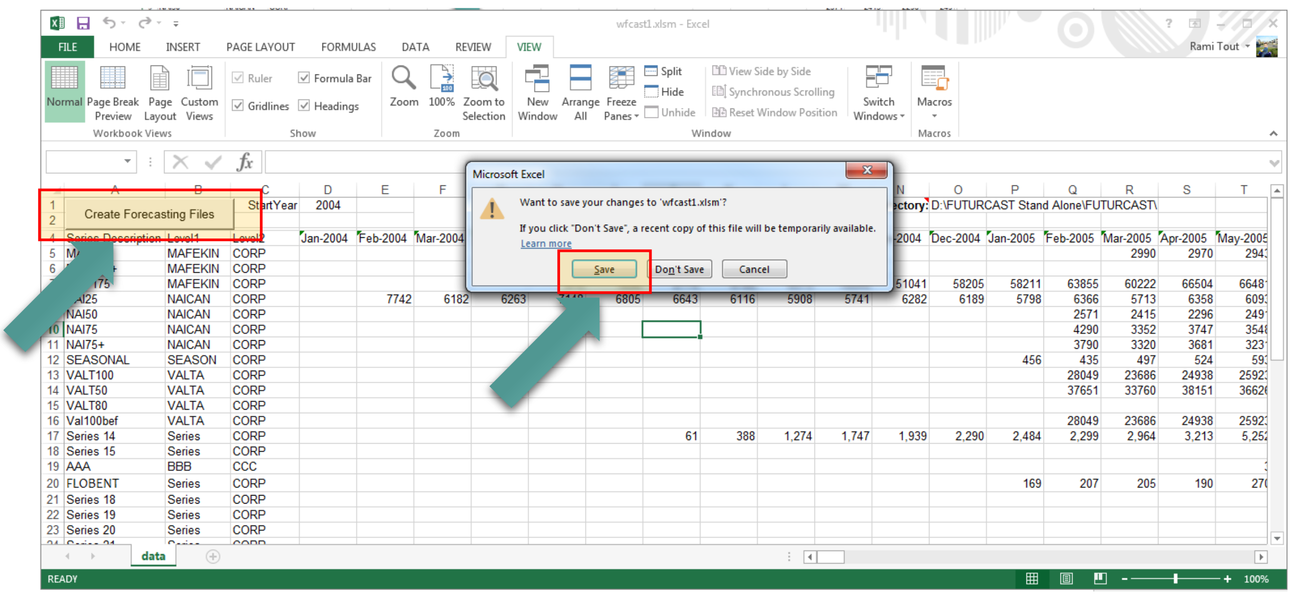
No blank cells should exist for a series

If in deleting NAI25 for example, the Excel function “clear contents” of an entire row would instead be applied; WFCAST will drop that row series and all row series below it as it will only create forecasting files for rows above the blanked row. An empty row breaks the sequence of data series and should therefore never exist. Also, no cell should be left blank within a series of data.



3.3 Creating Forecasting Files

Once monthly data values are entered or changes are made in monthly cell values click on the "**Create Forecasting Files**" button to continue. Save and close the Excel file.

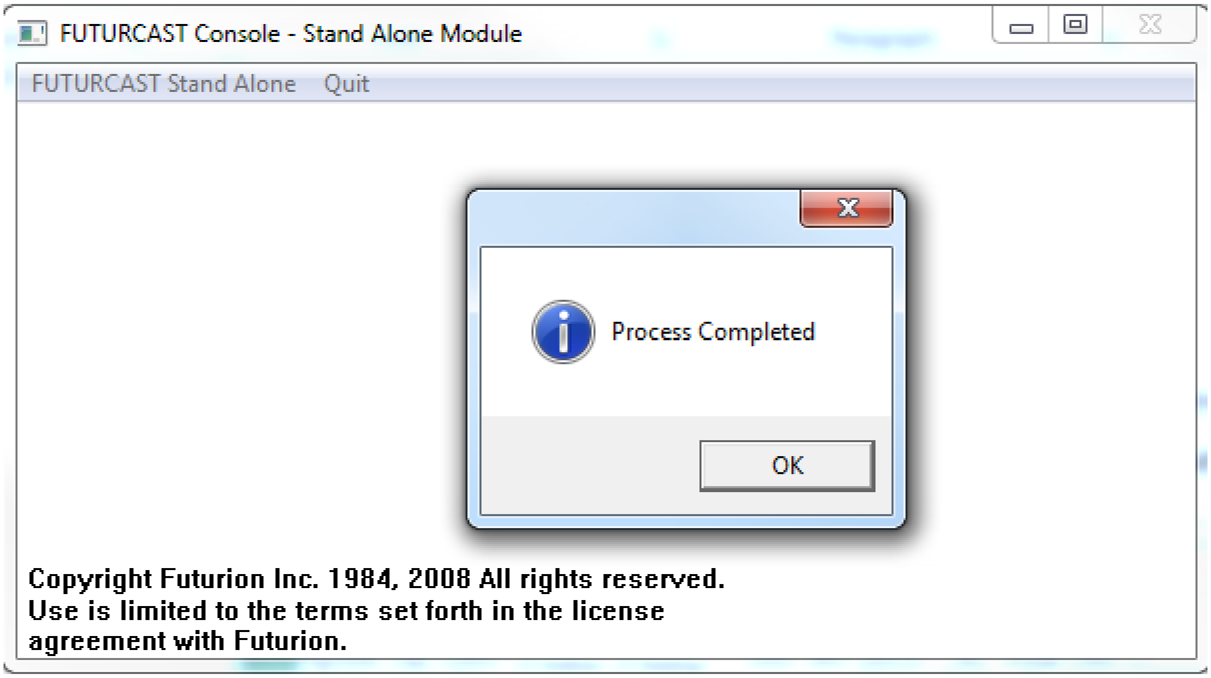


Note:

Create Forecasting Files: This function must be executed before exiting the WFCAST spreadsheet and whenever changes are made to the stored data in order to Batch create the forecast for each series. . **It will automatically save and exit the Excel spreadsheet.**

Once the Excel file closes, the following window will appear notifying you that the data preparation process and Batch forecast execution are completed.

Click on **OK** to continue.



4 Forecasting Methods

FUTURCAST Stand Alone forecasting engine automatically filters and find substitute values for outliers before applying a forecasting method whenever data are not found to be inherently seasonal. In the latter cases, seasonality is first removed from data by using the Classical Decomposition method (Census method). Then, the chosen forecasting method is applied on the trend-cycle data, and seasonality is thereafter integrated in the forecasts using the computed seasonal factors.

FUTURCAST Stand Alone selects the most appropriate method from the following 5 options that have been found to be the most accurate and relevant methods depending on the pattern observed.

4.1 Forecasting with SINGLE (Single Exponential Smoothing)

Exponential Smoothing methods were developed in the early 1950s. Since then, they have become particularly popular methods for short term forecasting because they are easy to understand and need only a few data points to produce future predictions. These smoothing methods are well suited for immediate term predictions of individual items/products.

The method of single exponential smoothing is based on averaging (smoothing) past values of a time series in a decreasing (exponential) manner. It is suitable for stationary data or when there is a slow growth or decline over time. This is achieved by formula (1.1) which, if expanded by substituting previous values of F_t [see (1.2)], results in an exponentially decreasing weighting of past observations. Another way of looking at equation (1.1) is to express it in the form of equation (1.8), which is obtained by a simple algebraic manipulation of (1.1). Equation (1.8) indicates that the forecast for the next period is equal to the forecast of the current period plus an adjustment that depends upon the magnitude and sign of the error. This adjustment will be a multiple of the value of alpha. Thus, the error between the actual and the forecasted value for the current period is used to correct the forecast for the next period.

$F_{t+1} = \alpha X_t + (1-\alpha)\, F_t$ (1.1)

But

$F_t = \alpha X_{t-1} + (1-\alpha)\, F_{t-1}$ (1.2)
$F_{t-1} = \alpha X_{t-2} + (1-\alpha)\, F_{t-2}$ (1.3)

Substituting (1.2) into (1.1) gives:

$F_{t+1} = \alpha X_t + (1-\alpha)\,(\alpha X_{t-1} + (1-\alpha)\, F_{t-1})$ (1.4)
$F_{t+1} = \alpha X_t + \alpha(1-\alpha)\, X_{t-1} + (1-\alpha)^2\, F_{t-1}$

Similarly, substituting (1.3) into (1.4) will result in:

$F_{t+1} = \alpha X_t + \alpha(1-\alpha)\, X_t -1 + \alpha(1-\alpha)^2\, x_{t-2} + (1-\alpha)^3\, F_{t-2}$ (1.5)

In general,

$F_{t+1} = \alpha X_t + \alpha(1-\alpha)\, X_{t-1} + \alpha(1-\alpha)^2 X_{t-2} + \alpha(1-\alpha)^3 X_{t-3} + \alpha(1-\alpha)^4\, X_{t-4} + \ldots$ (1.6)

Equation (1.6) illustrates how past values of the time series xt, are weighted in an exponentially or geometrically decreasing manner, accounting for the name, exponential smoothing.

Equation (1.1) can be rewritten as:

$F_{t-1} = \alpha X_t + F_t - \alpha F_t$
Or
$F_{t+1} = F_t + \alpha(X_t - F_t)$ (1.7)
Or
$F_{t+1} = F_t + \alpha_t\, e_t$ (1.8)

Where X_t - F_t is the difference between the actual and forecasted value, i.e. the residual error, e_t. Thus, the forecast for period t+1 is the same as that of period t plus a percentage adjustment of the last error (the forecast is adjusted in the direction indicated by the sign of the error). This adjustment principle is a powerful one and is used widely in engineering and statistics.

In order to use single exponential smoothing, a value alpha (α) must be specified. Default values are set depending upon data frequency. In general a value of .3 is used whereas a value of .1 is applied when historical data are sparse (many zero values). Alternatively, the user of **FUTURCAST Stand Alone** can select his or her own value for alpha. In general, the smaller the value of alpha, the more the smoothing (averaging) of the data and vice versa. The output of SINGLE includes the value of alpha used by the program and gives equation (1.1) with the numerical value of alpha.

Key points related to the use of **SINGLE** method:

- No trend (no forecasted growth or decline)
- Forecasts level
- Stationary data
- Alpha = % of weight on last observation
- Alpha = 0.10: Stable forecast (uses last 12 months to determine level)
- Alpha = 0.30: Reactive forecast (uses last 6-8 months to determine level)
- Alpha should not be greater than 0.5
- The closer alpha value is to zero, the more weight is placed on the long term history

Note:

Use **SINGLE** for products with flat demand, increasing products that have leveled or decreasing products that have leveled.

4.2 Forecasting with CMFS (Carbone-Makridakis Forecasting System)

All other forecasting methods assume that established patterns will not change in the future. However, this is not a realistic assumption for business and economic series that exhibit frequent pattern changes. This section describes a novel method for forecasting which makes a clear distinction between the two phases of forecast preparation. The first phase requires fitting a model to available historical data. The second phase involves forecasting beyond the present for future values that are not yet known. Unlike all other methods, the emphasis is placed on the second phase. The approach is based on the idea of using different forecasting strategies (models) depending upon the extent of pattern stability identified in the past data.

CMFS differentiates between two basic models (strategies): a short and a long term. The former employs a model that can readily adapt to changes in the data pattern as they occur. Since its objective is the short term, it does not care whether the changes are temporary or permanent. The long term strategy recognizes that all pattern changes are temporary. This implies that the most recently established pattern does not necessarily provide the best basis to extrapolate for the further future. Thus, a long term model which does not overreact to transient pattern shifts is needed. This model captures and extrapolates the established long term trend. The two models produce different forecasts that must be reconciled to produce final forecasts.

The general model formulation which encompasses both strategies can be written as:

$$X(t) = \sum_{j=0}^{q} b_j(t)t^j[\prod_{i=1}^{L} l_i(t)^{Z_i(t)}] + e(t) \quad (5.1)$$

Where t indicates time period, thus t = 1, 2, 3, ..., T, and T is the number of historical data periods,

x(t) represents the elements of the time series at time t, z(t) equal 1 if the t-th observation is of season I

Otherwise, it is 0,

L is the length of the seasonality

q is the degree of a polynomial in time,

l (t) is the value, at time t, of the seasonal coefficient assigned to the I-th season.

The b's are the time-varying values assigned to the various specified terms (mean, trend, quadratic, etc.) of the polynomial function and e(t) is a random noise term.

Forecasting strategies are determined within the context of (6.1) by specifying a value for q – the higher the value of q, the more short term the forecasting strategy. If q is set to two, this results in a trend model that for all practical purposes is adequate for adapting and capturing short term pattern changes. The model when q = 2 is as follows:

$$X(t) = b_0 + b_1(t) + b_2(t)t^2 \left[\prod_{i=1}^{L} l_i^{Z_i(t)} \right] + e(t) \qquad (5.2)$$

The long term model can be best expressed when q=0 as

$$X(t) = b_0(t) \left[\prod_{i=1}^{L} l_i(t)^{Z_i(t)} \right] + e(t) \qquad (5.3)$$

Fitting the models represented by expressions (5.2) and (5.3) by some adaptive filtering method has been shown to be theoretically similar to running respectively Holt and some variant of single exponential smoothing. **CMFS short term forecasts in FUTURCAST are then those produced by Holt's exponential smoothing**. As for the long term forecasts, they are obtained by applying the following step approach.

Step 1: Run single exponential smoothing to identify the optimal smoothing constant.
Step 2: Identify by how much the smoothing constant must be reduced to avoid perturbations caused by random fluctuations. Run single exponential smoothing using that new smoothing constant.
Step 3: Store the new smoothed fitted values.
Step 4: **Run a trend regression on the values stored at Step 3 and extrapolate to obtain the long term forecasts.** This step is performed automatically by **FUTURCAST Stand Alone**.

The short and long term forecasts are then reconciled as follows:

$$\begin{aligned} F(h) &= F_s(h) && if\ h < h_0 \\ F(h) &= F_I(h) + \alpha^{h-h_0}[F_S(h) - F_I(h)] && if\ h \geq h_0 \end{aligned} \qquad (5.4)$$

Where F(h), F_s (h) and F_l(h) are the final, short and long term forecasts

Respectively and the parameters h_o and α determine the timing and speed of reconciliation.

Their limits are

$h_o < K$

$0 < \alpha < 1$

In expression (5.4) it can be seen that the short term model is exclusively used until period ho. After period ho both the short and the long term models are utilized and their difference (F_s (h) - F_l (h)) reconcile. The reconciliation depends upon the value of alpha and is done in an exponential fashion. This has been found to be the best reconciliation technique.

To run CMFS, two specific questions must be answered. The first is "After how many forecasts should reconciliation begin?" The default option is 1. You can change this to a larger integer if you believe that the most recent pattern in your data is likely to continue longer. That is, if you believe that the short term forecasting model should be used, exclusively for more than X periods (in terms of expression (5.4) you are asked to specify h_o).

The second specific question is "Speed of Reconciliation". The default implies an average speed in terms of going from the short to the long term forecasts. The smaller the default value, the faster the reconciliation. Larger the value, slower is the reconciliation. The closer the value is to 1, the forecast will exhibit more and more the short term trend. For example, for $\alpha = 0.1$, convergence to long term forecasts will be achieved in 3 periods; for $\alpha = 0.9$, around 7 periods; for $\alpha = 0.95$, around 30 periods and so on.

The Carbone-Makridakis Forecasting System is a most powerful and accurate forecasting approach. Its performance is, however, dependent on the turning point indicator and speed of reconciliation used. Empirical analysis on many series has indicated that the method is most suited for growing products (data) since it automatically incorporates a trend dampening factor.

Key points related to the use of **CMFS** method:

- Reconciles a short term and long term forecast
- Short term forecast based on HOLT, long term forecast is based on LINEAR on smoothed data.
- Turning point is the number of months to use the short term forecast (HOLT).
- Speed of reconciliation is the rate at which the forecast turns from the short term to the long term forecast.
- Embodies concept of trend dampening.

Note:

Use **CMFS** for growing products.

4.3 Forecasting with Holt (CMFS: Short-Term Only)

Holt's exponential smoothing is similar to single except that it includes an extra equation to estimate the trend that is then used to forecast. As such, it attempts to deal with data that exhibit a significant trend.

The three equations used in Holt's model are:

$$S_t = \alpha X_t + (1-\alpha)(S_{t-1} + T_{t-1}) \quad (2.1)$$
$$T_t = \beta(S_t - S_{t-1}) + (1-\beta) T_{t-1} \quad (2.2)$$
$$F_{t+m} = S_t + mT_t \quad (2.3)$$

where m is the number of periods ahead of the last historical observation to be forecasted.

Equation (2.1) is similar to the original single exponential smoothing equation except that at term for the trend (T_{t-1}) added. The value of this term is calculated using equation (2.2). The difference between two successive exponential smoothing values is used as an estimate of the trend. Since successive values have been smoothed for randomness, their difference constitutes the trend in the data. The estimate of the trend ($S_t - S_{t-1}$) is smoothed by multiplying it by the smoothing constant β and then added to the product of the old estimate of the trend multiplied by $(1 - \beta)$. That is, equation (2.2) is similar to equation (2.1), or the general form of the smoothing equation, except that the smoothing is not done for the actual data but rather for the trend. The final result of (2.2) is a smoothed trend that does not include randomness.

In order to forecast, the last estimated trend is multiplied by the number of periods ahead that one desires to forecast and then the product is added to S_t (the most current level of the data that has been smoothed to eliminate randomness).

Alpha is the same as that used in single. In Holt's model, the alpha parameter smooths the data to eliminate randomness in the level (mean) of the data. The Holt method is a special case of CMFS, It is the method applied if all forecast are specified as short term (turning point equals the number of forecasts). Alpha and/or beta optimal values are found automatically through **FUTURCAST**.

The specific output of **FUTURCAST** for CMFS short term is the forecasted values.

Key points related to the use of **Holt** method:

- Straight line extrapolation based on the last estimated trend. Highly reactive method.
- Alpha and Beta should be automatically specified by **FUTURCAST**.

Note:

Use **Holt** for growing products with expected short term continued growth.

4.4 Forecasting with Linear (CMFS: Long Term Only)

Linear trend fits a straight line to a set of data and then it extrapolates it in order to forecast. The concept behind linear trend fitting is to draw a straight line in such a way that it passes through the middle of the data. The mathematical equation describing this straight line is given by (3.1). It is fitted in such a way that the sum of the squared deviations (the differences between actual values of the time series and those estimated by equation (3.1) are as small as possible). This is done by calculating the values of a and b (needed to specify the line) using the method on least squares.

