US Historical Inflation Rate
12/07/2025

The inflation rate generally refers to percent change of the consumer price index (CPI) which is a measure of the average change over time in the prices of a representative basket of consumer goods and services. CPI is also used to adjust income eligibility for government assistance, federal tax brackets, federally mandated cost-of-living increases, private sector wage and salary increases, poverty measures, and consumer and commercial rent changes.

This article uses percent change of the sticky price CPI which is calculated from a subset of goods and services included in the original CPI whose prices change relatively infrequently. These prices imply expectations about future inflation to a greater degree than prices that change more frequently. Sticky price CPI percent change is published by the federal reserve Atlanta through the federal reserve economic data (FRED) database available at https://fred.stlouisfed.org/.

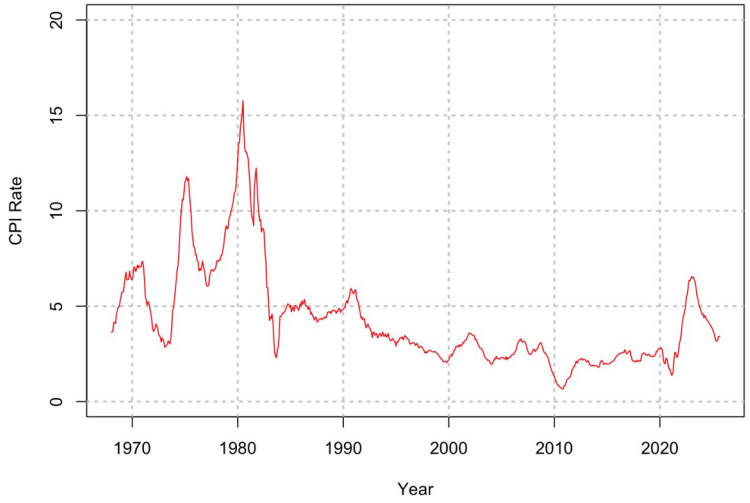

Figure 1, Percent Change of Sticky Price Consumer Price Index (CPI) from 1968 to 2025.

The downloaded percent change of CPI was first transformed into the base CPI using the monthly percent changes that are otherwise quite volatile from nearly two percent in 2010 to 16 percent in 1980 (see Figure 1). Assuming the CPI in 1968 as 100, the data transformation follows the formula:

$$CPI_{this\,month} = CPI_{last\,month} \times \left(1 + \frac{CPI\ Rate_{last\,month}}{100}\right)^{1/12}$$

Figure 2 shows CPI and a linear fit. To convert the CPI back to percent change as provided by the federal reserve, the following formula can be quite helpful:

$$CPI\ Rate_{this\,month} = 100 \times \left[\left(\frac{CPI_{this\,month}}{CPI_{last\,month}}\right)^{12} - 1\right]$$

The linear fit captures the overall trend but shows a rapid increase in CPI after 2023. The seasonality of the CPI is modeled using the Fourier transformation. Figure 3 shows the spectrogram of the residual term from the trend model.

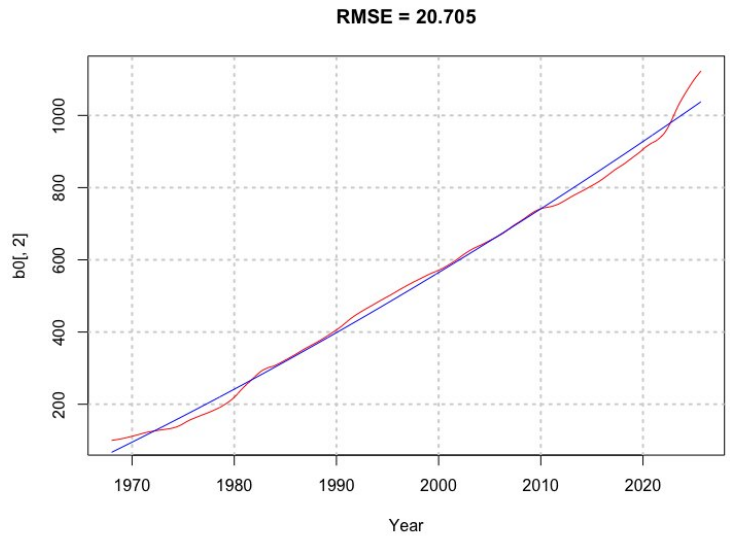

Figure 2, CPI using Monthly CPI Percent Change (red) and the General Trend Line (blue) of a Linear Model.

