MACROECONOMIC ADVISERS
By IHS Markit

Macro Focus

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Anticipating the Next Downturn: A Probabilistic Approach

Summary

History suggests that, given today's low unemployment rate, a recession is likely within the next few years. Yet uncertainty about the magnitude and timing of that next recession discourages forecasters from including a downturn in their "base" forecasts. For example, the base forecast of Macroeconomic Advisers by IHS Markit shows, from 2021 through 2025, an unprecedented five-year span of below-trend growth of real GDP that pushes the unemployment rate up from a cyclical trough of 3.5% to the full-employment rate of 4.6%. However, we relegate an outright recession to an alternative scenario.[1]

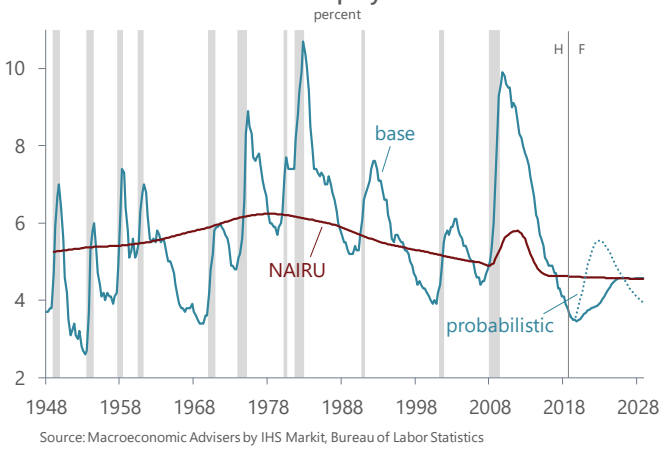
In this Macro Focus, we formulate a "probabilistic" forecast as the weighted average of a sequence of six scenarios. Each scenario shows continued expansion, ending in a typical recession, but in each scenario the recession begins one year later than in the previous scenario of the sequence. The weights are determined by the probabilities, based on historical experience at low unemployment rates, of a recession beginning within the given number of years. The probabilistic forecast shows GDP growth flirting with zero in 2020 and 2021, and a cyclical rise in the unemployment rate to 5½% by 2022, before a period of above-trend growth pushes the unemployment rate back towards 4%. It suggests our base forecast for growth and unemployment is too optimistic in the intermediate term and too pessimistic in the second half of a ten-year forecast horizon.

The methodology, while suggestive, has shortcomings. One must choose the profile of the next recession and recovery. The cause of the next recession is equally important in the calculation: expansion-ending demand shocks push inflation and interest rates down, while expansion-ending inflation shocks resisted by tighter monetary policy can push them up, at least initially. And, of course, historical regularities may not repeat themselves! Nevertheless, we believe this approach yields valuable insights that can help customers plan for the next recession.

Backdrop

An adage familiar to macroeconomists is that expansions don't die of old age, but rather are killed by shocks or policy mistakes. There is evidence to this effect. Some expansions have been long, some short, muddying estimates of any relationship between the age of an expansion and the date of its demise. Consider, however, Chart 1, which shows the history and our base forecast of the unemployment rate in the solid acqua line[2], along with the Congressional Budget Office's estimate and projection of the "non-

Chart 1. Unemployment rate



Source: Macroeconomic Advisers by IHS Markit, Bureau of Labor Statistics

[1] Our decision suggests we perceive there to be greater cost, reputationally or business wise, associated with forecasting a recession prematurely than adjusting the forecast either shortly before or after the onset of recession.

[2] Published by Macroeconomic Advisers by IHS Markit on 4 December 2018.

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accelerating inflation rate of unemployment" (NAIRU) in the solid maroon line.[3] Recession periods are shown by gray bars.[4]

Three things stand out about this chart. First, if one considers—as we do—the 1980 and 1981 recessions as a single event, then all post-WWII recessions have begun with the unemployment rate below NAIRU. For whatever reasons, expansions are "murdered" when they are "mature," as judged by a low unemployment rate. Second, the current unemployment rate of 3.7% is well below NAIRU, so historical regularities suggest a recession is likely within a few years. And third, our base forecast does not show a recession before 2028, only a period of below-trend growth that raises the unemployment rate to NAIRU—the mythical (that is, never achieved!) "soft-landing from below." In this forecast, the economy nearly doubles the longest expansion on record.[5] It also breaks rules of thumb that identify the onset of recession by increases in the unemployment rate.

