CHAPTER 2

INFLATION SCARES

Since the beginning of 2021, headline consumer price index (CPI) inflation has increased in advanced and emerging market economies, driven by firming demand, input shortages, and rapidly rising commodity prices. Despite large uncertainty about the measurement of output gaps around the pandemic, a significant relationship remains between economic slack and inflation. Long-term inflation expectations have stayed relatively anchored so far, with little evidence that recent exceptional policy measures have de-anchored those expectations. Looking ahead, headline inflation is projected to peak in the final months of 2021, with inflation expected back to pre-pandemic levels by mid-2022 for both advanced economies and emerging markets country groups, and with risks tilted to the upside. Long-term inflation expectations are projected to remain anchored in the baseline forecast. Given the recovery's uncharted nature, considerable uncertainty remains, particularly relating to the assessment of economic slack. Prolonged supply disruptions, commodity and housing price shocks, longer-term expenditure commitments, and a de-anchoring of inflation expectations could lead to significantly higher inflation than predicted in the baseline. Clear communication, combined with appropriate monetary and fiscal policies tailored to country-specific contexts, however, could prevent "inflation scares" from unhinging inflation expectations.

Introduction

Headline inflation has risen rapidly in advanced economies and emerging market and developing economies since the beginning of 2021, though it has been relatively stable in low-income countries (Figure 2.1). While core inflation—the change in the prices of goods and services excluding food and energy—has risen less than headline rates, it has also ticked up in recent months. These developments have occurred amid still-substantial policy support as economies recover from the deep contraction of 2020. Moreover, as economies reopen, the release of excess savings accumulated during the pandemic could further fuel private spending. This combination of unprecedented factors has led to concern about the possibility of persistently high inflation.

From a macroeconomic perspective, a sustained rise in inflation in advanced economies leading to an unanticipated withdrawal of monetary accommodation could disrupt financial markets. Emerging market and developing economies would be especially affected from the resulting spillover effects through capital outflows and exchange rate depreciations, as seen during the taper tantrum episode in 2013. High inflation would also tend to hurt those who rely primarily on labor income (generally lower-income individuals) but could also benefit debtors while hurting lenders. Inflation can, therefore, have complex distributional consequences.

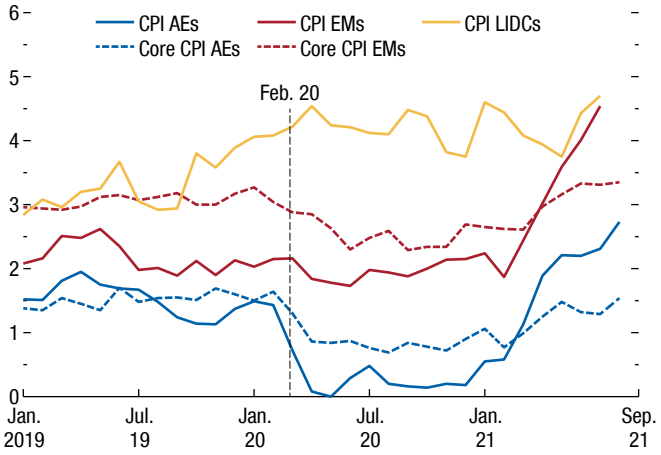
This chapter assesses the outlook for inflation and evaluates the risks around it. It first takes stock of inflation trends during the pandemic and then examines the drivers of inflation using the Phillips curve, which relates inflation to domestic slack—a key framework central banks use to form their views on inflation and, in turn, on monetary policy. It also examines whether there has been a change in the overall relationship between economic slack and inflation with inclusion of the pandemic period. This could have major implications for evaluating the effect of accelerating demand during the recovery and for the conduct of monetary policy (see, for example, Draghi 2017 and Powell 2018).

Inflation expectations and supply shocks are also crucial to understanding the inflation process. A key concern is identifying the conditions that could cause recent inflation spikes to persist, leading to unanchored expectations and self-fulfilling inflation spirals. Policymakers worry that the unprecedented policy support enacted in response to the COVID-19 crisis may have reduced the room for monetary policy to maneuver,

The authors of this chapter are Francesca Caselli (co-lead), Sonali Das, Christoffer Koch, Prachi Mishra (co-lead), and Philippe Wingender, with contributions from Chunya Bu and support from Youyou Huang and Cynthia Nyakeri. Swapnil Agarwal and Mattia Coppo also provided data support. The chapter benefited from discussions with Rodrigo Valdés and from comments by internal seminar participants and reviewers. Olivier Coibion provided valuable guidance and suggestions.

Figure 2.1. Consumer Price Inflation, by Country Group
(Median, year-over-year percent change)

Broad-based rise in headline inflation.



Sources: Haver Analytics; IMF, CPI database; and IMF staff calculations.
Note: The vertical line indicates February 2020. AEs = advanced economies; CPI = consumer price index; EMs = emerging market economies; LIDCs = low-income developing countries.

thereby impacting the credibility of central banks and leading to possible de-anchoring of inflation expectations. This chapter examines how robust the anchor was during the pandemic and assesses the potential risk of de-anchoring during the recovery phase. Finally, the analysis zooms in on sectoral and commodity price movements, asking how supply shocks could contribute to the inflation outlook.

The key findings of the chapter suggest the following:

Inflation is expected to revert to pre-pandemic levels by mid-2022. The analysis indicates that headline inflation and medium-term inflation expectations are projected to revert to pre-pandemic levels by mid-2022. Although much uncertainty remains, particularly regarding measurement of output gaps, recovering demand is expected to have only a small impact on future inflation. The IMF staff's baseline forecasts suggest that, for the advanced economy country group, on average, headline inflation will peak in the final months of 2021 and will decline to about 2 percent by mid-2022. Risks remain tilted slightly to the upside over the medium term. The outlook for emerging market and developing economies similarly shows headline inflation declining to about 4 percent after a peak of 6.8 percent later this year, with risks tilted to the upside over the medium term. A key feature of the outlook is the significant cross-country heterogeneity across advanced and emerging market and developing economies—and even within advanced economies. While the United States drives the strong inflation dynamics in advanced economies in the short term, with near-term risks tilted to the upside, underlying inflation dynamics in the euro area and Japan remain weak.

Risks: Inflation expectations have stayed relatively anchored so far, and risks of de-anchoring appear limited for advanced economies despite frequent monetary and fiscal policy announcements during the pandemic. The density forecast in the baseline also indicates anchored inflation expectations in emerging market and developing economies over the next two years. However, considerable uncertainty surrounds these forecasts, particularly related to the assessment of economic slack and reflected in the distribution around the baseline and in the counterfactual scenarios. Sharply rising housing prices and prolonged input supply shortages in both advanced economies and emerging market and developing economies and continued food price pressures and currency depreciations in the latter group could keep inflation elevated for longer. Simulations of a tail risk scenario with continued sectoral disruptions and large swings in commodity prices show that headline inflation could rise significantly higher than the baseline. Simulations including a temporary de-anchoring of inflation expectations lead to even higher, more persistent, and volatile inflation.

Policy implications: Selected case studies complement the statistical analysis and confirm that persistent "inflation scares" could lead to higher inflation expectations. While strong, sustained policy action was often needed to bring down inflation and inflation expectations in the past, these actions were accompanied by—and helped reinforce the credibility of—sound and clear communication. Importantly, longer-term expenditure commitments could be associated with unhinged expectations and underscore the importance of credible medium-term fiscal frameworks in keeping expectations anchored (see Chapter 2 of the October 2021 *Fiscal Monitor*). It is important that policymakers be on the lookout and be prepared to act, especially if some of the risks highlighted in this chapter should materialize at the same time—prolonged supply disruptions, rising commodity and housing prices, permanent and unfunded fiscal commitments, a de-anchoring of expectations, combined with mismeasurement of output gaps.

The rest of the chapter starts with an overview of recent inflation developments before assessing the implications of recovering demand on the inflation outlook through the lens of a Phillips curve. It then explores the conditions under which inflation spikes have tended to persist and inflation expectations to become de-anchored in the past. Next, the chapter examines the implications of the recent sectoral price shocks for overall inflation and inflation expectations. The chapter concludes with a discussion of the analysis's main policy implications.

Inflation Dynamics: Recent Drivers

The framework employed here sheds light on three broad drivers of increases in headline inflation: (1) a pickup in economic activity or closing output gaps supported by accommodative fiscal and monetary policies, along with the release of pent-up demand and accumulated savings (Figure 2.2, panel 1); (2) rapidly rising commodity prices (Figure 2.2, panel 2); and (3) input shortages and supply chain disruptions (Figure 2.2, panel 3). Some have suggested that the fiscal expansion—unprecedented as it was, especially in advanced economies—may push unemployment low enough to cause overheating, possibly de-anchoring inflation expectations and resulting in a self-fulfilling inflation spiral (Blanchard 2021; Summers 2021). Others see a persistent surge in price pressures from a "one-time surge in spending" as unlikely (Powell 2021).

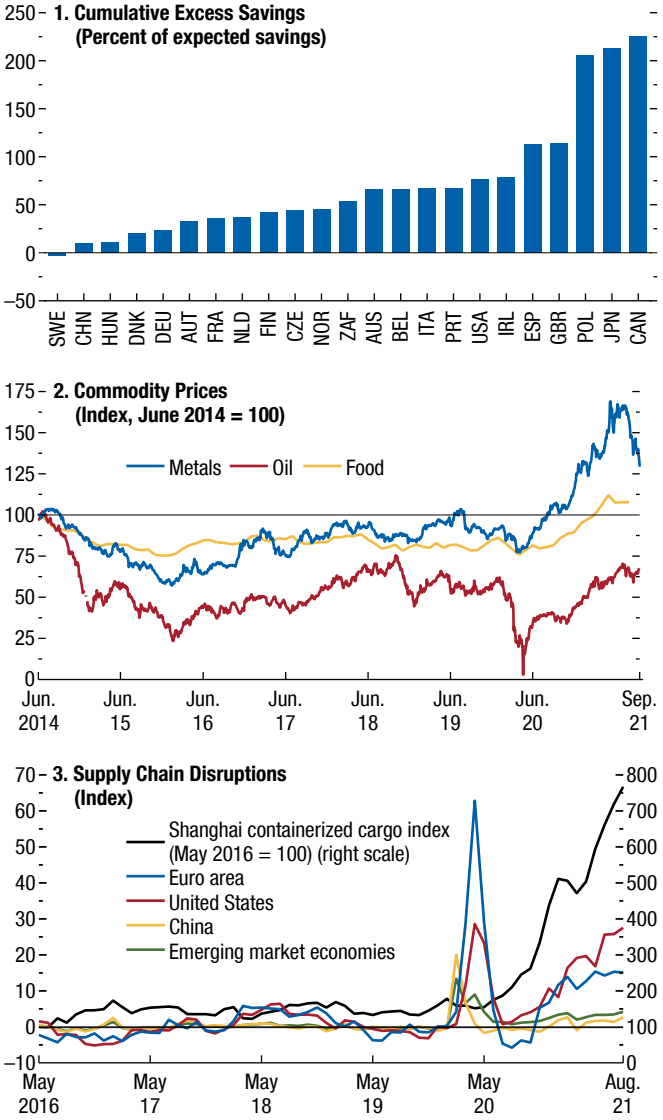
An Uncertain Outlook

The contrasting views on inflation prospects point to the high uncertainty surrounding the outlook for price movements. Factors behind the uncertain inflation outlook—not necessarily covered explicitly in this chapter—include the evolution of housing (see Box 1.1 in Chapter 1), structural transformation in labor markets, and food prices. Global food prices are up by about 40 percent since the start of the pandemic. This has implications especially for low-income countries, where the share of food in consumption baskets is high (see Box 2.1).

