

# Inflation's next phase

## Multi-asset implications

March 2017

### IN BRIEF

- The recent upswing in global inflation highlights the distance traveled by economies and markets over the course of this expansion. Both are transitioning away from the post-financial crisis world to one of higher nominal growth—or reflation—and policy normalization.
- How far will reflation go, and what does it mean for financial markets? Inflation dynamics themselves will be a key bellwether. Our framework calls for a gradual rise of U.S. inflation in the coming years, influenced by the pull of labor market outcomes and the possibility that a more cloistered U.S. trade policy will push up prices. We anticipate support for the dollar around current levels and, similarly, do not expect large distortions from oil prices to significantly skew the outlook.
- We also view the possibility of either extreme inflation or deflation as remote. Inflation expectations remain anchored by decades of central bank credibility, among other factors—leaving inflation highly inertial and putting up guardrails on the set of likely outcomes. Moreover, notwithstanding the synchronized upturn in global inflation, the lower levels of, and inertia in, inflation elsewhere should keep U.S. outturns on an even keel.
- For investors, the recovery of inflation and inflation risk premia, against the backdrop of anchored inflation expectations, imply a supportive environment for risk assets. Our outlook suggests continued upward pressure on the market pricing of inflation, manifesting in higher bond yields and a widening spread between nominal and inflation-protected bonds.

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### PERSPECTIVES ON INFLATION FORECASTING: FACTS AND METHODS

The investing community's perception of inflation has recently passed an inflection point, the latest in a series of swings that have marked the current expansion. The first occurred as central banks implemented unprecedentedly accommodative monetary policy in the wake of the Great Recession, sparking discussion that a surge in inflation might ensue as a consequence. Subsequently, the collapse of oil prices, and associated weakness in emerging economies, generated a move the other way, toward fear of global deflation. Since mid-2016, markets have begun focusing on a reflation theme, again accompanied by worries that some economies, particularly the U.S., could overshoot their central banks' targets. By contrast, throughout these periods, inflation itself, at least excluding volatile energy and food prices, has displayed surprising stability.

Amid this most recent phase, the Federal Reserve (Fed) has hinted it will accelerate a thus-far highly cautious tightening cycle, emboldened by increasing confidence in meeting its inflation target. Like most central banks pursuing such goals, the Fed projects inflation via a Phillips

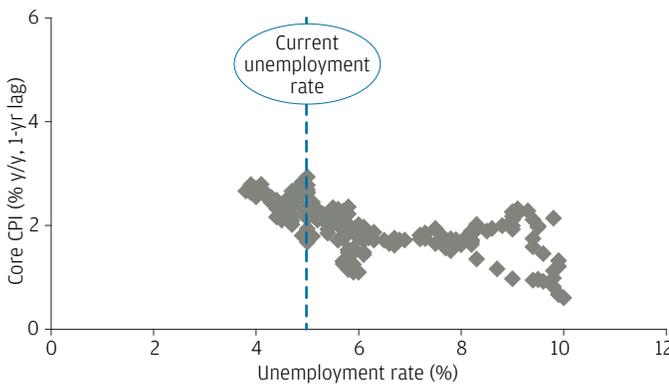
curve<sup>1</sup> framework, which relates price developments to the amount of slack in the economy and, in particular, the labor market. On occasion during the past few years, members of the Federal Open Market Committee (FOMC) have called into question the very validity of that approach, suggesting that the Phillips curve might have broken down in recent years. A cursory look at the data suggests that the curve probably does exist for the U.S., although it has likely flattened out, such that large moves in the unemployment rate are required in order to generate a significant inflation response (**EXHIBIT 1**). Similarly, U.S. cities display some relationship between joblessness and inflation (**EXHIBIT 2**).

We contend the Phillips curve is still intact, working best during the business cycle's extreme states and less so in the cycle's murky middle. Our analysis finds its efficacy strongest for services subsectors tied to local labor market conditions (food, accommodation, recreation, housing) and weaker for global goods and regulated services sectors (i.e., finance, transportation, health care). Using the model and additional research, we arrive at a baseline U.S. inflation outlook: a gradual rise over two years as labor markets tighten—and we rule out extreme inflation or deflation. We find little reason to worry that a wage-price dynamic will spiral out of control in the U.S.; Phillips curve estimates through 2018 (implied by a decline in unemployment to 4.5% over the period) show core personal consumption expenditure (PCE) inflation ending at 2%. Globally, a synchronized upturn in inflation is underway, yet we find it may be slowed by the inertia suppressing inflation outside of the U.S.

<sup>1</sup> The Phillips curve (named for economist A.W. Phillips) delineates a negative correlation between inflation and unemployment, with labor market tightness transmitted to higher wages and consumer prices.

**The U.S. Phillips curve appears to be fairly flat**

**EXHIBIT 1: U.S. JOBLESS RATE (%) AND CORE CPI (% Y/Y, 1-YR LAG), POST-2000**



Source: Bureau of Labor Statistics, J.P. Morgan Securities LLC, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

Our study of forecasting also examines three influential supply-side factors: oil, the dollar and trade policy. We find it unlikely that large distortions from oil prices will significantly skew our outlook and anticipate support for the dollar near current levels. However, with a more cloistered U.S. trade policy, we see scope for a near-term upside inflationary shock, through import tariffs or as a side effect of corporate tax reform if it includes tariff-like border adjustment taxes.

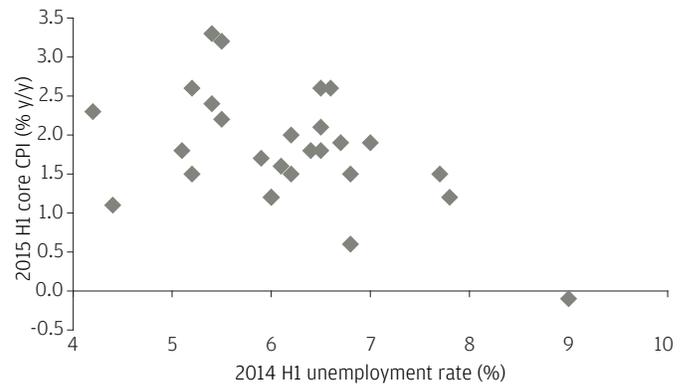
In this paper, we explore these topics more fully. First, we outline stylized facts—simplified, broadly generalized empirical findings—that together might serve as guides for forecasting inflation in the face of large swings in market pricing. Second, we examine methods of forecasting inflation, including the Phillips curve and possible alternatives to it, to select a general approach and create a baseline scenario for the coming years. On balance, using these methods suggests that inflation will likely continue to grind gradually higher over time.

**WHAT DO WE KNOW ABOUT INFLATION?**

A survey of inflation across developed market (DM) economies over time produces five stylized facts about its behavior. These regularities need not hold at all times and for all places, but they can provide guidance as investors consider the likelihood of various outcomes and trajectories, and serve as inputs into seat-of-the-pants forecasts.

**The Phillips curve relationship is evident in city-level data**

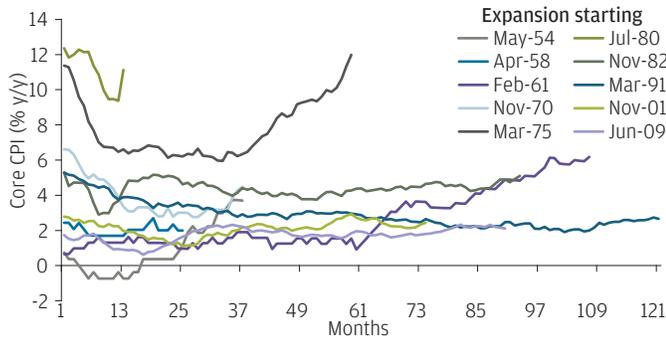
**EXHIBIT 2: U.S. METRO AREA JOBLESS RATE AND CORE CPI INFLATION (%)**



Source: Bureau of Labor Statistics, J.P. Morgan Asset Management Multi-Asset Solutions; data through 2015.

