Finance and Economics Discussion Series

Federal Reserve Board, Washington, D.C.
ISSN 1936-2854 (Print)
ISSN 2767-3898 (Online)

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Michael T. Kiley and Frederic S. Mishkin

2024-035

Please cite this paper as:
Kiley, Michael T., and Frederic S. Mishkin (2024). "Central Banking Post Crises," Finance and Economics Discussion Series 2024-035. Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/FEDS.2024.035.

Central Banking Post Crises

by

Michael T. Kiley
Board of Governors of the Federal Reserve System
and
Frederic S. Mishkin
Graduate School of Business, Columbia University
and
National Bureau of Economic Research

Abstract

The world economy has experienced the largest financial crisis in generations, a global pandemic, and a resurgence in inflation during the first quarter of the 21st century, yielding important insights for central banking. Price stability has important benefits and is the responsibility of a central bank. Achieving price stability in a complex and uncertain environment involves a credible commitment to a nominal anchor with a strong response to inflation and pre-emptive leaning against an overheating economy. Associated challenges imply that central bank communication and transparency are key elements of monetary policy strategies and tactics. Crises have emphasized the role of central banks in promoting financial stability, as financial stability is key to achieving price and economic stability, but this role increases risks to independence. Goals for central banks other than price and economic stability, complemented by financial stability, can make it more difficult for them to stabilize both inflation and economic activity.

Keywords

central bank governance, central banking, financial stability, monetary policy, science of central banking

Prepared for *The Oxford Handbook of Banking,* Fourth Edition. The authors would like to thank Jane Krohn for her research assistance. The views expressed here are our own and are not necessarily those of the Board of Governors of the Federal Reserve System, Columbia University, or the National Bureau of Economic Research. Disclosure of Mishkin's outside compensated activities can be found on his website at http://www0.gsb.columbia.edu/faculty/fmishkin/

23.1 Introduction

Central banks are experiencing the apocryphal curse that they are living through interesting times.[1] In the last twenty years, they have faced the global financial crisis of 2007-2009, the Covid pandemic of 2020, and a surge in inflation in 2022-2023. This chapter examines the challenges that central banks face in the wake of these crises. We focus on how governance, monetary policy and financial stability policy at central banks has evolved in recent years.

A central bank is a unit of government that controls monetary policy. The policy goals of central banks focus on price stability, stability in economic activity, and financial stability—goals that have evolved over centuries of practice (Bordo, 2007). To promote these goals, a central bank controls the quantity and/or pricing of the government's monetary liabilities, currency and reserves, and the terms of lender-of-last-resort facilities.

Because the preeminent role of central banks is the stabilization of prices and economic activity through the setting of monetary policy, we start by discussing the core economics of central banking, and then discuss how this analysis impacts the tools and design of monetary policy. The broad effects of central bank's actions on macroeconomic and financial conditions are primary channels through which a central bank's activities impact the banking system.

The role of central banks in promoting financial stability stems from a least two factors. First, financial stability promotes price and economic stability. Second, the tools of monetary policy include lender-of-last-resort activities that stem from central banks control of the government's monetary liabilities. These tools can be used to combat financial instability and contribute to a role for central banks in supervising the banking sector. We review these issues in our discussion

[1] The curse, "May you live in interesting times" has often been attributed to ancient China, but source for such attribution is not clear. Among the early published uses of this phrase is a memoir of Sir Hughe Knatchbull-Hugessen, who served as the British ambassador to China in the mid-1930s (Knatchbull-Hugessen, Hughe (1949). *Diplomat in Peace and War*. John Murray).

of central bank mandates. Our discussion also touches on potential additional mandates for central banks that have been discussed recently.

To illustrate the macroeconomic and financial challenges faced by central banks as they pursue their mandates, we discuss challenges created by low interest rates following the global financial crisis and the Covid pandemic and by the inflation surge in 2021-22. Finally, we conclude with a summary of the lessons we have learned for central bank strategies and tactics, including issues for further research.

23.2 The Core Economics of Central Banking

Over the last six decades, economists have derived from theory and empirical evidence a core of economic analysis that guides central bank's in setting monetary policy. We discuss this economic analysis, which is often referred to as the "science of central banking" (Clarida, Gali and Gertler, 1999) by discussing the following core economic principles:

- Price stability has important benefits and is primarily the responsibility of a central bank.

- There is no long-run tradeoff between unemployment and inflation, but a short-run tradeoff exists.

- Expectations play a crucial role in the macro economy and the role of expectations can create time-inconsistency problems that impair achievement of price stability. A transparent policy framework for monetary policy can constrain discretionary behavior and alleviate some of the time-inconsistency problems.

- Central bank independence promotes price stability and economic performance, in part by addressing time-inconsistency challenges.

23.2.1 Price Stability has Important Benefits and is the Responsibility of a Central Bank

With the rise of inflation in the 1960s and 1970s, economists, and also the public and politicians, began to discuss the high costs of inflation (for example, see the surveys in Fischer, 1993; Anderson and Gruen, 1995; and Kiley, Mauskopf, and Wilcox, 2007). High inflation undermines the role of money as a medium of exchange by acting as a tax on cash holdings. On top of this, a high-inflation environment leads to overinvestment in the financial sector, which expands to help individuals and businesses escape some of the costs of inflation (English, 1996). The interaction of the tax system and inflation also increases distortions—for example through lack of indexation of capital gains—that adversely affect economic activity (Feldstein, 1997). Unanticipated inflation causes redistributions of wealth that harm some households or sectors and benefit others, potentially causing economic or political spillovers (for example, Doepke and Schneider, 2006a and 2006b).

Inflation also leads to uncertainty about relative prices and the future price level, making it harder for firms and individuals to make appropriate decisions, thereby decreasing economic efficiency (e.g., Lucas, 1972, Briault, 1995). Economists have observed a correlation between the *level* and the *volatility* of inflation, with the latter serving as a proxy for uncertainty (for example, Okun, 1971; Kiley, 2007; and Cecchetti et al, 2023). In addition, nominal rigidities and staggered wage and price setting imply that inflation creates dispersion in relative prices which is inefficient, lowering activity and harming welfare; while this channel is central in New-Keynesian models (for example, Woodford, 2003), empirical analysis does not clearly suggest this channel is large (for example, Nakamura et al, 2018).

Finally, there are behavioral cost associated with high inflation. Some households undoubtedly do not fully understand the implications of a general trend in prices—that is, they may suffer from nominal illusion—making financial planning more difficult. This is consistent with survey evidence showing that the public strongly dislikes inflation (for example, Shiller, 1997).

The total effect of these distortions became more fully appreciated over the course of the 1970s, and the recognition of the high costs of inflation led to the view that low and stable inflation can increase the level of resources productively employed in the economy.[2] The deleterious effects of inflation on economic efficiency implies that the level of sustainable employment is probably lower at higher rates of inflation. Thus, the goals of price stability and high employment are likely to be complementary, rather than competing, over the medium and long run.

At the same time, the high level of inflation in the 1970s led economists and policymakers to examine the policies most appropriate for controlling inflation. In the 1970s, the role of supply factors in driving up inflation and uncertainty about the relationship between inflation and economic activity contributed to a sense, in some analyses, that inflation was not a monetary problem. As a result, alternative approaches, such as price or wage controls, were considered. For example, the Nixon Administration imposed price controls in the early 1970s. These efforts temporarily lowered inflation, but inflation returned after their removal. Tobin (1980) argued that lowering inflation through monetary policy would be excessively costly and that wage and price controls were an appropriate tool. However, over time, a consensus emerged that monetary policy was the key factor in inflation over medium-term horizons. Among other factors, the rapidity of the Volcker disinflation in the early 1980s, a growing appreciation for the role of expectations (discussed below), and additional cross-country evidence which supports a nominal-anchor-cemented monetary policy as the key medium-term factor in inflation dynamics and thereby emphasized that inflation control is primarily the responsibility of a central bank.

23.2.2 No Long-Run Tradeoff Between Unemployment and Inflation

An influential paper published in 1960 by Paul Samuelson and Robert Solow (1960) argued that work by A.W. Phillips (1958), which became known as the Phillips curve, suggested that there was a long-run tradeoff between unemployment and inflation and that this tradeoff could be exploited. Under this view, the policymaker would have to choose between two competing

[2] A further possibility is that low inflation may even help increase the rate of economic growth. While time-series studies of individual countries and cross-national comparisons of growth rates are not in total agreement (Anderson and Gruen, 1995), the consensus is that inflation is detrimental to economic growth, particularly when inflation rates are high.

goals--inflation and unemployment--and decide how high an inflation rate he or she would be willing to accept to attain a lower unemployment rate.

The tradeoff suggested by Samuelson and Solow was hotly contested by Milton Friedman (1968) and Edmund Phelps (1968), who independently argued that there was no long-run tradeoff between unemployment and the inflation rate: Rather, the economy would gravitate to a natural rate of unemployment in the long run no matter what the rate of inflation was. In other words, the long-run Phillips curve would be vertical, and attempts to lower unemployment below the natural rate would result only in higher inflation. The Friedman-Phelps natural rate hypothesis was immediately influential and was quickly incorporated in formal econometric models.

23.2.3 Importance of Expectations and the Time-Inconsistency Problem

A key aspect of the Friedman-Phelps natural rate hypothesis was that sustained inflation may initially confuse firms and households, but in the long run sustained inflation would not boost employment because *expectations* of inflation would adjust to any sustained rate of increase in prices. Starting in the early 1970s, the rational expectations revolution, launched in a series of papers by Robert Lucas (1972, 1973, and 1976), took this reasoning a step further and demonstrated that the public and the markets' expectations of policy actions have important effects on almost every sector of the economy.[3] As a result, the systematic component of policymakers' actions--i.e., the component that can be anticipated--plays a crucial role in the conduct of monetary policy.[4] Indeed, the management of expectations about future policy has become a central element of monetary theory, as emphasized in Woodford (2003).

While there is no long run tradeoff between unemployment and inflation, there is a short-run tradeoff that can lead to the time-inconsistency problem (Kydland and Prescott, 1977, Calvo,

[3] Note that although Muth (1961) introduced the idea of rational expectations more than ten years earlier, his work went largely unnoticed until resurrected by Lucas.

[4] Indeed, one implication of rational expectations in a world of flexible wages and prices was the policy ineffectiveness proposition, which indicated that if monetary policy was anticipated, it would have no real effect on output; only unanticipated monetary policy could have a significant impact. Although evidence for the policy ineffectiveness proposition turned out to be weak (Barro, 1977; Mishkin, 1982a, b, 1983), the rational expectation revolution's point that monetary policy's impact on the economy is substantially influenced by whether it is anticipated or not has become widely accepted.

1978, and Barro and Gordon, 1983). The time-inconsistency problem arises when monetary policy is conducted on a discretionary basis. Policymakers may find it tempting to exploit a short-run Phillips curve tradeoff between inflation and unemployment by seeking lower unemployment through surprise inflation. Private agents, cognizant of this temptation, will adjust expectations to anticipate the expansionary policy, resulting in higher inflation with no short-run increase in employment In other words, without a commitment mechanism, monetary policy makers are unable to manage expectations for low inflation because private agents will understand that low inflation is not *consistent* with the temptation of policymakers to engender a surprise inflation*;* that is, policy intentions to pursue low inflation can be *time-inconsistent* and so will soon be abandoned. The time-inconsistency problem of discretionary monetary policy has led to important insights regarding central bank governance and behaviour.

The time-inconsistency problem brought to the fore the role of rules versus discretion in the setting of monetary policy. This debate has been a long standing one.[5] A *rule* requires that monetary policy is essentially automatic: it involves a precise prescription for how monetary policy reacts to a set of economic circumstances. One example of a monetary policy rule is the constant-money-growth rule advocated by Milton Friedman, in which the money supply is set by the central bank to grow at a constant rate. A more recent alternative is the classic Taylor (1993) rule in which the policy interest rate, the federal funds rate, is set to be a weighted average of an output gap (actual output minus potential output) and an inflation gap (actual inflation minus the target inflation rate). The opposite of a monetary policy rule, according to the traditional classification of policy regimes, is *discretion*. Discretion, in its purist form, involves monetary policymakers setting their policy instruments on a day-to-day basis as economic events unfold, with no public commitments about their objectives or actions.