Another source of uncertainty is wage processes coming out of the pandemic, with accelerating labor demand hitting up against likely temporary shortages, leading to worries about fueling a wage-price spiral. Consistent with a resumption of greater activity, signs

Figure 2.2. Excess Savings, Commodity Prices, and Supply Chain Disruptions

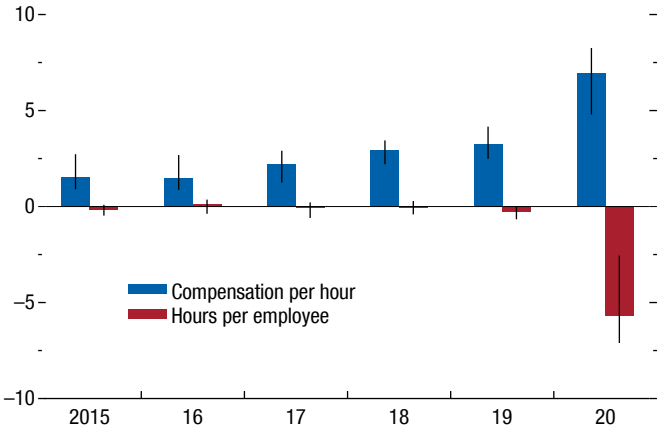
Rise in headline inflation amid pent-up demand, commodity price pressures, and supply chain disruptions.



Sources: Baltic Exchange; Haver Analytics; IMF, Primary Commodity Price System; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Cumulative excess savings are household savings from 2020:Q1–21:Q1 or the latest quarter available, exceeding expected savings based on a calculated linear trend from 2017:Q1–19:Q4 for each country. In panel 3, the composite emerging market economy data are from IHS Markit. Supply chain disruptions are calculated as the difference between the supply delivery times subindex in the purchasing managers' index (PMI) and a counterfactual, cyclical measure of supply delivery times based on the manufacturing output subindex in the PMI. Data labels use International Organization for Standardization (ISO) country codes.

Figure 2.3. Labor Demand in Advanced Economies
(Year-over-year percent change)

While wages increased in 2020, this was concomitant with a decline in hours.



Sources: Eurostat; Haver Analytics; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The bars represent medians; vertical lines represent the interquartile ranges of corresponding variables across 24 advanced economies. See Online Annex 2.1 for further details.

of higher wage growth are apparent in sectors that were hurt the most by the COVID-19 shock early on—for instance, there have been notable upticks in wages for jobs in leisure and hospitality and retail, among other sectors, in the United States. Evidence from a sample of 23 advanced economies also suggests that the average compensation per hour went up significantly in 2020. However, this wage growth happened at the same time as a decline in hours (Figure 2.3), and the brunt of the reduction was disproportionately borne by low-skilled workers and youth, who tend to earn less. Despite sectoral wage pressures, and a slight uptick in economy-wide nominal wage inflation in the United States, few signs of acceleration in economies are visible where data are available through the middle of the year (Canada, Germany, Spain, United Kingdom). Even after adjusting for composition effects, overall wage growth has remained within normal ranges, according to the Federal Reserve of Atlanta's US Wage Growth Tracker. As health metrics improve and exceptional income support measures expire, hiring difficulties in certain sectors could abate. That said, substantial uncertainty remains—and depends on whether firms can hold off filling the vacancies, their views on how long current worker shortages will persist, and how workers' health-risk-adjusted reservation wages evolve (see Chapter 1).

To take into account exceptionally large changes in prices of items other than food and energy—such as tourism and travel—during this crisis, alternative measures (such as trimmed means or medians that filter out these unusual movements) point to a more muted increase in underlying inflation (see Box 2.2). While some of the current price pressures could indeed be transitory (for example, because of droughts, export restrictions, and stockpiling of food stocks), much uncertainty remains regarding the evolution of several factors.

Economic Slack and the Inflation Outlook—Evidence from the Phillips Curve

A key element of central banks' policy frameworks is the Phillips curve relationship. This describes a trade-off between low slack (for instance, low cyclical unemployment) and high inflation.[1] In the Phillips curve, the inflation process is also related to cost-push shocks driven by supply disturbances and to long-term inflation expectations. As inflation-targeting regimes have become more prevalent, long-term inflation expectations have played a greater role in explaining inflation outcomes.[2]

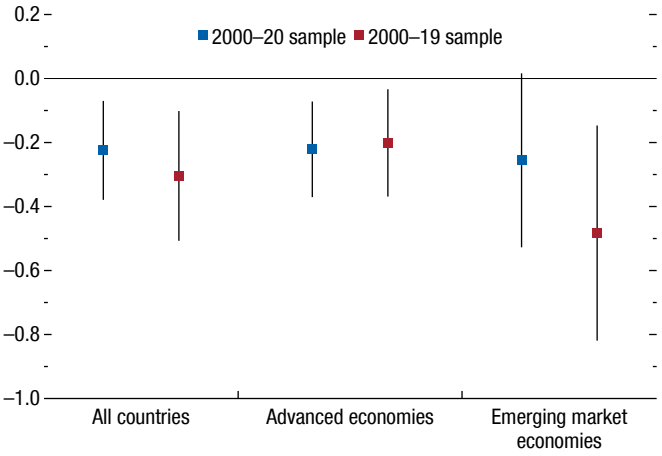
This section focuses on evaluating the strength of the relationship between inflation and economic slack to assess the extent to which expanding demand could contribute to inflation in the period ahead. A Phillips curve that includes forward-looking inflation expectations, lagged inflation, foreign price pressures, and output gaps is estimated on a large sample of advanced economies and emerging markets for 2000–20. Figure 2.4 reports the estimates for the pooled sample and the group of advanced economies

[1]Monetary policymakers typically use the "New Keynesian" framework comprising (1) an aggregate demand relationship, (2) optimal monetary policy, and (3) a Phillips curve relationship (see Clarida, Galí, and Gertler 1999). Alternative approaches to understanding the inflation process consider monetary aggregates as potential predictors of inflation (see, for instance, Pradhan and Goodhart 2021 for a review). In the context of the current crisis, Agur and others (2021) documents that large increases in the money supply because of major fiscal and monetary stimulus have led to only modest short-term pass-through from money growth to inflation, especially in countries with credible central banks.

[2]Major central banks, such as the European Central Bank and the US Federal Reserve, have recently adjusted their frameworks to guide long-term inflation expectations and mitigate deflationary risks, among other objectives. Thus far, the evolution of inflation expectations is consistent with the intended objectives of the frameworks' adjustment.

Figure 2.4. Unemployment Gap–Inflation Phillips Correlation
(Percentage points)

Unemployment changes away from the natural rate are associated with softer inflation, more so in emerging market economies.



Sources: Haver Analytics; and IMF staff calculations.
Note: The squares represent the coefficient estimates of the unemployment gap-inflation Phillips correlation. The vertical bars represent the 90 percent confidence intervals. See Online Annex 2.1 for further details.

and emerging markets separately (see Online Annex 2.2 for details of the sample composition and estimation).[3] A 1-percentage-point widening of the unemployment gap—that is, unemployment higher than the natural rate of unemployment—is associated with a decline in core inflation of 0.22 percentage point, on average. A similar point estimate is seen for advanced economies when splitting the sample by income groups. The coefficient for emerging markets is broadly similar, but not statistically distinguishable from zero.

The COVID-19 period, however, poses many challenges to estimating this relationship. There is much uncertainty about unemployment and output gaps during the pandemic (see Chapter 1). A massive, unprecedented fiscal and monetary policy response to the economic shock may also obscure the relationship between slack and inflation to a greater extent than would be seen over the course of a typical business cycle. Moreover, supply chain disruptions, sectoral dislocation associated with the pandemic, commodity price volatility, changing weights in consumer baskets (Cavallo 2020; Reinsdorf 2020), and extreme base effects also contribute to measurement challenges beyond those related to potential output.

[3]All annexes are available at www.imf.org/en/Publications/WEO.

Comparison with the Phillips curve relationship prior to the pandemic can shed light on the extent to which the unusually sharp fall and rebound in effective potential output induced by lockdown and reopening in 2020 might have affected the estimates. Figure 2.4 reports the response of core inflation to the changes in the unemployment gap estimated up to the fourth quarter of 2019 for advanced economies. The unprecedented pandemic disturbances do not seem to have altered the Phillips curve relationship for advanced economies. Estimates for emerging markets instead seem to be more sensitive to the inclusion of the pandemic period.[4] The results also point to mixed evidence on nonlinear effects at different levels of slack (see Online Annex 2.2).

A Causal Phillips Curve Confirms the Relevance of the Inflation-Activity Trade-Off

Although these results are based on a model that includes country-specific indicators and several controls, they could still be confounded by omitted variables and reverse causality. A widening output gap and weakening of inflation, for example, could induce central banks to reduce interest rates to boost demand, and so blunt what might have otherwise shown up as pronounced movement in the data (for a detailed discussion of the endogeneity issues in this setting, see McLeay and Tenreyro 2020). To address such concerns, an alternative estimation based on a treatment effect methodology is performed.[5] As proposed by Barnichon and Mesters (2021), well-identified demand shocks can be used to instrument for changes in unemployment. In particular, monetary policy shocks are used to proxy for demand shocks, to recover a causal relationship between inflation and activity. Causal estimates of the Phillips coefficient can be recovered by taking the

[4]The larger magnitude of the estimated coefficient for emerging markets in the pre-COVID-19 sample could be driven by different policies and shocks and could point to measurement errors too, especially in measuring slack, attenuating the estimates in the 2000–20 sample toward zero.

[5]This involves estimating central banks' monetary policy reaction functions and using inverse probability weighting to identify the impact of unexpected changes in short-term rates. The methodology proposed by Angrist, Jordà, and Kuersteiner (2018) is extended here to a panel setting. Recent macroeconomic studies that use this methodology to achieve identification include Jordà and Taylor (2016), Serrato and Wingender (2016), Acemoglu and others (2019), and Caselli and Wingender (2021). Willems (2020) instead constructs a measure of monetary policy tightening based on large and unexpected interest rate hikes for 162 countries.