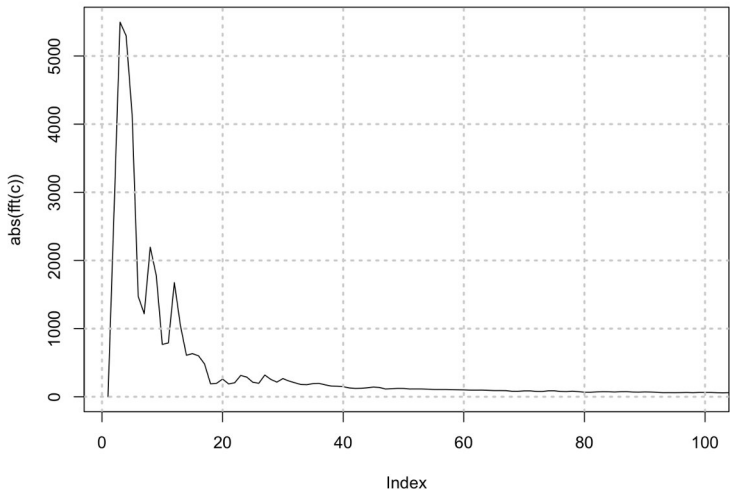

Figure 3, Fourier Transformation of the Residual Term from the Trend Model.

Several important frequency components are located at frequency indexes of 3, 4, 8, and 12 corresponding to seasonalities of 693/12/3 = 19 years, 693/12/4 = 14 years, 693/12/8 = 7 years, and 693/12/12 = 5 years. The Fourier transformation therefore includes all the frequency components whose index are below 14. Figure 4 shows the modeling result. The RMSE decreases from 20.705 to 3.710, a considerable improvement. The above seasonality cycles perhaps reflect the major CPI changes as shown in Figure 1.

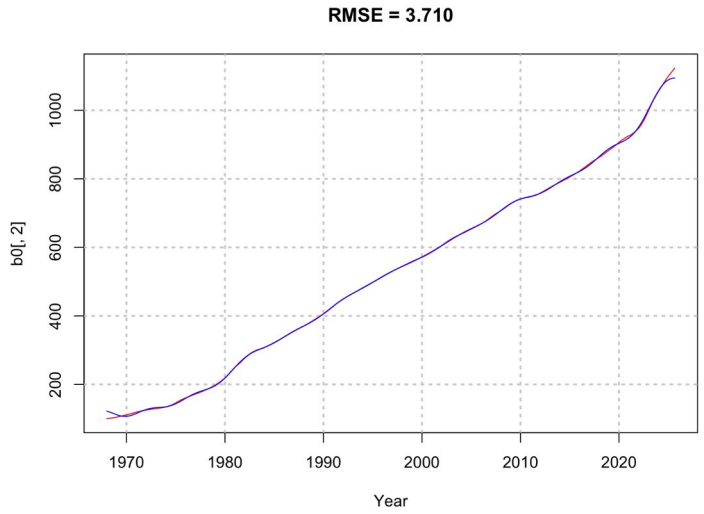

Figure 4. CPI (red line) and Model of both the Trend and Seasonality (blue line).

The partial autocorrelation function (PACF) of the residual term from the seasonality model is shown in Figure 5. It suggests that the monthly CPI is only correlated to the last month's CPI, not any other earlier CPIs. This CPI term is then incorporated into the autoregression model of the residual term.

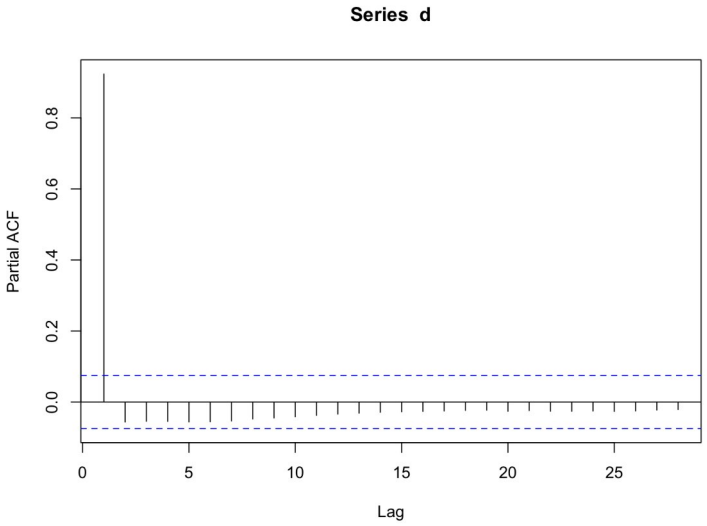

Figure 5, Partial Autocorrelation Function of the Residual Term (d) from the Seasonality Model.