As an illustration of the debate and challenges associated with rules, the early 2000s experience in the United States and other countries is instructive. Taylor (2007) argues that excessively loose monetary policy contributed to a global housing bubble and the global financial crisis of 2008. Dokko et al (2011) look across a wide number of countries and find little evidence that discretionary monetary policy contributed significantly to the housing bubble. Mishkin (2018)

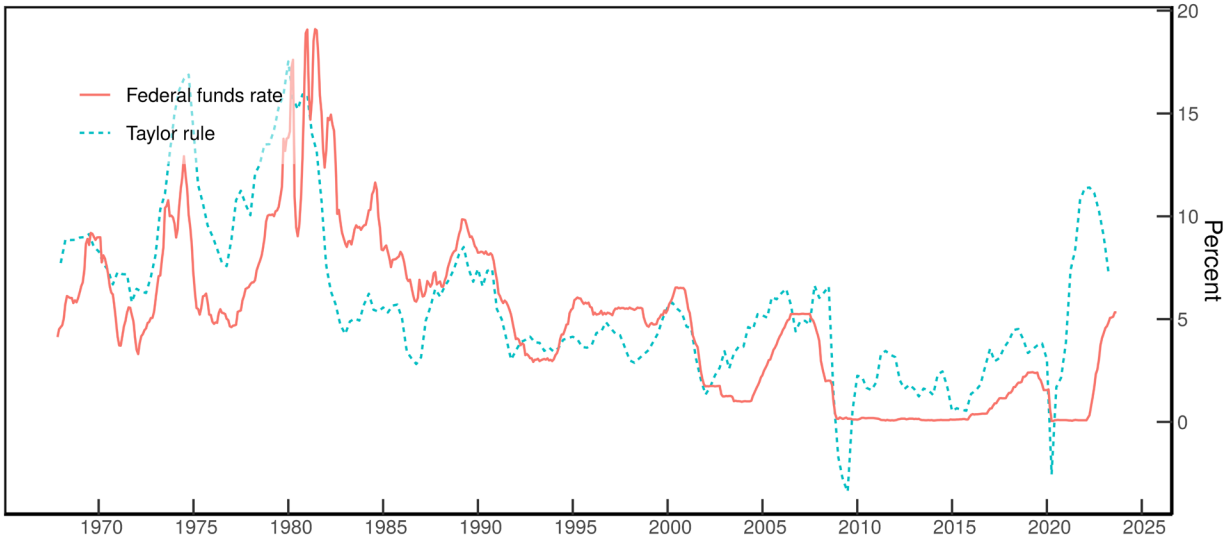
[5] See Mishkin (2018) for a more detailed discussion on the rules versus discretion debate discussed here.

conducts an exercise which evaluates how well a traditional Taylor (1993) rule would have performed during the global financial crisis and its aftermath. To illustrate these points, figure 23-1 presents the prescriptions from the Taylor (1993) rule (equation (1), in which the nominal short-term interest rate, i_t, is a function of inflation, π_t, and the output gap, y_t.

Equation 1

$$i_t = 2 + \pi_t + 0.5(\pi_t - 2) + 0.5y_t \ .$$

Figure 23- 1: Federal funds rate and prescriptions from the Taylor rule



Source: Authors' calculations and Board of Governors of the Federal Reserve System (US), Federal Funds Effective Rate [FEDFUNDS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/FEDFUNDS; U.S. Congressional Budget Office, Real Potential Gross Domestic Product [GDPPOT], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPPOT; U.S. Bureau of Economic Analysis, Real Gross Domestic Product [GDPC1], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPC1; U.S. Bureau of Economic Analysis, Gross Domestic Product: Implicit Price Deflator [GDPDEF], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPDEF; U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index [PCEPI], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PCEPI. All retrieved October 17, 2023.

The federal funds rate was somewhat below the prescriptions of the Taylor rule in the early 2000s, but the gap was not large by historical standards. And over the course of the 2010s the rule consistently prescribed a funds rate above the actual funds rate; however, inflation and economic activity were arguably below target and full employment for much of this period (Clarida, 2021), highlighting how strict adherence to a rule may have led to policy mistakes.

Furthermore, the Taylor rule did not prescribe the Fed's preemptive lowering of the funds rate in the early stages of the global financial crisis and the Covid pandemic. These exercises suggests that a Taylor rule would have performed suboptimally, by not lowering interest rates sufficiently at the outset of these crises and then raising interest rates far too quickly in the aftermath of the global financial crisis. The Taylor rule did not take account of the financial disruptions that were an important factor in the evolution of the economy at that time and that were largely absent from the core models used at central banks (see Mishkin, 2011). Despite the limitations of the Taylor rule, the rule does capture the broad contours of historical policy, which suggests that reference to policy rules may inform policy discussions. For example, the deviations were very large in 2021.

Bernanke and Mishkin (1997) argues that the rules-versus-discretion debate has been miscast because the dichotomy between rules and discretion is too simple. Advocates of rules argue against *pure* discretion, while advocates of discretion argue against *rigid* rules. Bernanke and Mishkin (1997) argued that by imposing a structure that imposes discipline on monetary policy, but does not eliminate flexibility, what they called *constrained discretion,* monetary policy could avoid some of the disadvantages of either rigid rules or pure discretion. Constrained discretion is an attempt to achieve the best of both rules and discretion by making discretion have rule-like properties, mitigating the time-inconsistency problem. An approach of constrained discretion considers the prescriptions of simple policy rules, augmented with judgment.

23.2.4 Central Bank Independence

The potential problem of time-inconsistency has led to a great deal of research that examines the importance of institutional features that can give central bankers the commitment mechanisms to pursue low inflation. Perhaps the most significant has been research showing that central bank independence, at least along some dimensions, is likely very important to maintaining low inflation. However, it is important to distinguish between two types of independence made by Debelle and Fischer (1994) and Fischer (1994). *Goal independence* is the ability of the central bank to set its own goals for monetary policy, while *instrument independence* is the ability of the central bank to independently set the instruments of monetary policy to achieve its goals.

Central bank instrument independence can help insulate central banks from short-run pressures to exploit the Phillips-curve tradeoff between employment and inflation and thus avoid the time-inconsistency problem.[6] Evidence supports the conjecture that macroeconomic performance is improved when central banks are instrument independent. When central banks in industrialized countries were ranked from least legally independent to most legally independent, the inflation performance was found to be the best for countries with the most independent central banks (Alesina and Summers, 1993; Cukierman, 1993; Fischer, 1994; and the surveys in Forder, 2000, and Cukierman, 2006).[7]

Although there is a strong case for instrument independence, which is more common, the same is not true for goal independence. If the goals of monetary policy are set by the elected government, then the democratic principles that the public exercises control over government actions and holds policymakers accountable has been satisfied. Although basic democratic principles argue for the government setting the goals of monetary policy, the question of whether it should set goals for the short-run or intermediate-run is more controversial. For example, an arrangement in which the government set a short-run inflation or exchange rate target that was changed every month or every quarter could easily lead to a time-inconsistency problem in which short-run objectives would dominate. In practice, however, this problem does not appear to be severe: for example, in many countries in which the government sets the annual inflation target, the target is rarely changed.

Instrument independence generally calls for processes to hold the central bank accountable for achieving its objectives. The most straightforward approach to such accountability is

[6] For an example of how the time-inconsistency problem can be modeled as resulting from political pressure, see Mishkin and Westelius (2008).

[7] A case study that provides a striking example of the benefits of instrument independence occurred with the granting of instrument independence to the Bank of England in May of 1997 (Mishkin and Posen, 1997; Bernanke, Laubach, Mishkin and Posen, 1999); before that date, the Chancellor of the Exchequer (the finance minister) set the monetary policy instrument, not the Bank of England. During 1995-96 the U.K. retail inflation rate (RPIX) was fairly close to 3 percent, but the spread between nominal and indexed bond yields--referred to as 10-year breakeven inflation--was substantially higher, in the range of 4 percent to 5 percent, reflecting investors' inflation expectations as well as compensation for perceived inflation risk at a 10-year horizon. Notably, breakeven inflation declined markedly on the day that the government announced the Bank of England's independence and has remained substantially lower ever since.

transparency in the setting of its instruments to achieve its objectives. As a result, it is common for independent central banks to publish monetary policy or inflation reports. The trend toward greater central bank independence has been accompanied by greater transparency on the part of central banks (for example, Dincer and Eichengreen, 2014).

23.3 Central Bank Mandates

The core objective of central banks is price stability. Around the world, this mandate for monetary policy is governed by different arrangements, with a different degree of focus on the complementary goals of economic stability and price stability. Our review of monetary policy mandates focuses on these structures. In addition, financial stability factors are important for price and economic stability, and we devote considerable space to these considerations. We conclude with recent research on other mandates that have been discussed recently.

23.3.1 Monetary Policy Mandates

Two types of monetary-policy mandates for central banks are common: hierarchical and dual mandates. Because monetary policy is the primary determinant of inflation over the long run, many countries have decided that the mandate for a central bank focus on price stability. For example, the Maastricht Treaty, which created the European Central Bank, states, "The primary objective of the European System of Central Banks [ESCB} shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Community," which include objectives such as "a high level of employment" and "sustainable and non-inflationary growth." Mandates of this type, which put the goal of price stability first and then state that other goals can be pursued if price stability is achieved, are known as *hierarchical mandates.* Other central banks with hierarchical mandates include the Bank of England, the Bank of Canada, and the Reserve Bank of New Zealand.

In contrast, the legislation that defines the mission of the Federal Reserve states, "The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long-run growth of the monetary and credit aggregates commensurate with the

economy's long-run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates." Because moderate long-term interest rates require that inflation be kept low, the statement in practice is a *dual mandate* to achieve two coequal objectives: price stability and maximum employment (output stability).

Because no inconsistency exists between achieving price stability in the long run and the natural rate of unemployment, these two types of mandates are not very different *if maximum employment is defined as the natural rate of employment*. In practice, however, substantial differences between these two mandates might exist. For example, a hierarchical mandate could lead a central bank to put too much emphasis on inflation control and not enough on stabilizing output.[8] Indeed, the ECB's hierarchical mandate may have led it to focus too much on controlling inflation and not enough on stabilizing output and unemployment.[9] This might be one reason for the ECB's tighter monetary policy than the Federal Reserve's during the recovery from the global financial crisis. Conversely, a dual mandate might lead to pressure on a central bank to focus too much on stabilizing output and unemployment rather than stabilizing inflation.

23.3.2 Financial Stability

Financial stability supports the ability of central banks to stabilize both price and economic stability, and so is subsumed under the goals of price and economic stability. While our focus is not on the link between financial instability, economic activity, and price stability, the related literature is large. Research outlines how asymmetric information could impede the efficient functioning of the financial system (Akerlof, 1970; Myers and Majluf, 1984; and Greenwald, Stiglitz, and Weiss, 1984). When financial instability results, the economy can experience a severe economic downturn (Mishkin, 1997). Financial instability played a central role in the collapse of economic activity during the Great Depression (Mishkin, 1978; Bernanke, 1983; and

[8] Hierarchical mandates can make it harder to achieve the goal of economic stability if they lead to an extreme focus on price stability in which a central bank is, as described by the former Governor of the Bank of England, Mervyn King, as an "inflation nutter"—that is, a central bank that focuses solely on inflation control, even in the short run, and so undertakes policies that lead to large output fluctuations.
[9] See the discussion of Hartmann and Smets (2018).

the survey in Calomiris, 1993), and it spawned a large literature on the role of financial frictions in business cycle fluctuations (e.g., Bernanke and Gertler, 1999, 2001; Bernanke, Gertler, and Gilchrist, 1999; Kashyap and Stein, 1994). Empirical evidence strongly supports the proposition that the most severe business cycle downturns are always associated with financial instability (Mishkin, 1991, 1996).

When a sector of the financial system, especially the banking system, suffers a disruption that renders it unable to perform its normal function, the central bank can provide liquidity to this sector to keep it operating. This function of the central bank has become known as the lender of last resort, because the central bank is the only entity in an economy that can create unlimited amounts of liquidity (e.g., Bagehot, 1873). The lender-of-last resort role involves addressing financial-sector strains after they have emerged. Because such actions may encourage risk-taking (i.e., lead to moral hazard), central banks often supervise banks.[10]

These principles are apparent in practice around the world. For example, Liang and Edge (2017) review the financial stability and supervisory responsibilities of central banks across 58 countries. In their sample, all but two of the central banks are involved in policies related to financial stability. Regarding supervision, 36 of the 58 central banks have a direct supervisory role. However, these responsibilities are recent: A formal financial stability role for central banks was less common prior to the global financial crisis (BIS SG-CBGG, 2011).

Central banks have two types of financial stability policies: 1) reactive, which involve the provision of liquidity to sectors of the financial system to restore their functioning once a disruption to the financial system results in financial instability, and 2) proactive, which involves supervision of the financial system to prevent financial instability. Galati and Moessner (this volume) discuss macroprudential policies, or proactive policies through supervision and related

[10] Domanski, Moessner, and Nelson (2014) discuss the role of central banks in the provision of emergency liquidity assistance and review related literature. While it is common for central banks to have a regulatory and supervisory role related to banks for the reasons discussed, this role has not been without debate; for example, Goodhart (2002) and Nier et al (2011).

means to promote financial stability, and hence the focus herein is on liquidity provision and potential issues associated with financial dominance on monetary policy.

23.3.2.1 Reactive Policy: Liquidity Provision

When a sector of the financial system, especially the banking system, suffers a disruption that renders it unable to perform its normal function, the central bank can provide liquidity to this sector to keep it operating. This function of the central bank has become known as the *lender of last resort*, because the central bank is the only entity in an economy that can create unlimited amounts of liquidity. During the recent global financial crisis, central banks throughout the world not only performed this lender of last resort role by providing liquidity to banking institutions, but also undertook extraordinary actions, especially in the United States, to provide liquidity to non-bank sectors of the financial system, such as investment banks and money market mutual funds that make up the so-called shadow banking system (Mishkin and White, 2016).[11] This liquidity provision was taken even further during the Covid pandemic, when the Fed extended its liquidity facilities to additional entities. The increased role of nonbank financial institutions in financial markets and provision of backstop liquidity to such institutions contributed to the recent decision by the Bank of England to set up lender-of-last-resort facilities for certain nonbanks as a standing policy tool (Hauser, 2023).