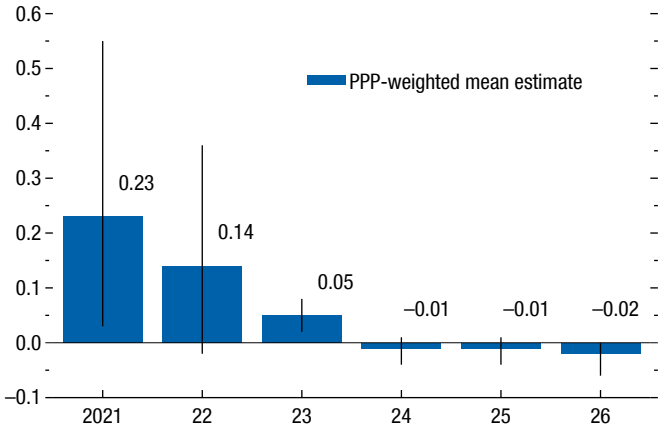
ratio of these impulse response functions of inflation to unemployment at the relevant horizon.[6] A negative and statistically significant slope coefficient of minus 0.22 is estimated for advanced economies, providing reassurance of the validity of the reduced form results. These findings provide further evidence of strength in the relationship between inflation and slack.[7]

The Impact of Recovering Demand on Inflation Dynamics

What role will the closing of output gaps play in the inflation outlook while the recovery is under way? The previous causal relationship is used to back out the contribution of the projected closing of the unemployment gap in advanced economies on inflation dynamics for the next six years.[8] This year and the next exhibit a moderately positive inflation impulse of about 0.23 percentage point and 0.14 percentage point, respectively (Figure 2.5). This impact softens in 2023 and 2024 before turning into a negligible disinflation impulse in 2026. These aggregate figures mask a significant degree of heterogeneity, as shown by the interquartile ranges, with the United States and its extraordinary policy support driving short-term inflation dynamics. Results for emerging markets using reduced-form estimates show a stronger impulse toward inflation as a result of recovering labor markets equal to 0.5 percentage point in 2021, but moderate contributions through the forecast horizon (see Online Annex 2.2).[9] These calculations crucially rely on the projected unemployment paths and estimates of the potential scarring from the crisis (see Chapter 1). Given the recovery's uncharted nature, considerable uncertainty around these economic-slack-induced dynamics remains because of the difficulties in quantifying the extent of potential scarring and the effects of the crisis on potential output.

Figure 2.5. Slack-Induced Inflation Dynamics from Structural Phillips Curve in Advanced Economies
(Percentage points)

Changes in advanced economies' unemployment gaps lead to a small inflation impulse from slack.



Sources: Haver Analytics; and IMF staff calculations.
Note: The bars represent the inflation impulse from changes in the unemployment gap based on the October 2021 *World Economic Outlook* vintage and the structural Phillips curve estimation described in the chapter. The vertical lines represent the interquartile ranges. PPP = purchasing power parity.

The Role of Anchoring of Inflation Expectations

The previous section presented evidence that expanding demand is likely to have a muted impact on future inflation. Nevertheless, other factors, such as the

[6]Online Annex 2.2 presents the details of the impulse responses of inflation and unemployment to contractionary monetary policy surprises and discusses their dynamics. Online Annex Figure 2.2.2, panel 1, shows that the unemployment rate increases by 1 percentage point, on average, in response to a cumulative 40-basis-point surprise tightening, compared with a neutral stance, and the full impact takes about 12 quarters to materialize. Online Annex Figure 2.2.2, panel 2, shows that core inflation significantly decreases by about 0.2 percentage point after 15 quarters to the same sequence of monetary policy tightening. While the estimated impulse response function for the unemployment rate is at the higher end, it is consistent with the empirical literature that exploits narrative approaches to estimate the effects of monetary policy shocks on real activity (Ramey 2016). Moreover, it is important to stress the differences in terms of sample period and composition and estimation approach compared with the bulk of the literature, which focuses on linear models in the United States. See Online Annex 2.2 for a more detailed discussion.

[7]Results are reported for advanced economies only. Data limitations and variability in policy reaction functions for emerging market central banks result in a weak first stage for these countries.

[8]The literature points to mixed evidence about the strength of the Phillips curve. Several explanations have been offered for a potential flattening of the Phillips curve. For instance, since the mid-1990s inflation expectations have become increasingly more important in explaining current inflation (Chapter 3 of the April 2013 *World Economic Outlook* [WEO]; Yellen 2015). Second, globalization forces have been mentioned as potential drivers of a weakening relationship between inflation and domestic slack (Borio and Filardo 2007; Auer, Borio, and Filardo 2017; Chapter 3 of the October 2018 WEO; Bems and others, forthcoming). Third, other long-term structural changes, such as workers' declining bargaining power and automation, greater employer concentration, and higher wage rigidity reduced the sensitivity of inflation to the level of slack (Yellen 2012; Daly, Hobijn, and Pyle 2016; Hooper, Mishkin, and Sufi 2019).

[9]The calculation for emerging markets is presented in Online Annex Figure 2.2.3, and is based on ordinary least squares coefficients.

anchoring of inflation expectations and supply shocks, are also crucial to understanding the inflation process. A key question is the conditions under which recent inflation spikes could persist, including because expectations become unanchored and lead to self-fulfilling inflation spirals. This section explores the conditions under which expectations can become unanchored. It then examines what countries have done in the past to successfully keep expectations anchored or bring them down once they rose.

Anchoring: The literature proposes various indicators to measure the degree of anchoring. Chapter 3 of the October 2018 WEO and Bems and others (2021) construct a synthetic indicator that includes four subcomponents capturing either operational or practical characteristics associated with stable and anchored inflation expectations.[10] Inflation expectations are considered anchored if they are stable over time, exhibit little cross-sectional dispersion, are insensitive to macroeconomic news, and are close to the central bank target. As shown in Figure 2.6, panel 1, although advanced economies presented a relatively stable degree of anchoring during the past two decades, consistent with early adoption of inflation-targeting regimes, emerging markets have seen significant improvements since the beginning of the 2000s. These economies have achieved anchoring comparable to that of advanced economies in recent years. Nevertheless, among emerging market economies, significant variability remains—as shown by the wider interquartile range in Figure 2.6, panel 1.

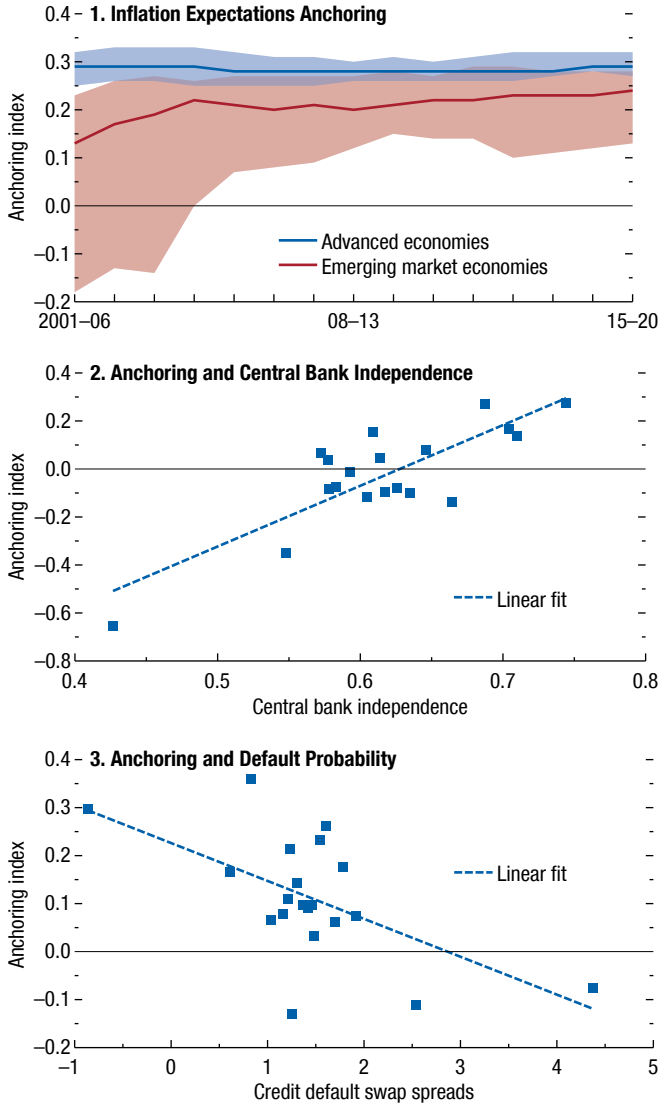
Institutional characteristics and anchoring of inflation expectations: The extent of anchoring is closely associated with institutional characteristics, such as the credibility of monetary and fiscal policy as well as the general macroeconomic situation and structural characteristics. In this regard, an independent and transparent central bank and sound and sustainable fiscal policy are key prerequisites for credible policies (Mishkin 2000; Mishkin and Savastano 2001). The cross-country variation in the degree of anchoring is positively correlated with the degree of independence of the central bank (Figure 2.6, panel 2) and negatively associated with the probability of default (Figure 2.6, panel 3).

Benefits of anchoring: What are the benefits of anchored inflation expectations? If long-term inflation expectations are not anchored, shocks that weaken

[10]These include (1) the variability of long-term inflation forecasts over time—if expectations are anchored, revisions to long-term forecasts should be small, and thus the average forecast relatively stable over time; (2) the dispersion of expectations across agents; (3) the sensitivity of long-term expectations to expectations about short-term inflation or macroeconomic surprises; and (4) the deviation of medium- or longer-term inflation expectations from the central bank's target. For details on the construction of the index, see Bems and others (2021). The index is constructed using professional forecasters' long-term (three-year and longer) inflation expectations.

Figure 2.6. Inflation Anchoring
(Index)

Anchoring has improved, particularly in emerging market economies, but it still varies across countries. Sound and suitable monetary and fiscal policies are associated with more anchored expectations.



Sources: Bems and others (2021); Concensus Economics; Dincer and Eichengreen (2014); Garriga (2016); Haver Analytics; and IMF staff calculations.
Note: In panel 1, lines represent the median; shaded areas represent the interquartile range of anchoring index by country group. See Online Annex 2.1 for further details.

economic activity could present the central bank with a policy dilemma. Although loose monetary policies might be appropriate to boost demand, they could accelerate price pressure and increase uncertainty, which would hold back private investment and employment growth. By contrast, if inflation expectations are anchored, the central bank has more scope to pursue the appropriate countercyclical policy response to stimulate demand (Chapter 3 of the October 2018 WEO; Bems and others 2020).

