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MONTHLY INFLATION REPORT

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Key Statistics:

- Inflation was 5.6 percent from Dec 2021 to Dec 2022.
- Inflation has averaged 3.5 percent since Jan 2020.
- FOMC projects 2.6 percent inflation for 2022.
- Bond markets are pricing in 2.6 percent inflation per year over the next five years.

Overview

Inflation is an increase in the general level of prices. Higher prices mean that a dollar buys fewer goods and services than it did in the past.

Since inflation was low and relatively stable over much of the last three decades, most Americans grew accustomed to adjusting wages and prices at more-or-less the same rate each year. However, higher inflation over the last year and the likelihood that inflation will remain high in the near future means we should think more carefully about the value of the dollar when entering into long term contracts. Workers should think about inflation when deciding whether and how much to work for an offered wage or salary. Businesses should think about inflation when making purchase agreements. Borrowers and lenders should think about inflation when deciding how much interest they are willing to pay or accept.

In this report, we present several key indicators related to inflation in order to help people renegotiate existing employment, purchase, and lending contracts or enter into new contracts more confidently. Specifically, we

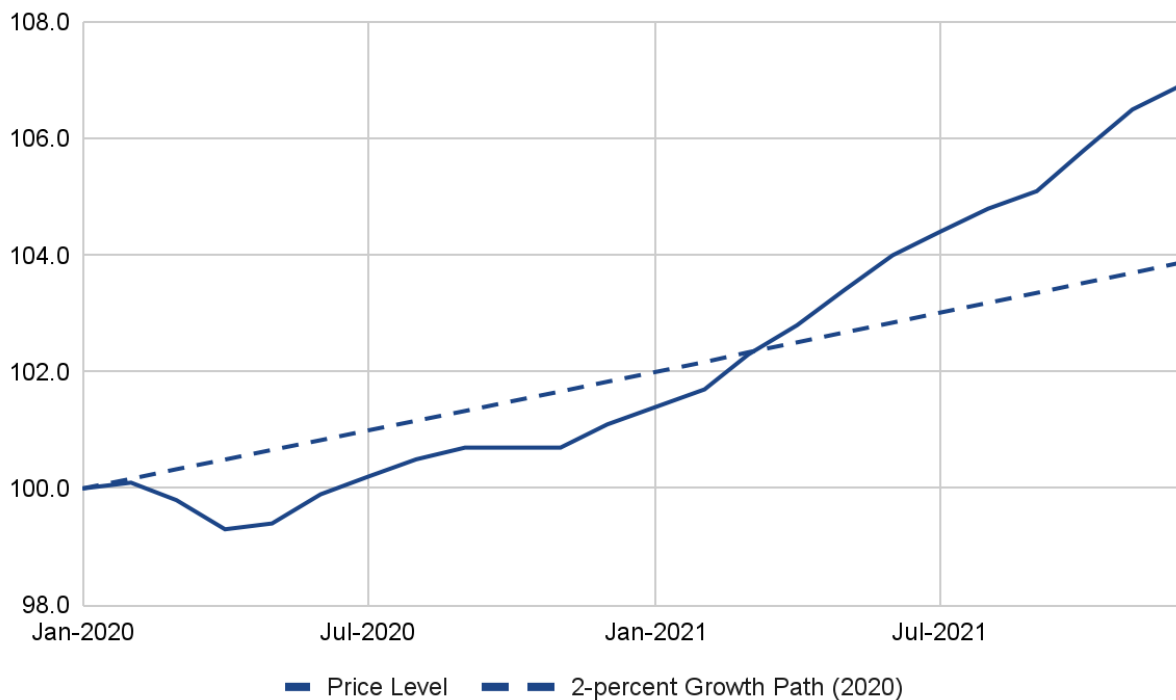
- compare the most recent data on the price level to the price level that would have resulted if prices had merely grown at 2 percent since January 2020;

- offer forecasts of the price level based on projections from the Federal Reserve's monetary policy committee; and
- estimate the expected annual rate of inflation over the next five- and ten-year periods based on prevailing prices in bond markets.

Taken together, the indicators presented in this report help one form a clear picture of how prices have evolved in the recent past and the extent to which they are likely to rise in the near future.

The Price Level

The personal consumption expenditures price index (PCEPI) is constructed by the Bureau of Economic Analysis. It measures the prices people pay when buying goods and services in the United States. Economists generally prefer the PCEPI to other measures of the price level because it considers a wide range of consumer expenses while also reflecting changes in consumer behavior. Other measures of the price level, like the consumer price index (CPI), do not reflect changes in consumer behavior.



The PCEPI presented above uses January 2020 as the base year. Each observation is expressed as a percent of the observation in January 2020. For example, the price level in June 2021 was 104.0—or, 4 percent higher than it had been in January 2020.