Although the lender-of-last-resort function of central banks can mitigate and sometimes even stop a financial disruption in its tracks (e.g., as in 1987, see Mishkin, 1991), it does lead to a moral hazard problem: financial institutions, knowing that the central bank will provide them with liquidity when they get into trouble, take on more risk that can make financial instability more likely in the future. One solution to this problem was proposed by Bagehot (1873), who recommended that central bank lender-of-last-resort lending be done only for solvent institutions and at a penalty rate. However, in practice, his recommendation can be challenging. Determining which institutions are solvent is difficult. An institution may be solvent when there is no financial disruption, but insolvent if there is a financial disruption. Furthermore, determining what a penalty rate should be during a financial disruption is far from clear cut. If the rate is set

[11] Additional analyses of these programs include Duygan-Bump et al (2010), Adrian, Kimbrough, and Marchioni (2011), Wiggins and Metrick (2020), and Yang (2020).

too high, then solvent, but liquidity-deficient institutions may still fail; if the rate is set too low, then it encourages risk-taking by financial institutions because they recognize that they will get loans at subsidized rates when they get in trouble. Supervision by a central bank can help it distinguish between solvency and liquidity as well as limit moral hazard through prudential regulation.

23.3.2.2 Financial Stability, Monetary Policy, and Financial Dominance

Before the global financial crisis, the standard view in central banks was that there was a separation between financial stability policy and monetary policy. Monetary policy would focus on stabilizing output and inflation, while financial supervision would separately focus on promoting financial stability. The global financial crisis suggests that this separation is a false one. There is now a strong argument that there is an interaction between monetary policy and financial stability.

Some economists have suggested that monetary policy has contributed to financial instability, in a manner echoing issues from the classic rules versus discretion debate discussed earlier. The fact that the low interest rate policies of the Federal Reserve from 2002 to 2005 were followed by excessive risk-taking leads Taylor (2007) to argue that excessively low policy rates led to the housing bubble, while Bernanke (2010), Bean et al (2010), Turner (2010) and Posen (2009) have argued otherwise. Dokko et al (2011) examine experience in the United States, United Kingdom, Europe, Australia, Canada, and others during this period and find little role for monetary policy in the global housing bubble.

Nonetheless, monetary policy has broad effects on the economy—it "gets in all the cracks" (Stein, 2013)—and hence influences factors relevant for financial stability. Ajello et al (2022) review the related literature and suggest several broad channels through which monetary policy affects vulnerabilities related to financial stability including interest rate and asset price channels interacting with balance sheet channels and reach-for-yield channels.

Expansionary monetary policy compresses risk premiums and boosts asset prices through financial accelerator channels. These effects additionally operate through balance sheet channels,

increasing borrowing through higher collateral values (Bernanke, Gertler and Gilchrist, 1999; Kiyotaki and Moore, 1997), and allowing leverage investors to take on more risk (Adrian and Shin 2009, 2010; Adrian, Moench and Shin, 2010; and Allen and Gale, 2010). Moreover, in models with irrational beliefs, higher asset prices may lead to overborrowing and instability (Krishnamurthy and Li, 2020).

The literature provides several reasons why low interest rates might promote excessive risk-taking through reach-for-yield. First, as Rajan (2005, 2006) points out, low interest rates can increase the incentives for asset managers in financial institutions to search for yield and hence increase risk-taking. These incentives could come from contractual arrangements that compensate asset managers for returns above a minimum level, often zero, and with low nominal interest rates only high-credit risk or high-interest-rate-risk, long-duration investments will lead to high compensation. They could also come from fixed-rate commitments, such as those provided by insurance companies, forcing the firm to seek out higher-yielding, riskier investments. Or they could arise from behavioural tendencies such as money illusion, in which the managers believe that low nominal rates indicate that real returns are low, encouraging them to purchase riskier assets to obtain a higher target return. Models exploring these risks include Campbell and Sigalov (2021), Lian et al. (2019), and Martinez-Miera and Repullo (2017).

Micro-empirical analysis provides a fair amount of support for various risk-taking channels of monetary policy. For example, Jimenez, Ongena, Peydro and Saurina (2009), using Spanish credit registry data, find that low nominal interest rates, despite decreasing the probability of defaults in the short term, lead to riskier lending and more defaults in the medium term. Moreover, the empirical support for broad financial channels of monetary policy through financial imperfections are strong.

Nonetheless, empirical research does not suggest that monetary policy has been an important driver of financial vulnerabilities leading to financial instability (Boyarchenko, Favara, and Schularick, 2022). At least two factors contribute to this assessment. Quantifying the link between monetary policy and financial vulnerabilities is hard because financial vulnerabilities (like excessive borrowing) move slowly. And the literature does not often separate the

implications of changes in monetary policy from those due to changes in the long-run neutral interest rate.

Given this evidence, the case for using monetary policy to lean against credit bubbles is not strong. In addition, using monetary policy to address credit bubbles is a violation of the Tinbergen (1939) principle, because one instrument is being asked to do two jobs: 1) stabilize the financial sector; and 2) stabilize the economy. Macroprudential tools are better able to address financial stability, leaving monetary policy to focus on price and output stability. But macroprudential tools are limited and may be subject to political pressure (Tucker, 2018). The possibility that macro-prudential policies may not be implemented sufficiently well to constrain credit bubbles provides a reason why central banks might want to use monetary policy to limit them in rare circumstances.

Financial vulnerabilities may also create constraints on the ability of monetary policy to pursue price and economic stability. When financial vulnerabilities are high, a central bank may be unable to tighten monetary policy to restrain inflation. Because banking institutions often engage in the traditional business of borrowing short and lending long, a rise in interest rates lowers the value of assets more than the value of liabilities fall. The result is a deterioration in bank balance sheets that can lead to bank failures, with the result that a banking or financial crisis can erupt. More generally, overborrowing by households and businesses may lead them vulnerable to an increase in interest rates. In such situations, raising interest rates to contain inflation may thus no longer be an option for a central bank, a situation that is referred to as *financial dominance* (e.g., Brunnermeier, 2023).

Boissay et al (2023) examine the interaction of monetary policy, financial stress, inflation, and macroprudential policies to shed light on policy strategies that may limit the risk of financial dominance. They present evidence that monetary policy tightening raises the likelihood of financial stress down the road if the hikes take place when the initial level of private sector debt is high and inflationary pressures call for a strong policy reaction; this combination suggests a risk of financial dominance. However, they also show that macroprudential measures help to reduce the likelihood of financial stress. They conclude that macroprudential policy can allow

monetary policy to focus more freely on its fight against inflation, by mitigating the risk of financial dominance. This provides further support for an effective macroprudential toolkit and the complementary role for central banks between monetary and macroprudential policies as part of an economic and financial stability framework of the type outlined herein and in Brunnermeier (2023) and Borio et al (2022).

23.3.3 Additional Mandates

A key reason for not expanding central bank mandates beyond price and economic (output) stability (and financial stability within those goals) is that these goals are difficult enough to achieve. A focus on additional goals may lead to central banks taking their eye off the ball on achieving price and economic stability and thus could lead to poorer central bank performance on achieving these goals. In addition, additional goals may not be achievable with monetary tools: achievement of a set of goals requires a set of policy tools sufficient to jointly meet all the goals; the absence of sufficient policy instruments implies that a central bank may not be able to achieve multiple goals (Tinbergen, 1939). Expanding the goals of a central bank by assigning it more policy instruments, may overburden a central bank or lead to challenges in prioritizing goals and policy actions. If central banks pursue additional goals, the risk of disagreements over goals and policies is higher, potentially affecting support for central bank independence in monetary policy.

While debates regarding additional mandates for central banks are ongoing, it is common for experienced central bankers to voice significant the potential downsides outlined above.[12] Recent debates on additional goals for central banks have also included how central banks account for climate change or inequality, and policymakers and researchers have also highlighted the challenges noted above. For example, regarding climate change, researchers have highlighted how additional mandates could compromise central bank independence in the longer run and

[12] Paul Tucker, a former senior official at the Bank of England, summarized his views in 2018 as follows: "I worry that too much is now expected of central banks. We hope they'll solve all of the macroeconomic and financial problems that we have. I worry that some central banks have powers that make it possible for them to enter territory which really belongs to the politicians. The slogan is, "Central banks are the only game in town," and I don't think that's sustainable." In English and Tucker (2018). See also Tucker (2018).

divert central banks' focus on core mandates (e.g., Hansen, 2022, Brunnermeier and Landau, 2022). With regard to income inequality, discussions have emphasized several issues: central banks are aware, and have concerns about the consequences of their actions on income and wealth distribution over shorter horizons relevant for their stability mandates; central banks do not have the necessary tools to achieve distributional outcomes; and high inflation and recessions can be extremely costly for inequality, suggesting that a focus on core mandates is how central banks can limit adverse distributional outcomes (e.g., Carstens, 2023 and Rajan, 2023). These observations highlight how discussions regarding new mandates for central banks appear to suggest caution, reflecting the challenges an organization faces when executing to achieve multiple goals, a lack of policy levers relevant for addressing new mandates, and concerns over an expansion in responsibilities that may lower independence and hence undermine price stability.

23.4 The Design and Tools of Monetary Policy

Here we look at the implications of the science of monetary policy for the design and tools of monetary policy. First, we discuss central bank mandates. In particular, the price stability and economic stability mandates common to central banks derive from the science of monetary policy. At the same time, the important role of financial stability in promoting price and economic stability highlight how financial stability factors are important for the achievement of central bank mandates; this has led to a greater focus on the role of financial stability in central bank mandates, implicitly or explicitly. We then discuss the role of a nominal anchor and different approaches to the implementation of a nominal anchor. We then turn to the properties of monetary policy that enable central banks to achieve price and economic stability, focusing primarily on approaches to implementing flexible inflation targeting. This focus leads to a discussion of the properties of approaches to adjusting short-term policy interest rates to achieve price and economic stability, which has been the primary tool used by inflation targeting central banks. We conclude with the role of forward guidance and quantitative easing (nonconventional monetary policy tools) that have been used extensively since 2008.

23.4.1 Inflation Targeting and Properties of Monetary Policy to Achieve Price and Economic Stability

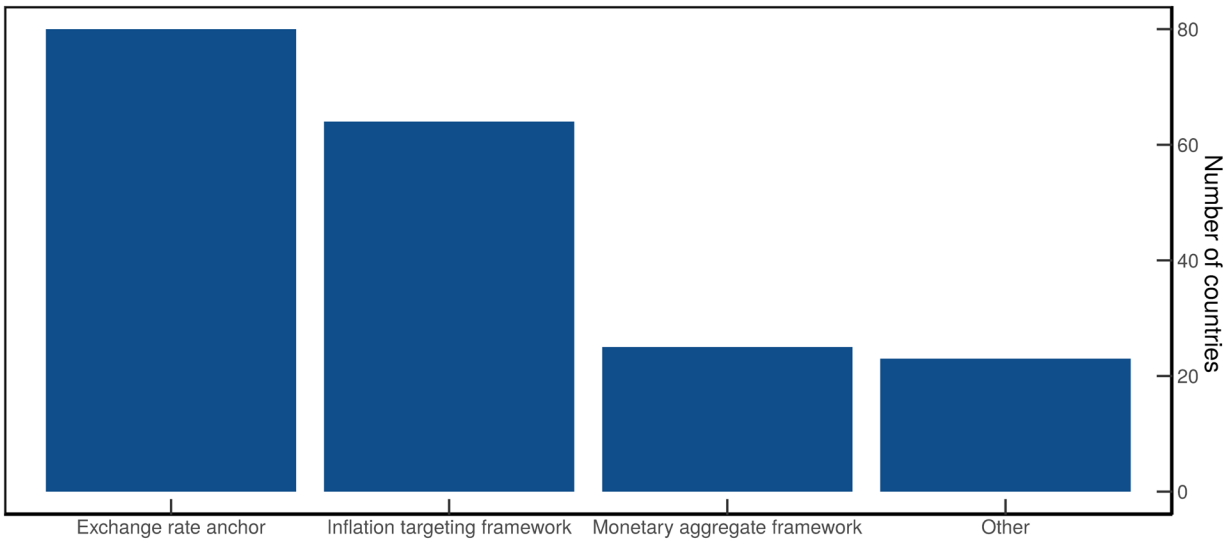
23.4.1.1 The Role of a Nominal Anchor and Inflation Targeting

Commitment to a nominal anchor – i.e., stabilization of a nominal variable such as the inflation rate, the money supply, or an exchange rate—provides a counterbalance to the time-inconsistency problem. It makes it clear that the central bank is focusing on the long-run and is thus able to resist the temptation to pursue short-run expansionary policies that are inconsistent with the nominal anchor. Commitment to a nominal anchor can also encourage the government to be more fiscally responsible, an issue we discuss below, which also supports price stability. For example, persistent fiscal imbalances have, in the absence of a strong nominal anchor, led some governments, particularly in less-developed economies, to resort to the so-called inflation tax--the issuing/printing of money to pay for goods and services that leads to more inflation and is thus inconsistent with price stability.