When Have Expectations Become Unanchored in the Past?

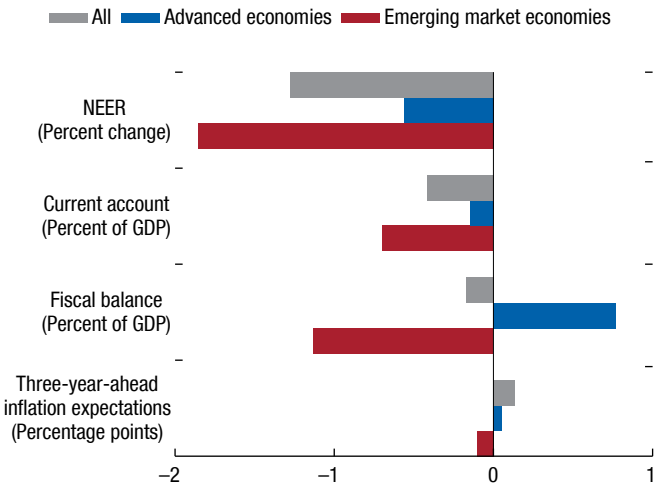
Analysis of past inflation episodes can help shed light on conditions that contribute to de-anchoring of inflation expectations. The exercise identifies turning points in inflation—"inflation accelerations or scares"—following the approach used in Hausmann, Pritchett, and Rodrik (2005) (for growth performance). Fifty-five episodes distributed equally across advanced economies and emerging markets are identified (Figure 2.7).

Inflation accelerations are associated with sharp exchange rate depreciations in emerging markets. On average, the nominal effective exchange rate depreciated by about 8 percent in the quarter the episode began.[11] Inflation accelerations were also preceded by an upsurge in fiscal and current account deficits in emerging markets. Unlike the full sample or emerging market and developing economy estimates, fiscal balances in advanced economies rose prior to high inflation episodes, on average, which suggests that aggregate demand shocks could have driven both fiscal performance and inflation in advanced economies. Short- and medium-term inflation expectations rose sharply too during inflation scares. More persistent episodes, defined as those during which inflation remained elevated for six quarters or more, were associated with a steeper rise in three-year-ahead inflation expectations (see Online Annex 2.3).

Given the difficulty of quantifying some important policy variables, such as communication from the central bank, this section also applies a narrative approach to selected case studies (Box 2.3). An analysis of macroeconomic outcomes in the case studies confirms many of the findings of the statistical analysis and offers additional insights. Longer-term expenditure commitments (for example, financing the Vietnam War and Great Society programs in the 1960s in the United States, and soaring subsidy bills and agricultural debt waivers in India in the late 2000s) could be associated with unhinged expectations.[12] External shocks combined with sharp exchange rate depreciations (for example, in Brazil in the early 2000s) could also trigger a de-anchoring of expectations, especially in countries starting from an environment of low monetary policy credibility. Moreover, even when expectations are well anchored, a prolonged deviation of inflation from target could cause expectations to move (such as in Chile before the global financial crisis).

Figure 2.7. Inflation Episodes

Episodes of high inflation are associated with large exchange rate depreciations.



Sources: Bloomberg Finance L.P.; Consensus Economics; Haver Analytics; and IMF staff calculations.
Note: The chart presents the difference in the three-quarter averages just prior to the start of an inflation acceleration episode (from $t-3$ to $t-1$) compared with the previous six-quarter averages ($t-9$ to $t-4$). NEER = nominal effective exchange rate.

Expectations Anchoring during the COVID-19 Pandemic

How robust has the inflation anchor been during the COVID-19 pandemic? If inflation expectations are well anchored, they should not respond to inflation surprises. To zoom in on the pandemic

[11]The exchange rate depreciation is the only factor that appears as statistically significant.

[12]Coibion, Gorodnichenko, and Weber (2021) finds that US households anticipate higher short-term and long-term inflation following news about future debt but do not in response to information about current debt, suggesting that households are able to distinguish between transitory fiscal changes and those that are more permanent.

period, a daily market-based measure of long-term inflation expectations, the five-year, five-year forward breakeven inflation rate, is analyzed for a sample of 14 countries.[13] Inflation surprises are proxied by oil price shocks, measured as the change in the price of one-year-ahead oil futures contracts. Consistent with the previous literature (Gürkaynak, Sack, and Wright 2010; Beechey, Johannsen, and Levin 2011; Celasun, Mihet, and Ratnovski 2012), the results indicate a small but significant effect of oil price shocks on expectations (Figure 2.8, panel 1). The introduction of an interaction term of oil futures prices with an indicator for the pandemic period (starting in March 2020) reveals that, on average, in the limited sample, there was no significant change in the relationship between oil price surprises and the breakeven rate during the pandemic compared with normal times (Figure 2.8, panel 2). Breakeven inflation rates in the United States, however, overshot their pre-pandemic levels in January 2021.[14] An analysis of daily monetary and fiscal policy announcements reveals no evidence of de-anchoring in response to the exceptionally large policy responses to the pandemic (see Online Annex Figure 2.3.2). Overall, these findings suggest that the anchor has remained relatively stable so far during the COVID-19 pandemic crisis.

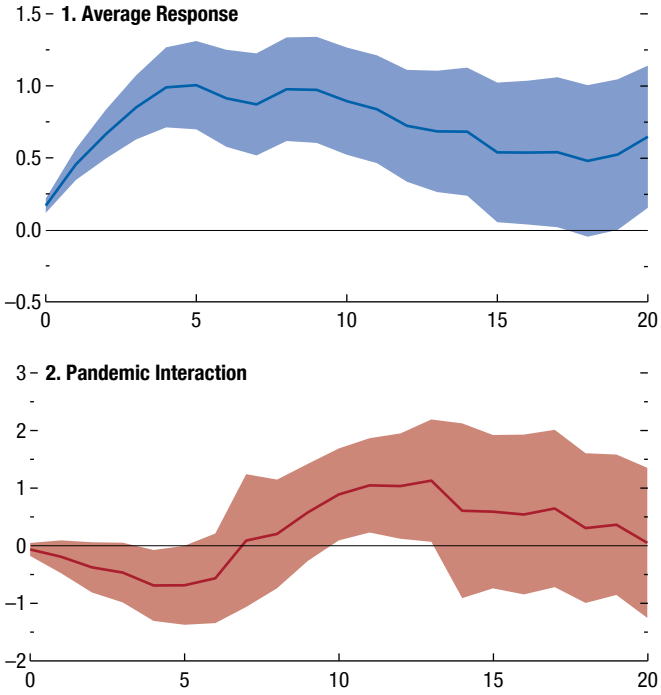
Sectoral Shocks and the Inflation Outlook

The COVID-19 crisis triggered large price movements in some sectors, notably transportation, food, clothing, and communications (see Online Annex 2.4). However, overall sectoral price dispersion so far has remained relatively subdued by recent historical standards, especially compared with the global financial crisis (Figure 2.9, panel 1). As illustrated in Figure 2.9, panel 2, this is driven by somewhat smaller and shorter-lived swings in fuel (transport), food, and housing prices, which are the three largest components of consumption baskets, on average.

In addition, a case study of the semiconductor industry in the United States points to only a modest increase in overall inflation, given a potential doubling of semiconductor input prices (see Online Annex Figure 2.4.2). This is because categories with the highest potential increase in inflation, as a result of the doubling input price of semiconductors, have a very small weight in personal consumption expenditures (such as personal computers and photographic equipment).[15] An important caveat though is, while

Figure 2.8. Response of Five-Year, Five-Year Forward Breakeven Inflation to Oil Price Shocks
(Basis points)

Market-based inflation expectations respond to oil price surprises but have not become more sensitive to surprises during the pandemic.



Sources: Bloomberg Finance L.P.; and IMF staff calculations.
Note: The solid lines represent the estimated response; shaded areas represent 95 percent confidence intervals. The *x*-axis indicates the number of days after the shock starts.

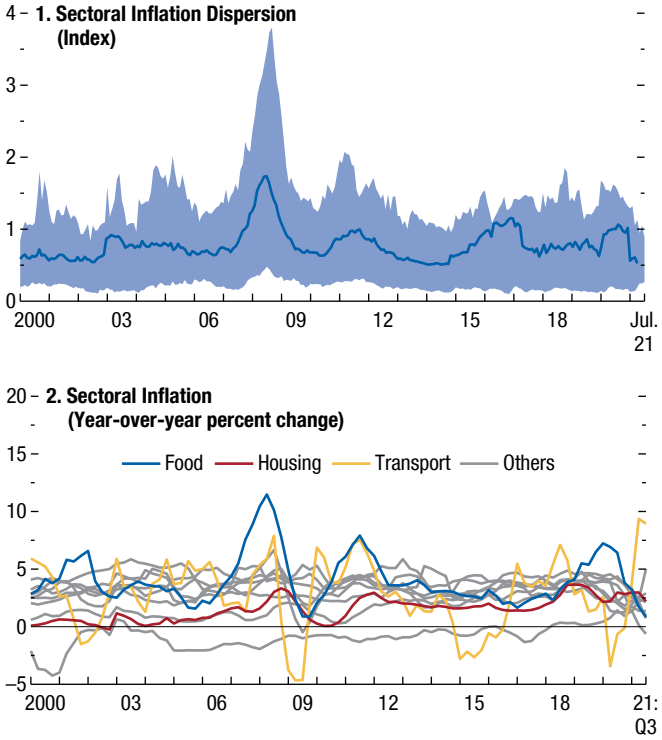
[13]See Online Annex 2.3 for country coverage, variable definitions, and estimation details. In addition to reflecting expectations about future inflation, breakeven rates include both liquidity risk premiums and inflation risk premiums, reflecting uncertainty about future inflation, which could have important policy implications (Chapter 1 of the October 2021 *Global Financial Stability Report*). Countries for which breakeven inflation rates are available are mostly advanced economies or major emerging markets with high central bank credibility and well-anchored inflation expectations. Robustness exercises with liquidity-adjusted measures are implemented following Gürkaynak, Sack, and Wright (2010). The time-varying effect of liquidity on inflation compensation is measured as the fitted values from a regression of the breakeven rate on liquidity proxies for both bonds.

[14]Consistent with the shift to the flexible average inflation-targeting framework, breakeven inflation rates in the United States rose, particularly at shorter horizons, primarily due to an increase in the risk-adjusted expected inflation component (Chapter 1 of the October 2021 *Global Financial Stability Report*).

[15]In contrast, consumption items with the highest weights in the consumption basket (for example, housing) exhibit negligible price increases from higher semiconductor input prices. The analysis makes use of US input-output tables.

Figure 2.9. Sectoral Inflation Dynamics

Sectoral inflation dispersion during the pandemic does not stand out by historical standards. This is largely due to smaller and shorter-lived swings in fuel, food, and housing prices.



