Forecasting 10-year US treasury bond yields from PCE inflation rate

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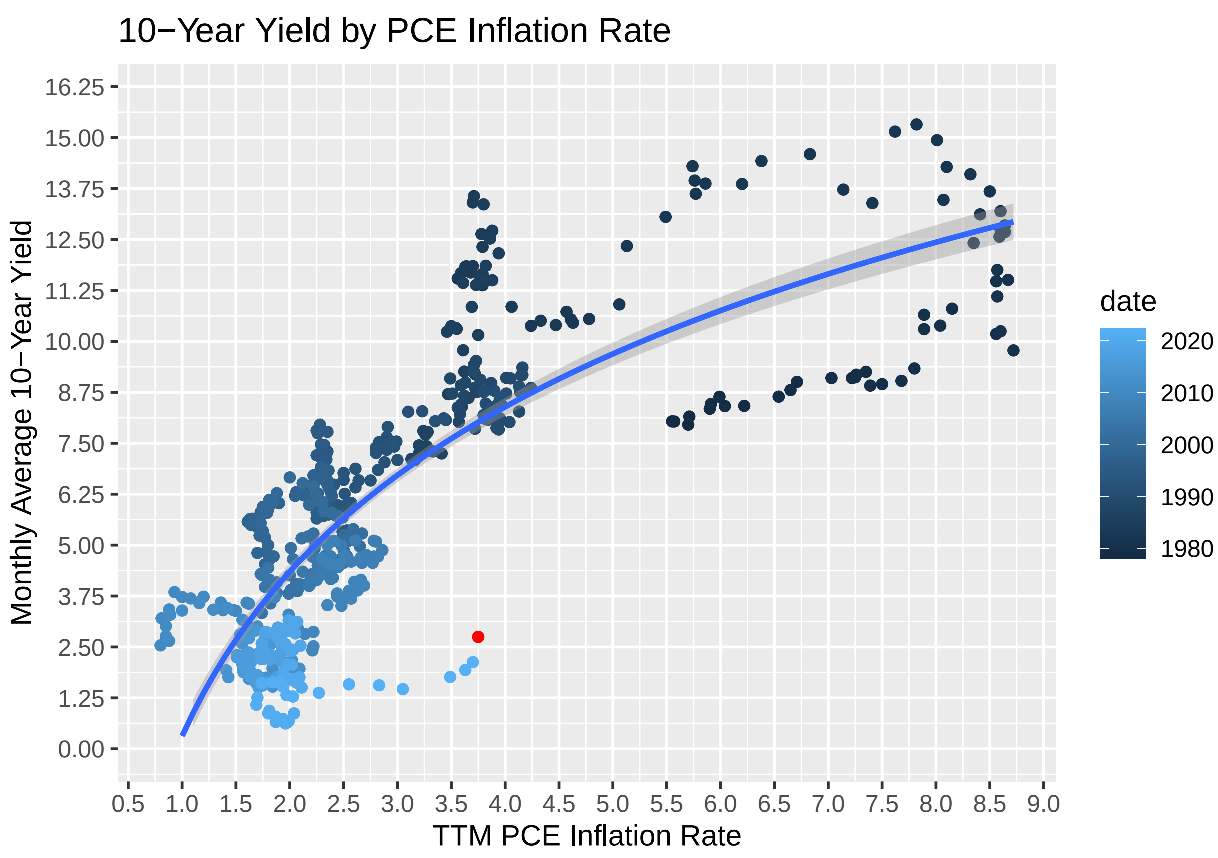
Introduction

