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BACKGROUND PAPER

BP/19-01/07

Frontier Issues in Central Banking: An Assessment of IMF Contributions

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May 14, 2019

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ABBREVIATIONS

BIS	Bank for International Settlements
BoC	Bank of Canada
BoE	Bank of England
BoJ	Bank of Japan
CBDC	central bank digital currency
ECB	European Central Bank
ELB	effective lower bound
Fed	U.S. Federal Reserve
FG	forward guidance
GFC	Global Financial Crisis
QE	quantitative easing
RePEc	Research Papers in Economics
UMP	unconventional monetary policy

EXECUTIVE SUMMARY

The activism of central banks over the past decade has raised questions that are expected to endure even after the present cycle of easing runs its course. These include issues around the use of unconventional monetary policies in future downturns; the appropriate monetary policy framework; accountability and oversight of central banks, and the issuance of central bank digital currency (CBDC).

The Fund has contributed to debates on these frontier central banking issues through policy papers and staff discussion notes and a 2018 book on *Advancing the Frontiers of Monetary Policy*. It has also used its convening power to organize conferences to discuss these issues with experts. However, on many issues the Fund has not provided clear guidance and its contributions to extending the frontier of the profession's thinking have been limited. Stepped up engagement would help the Fund be better prepared to advise its member countries:

- **Monetary policy toolkit:** An update of IMF staff's 2013 policy paper on the experience with UMP would be useful, setting out the IMF's views on the considerations that should govern the future use of UMP. With exit from UMP incomplete but a softening of the economic cycle at a time when policy rates remain very low leading to a real possibility that recourse to UMP will again become necessary in the foreseeable future, a sense of urgency should accompany this engagement.

- **Central bank governance:** While central banks are aware of the need to strengthen their credibility though increased transparency and accountability, the IMF is in a good position as a neutral third party to disseminate best principles and practices in this area.

- **Central bank digital currency:** This is a fast-moving issue on which Fund guidance and leadership can be quite influential given the lack of agreement within the central banking community itself on the feasibility of CBDC.

While not in a position to push the analytic frontier on all issues, the IMF is ideally placed to provide an unbiased perspective through its assessment of the solutions being proposed and its review of cross-country experience. It can also provide a counterweight to the risks of group think among central bankers, bringing a broader governance perspective. Developing a stronger reputation and capacity as thought leader would also raise the value added and influence of IMF advice in individual country cases. Establishing a small group of top monetary policy experts with a clear mandate to investigate these issues and contribute to the policy debates at a cutting-edge level would help to achieve these ends.

I. INTRODUCTION

1. Unconventional monetary policies (UMP) were used extensively by central banks in the major advanced economies, once policy interest rates hit the effective lower bound (ELB), to meet macroeconomic goals. While there is a broad consensus that the actions taken in 2008–09 were effective in stabilizing financial conditions and erasing fears of another Great Depression, the effectiveness of subsequent actions continues to be debated. Moreover, the activism of central banks has raised issues that are expected to endure even after the present cycle of easing runs its course. These issues range from whether UMP should be used in in future downturns to whether the issuance of central bank digital currencies can obviate use of UMP.

2. This paper describes and assesses the Fund's contribution to these broader issues:

- **Monetary policy toolkit:** An apparent secular decline in equilibrium interest rates has increased the potential for the ELB to constrain policy rate cuts in future downturns. Should UMP become part of the conventional toolkit of central banks and be used to support the recovery during future slowdowns and recessions?

- **Monetary policy framework:** Should the inflation target be raised, possibly keeping the economy away from the ELB and diminishing the need for UMP? Would pursuing an inflation range rather than a point target provide central banks with some flexibility in unusual circumstances? Would price-level path targeting or nominal GDP targeting provide a more powerful framework for monetary policy than conventional inflation targeting?

- **Governance of central banks:** Some observers feel that central banks carried out operations over the past decade that crossed into quasi-fiscal territory and were not fully transparent with the public about the risks involved (Tucker, 2018). Should central banks be subject to greater political oversight?

- **Central bank digital currency (CBDC):** CBDC has the potential to significantly modify financial intermediation and the implementation of monetary policy. Could its use alleviate the constraints placed by the ELB and limits to the effectiveness of UMP?

3. IMF staff have contributed to the discussion on these issues through policy papers and staff discussion notes and a 2018 book (Fujita and others, 2010; Mancini-Griffoli and others, 2013; Bayoumi and others, 2014; Jacome and others, 2016; and Adrian, Laxton, and Obstfeld, 2018). The Fund has also convened conferences to discuss these issues with experts, including the "Rethinking Macro" series, the 2014 conference on Monetary Policy in the New Normal, and the Camdessus Central Banking Lecture. Sections II to V discuss each of the frontier issues mentioned and the IMF's work on these issues. Section VI provides an assessment and recommendations.

II. MONETARY POLICY TOOLKIT

4. Experience with monetary policy since the Global Financial Crisis (GFC) has triggered concerns about whether central banks are adequately equipped to deal with adverse shocks to the economy, especially since a similar decline in lower equilibrium interest rates would imply that the ELB on the policy rate is likely to be binding more frequently in the future (Fuhrer and others, 2018).

5. Ideally, renewed use of UMP during future recessions would be based on clear evidence of its past effectiveness. However, the evidence remains a subject of active discussion. In the context of the initial response to the GFC, UMP seems to have had clear benefits, mainly as it helped restore the functioning of financial markets and contributed to bringing down long-term interest rates (Quint and Rabanal, 2017). However, the effectiveness of repeated or prolonged use of UMP, in particular on economic activity outside crisis conditions, is less well established. The fact that various tools were used concurrently has made it difficult to assess their relative effectiveness (Kuttner, 2018; Blinder and others, 2016).[1]

6. Forward guidance (FG) was the most commonly used tool, followed by quantitative easing (QE) through asset purchases (predominantly of government debt but also other assets), while some central banks used negative interest rates.[2] Each of these tools is discussed in turn.

Forward guidance

7. FG operates by affecting expectations of future policy rates and is implemented through central bank communication about the monetary policy framework. FG had already established its credentials well before the GFC. While qualitative FG had been around even longer, New Zealand introduced quantitative conditional FG by publishing the policy interest rate path in 1997 (Svensson, 2014).

8. Post-GFC, FG took an even more prominent role to guide market expectations about future policy actions. Bernanke (2017) suggests that FG will continue to play a critical role going forward, regardless of country circumstances. In a survey conducted by Blinder and others (2017), half of central bank heads felt that FG should be used in the future (Figure 1(a)). However, there are concerns that there may be limits to its effectiveness if the economy is expected to be at the zero lower bound for a very long time (Swanson, 2018). Moreover, FG may also not be very

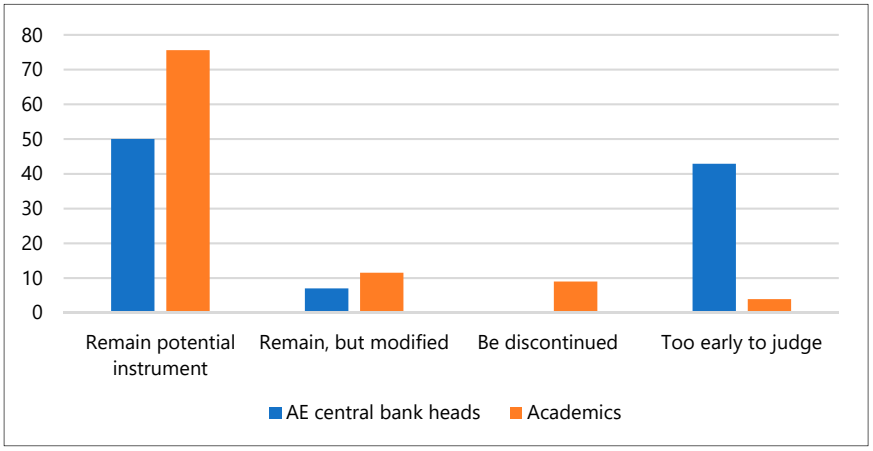
[1] For example, as of mid-2018 the Bank of Japan had FG, QE (expanding the balance sheet), qualitative easing (purchases of equity), negative policy interest rates, and yield curve control (targeting sovereign yields up to 10-year maturity) in place.

[2] Other tools such as targeted long-term liquidity operations, funding for lending schemes, and yield curve control were used less commonly, reflecting specific country circumstances.

