



# How Good Are Inflation Forecasts ?



Tristan Gacon for PragmaOne.com, July the 06th 2022.

Forecasting future inflation rates is one of the primary missions of central banks, whose mandate is to fight against excessively high inflation and maintain expected inflation at low levels. Central bankers adjust their monetary policies according to the performance of inflation, as evidenced by the recent rate hikes made by the FED at the start of 2022, in response to an unexpected rise in the US CPI above 8 %.

Therefore, good predictions for the path of inflation are necessary to understand the subsequent decisions of central banks. For investors, the inflation and nominal rate levels are essential factors in their assets' valuation, so it is crucial to anticipate their movements to adapt their allocations.

Forecasting inflation beyond a few months is challenging, as unforeseen events, such as the Covid pandemic or the war in Ukraine, can cause significant upward or downward shocks. There are 3 types of inflation forecasting methods today:

- The survey methods,
- The statistical models, most of the time linear regressions using various explanatory variables,
- The analysis of inflation implied from the market prices of inflation linked bonds.

In this article, we analyze the quality of the US headline CPI forecasts from 1981 to 2021. **We compare estimates from well-known surveys, the Michigan Consumer Survey, The Philadelphia Survey of Professional Forecasters, and inflation implied from the TIPS's market.** A model of those observations will be the subject of an upcoming article.

## The Michigan Survey of Consumers

The Michigan Consumer Survey is performed monthly by the statistical bureau of the University of Michigan. It shows how American consumers feel about the economy, personal finances, business, and buying conditions. The most followed statistic is the Michigan Sentiment Index, a consumer confidence index used to anticipate sales and consumption, and thus growth in general. But the survey also publishes forecasts for the year ahead inflation and long-term inflation expectations. The FED is attentive to these publications as they demonstrate if inflation expectations remain well-anchored.

More than 500 representative American households are asked the question, "By about what percent do you expect prices to go (up/down) on the average, during the next 12 months?". If the answer is above 5%, the answer is rechecked. The data is collected monthly during the first two weeks of the month and released two weeks apart: a preliminary report is released on the second Friday of each month; the final report is published on the last Friday of each month.

Considering when the survey is done, we measure the error by comparing the one year ahead forecast of months  $m$  to the realized inflation between  $m-1$  and  $m+11$ :

$$\text{Error}(m) = [ \text{CPI}(m+11) / \text{CPI}(m-1) - 1 ] - \text{MICH1YR}(m)$$

## The Survey of Professional Forecasters

The Survey of Professional Forecasters (SPF) is a quarterly survey of macroeconomic forecasts for the US economy issued by the Federal Reserve Bank of Philadelphia. It is the oldest survey of the sort and was taken over by the Federal Bank of Philadelphia in 1990.

The survey is organized and published during the 2nd month of each quarter, after the estimate for the previous quarter's GDP is released. We can expect the release of the survey results at the end of the 4th week of the middle month of the quarter.

Around 35 to 45 professional forecasters, prominent economists, researchers, and analysts fill a form, giving headline inflation estimates for the current quarter and the following 4. From those estimates, a one-year ahead inflation rate is calculated:

- CPI1 is the previous quarter inflation,
- CPI2 is the current quarter inflation estimate,
- CPI3...CPI6 are estimates for the 4 next quarters,
- INFCPI1YR is the one year ahead inflation estimate, starting for the next quarter,
- CPI5YR forecasts for the annual average rate of headline CPI inflation over the next 5 years,
- CPI10YR is the same for the next 10 years.

To measure the quality of their forecasts, we define an error variable as the difference between the annual headline inflation over the next 4 quarters to their prediction:

$$\text{Error}(Q) = [ \text{CPI}(Q\_last\_month+12m) / \text{CPI}(Q\_last\_month) - 1 ] - \text{SPF\_INFCPI1YR}(Q)$$

## Implied Inflation Measured from TIPS

Inflation forecasts can also be observed directly from market prices. In 1997, the US Treasury issued a new type of bond whose principal and coupons are protected against inflation. By estimating the difference between the nominal rate of a standard T-Note to the real rate of a TIPS of the same maturity, we obtain the breakeven inflation rate for this maturity. Furthermore, when enough TIPS of different maturities are available, estimating the whole term structure of implied inflation is possible. The end-of-month breakeven curves have been made available by the Treasury Department since 2003\*.