The Federal Reserve conducts monetary policy to achieve 2 percent inflation, on average. With this in mind, we have presented the price level alongside a 2-percent growth path, which reflects what the level of prices would be if inflation had averaged 2 percent since January 2020. For example, in June 2021 the 2-percent growth path was 102.8, meaning that the price level would have been just 2.8 percent higher in June 2021 than it had been in January 2020 if inflation had merely averaged 2 percent over the period.

The difference between the price level and the 2-percent growth path is expressed in percentage points and indicates how much higher the price level is relative to what it would have been if prices had merely grown by 2

percent over the period. For example, in June 2021 the price level was $104.0 - 102.8 = 1.2$ percentage points higher than it would have been with 2 percent inflation.

A continuously compounding annual rate of inflation can be calculated between any two observations in the series using the formula $[\ln(P_f) - \ln(P_i)]/[(f - i)/12]$, where P_i is the initial price level, P_f is the final price level, and $(f - i)$ is the number of months between the two observations.

The price level grew 5.6 percent from December 2020 to December 2021. It has grown at an average annual rate of 3.5 percent since January 2020. The price level was 3.0 percentage points higher in December 2021 than it would have been if inflation had averaged 2 percent since January 2020.

Forecasting the Price Level

Monetary policy is arguably the most important factor for forecasting the price level over the next few years. By understanding how the Federal Reserve intends to conduct monetary policy, one can form a reasonable expectation of how the price level is likely to evolve.

The Federal Open Market Committee (FOMC) is the Federal Reserve's monetary policy committee. It consists of the seven members of the Board of Governors of the Federal Reserve System; the president of the Federal Reserve Bank of New York; and four of the remaining eleven Reserve Bank presidents, each of whom serve a one-year term on rotation.

The FOMC meets eight times per year to assess the condition of the economy and determine the appropriate course of monetary policy given the Federal Reserve's Congressional mandate to promote maximum employment, stable prices, and moderate long term interest rates.

Prior to an FOMC meeting, each participant submits a projection of the most likely outcome for inflation in the personal consumption expenditure price index (PCEPI). These projections are based on information available at the time of the meeting and are made under the assumption that monetary policy will be conducted appropriately, as each individual FOMC member sees it, and that the economy is not affected by any unforeseen disturbances. Projections are typically submitted for the current year, the following three years, and the longer run period thereafter.

The Federal Reserve releases the median, central tendency, and range of PCEPI inflation projections in its Summary of Economic Projections. The median reflects the projection of the FOMC member in the center of the distribution. The central tendency omits the three highest and three lowest projections. The range includes the highest and lowest projection.

	Median Inflation Projection				
Projection Date	2021	2022	2023	2024	Longer run
December 2021	5.3	2.6	2.3	2.1	2.0

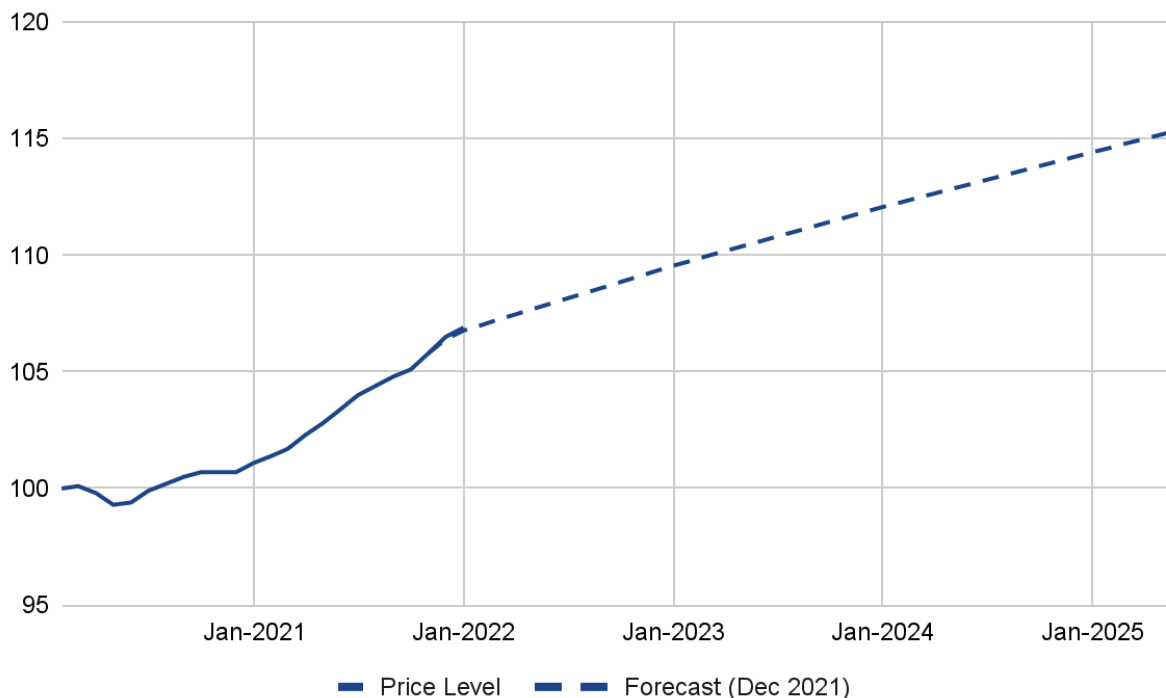
	Central Tendency of Inflation Projections				
Projection Date	2021	2022	2023	2024	Longer run
December 2021	5.3–5.4	2.2–3.0	2.1–2.5	2.0–2.2	2.0