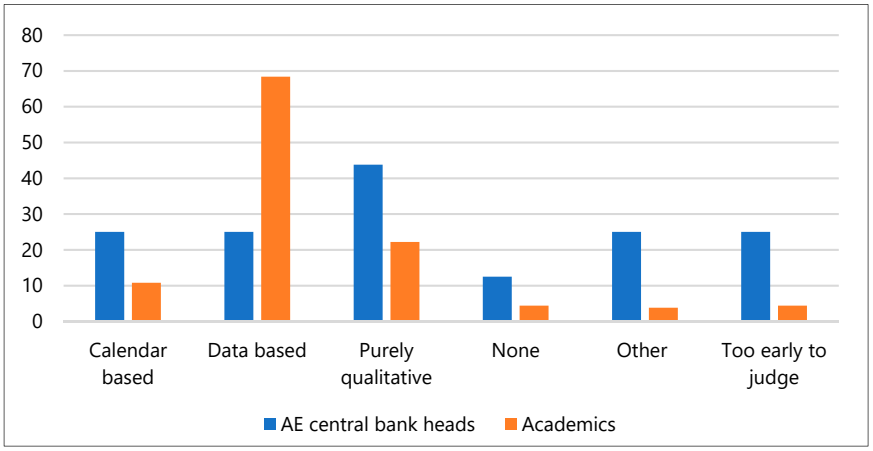
effective in the event of a very adverse shock unless used in combination with additional instruments such as asset purchases to bolster credibility (Levin and others, 2010).

Figure 1. Forward Guidance and Its Role in the Future
(Percent of responses)

(a) Views on suitable future of forward guidance



(b) Views on suitable type of future forward guidance



Source: Blinder and others (2017).

9. A key debate has been about whether FG should be time based, data based, or purely qualitative. Under a time-based approach, the central bank commits to a set of policies until a particular date is reached; under a data-based approach, the commitment is defined in terms of data (e.g., inflation) outcomes. Another overlapping distinction in the literature is whether FG is "Odyssean," reflecting a firm commitment by the central bank on future actions or "Delphic," reflecting a policy intention conditional on the future trajectory of the economy (Campbell and others, 2012). All forms of FG were tried in the aftermath of the GFC with central banks shifting over time in response to different challenges. Time-based FG—e.g., the U.S. Federal Reserve (Fed) in 2011, and the Bank of Japan (BoJ) in various episodes—entails a very strong commitment that could be useful to help shift public expectations in unusual circumstances without unduly

restricting future central bank action (Williams, 2016). Nonetheless, it could run into a time consistency problem if subsequent economic developments require a deviation from the policy path to which the central bank committed. Simple data-based FG is easy to communicate but runs into a similar problem if the variable to which policy action is tied is not behaving in a manner consistent with achieving the central bank's stabilization objectives.[3] Coenen and others (2017) argue that FG is most effective when it is state (i.e., data-contingent), a view shared by academics and market analysts (Feroli and others, 2016). The survey of central bankers shows a preference for qualitative FG, though many also feel that is too early to judge which type is the most effective (Figure 1(b)).

10. The IMF was supportive of FG as an important component of the aggressive monetary easing in response to persistently weak economic conditions following the GFC. Staff also concluded that FG can be a "useful communications tool even in normal times" when central banks cannot communicate clearly their future strategies—for example when it proves difficult to fully specify the central bank reaction function—and suggested that such techniques could continue to be relevant in future cycles (Bayoumi and others, 2014). The same analysis also supported data-based FG over time-based announcements.

11. The IMF's modeling team has also long advocated and provided support for the use of data-based FG as an integral part of a state-of-the-art inflation-forecast targeting framework. It has actively offered technical assistance to central banks interested in applying this approach and produced evidence that it has been effective in countries that have adopted such a framework (see, e.g., Clinton and others, 2015; Pescatori, 2018; Jones, Kulish, and Rees, 2018).

Quantitative easing through asset purchases[4]

12. Conceptual work on QE has delineated three main channels through which it can lift economic activity and inflation. The first is through calming markets when they have become disorderly and illiquid. The second is through signaling: asset purchases could make central bank FG that policy rates would remain low for some time more credible. The third channel is the portfolio channel: the reduced supply of government bonds to the private sector lowers long-term risk-free interest rates and encourages purchases of other assets.

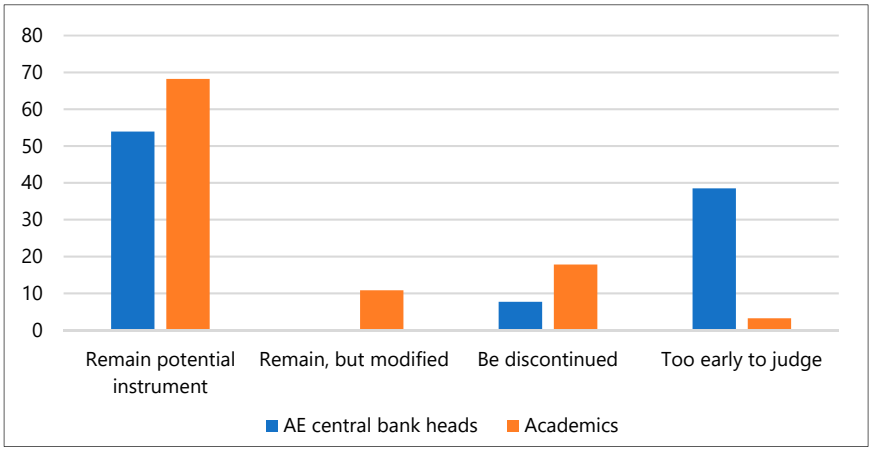
[3] This was apparent with the so-called Evans rule used by the Fed in 2012, which was too narrowly interpreted as a straight link of policy interest rates to the unemployment rate. Though very useful in getting policies pointed in the right direction, this approach proved untenable when the unemployment rate reached the specified level without putting pressure on prices. It was replaced by a more contingent, data-based FG with the policy rate to "depend on the economic outlook as informed by incoming data."

[4] This discussion does not cover the more radical policy options associated with "helicopter money"—for example, central bank balance sheet expansion through direct lending to the government to finance additional public spending.

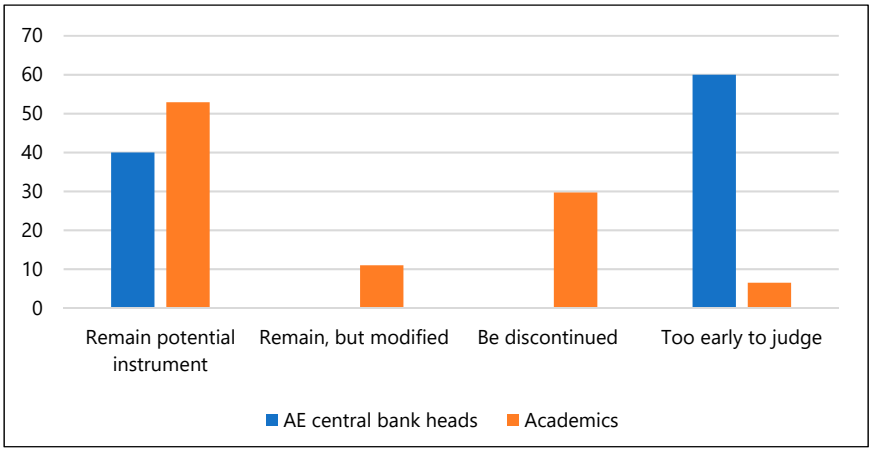
13. There is a consensus that QE has been effective in lowering long-term interest rates, though the channels of transmission have proved difficult to disentangle, leading former Fed chair Bernanke to quip that "the problem with quantitative easing is that it works in practice, but it doesn't work in theory." The review by Ball and others (2016) concludes that the empirical literature is "remarkably consistent in pointing to the successful transmission of such programmes to long-term rates and asset prices." Kuttner (2018) concludes that QE did have a meaningful impact in the United States but notes the empirical difficulty of separating the effects of asset purchases from those of FG. Other open questions relate to the possibility of diminishing returns to asset purchases (Goodhart and Ashworth, 2012), the merits of rule-based approaches to asset purchases (Kuttner, 2018), and the interaction between central bank balance sheet policies and government debt management operations. On balance, both central bankers and academics believe that asset purchases will remain a potential tool for UMP in future downturns (Figure 2).

Figure 2. Should QE Still Be in the Toolkit After the Crisis?
(Percent of responses)

(a) Views on suitable future of QE using government debt



(b) Views on suitable future of QE using other assets



Source: Blinder and others (2017).

