Question

I want a monthly forecast from Moody's Analytics. Can I do this? Are there caveats?

Background

The Moody's Analytics forecasts are quarterly updated monthly – that is, the forecast time series have a quarterly native frequency, and we run the forecast model each month, updating their results with the latest historical data. Our model is designed to predict national accounts, which are quarterly.

We do not generate monthly forecasts. If you see a forecast series with a monthly frequency, it is synthetic – that is, it was converted from its native quarterly frequency using the frequency conversion tools on Data Buffet. These tools use linear or cubic interpolation.

Inevitable side effects

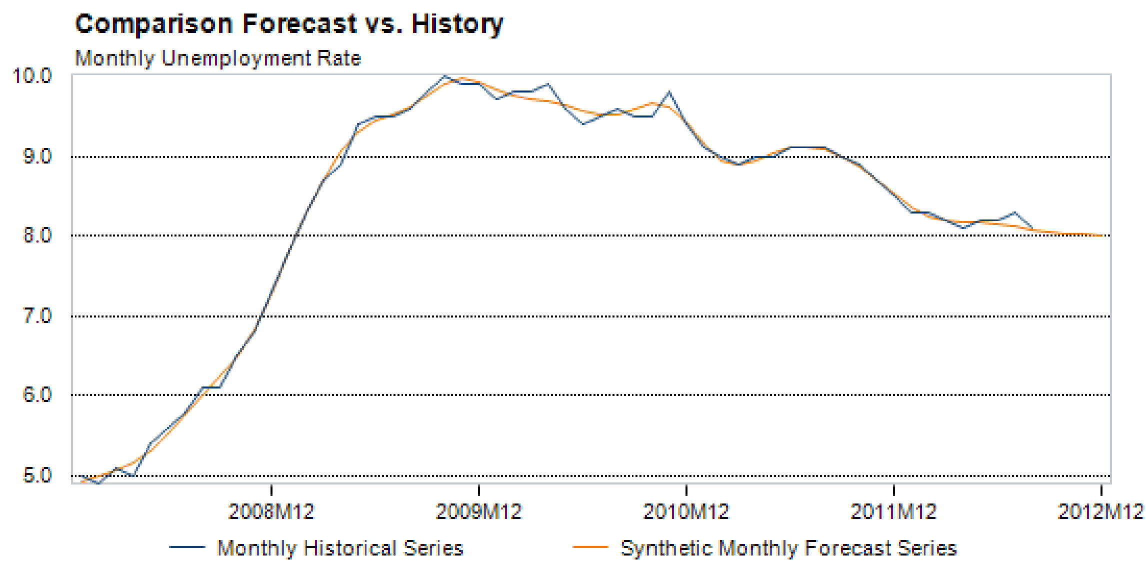
If you choose to convert a forecast series to a monthly frequency, **we urge caution,** because interpolation has two **major side effects:**

1. The synthetic forecast data will not match a non-quarterly historical driver.

For example, the U.S. Bureau of Labor Statistics publishes a monthly household unemployment rate, which we store as Data Buffet historical time series `LBR.US`, and copy into our quarterly forecast series `FLBR.US`. If you convert `FLBR.US` to a monthly frequency, you will not recover `LBR.US`.

Why not? When we populate the historical portion of `FLBR.US`, we average three monthly values to produce each quarterly value. Some detail has been lost, and you cannot "unscramble the egg." In graphical terms, a jagged high-frequency curve has changed to a smooth low-frequency curve, and back-conversion merely picks intermediate points from the smooth curve.