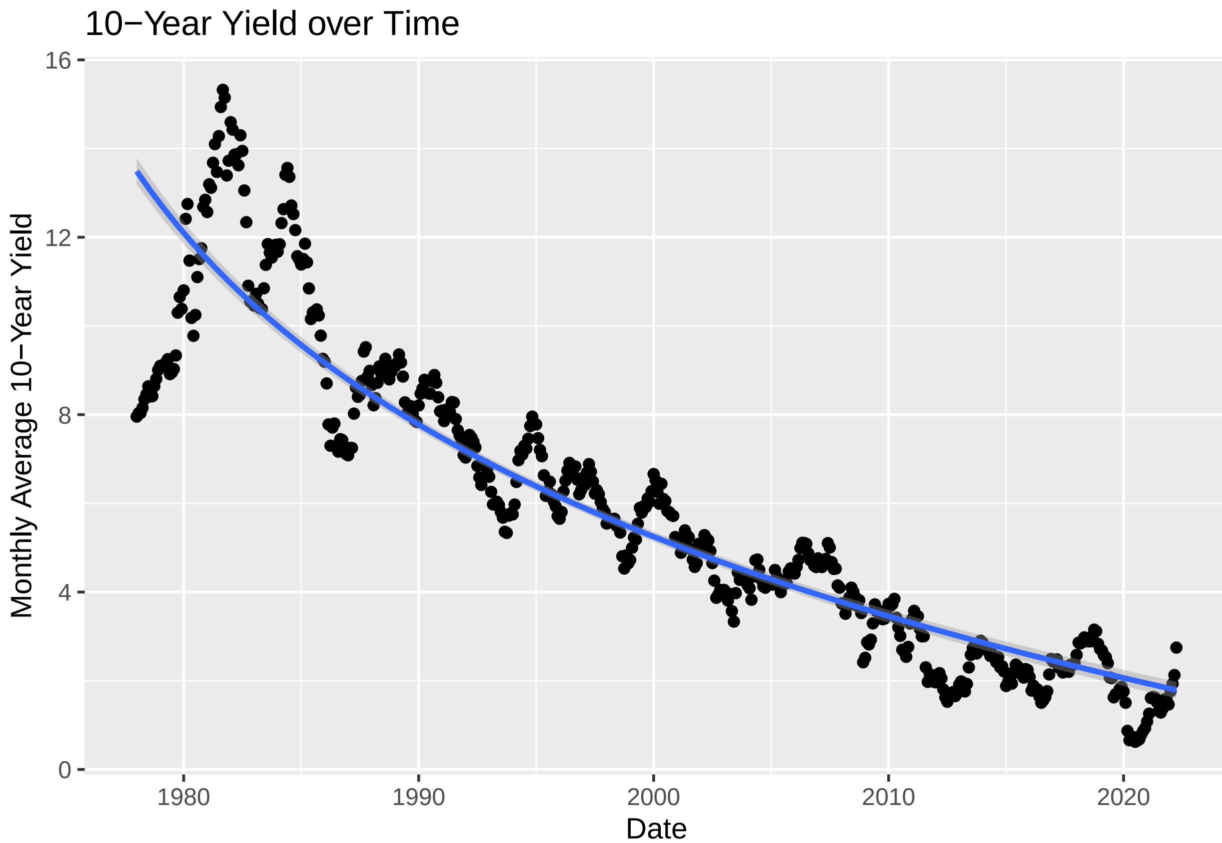
Versions of this chart have been making the rounds. I've shared it myself. Plot historical 10-year bond yields (Board of Governors, 2022a) against historical PCE inflation rates (Board of Governors, 2022b), run a simple log regression, and *voila!* today's 10-year yield should be 8.02%!

But this is not quite right.