The combined model is shown in Figure 6. The RMSE of the combined model further reduces from 3.71 to 0.434, a nearly ten fold improvement. A closeup view of the model is also shown in Figure 7 for the CPI percent change (converted back from the CPI) for the recent years that follows a slow, downward trajectory after the rapid climbing in 2023.

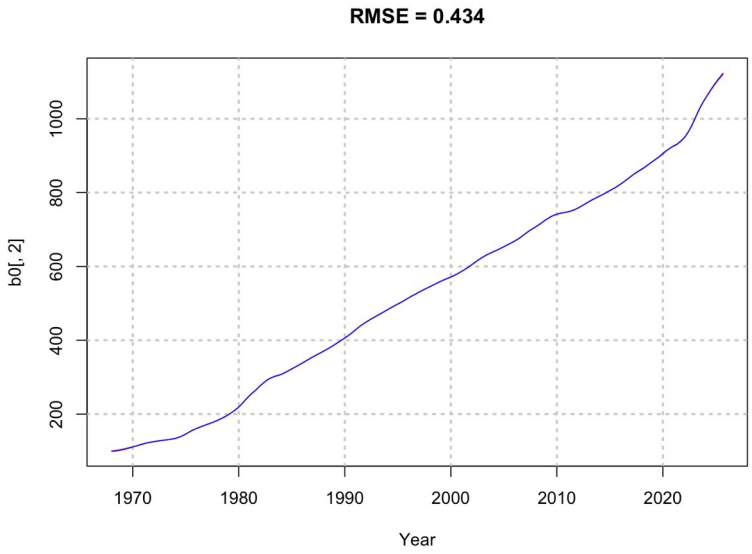

Figure 6, Combined Model with Trend, Seasonality, and Autoregression Components.

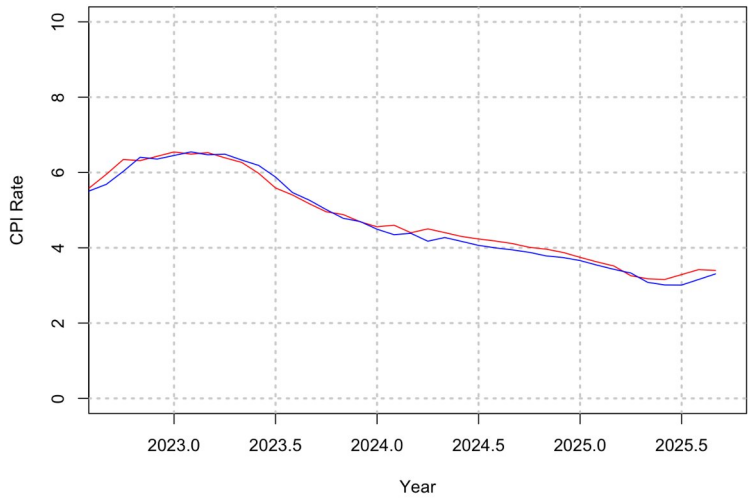

Figure 7, A Closeup View after Conversion of the CPI in Figure 6 back to Percent Change of CPI (red line) and Model Prediction (blue line)

Concluding Remarks

The CPI is a much better measure for modeling than the percent change of CPI (Figure 1) as published by the Federal Reserve. However, the large number of frequency components (total 14) used as the parameters reflects on the irregularities in the percent changes of CPI. On average, a "normal CPI increase" is approximately 15 points per year. Therefore, the average prices for consumer goods and services become nine times as expensive as those in 1968. The recent CPI increase (2023) was much rapid and more impactful than those experienced in 1980s (see Figure 6) which has not been broadly recognized only because the base CPI has become larger.