Assessing the Federal Reserve's Toolbox for Providing Monetary Stimulus at the Effective Lower Bound

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This year marks the tenth anniversary of the date that the NBER designated as the start of the recovery from the Great Recession. In retrospect, however, this recovery has clearly been the most protracted and painful since the Great Depression of the 1930s. Therefore, as the FOMC proceeds with its "Fed Listens" initiative, a key consideration should be that the current monetary policy framework has not provided satisfactory outcomes for ordinary American families. The FOMC's ability to carry out its dual mandate has been substantially constrained by the effective lower bound (ELB) on nominal interest rates, and that constraint could become even more problematic in coming years. In the context of a turbulent global economy, the challenge of strengthening the FOMC's policy toolbox has become increasingly urgent.

Indeed, while the label "The Fed Listens" seems snappy and upbeat, it does raise some significant questions and concerns:

-- *What's new about the "Fed Listens" initiative?* Is there an implicit message that the Fed wasn't really listening to public input prior to the launch of this project, or that the Fed will stop listening after this initiative is concluded? Could the FOMC commit itself to a greater degree of openness to public input on an ongoing basis?

-- *To whom is the Fed listening?* A recent essay by the Bloomberg editorial board described this initiative as only reaching out to the "penumbra" of the Federal Reserve.[1] (For the non-astronomers among us, the penumbra is the narrow edge of the sun that only becomes visible during a solar eclipse.) Such limitations on the scope of inquiry pose the risk that some problematic core assumptions could remain unquestioned and that some potentially fruitful options could remain unexplored. In effect, this is an example of the "groupthink" that was prevalent at the Federal Reserve and elsewhere in the leadup to the global financial crisis.[2]

-- *Will this initiative lead to any significant adjustments in the FOMC's policy framework?* A common symptom of groupthink is an undue sense of complacency and passivity, even in the face of significant risks, that reinforces a tendency to make decisions reactively instead of proactively. Unfortunately, the July 2019 FOMC minutes indicate that the Committee had an extensive discussion and seemed quite comfortable with reaching the conclusion to simply maintain its current policy framework, perhaps with a few refinements to the "dot-plot" or other FOMC communications.[3]

With these broad considerations in mind, let's now turn to the question of whether the Fed's toolbox is adequate in providing monetary stimulus at the ELB. I will begin by highlighting some empirical findings from my forthcoming paper with Prakash Loungani, in which we document the limitations of quantitative easing (QE) as a tool for providing monetary stimulus.[4] And then I'll talk about how the introduction of digital cash can strengthen the Fed's ability to mitigate severe adverse shocks, drawing on my joint work

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[1] *https://finance.yahoo.com/news/fed-stands-pat-while-big-221243611.html*
[2] See Archer and Levin (2018).
[3] *https://www.federalreserve.gov/monetarypolicy/fomcminutes20190731.htm*
[4] See Levin and Loungani (2019).

with Michael Bordo – including some highlights from the presentation that we gave at the Hoover conference two years ago as well as our recent Hoover working paper.[5] In particular, our analysis has demonstrated the merits of providing digital cash thru a public-private partnership between the Federal Reserve and supervised financial institutions, and we've set forth design principles that would eliminate the effective lower bound while ensuring that ordinary households and small businesses are insulated from negative interest rates and are not burdened with any implicit taxes or fees.

Assessing the Adequacy of the Economic Recovery

In assessing the efficacy of the Fed's current monetary toolbox, it seems sensible to start by reviewing the experience of the past decade. The July 2019 FOMC minutes indicate that *"With regard to the current monetary policy framework, participants agreed that this framework had served the Committee and the U.S. economy well over the past decade."* But that conclusion seems overly sanguine in light of the actual evolution of U.S. inflation and employment.

The upper panel of Figure 1 shows the level of core inflation over the past decade, as measured by the price index for personal consumption expenditures (PCE) excluding food and energy. Evidently, core inflation has remained persistently below the Fed's 2 percent target, even though the FOMC has regularly reiterated that this target is *"symmetric"* and that *"the Committee would be concerned if inflation were running persistently above or below this objective."*[6] These persistent shortfalls have not been innocuous. Over the past five years, market-based measures of longer-term inflation expectations have shifted down by about ¾ percentage point, and a similar trend has been evident in the benchmark survey of consumer sentiment conducted by the University of Michigan.