14. The IMF's work has generally concluded that QE lowered interest rates but found the impact on economic activity and inflation more difficult to pin down. As noted earlier, the IMF's Policy Paper "Unconventional Monetary Policies—Recent Experience and Prospects" concluded that asset purchases had "significantly lowered long-term yields, especially following early announcements, at the peak of domestic market turmoil" (IMF, 2013). It also suggested that this fall in yields had benefited growth and price stability, while admitting that these findings were less clear cut than those about the impact on yields "owing to lags, unstable relations among variables and unresolved … counterfactuals." The paper did not discuss whether UMP should be used in future downturns. Bayoumi and others (2014) also did not take a strong position on whether asset purchases should be used in the future. But the IMF has continued to be supportive of the use of asset purchases, particularly in the case of Japan, and has urged a gradual and cautious exit in other countries. Dell'Ariccia, Rabanal, and Sandri (2018) conclude that—in the euro area, Japan, and the United Kingdom—UMP "likely had beneficial effects on macroeconomic variables such as real GDP growth and price stability, although these are more difficult to model and measure" than the impact on long-term yields.

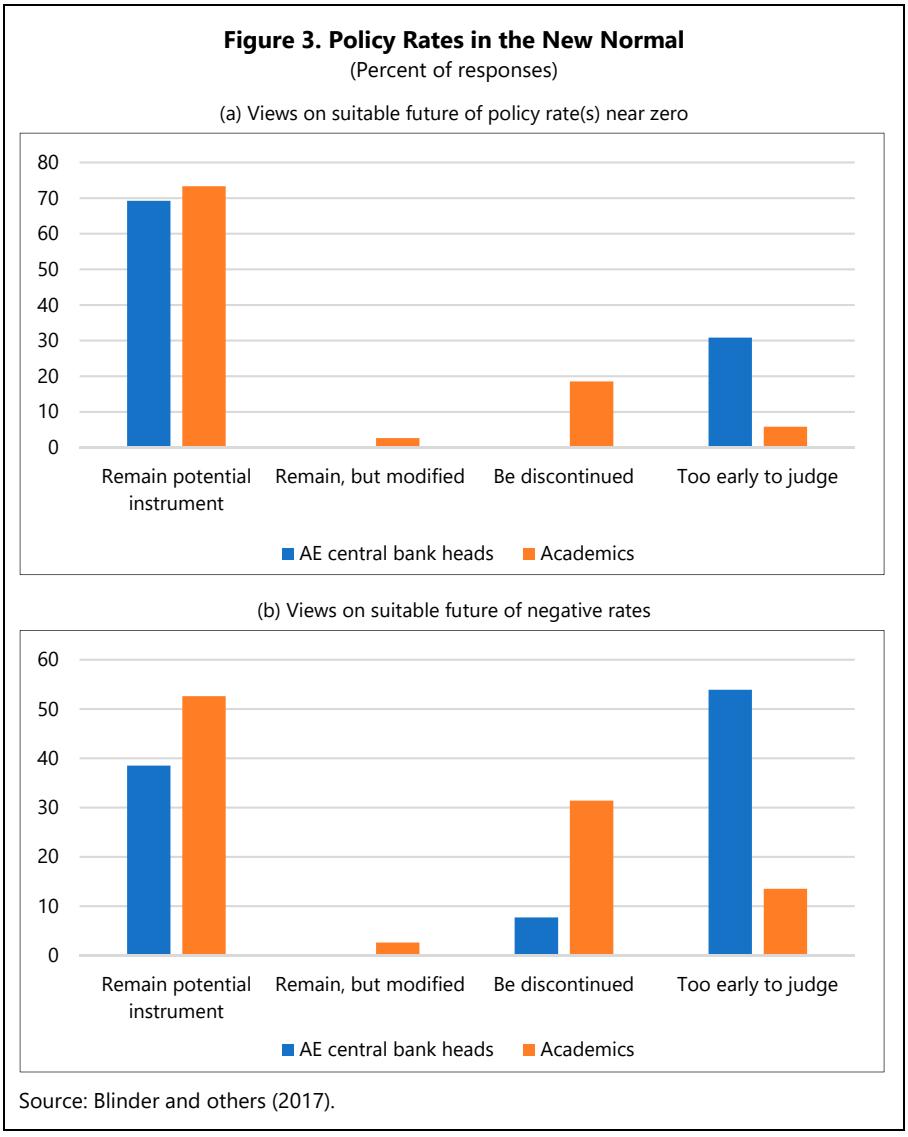
Negative policy interest rates

15. While many advanced economies followed Denmark's lead in 2012 to cut policy interest rates below zero, a number showed reluctance, in part because of operational concerns (see Ball (2019) and Honohan (2019) for country case studies). In part reflecting this experience, central bankers on balance feel that it is too early to judge whether negative interest rates will remain a tool even though the strong majority consider it likely that policy rates near zero will remain a potential instrument (Figure 3). For the United States, Bernanke (2017) argues that negative policy rates could work under certain circumstances but that further analysis is needed on practical and legal issues and specific features of the structure of the financial system (e.g., prevalence of money market funds) before it could be applied. The European Central Bank (ECB) has generally been positive about its experience with negative policy rates, but emphasizes that their adoption was complementary to its asset purchase program and that there are limits to this policy tool (Cœuré, 2016). The BoJ's implementation of negative policy rates led to some surprises-—e.g., a flattening of the yield curve rather than the intended steepening, a decline in money market trading, and a public backlash—emphasizing the need for adequate technical preparation and good communication with the public.

16. It is generally accepted that there are limits to how negative policy rates can go. These limits arise not just from the opportunity cost of holding cash but also because of the pressure on bank profitability when negative rates drop below a threshold (Brunnermeier and Koby, 2016). Banks have been reluctant to pass on negative rates to retail customers and have attempted (and thus far largely succeeded) to make up for the incomplete pass-through by raising fees, while central banks have helped by introducing schemes such that the negative rate applies at the margin but not on average deposits at the central bank. Still there are limits to how far such approaches can go to protect bank profitability. Finally, there is a general concern that negative

interest rates when in place for a long time could contribute to financial instability. While there does not yet seem to be significant evidence of excessive risk-taking specifically on account of negative policy interest rates, some research finds that banks with ample deposits have started to lend to riskier borrowers after the ECB adopted negative interest rates (Heider, Saidi, and Schepens, 2018).

Figure 3. Policy Rates in the New Normal
(Percent of responses)



Source: Blinder and others (2017).

17. In April 2016, the IMF published a blog co-authored by its Financial Counsellor stating:

"we support the introduction of negative policy rates by some central banks given the significant risks we see to the outlook for growth and inflation. Such bold policy action is unprecedented, and its effects over time will vary across countries … Although the experience with negative nominal interest rates is limited, we tentatively conclude that overall, they help deliver additional monetary stimulus and easier financial conditions,

which support demand and price stability. Still, there are limits on how far and for how long negative policy interest rates can go" (Viñals, Gray, and Eckhold, 2016).

18. The IMF's 2017 Policy Paper "Negative Interest Rate Policies—Initial Experiences and Assessments" provided a fuller survey of experience and concluded that countries that implemented negative policy rates saw an easing in financial conditions, with transmission to money market rates and bond yields working well (IMF, 2017; see also Jobst and Li, 2016, on negative interest rate policies in the euro area specifically). However, the transmission to deposit and lending rates appeared more limited than in the case of conventional monetary policy because constraints on bank pass-through. The IMF also noted that the ultimate effect of negative interest rate policies on inflation and output was hard to discern and tended, in the medium run, to hurt bank profitability.[5] The paper suggested that "pushing policy interest rates much further below … was untested and politically controversial" and, while not ruling out use of negative interest rates in future, concluded that "further work is needed to analyze the impact of NIRPs and compare its effects with other monetary policy instruments."

III. MONETARY POLICY FRAMEWORK

19. Before the GFC, there was broad consensus among central banks around a flexible inflation-targeting approach, with some suggesting that its adoption was one of the contributors to the "Great Moderation"—the period of low and stable inflation that preceded the crisis. Since the GFC, questions have arisen about whether the monetary policy framework needs to be modified, with the main proposals being to raise the inflation target, introduce a target range, or move to a level target for prices or nominal GDP.[6] More radical voices have also entered the debate and attracted considerable attention.[7]

[5] Staff analysis shows that since Japan introduced the policy in 2016, banks with business models that were more exposed to negative interest rates increased their credit and took on more risk compared with other banks (Hong and Kandrac, 2018).