What nominal anchor should be chosen and how should it be implemented? Figure 23-2 presents information on the nominal anchors used by central banks around the world, as reported in IMF (2022). The most prominent nominal anchor is an exchange rate anchor; however, this anchor is most common in less developed economies, often reflecting the limited degree of financial development. An inflation targeting framework is the second most common and is used across major advanced economies (for example, the United States, the euro area, Japan, the United Kingdom, Canada, Australia, and Sweden) and large emerging market economies (for example, Brazil, Chile, India, Korea, and South Africa).[13]

[13] Note that we classify the United States and euro area countries as inflation targeting regimes, whereas the IMF (2022) refers to the regimes as "other".

Figure 23- 2: Nominal anchors in countries around the world



Source: Author calculations based on Annual report on exchange arrangements and exchange restrictions: overview 2022. International Monetary Fund, Washington, D.C.
https://www.elibrary.imf.org/display/book/9798400235269/9798400235269.xml?code=imf.org

Inflation targeting includes an announcement of an inflation objective, typically close to 2 percent. The framework involves an institutional commitment to achieve this target over the medium term and accountability via central bank communication and transparency about how the target is to be achieved and how past policy actions were consistent with achieving the inflation target. As described above, inflation targeting is a form of constrained discretion in which central banks have the flexibility (discretion) to avoid some of the problems with instrument rules described above, but accountability to meet the inflation target prevents the central bank from reneging on the optimal, long-run monetary policy plan to keep inflation low and stable, and so inflation targeting avoids the time-inconsistency problem. Furthermore, countries that have adopted inflation targeting have had better inflation performance, that is, low and stable inflation, without bearing the cost of larger fluctuations of output (Mishkin and Schmidt-Hebbel, 2002, 2007).

23.4.1.2 Implementing Flexible Inflation Targeting

An inflation targeting regime involves a commitment to a numerical inflation target and communications regarding how to achieve the target. Implementation requires a policy strategy, which links the setting of policy instruments to the achievement of the policy goals.

A policy strategy within a constrained discretion framework involves a specification of the policy instrument(s) and how they are set to achieve objectives, including a description of the factors at a given time that lead to the choice for the policy instrument. A particularly clear articulation of a strategy is the forecast targeting approach of Svensson (2020). Under this approach, a central bank would communicate their setting of the policy instrument and plans for future settings of the instrument and would describe the paths expected for their goal variables under this policy setting. In addition, the central bank would describe, qualitatively or quantitatively through alternative scenarios, how the setting of the policy instrument would adjust if economic conditions changed the outlook for the goal variables.

In concrete terms, consider a central bank whose primary policy instrument is the short-term nominal interest rate and whose goal variables are inflation, with a target of 2 percent, and full employment. Based on the available information, the central bank would describe its outlook for the economy under appropriate settings for the short-term nominal interest rate: for example, in a situation in which inflation is below 2 percent and employment is below full employment, the central bank would set the nominal interest rate below its neutral level—that is, set the interest rate to an accommodative level—and outline its expectation for the future path of interest rates, inflation, and employment that achieve the 2 percent inflation target and full employment within an appropriate time period. Loosely speaking, this is the approach taken by major central banks (such as the Federal Reserve in the Federal Open Market Committee's Summary of Economic Projections or the Bank of England in the Monetary Policy Committee's Inflation Report).

23.4.1.2 Adjusting Short-term Interest Rates to Achieve Price and Economic Stability

While the forecast targeting approach has benefits and aligns, in some ways, with practice, it is nonetheless critical that any approach—whether based on forecast targeting, an instrument rule,

or a combination of information consistent with forecast targeting, guidance from instrument rules, and judgment—is consistent with principles that ensure price stability and stability in economic activity. Focusing on the baseline case in which the primary policy instrument is the short-term interest rate, the key ideas can be illustrated through an expanded instrument rule for the nominal interest rate that includes a response to inflation, a measure of the output gap (which captures deviations from full employment) and a time-varying measure of the neutral, or equilibrium, real interest rate:

$$i_t = r_t^* + \pi^T + \varphi(\pi_t - \pi^T) + \theta y_t$$

This augmented instrument rule highlights issues that are important for policy strategy and will arise in out discussion of experience since 2008, especially experience in the early 2020s.

First, a central principle for the achievement of price stability is that the nominal interest rate increases more that one-for-one with inflation, $\varphi>1$—a condition known as the Taylor principle. (The term "Taylor Principle" is widely used and was popularized in the work of Woodford (2001 and 2003) and derives from the rule in Taylor (1993) and related works.) This condition ensures achievement of an inflation target over the medium term in a broad class of models.

However, a policy strategy that focused only on inflation and in an aggressive manner—that is, an "inflation nutter" as described by Mervyn King—would lead to excessive volatility in economic activity. As a result, the second issue is the responsiveness to output or full employment deviations (θ). Research has generally suggested that θ is nontrivial. The original Taylor rule set θ at 0.5, and Yellen (2017) suggests that a larger value of 1.0 provides a more balanced approach. The discussion of the robustness of strategies in Orphanides and Williams (2006) and Taylor and Williams (2010) suggests that a moderate response to output, as well as a moderate response to inflation, performs reasonably well across a range of macroeconomic models, including models with different assumptions regarding expectations formation. In contrast, extreme settings for the responsiveness to output or inflation can perform poorly.

The augmented policy rule also includes a time-varying estimate of the neutral real interest rate. This concept can capture two issues. First, factors beyond inflation and the output gap—and potentially outside of the factors captured in macroeconomic models—can prove important for the setting of monetary policy. A constrained discretion approach allows for such considerations, and communication of such factors through their implications for the neutral real interest rate and the outlook can be an important component of a policy strategy. Second, there has been a trend decline in the long-run neutral real interest rate. Accounting for this decline is important to setting an appropriate stance for monetary policy, especially as it may call for nonconventional policy instruments as we discuss below.

Importantly, both the output gap and the neutral real interest rate are unobservable. While accounting for these factors is important when setting monetary policy, the challenges associated with measuring these concepts implies that excessive reliance on such measures can lead to policy errors (for example, Orphanides, 2001; Orphanides and Williams, 2002). This issue was important in the 1970s (Orphanides, 2001). The slow recognition of changes in the neutral real interest rate may have contributed to the slow speed of the recovery in the 2010s and provided impetus to the Federal Reserve's review of its policy framework according to Clarida (2021).

23.4.2 The Effective Lower Bound and Nonconventional Monetary Policy Tools

Conventional monetary policy manipulates a policy rate that is typically a very short-term, interbank lending rate. However, this is not the interest rate that is the most relevant to household and business spending decisions, which is both longer term and has some credit risk. Nonetheless, a short-term interest rate is the standard policy instrument across advanced economy central banks. Adjustments in a short-term, risk-free rate broadly affect financial conditions and the economy. The current and expected short-term interest rate influences long-term safe interest rates on government bonds through the expectations component of the term structure of interest rates. These long-term rates affect the rates facing households and businesses—on mortgages, bank loans, corporate bonds, or other similar instruments—as investors react to the shifts in yields on safer assets; and similar adjustments propagate through to equity prices and other financial instruments. The behavior of the spectrum of financial

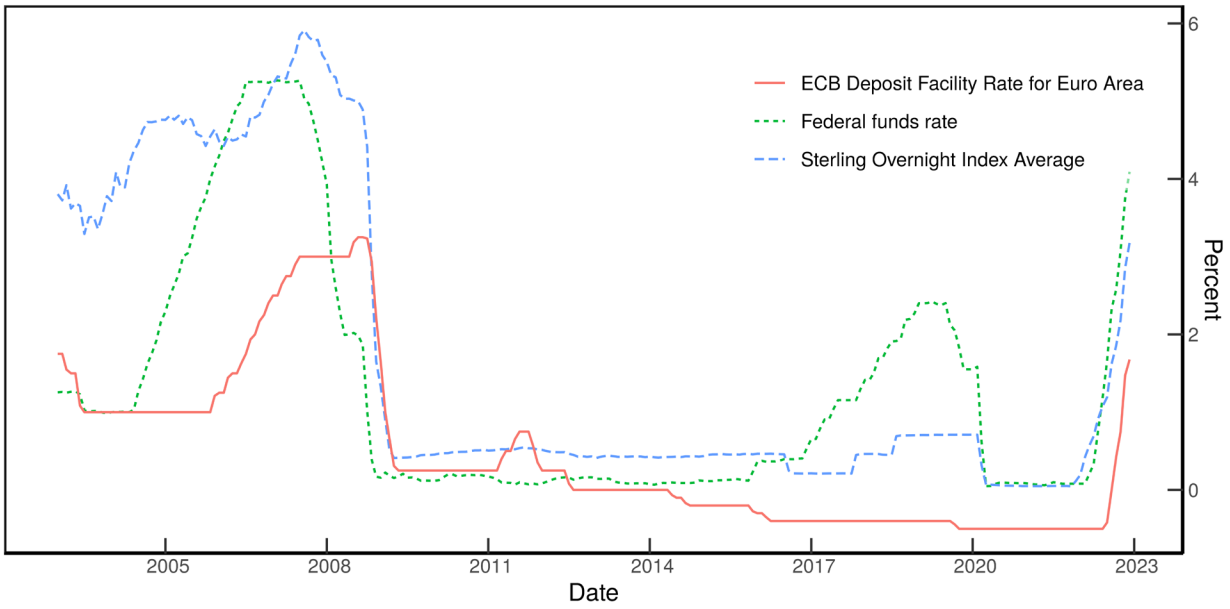
conditions—interest rates across the yield curve and lending and investment products, wealth as influenced by equity, house, and the prices of other financial assets, and the exchange value of the currency—are the determinants of household and business spending, and monetary policy's influence over economic activity and inflation operates through these transmission channels.[14]

On the eve of the Global Financial Crisis (GFC) of 2007-9, short term policy interest rates in the United States, euro area, and the United Kingdom ranged from 3 percent to just below 6 percent (figure 23-3). These levels were low by historical standards, but much of this decline owed to the stabilization of inflation near the 2 percent targets that were either explicitly or implicitly the objective of central banks that had adopted an inflation targeting framework. As a result, real short-term interest rates across these economies ranged from a level somewhat below 1 percent to about 3 percent. These levels of real short-term interest rates were below the levels that prevailed in earlier decades, especially in the 1980s. Nonetheless, real short-term interest rates remained in the 2 percent area that had been viewed as a reasonable benchmark, at least in the United States, since the work on the real interest rate appropriate for a balanced economy embedded in simple rules such as Taylor (1993).

As the GFC caused a sharp weakening in economic activity, central banks lowered their policy interest rates rapidly to levels at or near their effective lower bound in 2009. Once the effective zero-lower-bound constraint binds, central banks have resorted to stimulating spending by affecting the long-term rates and broader financial conditions that influence household and business spending with nonconventional monetary policies: forward guidance, including enhanced efforts to manage inflation expectations and, more prominently, the announcement of a future path for the policy interest rate; and large-scale asset purchases or quantitative easing.

[14] For example, Boivin, Kiley, and Mishkin (2010) review aspects of the monetary transmission mechanism.

Figure 23- 3: Short-term interest rates in the United States, euro area, and United Kingdom, 2003-2022



Source: Federal Reserve Bank of New York, Effective Federal Funds Rate [EFFR], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/EFFR; European Central Bank, ECB Deposit Facility Rate for Euro Area [ECBDFR], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/ECBDFR; Bank of England, Daily Sterling Overnight Index Average (SONIA) Rate [IUDSOIA], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/IUDSOIA. All accessed October 17, 2023.

23.4.2.1 Forward Guidance on the Future Path of the Policy Interest Rate

The increased emphasis on forward guidance during the effective-lower bound periods following 2008 represented an evolution. Central banks had been increasingly relying on communications and forward guidance as part of expectations management in a manner consistent with the emphasis on expectations management in New-Keynesian models (e.g., Woodford, 2003). For example, the FOMC used forward guidance in its statement in the early 2000s (Meade et al, 2015): the August 2003 statement stated that policy accommodation could be maintained "for a considerable period;" in January 2004, that forward guidance was changed to indicate that the Committee thought it could be "patient in removing" monetary policy accommodation.

However, the use of forward guidance during the effective lower-bound represented a shift to using guidance as a tool to communicate a commitment to a lower-for-longer interest rate strategy. As discussed in Campbell et al (2017), the FOMC first used loose and then specific calendar-based guidance. In December 2008, the FOMC indicated that the funds rate would

remain exceptionally low for "some time." In March 2009, the FOMC replaced "some time" with "extended period." In August 2011, the FOMC indicated that exceptionally low levels of the funds rate would remain in place "at least through mid-2013." The calendar-based language was replaced in the December 2012 with the state-contingent guidance that "this exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate remains above 6-1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent longer-run goal, and longer-term inflation expectations continue to be well anchored."

This evolution highlights how forward guidance has two types. The first type is *time-based* forward guidance in which there is an *unconditional* commitment by a central bank to set the policy rate at specific levels at specific calendar dates. An extreme version of time-based forward guidance would be a central bank committing not to raise interest rates from their current level for several years. Such a commitment would ignore incoming information, which is why the forward guidance is *unconditional* and *time-based*.

The second type of forward guidance is *data-based* forward guidance, in which the central bank provides information about the monetary policy reaction function by indicating the future path of the policy rate *conditional* on the data that is expected over the policy horizon. This means not only providing information on the policy path given the central bank's forecast, but also to indicate how that path changes when the central bank's forecast changes.