Before judging the base forecast too harshly, consider its underlying rationale. We do expect with high confidence there will be a recession before 2028, but have low confidence we can predict its onset accurately. We communicate to our customers both the risk and the uncertain timing of the next recession by developing a forecast characterized by a lengthy growth recession.[6] Yet this raises the question: are the risk and uncertainty better communicated by a forecast that reflects the historical regularity between the maturity of an expansion and the onset of recession? And, what characteristic would such a forecast share—or, perhaps more importantly, *not* share—with our base forecast?

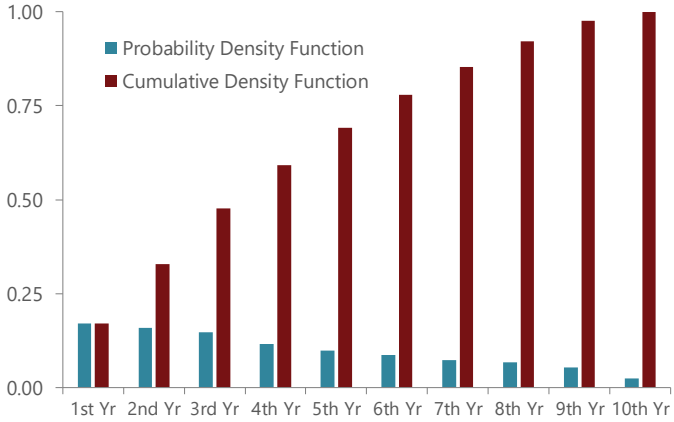
[3] NAIRU is the unemployment rate consistent with steady inflation. It is also sometimes referred to as the "natural rate" of unemployment, a term coined by Milton Friedman in his presidential address to the American Economic Association in 1967, or even more casually, the "full employment" unemployment rate.

[4] Recessions as identified by the Business Cycle Dating Committee of the National Bureau of Economic Research (NBER).

[5] The current expansion will be 114 months old in December 2018 and, by 2028, it would be 234 months old. The longest expansion on record is 120 months, from March 1991 to March 2001.

[6] In a growth recession, GDP expands but slower than potential, with the result that the unemployment rate rises.

Chart 2. Unconditional probability of recession in X years



Source: Macroeconomic Advisers by IHS Markit

The Unconditional Probability of a Recession

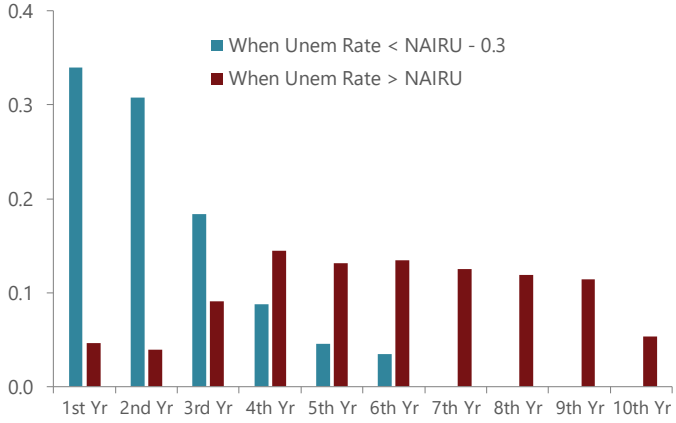
To establish our methodology we calculated, for expansion months since 1947, the frequency with which a recession began within X years[7], X running from one year to ten years, ten years covering the longest expansion in the post-WWII era. We did this first unconditioned by (that is, without regard to) the unemployment rate. The results are shown in Chart 2. The acqua bars are a discrete estimate of the probability density function (PDF) for a recession beginning in the X^{th} year forward. The horizon at which the onset of recession occurred most frequently (the mode of the PDF) is within one year, but with a probability of only 17%. The chart also shows the corresponding cumulative density function (CDF) in the maroon bars. The CDF rises above 50% between three and four years (the median of the PDF), implying that, without regard to the maturity of the expansion, and based on the experience of the last seventy years, the odds are better than fifty-fifty that, in any given expansion month, the US economy will enter a recession within four years.