The equation used to calculate the trend line is:

$$X_t^1 = a + bt \qquad (3.1)$$

Where

a is an estimate of the intercept

b is an estimate of the slope

t denotes time (i.e. 1, 2, 3, … .n)

X_t^1 is the estimate of the data point corresponding to period t.

The quantity X_t - X_t^1 is the residual or error, et. The squared sum of all the errors will be a minimum as long as (3.2) and (3.3) are used to estimate the values of **a** and **b.**

The values of **a** and **b** can be found using the following two formulae:

$$a = \frac{\sum X}{n} - b \times \frac{\sum t}{n} \qquad (3.2)$$

$$b = \frac{n \sum tX - \sum t \sum X}{n \sum t^2 - (\sum t)^2} \qquad (3.3)$$

Where all the summations go from 1 to n, and n is the number of data points.

Forecasting requires use of equation (3.4)

$$F_{t+m} = a + b(t + m) \qquad (3.4)$$

Where t + m is the number of the period for which a forecast is to be prepared.

There are some similarities between (3.2), (3.3), (3.4) and Holt's exponential smoothing. Both trend extrapolation and Holt's exponential smoothing require estimates for **a** (S_t) and **b** (T_t). However, in Holt's model these estimates (S and T) vary from period to period in a way that depends upon changes in the pattern of data. The final objective, however, is the same – both types of methods look for a level (**a** or S_t) and a trend (**b** or T_t) in order to forecast.

Trend extrapolation is appropriate for long term forecasting when cyclical (or other fluctuations) are not critical. The objective of trend fitting is to discover the best linear trend and then extrapolate it in order to forecast. Forecast under Linear are obtained by applying CMFS long term. This means that the turning point is set to 1 and speed of reconciliation is immediate (.01).

Key points related to the use of **Linear** method:

- Constant unit change model (straight line trend)
- Stable long term method
- Fits a straight line to historical data and extrapolates it into the future.

Note:

Use **Linear** for Minor products that are growing at a constant rate.

4.5 Forecasting with Expont (Exponential Growth/Decline models)

Exponential growth models are appropriate for long-term forecasting when growth rates are constant over time. This is characteristic of the sales of several products and companies. An exponential growth curve has a constant rate of growth at any point in time, resulting in large increases over longer periods of time as the increase is compounded exponentially. With an annual growth rate for 5%, the series will double in fourteen years and will become more than five times the initial value in thirty-four years' time. The model for a growth curve can be approximated by the following equations:

$$y_t = e^{a+bt} \qquad (4.1)$$

Where

y_t is the time series at time t

e= 2.71828

a is the intercept

b is the equivalent of the slope and denotes the growth rate.

Equation (4.1) can be transformed to make it linear, by taking natural logarithms of both sides of the equation. This gives:

$$\log y = (a + bt) \log(e)$$

Or

$$\log y = a + bt \qquad (4.2)$$

Since log (e) = 1

Defining

$$y_t^1 = \log e \, y_t \qquad (4.3)$$

Equation (4.2) becomes

$$y_t^1 = a + bt \qquad (4.4)$$

Applying then least squares to (4.4) allows us to estimate the values of a and b and then use them in (4.5) to forecast future values.

$$F_{(t+m)} = e^{a+bt} \qquad (4.5)$$

where m is the number of periods ahead to be forecasted. From the value of b the growth rate can be found as:

$$\text{Growth rate} = \text{b} + \frac{b}{2} + \frac{b}{6}$$

Thus, if b is found to be 0.052, the growth rate is:

$$0.052 + \frac{0.052}{2} + \frac{0.052}{6} = 0.0534$$

The specific inputs and outputs of EXPON are the same as those of LINEAR.

Key points related to the use of **Expont** method:

- Constant percentage model (exponential trend)
- Stable, long term method (weighs all data equally)

Note:

Use **Expont** for products declining at a steady rate with expected continued growth. Very rarely is exponential growth sustained through the years.

4.6 Seasonality Analysis Using CLASSD (The Classical Decomposition Method)

Decomposition methods, as the name implies, "breaks down" a time series into four components – seasonality, trend, cycle, and randomness – that constitute the great majority of economic and business time series. The principle of decomposition methods is empirical. Furthermore, decomposition approaches provide information (such as the state of the trend-cycle) which is not available with alternative methods.

In the decomposition category, there are two main techniques – Classical Decomposition, and the Census II method. Both are similar in principle. The only difference is that Census II is much more elaborate (this does not imply more precise). Both methods assume that economic or business-oriented time series are made up of four components – seasonality, trend, cycle, and randomness. They usually assume that the relationship between these four components is multiplicative (Census II allows for an additive relationship too) as show in equation (6.1) of the form:

$$X_t = S_t T_t C_t R_t \qquad (6.1)$$

Where

X_t is the time series

S_t denotes seasonality

T_t denotes trend

C_t denotes cycle

And

R_t denotes randomness

Alternatively, one could assume an additive relationship of the form

$$X_t = S_t + T_t + C_t + R_t$$

But additive models are not commonly encountered in practice.

If a moving average of L periods (where L is the length of seasonality, let us assume that L=12, that is if the data is monthly) is calculated, it will represent the mean value for the year. Such a value will obviously be free of seasonality since high months will be offset by low ones. If M denotes the moving average of (6.1), it will be free of seasonality and will contain little randomness (randomness, by definition is sometimes negative and other times positive). Thus, if twelve values are added, the average will include little or no randomness and Mt can be set as:

$$M_t = T_t C_t \qquad (6.2)$$

Equation (6.2) has no seasonality, or randomness that has been eliminated through the averaging process. Thus, the equation includes only the trend-cycles component. One can decompose (6.2) further by assuming some form of trend. For example, you might decide that the trend is linear (see 3.1). In this case, you will have:

$$T_t = a + b1 \qquad (6.3)$$

If (6.3) is divided into (6.2) the cycle will be isolated form the trend. That is:

$$\frac{M_t}{a + bt} = \frac{T_t C_t}{T_t} = C_t \qquad (6.4)$$

If a linear trend is not appropriate, you may wish to specify a nonlinear one. Alternatively you can assume any other type of growth and use it to separate the trend from the cycle. In practice, however, it is often preferable not to separate the trend from the cycle. That is, work with the trend cycle of (6.2).

Once the trend-cycle values of (6.2) are known, (6.2) can be divided by (6.1). The result is:

$$\frac{X_t}{M_t} = \frac{S_t T_t C_t R_t}{T_t C_t} = S_t R_t \qquad (6.5)$$

Expression (6.5) includes seasonality and randomness. In order to estimate seasonality, randomness needs to be eliminated from (6.5). This can be done by averaging the seasonal factors for each of the twelve months and computing their averages. These averages form the basis of the seasonal indices (the smallest and largest index is eliminated before the average is computed).

FUTURCAST Stand Alone automatically uses CLASSD to establish the seasonal indices under inherent seasonality.

Key points related to the use of **CLASSD**:

- Breaks down a time series into four components:
  - Seasonality
  - Trend
  - Cycle
  - Randomness
- Computes seasonal indices to integrate seasonality in the forecast

Note:

CLASSD is not a forecasting methodology. However, under Inherent seasonality, the selected forecasting method is applied on adjusted historical data values that are obtained by having removed seasonality from the data. This represents an alternative filtering process and fitted rather than filtered data are prepresented for the past.

4.7 Forecasting Method Selection

Method	Description	Method to Apply
SINGLE	SINGLE method is based on averaging (smoothing) past values of a data time series in a decreasing manner. Popular method for short-term forecasting because easy to understand and only use a few data points to produce future predictions. Suitable for when there is slow growth or decline of product over time.	**Use SINGLE for products with a flat demand, increasing products that have leveled, or decreasing products that have leveled.**
CMFS	CMFS is considered to be the most powerful and accurate method. Highly dependent on the turning point indicator CMFS involves forecasting beyond the present for future patterns not yet known. The model is best known for using different forecasting strategies while providing you with a list of both short term and longer term forecasts.	**Use CMFS for growing products**
EXPONT	Appropriate for long term forecasting with constant growth rates over time where many items are to be forecasted (i.e. sales of several products and companies).	**Use EXPONT for products declining at a steady rate with expected continued decline.**
HOLT	Similar to the SINGLE methodology, the HOLT method attempts to deal with data that shows significant evidence of a trend. HOLT smoothes the data to eliminate randomness in a level of data.	**Use HOLT for growing products with expected short term continued growth.**
LINEAR	The idea behind the LINEAR method is to draw a straight line in such a way that it passes through the middle of a series of data. Appropriate for long term forecasting when cyclic variations are not that significant to the forecast.	**Use LINEAR for minor products that are growing at a steady/constant rate.**
CLASSD	Only a diagnostic analysis, this model decomposes a time series of data into four components: 1) Seasonality 2) Trend 3) Cycle 4) Randomness. This indicates the direction in the data by individually analyzing these components.	**Not to be used for forecasting. Used to estimate seasoned indices.**

All methods may apply the CLASSD seasonal indices under the inherent seasonality option. Otherwise, all methods are applied on filtered data.

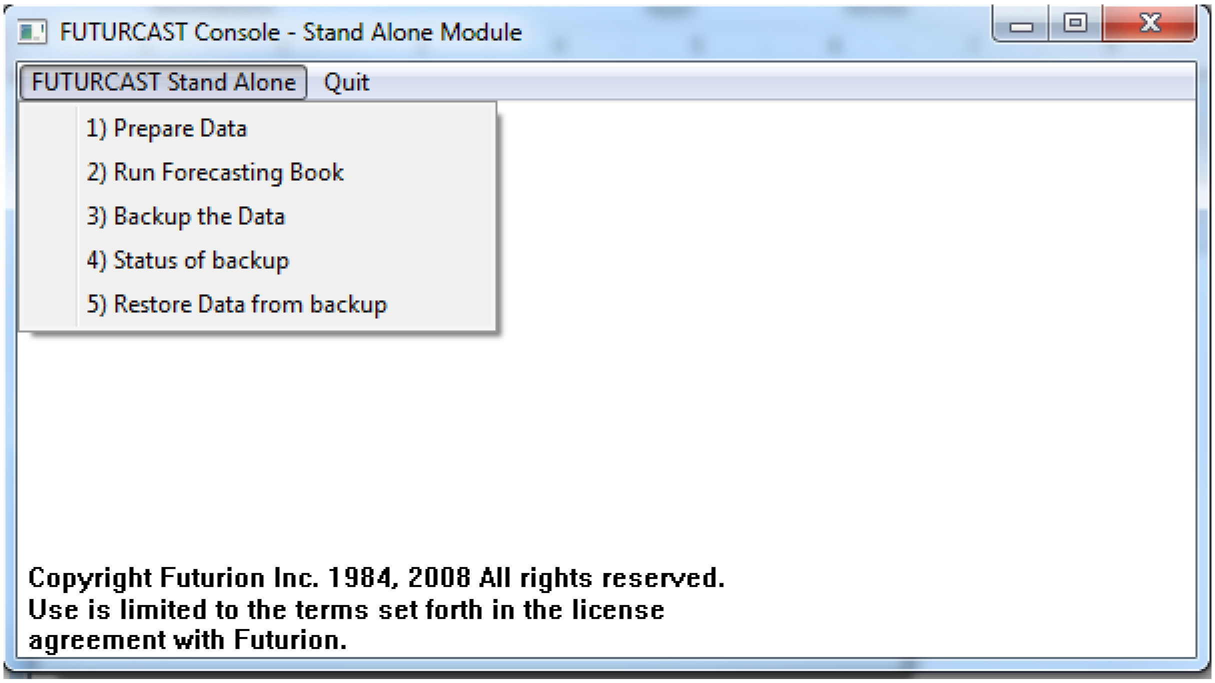
5 Glossary and Terms

CLASSD:	(Classical Decomposition Method) Breaks down a time series into four components - seasonality, trend, cycle, and randomness. Assumes that the relationship between these four is multiplicative.
CMFS:	(Carbone-Makridakis Forecasting System) Differentiates between two basic models: a short term and a long term. The short term model is produced by Holt's Exponential Smoothing. It readily adapts to changes in the data pattern. The long term model is produced by Linear, which captures and extrapolates the established long term trend. The long term model recognizes that all pattern changes are temporary.
CYCLICALITY:	Cycles do not repeat themselves at equal intervals. Depth and duration also vary. Cyclicality is calculated by the computer in the method Classical Decomposition.
ERROR:	Actual – Forecast
EXPONT:	(Exponential Growth Model) Appropriate for long term forecasting when product is declining at a steady rate. If used for a growing product will result in large increases over longer periods of time as the increase is compounded exponentially.
FIRST OBSERVATION TO BE USED:	One of the standard questions asked when using a forecasting method. User may want to ignore the first part of the historical data when developing a forecast and begin with an observation other than 1. The default is 1>.
HOLT:	(Holt's Exponential Smoothing) Similar to Linear Exponential Smoothing except that it includes an extra equation to estimate the trend in demand. The estimate of the trend is smoothed, not the actual data. Alpha smooths the data to eliminate randomness, beta smooths the trend. Alpha and beta can be specified by the user, or the optimal values can be calculated by **FUTURCAST**.
LINEAR:	Linear trend. Fits a straight line to a set of data and then extrapolates it in order to forecast. This method is appropriate for long term forecasting growth products when cyclicality is not critical.
NUMBER OF FORECASTS:	**FUTURCAST Stand Alone** automatically produces 36 forecasts.
R-SQUARE:	Measures fit of forecasting model. Ranges between 0 and 1, with "0" indicating no fit, and "1" indicating a perfect fit. However, a perfect fit does not guarantee a perfect forecast.
SEASONALITY:	A value of 1.00 means an average month in terms of demand; a value of less than 1.00 would be lower demand than the average month, while a coefficient of greater than 1.00, means the opposite. Seasonality is calculated by the system (historical data must have a minimum of 24 data points for seasonality to be calculated, using the Winter's method, or 36 data points for all other methods).
SINGLE:	Single Exponential Smoothing. Well suited for short term predictions. Needs only a few data points to produce a forecast. Based on a weighting of past values of a time series in a decreasing (exponential) manner.

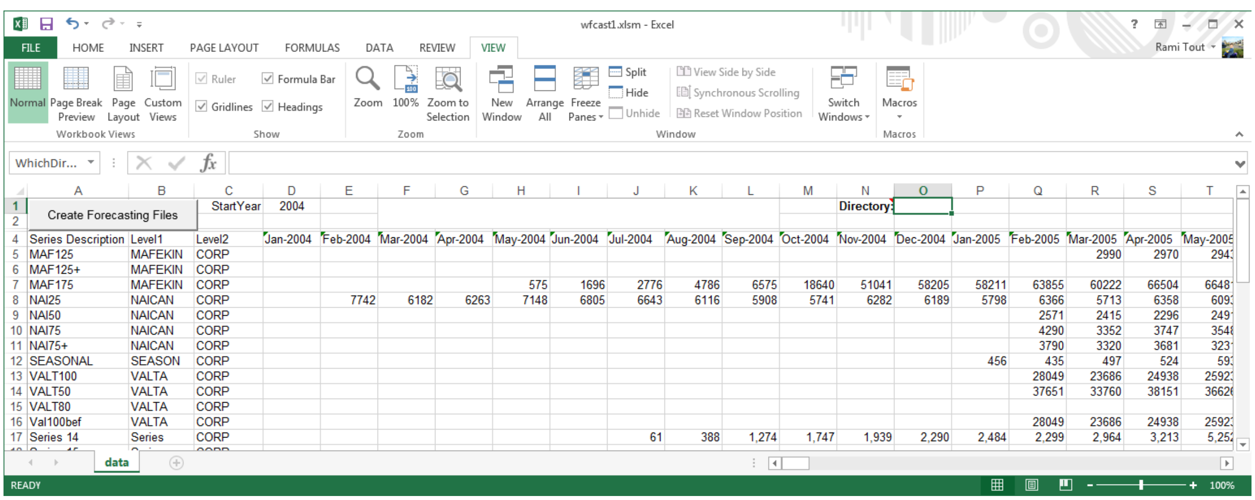
	Suitable for stationary products or when there is slow growth or decline over time. Does not predict turning points. The forecast for the next period is equal to the forecast of the current period plus an adjustment that depends upon the magnitude and sign of the error. This adjustment will be a multiple of the value of alpha, which can be specified or calculated by the computer.

6 Accessing, Modifying and Exporting the Batch Forecast

From the menu bar, select **FUTURCAST Stand Alone** to access the following drop window to either prepare and store the desired data you would like to forecast or run the Forecasting Book application or backup and restore your previously stored data.



Before we turn to describing the information content found in the **Forecasting Book**, let us examine the source Excel data file displayed again below.

