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Inflation indicators amid high uncertainty

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Inflation indicators amid high uncertainty

Key takeaways

- *In a low-inflation regime, inflation is driven largely by sector-specific price changes, with little effect on price- and wage-setting decisions. Core inflation measures tend to provide more accurate signals than headline measures do. The opposite holds in a high-inflation regime, when price changes become more synchronised across sectors and become more salient to workers and firms.*

- *Several inflation indicators using more detailed information can shed light on the future course of inflation. However, their usefulness depends on the prevailing inflation regime. They become particularly unreliable during transitions between regimes. Indicators based on mean reversion fare especially poorly.*

- *There are signals that can help to detect an ongoing transition: drifting inflation expectations, an increase in sectoral price co-movements and spillovers, and a rising pass-through from wages to prices and vice versa. Current readings of such indicators send mixed signals on whether a transition to a high-inflation regime is under way.*

Introduction

Inflation has risen sharply since 2021 in most economies. At first, higher inflation was concentrated in a few sectors, reflecting mainly supply bottlenecks, rising energy prices and the substantial policy response to the pandemic. But inflation has since broadened, also affecting stickier services prices, such as rents. The broadening of inflation has prompted concerns that economies could be shifting from a regime of low and stable inflation to one where inflation is higher and more volatile.[1]

When faced with a possible transition to a high-inflation regime, central banks need to act decisively to head it off. But calibrating the appropriate response requires taking a stance on the inflation outlook. Predicting inflation, its turning points and possible transitions across inflation regimes calls for a sound understanding of inflation drivers ("diagnosis") and accurate and timely indications of its future evolution ("prognosis"). A key challenge is that the forecasting performance of the available indicators depends on the prevailing inflation regime.

This Bulletin sets out a taxonomy of inflation indicators, describes their characteristics and examines their forecasting capabilities, notably when uncertainty is high or an inflation regime shift is likely.

A taxonomy of inflation indicators

Several indicators can be used to take the pulse of inflation (Table 1). Each has strengths and weaknesses.

The first set of indicators comprises changes in a variety of price indices. One is current inflation itself. Headline price indices reflect broad price changes as experienced by the population. Narrower measures (such as core and trimmed inflation) exclude the most volatile items (eg food and energy) and may shed

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[1]   For a characterisation of low- and high-inflation regimes, see BIS (2022).

light on the persistence of underlying inflationary pressures. Survey-based measures of firms' pricing decisions (eg purchasing managers' price indices) are useful due to their timeliness and easy availability.

The second set of indicators considers inflation from a more granular, sectoral perspective. These have several uses. Examining sector-specific price changes helps to identify their common component, which is in itself a measure of underlying inflation. Measures of price change similarity across sectors can also give a sense of the breadth of inflation. And understanding cross-sectoral price spillovers highlights interdependencies, eg upstream price changes that may later affect the prices of final goods and services.

A taxonomy of inflation indicators				Table 1
Indicator	Timeliness	Informativeness on drivers (diagnosis)	Forecasting ability (prognosis)	Robustness to regime shift
1. Current inflation, incl. core measures	High	None	Often hard-to-beat benchmarks	May reflect an ongoing regime shift
2. Granular measures (eg price similarity, spillovers)	Generally high	Mostly suggestive	Unknown	Greater commonality may signal turning points/regime shifts
3a. Expectations: markets-based	Very high	None	Good but can also incorporate shifts in risk appetite	Changes in the distribution may help predict a regime shift
3b. Expectations: survey-based	Generally low	Relevant, esp. under unanchored expectations	Good but might come with biases	Looking at the full distribution may reveal signs of a shift
4a. Models: Time series	Very high	Limited	Typically good	May be unstable around regime shifts
4b. Models: (semi)-structural	Low	High	Varies	Low

The third set includes measures of inflation expectations. Expectations based on financial prices are timely but can reflect (time-varying) risk and liquidity premia. Those of households and firms capture the views of the agents who actually set wages and prices but are survey-based and tend to be less timely and more limited in their coverage. The expectations of professional forecasters incorporate a richer information set, but tend to track central bank forecasts, so that they add relatively little value.