Sources: Haver Analytics; IMF, CPI database; and IMF staff calculations.
Note: In panel 1, the solid line represents the cross-country mean of sectoral inflation dispersion; shaded area represents the 10th–90th percentile range. The sectoral inflation dispersion index is calculated as the standard deviation of sectoral inflation weighted by consumption shares. Panel 2 presents averages weighted by country's purchasing-power-parity GDP.

it is possible that the shortage in semiconductor chips may not directly translate into higher prices, it could still lead to lower output of products that rely on chips as inputs, for instance cars, which in turn could lead to higher prices for these goods or their substitutes.

The Inflation Outlook

To assess how sectoral price dynamics could affect the inflation outlook, a structural quantile vector autoregression model is estimated for advanced economies and emerging market and developing economies to gauge the balance of risks by looking at broader moments of the density forecast (Koenker and Xiao 2006; Ghysels, Iania, and Striaukas 2018; Montes-Rojas 2019; Chavleishvili and Manganelli 2020; Boire, Duprey, and Ueberfeldt 2021).[16] Online Annex 2.4 provides details and definitions of the variables.

Density forecasts show a sharp rise in inflation in the near term. Headline inflation among advanced economies is expected to peak at 3.6 percent in the final months of 2021 (Figure 2.10, panel 1). The forecast then drops to 3.2 percent by the end of the year and reaches about 2 percent by mid-2022. Risks are tilted slightly to the upside over the medium term for advanced economies. These findings also suggest a 10 percent probability of inflation remaining above 3.4 percent through the end of 2021. While the density forecasts suggest that inflation is likely to peak later this year in advanced economies, uncertainty remains related to the factors mentioned earlier.

The outlook for emerging market and developing economies indicates a return to trend headline inflation of about 4 percent by mid-2022 (Figure 2.10, panel 3). Risks remain tilted to the upside over the medium term for emerging markets, as evidenced by the wider interquartile range at the top of the density forecast than at the bottom.[17]

Inflation expectations: Long-term inflation expectations present a relatively strong degree of anchoring. They gradually trend back to about 2 percent, on average, in the baseline forecast for advanced economies, with little risk of de-anchoring (Figure 2.10, panel 2). For emerging market and developing economies, expectations are projected to remain anchored over the medium term, but with upside risks, as shown by the mean forecast lying above the median forecast starting in mid-2023 (Figure 2.10, panel 4).

Assessing the Impact of Continued Strong Increases in Commodity Prices and Sectoral Price Dispersion

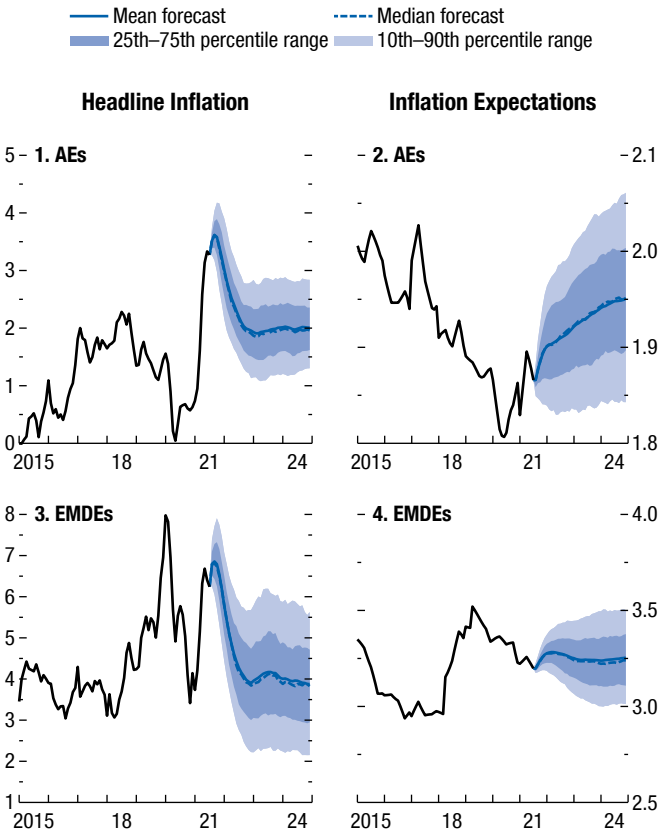
The previous results are based on the historical relationship between inflation dynamics and its determinants, including the reaction function of central banks to incoming data. Given the uniqueness of the current episode, any attempt to extrapolate lessons from experience into the future must be approached with caution. In particular, policymakers wonder about the effect of continued and sustained sectoral disruptions on the inflation outlook. Could sectoral price volatility, for example from housing or food prices,

[16]Following Lenza and Primiceri (2020), the estimation of parameters of the model excludes the pandemic period.

[17]Reversion to trend may be delayed if monetary policy does not respond as quickly to higher inflation as it has in the past.

Figure 2.10. Headline Inflation and Inflation Expectations Baseline Outlook
(Percent)

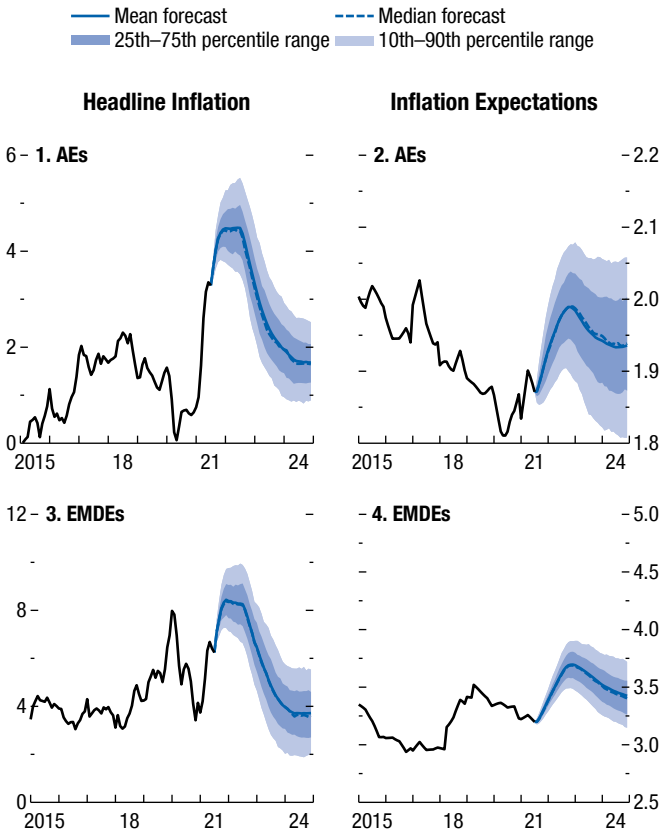
In the baseline forecast, headline inflation exhibits a short-lived increase in both advanced economies and emerging market and developing economies, and inflation expectations are projected to remain anchored over the medium term.



Sources: Consensus Economics; Haver Analytics; IMF, CPI database; and IMF staff estimates.
Note: The lines are averages weighted by countries' purchasing-power-parity GDP. Central tendencies for headline inflations are adjusted to ensure consistency with mean *World Economic Outlook* inflation forecasts. AEs = advanced economies; EMDEs = emerging market and developing economies. See Online Annex 2.1 for further details about the list of countries included in the samples.

Figure 2.11. Headline Inflation and Inflation Expectations Outlook with Adverse Sectoral and Commodity Price Shocks
(Percent)

A sharp rise in commodity prices and sectoral inflation dispersion over the next 12 months would have a strong but temporary impact on headline inflation. Inflation expectations could overshoot but revert to trend over the medium term.



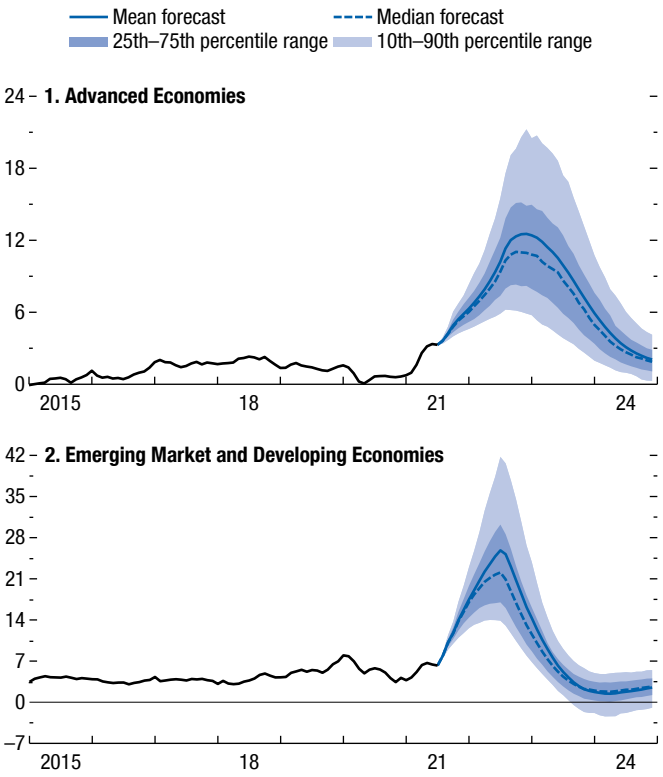
Sources: Consensus Economics; Haver Analytics; IMF, CPI database; and IMF staff estimates.
Note: The lines are averages weighted by countries' purchasing-power-parity GDP. Sectoral dispersion and commodity price shocks are assumed to be drawn from the top 75 percent of the predictive distributions for 12 consecutive months from July 2021 to June 2022. AEs = advanced economies; EMDEs = emerging market and developing economies. See Online Annex 2.1 for further details about the list of countries included in the samples.

spill over into headline inflation and lead to higher, more persistent, and volatile inflation? Could this lead to an inflation spiral propelled by the de-anchoring of inflation expectations?

Tail-risk scenario: A forward-looking exercise is used to answer these questions. The exercise simulates inflation developments assuming a tail scenario which, according to the model employed here, has less than 0.01 percent probability of materializing. This scenario is marked by strong rises in commodity prices and sectoral inflation dispersion over the next 12 months and allows an assessment of the potential impacts of continued supply disruptions or mismatches as the recovery proceeds. In this scenario, headline inflation would increase significantly, peaking at 4.4 percent, on average, in advanced economies by mid-2022 and 8.4 percent in emerging markets by early 2022 (Figure 2.11, panels 1 and 3). The forecasts in this scenario show broadly balanced risks over the medium term. However, even in this extreme scenario, headline inflation goes back to trend by early 2024. A look at inflation expectations

Figure 2.12. Headline Inflation with Adverse Sectoral and Commodity Price Shocks and Adaptive Expectations Shock
(Percent)

Sectoral and commodity, price shocks with unanchored expectations would lead to higher, more persistent, and volatile inflation.