**In recent decades, U.S. inflation has displayed little cyclicality**

EXHIBIT 3: U.S. CORE CPI (% Y/Y) BY BUSINESS CYCLE EXPANSION



Source: J.P. Morgan Securities LLC, NBER, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

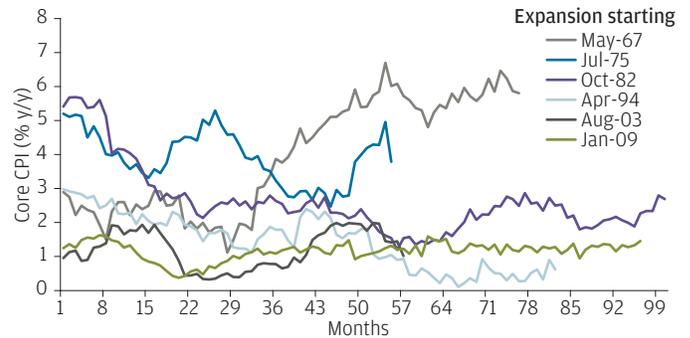
**In recent decades, not much cyclicality**

Since the 1980s, inflation in the U.S. and other DM economies has not displayed a strong connection to the business cycle and, in particular, has not consistently moved higher as expansions have progressed. Reality thus has run somewhat counter to the typical “mental model” of a business cycle. Inflation typically does decline during recessions, and often continues to do so in the early stages of the expansions that follow, but subsequently it does not move monotonically higher. Indeed, in five of the last six U.S. cycles, core inflation stood at a higher level in the first month of the expansion than in the last (EXHIBIT 3). Before the 1980s, inflation showed more cyclicality, at least some of the time. During the expansions that began in February 1961 and March 1975, especially, inflation climbed steadily from about the midpoint of the cycle onward.

Why so little cyclicality, and why the change in the 1980s? Three possible (and interrelated) explanations present themselves. First, long-run trends in inflation may have dominated shorter-term factors—especially the 30-year effort on the part of central banks, including the Federal Reserve, to squeeze high inflation out of the system after the 1960s and 1970s. Second, associated with that process, inflation expectations likely became better anchored around the Fed’s target from the 1980s onward, making it more difficult for cyclical forces to push actual inflation significantly away from 2%. Third, as mentioned above, the Phillips curve appears to have flattened in recent decades, in part because it is reflecting precisely that stability of inflation expectations, but possibly due to other factors as well, including a decline in worker bargaining power. As such, even fairly large moves in the unemployment rate likely exercise less influence on wages, and by extension prices, than they did in the past. These

**International inflation cyclicality has also declined**

EXHIBIT 4: GERMAN CORE CPI (% Y/Y) BY BUSINESS CYCLE EXPANSION



Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

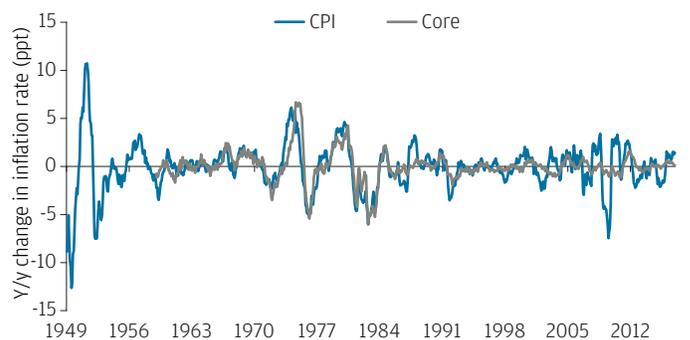
developments have occurred elsewhere in the world, too, and a resulting lack of cyclicality has characterized inflation in other DM economies, such as Germany (EXHIBIT 4).

**Core inflation moves slowly, and shocks have a tendency to correct**

Discussions of monetary policy often focus on the question of whether central banks, including the Fed, have fallen “behind the curve,” with the implicit assumption that runaway inflation poses a serious risk. In reality, inflation tends to move quite slowly, with only modest acceleration or deceleration over a one-year horizon. In other words, large swings in inflation—at least, in core inflation, which excludes food and energy prices—generally unfold only over multiple years. During the past 25 years, U.S. core inflation has not fluctuated much from one year to the next: a 0.5 percentage point (ppt) mean absolute value of annual acceleration (EXHIBIT 5). A similar pattern

**Core inflation generally moves slowly**

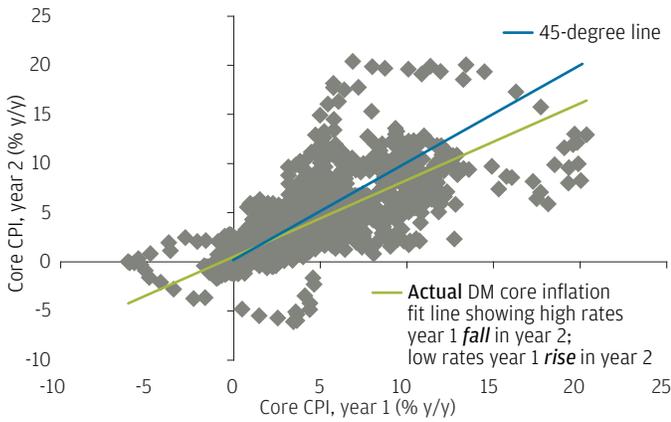
EXHIBIT 5: U.S. Y/Y INFLATION ANNUAL ACCELERATION (PPT)



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

**Inflation shocks tend to correct rather than to trend**

EXHIBIT 6: DM COUNTRY CORE INFLATION (% Y/Y), YEAR 1 VS. YEAR 2



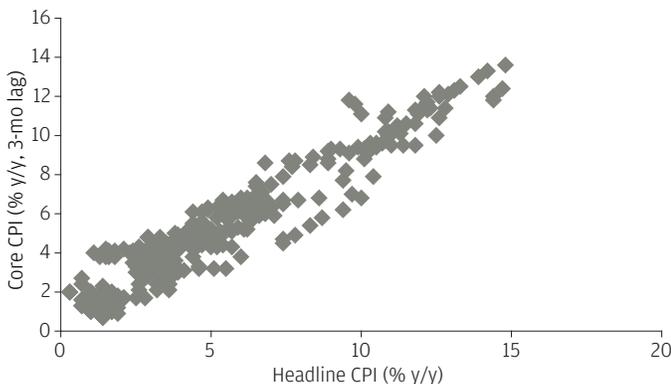
Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

holds true across DM economies. This low volatility implies that a good starting point for a year-ahead core consumer price index (CPI) forecast is that it will be fairly close to the current CPI rate.

Further contributing to the picture of stability is core inflation's small tendency to mean-revert rather than trend. Shocks one year, instead of leading to persistent acceleration or deceleration, more frequently give way to more typical inflation the subsequent year. **EXHIBIT 6** shows this pattern by comparing historical DM core inflation rates, shown on the x-axis, with the following year's observation for the same country, on the y-axis. The chart shows, on top of this scatter plot, a 45-degree line as well as a line fit to the data. Instead of tracking the 45-degree

**Headline inflation shocks formerly passed through into core**

EXHIBIT 7: U.S. HEADLINE AND CORE INFLATION, 1958-92



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

line, the fit line is rotated slightly in a clockwise direction. This implies that relatively high observations in year one are followed by somewhat lower inflation rates in year two, and conversely that low-side rates in year one are followed by higher rates the next year.

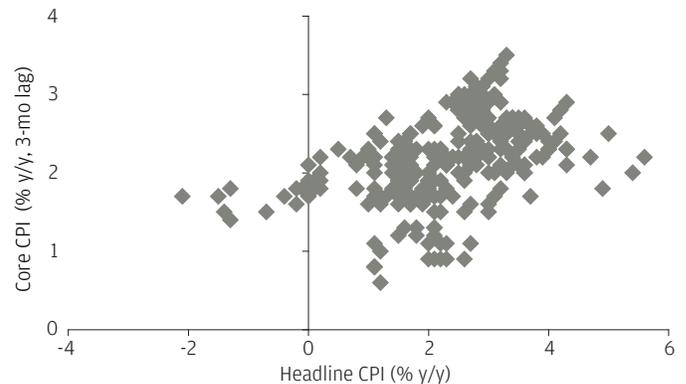
**Headline inflation shocks no longer pass through significantly to core**

Until the 1990s, U.S. headline and core inflation rates generally moved hand in hand. On the left side of Exhibit 5, the lines representing headline and core inflation rates in the 1960s, 1970s and into the 1980s are overlaid, essentially on top of each other. **EXHIBIT 7** also illustrates this idea, by comparing overall U.S. CPI inflation rates for the 1958-92 period with core inflation rates lagged three months. The strong relationship shown in the exhibit suggests that shocks to the headline inflation rate—for example, from moves in the price of oil—quickly affected prices more generally. This broadening effect likely owed to poorly anchored inflation expectations, along with formal and informal wage and price indexing in an era when workers had more collective bargaining power.