[7] Since the data are monthly, a recession beginning "within a year" means the recession begins in any one of twelve months following an expansion month.

Probabilities Conditioned on the Unemployment Rate

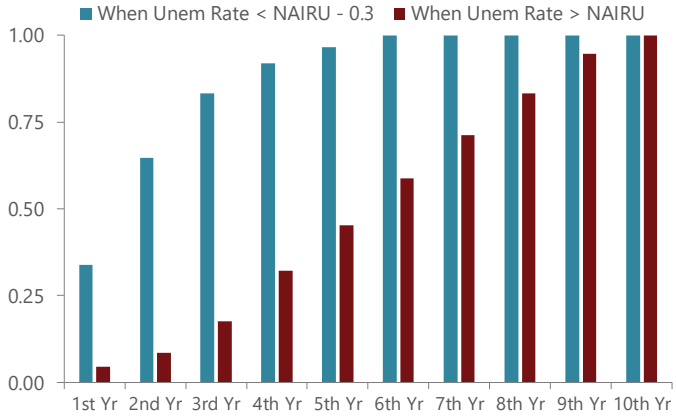
We know, however, that the current expansion is mature, and Chart 1 underscores that recessions begin sooner when the unemployment rate is low than when it is high. This suggests conditioning the probability distributions on the unemployment rate. Chart 3 shows two such PDFs. The first (maroon bars) is based on expansion months when the unemployment is above NAIRU. The second (acqua bars) is based on expansion months when the unemployment rate is more than 0.3 percentage point below NAIRU.[8] The corresponding CDFs are shown in Chart 4. The contrast between the distributions is striking. When the unemployment rate is above NAIRU, with the economy far from capacity constraints, the probability of a recession within one year is practically 0, and the probability of entering recession doesn't rise above 50% until the sixth year. When the unemployment rate is more than 0.3 percentage point below NAIRU, with the economy facing capacity constraints, the mode of the PDF is one year with a probability of 34%, and the median is between one and two years. Since the current unemployment rate of 3.7% is 0.8 percentage point below NAIRU, historical experience suggests we should expect a recession within two years, or by late 2020. To put a finer point on the exercise, we fit a Beta distribution through the annual PDF conditioned on the unemployment rate being more than 0.3 percentage point below NAIRU, and converted the time dimension to months (Chart 5). The mode of that distribution is fifteen months, while the median is twenty-two months.[9]

Chart 3. PDF for recession in Xth year



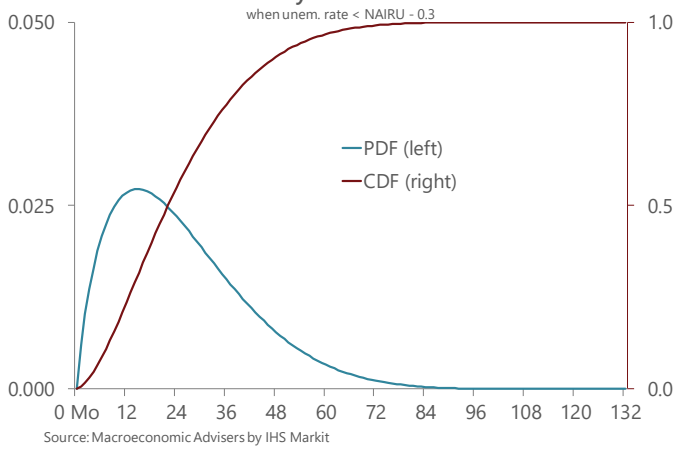
Source: Macroeconomic Advisers by IHS Markit

Chart 4. CDF for recession in X years



Source: Macroeconomic Advisers by IHS Markit

Chart 5. Probability of recession in X months



Source: Macroeconomic Advisers by IHS Markit

[8] This delineation was arrived at judgmentally after examining the data for the unemployment rate. In the underlying analysis, we conditioned the probability distributions on other ranges of the unemployment rate, including below NAIRU, and less than 0.3 percentage point below NAIRU.