[6] Central banks have been active in this debate. For example, the Fed is conducting an extensive review in 2019 of how it formulates, conducts, and communicates monetary policy, including by listening to a "wide range" of stakeholders on how to improve its policy approach. Options include raising the inflation target, choosing a range rather than a narrow target, or targeting nominal GDP. Fed Vice Chair Clarida raised the possibility of having strategies to reverse past misses of the inflation objective. Similarly, the Bank of Canada is debating monetary policy framework issues as part of its 2021 Inflation-Target Renewal, focusing on whether there are alternatives to inflation targeting and public policies to support the monetary policy framework (Poloz, 2016; Wilkins, 2018).

[7] For example, Modern Monetary Theory (MMT) has recently received wide attention for its claim that a government can pay for goods and service using money creation, and that inflation can be controlled by taxation and bond issuance. This approach has been strongly resisted by mainstream economists (e.g., Krugman, 2019). In Congressional testimony, Fed Chair Powell judged the main pillars of MMT as incorrect and mentioned that monetary policy will be more effective at tackling inflation than fiscal policy.

Altering inflation targets

20. If neutral interest rates are now indeed lower than before, increasing the inflation target could be a logical step to reduce the probability that policy rates encounter their ELB. In the academic debate, analysis from a welfare perspective finds that lower inflation is preferable (Schmitt-Grohé and Uribe, 2011). At the same time, however, academics and some former policymakers focusing on stabilization of output under adverse conditions have argued forcefully for a higher inflation target to provide more room for monetary policy to act (Krugman, 2014; Summers, Wessel, and Murray, 2018). These views are corroborated to some extent by simulations with large-scale macroeconomic models in situations where effective UMP tools are not available or feasible or when the neutral rate is negative or close to zero (Dorich and others, 2018).

21. Notwithstanding the conceptual arguments, practitioners have raised concerns about the practical question of how a higher target could be achieved in a stable, credible, and politically acceptable manner (Summers, Wessel, and Murray, 2018). The conceptual benefits of a higher target depend on the credibility of the higher target, which could be doubtful after a period of below-target inflation, as observed in many advanced economy central banks in recent years. Moreover, changing the inflation target could itself undermine the credibility of central banks, with possible detrimental effects on anchoring long-term inflation expectations. Mishkin (2011) believes that it would be more difficult to stabilize inflation at higher levels. Raising the target would also likely encounter substantial resistance from many elected officials and members of the public (Bernanke, 2018).

22. A less radical proposal would be to introduce a target range for the inflation rate rather than a point target. Such a shift could be beneficial because of its emphasis on symmetry around the midpoint and increased flexibility for monetary policymakers. Dudley (2018) emphasizes that a range could be viewed as a more realistic objective than a point target, given that actual inflation will very rarely be at the target even if central banks pursue an optimal policy. A range would convey a message of elevated concerns of the central bank to outcomes outside the target range. A drawback would be that inflation expectations may be less well anchored and continue to respond to changes in actual inflation (Freedman and Laxton, 2009).

23. The experience with changing inflation targets is mixed. New Zealand managed to increase its inflation target without major difficulties.[8] However, it should be noted that it did so gradually, first in 2002 by altering the midpoint of a target range and subsequently in 2012 by adding an explicit reference to the target midpoint. The motivation was to better anchor inflation expectations and reduce the need for frequent adjustments in the policy rate in response to shocks. Inflation expectations increased immediately and significantly at all horizons (Lewis, 2016). The experience of Japan was less favorable. The BoJ raised its inflation target from

[8] The inflation target was set initially to 0–2 percent and shifted to 0–3 percent in 1996, 1–3 percent in 2002, and 1–3 percent with a focus on the 2 percent target midpoint in 2012. See also Wadsworth (2017).

1 percent to 2 percent in 2013 as part of the broader shift to a more expansionary monetary policy at that time. However, inflation expectations responded only partially and remained well below the target 5 years after its adoption, which could be ascribed to the limited credibility of the central bank and the limited impact of its announcements on financial conditions (see Cecchetti and Schoenholtz, 2016; De Michelis and Iacoviello, 2016; and Ball, 2019). Alternatively, the slow or incomplete response in inflation expectations may have been due to their adaptive nature in light of a long history of low actual inflation.

24. IMF researchers discussed the pros and cons of moving to a higher inflation target quite early on (Blanchard, Dell'Ariccia, and Mauro, 2010). This discussion was part of an attempt to "rethink" macroeconomic policy after the crisis and intended to flag issues that would need consideration, but this particular suggestion elicited quite an adverse response from the central banking community, concerned about potential impact on central bank credibility. Bayoumi and others (2014) took a more conservative line, arguing that there are considerable risks to central bank credibility from raising the inflation target that make it "a difficult option for advanced economies." The IMF's broad operational guidance argues for changing inflation objectives only in the context of a systematic and transparent review of the monetary policy framework.

Adopting a price-level or nominal GDP path target

25. With inflation rate targets, central banks do not fully make up for past episodes of below-target inflation. A credible price-level target would convince economic agents that, in the event of underperformance, policy rates would be lower, and inflation be higher than target in the future, which could influence expectations in a manner that leads to a stronger outlook for economic activity. Simulations for the United States indicate that commitments mimicking price-level targeting, if feasible, could significantly alleviate ELB constraints (Kiley and Roberts, 2017). Recently, Bernanke (2017) suggested adopting temporary price level targeting when at the lower bound, while Yellen (2018) supported a "lower for longer" or "make-up" strategy. Nominal GDP level targets are similar to price-level targets though they may be more robust to supply shocks while being more vulnerable to issues related to revisions to GDP data.

26. The merits of moving to price-level targeting at all times are less clear, however (Hatcher and Minford, 2014). Credible level targeting could work relatively well for demand shocks, but it may be less helpful in the face of supply shocks, especially when they are temporary. Reacting to such shocks could introduce unnecessary volatility and even episodes of deflation. In response, proposals have been floated for temporary price-level targeting (Bernanke, 2017) or average inflation targeting over some period (Dudley, 2018). In its five-year policy review, the Bank of Canada (BoC) analyzed but rejected a move to price-level path targeting (BoC, 2016).

27. IMF researchers have been open to the possibility of moving from inflation targeting to nominal GDP or price-level targeting but have been skeptical about the benefits of such moves compared with using a state-of-the-art inflation-targeting framework (Blanchard, Dell'Ariccia, and Mauro, 2013; Bayoumi and others, 2014). In particular, like other critics of this approach, they

see difficulties for the central bank to establish a transparent and credible commitment to such a policy framework, which would in turn undermine its rationale and effectiveness. In recent work, the IMF has remained a strong supporter of flexible inflation targeting (Adrian, Laxton, and Obstfeld, 2018).

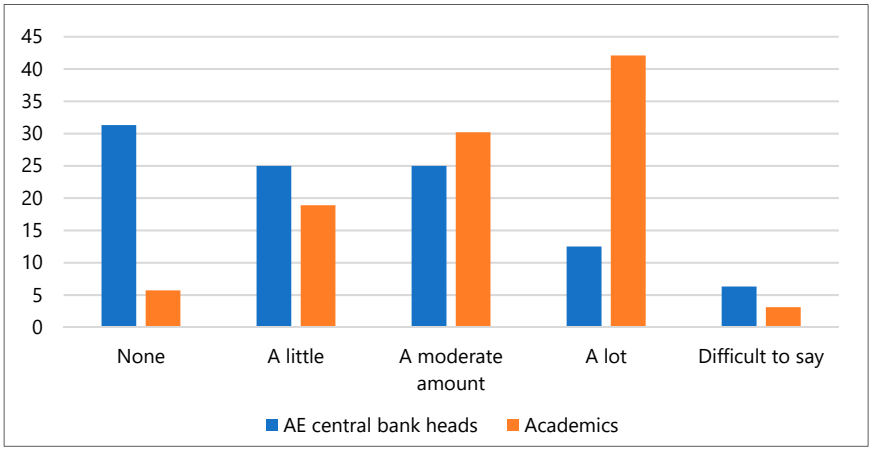
IV. CENTRAL BANK GOVERNANCE

28. Prior to the GFC, there was a broad consensus on the role of central banks and their governance. Economic research and experience had demonstrated the value of central bank independence and a transparent targeting approach for delivering good economic performance, particularly in terms of inflation (Taylor, 2016). For most central banks, the achievement and maintenance of price stability became the primary objective, and sometimes the single objective stated in their mandates. The appointment process and terms of employment of central bankers were structured to give them operational independence to meet their objectives. In exchange for independence, the central bank was to be held accountable through a variety of mechanisms, involving the publication of statements following monetary policy meetings, press conferences, minutes and other transcripts documenting the evolution of discussions underlying monetary policy decisions, testimonies and reports to the legislature, as well as recurrent oversight by supervisory boards.