As these conditions changed with the Federal Reserve's success in cementing inflation expectations and worker negotiation power fading alongside the weakening of trade unions, the strong relationship between headline and core inflation rates disappeared. **EXHIBIT 8** shows the same headline vs. core comparison as Exhibit 7, but for the post-1993 period. During these two decades, core and headline inflation rates have displayed almost no connection. Headline inflation has remained

**Headline inflation no longer pushes core inflation around**

EXHIBIT 8: U.S. HEADLINE AND CORE INFLATION, 1993-PRESENT



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

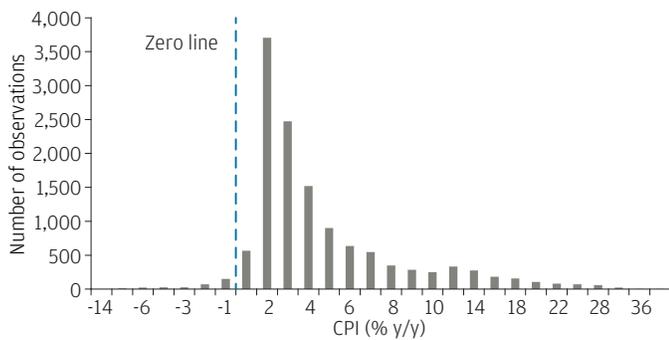
volatile, still strongly influenced by oil price swings in particular. These shocks, though, no longer pass through into the economy's broader price structure, leaving core inflation much more stable. Under these circumstances, central banks such as the Fed have grown comfortable downplaying even lasting deviations of headline inflation from their targets, as long as core inflation stays close to their goal. Put another way, the Fed no longer fears that isolated relative price changes—even in important areas such as energy—will bring significant consequences for the inflation process as a whole.

**Deflation is a rare outcome across countries and time periods**

After the collapse of oil prices starting in late 2014, simultaneous with weakness across much of the emerging market (EM) universe, fear rose sharply that the U.S. or other DM economies might slip into deflation. A look at history, though, demonstrates that deflation almost never occurs. **EXHIBIT 9** shows a strong skew toward the positive in the historical distribution of year-over-year (y/y) inflation rates across 24 DM economies, using the entire sample of available data, typically going back several decades—nearly 13,000 data points in all. Negative y/y headline inflation rates have prevailed in fewer than 7% of all observations in this large sample.

**Headline deflation is a rare outcome**

**EXHIBIT 9: 24 DM ECONOMIES' HISTORICAL CPI HEADLINE INFLATION (% Y/Y , BY FREQUENCY)**

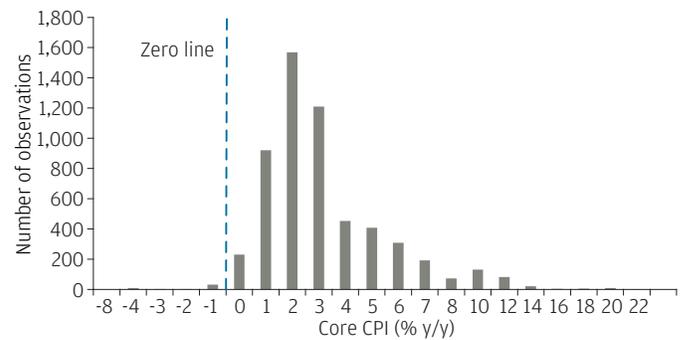


Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

For core inflation, which abstracts from the blunt-force effect of large moves in the price of oil (or, less frequently, food), negative observations happen even less often: below 5% frequency (**EXHIBIT 10**). Moreover, roughly three-quarters of these instances of negative core inflation rates have occurred in Japan and Switzerland, and many of the others happened recently in peripheral euro-area economies that were subject to severe economic shocks in a fixed exchange rate environment. Elsewhere, deflation has proven more elusive still. Indeed, the U.S. has never recorded a negative year-over-year figure since it began producing a core inflation series in the late 1950s. Other economies with floating currencies and independent central banks, such as the UK, Australia and Canada, have almost entirely avoided negative core inflation throughout history as well. Japan, which has experienced deflation, thus looks like an extreme outlier. Of course, the fact that deflation almost never has happened does not mean that it cannot, but experience suggests that deflation should be viewed as a highly unlikely outcome except under very specific circumstances.

**Core deflation has been even less common**

**EXHIBIT 10: DM HISTORICAL CORE CPI INFLATION (% Y/Y , BY FREQUENCY)**



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

### Currencies redistribute zero global goods inflation

In earlier work (see “In search of a global business cycle,” November 2015), we found a fairly limited connection between different DM economies’ inflation rates, at least for core prices. This divergence primarily reflects that services price inflation is dependent on local conditions, particularly labor markets. DM goods prices, by contrast, show somewhat stronger correlations, given highly integrated global manufacturing systems and markets. When data is not adjusted for exchange rates, the trend in core goods prices in major developed markets appears to have slowed between 2014 and 2015, during an extended period of weakness in global industry and significant spare capacity in parts of the global manufacturing supply chain (EXHIBIT 11). Core goods inflation did, though, remain above levels observed in the mid-2000s wave of globalization, and it subsequently stabilized.

At the same time, reported goods inflation rates feel significant effects from currency moves. Adjusting for currency swings produces a somewhat different picture (EXHIBIT 12) by assuming a pass-through from trade-weighted exchange rate moves, broadly proportional to each economy’s openness. In this version of the chart, the trending moves of the past seem to disappear. Broadly speaking, core goods inflation runs around zero at the global level, with big currency moves

generating price increases and decreases in individual economies. For example, the dollar’s strength beginning in mid-2014 pushed down U.S. core goods inflation, while Japan experienced the opposite effect from yen depreciation. At the moment, the UK is living through an upturn in goods inflation stemming from the sterling decline, while the dollar’s influence on the U.S. has waned.

What can we take away from these stylized facts to shape our thinking about inflation’s next phase? Three points seem particularly relevant at the moment: Core inflation tends to move slowly, it does not react to swings in headline inflation—such as the oil-generated spike currently underway—and core goods inflation remains steady around zero. These regularities point to an ongoing, gradual rise in U.S. core inflation rather than a surge. And in the euro area, where inflation has been running at a much lower level, these regularities suggest inflation is likely to remain well shy of the European Central Bank’s target. Applied to Japan, they suggest the Bank of Japan likely will also struggle to meet its 2% inflation goal, though a return to deflation seems somewhat unlikely, given the infrequency of this outcome globally (though in recent history Japan represents the major exception).

With these “naive” projections as a starting point, we will see later how much precision can be added by more sophisticated forecasting methods.

### Global goods price inflation appeared to slow in the past two years

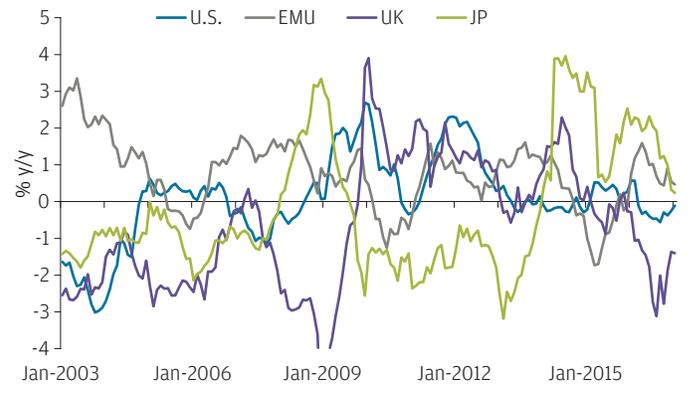
EXHIBIT 11: NON-ENERGY INDUSTRIAL GOODS (NEIG) CONSUMER PRICES (% Y/Y)



Source: J.P. Morgan Securities LLC, Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through February 2017.

### Currency moves redistribute core goods inflation

EXHIBIT 12: NON-ENERGY INDUSTRIAL GOODS (NEIG) CONSUMER PRICES WITH FX PASS-THROUGH ADJUSTMENT (% Y/Y)



Source: J.P. Morgan Securities LLC, Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through February 2017.