Sources: Consensus Economics; Haver Analytics; IMF, CPI database; and IMF staff estimates.
Note: The lines are averages weighted by countries' purchasing-power-parity GDP. Adaptive expectations assume that inflation is driven by one-year-ahead inflation expectations instead of the conventional three-year-ahead horizon for 12 consecutive months from July 2021 to June 2022. See Online Annex 2.1 for further details about the list of countries included in the samples.

points to fairly strong anchoring of about 2 percent in advanced economies, with little risk of de-anchoring (Figure 2.11, panel 2). For emerging market and developing economies, there is overshooting of expectations in the short term (Figure 2.11, panel 4). However, inflation expectations are projected to remain anchored over the medium term.

In summary, sectoral disruptions and large swings in commodity prices could mean upside risks for headline inflation, with higher peaks and a delayed return to trend inflation. The medium-term outlook, nevertheless, would likely still be driven by fundamentals, including the speed of the recovery and the continued anchoring of inflation expectations.

Potential effects of an additional de-anchoring shock: Importantly, the preceding scenario assumes inflation expectations remain anchored. While plausible—sectoral inflation dispersion reached very high levels after the global financial crisis without having long-lasting effects on headline inflation—the possibility of expectations deviating from target and creating a self-fulfilling inflationary spiral is a serious concern for policymakers. To evaluate the potential effects of a de-anchoring shock on the outlook, the previous scenario is extended to allow for inflation expectations to become adaptive for a period of 12 months, meaning expectations are no longer forward-looking but rather react to incoming data.[18] In Figure 2.12, inflation increases substantially in this extreme scenario and becomes more persistent and volatile, as indicated by the much wider interquartile ranges—pointing to the serious implications of inflation expectations becoming de-anchored.

Conclusions

Rising commodity prices and supply chain bottlenecks are putting upward pressure on headline inflation rates. Moreover, the unprecedented nature of the current recovery has raised questions about how long supply will take to catch up with accelerating demand. These uncertainties are fueling worries that inflation could persistently overshoot central bank targets and de-anchor expectations, leading to a self-fulfilling inflation spiral.

The analysis in this chapter suggests that likely will not be the case. Although the overall findings imply an increase in headline inflation in both advanced and emerging markets, it is expected to subside to pre-pandemic ranges by mid-2022 in the baseline.

However, this assessment is subject to significant uncertainty, given the uncharted nature of the recovery. Simulations of scenarios characterized by strong rises in commodity prices, continued sectoral shocks, and adaptive expectations suggest significant risks to the inflation outlook. More persistent supply disruptions and sharply rising housing prices in both advanced economies and emerging market and developing economies, or currency depreciations and food price

[18]The simulations assume that the expectations relevant for price formation in advanced economies are the one-year-ahead inflation expectations instead of the conventional three-year-ahead horizon. For emerging market and developing economies, expectations are assumed to be equal to the previous month's inflation.

pressure in the latter group emerging market and developing economies, could all lead inflation to remain elevated for longer than currently expected.

In terms of policy implications, there are four key lessons.

First, the narrative account of selected case studies and scenario analyses suggest that when expectations become de-anchored, inflation can quickly take off and be costly to rein back in. Ultimately, policy credibility and setting of inflation expectations are an endogenous, and possibly nonlinear, process that is hard to pin down precisely; moreover, any assessment of inflation anchoring cannot be decided entirely on the basis of relationships observed in historical data. Policymakers therefore must be ready to act and, more importantly, ensure that sound monetary frameworks are in place, including triggers that could require action. Such triggers could comprise early signs of de-anchoring inflation expectations—from forward-looking surveys, unsustainable fiscal and current accounts, or sharp movements in the exchange rate. In particular, policymakers must be alert to triggers for a perfect storm of inflation risks that could be relatively benign when considered individually but that, by materializing together, could lead to significantly higher inflation than predicted in the baseline forecasts.

Second, case studies demonstrate that, while strong policy action was often successful in bringing down inflation and inflation expectations, sound and credible communication also played a crucial role in keeping expectations anchored. In this context, clear and state-contingent forward guidance and communication (with well-articulated triggers for action) from advanced economy central banks are key during periods of policy normalization to avoid taper-tantrum-like scenarios. Similarly, a well-communicated plan for a gradual exit from exceptional monetary policy and liquidity support as the recovery strengthens would foster orderly market transitions in emerging markets, too. The case studies also highlight the importance of maintaining strong fiscal credibility for inflation anchoring.

Third, policymakers need to walk a tightrope between acting patiently to support the recovery and at the same time preparing to act quickly if inflation expectations show signs of de-anchoring. Central banks could look beyond temporary inflationary pressures and avoid tightening policies prematurely until there is more clarity on underlying price dynamics (conditional on expectations remaining firmly anchored). At the same time, central banks should also prepare to act quickly if the need arises and chart contingent actions that reveal their true preferences. Fiscal policies should adhere to sustainable medium-term frameworks. However, uncertainty about medium-term output gaps is still high and could affect the optimal timing for removal of policy support while the recovery is still under way. Policies, therefore, should be mindful of the unusual short-term dynamics and uncertainties surrounding potential output.

Fourth, a key feature of the outlook is the significant degree of cross-country heterogeneity among advanced economies and emerging market and developing economies and even within advanced economies. While the United States is projected to drive much of the slack-induced inflation dynamics in the baseline for advanced economies, with near-term risks tilted to the upside, underlying inflation dynamics in the euro area and Japan remain weak. Policy recommendations should be tailored to economies' particular vulnerabilities and business cycle phases. Yet, spillovers from asynchronous monetary and fiscal tightening must be at the core of multilateral policy discussions. For emerging markets, medium-term expectations rose sharply during inflation scare episodes, which were preceded by growing internal and external imbalances—all of which underscores the role of strong macroeconomic fundamentals and credible medium-term fiscal frameworks in keeping expectations anchored.

Box 2.1. Food Insecurity and Prices during COVID-19

Nominal global food prices have risen more than 40 percent since the start of the pandemic.[1] The prices of goods sold in a local market—a more relevant indicator, especially if the good is produced domestically (for example, cassava in central and western Africa)—were influenced by numerous local factors, including supply and demand, government policies, exchange rates, transportation costs, and income levels. Data for monthly market food prices across locations for seven staples (wheat, rice, sugar, maize, milk, poultry, cassava), which contribute about 60 percent of average daily consumption, from 259 markets in 73 emerging markets are used. The real local price of staples in emerging markets has increased by 4.0 percent since the pandemic began.[2] Significant price surges in staple foods in several countries are observed. By contrast, a number of food-producing countries that experienced favorable weather conditions have avoided upward price pressure.

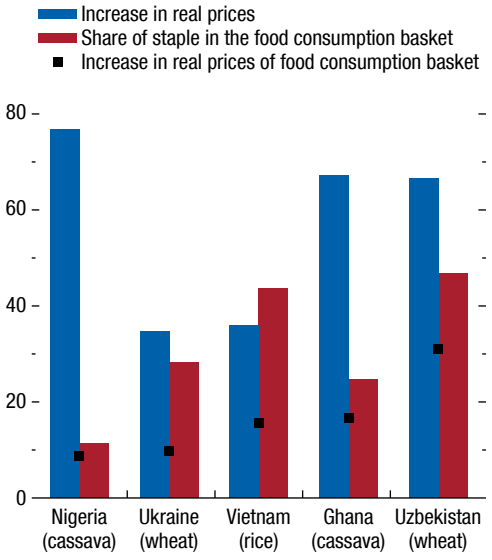
In the absence of frictions, such as transportation costs, prices tend to equalize across markets.

The authors of this box are Katrien Smuts, John Spray, and Filiz Unsal.

[1]IMF Primary Commodity Price System and authors' calculations; May 2020–May 2021 year-over-year change.

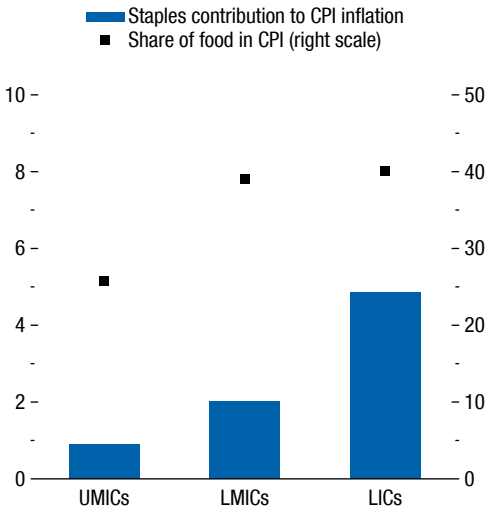
[2]The values are calculated as the regional median of consumption share$_{ij}$ * change in real prices in local currency$_{ij}$, in which i = country and j = staple: 2020:Q1–2021:Q1 year-over-year change.

Figure 2.1.1. Selected Countries' Commodity Price Surges
(Year-over-year percent change, unless noted otherwise)



Sources: FAOSTAT New Food Balances; GIEWS FPMA Tool; and IMF staff calculations.
Note: The real increase in consumption baskets includes all staples, not just the ones listed here. The data are from 2020:Q1–2021:Q1.

Figure 2.1.2. Food Staples Contribution to CPI Inflation; Median, by Income
(Percentage points; percent on right scale)



Sources: FAOSTAT New Food Balances; GIEWS FPMA Tool; IMF, *International Financial Statistics*; and IMF staff calculations.
Note: The staples included in the calculations are wheat, maize, rice, milk, poultry, sugar, and cassava. The countries included in the data set are those for which at least one staple price was available over the sample period. Missing prices are imputed from regional and income group averages. CPI = consumer price index; LICs = low-income countries; LMICs = lower-middle-income countries; UMICs = upper-middle-income countries. The data are from 2020:Q1–2021:Q1.

Box 2.1 *(continued)*

The pandemic, however, coincided with a sharp—20 percent, on average—increase in within-country variation in food prices.[3] This could indicate growing local supply shortages, likely because of pandemic-related declines in mobility—a greater concern for regions far from food production centers.

The dual shock of rising food prices and falling incomes will exacerbate inequality. In low-income countries, where food makes up about 40 percent of the consumption basket, staple food price growth raised consumer price index inflation 5 percentage points. Within countries, the poorest households spend proportionately more on food (people in sub-Saharan Africa with consumption below $2.97 a day spend about 58 percent of their income on food).

[3]Variations in food prices are calculated as $(\max(price_{ijct})_{jct} - \min(price_{ijct})_{jct})/\max(price_{ijct})_{jct}$ for commodity j, market i, in country c in quarter t. An average across commodities and countries within each region is then taken. Commodities that are not present in at least three markets are excluded. 2020:Q1–2021:Q1 year-over-year change.