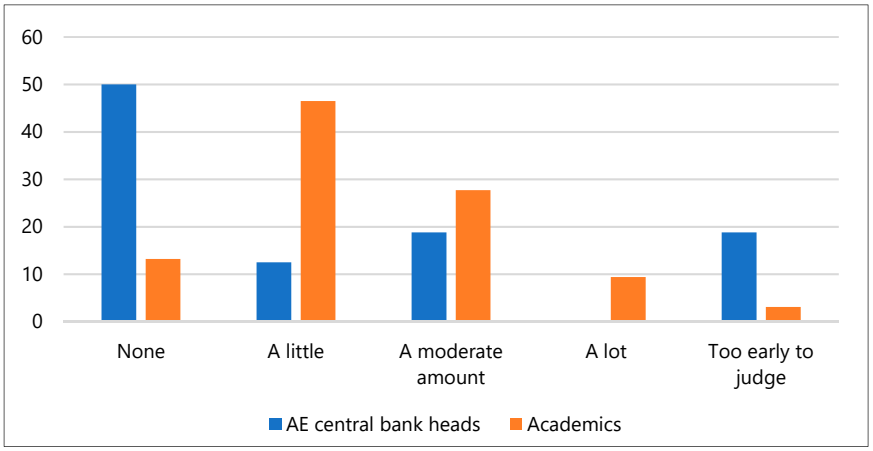
29. The GFC expanded the role of central banks along several dimensions, in the process attracting considerable criticism of central banks and generating some challenges to their independence (Figure 4). First, the crisis made it hard to maintain a clean separation between the goals of price stability and financial stability. While the debate continues about whether maintaining financial stability should be explicitly added to central bank mandates or become a shared mandate among a group of public institutions, central banks cannot avoid paying attention to financial stability issues. Second, central banks had to step into the breach by providing lender of last resort support to institutions, markets, and even governments. While liquidity support against secure collateral to safeguard the functioning of the financial system has always been a key central bank task, the scale at which it was provided during the crisis and the possible fiscal consequences ran the risk of it becoming politicized (Blinder and others, 2016). And third, even in the pursuit of the primary objective of price stability, some central banks may have taken a liberal interpretation of their legal authority in the context of recourse to unconventional monetary policies such as asset purchases, leading to the concern that central banks were crossing the line into the realm of fiscal policy, without the necessary political accountability.

Figure 4. Central Bank Independence
(Percent of responses)

(a) How much criticism did the central bank receive?



(b) Central bank independence is threatened



Source: Blinder and others (2017).

30. Central bankers have agreed that strengthening transparency and accountability is essential to preserving their democratic legitimacy and independence (Powell, 2018; Cœuré, 2018b; Poloz, 2018). How to do so remains quite unsettled, with many different views expressed:

- At one end of the spectrum lies the view that the reinforcing of transparency and accountability requires a return to a narrow interpretation of the central bank's role, lest it undermine the principle of democracy (Weidmann, 2018).

- Others argue that while a broader role should be maintained, central banks' pursuit of their mandates should become more rules based, with the decisions of the central bank vetted by the legislature (Taylor, 2016). Still others see a more complex trade-off between independence and accountability, as central banks are likely to have acquired more tools permanently (Balls, Howard, and Stansbury, 2018).

- Some authors have emphasized the need for multilayered decision-making to address such trade-offs. Archer and Levin (2017) suggest that short-term tactical decisions should be made autonomously by central banks, making the transparency and accountability of the monetary policy committee a critical component of central bank effectiveness and independence. Monetary policy decisions should be made by a diverse committee of experts who have individual accountability to elected officials to strengthen robustness of decisions and guard against group think. They further advocate regular consultations with elected officials on the key elements of the monetary policy framework, including its objectives, tools, operating procedures, decision-making process, and public communications (e.g., along the lines of the five-yearly reviews of the inflation-control target of the BoC). Publication of regular monetary policy reports explaining the rationale for decisions, the prospective policy path, and contingency plans for risk mitigation could also strengthen transparency and accountability.

31. In 1999, the IMF drew up a Code of Good Practices on Transparency in Monetary and Financial Policies which noted that "good governance calls for central banks and financial agencies to be accountable," particularly where they have been granted a high degree of autonomy. The IMF has since noted that expanded mandates for central banks complicate accountability and challenge independence; it sees scope for greater oversight over new central bank responsibilities (notably financial stability) while protecting the independence of narrowly defined monetary policy decisions (Bayoumi and others, 2014). The IMF also views transparency and accountability as paramount to safeguard the operational independence of central banks, which in turn it sees as critical for achieving price stability (IMF, 2015).[9]

V. CENTRAL BANK DIGITAL CURRENCY

32. The recent introduction of virtual currencies and the gradual decline in use of paper currency have led to considerable interest about whether central banks should issue their own digital currencies, and the implications for monetary policies. While acknowledging design and implementation challenges that would need to be addressed, researchers have observed that widespread use of CBDC would have the potential to alleviate the constraints placed by the lower bound on policy rates (Bordo and Levin, 2017; Prasad, 2018; Rogoff, 2015). The interest rate on CBDC could become the policy interest rate, which could be moved into negative territory if desired to add monetary stimulus, diminishing the need for other UMP tools, in particular quantitative easing (Levin, 2017).

33. Some central banks are actively considering issuing CBDC, including the Riksbank and the Eastern Caribbean Central Bank, and research on the pros and cons is underway at several

[9] Monetary and Capital Markets Department, Legal Department, and Finance Department are in the process of drafting a Board paper on central bank governance post GFC.

others (e.g., Norges Bank, 2018). Central banks facing a rapid decline of the use of printed cash are most favorably disposed to adopting CBDC (CPMI, 2018; IMF, 2018). Others, including the major central banks (BoE, BoJ, ECB, Fed) emphasize that adoption of CBDC is unlikely in the short term for technological and political reasons.[10] While they accept that in theory CBDC could diminish the need for other UMP tools, they see a need for more research to assess whether the ELB would be circumvented in the presence of CBDC, how much power there is in negative nominal interest rates, and how complex issues such as who should have access to the central bank balance sheet are to be resolved (Wilkins, 2017). Research by central banks recognizes the scope for CBDC to improve monetary policy effectiveness, provided some conditions are met (Fung and Halaburda, 2016), though skepticism about the net benefits of CBDC remains (Brainard, 2018; Cœuré, 2018a).

34. A number of monetary policy experts see good arguments for a proactive approach in studying the possible adoption of CBDC by central banks, though skepticism remains in some corners. Bordo and Levin (2019) call for central banks to move expeditiously in considering CBDC and investigating its logistical and technical details. They demonstrate "how CBDC could transform all aspects of the monetary system and facilitate the systematic and transparent conduct of monetary policy." In their view, CBDC could serve as a virtually costless medium of exchange, secure store of value, and stable unit of account if it were account based and interest bearing. Davoodalhosseini (2018) demonstrates that CBDC can be welfare enhancing. However, Cecchetti and Shoenholtz (2018) are concerned about the potentially systemic implications for financial intermediation of the use of CBDC. They see an increased risk of bank runs and political challenges for central banks particularly in relation to the features of the CBDC accounts. In response, Kumhof and Noone (2018) show that the risk to financial intermediation and bank runs in particular can be addressed by adopting a set of core principles for CBDC, including limits to the on-demand convertibility of bank deposits into CBDC.

35. The IMF has done considerable technical work on CBDC and has generally been forward leaning on suggesting the potential in this area, while also recognizing risks. Following earlier staff work on the introduction of electronic currency to eliminate the ELB (Agarwal and Kimball, 2015) and the prospects for virtual currencies (He and others, 2016), a recent Staff Discussion Note explores design options, the risks to financial integrity, and the implications for monetary policy of CBDC (Mancini-Griffoli and others, 2018). The paper states that CBDC is

[10] Mark Carney stated at the Riksbank 350th anniversary conference devoted to "The role of central banks in the past, present and future" on May 25, 2018, that he was open-minded about the prospect of CBDC "though we do not see this as a near term prospect." BoJ Deputy Governor Masayoshi Amamiya stated in a lecture "The Future of Money" at the Japan Society of Monetary Economics on October 20, 2018, that Japan had no plans to issue a digital currency, citing the widespread use and popularity of physical cash. On July 26, 2018, ECB President Draghi said that the ECB had no plan to issue a digital currency because the underlying technology was still fragile, and the use of physical cash remained high. Fed Vice Chair Quarles expressed concerns that a CBDC "that's held widely around the globe could be the subject of serious cyberattacks and could be widely used in money laundering and terrorist financing" and could also derail private sector plans to enhance their own digital payment systems (November 30, 2017).

unlikely to affect monetary policy transmission significantly but could strengthen it if it spurs greater financial inclusion, while alleviation of the lower bound on interest rate policy would occur only with constraints on the use of cash. While the paper concluded that there is "no universal case for CBDC adoption as yet," IMF management has appeared to be more open to "investigate it further, seriously, carefully, and creatively" (Lagarde, 2018).