A QUICK LOOK AT CURRENT INFLATION TRENDS

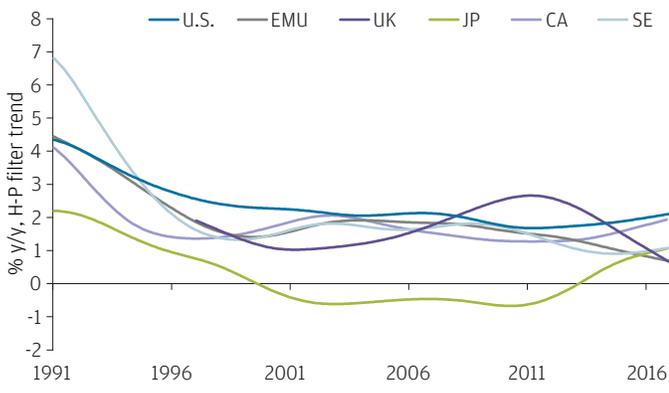
“Lowflation” is primarily a European problem

Market participants coined the term “lowflation” to describe the prevailing global atmosphere during 2014-15, when sluggish growth combined with plunging oil prices to produce unusually tame (and often negative) inflation rates across a swath of economies. With the recovery in oil prices, headline inflation in most economies has bounced, even in Europe to some degree. Core inflation, though, tells a different and less uniform story (EXHIBIT 13). It has trended lower in the euro area, Sweden and to some extent the UK, but not in the U.S. or Canada (nor in Japan). In the North American economies, core inflation has fluctuated during the past few years but without any strong tendency to make fresh lows. Japan has left behind the deflation that characterized the late 1990s and 2000s. But “lowflation” looks to be a more genuinely persistent phenomenon in Europe.

Shorter-term slices of the inflation trend suggest stabilization since mid-2015, even in Europe, and some pickup outside of the euro area (EXHIBIT 14). Nevertheless, using this sequential-trend metric, inflation continues to run below central bank targets (though only marginally in the UK). By contrast, U.S. inflation is closing in on the Federal Reserve’s 2% goal, thanks to ongoing acceleration in core services. Indeed, core CPI inflation has exceeded the 2% mark. Core PCE inflation is running below the Fed’s goal in large part because of an unusually wide gap between the two measures, a differential that seems likely to narrow in 2017.

Core “lowflation” looks like a primarily European problem

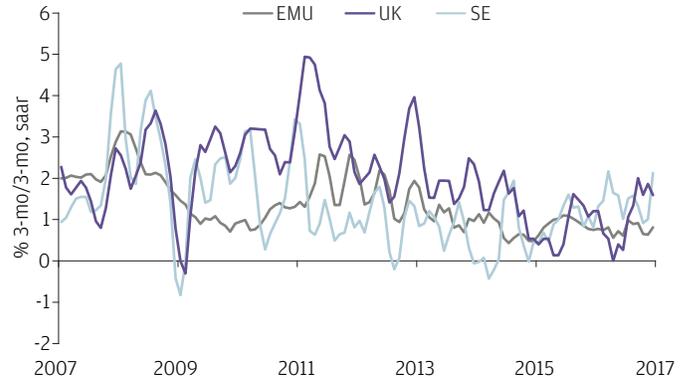
EXHIBIT 13: CORE CONSUMER PRICES (% Y/Y, HODRICK-PRESCOTT FILTER TREND)



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

European inflation has stabilized

EXHIBIT 14: CORE CONSUMER PRICES IN EUROPE, 3-MO/3-MO, SEASONALLY ADJUSTED ANNUAL RATE (SAAR)



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

HOW CAN WE FORECAST INFLATION?

One implication of the stylized facts above is that tomorrow’s inflation rate is likely to be in the vicinity of today’s. This naive, random walk-type of forecast is informative insofar as it rules out a host of extreme outcomes. However, what one would ideally like to know is: Can *additional* information be brought to bear on the trajectory of the inflation rate over the course of the next year or so?

Rounding up the usual suspects

Our first pass at answering this question surveys some commonly cited leading indicators for inflation:

- inflation expectations implied by bond markets
- economists’ projections of inflation in the near term
- measures of money supply growth

Despite the intuitive appeal of these indicators, and the possibility that they provide decent forecasts over longer time periods, none of them actually works that well at predicting inflation over short time horizons. This finding is consistent with a voluminous academic literature on the subject, in which theoretically compelling tools struggle to beat rudimentary models.<sup>2</sup>

<sup>2</sup> For a more holistic review of inflation forecast performance, see James H. Stock and Mark W. Watson, “Phillips curve inflation forecasts,” National Bureau of Economic Research, NBER Working Paper 14322 (2008), <http://www.nber.org/papers/w14322>; and James H. Stock and Mark W. Watson, “Why has U.S. Inflation become harder to forecast?” *Journal of Money, Credit and Banking* 39:1 (2007). A common theme in the academic literature is that a univariate forecast (i.e., that forecasts a variable based on lags of itself) tends to outperform an array of multi-variate models, which ostensibly add information.

For example, inflation expectations implied by TIPS are market-based, aggregating an immense amount of information embodied in the buying and selling decisions of market participants. Yet those measures do a terrible job of predicting subsequent realizations of inflation.<sup>3</sup> As illustrated in **EXHIBIT 15**, short-term fluctuations in two-year breakevens do not line up well with the direction or magnitude of changes in realized inflation over the next two years. Breakevens seem to tell us somewhat more about the underlying trends in inflation as captured by core CPI. However, even there, the oscillations of breakevens are much wider than those of actual inflation. That is because breakevens represent an inflation forecast along with various liquidity and risk premia in the TIPS and Treasury bond markets.

Another set of sources of inflation forecasts are professional economists, even though we all know that it is difficult to get a straight answer out of them. For instance, the Philadelphia Fed's Survey of Professional Forecasters (SPF) solicits inflation forecasts from about 40 professional economists each quarter.<sup>4</sup> At first glance, the SPF does a reasonably good job of forecasting core inflation one year ahead (**EXHIBIT 16**). However, it quickly becomes apparent that one reason for the SPF's success in capturing the trend in inflation is that those forecasters are observing the current rate. When forecasters project higher-frequency accelerations and decelerations, their performance is notably worse (**EXHIBIT 17**); the SPF only correctly gets the direction of the change in one-year inflation about 60% of the time, implying that those forecasters are, on average, not much better than the naive model.

And then there is the monetarist theory linking the rate of growth of the money supply with the rate of growth in inflation. That idea, formalized as the quantity theory of money in the late-19<sup>th</sup> and early-20<sup>th</sup> centuries, states that for a given level of GDP, inflation will move in proportion to changes in the supply of money.<sup>5</sup> However, the basic issue with the theory, in the context of formulating inflation forecasts, is that over time the

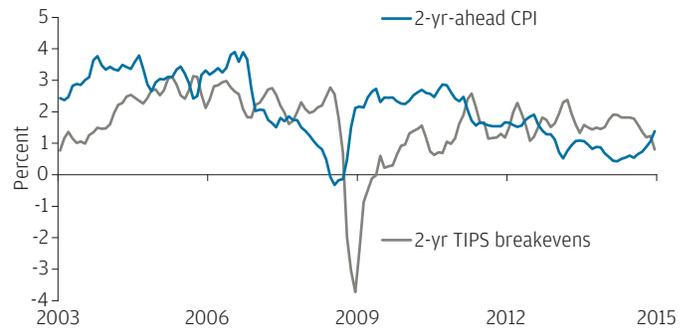
<sup>3</sup> The difference between the nominal Treasury yield and the TIPS real yield, a spread often referred to as break-even inflation, is what the market is pricing for future CPI inflation over the life of the bond.

<sup>4</sup> See <https://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters>.

<sup>5</sup> The related definitional relationship is:  $MV=PY$ , where M is the supply of money in circulation, V is the velocity of money (i.e., the frequency of usage of a unit of money for across all transactions), P is the aggregate price level, and Y is the quantity of transactions in the economy (i.e., the level of real GDP). The monetarist idea—that fluctuations in prices and output were both responding, in part, to exogenous changes in the supply of money—was perhaps advocated most vociferously by Chicago economist Milton Friedman in the 1950s. For a more detailed early treatment, see Milton Friedman, "The quantity theory of money: A restatement," *Studies in the Quantity Theory of Money*, ed. Milton Friedman et al. (University of Chicago Press, 1956).