[9] The parameters of the estimated Beta distribution plotted in Chart 5 are 1.84 and 7.73; the range is 0 to 132 months. The parameters were estimated by minimizing the sum of the squared differences between the annual PDF (green bars, Chart 3) and the Beta function. Note that by fitting the function over a range of ten years, the PDF allows for some possibility of expansions enduring more than six additional years even though this has never happened starting from today's low unemployment rate.

A Probabilistic Approach

How best to use these historical regularities when forming current expectations about the future economic environment? For starters, it makes sense to put an appreciable weight on a scenario that shows a recession beginning within the next year or two. Hence, Macroeconomic Advisers by IHS Markit constructs a "pessim" (or pessimistic) scenario that shows a recession starting in the first quarter of 2020 and subjectively assigns it a probability of 25%. This is less than the 34% suggested by historical experience, reflecting our conditioning of the forecast on information other than just the unemployment rate. In particular, late-cycle fiscal stimulus, in combination with financial conditions still supportive of growth, suggests the economy will remain on solid footing through 2019, encouraging us to shade down our subjective estimate of the probability of a recession beginning within a year.[10]

What, however, is the alternative, or complement, to "recession within a year"? Further expansion for at least a year, yes; but uninterrupted expansion through 2028? Almost certainly not. For the historical experience is that, starting from today's low unemployment rate, if the next recession doesn't begin within one year, there is an even larger chance it will begin within two years. And if it doesn't begin within two years, there is an even larger chance it will begin within three years, etc. This suggests considering a forecast that is a probability-weighted average of a sequence of scenarios in which the current expansion eventually succumbs to recession, but at later and later dates.

Recession Scenarios and the Probabilistic Forecast

To that end, we used the Macroeconomic Advisers model of the US economy (MA/US) to generate six scenarios in which the expansion is eventually killed by a demand shock, first after one more year of expansion, then after two more years of expansion, etc. In each scenario, a recession was generated simplistically by applying the same negative shock to the growth rates of all components of real private final sales in the last quarter of 2019, the last quarter of 2020, etc.[11] The shocks were calibrated to produce at lest two consecutive quarters of negative GDP growth (the lay definition of a recession), peak-to-trough declines in GDP of about 2¼%, and trough-to-peak increases in the unemployment rate of around 3 percentage points—a fairly "average" profile of recession.[12] In each scenario, expansion up to the recession is characterized through 2020 by above-trend growth that pushes the unemployment rate down to 3.5%, after 2020 by trend growth that maintains the unemployment rate near 3.5%, and inflation, measured by the rate of increase in the "core" price index for personal consumption expenditures (PCE), moving above the Federal Reserve's 2% objective before holding steady near 2.4%.[13]

These six scenarios are depicted by the dotted lines in Charts 6 and 7, for the growth of real GDP and the unemployment rate, respectively. The charts also show, in heavy acqua lines, the weighted average of the six scenarios, with the weights taken from the PDF in Chart 3 conditioned on the unemployment rate being more than 0.3 percentage point below NAIRU. In this

[10] The "Blue Chip" consensus sees a 24.2% "probability of a recession next year" (that is, 2019) and assigns a 35.3% probability to "if not then, what about 2020?" For the "Top 10 Average" in the panel, the respective probabilities are 39.9% and 56.5%. For the "Bottom 10 Average" of the panel, the respective probabilities are 12.7% and 18.7%. It is not entirely clear whether the respondents are reporting marginal or cumulative probabilities. See "Blue Chip Economic Indicators" (Vol. 43, No. 1, 10 December 2018).

[11] That is, we defined "within X years" to mean "at the end of X years". In principle, we want to identify the probabilistic starting date of recessions within each year—an impractical exercise for current purposes. A simpler and more practical alternative is to assume recessions start in the middle of the X^{th} year. That, however, implies a recession beginning as early as mid-2019. We consider that very unlikely given today's initial conditions and fiscal stimulus that we expect to remain significantly positive into late next year. Once we decided to show the "first" recession beginning late in 2019, we simply kept one-year intervals between the sequence of recessions.