	Range of Inflation Projections				
Projection Date	2021	2022	2023	2024	Longer run
December 2021	5.3–5.5	2.0–3.2	2.0–2.5	2.0–2.2	2.0

Given FOMC member projections, it is relatively straightforward to forecast the price level under the assumptions that (1) the FOMC conducts monetary policy as the median committee member intends, (2) there are no unforeseen disturbances to the economy over the forecast period, and (3) projected inflation is constant from month to month across each year.

In assessing the extent to which the median FOMC member projection is accurate, one must keep assumptions (2) and (3) in mind. Unforeseen disturbances to the economy might result in a higher or lower price level than was anticipated, but this does not necessarily imply that the initial projection was biased.

Likewise, a variable monthly inflation rate does not imply the median FOMC member’s projection is inaccurate, since above-projection inflation might be offset by below-projection inflation over the course of the year. With this in mind, it is perhaps most appropriate to evaluate projections at the end of each year.



We present the price level alongside the forecasted price level based on median FOMC member projections, noting parenthetically when the forecast was made. Each series uses January 2020 as the base year, meaning each observation is expressed as a percent of the observation in January 2020.

Our forecast of the price level based on median FOMC member projections indicates that prices will be roughly 9.6 percent higher in January 2023 than they were in January 2020. That amounts to an average annual rate of inflation of 3.0 percent since January 2020. We forecast that the price level will be 12.1 percent higher in January 2024 than it was in January 2020, meaning prices will have grown at an average annual inflation rate of 2.8 percent over the period. By January 2025, the price level is forecasted to be 14.4 percent higher than it was in January 2020. Our forecast implies that the average annual inflation rate from January 2020 to January 2025 will be 2.7 percent.

Expected Annual Inflation

Whereas our forecast of the price level relies on Federal Open Market Committee (FOMC) member projections, one can also assess the likely magnitude of future price increases by looking at bond markets. Bond traders must form expectations of inflation when deciding what they are willing to pay or accept for a bond. If bond traders overestimate inflation, bond buyers will tend to gain at the expense of bond sellers. If bond traders underestimate inflation, bond sellers will tend to gain at the expense of bond buyers. Since neither buyers nor sellers want to lose on a transaction, they have a strong incentive to estimate inflation accurately. What do their trades imply about the expected rate of inflation?

Using the Fisher equation and interest rates on traditional Treasuries and Treasury inflation-protected securities (TIPS), we can estimate the expected annual inflation implied by bond prices. The Fisher equation states that $i = r + E(\pi)$, where i is the nominal interest rate, r is the real (or, inflation-adjusted) interest rate, and $E(\pi)$ is expected inflation. Rearranging, we get the formula $E(\pi) = i - r$.

Traditional Treasuries promise to pay a specified dollar amount at some point in the future. TIPS, in contrast, adjust the future payment based on the changes in the consumer price index (CPI). These assets have the same issuer, meaning there is no difference in issuer risk, and can be considered for a given maturity date, meaning there is no difference in duration risk. There is a small difference in inflation risk, but otherwise these assets are identical.

Given the similarities between these two assets outlined above, we use the interest rate on traditional Treasuries as a measure of the nominal interest rate and the interest rate on TIPS as a measure of the real interest rate. Hence, expected inflation can be estimated by subtracting the TIPS rate

from the traditional Treasuries rate. The Federal Reserve refers to this implied market expectation of inflation as the breakeven inflation rate. Others call it the TIPS spread.