### Breakevens do not forecast headline inflation well

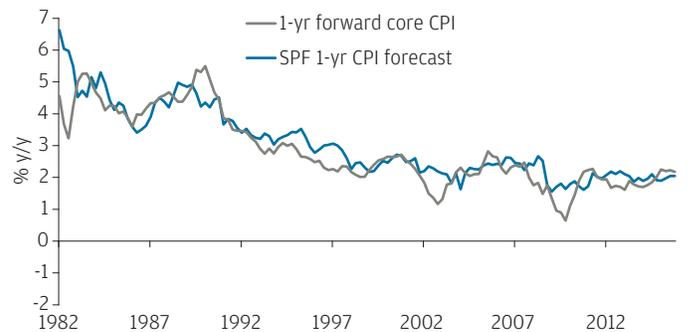
EXHIBIT 15: TWO-YEAR TIPS BREAKEVENS AND 2-YR-AHEAD CPI (%)



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

### Professional forecasters have tracked the broad trend in core inflation reasonably well

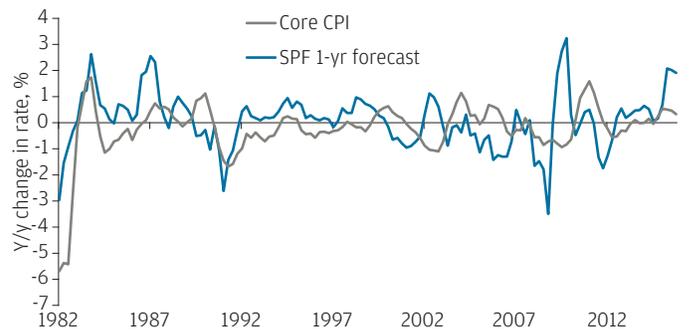
EXHIBIT 16: SPF 1-YR CPI FORECAST AND 1-YR FORWARD CORE CPI (% Y/Y)



Source: Federal Reserve Bank of Philadelphia, Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

### But forecasters have struggled with high-frequency turning points

EXHIBIT 17: ACCELERATION OF SPF 1-YR FORECAST AND CORE CPI (% Y/Y)



Source: Federal Reserve Bank of Philadelphia, Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

relationship between money and prices is highly unstable. For example, while one can see that the growth of the money supply in the U.S. and euro area is not uncorrelated with inflation rates, the proportionality of the relationship varies dramatically over time (EXHIBITS 18 and 19). At the root of the problem is that the velocity of money—the turnover of a unit of money in the economy—evolves over time in ways that are difficult to predict.<sup>6</sup> As such, the quantity theory, in practice, is difficult to operationalize as a near-term forecasting tool.

**The importance of the Phillips curve**

Where we do see the potential to add value to a naïve inflation forecast is through some version of the Phillips curve. The Phillips curve models the negative correlation between inflation and the unemployment rate. Named after economist A.W. Phillips, the idea rose to prominence in the 1950s and '60s as a description of how tightness in the labor market transmitted to higher wages and consumer prices. It was seized upon by Keynesian policymakers, who believed that they could exploit the relationship to lower unemployment rates by pursuing stim-

ulative monetary and fiscal policy (and by tolerating the higher inflation that resulted). However, the 1970s offered a famous rebuke to the Phillips curve, as inflation and unemployment simultaneously rose in the wake of large oil supply shocks.

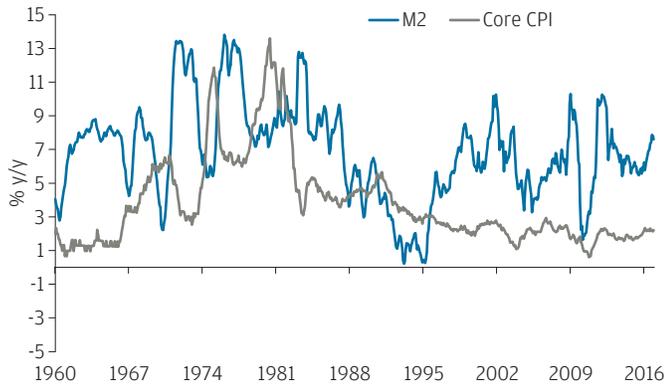
The Phillips curve endured by evolving. Its more recent incarnations relate inflation to tightness in the labor market and introduce an explicit role for inflation expectations. Inflation expectations, to the extent that they are anchored at a given level, build a degree of inertia into prices. For instance, if households and firms believe strongly that inflation will always revert to 2% in the long run, then their purchasing behavior will cause those beliefs to become self-fulfilling. Expectations were also a key ingredient in the stagflation of the 1970s. As inflation expectations rise, they stymie the trade-off between inflation and unemployment, and if they were to rise fast enough, then expansionary policy would lead only to a rise in inflation.<sup>7</sup>

<sup>6</sup> Monetarist theory holds that money velocity is a constant function of variables such as nominal income and interest rates, but the reality of the recent evolution of velocity does not seem to accord well with simple linear relationships of that sort.

<sup>7</sup> In modern versions of the model, inflation expectations shift the Phillips curve outward in the long run. So while expansionary policy can cause the unemployment rate to fall in the short run by bolstering aggregate demand, it also causes inflation expectations to rise and the curve to shift out, which pushes the unemployment rate back toward its natural rate at the new, higher rate of inflation.

**The relationship between money and inflation has fluctuated widely**

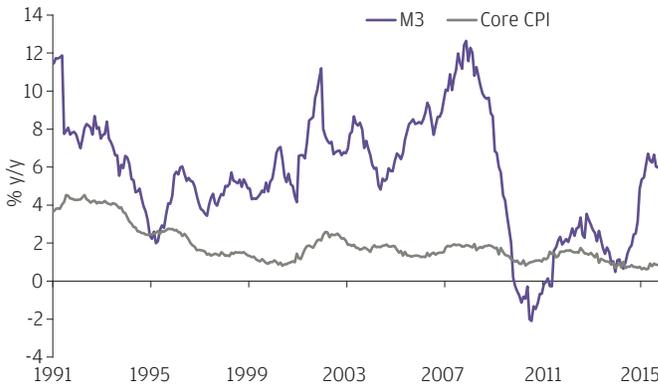
EXHIBIT 18: U.S. M2 AND CORE CONSUMER PRICES (% Y/Y)



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

**Monetary approaches to forecasting inflation have also worked poorly outside the U.S.**

EXHIBIT 19: EURO AREA M3 AND CORE CONSUMER PRICES (% Y/Y)



Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

The modern Phillips curve incorporates two components:

- The unemployment gap—a highly cyclical variable that is the difference between the unemployment rate and its long-run “natural” (i.e., full employment) rate, or non-accelerating inflation rate of unemployment (NAIRU) (EXHIBIT 20).
- A term measuring inflation expectations. And since inflation expectations can be thought of as evolving in an adaptive manner, they are often modeled as a function of lags of realized inflation.<sup>8</sup>

### The Phillips curve’s two drivers

Summing up, operationalizing the Phillips curve as a forecast entails modeling future inflation in terms of current inflation and the current unemployment gap. This way of specifying the Phillips curve model proffers the additional benefit that the inflation expectations term (today’s inflation and recent lags) is simply our old friend the naive forecast. So the basic intuition of the modern-day Phillips curve is the incremental explanatory power of the unemployment gap in addition to the naive inertial model.

The relative importance of these two facets of the Phillips curve is illustrated in EXHIBIT 21, which shows the regression estimates of U.S. core inflation for expectations (the blue bars) and the unemployment gap (the gray bars). It is evident that inflation expectations play an important role, with a 1% change in this quarter’s inflation rate translating into a roughly 0.9 ppt

increase in the rate in the next quarter. The unemployment gap has the expected (negative) sign—a tightening labor market implies a lower unemployment gap and higher inflation rate—but the magnitude of the effect is relatively small at less than -0.2 ppt for each 1% change in the unemployment gap.<sup>9</sup>

Moreover, the effect appears to be diminishing over time, with the greatest sensitivity of core inflation to the labor market in the 1970s and very muted effects ever since. This is what is meant when the Phillips curve is called relatively flat.<sup>10</sup> A common narrative explaining this shift is that the early 1980s ushered in an era of heightened central bank credibility, with Paul Volcker, who served as Fed chairman from 1979 to 1987, burnishing the central bank’s inflation-fighting credentials by tightening policy even as the unemployment rate stood at around 10%. The result was an anchoring of inflation expectations such that deviations from the central bank’s target inflation rate became more muted, even those driven by large swings in unemployment.