A key reason for these persistent inflation shortfalls is that policymakers have been overly reliant on recurringly overoptimistic forecasts. Those systematic forecast errors partly reflect shortcomings in analytic and statistical methods. For example, the basic structure of the Fed Board staff model, known as FRB/US, has remained essentially unchanged since that model was formulated in the early 1990s, including a rudimentary representation of the global economy and no consideration of the banking system, liquidity, or credit market frictions.

But the fundamental challenge in economic forecasting is the limitations of our understanding of the structure and dynamics of the macroeconomy. Thus, barring some revolution in economic forecasting, it seems gravely mistaken for the Fed to move in the direction of adopting a "makeup strategy", which aim at mitigating the ELB by relying even more heavily on forecasts at relatively long time horizons.

Turning now to the middle panel of Figure 1, the U.S. unemployment rate peaked at nearly 10 percent in autumn 2009 and declined at an agonizingly slow pace over subsequent years; indeed, it did not return to its pre-recession level until 2017. That outcome may partly owe to policymakers' pessimism about the sustainable level of unemployment *(U*)*; as of 2015, the median estimate of FOMC participants was about 5.5 percent, suggesting that the labor market was already on the verge of overheating, whereas their latest estimates (as of June 2019) had a range of 3.6 to 4.4 percent.

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[5] See Bordo and Levin (2017, 2019).
[6] *https://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf* .

Figure 1: Characterizing the U.S. Economic Recovery

Core PCE Inflation Rate

Unemployment Rate

Labor Force Participation of Prime-Age Adults
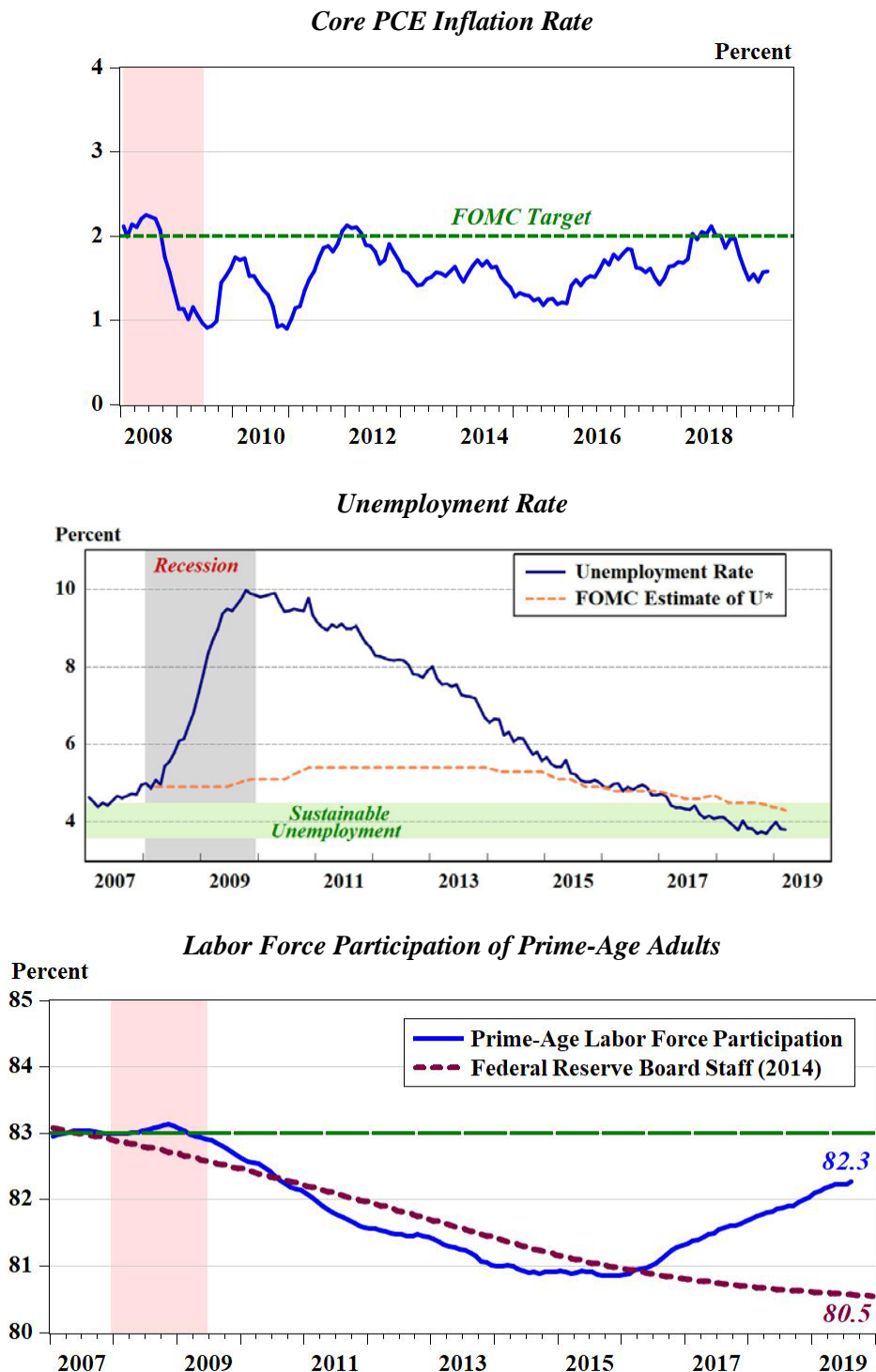
Sources: Bureau of Economic Activity, Bureau of Labor Statistics, Federal Reserve Board, NBER, and author's calculations. In the middle panel, the interval labeled "Sustainable Unemployment" denotes the range of FOMC participants' estimates of U* as published in September 2019. In the lower panel, the short-dashed line denotes the projection of Aaronson et al. (2014), and the long-dashed line denotes the 2007 average labor force participation rate of prime-age adults (ages 25 to 54 years).