The fourth set includes model-based indicators. Models building on purely statistical approaches, such as those relying on large data sets, can provide a real-time assessment of inflation as different indicators become available.[2] That said, their forecasting performance deteriorates at longer horizons. Models imposing economic relationships ("structure") on the data allow an economic interpretation of inflation drivers and can improve in-sample fit but they often forecast poorly and are typically not very timely. Indeed, it is hard to find fully fledged models that beat parsimonious benchmarks, such as random walks, autoregressive specifications, or even the inflation target itself.[3]

Inflation indicators across inflation regimes

The relative performance of inflation indicators depends on the prevailing inflation regime and on the likelihood that the economy will be transitioning across different regimes. In a low and stable inflation regime, inflation tends to fluctuate in a narrow corridor around the central bank's target and is driven largely by idiosyncratic movements in sector-specific prices. Agents typically pay little attention to headline inflation, so that it does not significantly affect their behaviour or their price and wage-setting

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[2]　Using nowcasting models for the euro area, Modugno (2013) finds that commodity price changes yield good predictive power at short horizons.

[3]　See Atkeson and Ohanian (2001) and Diron and Mojon (2008).

decisions.[4] In such a regime, broad indicators (eg headline inflation) that embed volatile prices tend to be a poor guide to future inflation. Narrower measures, such as core and trimmed mean inflation, provide more precise signals.

In a high-inflation regime, price changes are more synchronised. As headline inflation becomes more representative of sectoral price changes, agents become increasingly sensitive to it. The strong response of inflation to movements in individual "salient" prices, which receive greater public attention, erodes its mean-reverting properties. More volatile indicators may perform better in this regime. This is because inflation itself more closely reflects sectoral price changes and becomes the focal point of attention for agents. As it does so, more volatile and salient price changes (eg in energy and food prices, or exchange rates) may reveal the near-term direction of inflation and its expectations. When price changes become more persistent, the performance of models that embed mean reversion can deteriorate substantially.

Navigating transitions across inflation regimes

It is during a potential transition from a low- to a high-inflation regime that authorities face the toughest challenge in interpreting inflation indicators. Models tend to predict poorly during transitions because the economic relationships on which their forecasts are based are changing.[5] Importantly, this also affects the forecasts' long-run endpoint, as most models are mean-reverting. Models generally forecast a reversion towards a long-run average and show a tendency to over- or undershoot inflation when actual inflation readings persistently deviate from targets.

Recent experience confirms that mean-reverting models struggle to recognise a possible transition in real time. A simple exercise compares the forecast errors of a mean-reverting model (autoregressive) with those of a non-mean-reverting one (random walk) over six-month horizons. The ratio of these forecast errors is a measure of the relative forecasting performance of the two models (Graph 1, left-hand and centre panels, red line). When the ratio is above one, the mean-reverting model provides, on average, smaller errors, ie its performance is superior. This was the case amid the high volatility of the first months of the pandemic. But in 2021, as inflation rose, forecasts of a reversion to historical averages proved increasingly wrong. The ratio progressively declined until it fell below one at the end of the year, meaning that the random walk model performed better.

Admittedly, using an autoregressive model to forecast inflation is simplistic. Richer models can better characterise inflation dynamics and persistence. For example, state-of-the-art macroeconomic models of the dynamic stochastic general equilibrium (DSGE) family not only provide insights about the nature and the transmission of the underlying inflationary shocks, but also provide useful (albeit mean-reverting) forecasts.[6] All in all, these models have proved more accurate than the no-change forecast provided by a random walk, although even their relative performance deteriorated as inflation increased (Graph 1, left-hand panel, blue dots). Central banks' inflation projections augment model-based forecasts with expert judgment, allowing the speed of mean reversion to be smoothed out based on the nature of the underlying inflation drivers. For instance, the ECB's staff projections managed to keep a consistent advantage over a random walk throughout 2021, although their relative performance deteriorated swiftly in 2022 (centre panel, blue triangles).

Structural models that incorporate underlying economic mechanisms hold the potential promise of shedding light on the relative importance of the different inflation drivers (Graph 1, right-hand panel). This information can be a useful guide to the likely persistence of inflation, as well as the optimal policy response. For example, in the case of the United States, a DSGE-based decomposition attributes the bulk of the recent inflation surge to "cost-push" factors and, to a lesser extent, to wage shocks. Unfortunately,

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[4] A low and stable inflation regime is consistent with Volcker's concept of price stability (Volcker (1983)), where "expectations of generally rising (or falling) prices over a considerable period are not a pervasive influence on economic and financial behavior".