### Testing the Phillips curve’s forecasting ability

Having established a basic understanding of the model’s components and drivers, we now sharpen our pencils and run a battery of econometric tests on its forecasting ability, using PCE price inflation in the U.S. as a case study. The first hurdle to overcome in establishing the forecast efficacy of the Phillips

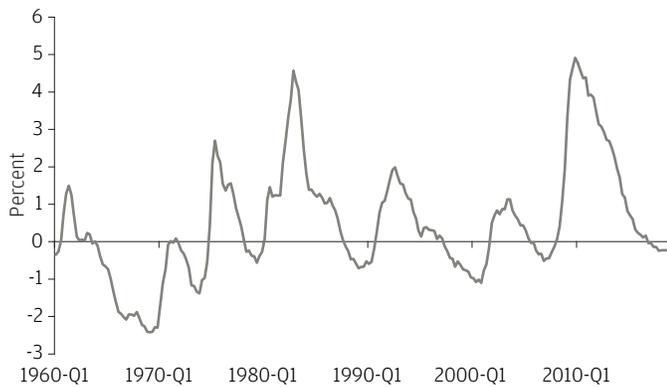
<sup>8</sup> An important caveat to this specification is that it makes it difficult to disentangle forward- and backward-looking inflation behavior.

<sup>9</sup> The explanatory power as measured by the R-squared contribution of the unemployment gap is also small, generally less than 0.1 for the regression results in Exhibit 21.

<sup>10</sup> For instance, see John Roberts, “Monetary policy and inflation dynamics,” *International Journal of Central Banking*, 2 (2006), 193-230.

### The labor market has come a long way this cycle

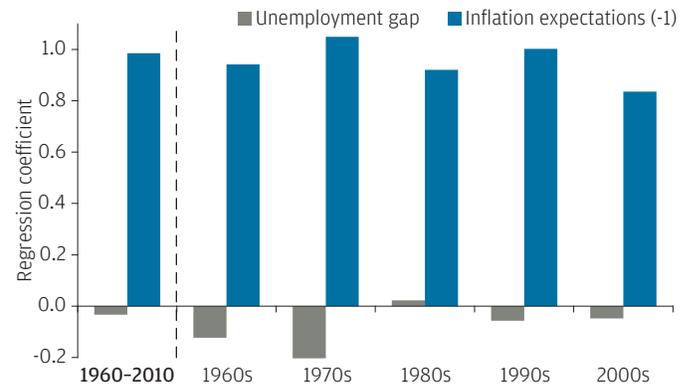
EXHIBIT 20: UNEMPLOYMENT GAP



Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

### Inertia is a dominant factor, labor market slack less so

EXHIBIT 21: ELEMENTS OF THE PHILLIPS CURVE FORECAST



Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

curve is that its performance during the financial crisis was weak: It predicted a large decline into deflation that never materialized. More generally, an ominous implication of the curve's flattening over time is that the incremental information that the labor market brings to bear on the inflation forecast appears to have dwindled.

The hypothesis that labor market information is dwindling in impact is supported by examining two instances when unemployment underwent very large swings and comparing how the swings filtered into Phillips curve forecasts of core U.S. inflation. In the first instance, in the early 1980s, a Phillips curve forecast using estimates for the 1960-19 period successfully predicted the roughly 8 ppt decline in core inflation in the subsequent few years (**EXHIBIT 22**). In stark contrast, a later estimate by the model, calibrated over the period 1987-2006 and then forecasting 2007-17, predicted a 3 ppt drop in core inflation into negative territory in the wake of the global financial crisis (GFC), a forecast flatly disproven when subsequent inflation proved to be fairly stable (**EXHIBIT 23**). Similar types of observations have led observers to ask: Is the Phillips curve dead?<sup>11</sup>

<sup>11</sup> For a review and rebuke of this question, see Robert J. Gordon, "The Phillips curve is alive and well: Inflation and the NAIRU during the slow recovery," National Bureau of Economic Research, NBER Working Paper No. 19390 (2013), <http://www.nber.org/papers/w19390>.

## Reports of its demise are greatly exaggerated

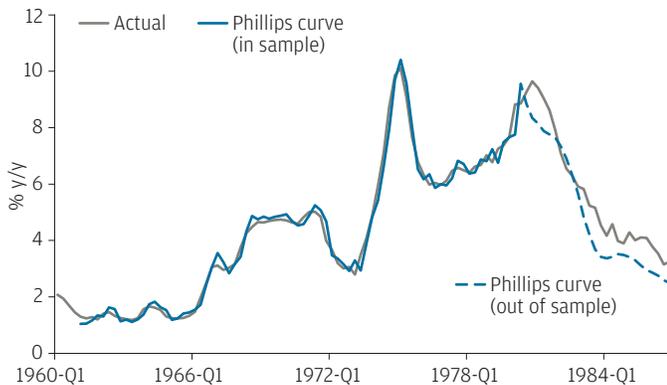
Our contention here is that the Phillips curve relationship is still intact, even if it has been somewhat obfuscated at the level of the overall core PCE price index. The empirical relevance of the relationship can be demonstrated in several different ways. For one, it works much better at forecasting services prices—which are more directly tied to local labor market conditions—than goods prices, which are driven to a greater extent by factors affecting the global manufacturing complex. When we do an out-of-sample forecasting exercise<sup>12</sup> analogous to the one in Exhibit 23 (i.e., estimating the model for the period 1987-2006 and then making a forecast using the unemployment gap in the subsequent period as an input), the Phillips curve forecast for durable goods inflation predicts a sharp decline in 2009, even as prices remained fairly stable (**EXHIBIT 24**, next page). However, it did a reasonably good job—in predicting a 2 ppt decline for services inflation—forecasting the actual decline in services prices and their slow recovery (**EXHIBIT 25**, next page).

The observation that the Phillips curve works better for services prices accords with the intuition that the unemployment rate, and other gauges of local labor market conditions, are more tightly connected to the prices of outputs for which labor is a greater share of input. This point is reinforced by looking in

<sup>12</sup> In statistical tests of models' forecast performance, data sets are commonly split into an in-sample period, used for the initial parameter estimation and model selection, and an out-of-sample period, used to evaluate forecasting performance.

### The Phillips curve worked well in the early 1980s ...

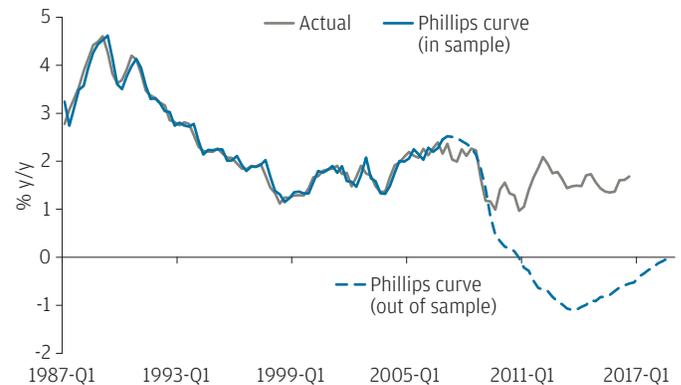
EXHIBIT 22: THE PHILLIPS CURVE IN THE 1980s



Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

### ... today, not so much

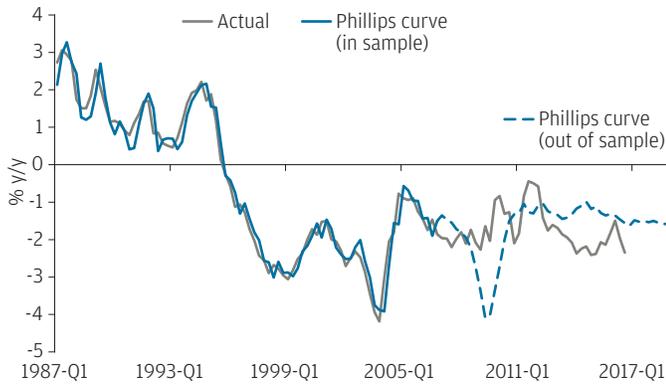
EXHIBIT 23: THE PHILLIPS CURVE POST-GFC



Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

A lot of the post-GFC forecast miss was driven by goods prices ...