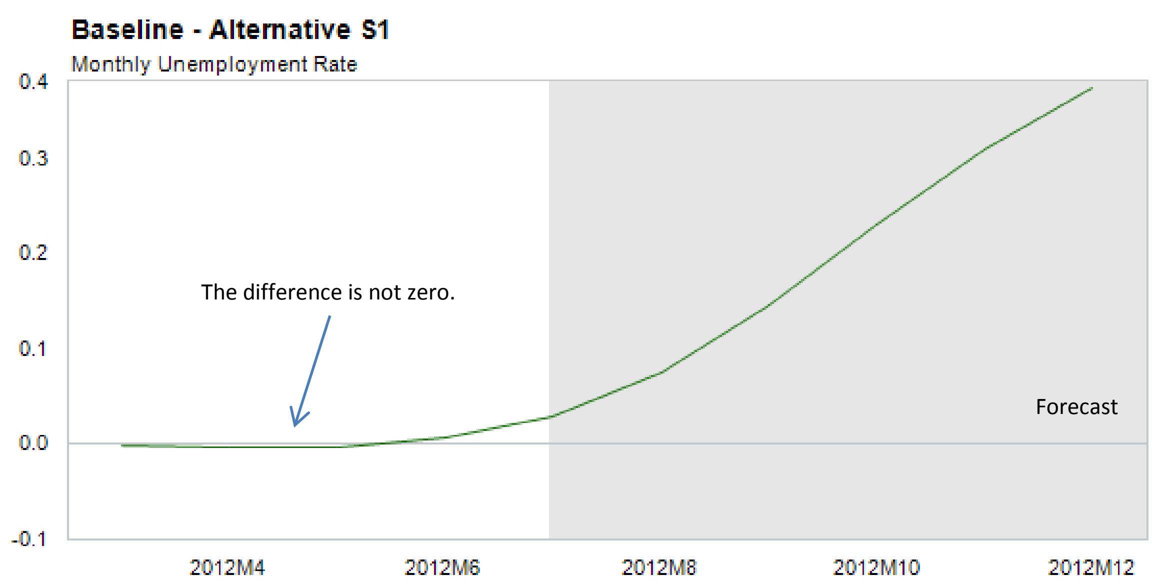
Figure 1: Comparison of forecast and historical time series



2. If you compare forecast scenarios, and convert them all to a monthly frequency, their historical portions will not match.

For example, `FLBR_B.US` is the baseline forecast of the household unemployment rate, and `FLBR_S1.US` is an alternative scenario. For the native series, the historical portions are identical. When converted, their respective historical portions (a) do not match `LBR.US`, and (b) do not match each other. The difference is small, but nonzero.

Figure 2: Comparison of baseline and alternative scenario after conversion



The mathematics of frequency conversion

The two side effects are consequences of the mathematical technique used by the Data Buffet frequency conversion tool, available in the view, basket, chart and map modules. The tool uses a standardized mathematical interpolation, that is, the math operates on any time series in isolation, with no special knowledge of its economic properties.

When converting from a low-frequency (quarterly) time series to a high-frequency (monthly) series, the goals are twofold: a curve that is (a) smooth, and (b) can be converted back to the original quarterly frequency.

Linear interpolation is used when the series has fewer than four observations, or the operator explicitly chooses it. Mathematically, linear interpolation uses a *linear spline*, a *piecewise curve* consisting of straight line segments (equation $y=ax+b$) that join at end points, called the *knots* of the spline. A linear spline resembles a jagged mountain range.

Otherwise, **cubic interpolation** is used. A *cubic spline* is similar to a linear spline in that it consists of segments joined at knots. However, each segment is a *cubic curve* ($y=ax^3+bx^2+cx+d$), and two adjoining segments must additionally have the same *slope* and *curvature* (in terms of differential calculus, the first two derivatives). In practice, a cubic spline is so smooth that you cannot see the knots; it resembles rolling hills.

In application, the constraints (the **observed attribute** of the input series, that the splines match the values of the input series, and that the splines are seamless at each knot) constitute a solvable system of equations and unknowns. Solving the system provides the equation coefficients a, b, c and d.

The act of creating a smooth continuous time series means that any given period is a function of previous and past periods. As seen in figure 2, converted alternative scenarios will have different values in the historical portion. The divergence grows larger near the historical/forecast boundary. By analogy, when a rope is shaken at one end, the movement propagates along its entire length.