VI. ASSESSMENT AND RECOMMENDATIONS

36. The Fund has contributed to the debates on frontier central banking issues. It periodically put together useful surveys of the literature helpful for informing the membership of the shifting debate on the future of central banking. However, on many issues the Fund has not provided clear guidance, and the Fund's own contributions to extending the frontier of the profession's thinking has been quite limited overall. While recognizing that this is a field that is evolving quickly, making it hard to draw firm conclusions or promote clear guidance, stepped up engagement on frontier central bank issues would help the Fund be better prepared to advise its member countries on monetary policy challenges they are likely to face. The Fund's mixed record in providing value-added advice to countries engaged in UMP over the past decade—shown in the advanced economy country case studies for the evaluation—underlines this point. With exit from UMP incomplete but a softening of the economic cycle already lurking and a real possibility that recourse to UMP will again become necessary in the foreseeable future, a sense of urgency should accompany this engagement.

37. *On the monetary policy toolkit:* For the IMF to provide valuable advice to member countries on the optimal monetary policy response to future downturns, it needs to carry out its own analytic work on these issues or be prepared to take clear positions based on a deep understanding of the analytic and empirical work done by others and its review of the cross-country evidence. On this basis, an update of IMF staff's 2013 policy paper on the experience with UMP would be useful, with the update setting out the IMF's views on the considerations or principles that should govern the future use on UMP. As part of this, the IMF should assess whether and under what circumstances UMP was effective in stabilizing the economy over the past decade (rather than accepting the central bank consensus that it was) and which tools were most effective under which circumstances (rather than just accepting that they all can be effective in some circumstance but without being specific).

38. *On monetary policy frameworks:* The IMF has weighed the pros and cons and appears largely to favor the status quo: "in many ways, the monetary policy framework should stay the same" (Bayoumi and others, 2014). The IMF still backs a flexible inflation-targeting framework while recognizing that "other intermediate objectives such as financial and external stability may have to play a greater role than in the past."

39. *On central bank governance:* While central banks are aware of the need to strengthen their credibility though increased transparency and accountability, the IMF as a neutral third party looking across different areas of policymaking is in a good position to develop best

principles and practices in this area and to disseminate findings across the broader membership. In this context, particular attention could be paid to ways to ensure adequate political accountability for the pursuit by central banks of their UMP.

40. *On central bank digital currency:* This is a fast-moving issue on which Fund management, which has been portrayed in the media as encouraging central banks to explore the adoption of CBDC, appears to have been more forward leaning than staff's analysis of the pros and cons. The Fund guidance and leadership on this issue can be quite influential given the deep disagreement within the central banking community itself on the feasibility of CBDC, making it important that the Fund stay at the cutting edge of developments rather than in reactive mode.

41. In sum, the IMF should be an active contributor to the healthy debate among central bankers and monetary policy experts on the challenges facing central banks. Establishing a small group of top monetary policy experts with a clear mandate to investigate these issues and contribute to the policy debates at a cutting-edge level would help to achieve this end. The Fund has many prominent economists but only a few are among the profession's top monetary policy experts and the most visible IMF work has been in areas other than monetary policy (Annex 1). While not in a position to push the analytic frontier on all issues, the IMF is ideally placed to provide an unbiased perspective through its assessment of the solutions being proposed and its review of cross-country experience. It can also provide a counterweight to the risks of group think among central bankers, bringing a broader governance perspective. And developing a stronger reputation and capacity as thought leader would raise the value added and influence of IMF advice in individual country cases. Accomplishing this task will require deliberate effort, as the IMF has had a tendency to be a follower of the consensus in central bank circles, only occasionally attempting to move it (e.g., on raising inflation targets) or play an active role in shaping it (e.g., on avoiding "leaning against the wind" and developing macroprudential tools instead as the first line of defense against financial stability risks).

ANNEX 1. IMF EXPERTISE ON MONETARY POLICY ISSUES: SOME EVIDENCE FROM ANALYSIS OF CITATIONS AND DOWNLOADS

The Research Papers in Economics (RePEc) website provides information on downloads and citations for papers written by nearly 50,000 economists across over 7000 institutions. Drawing on this information, RePEc provides a list of the top authors in the field of monetary policy (Table A.1). This list of 258 experts has only 9 Fund economists, roughly the same number as the much smaller Bank for International Settlements (BIS). Almost half of these top monetary policy experts are no longer at the Fund.[1]

While the Fund has about 50 economists who are listed among the profession's top economists—based on a commonly used index provided by RePEc—monetary policy expertise does not loom large in this group. Nor does the pipeline of top authors over the past 10 years contain many economists who would be considered monetary policy experts. Google Scholar provides further confirmation of the paucity of monetary policy expertise at the Fund. On this website, authors list the fields of their expertise; presumably authors who consider themselves monetary policy experts would rank that field high among their chosen fields. Of the 190 Fund staff who chose to create a Google Scholar page with their publications, only 20 chose monetary policy as a field of expertise and only five chose monetary policy as their top field of expertise.

Over the past decade, the Fund has conducted some very influential and highly cited research (Table A.2). Four papers on inequality and three papers on fiscal policy make the list. The three remaining papers do have some connection with monetary economics. The 2010 paper on "Rethinking Macroeconomic Policy" floated the idea of raising the inflation target to 4 percent, as part of a broader discussion of an array of macroeconomic policy issues. The other two papers discuss the choice of monetary policy instruments in the context of a more general analysis of how to handle volatile capital flows.

The IMF generally ends up at the top of the list of *institutions* based on research rankings but that partly reflects its larger size. Figure A.1 shows the relationship between the number of authors registered with RePEc and the institution's ranking.[2] The regression line shows the estimated nonlinear relationship between size and ranking. It appears that the IMF is "punching below its weight" as it places well above the regression line, in contrast with the BIS.[3]

[1] For this list, an IMF economist is defined as someone who spent a majority of time at the IMF over the past decade. Hence, the current Economic Counsellor is not included.

[2] This is an updated version of a chart in Allen, Bean, and De Gregorio (2016).

[3] Such data must be interpreted with caution since the majority of IMF economists have largely operational as opposed to research roles.

Table A.1. IMF Authors Among Top 10 Percent in the Field of Monetary Economics (October 2018)

(italicized names indicate authors no longer at the IMF)

Rank	Author
7	*Maurice Obstfeld*
41	*Olivier J Blanchard*
159	Atish Ghosh
199	Tobias Adrian
228	Jonathan Ostry
230	*Douglas Laxton*
231	Tamim Bayoumi
247	Pau Rabanal
253	*Michael Kumhof*

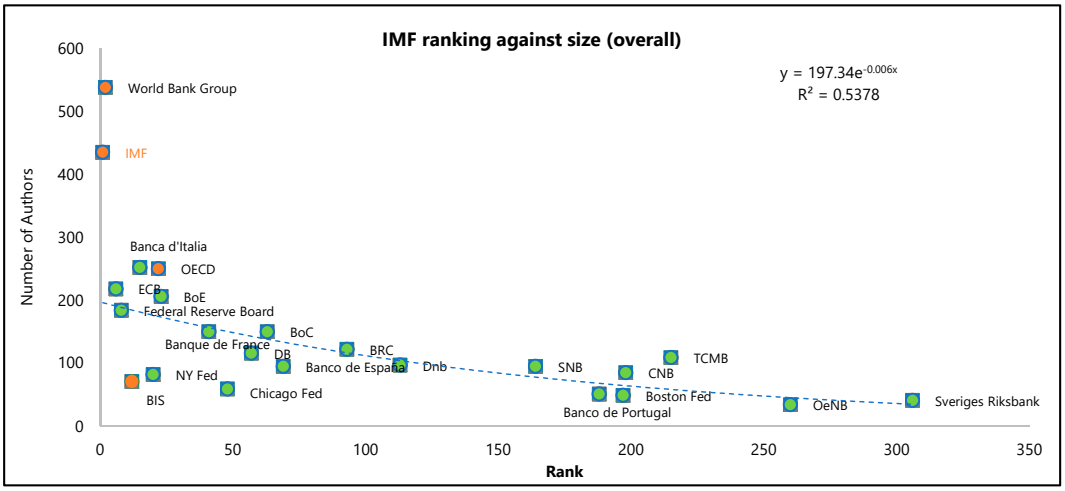
Source: RePEc.