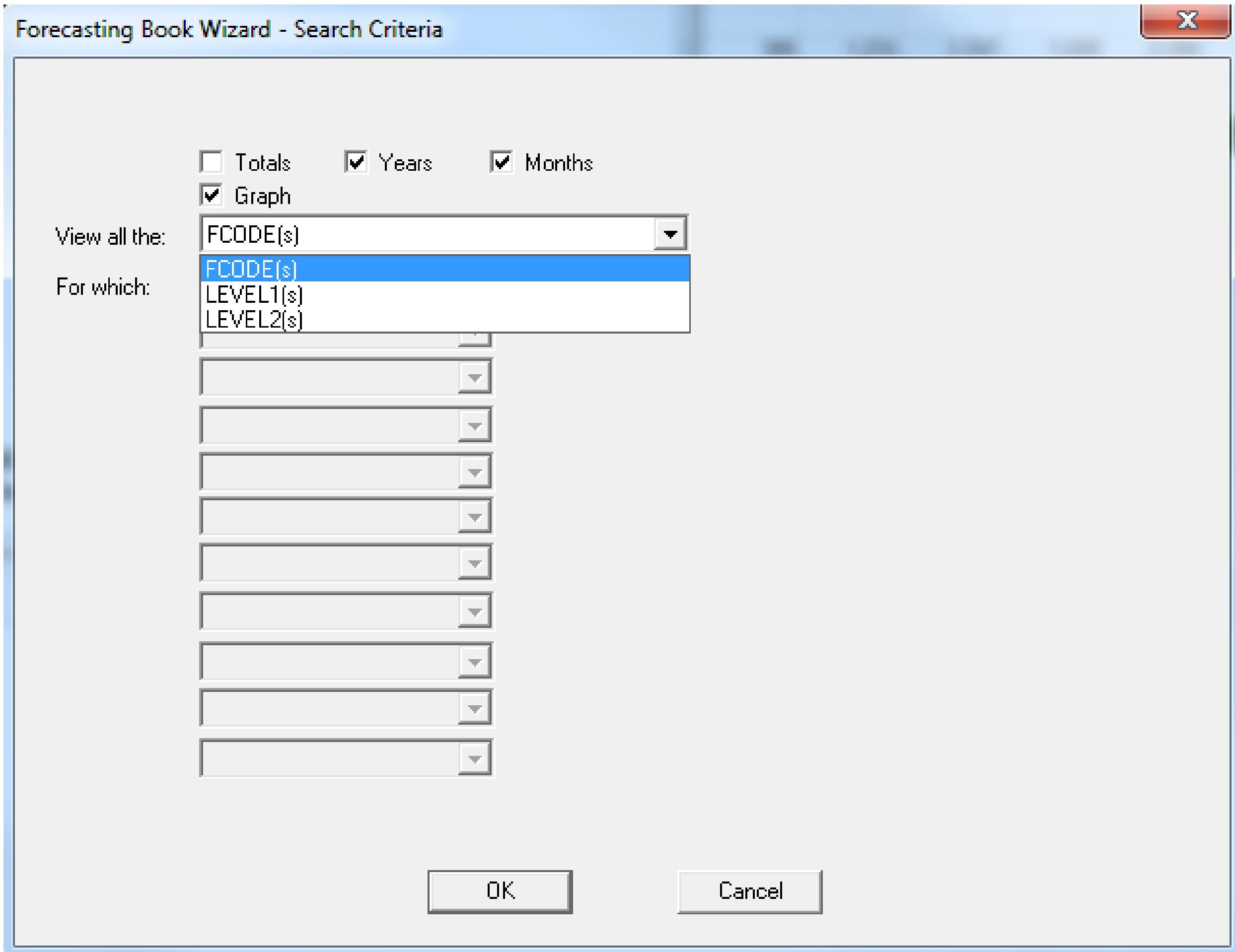


	A	B	C	D	E	F	G	H	I	J
4	Series Description	Level1	Level2	Jan-2004	Feb-2004	Mar-2004	Apr-2004	May-2004	Jun-2004	Jul-2004
5	MAF125	MAFEKIN	CORP							
6	MAF125+	MAFEKIN	CORP							
7	MAF175	MAFEKIN	CORP					575	1696	2776
8	NAI25	NAICAN	CORP		7742	6182	6263	7148	6805	6643
9	NAI50	NAICAN	CORP							
10	NAI75	NAICAN	CORP							
11	NAI75+	NAICAN	CORP							
12	SEASONAL	SEASON	CORP							
13	VALT100	VALTA	CORP							
14	VALT50	VALTA	CORP							
15	VALT80	VALTA	CORP							
16	Val100bef	VALTA	CORP							
17	Series 14	Series	CORP							61

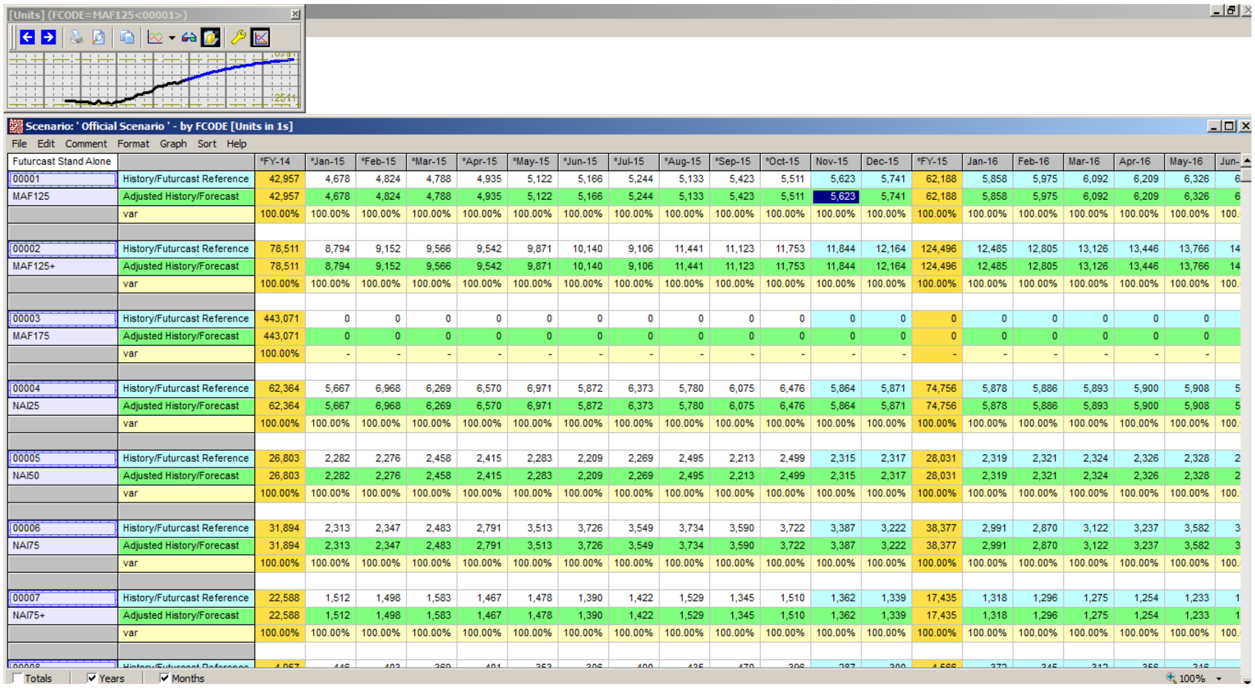
	K	L	M	N	O	P	Q	R	S	T
4	Aug-2004	Sep-2004	Oct-2004	Nov-2004	Dec-2004	Jan-2005	Feb-2005	Mar-2005	Apr-2005	May-2005
5								2990	2970	294
6										
7	4786	6575	18640	51041	58205	58211	63855	60222	66504	6648
8	6116	5908	5741	6282	6189	5798	6366	5713	6358	609
9							2571	2415	2296	249
10							4290	3352	3747	354
11							3790	3320	3681	323
12						456	435	497	524	59
13							28049	23686	24938	2592
14							37651	33760	38151	3662
15										
16							28049	23686	24938	2592
17	388	1,274	1,747	1,939	2,290	2,484	2,299	2,964	3,213	5,25

Please note columns **B** and **C** represent two user defined hierarchical or relational levels for displaying/modifying data at one of the selected higher dimension, running statistical methods for the level data, or modifying the forecast at the selected level that will cascade (prorate) back to the lowest level.

Click on **Run Forecasting Book**. The **Forecasting Book** wizard window will appear.



Click on **OK**, the Forecast View presented below will appear.



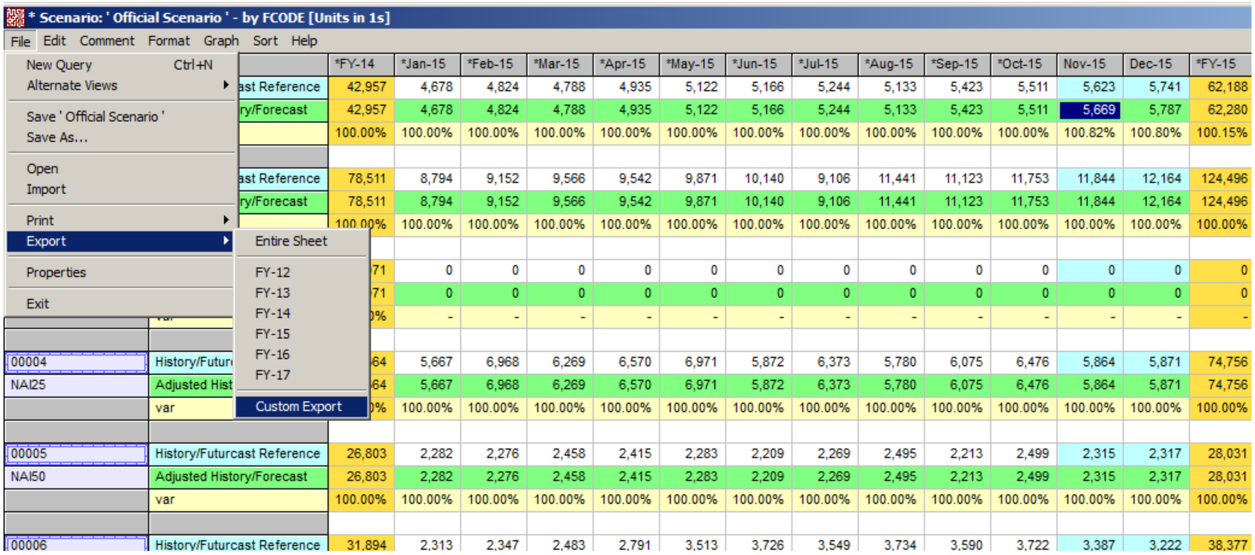
For each forecasting code (FCODE) the above Forecast View displays

a. The history and **FUTURCAST** reference forecast (Expert System Statistical Forecast)
b. A history/forecast line identical to the reference but which may be adjusted by either (1) selecting a different method or start point; or (2) applying the selected method from an earlier historical date; or (3) manually changing values applying the standard or advanced tab function in the fill confirmation window (discussed in the next section).
c. A variance (var) line that displays 100% unless an earlier ending historical date is selected to perform a forecast evaluation. In such cases, the variances computed for the evaluated months are (Forecast – Actual) / Actual multiplied by 100.

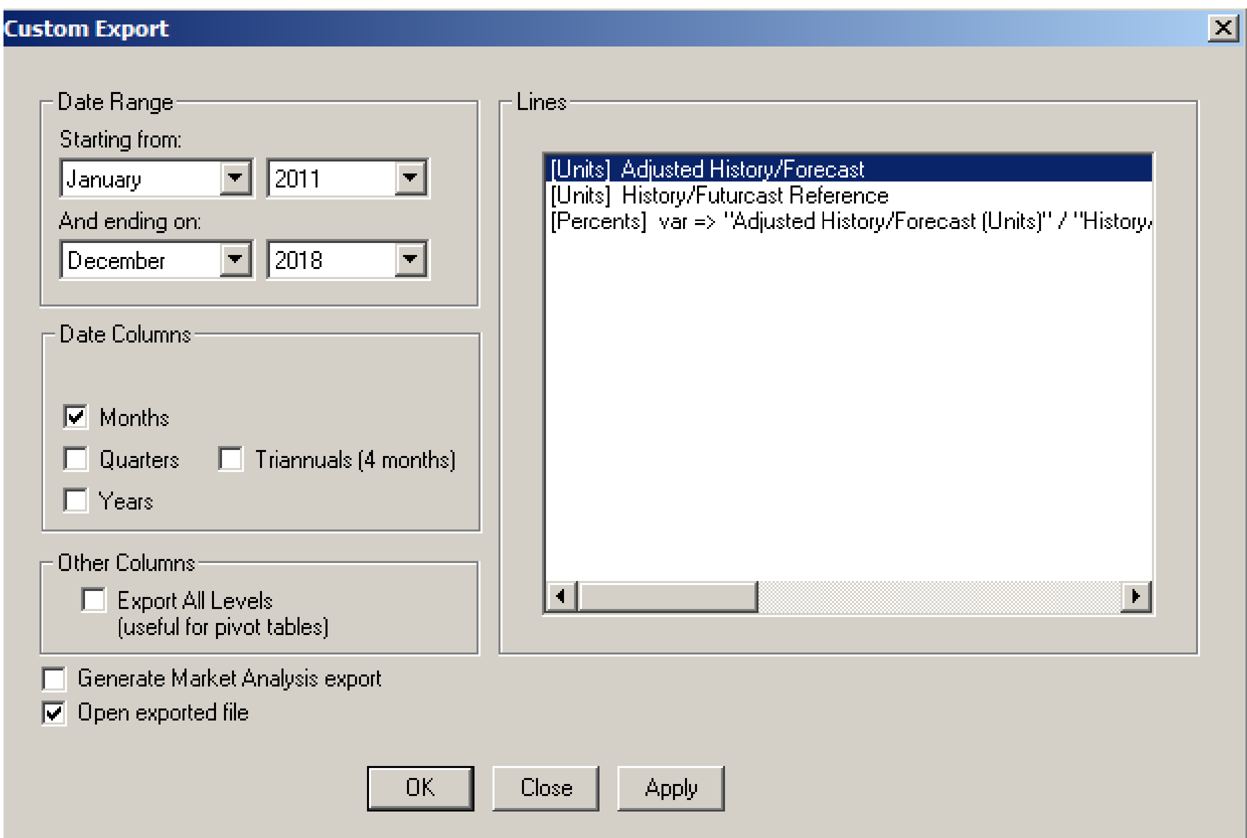
If you are not familiar with the **FUTURCAST Forecasting Book**, it is an Excel-like application. It is intuitive to navigate for Excel users. Often used functionalities are

6.1 Exporting the Forecast to Excel

Select Export option under **File** in the Forecast View and **Custom Export** as shown below.

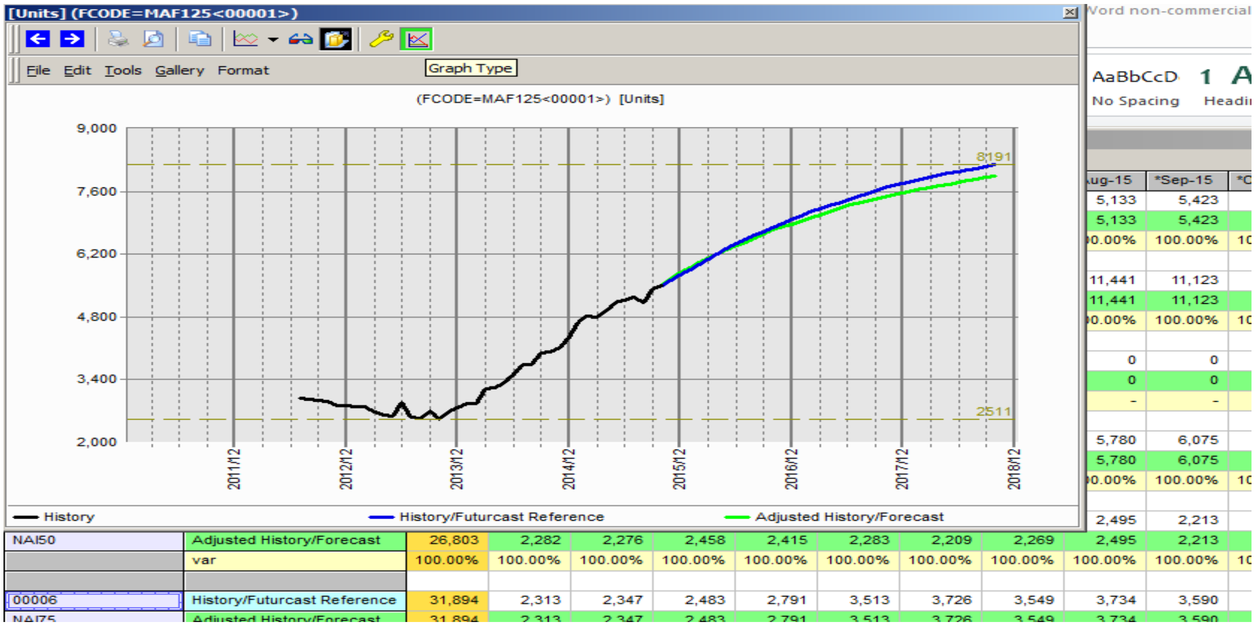


The Custom Export window will open in order for the user to specify the data to be exported into an Excel CSV file

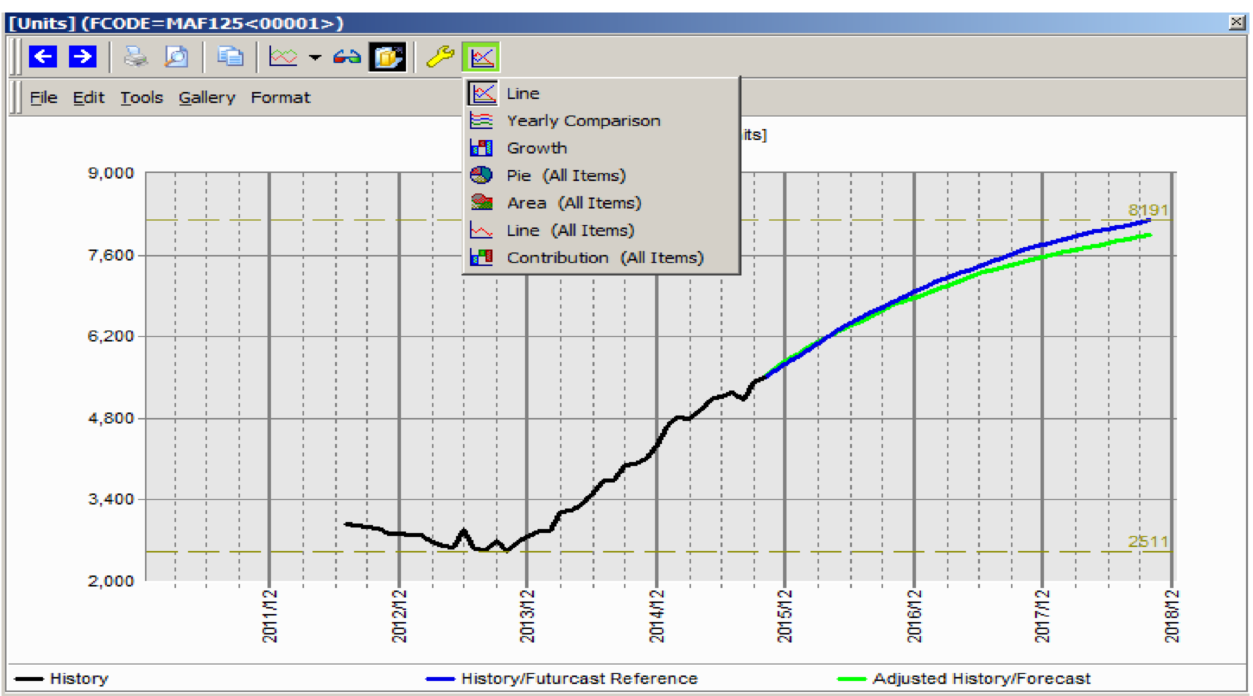


6.2 Graphing Options

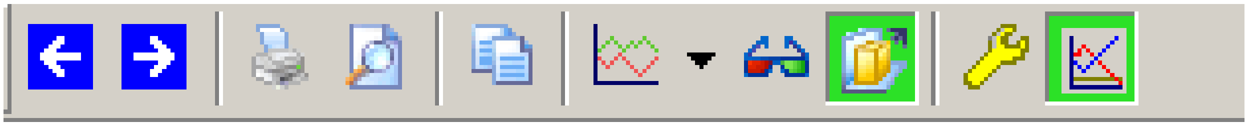
Enlarge the graph appearing on the left hand corner of the screen to the desired size and click on the *graph type* icon