[5] For example, ECB (2022) provides an evaluation of ECB inflation projections, explaining the underestimation of inflation since 2021 in terms of exceptional developments, such as unprecedented energy price dynamics and supply bottlenecks.
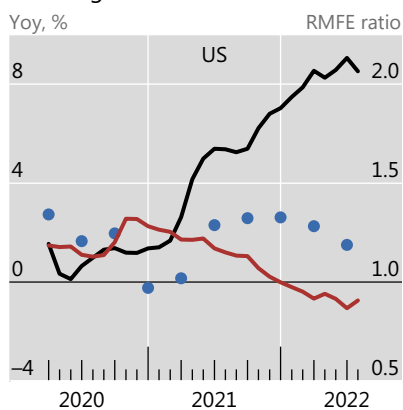
[6] See Del Negro and Schorfheide (2013).

the usefulness of these insights hinges on the correct specification of the model. As such, their usefulness is likely to diminish during a possible inflation regime shift, unless the model explicitly accounts for the possibility of such a shift.

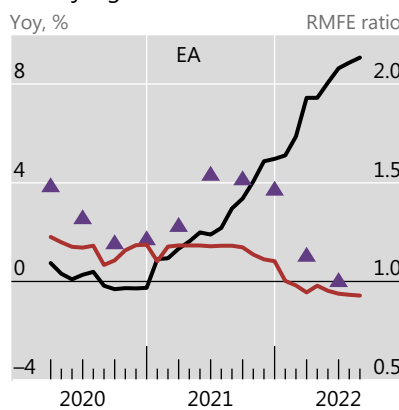The performance of mean-reverting models deteriorates in a transition   Graph 1

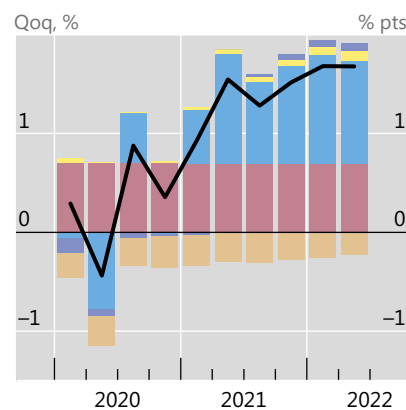Forecasting performance of mean-reverting models deteriorates...

...when inflation picks up, even when some judgment is embedded

Full-fledged models however can better trace the sources of inflation[5]

Lhs:
— Inflation[1]

Rhs: Ratio of root mean forecast error (RMFE):
● RW vs DSGE[2]

— RW vs AR[3]   ▲ RW vs official[4]

Lhs:
— Inflation[1]

Rhs: Contributions:
■ Constant
■ Cost push
■ Monetary policy
■ Wages
■ Other

[1] For the US, personal consumption expenditure (PCE) inflation.   [2] Ratio of the cumulative RMFE of two-quarters-ahead inflation (year-on-year) forecasts based on RW to that of a DSGE model similar to Smets and Wouters (2007).   [3] Ratio of the cumulative RMFE of six-months-ahead inflation (month-on-month annualised rate) forecasts based on random walk (RW) to that of an AR(1) model (estimated over Jan 2010–Dec 2019).   [4] Ratio of the cumulative RMFE of two-quarters-ahead inflation (year-on-year) forecasts based on RW to that in ECB/Eurosystem's macroeconomic projections.   [5] As per footnote 2, also based on a DSGE model similar to Smets and Wouters (2007).

Sources: Board of Governors of the Federal Reserve System; ECB; Datastream; BIS.

Measures of inflation expectations can shed light on agents' perception of possible regime shifts. For household and firm expectations, part of their information content reflects the fact that they are an input for wage- and price-setting. Regardless of the expectations indicator, utilising the whole distribution rather than just its mean (average) or mode (most likely outcome) can yield additional insights. Measures of the tail (more extreme outcomes), in particular, may signal heightened risk that changes in price and wage setting will conspire to entrench high inflation. Labour market indicators, such as variation in the sensitivity of prices to wages (and vice versa), may also signal that a transition is under way.