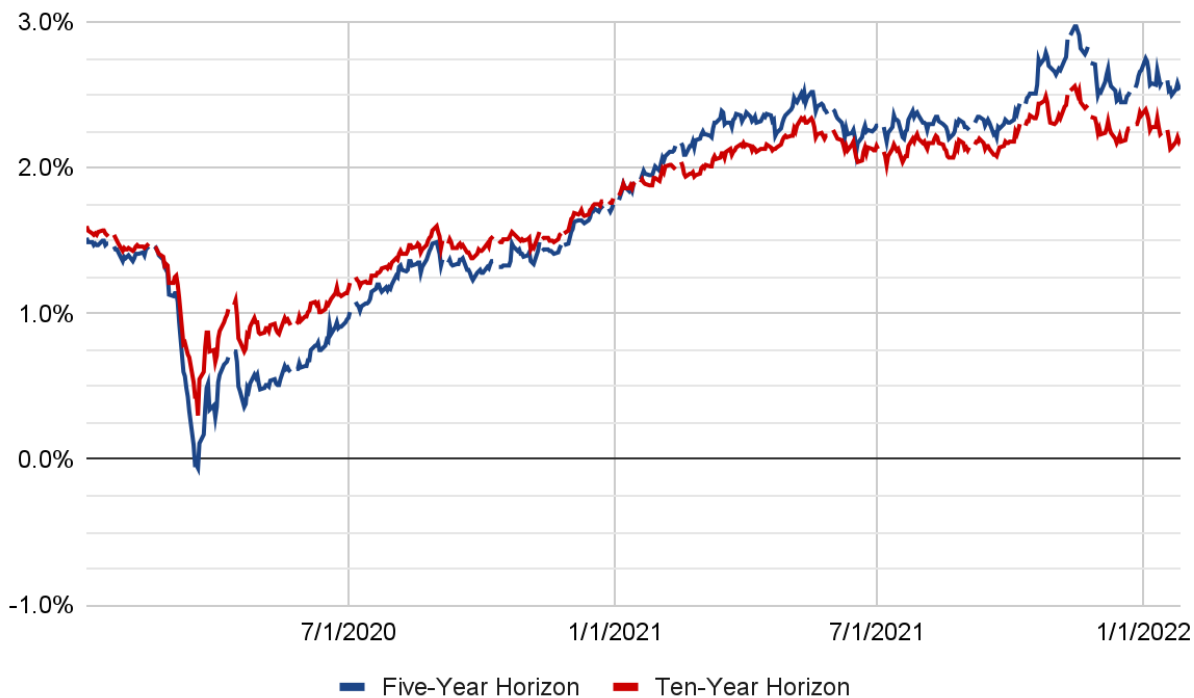
Recall that TIPS are adjusted for inflation using the CPI. Hence, the TIPS spread measures the implied market expectation of CPI inflation. Our preferred measure of inflation—and the measure used throughout this report—is the personal consumption expenditures price index (PCEPI). Since CPI inflation usually exceeds PCEPI inflation, the TIPS spread likely overstates expected PCEPI inflation.

In order to estimate expected PCEPI inflation, we adjust the TIPS spread by the average difference between CPI and the PCEPI inflation. More formally, $E(\pi_{PCEPI}) = TIPS\ spread - (\pi_{CPI} - \pi_{PCEPI})$.

From January 2010 to January 2020, CPI inflation averaged 1.8 percent. PCEPI inflation averaged 1.6 percent. The average difference between CPI and PCEPI inflation was 0.2 percentage points. Thus, our estimate of expected PCEPI inflation subtracts 20 basis points from the TIPS spread.

As noted above, there is a small difference in the inflation risk associated with traditional Treasuries and TIPS. If inflation differs from what was expected when the asset was purchased, someone holding traditional Treasuries will gain or lose while someone holding TIPS will see the final payment they receive adjusted for inflation. Hence, traditional Treasuries are associated with additional risk.

Since the interest rate on traditional Treasuries reflects the additional inflation risk of traditional Treasuries, expected inflation is likely lower than our estimates suggest. The risk that actual inflation will deviate significantly from what is expected is widely thought to be very low. Hence, the upward bias in our estimates is probably very small. As such, we acknowledge but make no effort to correct for this bias.



We present the expected average annual PCEPI inflation rates over the five- and ten-year horizons above. On January 27, 2022, bond markets were pricing in around 2.6 percent inflation per year over the next five years and 2.2 percent inflation per year over the next ten years. Expected inflation has generally declined since mid-November, when inflation was expected to average nearly 3.0 and 2.6 percent over the five- and ten-year horizons, respectively.

Note that the most recent estimate over the five-year horizon exceeds that over the ten-year horizon. This means bond markets expect inflation will decline over time. Although the pattern implied by bond prices is in line with the FOMC projections discussed above, the precise estimates suggest bond markets currently expect inflation will exceed FOMC projections in the near term.

About The Authors



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