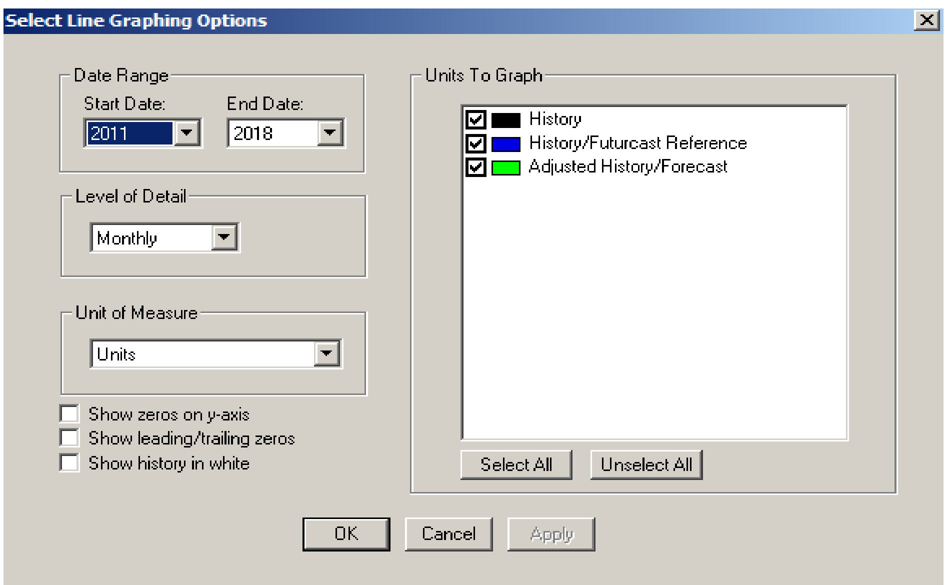
The multiple types of graph options will appear



The different icons in the Graph Window are



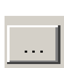
a. **Moving to a previous code/item**
b. **Moving to the next code/item**
c. **Printing the graph**
d. **Print preview**
e. **Copy to clipboard**
f. **Graphic gallery: possible display options for a type of graph**
g. **3D to 2D**
h. **Z-clustered**
i. **Possible options for a type of graph (for example: the line graph)**

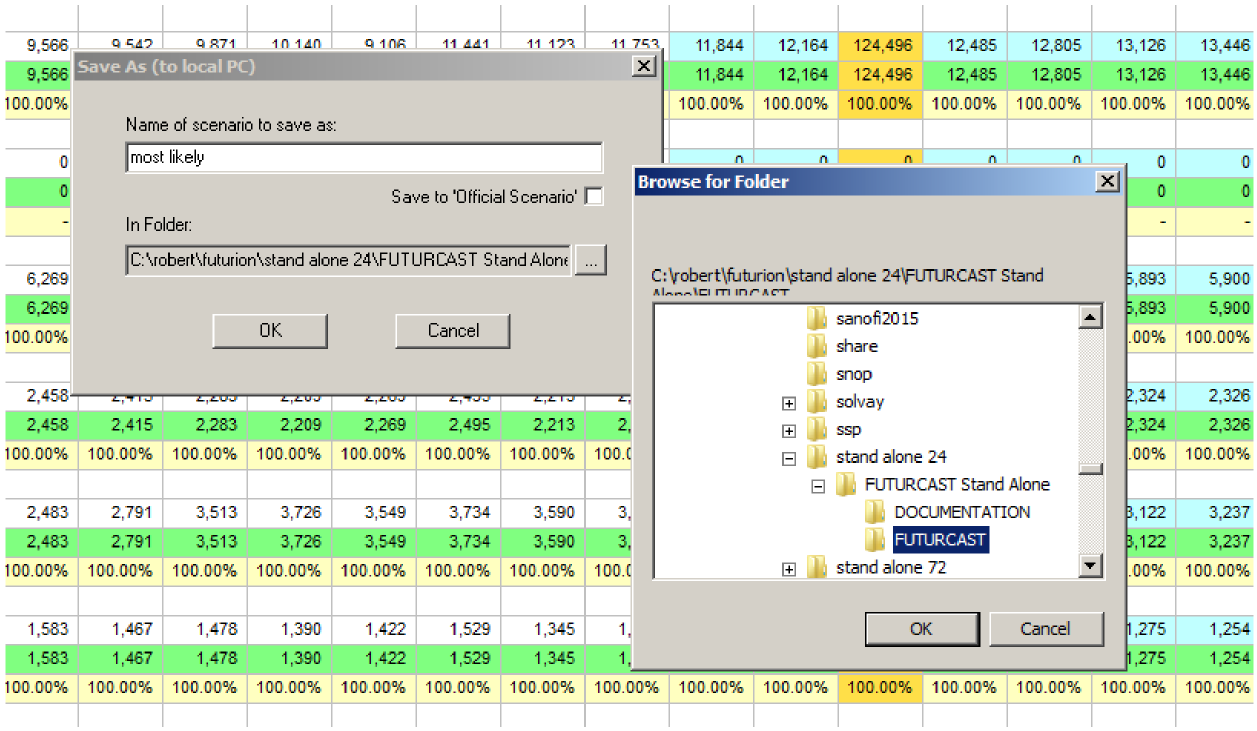


j. **The various types of graph available (line, pie etc.)**

6.3 Save 'As' or Saving a Forecast Scenario

Under File, select Save As, the Save As window will appear. Insert the name of a scenario and choose the storing location b clicking on the selection box

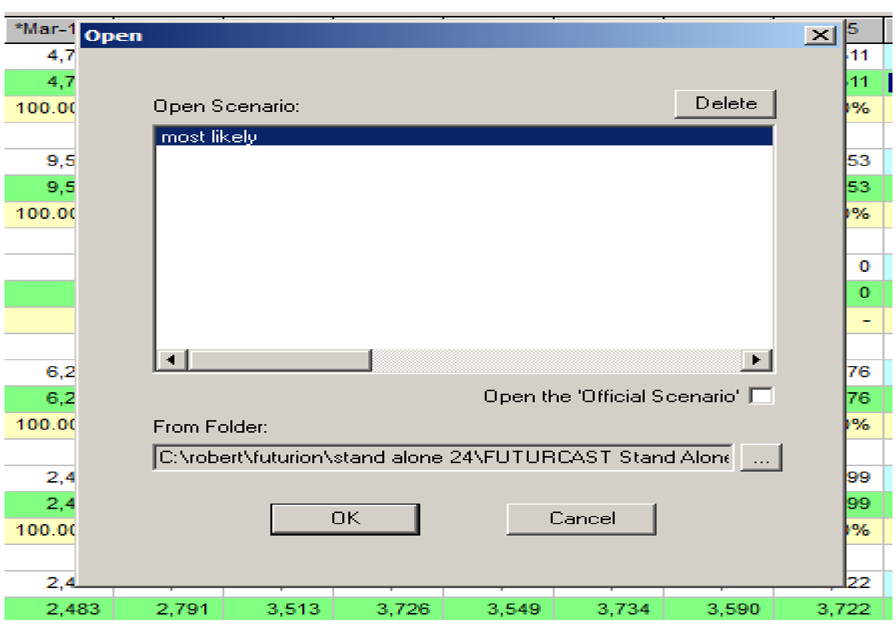




Storing your work in a scenario allows you to backup your forecasting activities

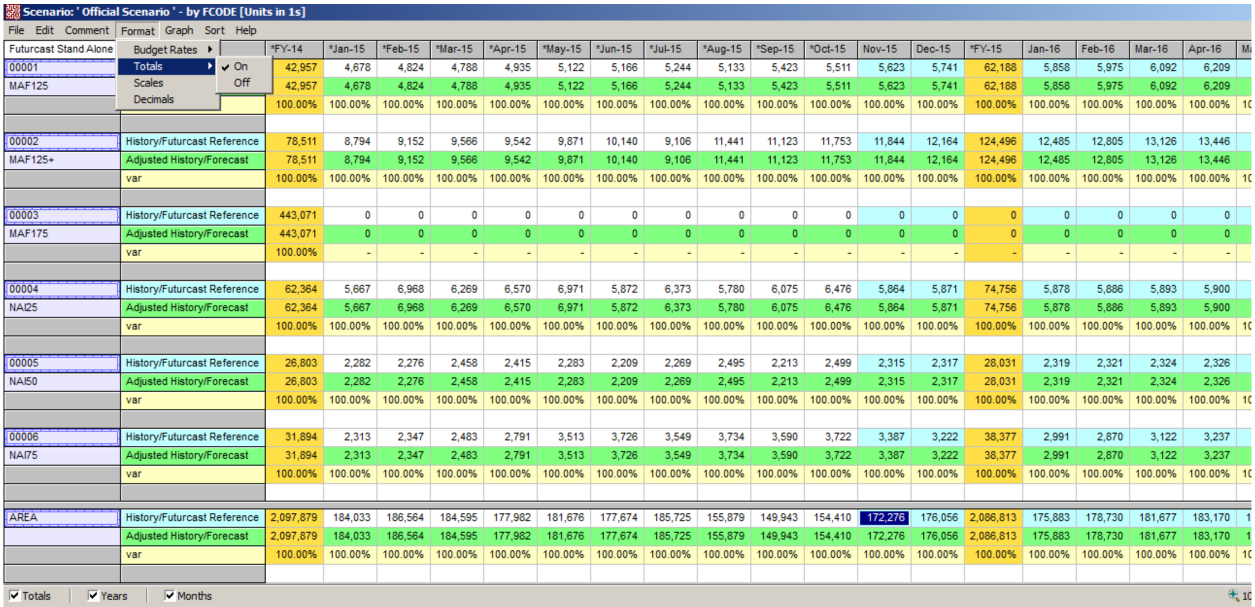
6.4 Accessing, Retrieving and Managing Scenarios

Under File, select Open and the Open scenario window will appear as shown below to allow you to open a selected scenario in the Forecasting application



6.5 AutoSum

Select **Totals | On** under format and the sum of each column will be displayed on the bottom of the view with a computation of the variances for the totals as shown below.



Futurcast Stand Alone		*FY-14	*Jan-15	*Feb-15	*Mar-15	*Apr-15	*May-15	*Jun-15	*Jul-15	*Aug-15	*Sep-15	*Oct-15	Nov-15	Dec-15	*FY-15	Jan-16	Feb-16	Mar-16	Apr-16
00001		42,957	4,678	4,824	4,788	4,935	5,122	5,166	5,244	5,133	5,423	5,511	5,623	5,741	62,188	5,858	5,975	6,092	6,209
MAF125		42,957	4,678	4,824	4,788	4,935	5,122	5,166	5,244	5,133	5,423	5,511	5,623	5,741	62,188	5,858	5,975	6,092	6,209
		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00002	History/Futurcast Reference	78,511	8,794	9,152	9,566	9,542	9,871	10,140	9,106	11,441	11,123	11,753	11,844	12,164	124,496	12,485	12,805	13,126	13,446
MAF125+	Adjusted History/Forecast	78,511	8,794	9,152	9,566	9,542	9,871	10,140	9,106	11,441	11,123	11,753	11,844	12,164	124,496	12,485	12,805	13,126	13,446
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00003	History/Futurcast Reference	443,071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAF175	Adjusted History/Forecast	443,071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	var	100.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00004	History/Futurcast Reference	62,364	5,667	6,968	6,269	6,570	6,971	5,872	6,373	5,780	6,075	6,476	5,864	5,871	74,756	5,878	5,886	5,893	5,900
NAI25	Adjusted History/Forecast	62,364	5,667	6,968	6,269	6,570	6,971	5,872	6,373	5,780	6,075	6,476	5,864	5,871	74,756	5,878	5,886	5,893	5,900
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00005	History/Futurcast Reference	26,803	2,282	2,276	2,458	2,415	2,283	2,209	2,269	2,495	2,213	2,499	2,315	2,317	28,031	2,319	2,321	2,324	2,326
NAI50	Adjusted History/Forecast	26,803	2,282	2,276	2,458	2,415	2,283	2,209	2,269	2,495	2,213	2,499	2,315	2,317	28,031	2,319	2,321	2,324	2,326
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00006	History/Futurcast Reference	31,894	2,313	2,347	2,483	2,791	3,513	3,726	3,549	3,734	3,590	3,722	3,387	3,222	38,377	2,991	2,870	3,122	3,237
NAI75	Adjusted History/Forecast	31,894	2,313	2,347	2,483	2,791	3,513	3,726	3,549	3,734	3,590	3,722	3,387	3,222	38,377	2,991	2,870	3,122	3,237
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
AREA	History/Futurcast Reference	2,097,879	184,033	186,564	184,595	177,982	181,676	177,674	185,725	155,879	149,943	154,410	172,276	176,056	2,086,813	175,883	178,730	181,677	183,170
	Adjusted History/Forecast	2,097,879	184,033	186,564	184,595	177,982	181,676	177,674	185,725	155,879	149,943	154,410	172,276	176,056	2,086,813	175,883	178,730	181,677	183,170
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

7 Using the Fill Feature

In the Forecasting View, double-click on a forecast value in the Adjusted History/Forecast row. The Fill confirmation window will open as shown in section 7.2. There are four different types of forecast Fill functions. These are explained in the next section.

7.1 Types of Fill

For a **Type of Fill**, there are four set of functions; (1) Standard Functions, (2) Advanced Functions, (3) Shifts Function, and (4) Statistical Forecast Method Tab.

7.1.1 Standard Functions

Standard Curves	
Constant Value	By default, this field holds the value in the selected cell. Keep this value or change it. The value in this field will be repeated in all the cells in the specified date range.
Change	Enter a value by which you want to increase or decrease the values in the specified date range. For example, if you enter 10, all the values in the specified date range will be increased by ten. Conversely, if you enter -10, all the values in the specified date range will be decreased by ten.
% Change	Enter a percentage by which the values in the specified date range will be increased. For example, if you enter 10, all the values in the specified date range will be increased by 10%. Conversely, if you enter -10, all the values in the specified date range will be decreased by 10%.

7.1.2 Advanced Functions

Advanced Curves	
Linear Curve	A simple mathematical model that calculates a straight line. By its nature, this curve is best suited to a time series that is expected to change by the same absolute amount in each time period.
Diffusion Curve	A mathematical model for a time series that is best applied for new products where adopters of a new product innovation or idea can be categorized as innovators, early adopters, early majority, and laggards.
% Diffusion Curve	A mathematical model for a time series that is best applied for new products where adopters of a new product innovation or idea can be categorized as innovators, early adopters, early majority, and laggards.
Exponential Curve	A mathematical model for a time series that is increasing or decreasing exponentially. An exponential curve is useful when it is expected that there will be increasing or declining growth for a time series.

Note:

For all Advanced Functions, the user may use the Solve Function to identify the best fit parameters for the selected curve.

7.1.3 Shift Function

Shift	
	Shift the value from an old date to a new date

7.1.4 Statistical Functions

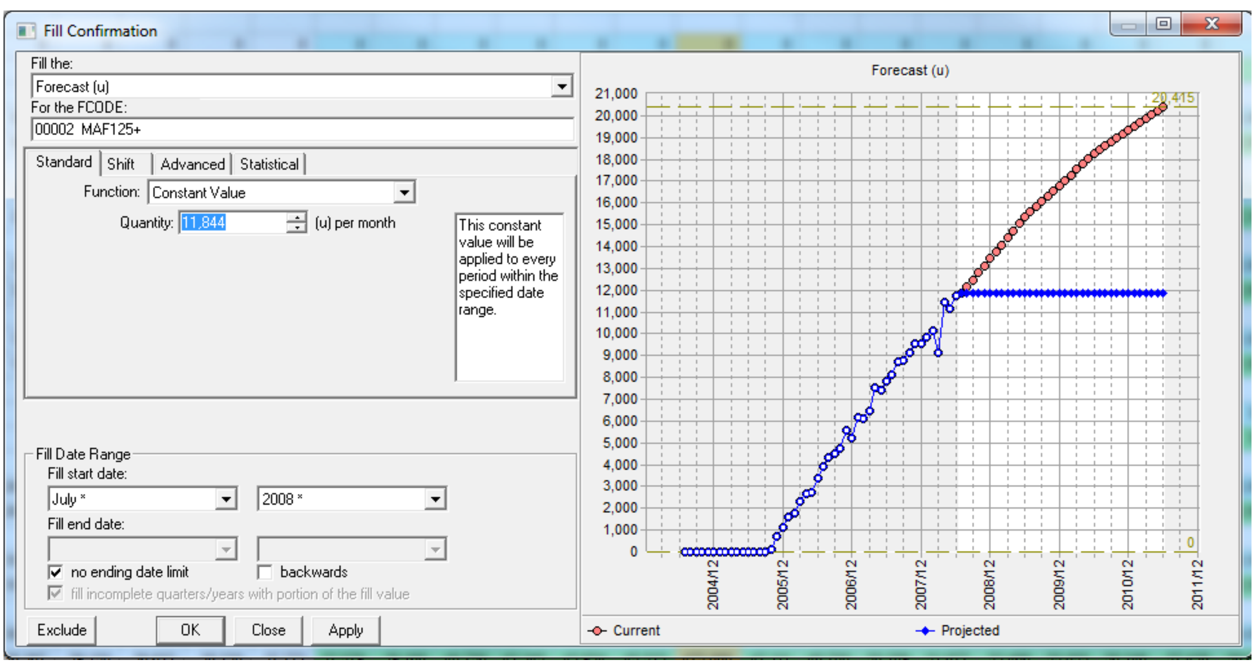
The Statistical Tab, when opened, displays the Expert System method selection and the key forecasting parameters as show in Section 9. The user may then change the method and/or its parameters, change the first observation to be used and/or the last, and generate a different statistical forecast.

7.2 Adjusting the Forecast using the Fill feature

This section will show you how to modify a forecast using the Fill feature. The Diffusion curve will be applied in order to adjust the forecast.

To add an impact to an assumption using the Fill feature, complete the following steps:

1. Double-click in the cell corresponding to the month in which you want the impact to begin.
    - The Fill Confirmation dialog box opens.

