VANDERBILT Ave.
ASSET MANAGEMENT

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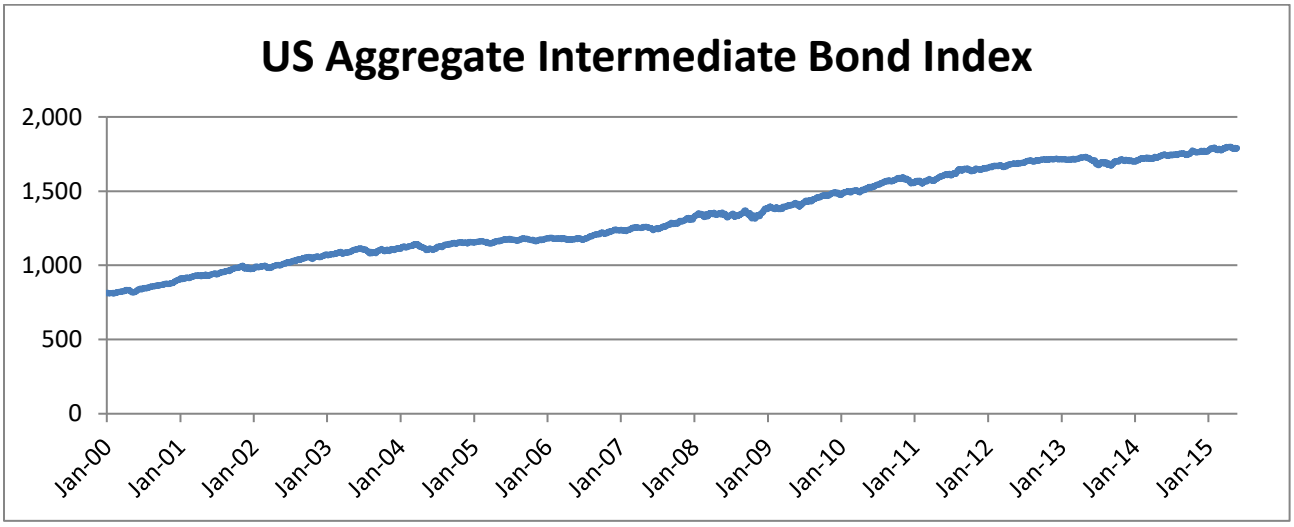
History Doesn't Repeat Itself, but Sometimes it Rhymes:

A Primer on Time Series Analysis

Time series techniques describe a collection of methods used for analyzing data. Time series data is a sequence of data points describing the behavior of a variable over a period of time. These could be as disparate as the yearly counts of sunspots from 2000-2015 or the monthly values for the Barclay's US Aggregate Intermediate Bond Index over the same period. Fundamentally, a time series will be present, wherever a variable is described over time (see Figure 1).

Figure 1 Example of Time Series



Source: Bloomberg

Given the temporal aspect of many economic and financial data, time series analysis arises quite frequently in these fields. The main purpose of these methods is to extract useful statistics or information from the data and potentially employ it to develop a forecast. Overall, there are a number of different methods used in time series analysis.

Simple plotting methods are often employed to ascertain the prevalence of a relationship between two distinct time series. Autoregressive methods are also used to check if the past behavior of some variable provides useful information on its future behavior. Trend fitting and momentum following methods can be used to determine whether a turning point is likely in the future. Still other methods are implemented for the purpose of decomposing a series into component parts. For example, time series analysis may be used to try to decompose the series into a seasonal component, a trend component, and a noise component.

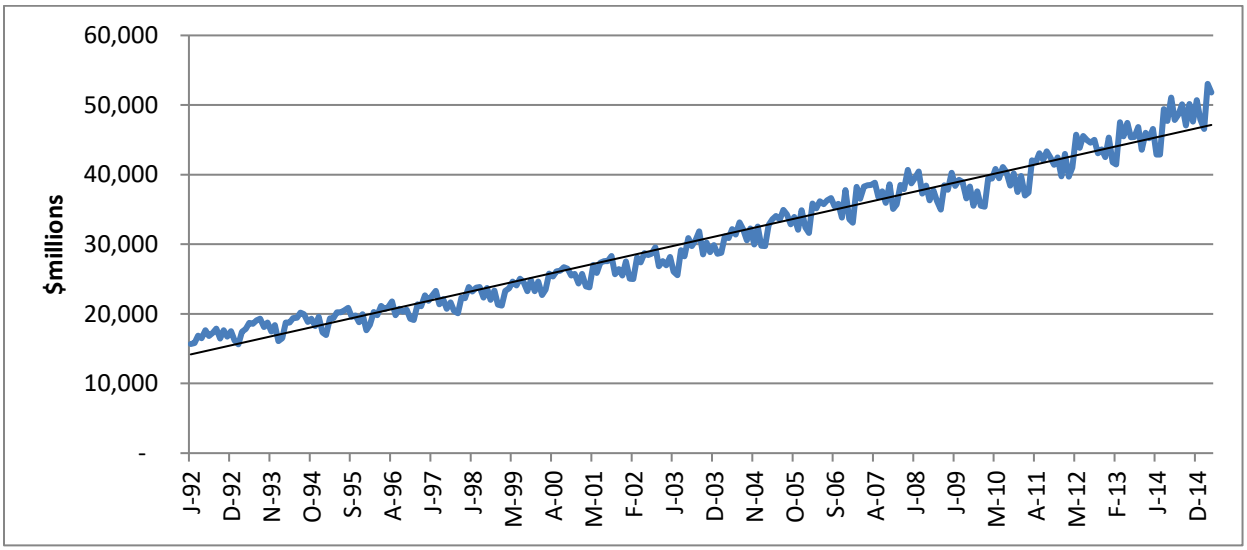
Difference from structural regression methods