Granular inflation measures can also offer useful signals of an ongoing transition. This is because a transition involves an increasingly broad base of price changes, ie price increases may spread more widely across sectors and the corresponding spillovers become stronger. Indicators such as the proportion of prices growing above the inflation target or the degree of commonality across sectoral price changes can thus reveal whether transition risks are rising or receding. And, since a transition requires changes in headline inflation to persist, indicators pointing to price increases in large CPI components characterised by a high degree of price rigidity, eg rents, can signal the risk of a persistent increase in inflation.
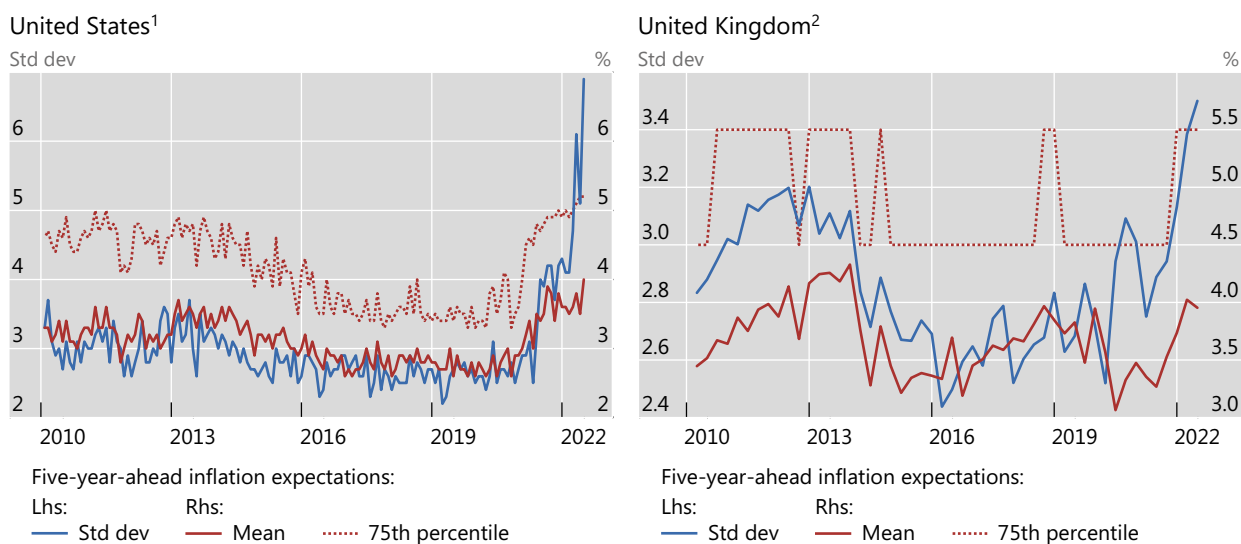
What do inflation indicators say on the likelihood of a transition?

Current readings of key indicators yield mixed signals regarding whether a transition to a high-inflation regime is under way. Measures of long-run inflation expectations show few signs of dramatic changes in price and wage formation down the road. Survey-based measures of households' long-run inflation

expectations have drifted upwards by only about 100 bp over their unusually low pre-Covid levels, and have recently stabilised – at least in the United States – on the back of tighter monetary policy (Graph 2, left-hand panel). That said, the variance and some measures of the tail thickness of households' expectations have increased – as they did in the early 1970s – and by more than the mean, signalling growing uncertainty and unease among some survey respondents.

Long-run inflation expectations have increased only moderately   Graph 2

United States[1]

United Kingdom[2]

Five-year-ahead inflation expectations:
Lhs: Rhs:
— Std dev   — Mean   ⋯⋯ 75th percentile

Five-year-ahead inflation expectations:
Lhs: Rhs:
— Std dev   — Mean   ⋯⋯ 75th percentile

[1] Based on University of Michigan's Surveys of Consumers.   [2] Based on Bank of England's quarterly survey of public attitudes to inflation.