Feroli et. al. (2017) argue that data-based forward guidance has substantial advantages over time-based forward guidance. To see the advantages of data-based forward guidance, consider a negative shock to aggregate demand when both the inflation gap and output gap are at zero. The result would be that both the inflation and output gaps would turn negative in the future and an optimal monetary policy reaction function would indicate that the federal funds rate path would be lowered. If the central bank's reaction function is well understood by the public, then without the central bank's taking any actions, expectations of the future policy rate would decline, which would result in lower longer-term interest rates and stimulate the economy. The result would

then be an immediate offset to the negative aggregate demand shock which would help stabilize the economy.

If instead, the forward guidance is time-dependent –the central bank says that the policy rate will be set to particular values at particular dates-- then when the inflation and output forecasts rise, there is no change in the policy path. Now the inflation shock does not lead to an automatic effective tightening of monetary policy. Indeed, time-dependent forward guidance can lead to expectation dynamics that make things even worse. Again, consider the situation in which the positive employment report leads to expectations that inflation will be higher than previously expected. With time-dependent forward guidance, the projected policy path does not change, but expected inflation rises. This means that the expected path of future *real* interest rates, policy interest rates minus expected inflation, now declines. The effect of the positive employment report shock is then an effective easing of monetary policy, the opposite to what would be an optimal effective monetary policy response.

Research has generally found forward guidance to be effective (e.g., Fisher et al, 2017). Cecchetti et al (2020) present evidence that calendar- or date-based guidance was relatively less effective than state-contingent guidance.

23.4.2.2 Large-Scale Asset Purchases, or Quantitative Easing

While enhanced forward guidance was extensively deployed, the post-2008 monetary toolkit was arguably equally as reliant on a more novel tool—asset purchases by the central bank in which the central bank purchases long-term government debt through the issuance of short-term (usually overnight) central bank liabilities (reserves) (Joyce et al, 2012). Because these purchases of assets lead to an expansion of the central bank balance sheet and the monetary base, they have become referred to as *quantitative easing (QE).* This name is something of a misnomer. Large-scale asset purchases of short-term government bonds, although they do lead to an expansion of the central bank balance sheet and the monetary base, are unlikely to be effective in stimulating household and business spending: they cannot drive short-term bond government bond rates down further. Indeed, this is the experience of the Bank of Japan which engaged in large-scale purchases of short-term government bonds that led to a huge increase in the Bank of Japan's

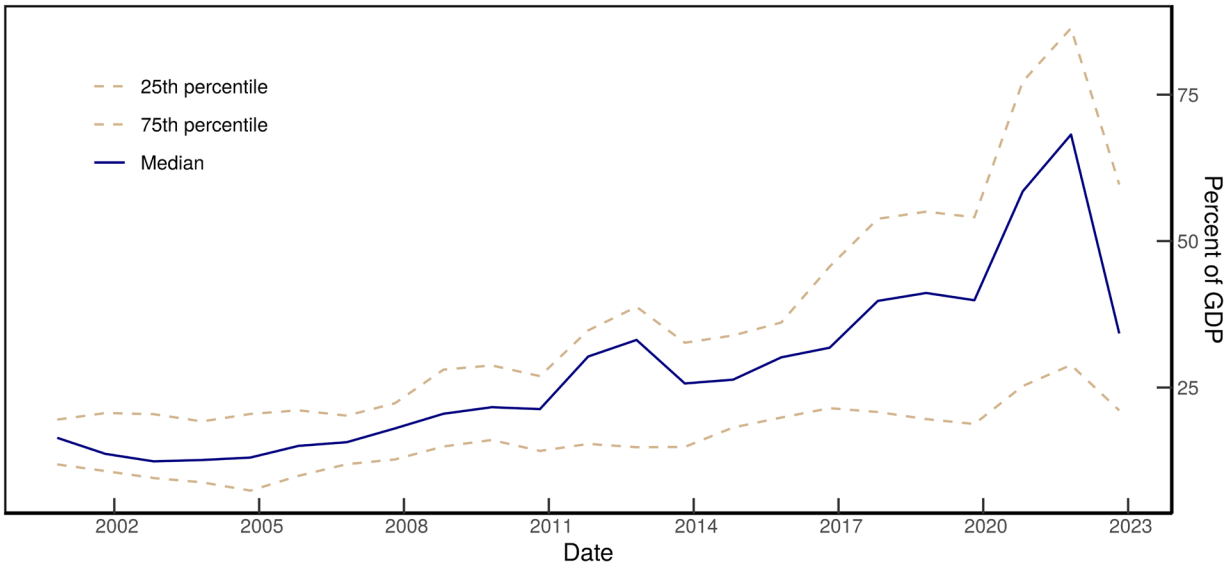
balance sheet in the 1990s, but which was unable to prevent deflation and a weak economy (see Kuttner, 2004, Curdia and Woodford, 2009). While quantitative easing has become the more popular term, it is critical to remember that expansion of a central banks balance sheet to stimulate activity requires purchases of long-duration assets, or other assets that are not near perfect substitutes for short-term liabilities issued by a central bank to finance the purchases, to alter the assets held by the private sector and potentially broadly affect financial conditions.

While the Bank of Japan had been conducting asset purchases and expanding its balance sheet for some time prior to 2008, the approach and prevalence of QE expanded notably when short-term nominal interest rates fell to near their effective lower bound in the United States and Europe. In November 2008, the Federal Reserve announced its first large-scale asset purchase (LSAP) program, a program that was quickly expanded to involve purchases "up to" $200 billion in agency debt, $300 billion in Treasury securities, and $1.25 trillion in agency MBS. Over the next four years, six additional versions of such programs, involving either asset purchases or changes in reinvestment policies, were announced (Ihrig et al, 2018). As a result of these policies (and, early in the period, emergency liquidity programs), the assets of the Federal Reserve rose from just above 5 percent of GDP to 25 percent in 2014 (figure 23-4). When Covid struck, the FOMC again engaged in QE—to address market functioning as a market-maker of last resort and subsequently to support aggregate demand—and the Federal Reserve's balance sheet was just below 35 percent of GDP at the end of 2022. The Bank of England similarly announced a substantial asset program when its policy rate fell to the effective lower bound in 2009. The ECB would only turn to quantitative easing later, with its asset purchase program in 2015; however, the ECB did substantially expand its balance sheet through liquidity programs in the years prior to 2015.

Quantitative easing was also deployed following the onset of Covid. In 2020 and 2021, quantitative easing was used by both advanced economies and emerging market economies (Adrian et al, 2021). In many cases, the use of QE among emerging markets was focused more on market functioning than on aggregate demand management. However, the widening of the set of economies using quantitative easing highlights how it has grown to be a more integral part of

central banks' toolkit. This can be seen in the general trend toward larger central bank balance sheets relative to GDP shown in figure 23-4.

Figure 23- 4: Central bank assets relative to GDP



Source: Bell et al, 2023. Based on 27 AEs including euro area national central banks.

QE provides economic stimulus through two channels. The first channel is a signaling channel: by demonstrating actions to provide stimulus and communicating intentions (e.g., the amount and time of purchases), QE can reinforce the central bank's communications on forward guidance and signal accommodation (Christensen and Rudebusch, 2012). The second channel is more direct and lowers long-term interest rate and raises asset prices through portfolio balance/imperfect substitution of financial assets (e.g., Vayanos and Vila, 2021). For example, some investors may have a strong preference for long-duration assets. QE, by reducing the supply of long-duration assets held by the public, may increase the price on such assets and lower their yields, with spillovers to the yields on other assets.

However, there is debate over the degree of spillovers to broader asset prices. Much of the literature from, for example, researchers employing macroeconomic models to assess QE assume broad spillovers to asset prices, which suggests that QE is a good substitute for adjustments in the short-term policy interest rate (e.g., Reifschneider, 2016; Kiley, 2018; Chung et al, 2023).

This is consistent with some of the literature on event studies of financial market reactions (e.g., Rogers et al, 2014). However, there is a literature suggesting that the spillovers to broader financial conditions are narrow, with only modest additional stimulus to the broader economy from QE (e.g., Krishnamurthy and Vissing-Jorgensen, 2011; D'Amico and King, 2013, Cahill et al., 2013, Joyce et al., 2020; Di Maggio et al., 2020; and Lucca and Wright, 2022).

All told, the relative efficacy of QE remains contentious. For example, Borio and Zabai (2016) Kuttner (2018), Kiley (2018), and Bernanke (2020) suggest that the empirical evidence and macroeconomic model simulations point to QE as a good substitute for conventional short-term interest rate adjustments. Others, including Greenlaw, Hamilton, Harris, and West (2018), Cecchetti et al (2020) and Krishnamurthy (2022) see the evidence as more mixed.

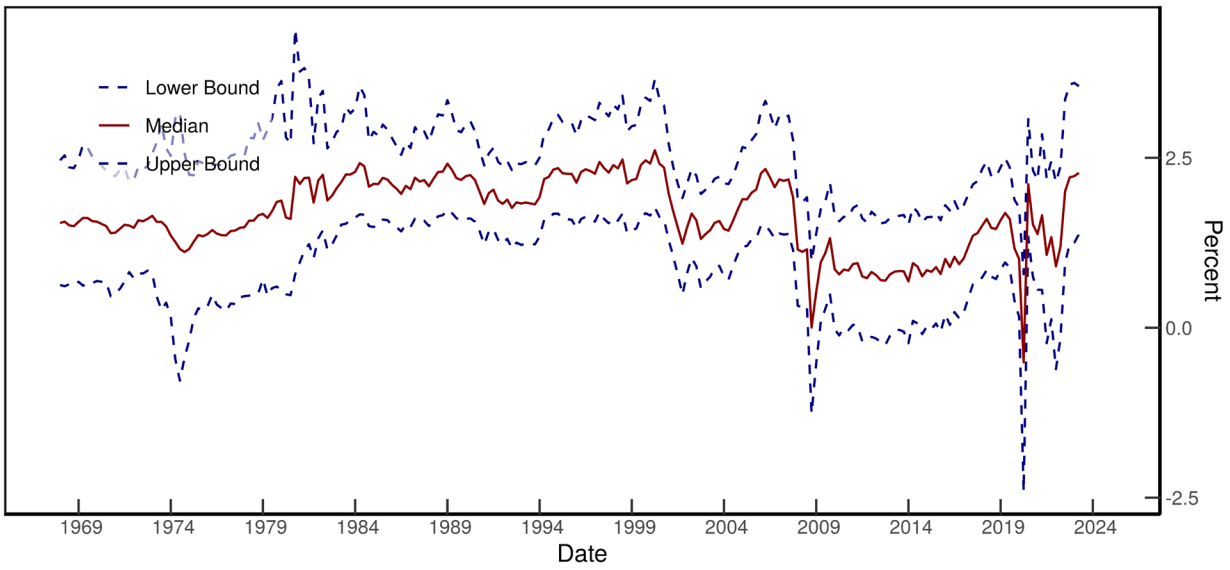
In addition, central banks have modest experience in unwinding QE, as is apparent from the experience across advanced economies in figure 23-4: the balance sheets of central banks that engaged in QE since 2008 have risen relative to GDP with only limited subsequent declines. The potential challenges associated with reducing a large central bank balance sheet may merit additional analysis to factor the implications of such challenges into policy strategies. Several factors seem relevant. First, the effects of balance sheet reductions—quantitative tightening (QT)—may not mirror those of QE for a variety of reasons. Wright (2022) summarizes the potential asymmetries. Identifying the effects of QT is challenging. QT has largely been anticipated and hence empirical work has not been able to exploit "announcement effects" to identify the impact of QT on asset prices (with limited exceptions, such as in D'Amico and Seida (2020) and Smith and Valcarel (2023)). More generally, QT occurs during stable recoveries, whereas QE has been initiated during periods or market dysfunction (e.g., 2008 and 2020). Policymakers have gone to pains to avoid signaling channels when conducting QT, as exemplified by the "watching paint dry" description of Yellen (2017). Finally, QE was undertaken when the effective lower bound was binding, whereas QT has not, which may alter financial market reactions.

23.5 Challenges from Low Interest Rates Post Crises and the Inflation Spike of 2021-22

23.5.1 Low Inflation and the Inflation Target

The reliance on forward guidance and QE over the 2010s raised questions regarding the implementation of inflation targeting frameworks. Two sets of developments loomed large in related academic research and policy discussions. First, real interest rates remained extremely low from an historical perspective in the 2010s, suggesting that the real interest rate consistent with price stability and full employment over the medium run—the equilibrium real interest rate r*—had fallen to low levels. Model-based estimates of r*, typically based on a framework like that of Laubach and Williams (2003), supported this conclusion. Prominent examples of research reaching this conclusion include Holston, Laubach, and Williams (2017) and Kiley (2020a, b). Figure 23-5 presents one such model-based measure that is regularly updated on the website of the Federal Reserve Bank of Richmond (from Lubik and Matthes, 2015). According to this estimate, r* in the United States fell below 1 percent for much of the 2010s. By the end of 2022, the estimate of r* had risen to near 2 percent, with a wide confidence interval. These model-based approaches imply substantial uncertainty about the level of r* (Hamilton et al, 2015; Kiley, 2020a, b), and some researchers highlighted concerns that the equilibrium real interest rate may be notably higher than suggested by 2010s experience (Hamilton et al, 2015).