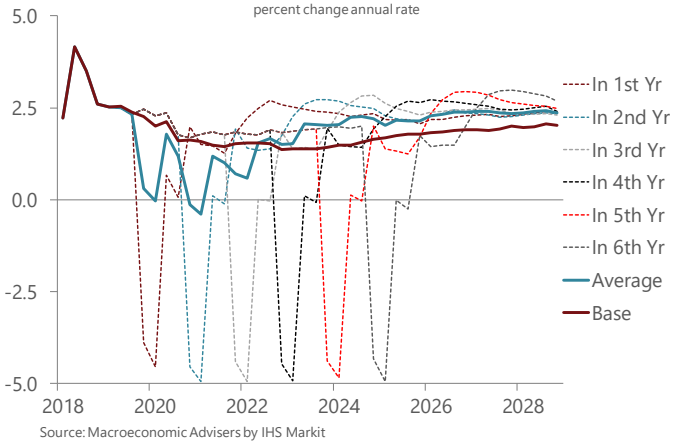
[12] It would, of course, be possible to generate more complicated, and so perhaps more realistic, recession scenarios, as well as recessions caused by supply shocks rather than demand shocks.

[13] The core index excludes food and energy prices that exhibit near-term volatility unrelated to monetary policy.

"probabilistic" forecast, the currently expected growth of real GDP turns briefly and slightly negative in both 2020 and 2021.[14] The expected unemployment rate reaches a plateau of 5½% in 2022. Given the extended period of weakness in GDP growth in 2021 and 2022, and the significant rise in the unemployment rate, the NBER Business Cycle Dating Committee likely would label this episode a recession.[15] After 2023, a cyclical rebound in GDP growth, to an above-trend 2¼%, promotes a gradual tightening of the labor market. By 2028 the unemployment rate falls to just under 4%. This is half a percentage point below NAIRU, but an "unemployment gap" that is typical late in cyclical declines of the unemployment rate.

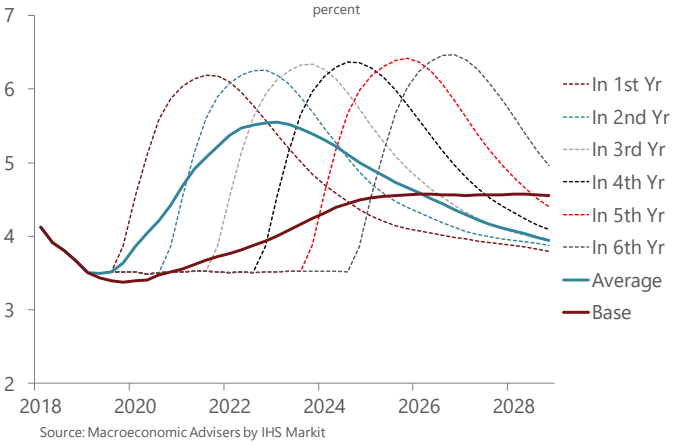
Given our decision to show recessions beginning at the end of the Xth year (see footnote 11), all six scenarios show at least one more year of expansion. Hence, in our empirical experiment, the implied probability of at least one more year of expansion is 100%. This obviously overstates the true probability, but does communicate the high degree of confidence we have in the first year of our base forecast.[16] Five of the six scenarios, accounting for 66% of the probability, show at least two more years of expansion. Four of the six scenarios, accounting for 35% of the cumulative probability, show expansion of at least three more years, etc. The last of the six scenarios shows six more years of expansion, but with only a 3% probability (Chart 8). Based on historical experience, the exercise assigns a zero probability to more than six years of expansion. This obviously understates the true probability, as there is at least some chance that the current expansion could break the historical mold.[17]

Chart 6. Real GDP growth by recession scenario



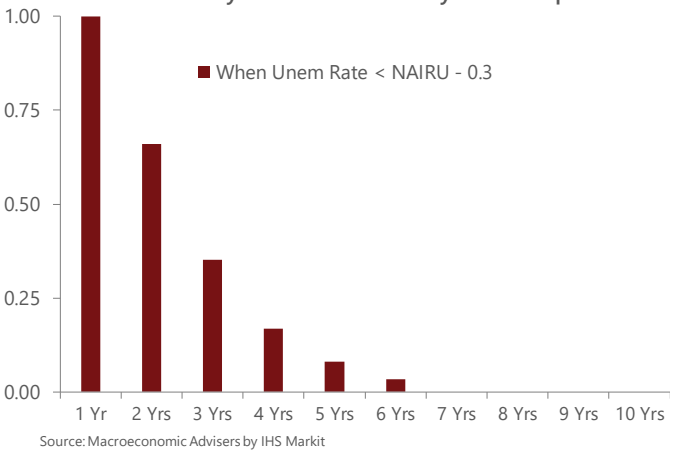
Source: Macroeconomic Advisers by IHS Markit