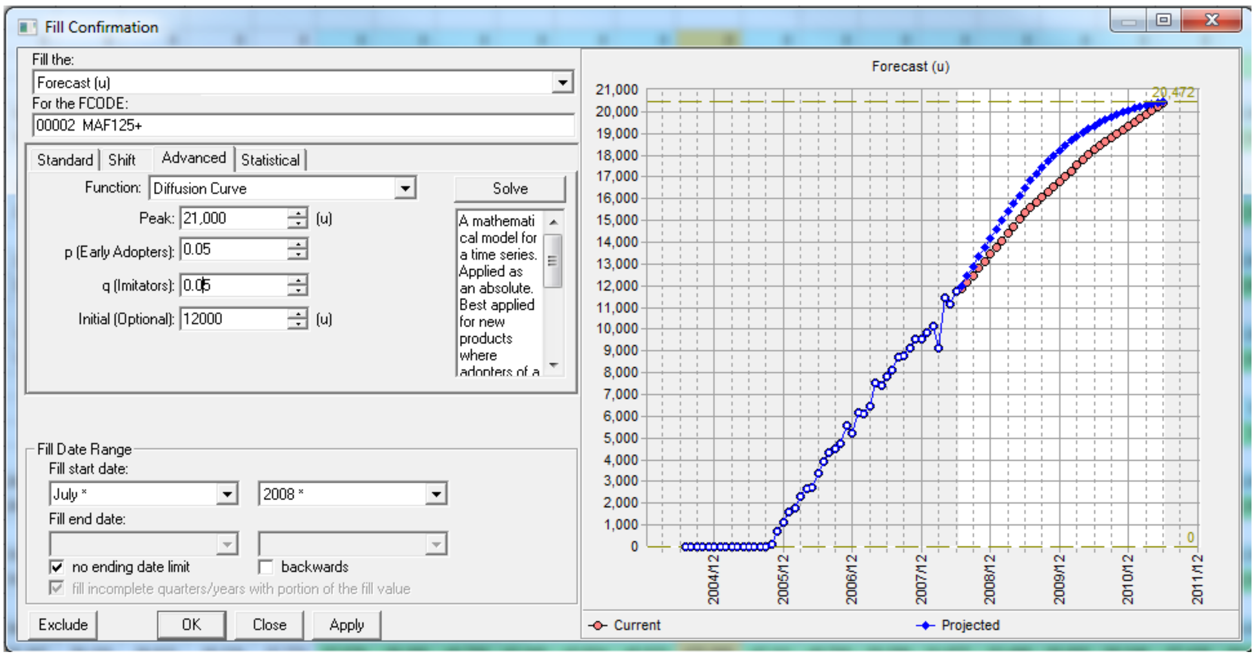


2. Click the Advanced tab and then select Diffusion in the drop-down list.
3. Enter **21000** for the **Peak** value.
    - The Projected graph adjusts automatically.
4. Enter **0.05** for the **p** value.
    - The Projected graph adjusts automatically.

5. Enter **0.05** for the **q** value.
    - The Projected graph adjusts automatically.
6. Specify a non-zero value for the **Initial Value** so that the first month of the forecast has no zeros for data. For example, specify a value of **12000**.
    - The Projected graph adjusts automatically (See graph below).

Notes:

- The higher the p value, the faster the diffusion will occur. The p value should always be greater than the q value.
- When making subsequent changes to the p and q values, only change one value at a time, view the graph and then change the other value (if necessary) to attain the preferred diffusion curve.
- The initial value represents the starting value for the Forecast. The **FUTURCAST** System interpolates the values between the Peak and the Initial Value.



7. In the **Date Range** panel, if you want to specify an ending date for the Forecast, uncheck the no ending date limit checkbox and then select a date from the Ending drop-down list; otherwise, leave the checkbox as is.
8. Click **Apply**.
9. Click **OK** to close this dialog Box.

8 Bass Diffusion Curves (overview)

8.1 Bass Diffusion Formula

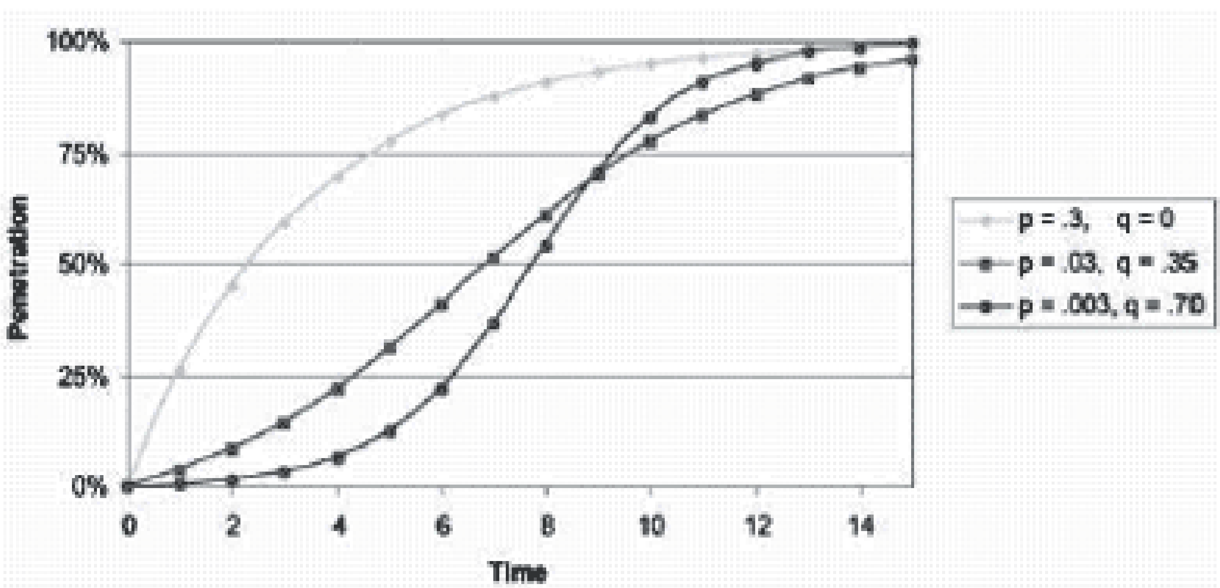
$$N_t = N_{t-1} + p(m - N_{t-1}) + q\frac{N_{t-1}}{m}(m - N_{t-1})$$

Where

m is the market potential (m>0) i.e. the total number of people (or %) who will eventually use the product

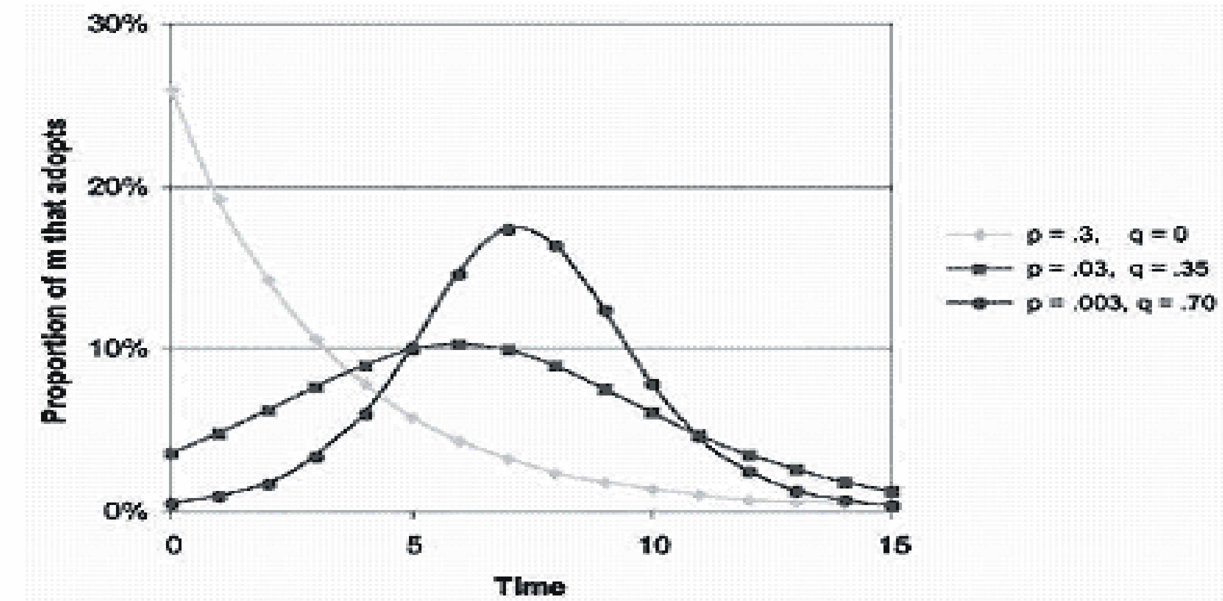
p is the coefficient of innovation (0<p<1) or the likelihood that somebody who is not yet using the product will start using it due to mass media coverage, advertising, or other external factors.

q is the coefficient of imitation (0<q<1) or the likelihood that somebody who is not yet using the product will start using it because of word of mouth or other influence from people already using the product.



p > q Pattern for new blockbuster products

p < q Less risky innovations (me-to products)



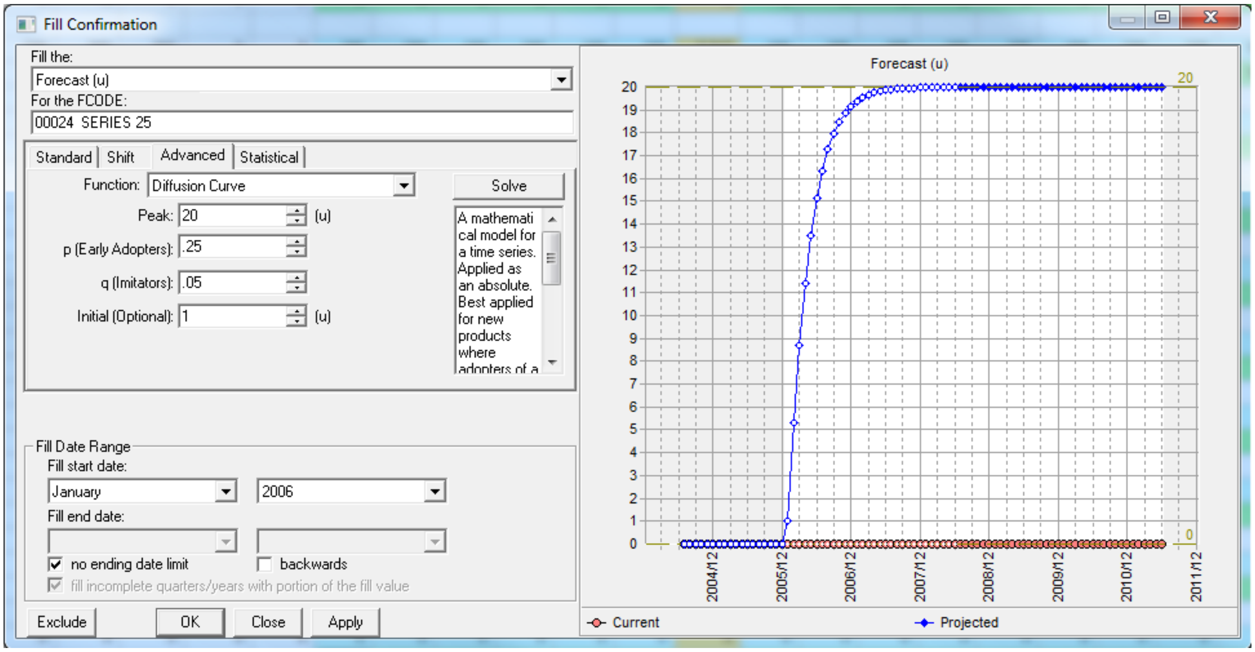
High value for p Diffusion has a quick start, but tapers off quickly
High value for q Diffusion is slow at first, but accelerates after a while

8.2 Bass Diffusion Application

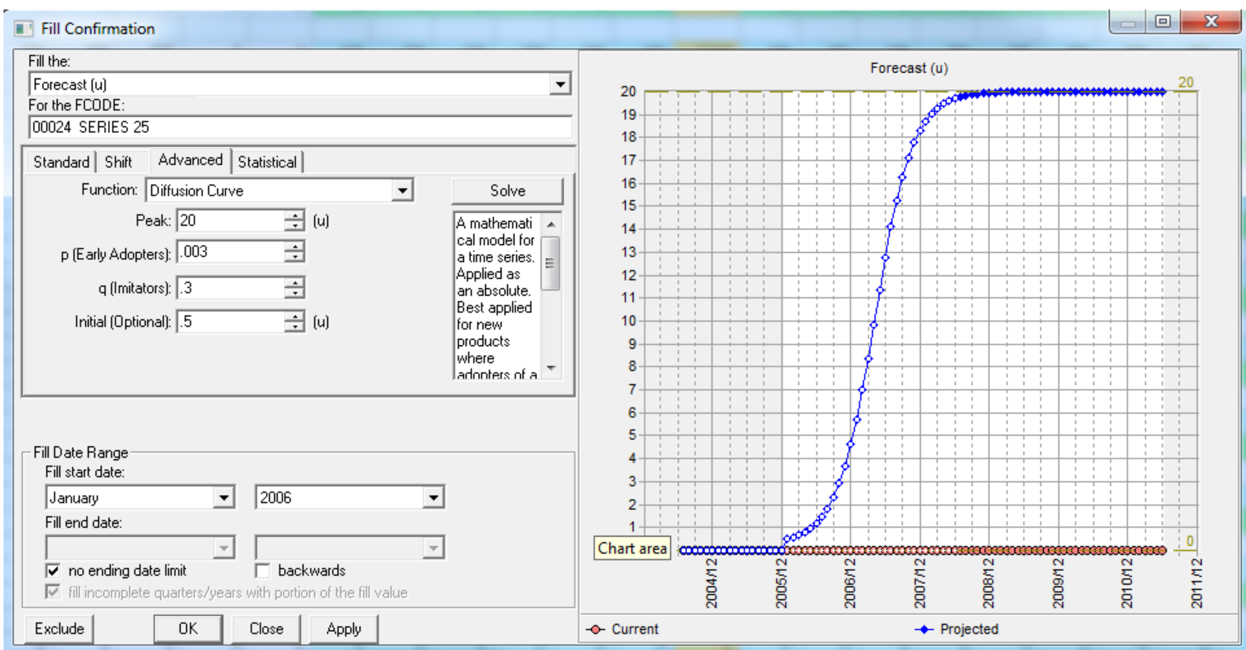
- The diffusion model may be applied to positive and negative situations (maximum loss instead of peak expressed as a negative peak with positive p and q). The result will be an exponentially declining function to the value of the maximum loss
- The preferred option for establishing a new product forecast
- The preferred option for assumptions/adjustments with single impact up-take curve values (not applicable in Stand Alone)

We can distinguish 4 different types of up-take curve. They are:

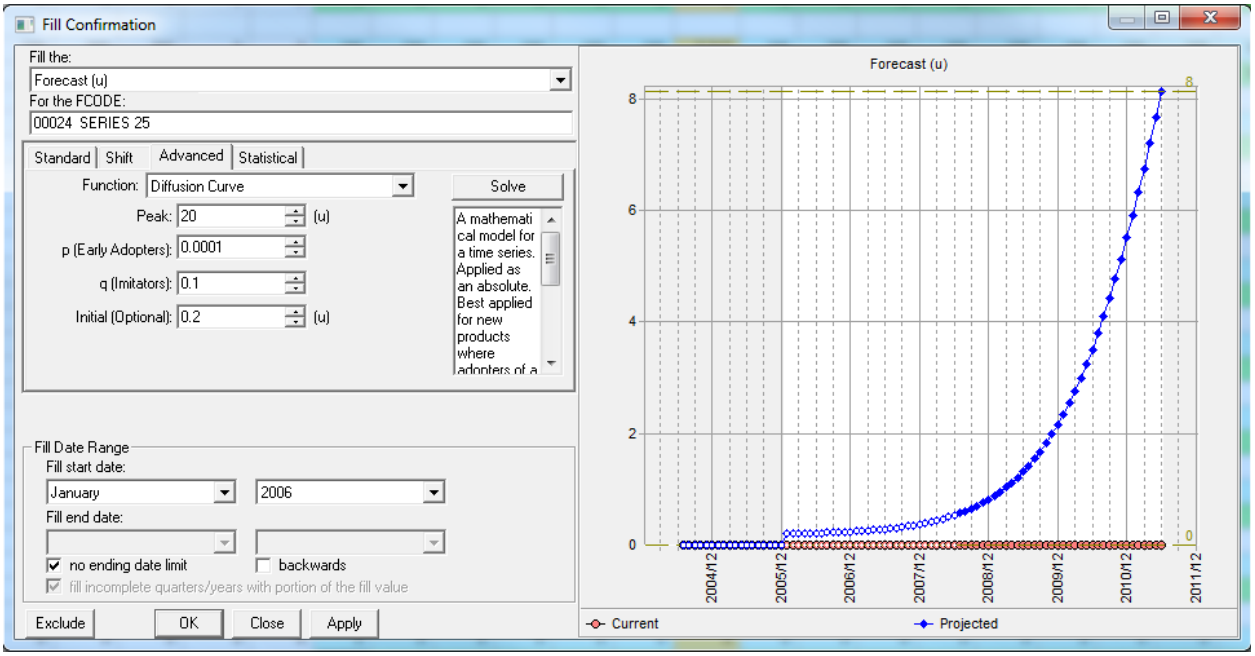
8.2.1 Fast up-take



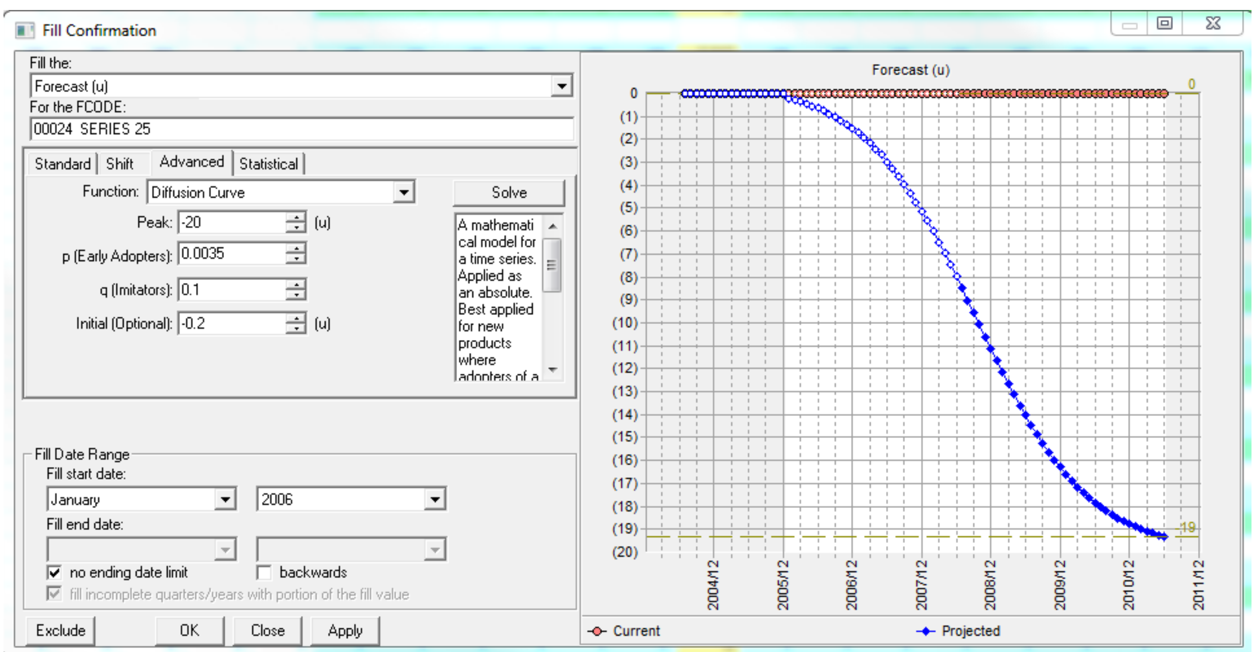
8.2.2 S-curve up-take



8.2.3 Exponential up-take



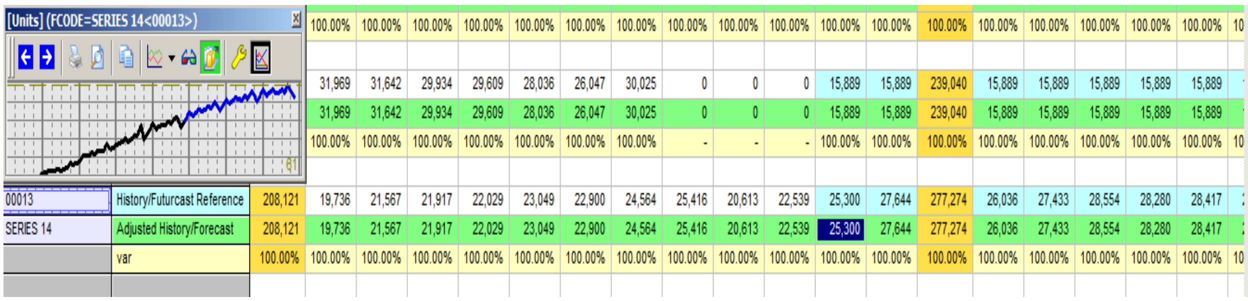
8.2.4 Negative up-take or Erosion



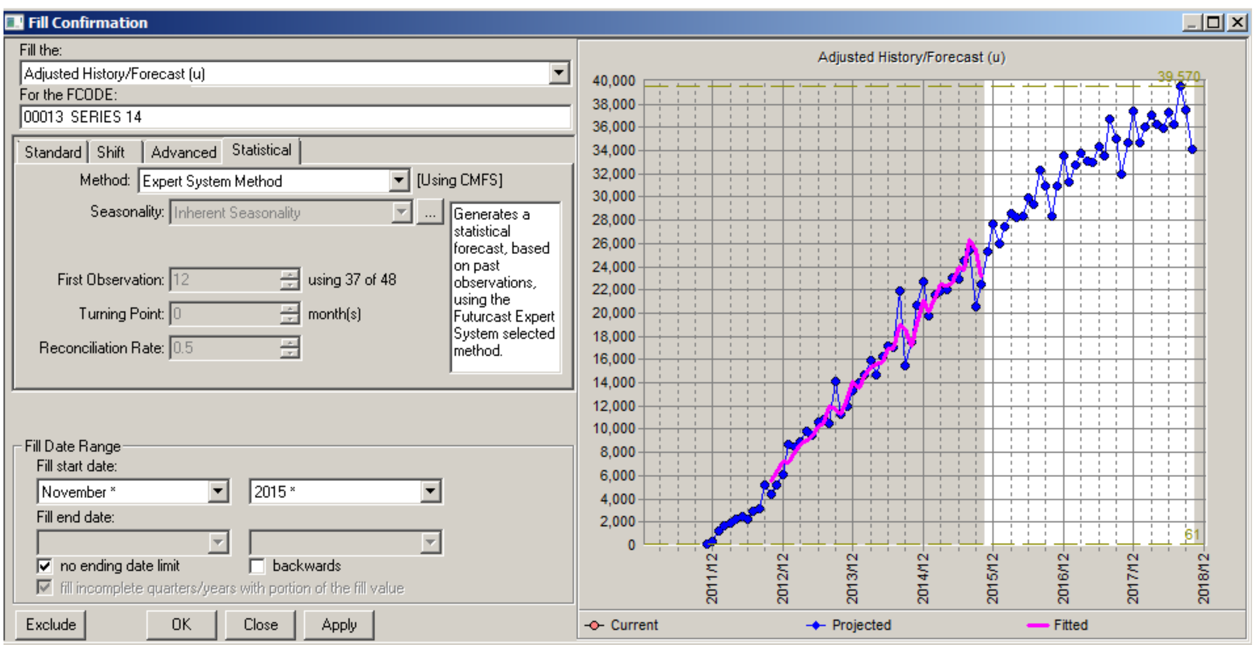
8.2.5 New Product or Line Extension Forecast by Analogy

A new product forecast may be established by identifying the shape of the up-take curve of an analogous product that was previously launched. This means estimating the p and q for this analogous product. **FUTURCAST Stand Alone** allows a user to compute the Best Fit Bass model on an analogous launched product.

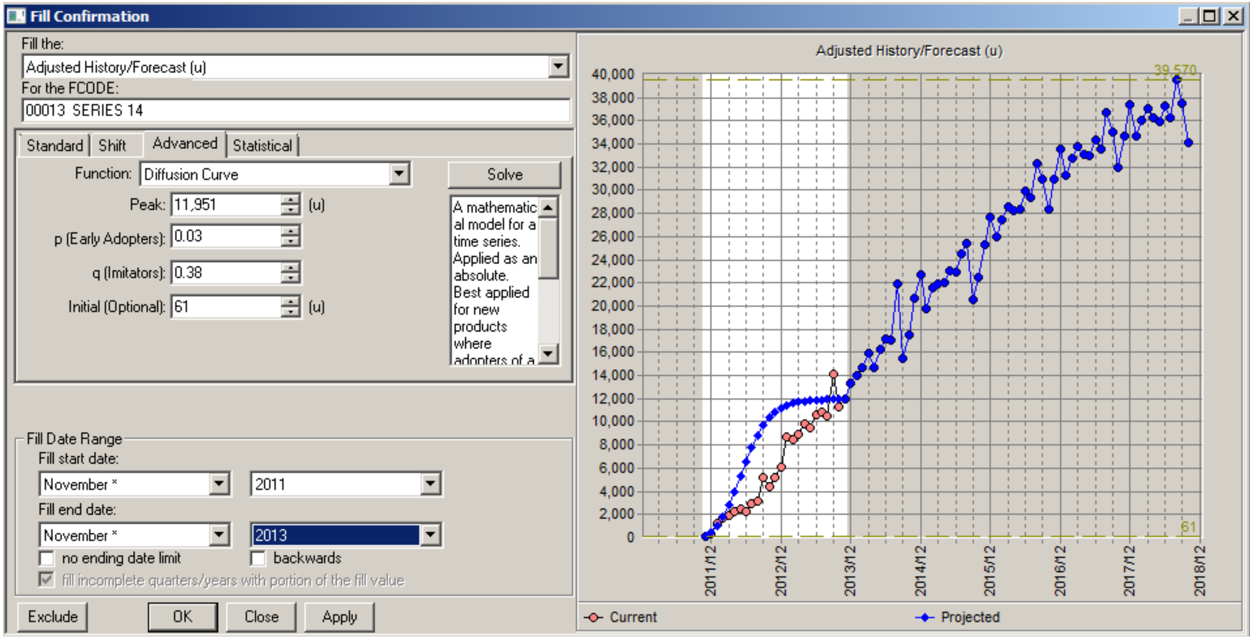
For example, such data have been entered as series 14



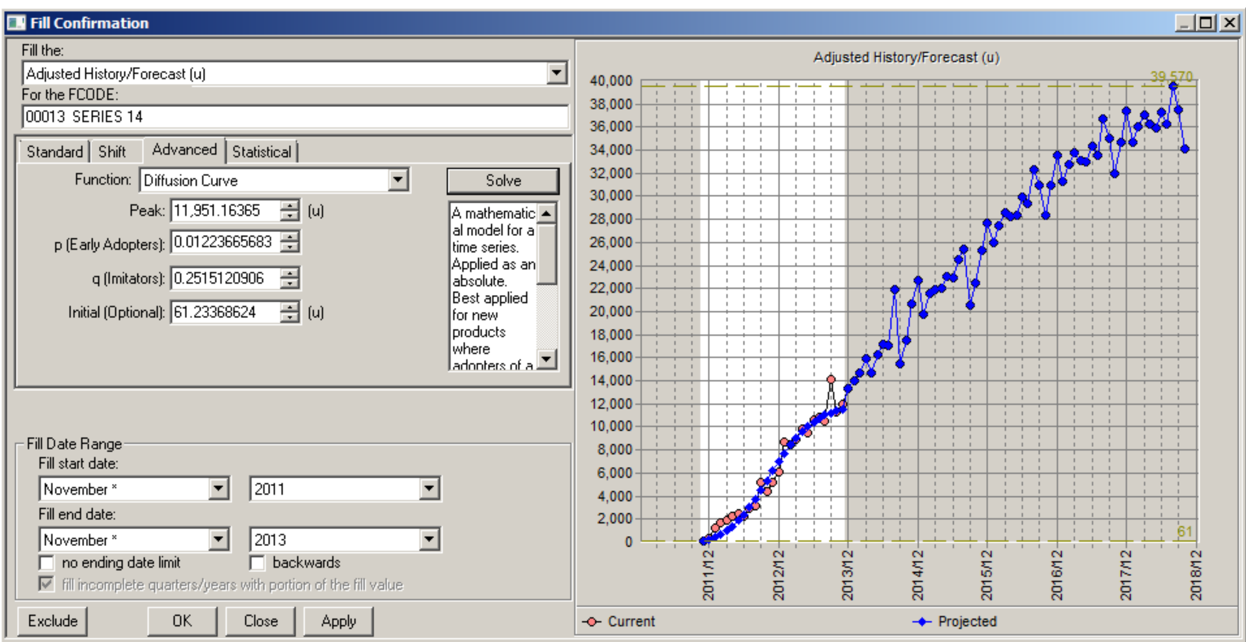
The fill confirmation window is opened by double clicking on the highlighted cell above.



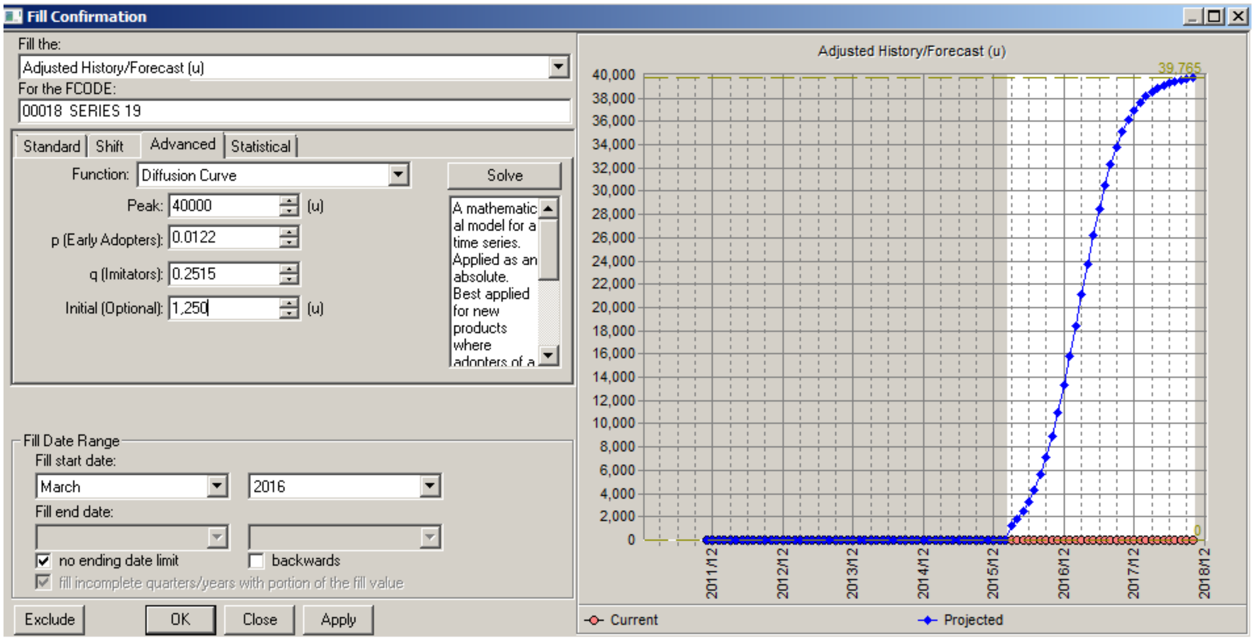
Select as shown below **Advanced | Diffusion Curve** and set in this case the **Fill Data Range** from November 2011 to November 2013 (the historical months of interest)



Click of the **Solve** bottom and Best Fit p (.0122) and q (.2515) values are automatically estimated

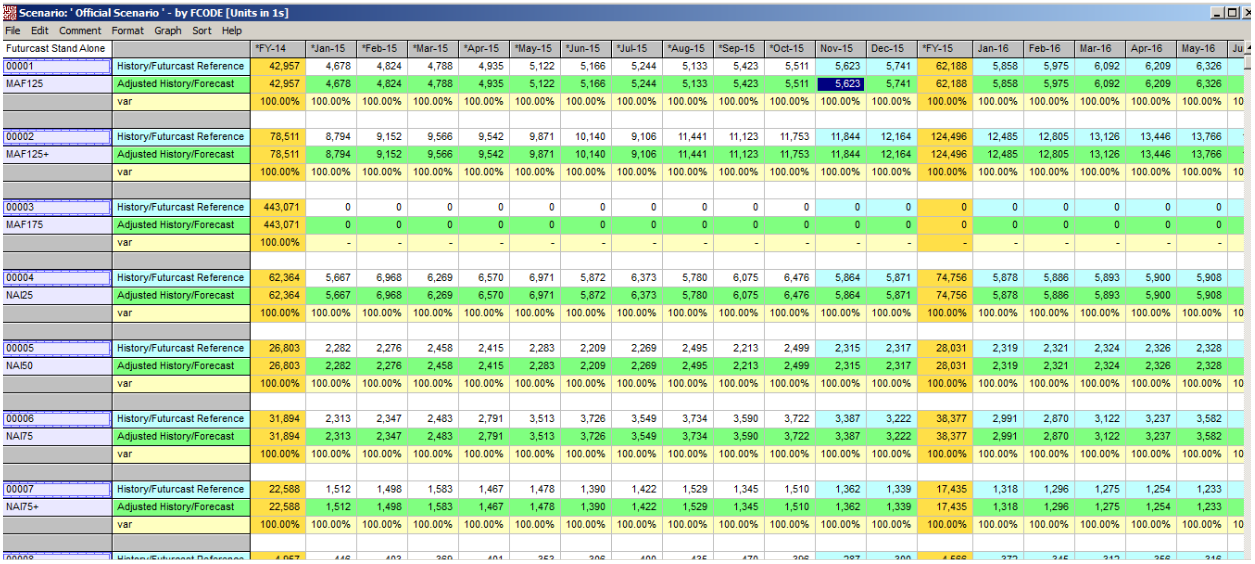


These values may then be used to establish the forecast for a product to be launched in the future given first and projected peak monthly sales. This is illustrated below for initial sales of 1250 and peak monthly sales of 40,000 and launch date of March 2016.

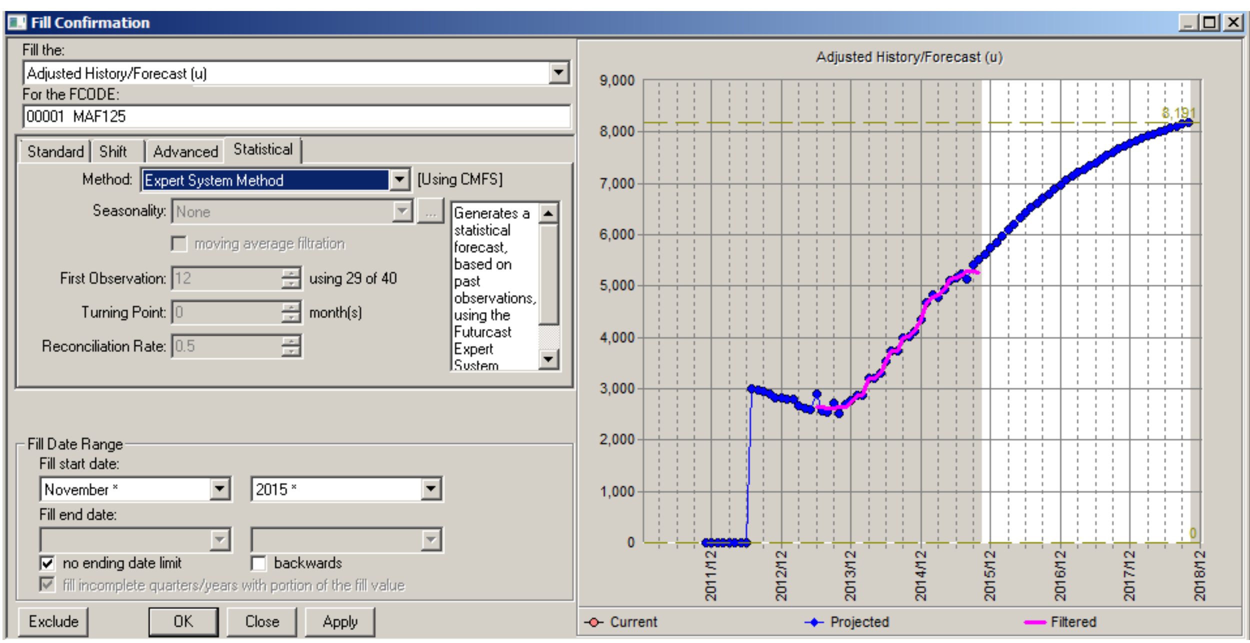

Fill Confirmation
Fill the:
Adjusted History/Forecast (u)
For the FCODE:
00018 SERIES 19
Standard
Shift
Advanced
Statistical
Function:
Diffusion Curve
Solve
Peak:
40000
(u)
p (Early Adopters):
0.0122
q (Imitators):
0.2515
Initial (Optional):
1,250
(u)
A mathematical model for a time series. Applied as an absolute. Best applied for new products where
Fill Date Range
Fill start date:
March
2016
Fill end date:
no ending date limit
backwards
fill incomplete quarters/years with portion of the fill value
Exclude
OK
Close
Apply
Adjusted History/Forecast (u)
39,765
Current
Projected

9 Creating a Statistical Forecast

In order to generate a statistical forecast simply double click on the first forecast month (highlighted cell) of the Adjusted History / Forecast line for a given code/product.