Table A.2. Top 10 IMF Papers on Google Scholar based on Citations Per Year

Paper	Citations per Year	Year of (initial) publication	Field
Rethinking Macroeconomic Policy	202	2010	Macroeconomic Policy
Redistribution, Growth and Inequality	194	2014	Inequality
Fiscal Multipliers	174	2012	Fiscal Policy
Neoliberalism: Oversold?	145	2016	Inequality
Causes of Inequality	132	2015	Inequality
Capital Inflows: Role of Controls	99	2010	International Economics
Two Targets, Two Instruments?	86	2016	International Economics
Inequality and Growth: Two Sides of the Same Coin?	74	2012	Inequality
Fiscal Fatigue	63	2009	Fiscal Policy
Fiscal Policy for the Crisis	50	2009	Fiscal Policy

Source: Google Scholar.

Figure A.1. Research Rank and Size of Institution



Source: Based on data from RePEC.
Note: Bank of Canada (BoC), Deutsche Bundesbank (DB), Banco de la Republica de Colombia (BRC), Dnb (de Nederlandsche Bank), Schweizerische Nationalbank (SNB), Česká Národní Banka (CNB), Türkiye Cumhuriyet Merkez Bankası (TCMB), Oesterreichische Nationalbank (OeNB).

REFERENCES

Adrian, Tobias, Douglas Laxton, and Maurice Obstfeld, 2018, *Advancing the Frontiers of Monetary Policy* (Washington: International Monetary Fund).

Agarwal, Ruchir, and Miles Kimball, 2015, "Breaking Through the Zero Lower Bound," IMF Working Paper 15/224 (Washington: International Monetary Fund).

Allen, Franklin, Charles Bean, and José De Gregorio, 2016, "Independent Review of BIS Research Final Report," Bank for International Settlements, December 23.

Amamiya, Masayoshi, 2018, "The Future of Money" lecture at the Japan Society of Monetary Economics, October.

Archer, David, and Andrew Levin, 2017, "Robust Design Principles for Monetary Policy Committees," in *Central Bank Frameworks: Evolution or Revolution?* (John Simon and Maxwell Sutton, eds.) conference volume for a joint 2018 RBA-BIS-Dartmouth conference.

Ball, Laurence, 2019, "IMF Advice on Unconventional Monetary Policies to Major Advanced Economies," IEO Background Paper No. BP/19-01/01 (Washington: International Monetary Fund).

Ball, Laurence, and others, 2016, "What Else Can Central Banks Do?" Geneva Reports on World Economy 18, International Center for Monetary and Banking Studies, Geneva, September.

Balls, Ed, James Howard, and Anna Stansbury, 2018, "Central Bank Independence Revisited: After the Financial Crisis, what Should a Model Central Bank Look Like?" Harvard Kennedy School. M-RCBG Associate Working Paper Series, No. 87.

Bank of Canada, 2016, *Renewal of the Inflation Control Target*, October 2016.

Bayoumi, Tamim, and others, 2014, "Monetary Policy in the New Normal" IMF Staff Discussion Note 14/3, April (Washington: International Monetary Fund).

Bernanke, Ben, 2017, "Monetary Policy in a New Era," Brookings Institution, paper prepared for the Conference on Rethinking Macroeconomic Policy, Peterson Institute, Washington DC, October 12–13, 2017.

_____, 2018, "Should the Fed Stick With the 2 Percent Inflation Target or Rethink It?" Brookings Institution, January 8 (Washington D.C.)

Blanchard Olivier, Giovanni Dell'Ariccia, and Paolo Mauro, 2010, "Rethinking Macroeconomic Policy," IMF Staff Policy Note 10/03 (Washington: International Monetary Fund).

_____, 2013, "Rethinking Macroeconomic Policy II: Getting Granular," IMF Staff Discussion Note 13/03 (Washington: International Monetary Fund).

Blinder, Alan, 2017, "Through a Crystal Ball Darkly: The Future of Monetary Policy Communication," AEA Papers and Proceedings, Vol. 108, pp. 567–71.

Blinder, Alan, and others, 2016, "Necessity as the mother of invention: monetary policy after the crisis," DNB Working Paper No. 525.

_____, 2017, "What will monetary policy look like after the crisis?" European Central Bank, Research Bulletin No. 39, October.

Bordo, Michael D., and Andrew T. Levin, 2017, "Central Bank Digital Currency and the Future of Monetary Policy," NBER Working Paper No 23711.

_____, 2019, "U.S. Digital Cash: Principles and Practical Steps," NBER Working Paper No. 25455.

Brainard, Lael, 2018, "Cryptocurrencies, Digital Currencies, and Distributed Ledger Technologies: What Are We Learning? : a speech at the Decoding Digital Currency Conference, Sponsored by the Federal Reserve Bank of San Fr," Speech 1001, Board of Governors of the Federal Reserve System (U.S.).

Brunnermeier, Markus, and Yann Koby, 2016, "The Reversal Interest Rate: An Effective Lower Bound on Monetary Policy," Working Paper, Princeton University.

Campbell, Jeffrey, and others, 2012, "Macroeconomic effects of FOMC forward guidance," *Brookings Papers on Economic Activity*, Spring, 1–54.

Cecchetti, Stephen G., and Kermit L. Shoenholtz, 2016, "The Bank of Japan at the policy frontier," https://voxeu.org/article/bank-japan-policy-frontier.

Cecchetti, Stephen G., and Kermit L. Shoenholtz, 2018, "Universal Central Bank Digital Currency," *Money Banking and Financial Markets* online Commentary, April 23, 2018.

Clarida, Richard H., 2019, "the Federal Reserve's Review of Its Monetary Policy Strategy, Tools, and Communication Practices," speech by Vice Chair Richard H. Clarida at the 2019 U.S Monetary Policy Forum, sponsored by the Initiative on Global Markets at the University of Chicago Booth School of Business, New York.

Clinton, Kevin, and others, 2015, "Inflation-forecast targeting: Applying the Principle of Transparency," IMF Working Paper 15/132, (Washington: International Monetary Fund).

Coenen, Gunter, and others, 2017, "Communication of monetary policy in unconventional times," ECB Working Papers No. 2080.

Cœuré, Benoît, 2016, "Assessing the implications of negative interest rates," speech by Benoît Cœuré, Member of the Executive Board of the ECB, at the Yale Financial Crisis Forum, Yale School of Management, New Haven.

_____, 2018a, "The Future of Central Bank Money," speech at the International Center for Monetary and Banking Studies, Geneva.

_____, 2018b, "Central Banking in Times of Complexity," remarks at a conference on the occasion of Sveriges Riksbank's 350th anniversary, Stockholm.

Carney, Mark, 2018, "Open to the idea of a Central Bank Digital Currency," remarks at a conference on the occasion of Sveriges Riksbank's 350th anniversary, Stockholm.

CPMI, 2018, "Central bank digital currencies," Committee on Payments and Market Infrastructures, BIS.

Davoodalhosseini, S. Mohammad R., 2018, "Central Bank Digital Currency and Monetary Policy," Bank of Canada Staff Working Paper 2018–36.

Dell'Ariccia, Giovanni, Pau Rabanal, and Damiano Sandri, 2018, "Unconventional Monetary Policies in the Euro Area, Japan, and the United Kingdom," *Journal of Economic Perspectives*, Volume 32, Number 4.

De Michelis, Andrea, and Matteo Iacoviello, 2016., "Raising an inflation target: The Japanese experience with Abenomics", *European Economic Review*, Vol. 88, issue C, 67–87.

Dorich, Jose, and others, 2018, "Could a Higher Inflation Target Enhance Macroeconomic Stability?" BIS Working Paper No. 720.

Draghi, Mario, 2018, "Central Bank Independence," First Lamfalussy Lecture at the Banque Nationale de Belgique, Brussels, October 26.

Dudley, William, 2018, "Important Choices for the Federal Reserve in the Years Ahead," Remarks at Lehman College, New York, April 18.

Eastern Caribbean Central Bank, 2019, "ECCB to Issue World's First Blockchain-Based Digital Currency," March.

Feroli, Michael, and others, 2016, "Language after liftoff: Fed communication away from the zero lower bound," *Research in Economics*, 2017, Vol. 71(3), pp. 452–490.

Freedman, Charles, and Douglas Laxton, 2009, "IT Framework Design Parameters," IMF Working Paper WP/09/87 (Washington: International Monetary Fund).