Figure 23- 5: An estimate of the natural rate of interest



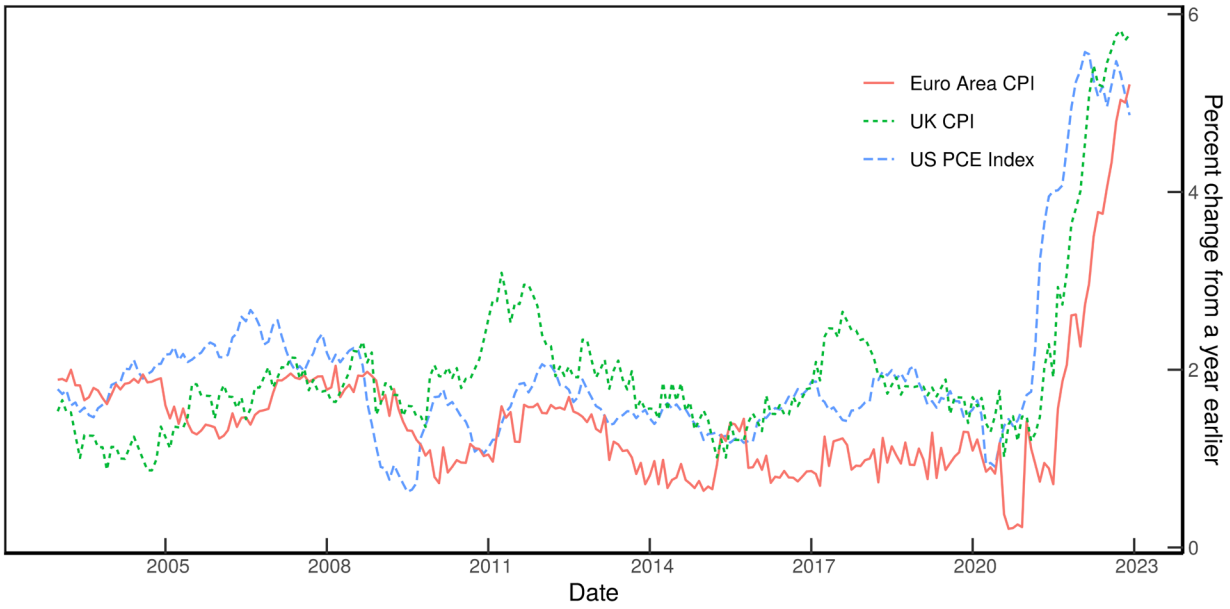
Source: Federal Reserve Bank of Richmond, Lubik-Matthes Natural Rate of Interest, accessed version updated September 27, 2023, https://www.richmondfed.org/research/national_economy/natural_rate_interest.

A low level of the equilibrium real interest rate implies that the effective lower bound will bind more frequently (Summers, 1991). The decline in the apparent level of r*--perhaps to levels below 1 percent—suggested that the effective lower bound may bind very frequently; for example, Kiley and Roberts (2017) suggested that standard Taylor-rule approaches to policy could imply the effective lower bound binding well more than 25 percent of the time. Other researchers, such as Andrade et al (2019), reach similar conclusions. These findings, combined with the long period during which interest rates were at the effective lower bound across advanced economies in the 2010s, suggested that the effective lower bound was a more significant constraint than appreciated just a few years earlier (e.g., Williams, 2009).

These concerns were amplified by the low level of inflation during the 2010s, despite extensive use of forward guidance and QE. In the 2010s, headline inflation in the United States, United Kingdom, and euro area inflation was below levels that prevailed in the 2000s and was notably below inflation targets in the mid-2010s (figure 23-6): In the United States, core inflation only

touched the 2 percent level briefly over this period, and core inflation fell short of 2 percent in the euro area for the entire period.[15]

Figure 23- 6: Core inflation, 2003-2022



Source: U.S. Bureau of Economic Analysis, Personal Consumption Expenditures Excluding Food and Energy (Chain-Type Price Index) [PCEPILFE], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PCEPILFE; Organization for Economic Co-operation and Development, Consumer Price Index: Harmonised Prices: All Items Less Food, Energy, Tobacco, Alcohol: Total for the Euro Area (19 Countries) [CPHPLA01EZM661N], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPHPLA01EZM661N; Organization for Economic Co-operation and Development, Consumer Price Index: OECD Groups: All Items Non-Food Non-Energy: Total for United Kingdom [GBRCPICORMINMEI], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GBRCPICORMINMEI. All accessed October 17, 2023.

The realization that the effective zero-lower-bound on nominal interest rates can be a significant constraint on monetary policy and persistently low inflation in the 2010s led to some rethinking of inflation targets. Prominent economists, such as Olivier Blanchard, Paul Krugman, and Lawrence Ball, suggested that the inflation target be raised from the 2% to the 4% level.[16]

Although the logic of this argument for a higher inflation target is correct, there are two major reasons why central banks have not decided to raise their inflation targets. Central banks are

[15] Research during the 2010s attributed the muted pace of inflation to changes in the Phillips curve, as reviewed in Kiley (2015) and Blanchard (2016). At the same time, some research noted the risk that Phillips curve relationships could re-emerge in a high-pressure economy and lead to higher-than-expected inflation ((e.g., Erceg et al, 2018; Hooper, Mishkin, and Sufi, 2019; McLeay and Tenreyo (2020) and Carpenter et al, 2022).
[16] E.g., see Blanchard, Dell'Ariccia and Mauro (2010), Krugman (2014), and Ball (2014),

concerned that significantly higher inflation targets do not accord with the Greenspan definition of price stability, i.e., "the state in which expected changes in the price level do not effectively alter business or household decisions".[17] Once inflation start to rise above this level, the public is likely to believe that price stability is no longer a credible goal of the central bank and then the question arises. This problem is more than a theoretical possibility: Korenok, Munro and Chen (2022) provide empirical evidence that households pay increasing attention to inflation has it rises to levels above 2 percent. A second argument against raising the long-run inflation target is that although raising the target might have benefits in the short-run, the costs of higher inflation in terms of the distortions it produces in the economy are ongoing. Thus, although they may not be large in any given year, these costs add up, and in present value terms might outweigh the intermittent benefits obtained from the zero lower bound not being binding in periods such as those we have recently experienced.

23.5.2 Price-level or Average Inflation Targets and Revisions to Policy Frameworks

While central banks have not raised their inflation targets, the combination of low interest rates, pervasive use of QE, and inflation generally below target levels led central banks to assess their policy frameworks in the late 2010s and early 2020s. The frameworks in the United Kingdom and Canada were reviewed periodically as part of the renewal of their inflation target, either implicitly through analysis and communication of the inflation target from the government to the Bank of England in the United Kingdom or through regular periodic (five-year) reviews of the inflation targeting framework in Canada. In the euro area, the policy framework was not formally reconsidered following its establishment in 2003 until a review over 2020 and 2021. In the United States, the FOMC adopted an explicit numerical price objective for its inflation target in 2012 and conducted a review of its policy framework over 2019 and 2020.

[17] Greenspan apparently first expressed this definition in the July 1996 FOMC meeting (page 51 of the transcript, which can be found at http://www.federalreserve.gov/monetarypolicy/files/FOMC19960703meeting.pdf). This definition was later made public in numerous speeches.

As central banks considered revisions to their frameworks, the related research literature was influential. An important literature on ways to make the zero lower bound less binding focused on adopting variants of inflation targeting that are, as Woodford (2003) describes, *history-dependent*: if the inflation target has been undershot in the recent past, monetary policy strives to overshoot it in the near future. Price level targets are one variant of inflation targeting that displays this history dependence, while other similar variants include nominal GDP targeting. These history-dependent targets result in a temporary rise in expected inflation when there have been undershoots in the past, thereby allowing the real interest rate to fall below what would have occurred when the nominal rate hits the zero lower bound under a conventional inflation target. In addition, research such as Svensson (1999), Ditmar, Gavin, and Prescott (1999, 2000), Vestin (2000, 2006) and Woodford (2003) have shown that a price-level target, which displays this type of history-dependence, produces less output variance than an inflation target in some models, most notably models with rational expectations. The reasoning is straightforward. A negative demand shock that results in say the price level falling below its target path, say a 2% growth path, leads monetary policy to try to raise the price level back to its 2% target growth path, so that inflation will temporarily rise above 2%. The rise in expected inflation then lowers the real interest rate, thereby stimulating aggregate demand and economic activity.

In practice, price-level or nominal-GDP targets may be less effective than suggested by rational expectations models: communication challenges are formidable, as a price-level target implies a time-varying short-run inflation target; changes in the short-run inflation target may undermine credibility of the long-run target; and price-level or nominal-income targets may be less effective if expectations are not perfectly rational.[18] These challenges help explain why central banks have not yet adopted either a price-level or a nominal-GDP target, although central banks continue to study these variants of inflation targeting. For example, the Bank of Canada has explicitly considered price-level targeting in its reviews of its inflation targeting framework.

At the same time, the basic idea that an overshooting strategy involving lower-for-longer interest rates may improve performance near the effective lower bound has proven influential. These

[18] Bernanke, Kiley, and Roberts, 2019 provide simulations demonstrating this possibility and discuss related research.

ideas have been studied for a long time, most notably beginning with Reifschneider and Williams (2000). Kiley and Roberts (2017) suggested that allowing inflation to rise to between 2½ and 3 percent following an ELB episode may be effective. Bernanke, Kiley, and Roberts (2019) considered a range of similar temporarily higher inflation targets, in which policy was accommodative until a one or three-year moving average of inflation reached the inflation target, and Williams and Mertens (2019) consider similar strategies.

These ideas appear to have influenced discussions at central banks, with discussions of the policy frameworks focused on elements of overshooting and/or (temporary) average inflation targeting. Table 23-1 summarizes some of the key elements of the policy frameworks recently adopted (or reconfirmed) in the United States, euro area, United Kingdom, and Canada. Both Canada and the United Kingdom renew their inflation targeting frameworks regularly. In the most recent remit letter to the Bank of England from HM Treasury, the inflation targeting framework was little changed by the 2010s experience. The framework acknowledges that forward guidance and unconventional policies—QE—have a role to play in the conduct of policy but also emphasizes that the inflation target always applies. This reference excludes targeting temporarily higher inflation as part of a strategy to address problems associated with the effective lower bound. Similarly, the Bank of Canada acknowledged the impact of the effective lower bound on the choice of policy tools; at the same time, the Bank noted that it considered average inflation targeting but concluded it was not superior to the preexisting inflation targeting framework. In contrast, both the ECB and the FOMC noted that it may be appropriate to aim for inflation above the 2 percent objective following periods over which the effective lower bound was binding and inflation fell short of objective. These statements appear to have been a response to the below-target levels of inflation over the 2010s and the research that suggested that policies that attempt to overshoot target inflation following inflation shortfalls, like average inflation targeting, may address challenges posed by the effective lower bound (e.g., Kiley and Roberts, 2017; Bernanke, Kiley, and Roberts, 2019; Mertens and Williams, 2019).

Table 23-1: Reviews of Inflation Targeting Frameworks in the early 2020s

	UNITED STATES	EURO AREA	UNITED KINGDOM	CANADA
INFLATION OBJECTIVE	2 percent, symmetric (unchanged)	2 percent, symmetric (changed from below, but close to, 2 percent)	2 percent, symmetric (unchanged)	2 percent, symmetric (unchanged)
ELEMENTS OF AVERAGE INFLATION TARGETING OR OVERSHOOTING	"following periods when inflation has been… persistently below 2 percent… policy will likely aim to achieve inflation moderately above 2 percent for some time"	"when the economy is close to the lower bound…" "may also imply a transitory period in which inflation is moderately above target."	"The inflation target of 2 percent applies at all times."	Considered average inflation targeting but "In the end, no alternative was better than flexible inflation targeting."
EXPLICIT CONSIDERATIONS RELATED TO THE EFFECTIVE LOWER BOUND	"the proximity of… the effective lower bound" suggests "downward risks to employment and inflation have increased."	Factors "have driven down equilibrium real interest rates. This has reduced the scope… to achieve their objectives by exclusively relying on changes in policy interest rates."	"In the event of… *(the)* effective lower bound, , the Committee may judge it necessary to deploy unconventional policy instruments" and "may also judge it to be appropriate to deploy forward guidance"	"central banks will have less room to lower the policy rate in response to negative shocks. As a result, the Bank will likely have to use other monetary policy tools more often"
ROLE OF ACTIVITY/EMPLOYMENT	"policy decisions must be informed by assessments of the shortfalls of employment" (asymmetric)	"support the… economic policies in the EU…" "includ*(ing)* ... a highly competitive social market economy aiming at full employment"	"support the economic policy of Her Majesty's Government, including its objectives for growth and employment"	"actively seek the level of maximum employment needed to sustainably achieve the inflation target."