Due to the lag in the publication of CPI's, Inflation-linked bonds are indexed using a ratio of daily inflation reference, inferred from the interpolation between two lagged CPI's:

$$\text{DIR}(d,m) = \text{CPI}(m-3) + (\text{CPI}(m-2) - \text{CPI}(m-3)) * ((d-1) / \text{No of days in month } m)$$

Considering our Time Serie of one-year breakeven available for the last day of the month, our inflation forecasts should be compared to a realized inflation lagged by two months:

$$\text{Error}(m) = [ \text{CPI}(m+10) / \text{CPI}(m-2) - 1 ] - \text{BreakEven1YR}(m)$$

\*See the TBI Time Series available at the link given in the data source section.

**Table 1. Michigan's error statistics**

|                    | <u>from 1981 to 2002</u> | <u>from 2003 to 2021*</u> | <u>from 1981 to 2021</u> | <u>Filter on high inflation**</u> |
|--------------------|--------------------------|---------------------------|--------------------------|-----------------------------------|
| Count              | 264                      | 221                       | 485                      | 143                               |
| Mean               | 0.08%                    | -0.75%                    | -0.30%                   | 0.93%                             |
| Median             | 0.05%                    | -0.81%                    | -0.25%                   | 0.85%                             |
| Standard Deviation | 0.85%                    | 1.52%                     | 1.27%                    | 0.92%                             |
| Range              | 4.68%                    | 9.02%                     | 9.02%                    | 5.23%                             |
| Minimum            | -1.80%                   | -5.08%                    | -5.08%                   | -1.29%                            |
| Maximum            | 2.87%                    | 3.94%                     | 3.94%                    | 3.94%                             |
| MAE                | <b>0.67%</b>             | <b>1.32%</b>              | <b>0.96%</b>             | <b>1.07%</b>                      |
| RMSE               | <b>0.85%</b>             | <b>1.69%</b>              | <b>1.28%</b>             | <b>1.31%</b>                      |
| CORREL             | <b>78%</b>               | <b>40%</b>                | <b>60%</b>               | <b>63%</b>                        |