Fuhrer, Jeff, and others, 2018, "Should the Fed Regularly Evaluate its Monetary Policy Framework?" Brookings Papers on Economic Activity, Fall edition.

Fujita, Kenji, and others, 2010, Central Banking: Lessons from the Crisis, IMF Policy Paper (Washington: International Monetary Fund).

Fung Ben S.C., and Hanna Halaburda, 2016, "Central Bank Digital Currencies: A Framework for Assessing Why and How," Bank of Canada Staff Discussion Paper 2016–22.

Goodhart, Charles A. E., and Jonathan P. Ashworth, 2012, "QE: a successful start may be running into diminishing returns," *Oxford Review of Economic Policy*, Vol. 28(4), pp. 640–70.

Hatcher, Michael, and Patrick Minford, 2014, "Stabilization policy, rational expectations and price-level versus inflation targeting: a survey," CEPR Discussion Paper No. 9820.

He, Dong, and others, 2016, "Virtual Currencies and Beyond: Initial Considerations," IMF Staff Discussion Note 16/03 (Washington: International Monetary Fund).

Heider, Florian, Farzad Saidi, and Glenn Schepens, 2018, "Life Below Zero: Bank Lending Under Negative Policy Rates," *Review of Financial Studies*, forthcoming. Available at SSRN: https://ssrn.com/abstract=2788204 or http://dx.doi.org/10.2139/ssrn.2788204

Hong, Gee Hee, and John Kandarac, 2018, "Pushed Past the Limit? How Japanese Banks Reacted to Negative Interest Rates," IMF Working Paper No. WP/18/131 (Washington: International Monetary Fund).

International Monetary Fund (IMF), 2013, "Unconventional Monetary Policies—Recent Experience and Prospects," April (Washington).

_____, 2015, "Evolving Monetary Policy Frameworks in Low-Income and Other Developing Countries," IMF Staff Paper, October (Washington).

_____, 2017, "Negative Interest Rate Policies-Initial Experiences and Assessments," IMF Policy Paper, August (Washington).

_____, 2018, *Global Financial Stability Report,* Box 1.4—Central Bank Digital Currencies, April (Washington: International Monetary Fund).

Honohan, Patrick, 2019, "Denmark, Switzerland, Sweden, and the Czech Republic," Chapter 2 in "IMF Advice on Unconventional Monetary Policies to Smaller Advanced Economies," IEO Background Paper No. BP/19-01/02 (Washington: International Monetary Fund).

Jacome, Luis I., and others, 2016, "Challenges for Central Banking: Lessons from Latin America," IMF Working Paper No. WP/16/197, September (Washington: International Monetary Fund).

Jobst, Andy, and Huidan, Li, 2016, "Negative Interest Rate Policy (NIRP): Implications for Monetary Transmission and Bank Profitability in the Euro Area," IMF Working Paper No. WP/16/172, August (Washington: International Monetary Fund).

Jones, Callum, Mariano Kulish, and Daniel M. Rees, 2018, "International Spillovers of Forward Guidance Shocks," IMF Working Paper No. WP/18/114, April (Washington: International Monetary Fund).

Kiley, Michael T., and John M. Roberts, 2017, "Monetary Policy in a Low Interest Rate World," BPEA Conference Drafts, March 23–24.

Krugman, Paul, 2014, "Inflation Targets Reconsidered," Draft paper for ECB Sintra Conference.

_____, 2019, "Running on MMT (Wonkish), article published in New York Times, February 25.

Kumhof, Michael, and Noone, 2018, "Central bank digital currencies—design principles and balance sheet implications," Bank of England Staff Working Paper No. 725.

Kuttner, Kenneth N., 2018, "Outside the Box: Unconventional Monetary Policy in the Great Recession and Beyond," *Journal of Economic Perspectives*, Vol. 32(4), pp. 121-46.

Lagarde, Christine, 2018, "Winds of Change: The Case for New Digital Currency" Speech by the IMF Managing Director at the Singapore Fintech Festival, November 14.

Levin, Andrew, 2017, Comments on "Re-Examining the Conduct of Monetary Policy: Towards the 2021 Framework Renewal," presentation at Bank of Canada workshop.

Levin, Andrew, and others, 2010, "Limitations on the Effectiveness of Forward Guidance at the Zero Lower Bound," *International Journal of Central Banking*, Vol. 6(1), pp. 143-189.

Lewis, Michelle, 2016, "Inflation Expectations Curve: A Tool for Monitoring Inflation," Reserve Bank of New Zealand Analytical Note Series, March (Wellington).

Mancini-Griffoli, Tommaso, and others, 2013, "Global Impact and Challenges of Unconventional Monetary Policies," IMF Policy Paper, October (Washington: International Monetary Fund).

Mancini-Griffoli, Tommaso, and others, 2018, "Casting Light on Central Bank Digital Currency," IMF Staff Discussion Note 18/08, November (Washington: International Monetary Fund).

Mishkin, Frederic S., 2011, "Monetary Policy Strategy: Lessons from the Crisis," NBER Working Paper 16755.

Norges Bank, 2018, "Central Bank Digital Currencies," Norges Bank Paper No. 1.

Pescatori, Andrea, 2018, "Central Bank Communication and Monetary Policy Surprises in Chile," IMF Working Paper No. WP/18/156, July (Washington: International Monetary Fund).

Poloz, Stephen S., 2016, "25 years of inflation targets—certainty for uncertain times," Speech at the Business Council of British Columbia, Vancouver, British Columbia.

_____, 2018, "Let Me Be Clear: From Transparency to Trust and Understanding," Remarks at Greater Victoria Chamber of Commerce Victoria, British Columbia.

Powell, Jerome H., 2018, "Financial Stability and Central Bank Transparency," Remarks at "350 years of Central Banking: The Past, the Present and the Future" A Sveriges Riksbank Anniversary Conference.

Prasad, Eswar, 2018, "Central Banking in a Digital Age: Stock-Taking and Preliminary Thoughts," Hutchins Center on Fiscal and Monetary Policy at Brookings, April.

Quarles, Randal, 2017, "Thoughts on Prudent Innovation in the Payment System," Speech at 2017 Financial Stability and Fintech Conference, Washington, D.C., Nov. 30.

Quint, Dominic and Pau Rabanal, 2017. "Should Unconventional Monetary Policies Become Conventional?" IMF Working Paper No. WP/17/85, March (Washington: International Monetary Fund).

Rogoff, Kenneth S., 2015, *The Curse of Cash,* Princeton University Press.

Schmitt-Grohé, Stephanie, and Martin Uribe, 2010, "The Optimal Rate of Inflation," Elsevier/North-Holland *Handbook of Monetary Economics*, Volume 3, January 30.

Summers, Lawrence H., David Wessel, and Michael Murray, 2018, *Rethinking the Fed's 2 percent inflation target*, a report from the Hutchins Center on Fiscal and Monetary Policy at Brookings.

Svensson, Lars E. O., 2014, "Forward Guidance," NBER Working Paper No. 20796, December.

Swanson Eric, 2018, "The Federal Reserve Is Not Very Constrained by the Lower Bound on Nominal Interest Rates," BPEA, September 13-14, 2018.

Taylor, John L., 2016, "Independence and the scope of the central bank's mandate," Sveriges Riksbank Economic Review 2016:3.

Tucker, Paul, 2018, "Unelected Power: The Quest for Legitimacy in Central Banking and the Regulatory State," Princeton University Press.

Viñals, Jose, Simon Gray, and Kelly Eckhold, 2016, "The Broader View: The Positive Effects of Negative Nominal Interest Rates," IMF Blog, April 10 (Washington D.C.)

Wadsworth, Amber, 2017, "An international comparison of inflation-targeting frameworks," Reserve Bank of New Zealand Bulletin, 80(8), pp. 1-34.

Weidmann, Jens, 2018, "From extraordinary to normal—reflections on the future monetary policy toolkit," Speech at the European Banking Congress, Frankfurt am Main.

Wilkins, Carolyn A., 2017, "Closing Remarks of the workshop Monetary Policy Framework Issues: Toward the 2021 Inflation-Target Renewal, Ottawa, Ontario, September 14.

_____, 2018. "Choosing the Best Monetary Policy Framework for Canada" Remarks at McGill University Max Bell School of Public Policy November 20, Montréal, Quebec.

Williams, John C., 2016, Discussion of "Language after Liftoff: Fed Communication Away from the Zero Lower Bound," Presentation at U.S. Monetary Policy Forum New York, NY.

Yellen, Janet L., 2018, "Comments on Monetary Policy At The Effective Lower Bound," Brookings, September 14.