Chart 7. Unemployment rate by recession scenarios



Source: Macroeconomic Advisers by IHS Markit

Chart 8. Probability of at least X more years of expansion



Source: Macroeconomic Advisers by IHS Markit

[14] The sawtooth pattern of GDP growth in the probabilistic forecast arises from the relatively long one-year interval assumed between the recessions. Hence, the economy is recovering from the recession in the first scenario before the recession in the second scenario begins, etc. The path would be smoother were the analysis done at a higher frequency. We will show this refinement in a subsequent piece.

[15] The probabilistic forecast of the unemployment rate is also shown in Chart 1 by the dotted acqua line. Its profile resembles those of the recessions of both 1990 and 2001.

[16] Similarly, both our base forecast and our pessimistic scenario show expansion until the fourth quarter of 2019.

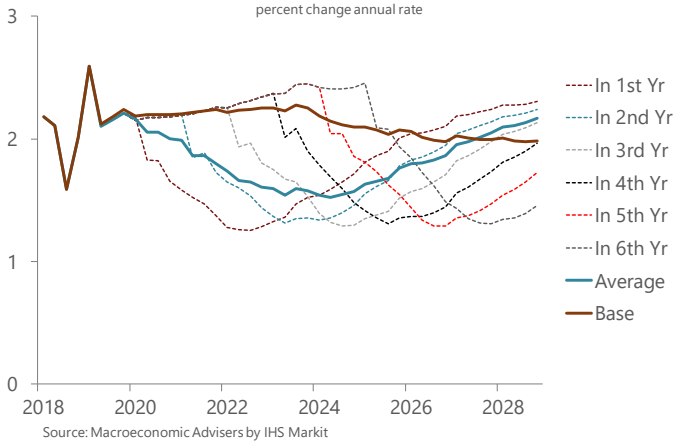
[17] For example, some may be quick to note that Australia has enjoyed almost two decades of uninterrupted expansion. The circumstances are undoubtedly special: the close (cont.)

What about Inflation (and Interest Rates)?

In our base forecast the unemployment rate remains below or at NAIRU for the next decade. In contrast, the probabilistic forecast shows the unemployment rate rising well above NAIRU before then crossing it from above—clearly more consistent with historical experience. Given the construction of the recession scenarios and our modeling of inflation[18], the logical consequence of the different paths for unemployment is that the base forecast shows core PCE inflation averaging above the Federal Reserve's 2% objective for the next decade, while the probabilistic forecast shows inflation averaging below 2% (Chart 9). Furthermore, with higher unemployment and lower inflation, one would expect interest rates (not shown here) to be lower in the probabilistic forecast than in the base forecast.[19]

Directionally, however, the results for inflation and interest rates in the probabilistic forecast arise from the explicit assumption that the recessions are caused by disinflationary demand shocks. Had we assumed instead that the recessions were caused by inflation shocks resisted by tight monetary policy, inflation and interest rates might have been higher than in our base forecast, not lower. Put somewhat differently, growth and unemployment have "typical" recessionary profiles, but inflation and interest rates don't necessarily.

Chart 9. Core PCE inflation by recession scenario



Source: Macroeconomic Advisers by IHS Markit

Hence, in this exercise, the cause of the recession has an important implications for many macroeconomic variables of interest.

Optimism versus Pessimism

In this probabilistic approach, the probability-weighted average of the six scenarios represents the currently expected outcome. The (most) pessimistic alternative scenario around that expected outcome is that a recession begins in the fourth quarter of 2019. The (most) optimistic alternative scenario is that the economy enjoys six more years of expansion with moderate inflation before finally succumbing to recession in the fourth quarter of 2024. The probability of the pessimistic scenario is a high 34%. The probability of the optimistic scenario is a low 3%. The risks are skewed towards recession sooner rather than later because the expansion is mature. Note that the uncertainty in this exercise is not whether a recession will occur, but when.