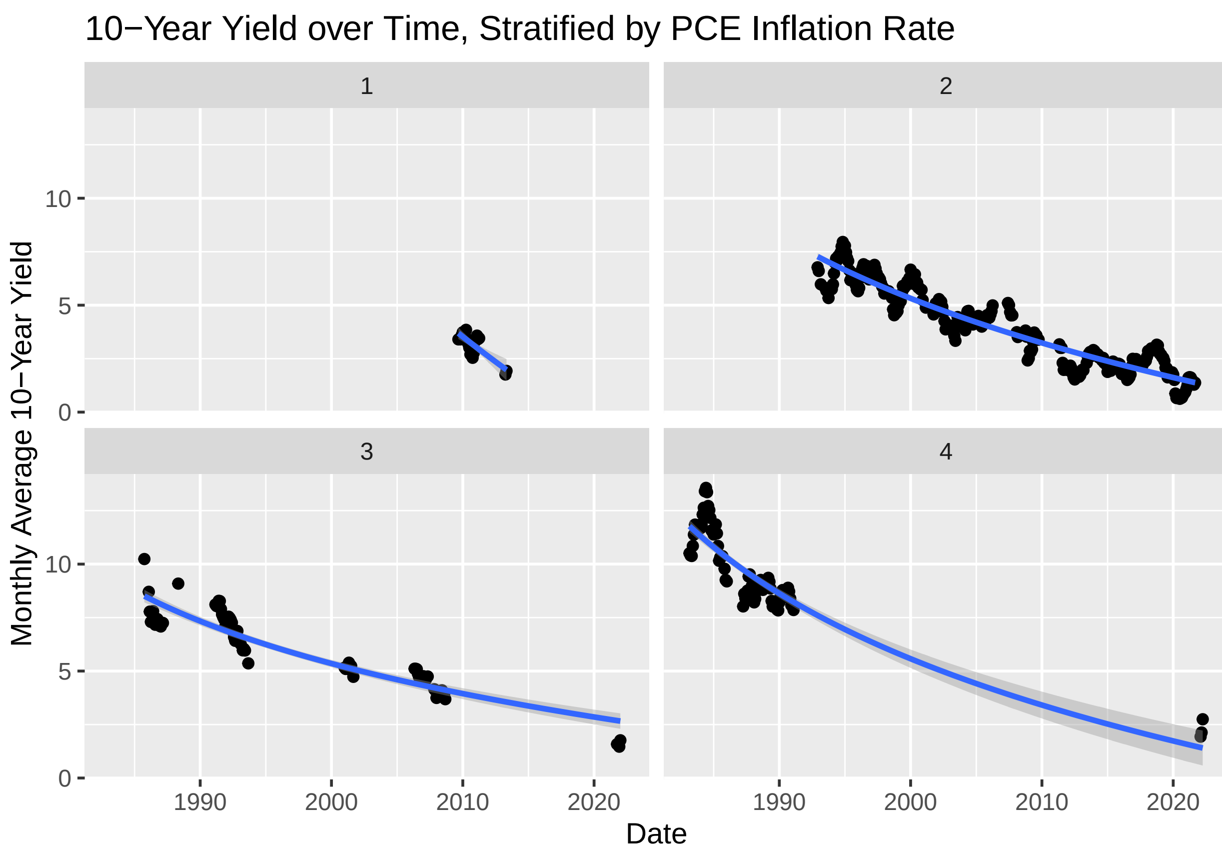


Controlling for time effects

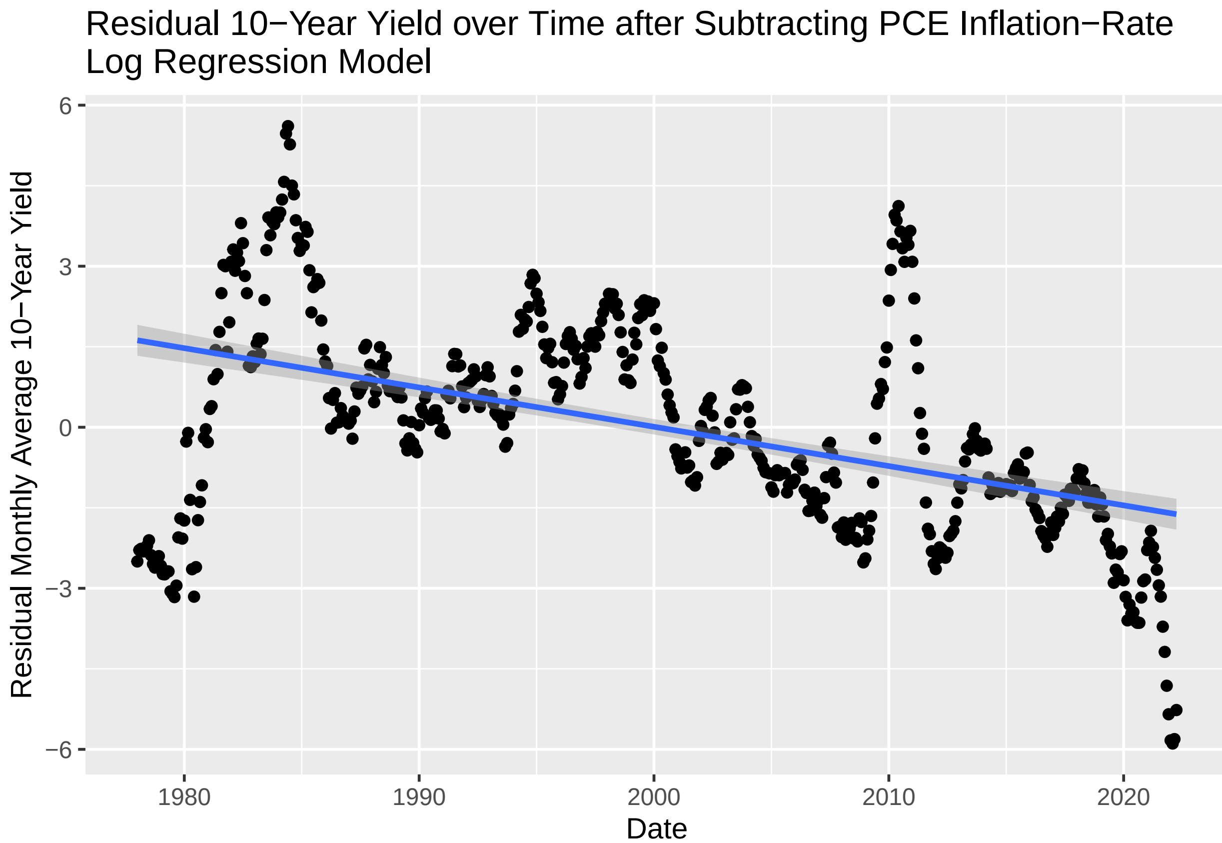
The problem with this plot is that it fails to control for the decrease of 10-year yields over time. Let's investigate whether the time effect on yields is separate from the inflation rate effect. (Spoiler: it is.)



One way to check whether the time effect is separate from the inflation rate effect is to stratify by inflation rate, and then plot yield vs. time for each stratum. Removing strata with fewer than 20 data points, we get four plots that all show a decline in yields over time.



Another way to check for an independent time effect is to subtract our PCE inflation-rate regression model's "predicted" yields from every y-value in our data set. Then we plot the leftover "residual" y-values against the date. Here, again, we find a decline in yields over time.