EXHIBIT 24: THE PHILLIPS CURVE FOR DURABLE GOODS



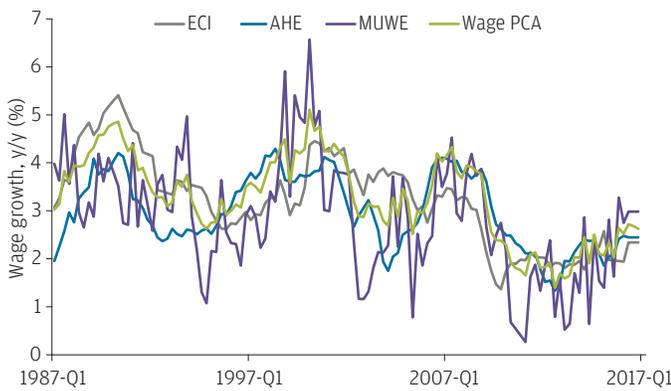
Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

more detail at particular subsectors of the economy: The Phillips curve's forecast errors were generally lower for service industries than for goods. And within the subset of services industries, forecast errors were the lowest—i.e., the Phillips curve performed the best—for sectors most closely linked to local conditions (such as food, accommodation, recreation and housing). For services sectors with a more global profile, including finance and transport, and those more tightly regulated (health care and again finance), the forecasts performed less well.

We can further test the idea that the Phillips curve works better the closer one gets to the labor market by trying to forecast the movement of wages rather than output prices. An

Wages are staging an incipient comeback

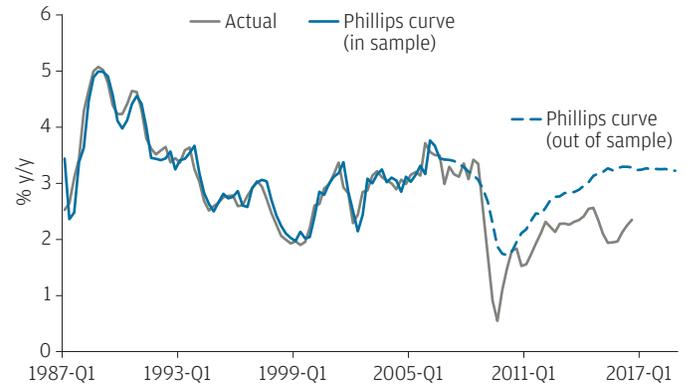
EXHIBIT 26: AGGREGATE MEASURE OF U.S. WAGES



Source: Bureau of Labor Statistics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

... while services forecasts did much better

EXHIBIT 25: THE PHILLIPS CURVE FOR SERVICES



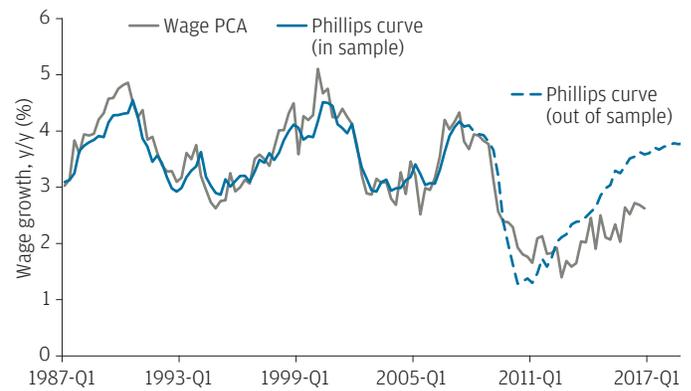
Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

array of wage measures is used to gauge labor compensation, with each measuring something slightly different.<sup>13</sup> Taking the first principal component (i.e., a statistical estimate of comovement across variables) of some of the most commonly used ones gives a decent sense of the general trajectory of wage growth (EXHIBIT 26). The wage Phillips curve's forecast performance is reasonable, capturing the depth of the wage deceleration during the Great Recession and the slow recovery afterward (EXHIBIT 27).

<sup>13</sup> The set that we consider here includes the employment cost index, average hourly earnings and median usual weekly earnings. Wage PCA denotes the first principal component of these three series.

The closer to the labor market, the better the model works

EXHIBIT 27: THE PHILLIPS CURVE FOR WAGES

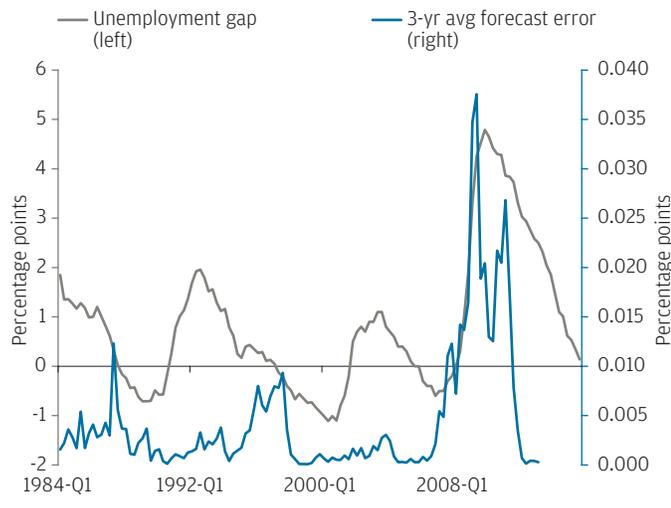


Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

We conclude our exploration of the Phillips curve as an inflation forecast with the observation that the model tends to work best in extreme states of the business cycle. That is, the connection between labor market slack and output prices is more pronounced when there is either a lot of slack or very little slack in the economy. That tendency is evident in **EXHIBIT 28**, which shows that the Phillips curve forecast error is closest to zero when the unemployment gap is near its extremes. In contrast, it is exactly when unemployment is close to its natural rate (i.e., when the gap is close to zero) that forecast errors spike. It is thus somewhat murky in the middle of the business cycle: In the absence of strong directional signals from the labor market, the efficacy of the Phillips curve moderates.

**Performance is also better when the labor market is at its extremes**

**EXHIBIT 28: PHILLIPS CURVE FORECAST ERRORS**



Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

**Supply shocks and inflation forecasting**

We have established that an inertial process with elements of labor market tightness forms a reasonable fundamental basis for a core inflation forecast. However, such a forecast abstracts U.S. inflation from a host of supply-side factors, such as productivity growth and others that affect the terms of trade (including oil price shocks, changes in currency value and trade policy). While it is difficult to predict innovations in these areas with any degree of confidence, we note that their influence on inflation generally has a mean-reverting quality. That allows us to augment our inflation forecast based on how they are evolving at present.

**Factoring in oil prices, the dollar and trade policy**

The rapid appreciation of the dollar and steep declines in global oil prices in 2014 and 2015 served to depress U.S. inflation below what the Phillips curve framework would have suggested. After the growth of these factors stabilized—as it inevitably did, given plausible assumptions about bounds on the level of oil prices and the dollar—the corresponding drag on U.S. inflation subsided. To pinpoint the exact dynamics of that process is difficult, but there are some handy rules of thumb available. Recent estimates suggest that following a 10% appreciation of the dollar, U.S. import prices decrease about 1 ppt in that quarter and an additional 2 ppt over the next year, with little, if any, subsequent decreases.<sup>14</sup> So the pass-through of the 10% broad dollar appreciation since mid-2016 will continue to put mild downward pressure on core inflation over the course of 2017, with more recent dollar softening partially offsetting the effect.

Trade policy may also play a role in buffeting U.S. inflation in the near to medium term. Specifically, the tack of the new U.S. administration toward a more cloistered international trade stance—whether by targeting offshoring firms, implementing border taxes or simply not participating in new free trade agreements—is likely to feed through into a higher level for domestic prices and a temporary bout of inflation as prices adjust. The channels through which trade policy transmits to inflation are varied. While tariffs and other border adjustment taxes directly increase import prices for those goods and services subject to the tax, which then pass through to final goods prices, there is also upward pressure on the prices of import-competing domestic firms, which face less competitive pressure. Moreover, unlike the slow build of labor market tightness on prices, the effect of trade restrictions would show up in inflation in relatively short order.

**WHAT TO EXPECT: INFLATION THROUGH 2018**

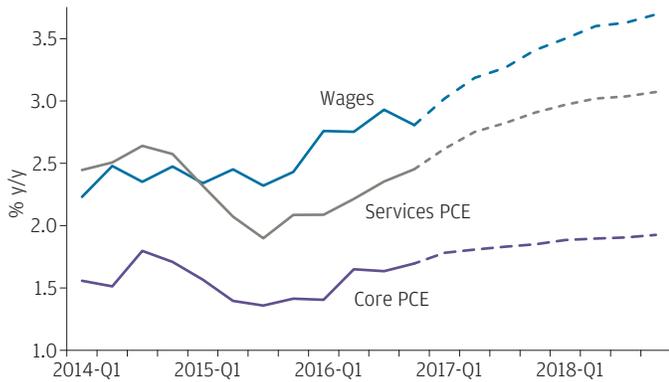
Our baseline outlook is for inflation to gradually grind higher over the next two years, as labor market tightness continues to apply upward pressure and with supply-side factors, if anything, likely pushing in the same direction. The basis for this forecast is the Phillips curve.