Source: Federal Open Market Committee Statement on Longer-Run Goals and Monetary Policy Strategy, https://www.federalreserve.gov/monetarypolicy/review-of-monetary-policy-strategy-tools-and-communications-statement-on-longer-run-goals-monetary-policy-strategy.htm; European Central Bank Strategy Review, https://www.ecb.europa.eu/home/search/review/html/index.en.html; HM Treasury Monetary policy remit: Autumn Statement 2022. Monetary policy remit: Autumn Statement 2022; Bank of Canada Policy Framework, https://www.bankofcanada.ca/core-functions/monetary-policy/monetary-policy-framework-renewal/ (2022-26).

The Federal Reserve's revised policy framework differed from its previous framework along two key dimensions. The first was the link to average inflation targeting associated with the idea that inflation above the 2 percent target may be appropriate following a period when the effective lower bound was binding and inflation fell short of objective. This statement introduced aspects of asymmetric average inflation targeting. The second revision was an emphasis on shortfalls of employment from full employment, rather than two-sided deviations in which employment may fall short or, or may exceed, full employment. This revision suggested that the FOMC would not act pre-emptively to tighten policy when employment was viewed as high relative to full employment in the absence of higher inflation. As emphasized by Clarida (2021), this approach may have been adopted because estimates of full employment were too pessimistic in the 2010s, potentially leading to a premature removal of policy accommodation, and because of research on the potential benefits of a "hot" economy (Aaronson et al, 2019). Notably, this change set aside the concerns in Erceg et al (2018), Hooper, Mishkin, and Sufi (2020) and McLeay and Tenreyo (2020) regarding the potential for a hot economy to lead to a re-emergence of high inflation.

23.5.3 The Inflation Spike of 2021-22: Causes and Lessons for Monetary Policy

Almost immediately after the shift in policy frameworks by the FOMC and ECB to consider the possibility of inflation overshooting objective following a period of low inflation, advanced economies witnessed the highest levels of inflation in a generation. As shown earlier in figure 23-6, inflation rose above 2 percent across the euro area, United States, and United Kingdom in 2021 and rose to levels between 5 and 10 percent in 2022; moreover, these increases were broad based in 2022, with core inflation above 5 percent.

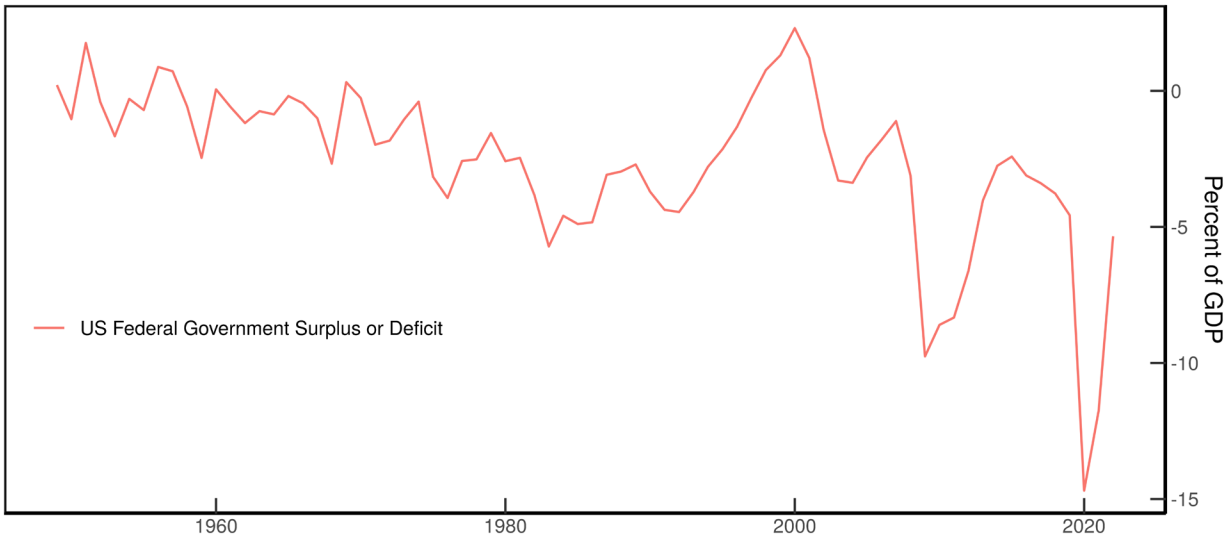
The causes of high inflation were multiple and differed somewhat, especially in timing, across advanced economies. Supply chain disruptions associated with the Covid pandemic were important and manifested first in the United States when the economy recovered strongly in 2021. Over time, price pressures broadened and appeared to increasingly reflect both excess aggregate demand pressures and momentum in price inflation. Moreover, the euro area and United Kingdom experienced acute price pressures from energy following Russia's invasion of

Ukraine in early 2022. Disentangling the relative importance of supply and demand factors has been the subject of recent research, with two broad conclusions emerging.

First, both supply and demand factors are important. For example, Giovanni et al (2022) present a macroeconomic model decomposition with a role for supply and demand factors; Shapiro (2022) presents a decomposition of prices into categories more or less influenced by supply and demand factors and similarly finds a role for both in U.S. inflation; and Eickmeier and Hofmann (2022) present an econometric analysis finding a role for both supply and demand factors, with supply factors more important in the euro area in 2022. Given that it is the balance between aggregate demand and aggregate supply that determines inflationary pressures and the large shocks to both supply (e.g., Covid-related disruptions and Russia's war on Ukraine) and demand (e.g., fiscal stimulus and pent-up demand from lockdowns), it is not surprising both supply and demand factors contributed to the high levels of inflation in 2021 and 2022.

While supply and demand factors were both important, separating supply and demand factors is always challenging. Moreover, the impetus to aggregate demand, especially in the United States but also in other economies, was extraordinary. In response to Covid, the U.S. federal government initiated substantial stimulus programs as real GDP collapsed. Figure 23-7 presents the evolution of the federal budget deficit as a percent of GDP. The decline in real GDP in the first half of 2020 was unprecedented. The fiscal response was equally unprecedented. In addition, the federal government provided additional stimulus payments to households and initiated a set of other spending programs in 2021, again widening the federal budget deficit to levels well outside historical norms. Even at the onset of the 2021 stimulus, analysis using standard measures of fiscal impact pointed to a large effect on real GDP that would push economic activity above potential (for example, Edelberg and Sheiner, 2021). Even so, many forecasts did not expect inflation to rise, as the Phillips curve had appeared dormant in the 2000s; we will see this pattern in the discussion of forecasts below.

Figure 23- 7: U.S. federal government budget surplus or deficit



Source: U.S. Office of Management and Budget and Federal Reserve Bank of St. Louis, Federal Surplus or Deficit [-] as Percent of Gross Domestic Product [FYFSGDA188S], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/FYFSGDA188S, October 17, 2023.

The challenges posed by assessments of the balance between aggregate supply and demand can be viewed through the lens of the instrument rules for short-term interest rates. The conduct of monetary policy involves the assessment of the neutral, or equilibrium, real interest rate and the output gap (or deviation from full employment). These concepts are not observable, and they are subject to both movements in trend and changes that may affect their short-run values. It is challenging to assess these factors when economic conditions behave in unusual ways: this was true in the 1970s, when productivity slowed and oil price shocks introduced a new inflationary factor; this was true following the GFC, when severe dislocations in the financial sector weighed on activity in persistent ways that contributed to a slow recovery; and it was true following the unprecedented Covid shock. While these shifts are hard to identify quickly, an enduring lesson is that policy approaches that are insufficiently cognizant of the possibility that these factors are shifting may lead to poor economic performance.

A second conclusion emerging from research is that the persistence of inflation beyond the initial impulses appears to be more in line with macroeconomic relationships that existed many decades ago. This is exactly what the analysis of McLeay and Tenroyo (2020); and Hooper, Mishkin and Sufi (2020) predicted, as pointed out Cecchetti et al 2023). Time-series analysis of these issues include Almuzara and Sbordone (2022) and Kiley (2022 and 2023).

How did monetary policy react to these developments. Three factors are salient: 1) the challenges associated with disentangling the role and persistence of supply and demand factors and 2) associated forecasting errors; and 3) the interaction of these forecast errors with the reduced role for preemptive policy tightening and tolerance for inflation overshooting associated with the revised policy frameworks.

The challenges associated with forecasting economic activity and inflation were important factors. Table 23-2 summarizes the projections for PCE inflation in the FOMC's Summary of Economic Projections for the years 2019-2023 (which includes forecast until 2024 and using the first available projections in each year); the figure also includes the realization of inflation in 2019-2022.

Table 23-2: Projections of FOMC Participants for PCE Inflation, 2019-2023

	Year					
FOMC Meeting Date	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
March 2019	1.8	2.0	2.0			
June 2020		0.8	1.6	1.7		
March 2021			2.3	2.0	2.1	
March 2022				4.4	2.7	2.3
March 2023					3.4	2.5
Realized inflation	1.6	1.3	6.0	5.3		

Note: Projections taken from the first Summary of Economic Projections (SEP) released by the Federal Open Market Committee in the in relevant year. In 2020, the March meeting did not release an SEP, and hence the projection from June is reported for 2020. Projections correspond to the median or midpoint (depending on the series reported in the SEP).

Source: U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index [PCEPI], retrieved from ALFRED, Federal Reserve Bank of St. Louis; https://alfred.stlouisfed.org/series?seid=PCEPI, October 17, 2023; U.S. Federal Open Market Committee and Federal Reserve Bank of St. Louis, FOMC Summary of Economic Projections for the Personal Consumption Expenditures Inflation Rate, Median [PCECTPIMD], retrieved from ALFRED, Federal Reserve Bank of St. Louis; https://alfred.stlouisfed.org/series?seid=PCECTPIMD or https://alfred.stlouisfed.org/series?seid=PCECTPICTM, October 17, 2023.

At the end of 2020, inflation remained subdued, and FOMC participants expected inflation to remain below 2 percent. Moreover, the unemployment rate (not shown) remained relatively high. This set of factors was consistent with FOMC communications at the time, which anticipated a prolonged period of policy accommodation.[19] In addition, the federal funds rate fell substantially below prescriptions from the Taylor rule over the course of 2021 and 2022 (e.g., Papell and Prodan, 2023). This likely reflected several factors. First, inflation was not expected to be persistent, as indicated by forecasts, and hence forward-looking prescriptions from interest rate rules suggested less need for a removal of accommodation. Second, the FOMC's 2020 framework did not emphasize preemption in response to low levels of the unemployment rate—that is, it focused on shortfalls. Asymmetric rules that ignored low unemployment suggested less need for a removal of accommodation (e.g., Papell and Prodan, 2023).

One factor that may have made monetary policy communications in the United States challenging in 2021 and 2022, beyond forecast errors and a lack of response to rapidly falling unemployment, was the role of temporary average inflation targeting. The FOMC's 2020

[19] The projections from the FOMC on inflation and other macroeconomic variables were similar to those of professional forecasters; Kiley (2022) reports projections from professional forecasters and Phillips curve models.

framework was not transparent with respect to a period over which inflation shortfalls would be computed and used in the determination of overshooting. This lack of clarity may have made it difficult to assess the degree of overshooting that would be tolerated, which could have led to a deanchoring of inflation expectations. While this risk was present in principle, longer-term inflation expectations remained well contained throughout this episode. As discussed in Cecchetti et al (2023), an important factor in preventing the deanchoring of inflation expectations was likely the rapid reversal of the Fed's easy monetary policy when it reestablished its commitment to stabilize inflation by raising the target range for the federal funds rate at a very rapid clip in 2022: with a 50 basis point increase at the May FOMC meeting and then unprecedented string of 75 basis point increases in June, July, September and November, with a further 50 basis point increase in December.

The asymmetric average inflation targeting elements likely were not central to the slow adjustment of monetary policy in 2021. The lack of preemption in the face of low and falling unemployment, the gradualism of the policy approach since the early 2000s, and the persistent forecast errors were likely more central. For example, research on strategies that suggested inflation overshooting would enhance the efficacy of policy generally called for modest overshooting. (Kiley and Roberts, 2017; Bernanke, Kiley, and Roberts, 2019; and Bernanke, 2020). The inflation rates in 2021 overshot these levels, and hence these types of overshooting strategies would have called for the removal of accommodation before the end of 2021.

The role of persistent forecast errors and the challenges associated with measuring the neutral real interest rate and the balance between aggregate demand and supply have not been limited to the United States. For example, the euro area has been struck by many of the same factors as the United States, and the euro area was more directly affected by the adverse supply and demand effects of the Russian invasion of Ukraine in 2022.

23.5.3 Financial (and Fiscal) Stability During the Low Inflation 2010s and Early 2020s Inflation Spike

The possibility that low interest rates during the 2010s would spur excessive risk taking—that is, create reach for yield—was much discussed during the period. Evidence is difficult to interpret. While the general impetus to reach-for-yield is consistent with previous research (discussed in section 23.3.2.2), the 2010s featured both low interest rates and tighter financial regulation, especially for banks in advanced economies. These factors push risk-taking in opposite directions. Nonetheless, some research highlights increased risk-taking associated with low interest rates. For example, Anadu et al (2019) highlight how pension funds in the United States appear to have been spurred by low interest rates to assume greater risk in the 2010s, and Choi and Kronlund (2018) and Foley-Fisher, Heinrich and Verani (2022) find that corporate bond mutual funds and insurance companies have also responded to low levels of interest rates post crisis by holding riskier investment portfolios. In contrast, research suggests that the Federal Reserve's forward guidance and asset purchase programs had beneficial effects on banks without inducing excessive risk-taking (Chodorow-Reich, 2014). The macroeconomic significance of these shifts is not clear (Boyarchenko, Favara, and Schularick, 2022).