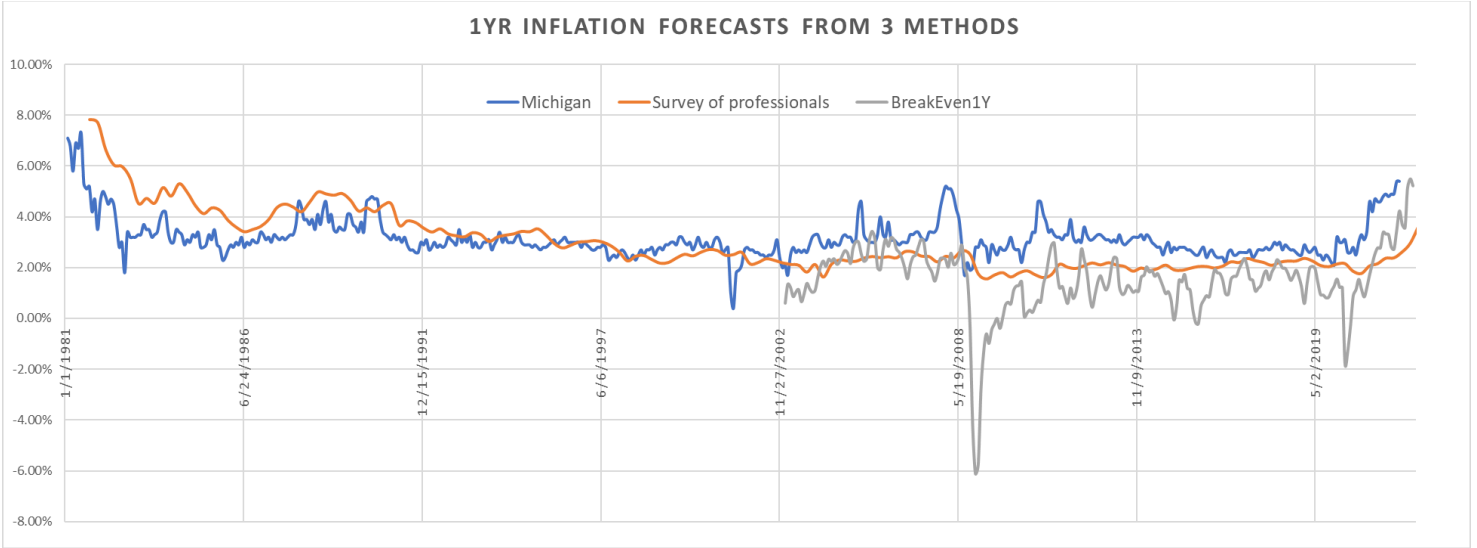
**Table 2. SPF's error statistics**

|                    | <u>from 1981 to 2002</u> | <u>from 2003 to 2021*</u> | <u>from 1981 to 2021</u> | <u>Filter on high inflation**</u> |
|--------------------|--------------------------|---------------------------|--------------------------|-----------------------------------|
| Count              | 86                       | 73                        | 159                      | 42                                |
| Mean               | -0.56%                   | 0.18%                     | -0.22%                   | -0.86%                            |
| Median             | -0.50%                   | -0.02%                    | -0.34%                   | -0.63%                            |
| Standard Deviation | 1.12%                    | 1.70%                     | 1.46%                    | 1.34%                             |
| Range              | 5.75%                    | 10.47%                    | 10.47%                   | 5.75%                             |
| Minimum            | -3.87%                   | -4.09%                    | -4.09%                   | -3.87%                            |
| Maximum            | 1.88%                    | 6.39%                     | 6.39%                    | 1.88%                             |
| MAE                | <b>0.95%</b>             | <b>1.17%</b>              | <b>1.02%</b>             | <b>1.21%</b>                      |
| RMSE               | <b>1.25%</b>             | <b>1.70%</b>              | <b>1.47%</b>             | <b>1.58%</b>                      |
| CORREL             | <b>53%</b>               | <b>-4%</b>                | <b>41%</b>               | <b>19%</b>                        |