<sup>14</sup> For example, see Etienne Gagnon, Benjamin R. Mandel and Robert J. Vigfusson, “Missing import price changes and low exchange rate pass-through,” *American Economic Journal: Macroeconomics* 6(2) (2014): 156-206.

**EXHIBIT 29** shows Phillips curve estimates for wages and prices through 2018, as implied by a continued decline in the unemployment rate to 4.5% over that period. The first noteworthy observation is that core PCE inflation ends 2018 at exactly 2%, so the FOMC's inflation target is coming into closer view.

**Our forecast: Inflation continues to rise, led by wages and services**

EXHIBIT 29: PHILLIPS CURVE FORECASTS THROUGH 2018



Source: Bureau of Labor Statistics, Congressional Budget Office, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

Another feature of the forecast is that where the Phillips curve has its greatest explanatory power, for services and wages, prices are expected to accelerate even more rapidly. With services inflation expected to rise by ~50 basis points and wages by ~90 basis points through 2018, both series are expected to break out above their post-crisis ranges. Again, we see little reason to worry that this change will ignite a wage-price dynamic that spirals out of control. Rather, a long-awaited normalization in U.S. domestic prices—relative to their recent growth and relative to what fundamentals would suggest—appears to be underway.

In terms of the influence of supply-side factors, the large changes in oil prices and the dollar that have roiled U.S. inflation since 2014 have almost entirely passed through the system. While it is generally difficult to say what volatility lies in wait for commodity prices, at the moment we are not seeing the types of large distortions that would significantly skew our two-year inflation outlook. Oil prices have found a new trading range around \$45 to \$55 per barrel, and global supply-demand dynamics seem more supportive than they have been for some time. We also anticipate that the dollar will be supported near current

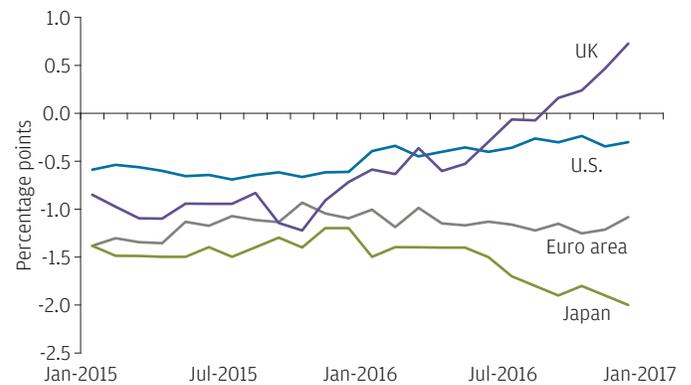
levels by solid economic performance, Fed normalization and the nature of international spillovers from U.S. fiscal policy. However, we do not see the ingredients appearing for an additional surge in dollar strength, given the relative pickup in the growth of economies outside the U.S. and with foreign central banks slowing their easing programs. All in all, the risks to our outlook from oil prices and the dollar are roughly in balance.

Where we do see scope for near-term upside shocks to inflation is via the U.S. international trade stance. Trade policy may well instigate a temporary boost to inflation, either through import tariffs or as a side effect of corporate tax reform, provisions of which could include border adjustment taxes likely to look like tariffs in the near term. We view the possibility of protectionism as broadening out the Phillips curve-type dynamics described above. Since the overall U.S. trade deficit is accounted for entirely by goods, while services trade is a non-trivial surplus, a new, tariff-induced uptick in goods prices would mirror upward labor market pressures on services prices.

Such a shift in U.S. trade policy would also reinforce the pattern of inflation dispersion already firmly entrenched across major DM economies. Economic theory suggests that when large economies implement tariffs, prices are depressed elsewhere; in this case, such a policy would boost the relative U.S. inflation rate. As illustrated in **EXHIBIT 30**, the U.S. is already among the leaders in inflation normalization, with its inflation gap steadily narrowing since 2015. In contrast, the euro area and Japan have seen stasis or even deterioration in inflation vs. their respective targets; inflation has accelerated notably in the UK, but mostly

**Inflation is a mixed bag across developed markets**

EXHIBIT 30: G4 INFLATION GAPS



Source: Haver Analytics, J.P. Morgan Asset Management Multi-Asset Solutions; data through December 2016.

due to the transient effects of recent currency depreciation. These observations provide important context for our inflation outlook, highlighting that the U.S. is at the vanguard in global reflation. We also note that today's synchronized upturn in inflation may yet be subject to the same inertial forces suppressing inflation outside of the U.S.

## INFLATION'S NEXT PHASE: ASSET CLASS IMPLICATIONS

The upswing in U.S. inflation and its pricing in markets present somewhat of a Rorschach test for investors. Some see a long-awaited normalization while others see something close to apocalyptic. Our interpretation aligns more closely with the former, as we view the gradual grind higher in U.S. core inflation as part and parcel of a reflating global economy. The rebound in the market pricing of inflation additionally reflects a growing awareness that the balance of inflation risks has materially improved from its post-crisis deflationary skew. If we are correct that developed market economies are experiencing a broad and synchronized rise in inflation, the breadth would further support the shifting balance.

Our expectation of a persistent, upward inflation trajectory implies that many reflationary trades will continue to work. One of the most direct manifestations of rising inflation is in duration and, specifically, its effect on inflation pricing in the Treasury market. Inflation expectations implied by 10-year breakevens have staged a remarkable recovery over the last 12 months, rising to about 2% after touching 1.2% in February 2016. Outside of recessions, that tenor of breakevens typically resides around 2.0%-2.5%, implying some further room to run as inflation closes in on, and even exceeds, its long-run rate. Moreover, in line with our observation that the oscillations of breakevens tend to be wider than those of actual inflation, there is probably some scope for breakevens to overshoot as the economy reflates.

The assertion that inflation pricing will continue to rise relies on two ancillary premises: (1) that the U.S. does not slip into recession through 2018, which would almost certainly cause breakevens to plunge; and (2) that the inflation-risk premium component of breakevens continues to normalize. We are fairly comfortable with the view that there will be no near-term recession, insofar as the economy is on an even keel and, by our estimation, the cycle is only now beginning to transition into its late stage. The trajectory of the inflation risk premium

is more difficult to quantify, since its movements can't be precisely distinguished from the underlying inflation forecast embedded in breakevens. But, again, our analysis suggests that inflation will be priced more aggressively by markets than underlying expectations are buffeted around (i.e., that changes in the inflation risk premium tend to be more amplified than changes in inflation expectations).

The way inflation pricing is passed through to equity and credit returns is a more nuanced phenomenon, in which the level of inflation matters a lot. Starting from the premise that corporate profits rise with nominal growth, higher inflation is a positive influence on earnings, creditworthiness and both equity and credit prices. Indeed, to the extent that inflation rising from low levels signals slimmer chances of a deflationary and/or recessionary funk, credit would benefit disproportionately. As inflation rises further and deflationary fears become even less pronounced, upside risks begin to outweigh the ebbing downside risks to profits, and equities reap the benefits.

Of course, both of these arguments reach their limit when inflation hits too high a level and asset valuations erode as a result. The example etched in many investors' minds is the experience of 1973-74, when year-on-year CPI inflation rose by 10 ppt and the S&P 500 index fell by almost 50%. In this regard, our analysis suggests that inertia has its benefits. The slow-moving nature of inflation we have documented, and the fact that the U.S. is still somewhere in the lower or middle portion of the inflationary spectrum, suggest that inflation remains in a supportive range for risk assets. And the underpinning for that inertia—the anchoring of inflation expectations by monetary policy—has remained intact since the mid-1980s.

We conclude with a caveat: that a strong reaction by monetary policymakers could, in principle, derail the transmission of inflation into asset prices. The main sources of uncertainty are how aggressively the Federal Reserve may tighten policy in response to rising inflation and how smoothly any changes are made. Our read of the Fed's behavior is that its members have a strong desire to get policy normalization underway and to ward off an overheating economy, but that they seem to feel little urgency at this moment to stymie inflationary pressures. The momentum in core inflation is not dramatic by any means, and the degree of overheating in the labor market (and the natural rate of unemployment in particular) is subject to some measurement uncertainty. So while policy normalization will progress, along with reflation, policymakers are unlikely to remove the punch bowl in a hurry.

## INVESTMENT INSIGHTS

## J.P. MORGAN ASSET MANAGEMENT

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