Box 2.2. Core Inflation in the COVID-19 Crisis

US headline inflation has risen sharply since the start of the pandemic. To interpret such developments, economists distinguish between underlying or "core" inflation, which reflects macroeconomic conditions and is especially salient for monetary policy deliberations, and transitory fluctuations around the core arising from changes in relative prices caused by microeconomic factors. But making this distinction is challenging in the current environment because different measures of core inflation give different signals.

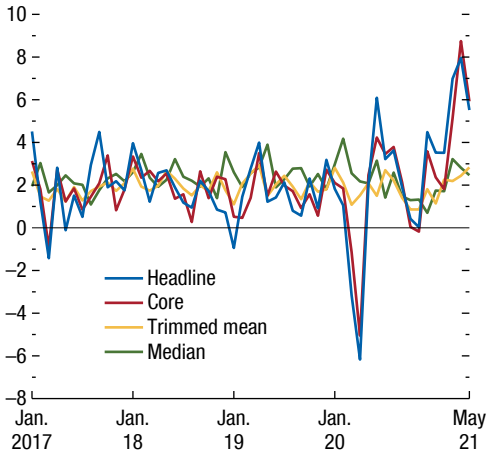
A common measure of core personal consumption expenditure inflation that excludes food and energy prices has recently spiked even higher than headline inflation. But simply removing food and energy prices is not the best way to measure core inflation: transitory movements can arise in different industries (Dolmas 2005). These concerns have led to core measurement based on median inflation (the price change at the 50th percentile of all prices each month) or on trimmed mean inflation (stripping out a fixed share of price changes).

Based on median or trimmed mean inflation, recent developments are less alarming. This difference reflects the large sectoral shocks to industries other than food and energy, which caused the traditional measure to rise sharply but are filtered out of median or trimmed mean inflation. For example, the April 2021 inflation spike reflected the prices of light trucks, hotel rooms, air transportation, spectator sports, and car rentals, which more than doubled at a monthly annualized rate, while median inflation was only 2.8 percent (Figure 2.2.1).

Which of these core measures is more relevant for understanding the current situation? Historical data suggest that it is median or trimmed mean inflation. Figure 2.2.2 compares the volatility of inflation and the strength of its relationship with unemployment using different measures. Trimming more extreme price movements increases the stability of the underlying inflation measure and strengthens its relationship with macroeconomic conditions. Inflation excluding food and energy has been 70 percent more volatile than median inflation and has had a much weaker relationship with unemployment. The COVID-19 crisis has strengthened the case for median or trimmed mean inflation.

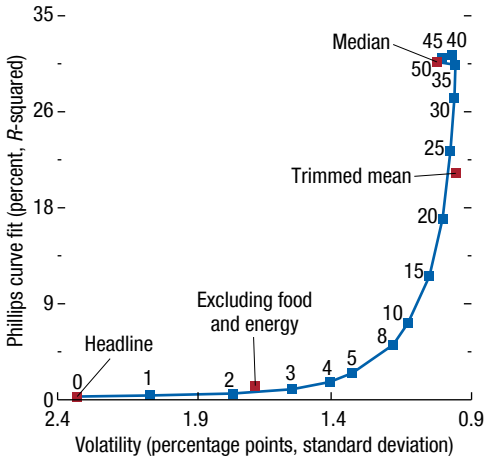
The authors of this box are Laurence Ball, Daniel Leigh, Prachi Mishra, and Antonio Spilimbergo.

Figure 2.2.1. Headline and Underlying Inflation in the United States
(Percent)



Sources: Haver Analytics; and IMF staff calculations.
Note: Inflation rates are based on the personal consumption expenditure chain-type price index. Trimmed mean is produced by the Federal Reserve Bank of Dallas.

Figure 2.2.2. Inflation Rates in the United States; by Industry, April 2021



Sources: Haver Analytics; and IMF staff calculations.
Note: Points along the line indicate different trimming percentages from monthly distribution of all price changes. Volatility is defined as standard deviation of change in monthly annualized inflation for each measure (January 1990–May 2021). Phillips curve fit indicates *R*-squared of estimated relationship between quarterly annualized inflation for each measure in deviation from 10-year-ahead Survey of Professional Forecasters expectations and four-quarter average gap between unemployment and its Congressional Budget Office natural rate, estimated based on quarterly data for 1990:Q1–2019:Q4.

Box 2.3. Policy Responses and Expectations in Inflation Acceleration Episodes

United States 1965–83

Background: After two decades of low inflation following World War II, inflation started to increase gradually in the mid-1960s. Inflation continued to drift upward during the 1970s amid several external price shocks, high fiscal deficits due to military engagements and rising social spending, a likely overestimation of productivity growth and potential output, and dovish destabilizing monetary policy.

Policy response and results: The 1978 Humphrey-Hawkins Act amended the Federal Reserve's mandate and enabled then-Federal Reserve Board Chair Paul Volcker to aggressively raise interest rates. The federal funds rate averaged 11.2 percent in 1979, the first year of Volcker's tenure, and rose to 20 percent in June 1981. Inflation peaked in March 1980 at almost 15 percent and fell to 3 percent by 1983. The drop was induced by a sharp demand-led recession that raised the unemployment rate from 5.6 percent in May 1979 to 10.8 percent in November 1982.

Policy conclusions: Important policy lessons were learned from the US Great Inflation of the 1970s and its demise. Central bank independence as a potential mitigant to inflationary bias, as well as central bank transparency, prudent medium-term fiscal planning, and adherence to stabilizing monetary rules and inflation targeting became central.

Brazil 2002–05

Background: Currency depreciations coupled with domestic and external shocks in 2001 triggered a sudden stop in 2002. Brazil experienced a reversal in capital flows and cuts to trade credit lines, and the *real* depreciated by 53 percent in 2002. Inflation expectations rose along with the increase in inflation.

Policy response and results: Starting from low monetary policy credibility and concerns about fiscal dominance, policymakers decided against a gradual tightening. A cumulative increase of 550 basis points was implemented by February 2003, accompanied by an increase in banks' reserve requirements. Expectations began to lower only after the country's monetary policy committee kept the policy rate at 26.5 percent in April 2003 for a third month in a row, despite public outcry. Inflation expectations remained stable until mid-2004. In September 2004, the committee responded to rising inflation concerns by starting another tightening cycle and clearly laying out conditions under which they would act. They committed to a forward-looking inflation objective for 2005 and announced that policy would respond asymmetrically to inflation-increasing and -decreasing shocks. Expectations fell afterward, even as inflation continued to rise, and expectations indeed converged to the target by the end of 2005. The new government also made efforts to assert a fiscally prudent policy.

Policy conclusions: Considered a stress test of a new inflation-targeting framework, the experience showed (1) the need for larger monetary policy action to counter unanchored expectations and establish credibility, and (2) how clear and state-contingent guidance could complement the initial response.

Chile 2007–09

Background: The Banco Central de Chile (BCC) formally adopted a flexible inflation-targeting framework in 1999. Inflation expectations were well anchored thereafter at about 3 percent. The new monetary policy regime was accompanied by a credible fiscal rule, sound financial sector regulation, and supervision. From mid-2007 to late 2008, however, Chile experienced upward inflation pressure from international factors—rising copper, food, and energy prices. Headline inflation exceeded the target range in August 2007. Inflation expectations began to increase and moved above the 3 percent target by late 2008.

Policy response and results: In the second half of 2007 the BCC tightened monetary policy, raising the policy rate by 25 basis points in July 2007. Despite a cumulative rate increase of 325 basis points by September 2008, two-year-ahead expectations increased to 3.9 percent. The BCC was somewhat slow to act on the rise in inflation for several reasons: (1) the degree of slack in the economy did not rise as high as was estimated, (2) the pass-through from the appreciating exchange rate was lower than expected, and (3) the size and persistence of the increase in agricultural commodity prices was unanticipated. The global financial crisis then led to a recession and reversal of commodity prices rises, while inflation declined sharply and expectations came down to target through 2009.

Policy conclusions: Even when expectations are well anchored, risks to credibility could arise when inflation moves far from its target or when it remains above its band for an extended period.

The authors of this box are Sonali Das, Christoffer Koch, and Prachi Mishra.

Box 2.3 *(continued)*

India 2010–14

Background: Following a rebound after the global financial crisis, growth began to slow in 2011 because of domestic and external factors. The 2003 fiscal rule was abandoned, leading to internal and external imbalances. Inflation expectations were not anchored during this time. At the first hint of US monetary policy tapering on May 22, 2013, India's large current account deficit and excessive dependence on portfolio flows stood badly exposed. A plunging rupee heightened concerns of even higher inflation and risks of a ratings downgrade.

Policy response and results: A new central banker was appointed and laid out several priorities on the first day, September 2, 2013. Two things stood out: (1) a pledge to restore confidence, and (2) a commitment to make the central bank more transparent and predictable. A new inflation-targeting framework began guiding policy and communications in January 2014. Foreign exchange interventions to address commodity price volatility accompanied this strategy. Confidence in the country's economy was achieved as rupee expectations became firmly anchored and inflation and inflation expectations were brought under control.

Policy conclusions: Monetary policy operations improvements and communication strategies, along with a transparent and credible commitment to reducing inflation, worked to disinflate from high levels. The central bank's success on this front opened up the space to pursue other objectives without disturbing inflation expectations.

References

Acemoglu, Daron, Suresh Naidu, Pascual Restrepo, and James A. Robinson. 2019. "Democracy Does Cause Growth." *Journal of Political Economy* 127 (1): 47–100.

Agur, Itai, Damien Capelle, Giovanni Dell'Ariccia, and Damiano Sandri. Forthcoming. "Monetary Finance: Do Not Touch or Handle with Care?" Departmental Paper, Research Department, International Monetary Fund, Washington, DC.

Angrist, Joshua D., Òscar Jordà, and Guido M. Kuersteiner. 2018. "Semiparametric Estimates of Monetary Policy Effects: String Theory Revisited." *Journal of Business & Economic Statistics* 36 (3): 371–87.

Auer, Raphael, Claudio Borio, and Andrew Filardo. 2017. "The Globalization of Inflation: The Growing Importance of Global Value Chains." CEPR Discussion Paper 11905, Centre for Economic Policy Research, London.

Ball, Laurence, Gita Gopinath, Daniel Leigh, Prachi Mishra, and Antonio Spilimbergo. 2021. "Underlying US Inflation: Set for Take-Off? VoxEU, May 7.

Barnichon, Regis, and Geert Mesters. 2021. "The Phillips Multiplier." *Journal of Monetary Economics* 117: 689–705.

Beechey, Meredith, Benjamin Johannsen, and Andrew Levin. 2011. "Are Long-Run Inflation Expectations Anchored More Firmly in the Euro Area than in the United States?" *American Economic Journal: Macroeconomics* 3: 104–29.