Finally, Charts 6, 7 and 9 show, in heavy maroon lines, our base forecasts for growth, unemployment, and inflation. A comparison of our base forecast to the probabilistic forecast suggests our forecast for growth is too optimistic through 2022 and too pessimistic afterwards, that our current forecast for the unemployment rate is too optimistic through 2026 and too pessimistic afterwards, and that our forecast for inflation is too high for most of the coming decade—at least under the assumption that the current expansion is eventually killed by an adverse demand shock.

[17 (cont.)] economic ties between Australia and China allowed Australia to avoid begin sucked into the "Great Recession". That, however, might just be the point. Unforeseen special circumstances could arise to extend the US expansion beyond the previous experience. This possibility is at least suggested by our fitting of a Beta distribution (Chart 5) to the discrete PDF conditioned on a low unemployment rate. The Beta distribution does show a small, but non-zero, probability of expansion lasting more than an additional seventy-two months.

[18] We model inflation as long-term inflation expectations, anchored at 2%, plus a cyclical component that depends inversely on the gap between the unemployment rate and NAIRU. All else equal, when the unemployment rate falls below NAIRU, inflation eventually moves above 2%, and vice-versa. Note that inflation is initially higher in the recession scenarios than in the base forecast because, up to the onset of recession in the recession scenarios, the unemployment rate, at 3.5%, is lower than in the base forecast.

[19] In the recession scenarios, we assumed no fiscal policy response and let short-term interest rates be determined endogenously by a monetary rule that suggests the federal funds rate will become constrained by the zero lower bound during the next recession and early stages of the ensuing recovery if the recession is caused by demand shock.

Limitations, Future Directions

The probabilistic approach to constructing the forecast can yield valuable insights helpful for anticipating the next recessionary environment. Yet it has limitations. The numerical specifics depend on the assumed profile of the next recession and recovery and, as argued above, the cause of the recession can color the results importantly. There are literally countless scenarios of continued expansion until the next recession. The probabilities used here are only fixed estimates of the underlying distributions that shift constantly with changing initial conditions. And, of course, history may not repeat itself. As such, perhaps for now it is wiser to consider the probabilistic forecast developed here as another alternative to our base forecast. But to bring the discussion full circle, return to Chart 1, which shows not only the base forecast of the unemployment rate through 2028, but also, in the dotted green line, the probabilistic forecast. Then ask this: in historical context, which looks more reasonable?

Our exercise focused exclusively on cyclical risks, given our estimates of trend growth and NAIRU. One can imagine other scenarios involving shifts in the structural underpinnings of the economy: an unexpected acceleration or deceleration in innovation (total factor productivity), an unexpected increase or decrease in the natural rate of unemployment, etc. Our current optimistic (or "optim") scenario, which shows faster growth of potential GDP at a lower sustainable unemployment rate than our base forecast, is one such case.

Or, one can build scenarios based on an assumed geopolitical, economic, or policy shock.[20] Such scenarios are certainly interesting and potentially informative but, unlike business cycles that exhibit identifiable regularities, their idiosyncratic nature forces one to assign to them subjective probabilities that often amount to little more than speculation. Or, such scenarios are simply designated as "tail events" with potentially large impact.

We believe our probabilistic cyclical exercise is informative enough that we intend to update it periodically. In addition, in future pieces we might consider passing the macroeconomic results of the probabilistic forecast through the industry module of the IHS Markit model to produce estimates of the implications for gross output, employment, and prices by industry. Similarly, it might be informative to pass the macroeconomic results through the IHS Markit suite of state models to explore the regional implications of the analysis.

[20] Such global scenarios are routinely prepared by our Chief International Economist, Elizabeth Waelbroeck-Rocha, using the IHS Markit 68-country "Global Link Model", for our *Executive Strategy Council Service*. In addition, each month Macroeconomic Advisers by IHS Markit prepares seven alternative scenarios for the US economy, each with a specific narrative that shapes the paths of output, employment, inflation, interest rates and equities—indeed, all the detail in MA/US. For the base forecast, optim and pessim scenarios, all of the detail from the IHS Markit macro, industry, and regional models is available.

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