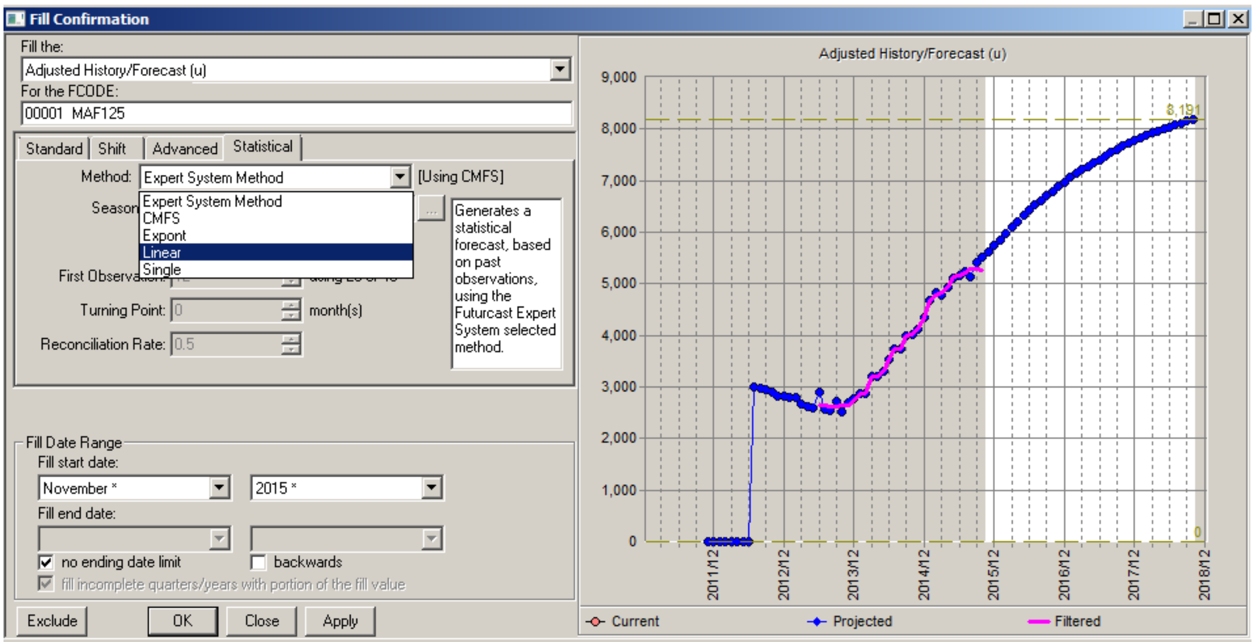


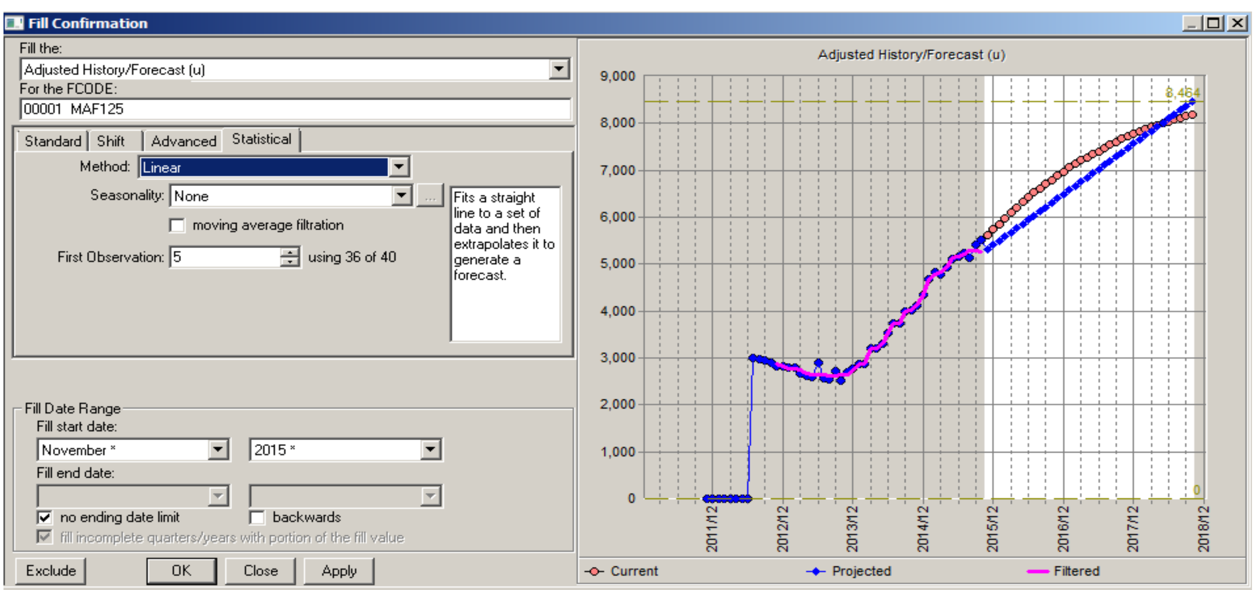
In the Fill Confirmation window that opens click on the Statistical Tab.



The Statistical tab displays by default the Expert System Method that would be used on the historical data (CMFS in this example). In addition to the forecast that is generated by using this method on the automatically filtered (outliers removed) data (pink values) that are displayed in the graph, the widow indicates the first observation used (12) or the number of last months used (the 29 last months out of the 40 historical months).

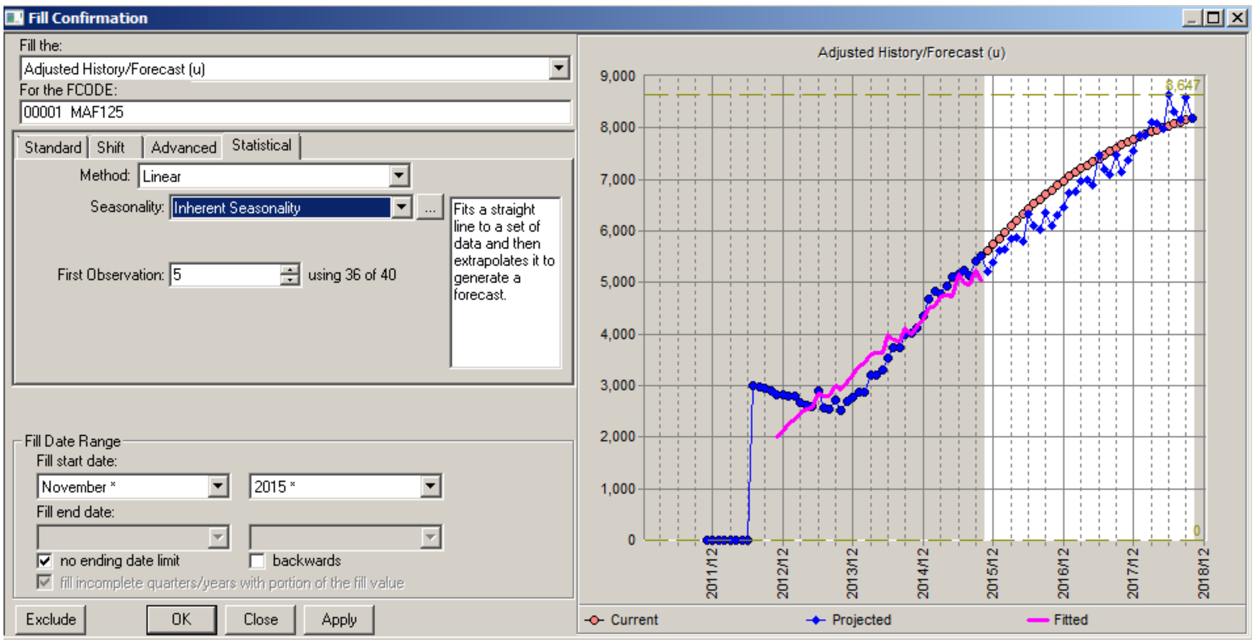
In order to create a forecast based with an alternative method, select the method of your choice (for example Linear) in the Method drop down menu



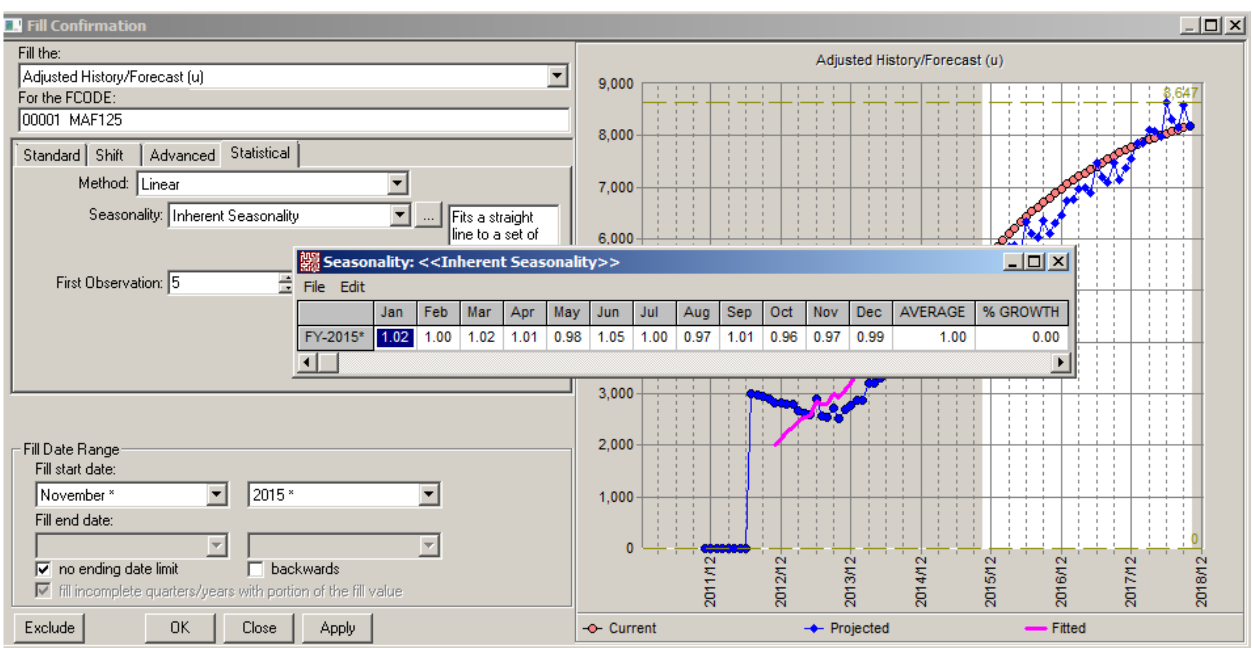


and set the first observation to be used (5 for example or extrapolate using the 36 last historical months). The forecasts (in blue) are displayed in the above Fill Confirmation window along with the current forecasts (in orange). To replace the current forecasts by the newly generated values, press **Apply** and **OK**.

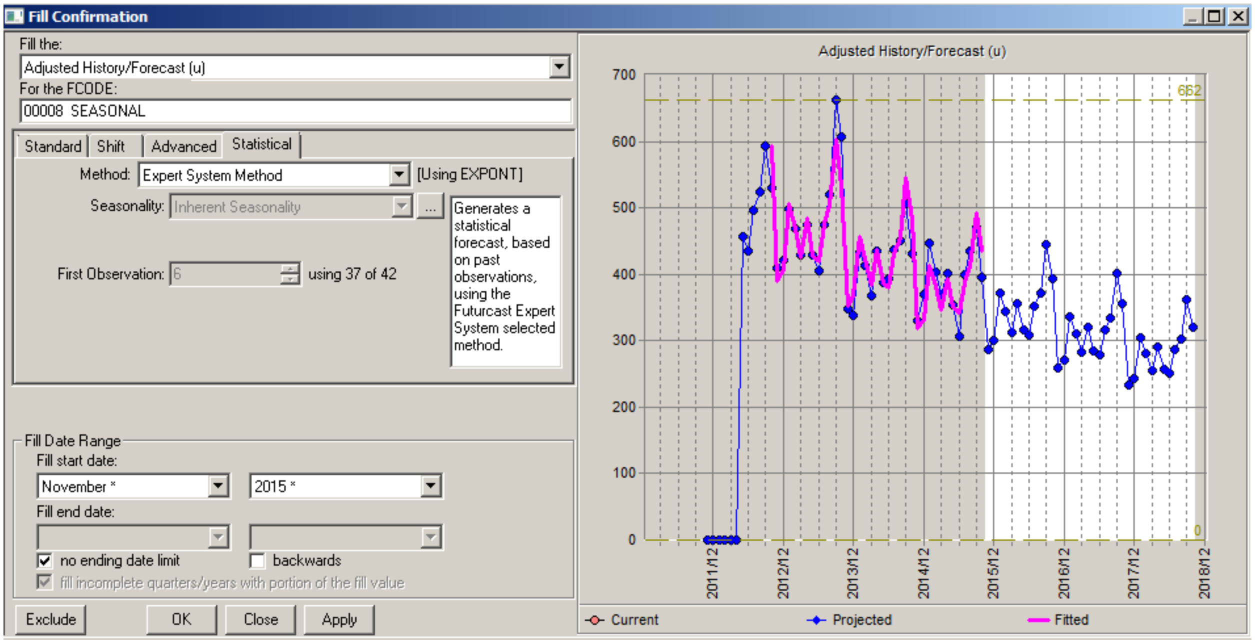
In **FUTURCAST Stand Alone** you may apply inherent seasonality while generating a statistical forecast. In our example above, we have selected **None** as seasonality (i.e. no seasonality). Select **Inherent Seasonality** in the Seasonality drop down Menu, the seasonally adjusted forecasted values will now appear. Please note the filtered data are now replaced by the historical fitted values as determined by the best fit linear model.



Press on the selection bottom next to the drop down seasonality menu bottom, and the monthly seasonal factors estimated by the Census Method (ClassD) will appear.

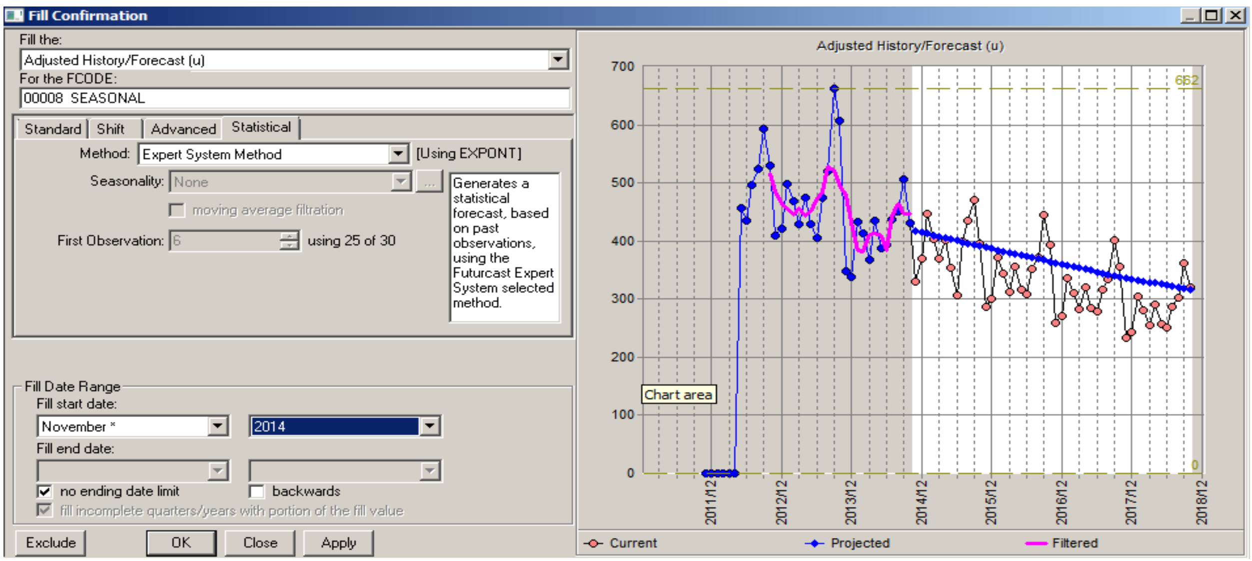


On highly seasonal series of data, the **FUTURCAST** Expert System method will automatically identify inherent seasonality as one of the selected choices as illustrated below

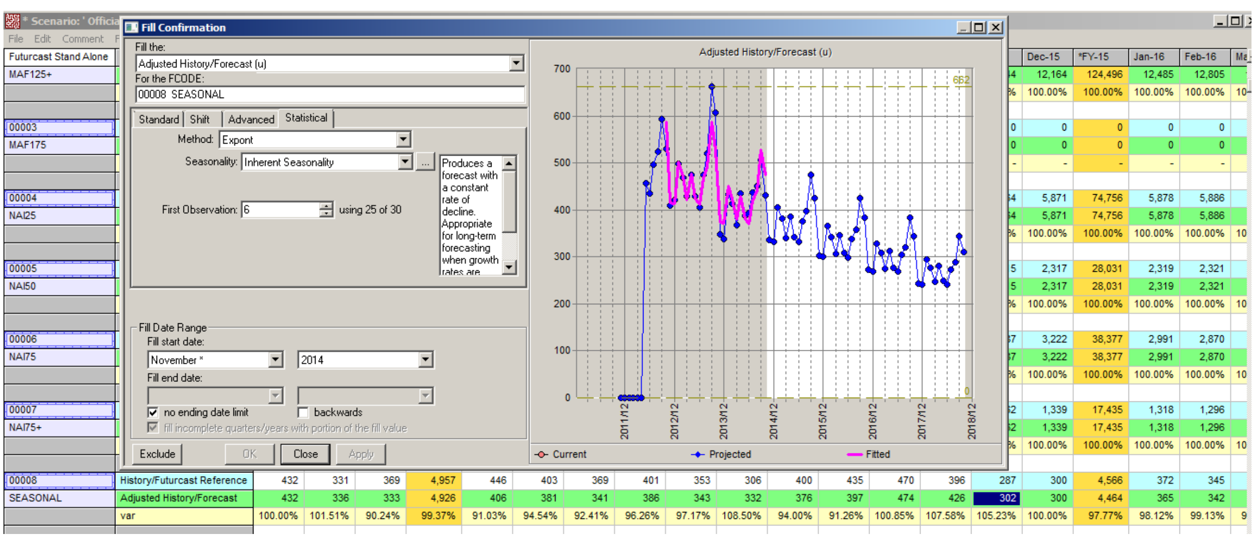


10 Evaluating a Statistical Forecast

In **FUTURCAST Stand Alone** you may evaluate the forecasts generated by using not all the historical data. For example, we would like to examine for the Seasonal series what would have been the accuracy of the forecasts for the last 12 months using the Expert System method under inherent seasonality (the forecast produced with November 2014 as the last historical month that begins in December 2014). In order to proceed with this evaluation, the user must first in the Fill Confirmation Box set in the Fill Data Range section the Fill Start Date to November 2014 (the selected ending date of the historical data).