Bems, Rudolfs, Francesca G. Caselli, Francesco Grigoli, and Bertrand Gruss. 2020. "Gains from Anchoring Inflation Expectations: Evidence from the Taper Tantrum Shock." *Economics Letters*, Volume 188, March 2020, 108820.

Bems, Rudolfs, Francesca G. Caselli, Francesco Grigoli, and Bertrand Gruss. 2021. "Expectations Anchoring and Inflation Persistence." *Journal of International Economics* 132: 103516.

Bems, Rudolfs, Francesca G. Caselli, Francesco Grigoli, and Bertrand Gruss. Forthcoming. "Is Inflation Domestic or Global?" *International Journal of Central Banking*.

Blanchard, Olivier. 2021. "In Defense of Concerns over the $1.9 Trillion Relief Plan." *Real Time Economic Issues Watch*, Peterson Institute for International Economics, Washington, DC.

Boire, François-Michel, Thibaut Duprey, and Alexander Ueberfeldt. 2021. "Shaping the Future: Policy Shocks and the GDP Growth Distribution." Bank of Canada Working Paper 2021–24, Ottawa.

Borio, Claudio, and Andrew Filardo. 2007. "Globalization and Inflation: New Cross-Country Evidence on the Global Determinants of Domestic Inflation." BIS Working Paper 227, Bank for International Settlements, Basel.

Carrière-Swallow, Yan, Bertrand Gruss, Nicolás E. Magud, and Fabián Valencia. 2021. "Monetary Policy Credibility and Exchange Rate Pass-Through." *International Journal of Central Banking* 17 (3): 61–94.

Caselli, Francesca, and Philippe Wingender. 2021. "Heterogeneous Effects of Fiscal Rules: The Maastricht Fiscal Criterion and the Counterfactual Distribution of Government Deficits." *European Economic Review* 136.

Cavallo, Alberto. 2020. "Inflation with COVID Consumption Baskets." NBER Working Paper 27352, National Bureau of Economic Research, Cambridge, MA.

Celasun, Oya, Roxana Mihet, and Lev Ratnovski. 2012. "Commodity Prices and Inflation Expectations in the United States." IMF Working Paper 12/89, International Monetary Fund, Washington, DC.

Chavleishvili, Sulkhan, and Simone Manganelli. 2020. "Forecasting and Stress Testing with Quantile Vector Autoregression." ECB Working Paper 2330, European Central Bank, Frankfurt.

Chernozhukov, Victor, Iván Fernández-Val, and Alfred Galichon. 2010. "Quantile and Probability Curves without Crossing." *Econometrica* 78 (3): 1093–125.

Clarida, Richard, Jordi Galí, and Mark Gertler. 1999. "The Science of Monetary Policy: A New Keynesian Perspective." *Journal of Economic Literature* 37 (4): 1661–707.

Coibion, Olivier, and Yuriy Gorodnichenko. 2015. "Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation." *American Economic Journal: Macroeconomics* 7 (1): 197–232.

Coibion, Olivier, Yuriy Gorodnichenko, Saten Kumar, and Mathieu Pedemonte. 2020. "Inflation Expectations as a Policy tool?" *Journal of International Economics* 124.

Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber. 2021. "Fiscal Policy and Households' Inflation Expectations: Evidence from a Randomized Control Trial." CESifo Working Paper Series 8905, Center of Economic Studies, Munich.

Daly, Mary C., Bart Hobijn, and Benjamin Pyle. 2016. "What's Up with Wage Growth?" Federal Reserve Bank of San Francisco Economic Letter 2016-07, March 7.

Dincer, N. Nergiz, and Barry Eichengreen. 2014. "Central Bank Transparency and Independence: Updates and New Measures." *International Journal of Central Banking*. 10 (1): 189–259.

Dolmas, Jim. 2005. "Trimmed Mean PCE Inflation." Research Department Working Paper 0506, Federal Reserve Bank of Dallas.

Draghi, Mario. 2017. "Accompanying the Economic Recovery." Speech at the European Central Bank Forum on Central Banking, Sintra, June 27.

Galí, Jordi, and Mark Gertler. 1999. "Inflation Dynamics: A Structural Econometric Analysis." *Journal of Monetary Economics* 44 (2): 195–222.

Galí, Jordi, Mark Gertler, and David Lopez-Salido. 2001. "European Inflation Dynamics." *European Economic Review* 45 (7): 1237–270.

Galí, Jordi, Mark Gertler, and David Lopez-Salido. 2005. "Robustness of the Estimates of the Hybrid New Keynesian Phillips Curve." *Journal of Monetary Economics* 52 (6): 1107–118.

Galí, Jordi, Frank Smets, and Rafael Wouters. 2012. "Unemployment in an Estimated New Keynesian Model." *NBER Macroeconomics Annual* 26: 329–60.

Garriga, Ana Carolina. 2016. Central Bank Independence in the World: A New Dataset. *International Interactions* 42 (5):849–868.

Ghysels, Eric, Leonardo Iania, and Jonas Striaukas. 2018. "Quantile-Based Inflation Risk Models." National Bank of Belgium Working Paper 34, Brussels.

Goel, Rohit, and Sheheryar Malik. 2021. "What Is Driving the Rise in Advanced Economy Bond Yields?" IMF Global Financial Stability Note 2021/03, International Monetary Fund, Washington, DC.

Gopinath, Gita. 2015. "The International Price System." NBER Working Paper 21646, National Bureau of Economic Research, Cambridge, MA.

Gürkaynak, Refet S., Brian Sack, and Jonathan H. Wright. 2010. "The TIPS Yield Curve and Inflation Compensation." *American Economic Journal: Macroeconomics* 2 (1): 70–92.

Hausmann, Ricardo, Lant Pritchett, and Dani Rodrik. 2005. "Growth Accelerations." *Journal of Economic Growth* 10 (4): 303–29.

Hooper, Peter, Frederic Mishkin, and Amir Sufi. 2019. "Prospects for Inflation in a High-Pressure Economy: Is the Phillips Curve Dead or Is It Just Hibernating?" NBER Working Paper 25792, National Bureau of Economic Research, Cambridge, MA.

Imbens, G. W., and J. M. Wooldridge. 2009. "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature* 47 (1): 5–86.

Jordà, Òscar. 2005. "Estimation and Inference of Impulse Responses by Local Projections." *American Economic Review* 95 (1): 161–82.

Jordà, Òscar, and Alan Taylor. 2016. "The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy." *Economic Journal* 126 (590): 219–55.

Koenker, Roger, and Zhijie Xiao. 2006. "Quantile Autoregression." *Journal of the American Statistical Association* 101 (475): 980–90.

Kumar, Anil, and Orrenius, Pia M. 2016. "A Closer Look at the Phillips Curve Using State-Level Data." *Journal of Macroeconomics* 47 (Part A): 84–102.

Lenza, Michele, and Giorgio Primiceri. 2020. "How to Estimate a VAR after March 2020." NBER Working Paper 27771, National Bureau of Economic Research, Cambridge, MA.

Lopez-Salido, David, and Francesca Loria. 2020. "Inflation at Risk." Finance and Economics Discussion Series 2020-013, Board of Governors of the Federal Reserve System, Washington, DC.

Mavroeidis, Sophocles, Mikkel Plagborg-Møller, and James H. Stock. 2014. "Empirical Evidence on Inflation Expectations in the New Keynesian Phillips Curve." *Journal of Economic Literature* 52 (1): 124–88.

McLeay, Michael, and Silvana Tenreyro. 2020. "Optimal Inflation and the Identification of the Phillips Curve." *NBER Macroeconomics Annual 2020* 34: 199–255.

Mihailov, Alexander, Giovanni Razzu, and Zhe Wang. 2019. "Heterogeneous Effects of Single Monetary Policy on Unemployment Rates in the Largest EMU Economies." Economics Discussion Papers em-dp2019-07, Department of Economics, University of Reading.

Mishkin, Frederic S. 2000. "Inflation Targeting in Emerging Market Countries." *American Economic Review* 90 (2): 105–9.

Mishkin, Frederic S. 2007. "Inflation Dynamics." *International Finance* 10 (3): 317–34.

Mishkin, Frederic S., and Miguel A. Savastano. 2001. "Monetary Policy Strategies for Latin America." *Journal of Development Economics* 66 (2): 415–44.

Montes-Rojas, Gabriel. 2019. "Multivariate Quantile Impulse Response Functions." *Journal of Time Series Analysis* 40 (5): 739–52.

Powell, Jerome H. 2018. "Monetary Policy at a Time of Uncertainty and Tight Labor Markets." Remarks at Price and Wage-Setting in Advanced Economies, European Central Bank Forum on Central Banking, Sintra, Portugal, June 20.

Powell, Jerome H. 2021. "Virtual Hearing—Oversight of the Treasury Department's and Federal Reserve's Pandemic Response." March 23.

Pradhan, Manoj, and Charles Goodhart. 2021. "Friedman vs Phillips: A Historic Divide." *VoxEU* column, February 26.

Ramey, Valerie A. 2016. "Macroeconomic Shocks and Their Propagation." In *Handbook of Macroeconomics* 2A, edited by John B. Taylor and Harald Uhlig, 71–162.

Reinsdorf, Marshall. 2020. "COVID-19 and the CPI: Is Inflation Underestimated?" IMF Working Paper 20/224, International Monetary Fund, Washington, DC.

Romer, Christina D., and David H. Romer. 2004. "A New Measure of Monetary Shocks: Derivation and Implications." *American Economic Review* 94 (4): 1055–84.

Serrato, J. C., and P. Wingender. 2016. "Estimating Local Fiscal Multipliers." NBER Working Paper 22425, National Bureau of Economic Research, Cambridge, MA.

Strohsal, Till, and Lars Winkelmann. 2015. "Assessing the Anchoring of Inflation Expectations." *Journal of International Money and Finance* 50 (C): 33–48.

Summers, Laurence H. 2021. "The Biden Stimulus Is Admirably Ambitious. But It Brings Some Big Risks, Too." Opinion, *Washington Post,* February 4.

Willems, Tim. 2020. "What Do Monetary Contractions Do? Evidence from Large Tightenings." *Review of Economic Dynamics* 38: 41–58.

Yellen, Janet L. 2012. "Perspectives on Monetary Policy." Speech at the Boston Economic Club, Boston, MA, June 6.

Yellen, Janet L. 2015. "Inflation Dynamics and Monetary Policy." Speech at the Philip Gamble Memorial Lecture, University of Massachusetts, Amherst, September 24.

Yellen, Janet L. 2016. "Macroeconomic Research after the Crisis." Speech at the 60th Annual Economic Conference, The Elusive "Great" Recovery: Causes and Implications for Future Business Cycle Dynamics, sponsored by the Federal Reserve Bank of Boston, October 14.