The distinguishing feature between time series analysis and structural regression models is that, in its simplest form, time series analysis doesn't attempt to explain the relationship between variables but rather looks for statistically distinguishable patterns that repeat themselves. That is, there is no attempt at determining cause and effect relationships, but rather anticipating movements extrapolated from the statistical characteristics of the data. This can be useful as it allows for an unconstrained forecast. In other words, very little information is needed to produce estimates of future values. Often only the historical data of the forecasted value is needed.

Example of time series analysis

Take for example a series of monthly retail sales from 1992-2015 (Figure 2). One can immediately observe patterns in the data. First, there is a clear upward trend in the series, as evidenced by the black trend line. Next, sales seem to go up in certain months and consistently decline in others. These patterns are termed seasonal, as they coincide with similar periods every year.

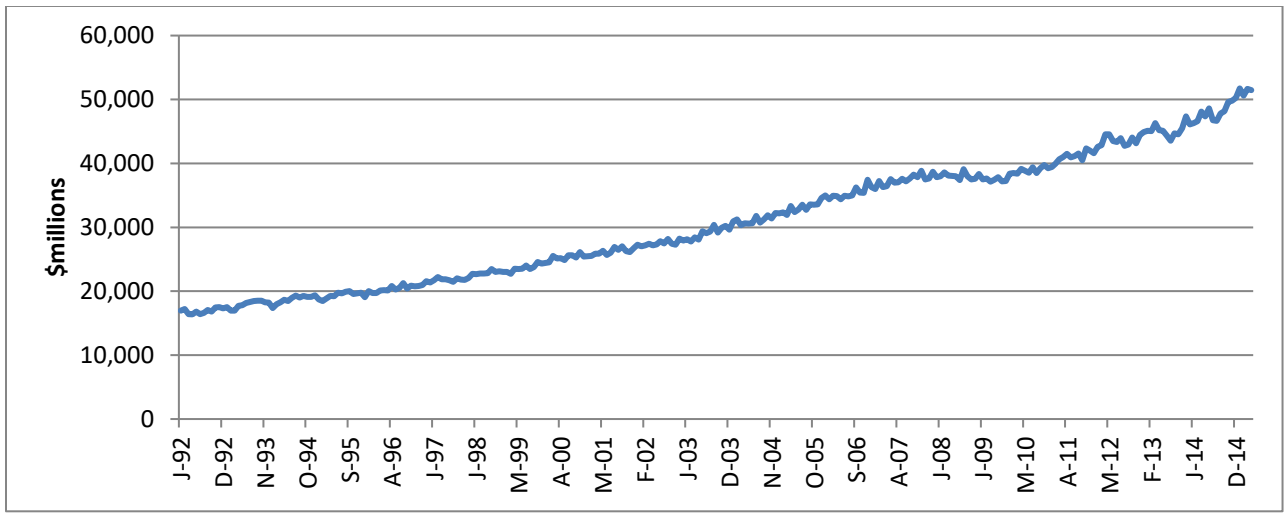
Figure 2 Monthly Retail Sales US



Source: Federal Reserve Economic Data

By applying time series analysis, we can remove the seasonal component that is present in the series in figure 2 in order to discern the underlying trend. Figure 3 on the following page demonstrates the results of this process. As shown in the graph, the series no longer exhibits periodic swings but rather exhibits a constant trend. Now we can utilize this seasonally adjusted series to produce a forecast.