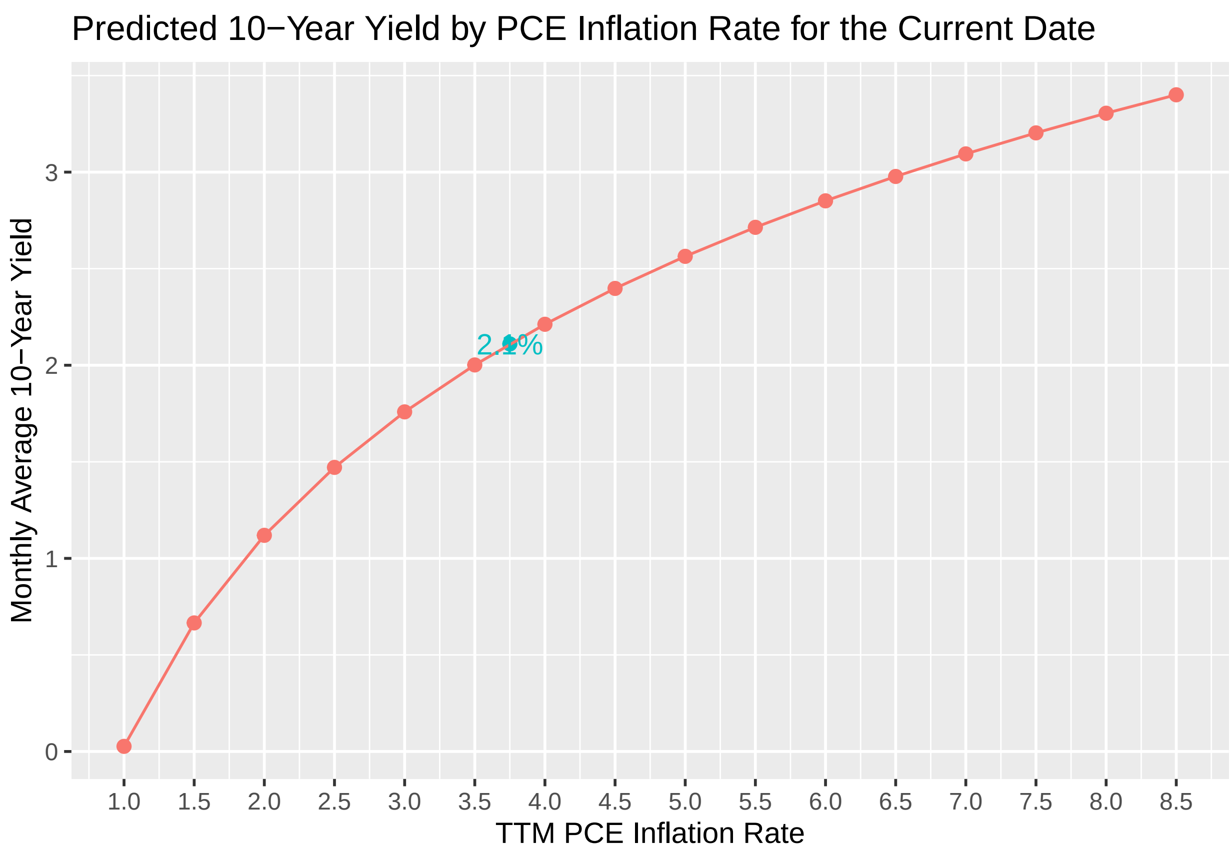


Running a multiple regression on our data will give us a combined model that incorporates both the PCE inflation rate effect and the time effect. But should we use log regression, linear regression, or some combination of the two? To find out, we use a machine learning method called 10-fold cross-validation. This involves partitioning the data ten times, with 90% of the data in a training set, and the other 10% in a testing set. Then we run regression models on the training data and use them to make predictions on the testing data, and we choose the model that, on average, minimizes the residual mean squared error of predictions across all ten trials.

Model	Mean_RMSE
Double linear	1.230843
Double log	1.908788
Linear date, log PCE	1.217967
Log date, linear PCE	2.045011