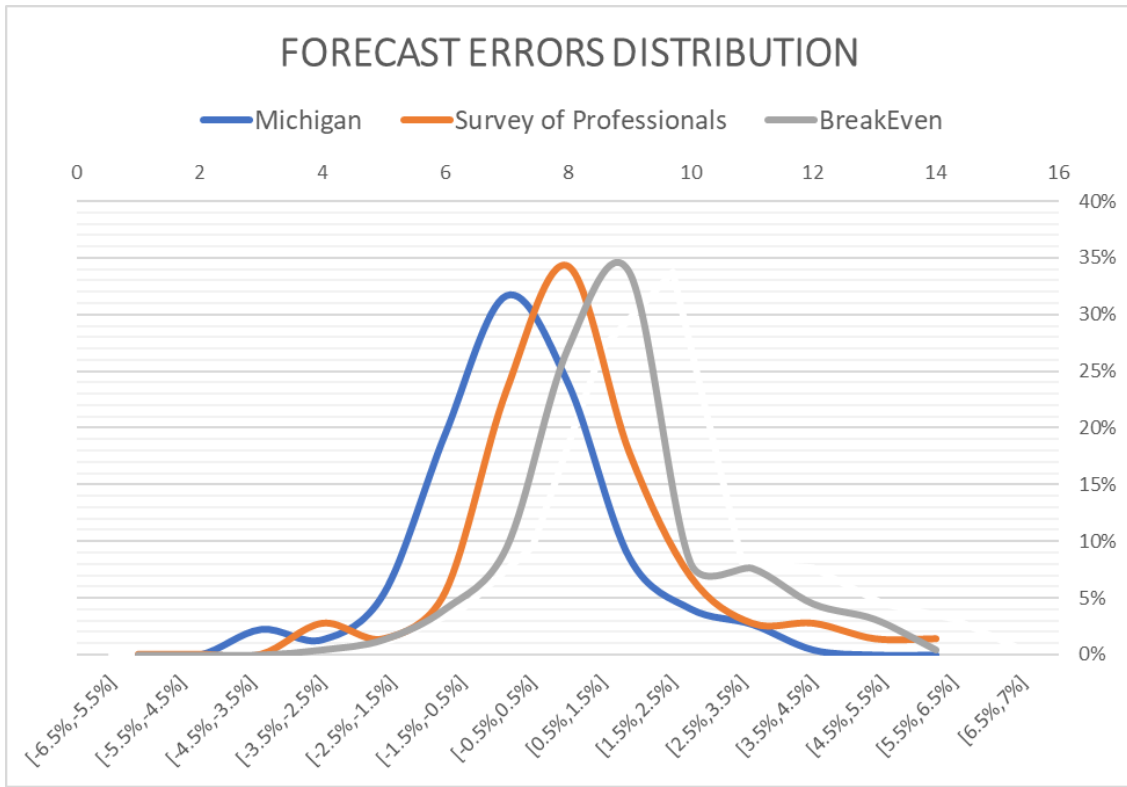
**Table 3. TIPS' error statistics**

|                    | <u>from 1981 to 2002</u> | <u>from 2003 to 2021*</u> |
|--------------------|--------------------------|---------------------------|
| Count              |                          | 222                       |
| Mean               |                          | 0.86%                     |
| Median             |                          | 0.65%                     |
| Standard Deviation |                          | 1.62%                     |
| Range              |                          | 9.19%                     |
| Minimum            |                          | -3.63%                    |
| Maximum            |                          | 5.57%                     |
| MAE                |                          | <b>1.32%</b>              |
| RMSE               |                          | <b>1.83%</b>              |
| CORREL             |                          | <b>40%</b>                |

**Graph1: 1 year-ahead inflation forecasts**



**Graph2: Forecast errors distribution for the period 2003-2022**



## Results

We obtained inflation data from the year 1981 until 2022. We performed our forecast error statistics until Spring 2021. The last values compare the actual inflation realized between Spring 2021 and Spring 2022 to the one-year forecasted inflation as of Spring 2021.

Considering Table 2, we can appreciate **that the Survey of Professionals Forecasters is a low-biased predictor of inflation.** The median error is close to 0% and remains below 0.5% over different periods. Overall, since 1981, **the Michigan Survey of Consumers also displays low bias, but overshoots realized inflation after 2003** (the forecast error is negative -0.75% on this period). However, the predicted inflation measured from **TIPS' prices tends to underestimate realized inflation,** with an average positive error of +0.8%.

As part of our analysis, we studied the performance of inflation indicators by filtering the data over higher levels of realized inflations (realized inflation above 3.5%) to test their dynamics. The Michigan and SPF forecasts both underestimated realized inflation by 0.96% and 0.86% over those inflationary periods. Most concerning, **all three indicators failed to predict the latest sudden surge in inflation over 2021-2022.**

Let's compare the three methods based on the Root Mean Squared Error criteria. We notice an evident deterioration in the quality of the forecasts between the 1981 to 2002 period and after 2003. This phenomenon might be explained by what is called the "great moderation" of inflation, where realized inflation was low with no clear trend. **Based on the RMSE, the Michigan Consumer Index proves to be the most reliable measure, ahead of the SPF and the TIPS in 3rd position.**

**It is stunning to notice that the correlation between the prediction of the SPF and realized inflation is almost 0 following 2003. At an equivalent RMSE, it is thus more reasonable to choose the predictor with the highest correlation, which in this case is the Michigan Consumer Index.**

We can conclude that the survey of non-professionals performed by the University of Michigan via its Michigan Consumer Index is the best inflation predictor out of the three indicators we studied. Vox Populi won before the models of Professional Forecasters and the market prices of traders! **This can ultimately justify the FED's choice of using the Michigan Survey to make its monetary decisions.**

## References

Curtin, R. (1996). 'Procedure to Estimate Price Expectations'. Survey of Consumers. University of Michigan.

Federal Reserve Bank of Philadelphia, (2021). 'Survey of Professional Forecasters'. Philadelphia: 60 pages.

## Data Sources

- Michigan Survey of Consumers:  
<https://data.sca.isr.umich.edu/>
- Philadelphia's FED Survey of Professional Forecasters:  
<https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/survey-of-professional-forecasters>
- TIPS market data (TBI curves):  
<https://home.treasury.gov/data/treasury-coupon-issues-and-corporate-bond-yield-curves/treasury-coupon-issues>