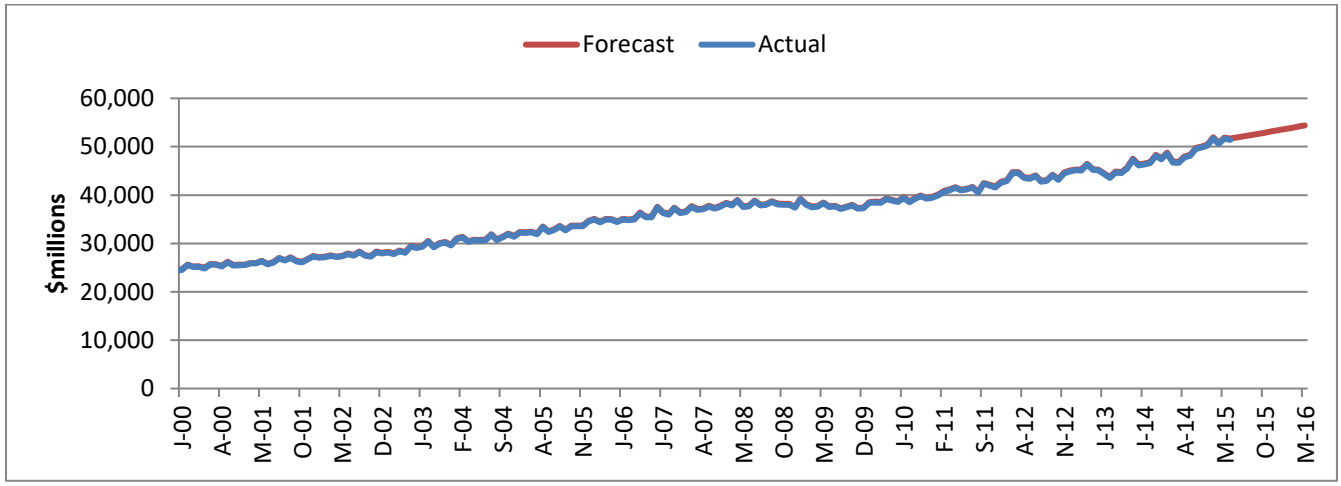
Figure 3 Monthly Retail Sales Seasonally Adjustment



Source: Vanderbilt Avenue Asset Management, LLC, Federal Reserve Economic Data

In Figure 4, we forecast retail sales data based on the autoregressive features of the seasonally adjusted series. As shown in the graph, consistent with our economic outlook for 2015, we expect retail sales to grow modestly over the course of the coming months supported by an improving labor market. Once the forecast is produced, all that is needed is to "reseasonalize" the underlying trend.

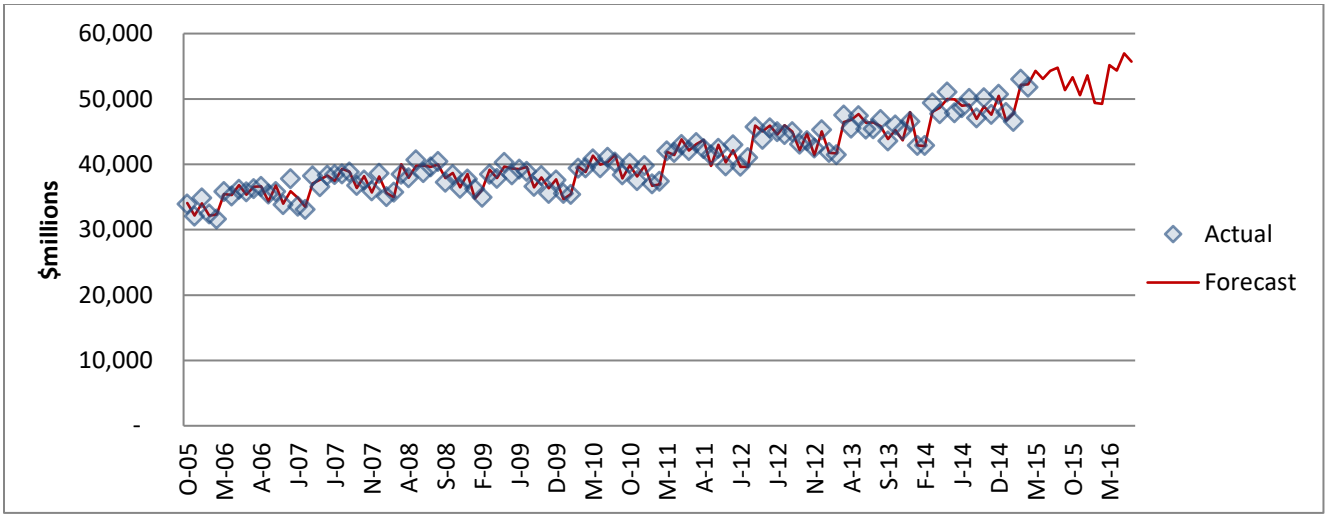
Figure 4 Seasonally Adjusted Forecast vs. Actual



Source: Vanderbilt Avenue Asset Management, LLC, Federal Reserve Economic Data

By applying seasonal factors derived from the original data, we can "reseasonalize" the forecast. Figure 5 below demonstrates the end result. As demonstrated by the proximity between our forecasts and the actual observations, this series lends itself well to this type of forecasting procedure. We extend the forecast further than the sample in order to demonstrate that the procedure could theoretically produce estimates into the future (see Figure 4 and 5).

Figure 5 Forecast of Monthly Retail Sales vs. Actual



Source: Vanderbilt Avenue Asset Management, LLC, Federal Reserve Economic Data

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