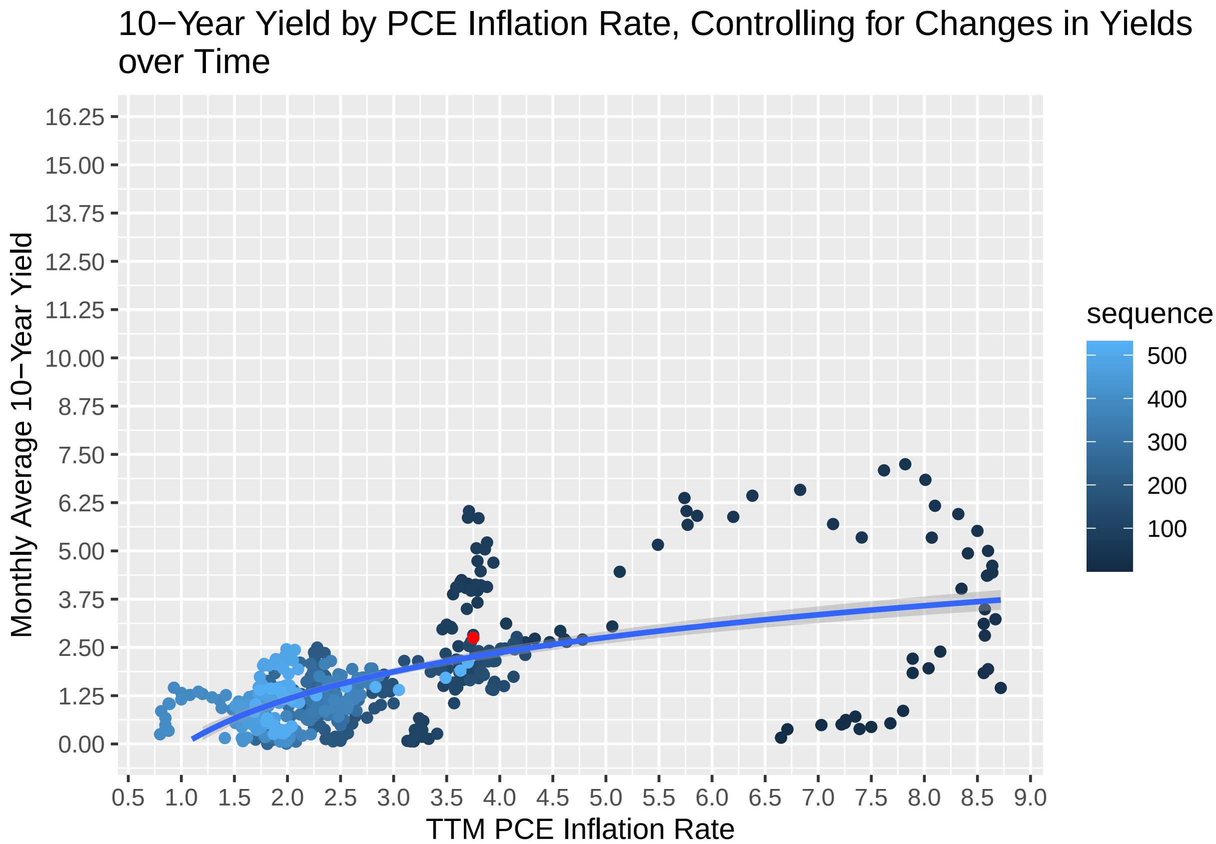
The winning model uses a linear regression on the date, and a log regression on the mean trimmed PCE inflation rate. We re-train this model on the whole data set.

With this model, we can predict 10-year yields by PCE inflation rate for the current date. At the current level of trimmed-mean PCE inflation, this gives us a predicted 10-year yield of 2.08%.



Conclusion

Subtracting all time effects prior to the current date, we can re-plot our original plot of 10-year bond yields against historical PCE inflation rates, this time controlling for changes in yields over time. As the chart shows, our model's predicted 10-year yield at about 2.1% is a little below today's roughly 3.1% yield, and far below the approximately 8% yield predicted by a log regression on the PCE inflation rate without controlling for the change in yields over time.



To be sure, the 10-year yield could go much higher. The dispersion of data on our chart is wide. However, this analysis suggests that the 10-year bond may be fairly priced or even slightly underpriced for the current level of inflation, making this a reasonable time to invest in 10-year bonds.

Bibliography

Board of Governors of the Federal Reserve System (US). 2022a. "Market Yield on u.s. Treasury Securities at 10-Year Constant Maturity, Quoted on an Investment Basis [Dgs10]." FRED. Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/DGS10.

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