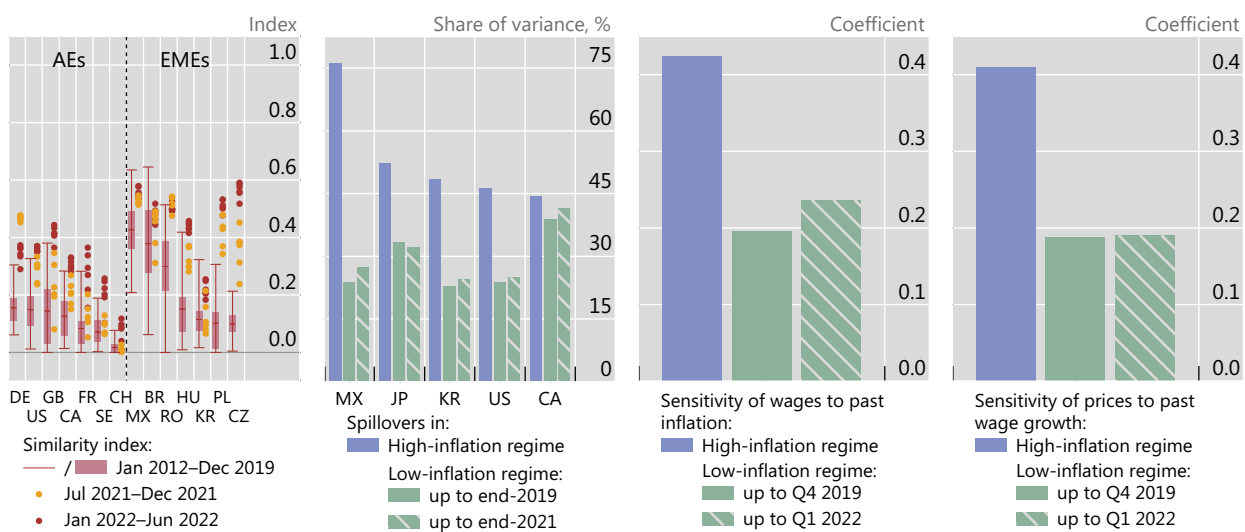Sources: Bank of England; University of Michigan; BIS.

Other indicators show a broadening of inflation over the past year. Recent readings of an index of price change similarity are out of line with their historical distribution during the low-inflation years (Graph 3, first panel). Indices of total price spillovers across sectors are also ticking higher (except for Japan) when the most recent observations are included in the estimation sample (second panel), although they are still far from previous high-inflation readings.

Signs that higher inflation is feeding into higher wages, and vice versa, are more reliable clues of an ongoing transition.[7] Based on data available to date, wage growth has varied more than inflation across countries. Nominal wage growth has picked up noticeably in Germany, Korea and the United States, but less so in Canada, Japan and the Netherlands. The most recent estimates of the coefficients of simple wage and price equations are not statistically different from what they were pre-Covid (Graph 3, third and fourth panels), when pass-through was moderate. That said, as wage negotiations are typically staggered, demands for persistent increases to compensate for past purchasing power losses may appear with a considerable lag. By the time they become evident, the transition may be well under way.

Faced with a possible transition to a high-inflation regime, central banks have little choice but to act forcefully. Calibrating the appropriate response is complicated by the fact that, as uncertainty about the current inflation regime rises, forecasts and indicators of the inflation outlook become less reliable. And formulating a diagnosis on the drivers of inflation becomes more problematic, as models typically provide answers conditional on being in each regime. Amidst heightened uncertainty, central banks may benefit from monitoring a battery of inflation indicators, while being mindful of their individual shortcomings. Nonetheless, at these times, judgment and a balanced awareness of the different risks comes at a premium.

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[7]   See also Boissay et al (2022).

Current indicators provide mixed signals on a transition to high-inflation regime[1]

Graph 3

Sectoral price changes become more similar...[2]

...and sectoral price spillovers increase[3]

Sensitivity of wages to past inflation mildly higher...[4]

... while that of prices to past wage growth is stable[4]

Similarity index:
— / ▨ Jan 2012–Dec 2019
• Jul 2021–Dec 2021
• Jan 2022–Jun 2022

Spillovers in:
■ High-inflation regime
Low-inflation regime:
■ up to end-2019
▨ up to end-2021

Sensitivity of wages to past inflation:
■ High-inflation regime
Low-inflation regime:
■ up to Q4 2019
▨ up to Q1 2022

Sensitivity of prices to past wage growth:
■ High-inflation regime
Low-inflation regime:
■ up to Q4 2019
▨ up to Q1 2022

[1] See online appendix for details.   [2] Similarity index based on Mink et al (2007), with higher numbers indicating great similarity of price changes at each point in time. Box plots show mean, minimum, maximum values and interquartile range.   [3] Share of the variance of sectoral price changes explained by shocks to prices in other sectors over a horizon of 12 months, see Lombardi and Zakrajšek (2022).   [4] Based on quarterly data for AU, BE, CA, DE, DK, ES, FR, GB, IE, IT, JP, NL, SE and US.

Sources: Board of Governors of the Federal Reserve System; FRED; OECD; World Bank; CEIC; Datastream; national data; BIS.

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