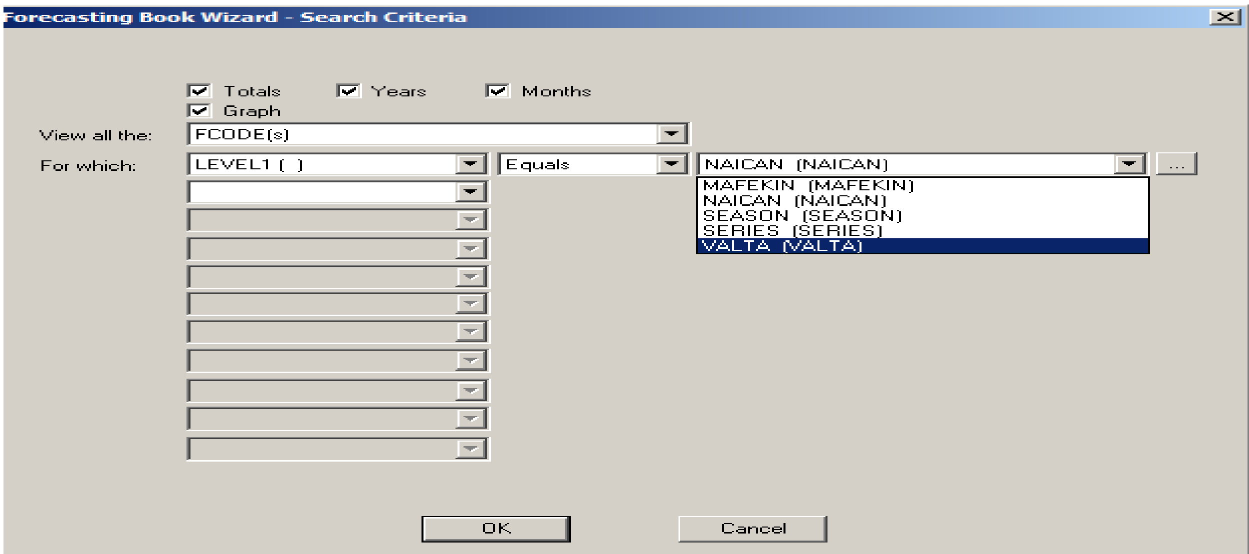
To reproduce the forecasts under the method EXPONT with inherent seasonality, the user replaces the Method by EXPONT; thereafter, selects seasonality as inherent and 6 as first observation. Press **apply** and the variances to the actual values for the last 12 months are exhibited in the view.



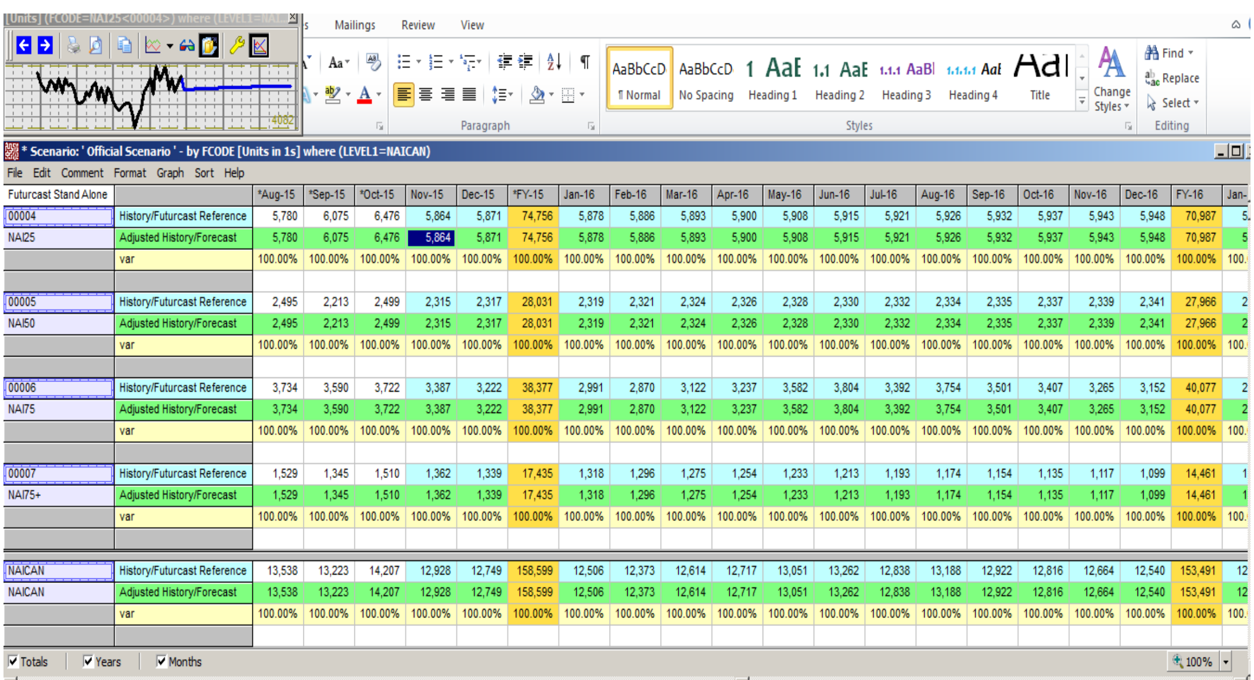
11 Creating a Top-Down Forecast

In **FUTURCAST Stand Alone** you may, from the summed-up forecast at one of the 2 levels, force that summed-up forecast to meet a yearly objective and pro-rate down each month forced value to each code/product included in the selected level.

Select under file New Query and choose the level in the Forecasting Book Wizard – Search Criteria window

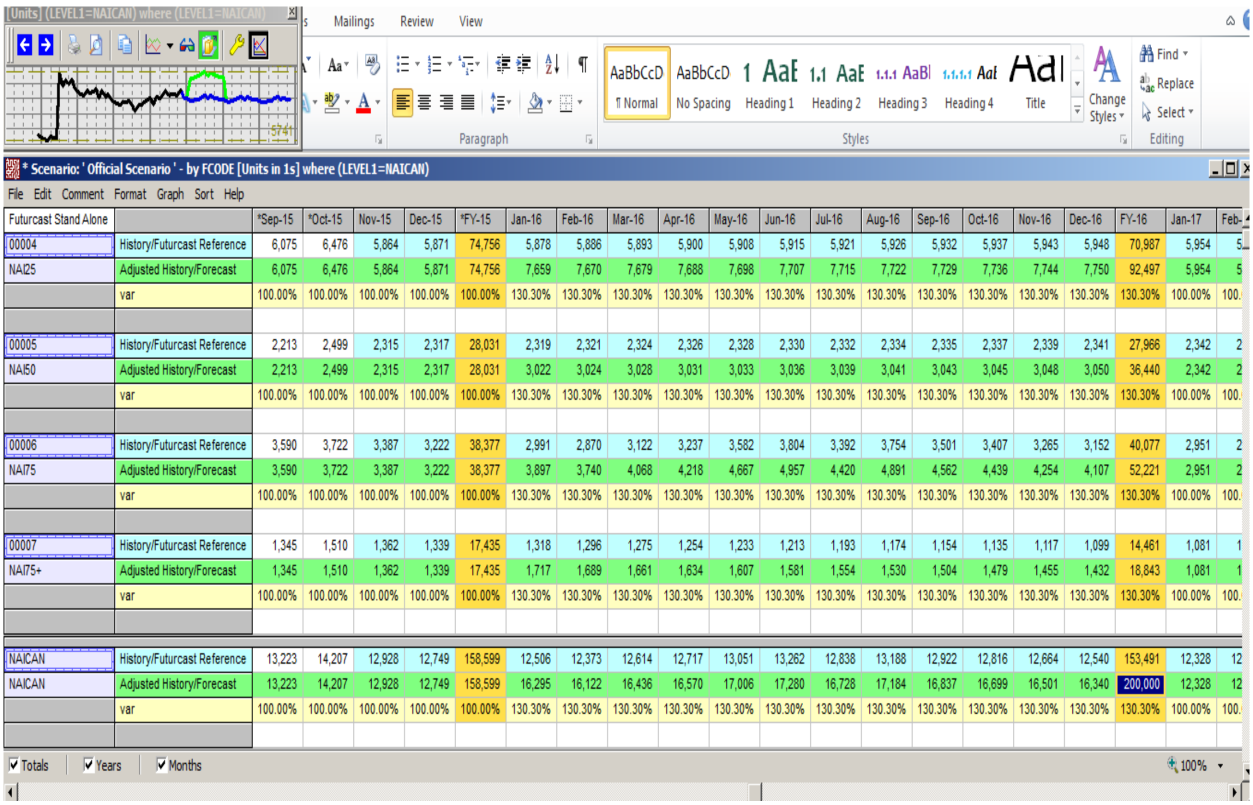


Select Totals before pressing on OK to generate the summed-up values at the bottom of the view


* Scenario: ' Official Scenario ' - by FCODE [Units in 1s] where (LEVEL1=NAICAN)

Futurcast Stand Alone		*Aug-15	*Sep-15	*Oct-15	Nov-15	Dec-15	*FY-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	FY-16
00004	History/Futurcast Reference	5,780	6,075	6,476	5,864	5,871	74,756	5,878	5,886	5,893	5,900	5,908	5,915	5,921	5,926	5,932	5,937	5,943	5,948	70,987
NAI25	Adjusted History/Forecast	5,780	6,075	6,476	5,864	5,871	74,756	5,878	5,886	5,893	5,900	5,908	5,915	5,921	5,926	5,932	5,937	5,943	5,948	70,987
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00005	History/Futurcast Reference	2,495	2,213	2,499	2,315	2,317	28,031	2,319	2,321	2,324	2,326	2,328	2,330	2,332	2,334	2,335	2,337	2,339	2,341	27,966
NAI50	Adjusted History/Forecast	2,495	2,213	2,499	2,315	2,317	28,031	2,319	2,321	2,324	2,326	2,328	2,330	2,332	2,334	2,335	2,337	2,339	2,341	27,966
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00006	History/Futurcast Reference	3,734	3,590	3,722	3,387	3,222	38,377	2,991	2,870	3,122	3,237	3,582	3,804	3,392	3,754	3,501	3,407	3,265	3,152	40,077
NAI75	Adjusted History/Forecast	3,734	3,590	3,722	3,387	3,222	38,377	2,991	2,870	3,122	3,237	3,582	3,804	3,392	3,754	3,501	3,407	3,265	3,152	40,077
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
00007	History/Futurcast Reference	1,529	1,345	1,510	1,362	1,339	17,435	1,318	1,296	1,275	1,254	1,233	1,213	1,193	1,174	1,154	1,135	1,117	1,099	14,461
NAI75+	Adjusted History/Forecast	1,529	1,345	1,510	1,362	1,339	17,435	1,318	1,296	1,275	1,254	1,233	1,213	1,193	1,174	1,154	1,135	1,117	1,099	14,461
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
NAICAN	History/Futurcast Reference	13,538	13,223	14,207	12,928	12,749	158,599	12,506	12,373	12,614	12,717	13,051	13,262	12,838	13,188	12,922	12,816	12,664	12,540	153,491
NAICAN	Adjusted History/Forecast	13,538	13,223	14,207	12,928	12,749	158,599	12,506	12,373	12,614	12,717	13,051	13,262	12,838	13,188	12,922	12,816	12,664	12,540	153,491
	var	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To force the forecast year 2016 of NAICAM to 200000 for example, move to the NAICOM 2016 year cell and enter 200000. All the monthly forecast for the year 2016 of all codes/products belonging to NAICAM will automatically be modified to meet this objective as is illustrated below.



* Scenario: ' Official Scenario ' - by FCODE [Units in 1s] where (LEVEL1=NAICAN)

Futurcast Stand Alone		*Sep-15	*Oct-15	Nov-15	Dec-15	*FY-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	FY-16	Jan-17	Feb-
00004	History/Futurcast Reference	6,075	6,476	5,864	5,871	74,756	5,878	5,886	5,893	5,900	5,908	5,915	5,921	5,926	5,932	5,937	5,943	5,948	70,987	5,954	5
NAI25	Adjusted History/Forecast	6,075	6,476	5,864	5,871	74,756	7,659	7,670	7,679	7,688	7,698	7,707	7,715	7,722	7,729	7,736	7,744	7,750	92,497	5,954	5
	var	100.00%	100.00%	100.00%	100.00%	100.00%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	100.00%	100.
00005	History/Futurcast Reference	2,213	2,499	2,315	2,317	28,031	2,319	2,321	2,324	2,326	2,328	2,330	2,332	2,334	2,335	2,337	2,339	2,341	27,966	2,342	2
NAI50	Adjusted History/Forecast	2,213	2,499	2,315	2,317	28,031	3,022	3,024	3,028	3,031	3,033	3,036	3,039	3,041	3,043	3,045	3,048	3,050	36,440	2,342	2
	var	100.00%	100.00%	100.00%	100.00%	100.00%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	100.00%	100.
00006	History/Futurcast Reference	3,590	3,722	3,387	3,222	38,377	2,991	2,870	3,122	3,237	3,582	3,804	3,392	3,754	3,501	3,407	3,265	3,152	40,077	2,951	2
NAI75	Adjusted History/Forecast	3,590	3,722	3,387	3,222	38,377	3,897	3,740	4,068	4,218	4,667	4,957	4,420	4,891	4,562	4,439	4,254	4,107	52,221	2,951	2
	var	100.00%	100.00%	100.00%	100.00%	100.00%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	100.00%	100.
00007	History/Futurcast Reference	1,345	1,510	1,362	1,339	17,435	1,318	1,296	1,275	1,254	1,233	1,213	1,193	1,174	1,154	1,135	1,117	1,099	14,461	1,081	1
NAI75+	Adjusted History/Forecast	1,345	1,510	1,362	1,339	17,435	1,717	1,689	1,661	1,634	1,607	1,581	1,554	1,530	1,504	1,479	1,455	1,432	18,843	1,081	1
	var	100.00%	100.00%	100.00%	100.00%	100.00%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	100.00%	100.
NAICAN	History/Futurcast Reference	13,223	14,207	12,928	12,749	158,599	12,506	12,373	12,614	12,717	13,051	13,262	12,838	13,188	12,922	12,816	12,664	12,540	153,491	12,328	12
NAICAN	Adjusted History/Forecast	13,223	14,207	12,928	12,749	158,599	16,295	16,122	16,436	16,570	17,006	17,280	16,728	17,184	16,837	16,699	16,501	16,340	200,000	12,328	12
	var	100.00%	100.00%	100.00%	100.00%	100.00%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	130.30%	100.00%	100.

12 Summary of Functionalities and Capabilities of FUTURCAST Stand Alone in Comparison with the FUTURCAST System Platforms

	Stand Alone	FUTURCAST Sales & Operations	Assumption-based	Total Market
Users				
Single	X			
Multiple remote		X	X	X
Multiple live			X	X
Database				
Excel file (2 levels)	X			
MS SQL relational (50 levels)		X		
Oracle relational (50 Levels)		X	X	X
Database Functionalities				
Adding, deleting codes	X	X	X	X
Restaging/merging codes		X	X	X
Discontinuing codes		X	X	X
Creating ABC classification		X	X	X
Managing monthly prices/discounts		X	X	X
Managing users		X	X	X
Creating/editing seasonal profiles		X	X	X
Data & Forecast Environment				
Multiple input data sources		X	X	X
Custom export to Excel	X	X	X	X
Automatic data import & export		X	X	X
ERP integration		X	X	X
Maximum forecast products/codes	30	NA	NA	NA
Maximum forecast months	24	42	72	120
Forecasting Capabilities				
Multiple methods	X	X	X	X
Expert System Method Selection	X	X	X	X
Identifying & removing outliers	X	X	X	X
Identify & apply inherent seasonality	X	X	X	X
Apply seasonal profile		X	X	X
Custom data views		X	X	X
Top/down forecasting	X	X	X	X
Top/down forecasting (excluding products)		X	X	X
Multiple graphic options	X	X	X	X
Force yearly objectives to months	X	X	X	X
Force currency objective to units		X	X	X
Kit/pallet management*		X	X	X
Weekly forecasting*		X		
Force monthly objectives to weeks*		X		
Force Rx objectives to units				X

	Stand Alone	FUTURCAST Sales & Operations	Assumption-based	Total Market
Forecast Modifications Capabilities				
Multiple event lines & drivers		X	X	X
Document independent events			X	X
Distinguish market from product drivers				X
Insert comments to product series	X	X	X	X
Store/access multiple forecast scenarios		X	X	X
Store/access multiple market scenarios				X
Business Analysis Capabilities				
Best fit Bass diffusion model for new product forecasting	X	X	X	X
Key Performance Indicators (KPI)				
Variance analysis (at a code/level)	X	X	X	X
Weighted Accuracy (point vs cumulative)		X	X	X
Bias Analysis		X	X	X
Forecast change analysis (rolling report)		X	X	X
Business Intelligence Reporting				
Micro/macro comparison to budget		X	X	X
Identifying best/worst performers		X	X	X
Price/volume analysis		X	X	X
Forecast consumption analysis		X	X	X
Supply Chain Capabilities				
Safety Stock calculation		X	X	X
Auto Conversion of Sales forecast to		X	X	X
Batch replenishment values*				
Supply/demand balancing views		X	X	X
Integrated S&OP*		X	X	X
*** Optional Capabilities**				