In addition, central banks (and other authorities) increasingly deployed macroprudential tools to limit the build-up of risk. Across advanced economies, a significant number of jurisdictions raised the countercyclical capital buffer (CCyB)—a prudential measure introduced under Basel 3 that can be raised or lowered in response to changes in vulnerabilities. For example, eight of 27 Basel Committee for Banking Supervision (BCBS) member jurisdictions had a CCyB rate greater than zero at the onset of the Covid pandemic, and seven of these jurisdictions lowered the CCyB following the onset of the pandemic. These actions may have supported bank lending (BCBS, 2022).

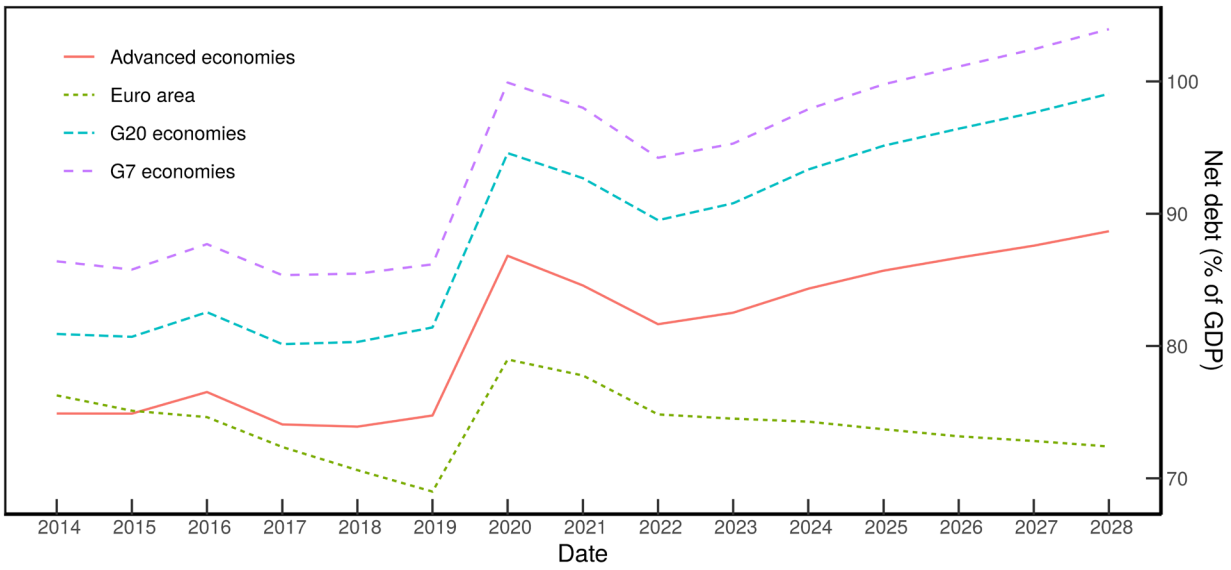
The deployment of macroprudential tools followed the separation principle of Tinbergen (1939)—that is, that promotion of multiple goals (price stability, economic stability, and financial stability) requires multiple tools. Recent events have led some to again question the degree of separation between price, economic, and financial stability. For example, financial

markets experienced heightened volatility in September 2022 as pension funds with leveraged positions (in liability-driven investments) had trouble meeting margin calls associated with a rapid increase in long-term interest rates, leading the Bank of England to intervene. In March 2023, two banks in the United States failed owing to excessive interest rate risk exposures, among other weaknesses, and another large bank failed in early May. In addition, a global-systemically-important bank in Switzerland was acquired in a transaction that led to losses for holders of convertible debt instruments following distress. These developments led to some concerns over the interaction of monetary actions and financial instability, including financial dominance (e.g., Rajan, 2023 and Brunnermeier, 2023).

The low-interest rate period and subsequent significant increase in interest rates has also led to renewed discussions of fiscal/monetary interactions. There are important potential effects of monetary policy actions on fiscal authorities. Central bank balance sheets grew substantially during the 2010s owing to nonconventional policy actions. For a time, this increased the remittances from central banks to the fiscal authority, but the increase in interest rates in the 2020s has led to large mark-to-market losses on the asset holdings of advanced economy central banks (Bell et al, 2023). Such losses have little direct bearing on a central bank's ability to conduct monetary policy, but they may create communication challenges and undermine public or political support for independence (e.g., Rajan, 2022 and 2023, and Brunnermeier, 2023).

Rajan (2022, 2023) and Brunnermeier (2023) highlight an additional challenge that central banks could face should interest rates remain high or rise further than has already been the case since 2021. Government debt levels across advanced economies are high and projected to remain high or rise, as show in figure 23-8.

Figure 23- 8: Advanced economies: General government net debt



Source: IMF Fiscal Monitor (https://www.imf.org/external/datamapper/datasets/FM), accessed May 10, 2023.

High levels of debt imply that higher interest rates could create pressure on the fiscal position in advanced economies. As a result, central banks may face political pressure not to raise interest rates or may find the adverse effects of interest rate increases to be too large to tolerate. Such dynamics could undermine the pursuit of price stability, a situation called fiscal dominance. Recent experience does not suggest this concern is presently material, but the historical experience of fiscal effects on inflation highlights the importance of central banks' understanding the effects of their actions on the fiscal position and, if any such effects are non-negligible, communicating clearly why the policy stance is appropriate to achieve improved outcomes.

23.6 Conclusions: Lessons for Central Banks

Our review of central bank activities and economic performance points to several lessons for central banks. These lessons include relearning, or reemphasizing, earlier lessons as well as lessons on how to adapt central bank practices to accommodate new challenges and tools.

Lesson 1: Price stability has important benefits and is the responsibility of a central bank.

Our first lesson, perhaps relearned or at least reemphasized, is that price stability has important benefits and is the primary responsibility of the central bank. Recent experience suggests this lesson, while not forgotten, may have been underappreciated over the past decade. Central banks and economic research in general were concerned about persistently low inflation among advanced economies in the 2010s. Inflation remained low even after the economy approached levels of full employment. Inflation expectations appeared well anchored, even following large shocks to the economy including the Global Financial Crisis and Covid. This combination suggested the Phillips curve was sufficiently flat (or nonexistent) to lead to an increased emphasis on the benefits of a high-pressure economy.

Inflation returned to high levels in 2021 and 2022. While a very large share of the increase, especially initially, reflected supply shocks, excess aggregate demand has played a role. The Phillips curve has returned, as would be expected when monetary policy became less preemptive. High inflation has imposed costs on households and businesses. Bringing inflation down became the central factor—at least in 2022—in the determination of the monetary policy stance.

Lesson 2: Achieving price stability in a complex and uncertain environment benefits from a credible commitment to a nominal anchor with a strong response to inflation and preemptive leaning against an overheating economy.

A credible commitment to a nominal anchor provides a counterbalance to the time-inconsistency problem, helps anchor inflation expectations, and can promote fiscal responsibility, all of which help a central bank to achieve price stability. However, even with a credible nominal anchor, containing inflationary pressures, once they emerge, requires a monetary stance sufficiently tight to reverse inflationary pressures. Judging whether a monetary stance is appropriately tight is not simple for several reasons. The neutral real interest rate is not observable. Central banks mandates call for a balancing of inflation and activity, but the level of full employment or potential output is similarly unobservable. As a result, gauging the appropriate level of interest rates to achieve an appropriate balance between price and economic stability is challenging. In

addition, the monetary stance near the effective lower bound has involved quantitative easing, which affects long-term interest rates and financial conditions in general. QE implies that the stance of monetary policy is multidimensional, which further complicates the setting of monetary policy and the achievement of price stability.

All these factors have been important since the Global Financial Crisis. The level of the neutral real interest rate in the 2010s was lower than in earlier decades, but this was difficult to assess in real time. The level of full employment in the United States appears to have been higher (a lower equilibrium real interest rate) in the 2010s than appreciated in real time. The appropriate level of the central bank's balance sheet was also hard to gauge in real time, as illustrated by the challenges in the United States in gauging a sufficiently ample level of reserves. Moreover, all these uncertainties were arguably amplified by Covid, which caused significant impediments to aggregate supply and was met with a large fiscal expansion and QE in the United States and elsewhere. The uncertainties associated with this complex environment contributed to the high and persistent inflation over 2021 and 2022.

Nonetheless, experience and the literature emphasize several principles that can enhance the ability of central banks to achieve the goal of price stability. Real interest rates must rise with inflation more than one-for-one to cut short inflationary pressures. Economic models and forecasts are subject to significant errors and excessive reliance on forecasts can lead to policy mistakes. Similarly, excessive reliance on measures of the neutral interest rate, potential output or full employment, or changes in the Phillips curve relationship have contributed to policy mistakes—in both directions. Research suggests that these uncertainties can be addressed by a balanced approach with systematic responses to inflation, a degree of preemption in which policy responds to sizable changes in labor market conditions or economic activity, and flexibility.

Lesson 3: Central bank communication and transparency are key elements of monetary policy strategies and tactics.

A credible commitment to a nominal anchor, such as an inflation target, can only be achieved if a central bank communicates in a transparent manner its target and how it plans to achieve it. Central bank practice has incorporated this lesson, as inflation targeting has become among the

most common frameworks and has been accompanied by enhanced communications. However, as central banks have adopted elements of average inflation targeting schemes, communications regarding the new elements (such as the degree or period for overshooting inflation) have not been well developed. This underdevelopment may have contributed to some of the challenges that followed the Federal Reserve's framework adopted in 2020.

Furthermore, transparency and communication are what enable a central bank to constrain discretion, thereby alleviating the time-inconsistency problem. Central-bank instrument independence, which has many benefits, is only sustainable if the central bank is accountable to the public, and accountability only occurs if the central bank communicates clearly about its objectives and how it sets its policy instruments. In addition, nonconventional monetary policy such as forward guidance has its intended effects directly through transparent communication about the future path of policy instruments. Indeed, increased central bank communication and transparency have been key features of the evolution of central banks over the last 30 years.

A substantial share of the new issues confronting central banks since the 2000s stem from low levels of nominal and, especially, real interest rates. Low interest rates imply that the effective lower bound is more likely to bind. As a result, central banks turn to forward guidance and quantitative easing to provide monetary accommodation. However, the use of forward guidance and QE remains a work in progress. Regarding forward guidance, both the ECB and the Federal Reserve communicated in their framework reviews around 2020 a tolerance of a modest inflation overshoot following periods when the nominal rate was constrained by its effective lower bound. The efficacy of these approaches has not been tested, as the large shocks following Covid quickly raised inflation beyond levels consistent with even an average inflation targeting framework. Moreover, real interest rates are now higher, but the long-run level of real interest rates remains uncertain. As a result, the communication and implementation challenges of new frameworks remain to be addressed.

Lesson 4: Crises have emphasized the role of central banks in promoting financial stability, as price and economic stability cannot be achieved without financial stability, but this role increases risks to independence.

The Global Financial Crisis, low interest rates and the potential for reach-for-yield behavior, and the use of central bank balance sheets to promote financial stability (in addition to the use for QE) have highlighted the importance of financial stability and the associated role for central banks. Financial stability is important for price and economic stability. Central banks have a macroeconomic perspective and a role in payments and financial supervision. This combination implies a role for central banks in financial stability.

At the same time, financial stability typically involves extensive coordination with other parts of the government, including with fiscal authorities in cases where credit risk or other quasi-fiscal actions are involved. Such coordination brings the potential for political conflict which could affect independence in the setting of monetary policy. In addition, higher interest rates may create budgetary pressures for fiscal authorities. Frameworks with clear delineation of the roles and responsibilities of different parts of the government are important for avoiding such risks to monetary policy independence.

Lesson 5: Goals for central banks other than price and economic stability, complemented by financial stability, can make it more difficult for central banks to stabilize both inflation and economic activity.

Even with mandates focused primarily on price and economic stability, with a complementary mandate for financial stability, the task before central banks has become increasingly complex over the past twenty years. Low interest rates have led to nonconventional policies such as forward guidance and QE, and the combination of low interest rates and inflation in the 2010s led to consideration of variants of average inflation targeting. These tools and strategies remain works in progress. Interest rates have risen with high inflation since 2021, posing new challenges to financial stability and fiscal positions.

Given this complex landscape, central banks have a difficult job. Despite this, there has been some call for central banks to take on additional mandates, including issues such as inequality and climate change. These issues have important macroeconomic and financial implications, and as a result central bank analysis to understand these issues is part of promoting price, economic, and financial stability. However, the central banks have limited tools and additional mandates for central banks may not be achievable given their tools. Such additional mandates may also affect monetary policy independence in ways that affect the achievement of price, economic, and financial stability.

Lesson 6: Research on key questions is critical.

Our review also points to critical areas for future research. Whether the global economy will return to low real interest rates will shape monetary policy, financial stability, and fiscal vulnerabilities and remains highly uncertain. Understanding these issues will inform policy. In addition, uncertainty about the roles of monetary policy and macroprudential policies in jointly promoting price, economic, and financial stability demand further research, in part, because experience with macroprudential policies has a relatively short history.

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