However, the unemployment rate is not a satisfactory measure of labor market slack, especially in the context of a severe downturn and sluggish recovery.[7] For example, the U.S. unemployment rate began moving downward during 2010 and 2011, but that decline did not reflect unemployed workers taking jobs; instead, discouraged individuals were simply giving up and exiting from the job market.

As shown in the lower panel of Figure 1, the labor force participation rate (LFPR) of prime-age adults declined markedly in the wake of the Great Recession. But the Federal Reserve Board's staff attributed that decline to structural factors as well as "permanent damage" from the recession, projecting in 2014 that prime-age LFPR would continue heading downwards through the end of the decade. In effect, that projection characterized millions of people in their prime working years as permanently unemployable. Fortunately for American workers and their families, the Fed Board staff projection turned out to be utterly mistaken. Since 2015, the prime-age LFPR has moved back upwards but still remains a bit below its pre-recession average, suggesting that the U.S. labor market still may not have not fully recovered even a decade after the start of the recovery

Reassessing the Fed's Monetary Toolbox

The painfully slow and protracted economic recovery also underscores the intrinsic limitations of the Fed's monetary toolbox. In particular, the Fed's open-ended asset purchase program, commonly referred to as QE3, was launched in fall 2012 with the aim of boosting the pace of the recovery by exerting downward pressure on term premiums and longer-term bond yields. Subsequent Fed analysis has continued to maintain that assumption about the transmission mechanism of QE; for example, a recent paper by Fed Board staff states that *"The balance sheet expansion lowers the path of the term premium on 10-year Treasury yields."*[8]

The assumed efficacy of QE has mainly rested on event studies of the Fed's initial round of asset purchases (QE1), which was initiated in late 2008 and expanded in March 2009.[9] Nonetheless, at the Jackson Hole conference in August 2012, Michael Woodford noted that such balance sheet actions might be very effective in the midst of a financial crisis but relatively ineffectual (except as a signaling device) once those financial strains had subsided. Thus, it seems sensible to revisit the QE3 program and examine its impact on term premiums as well as broader macroeconomic indicators.

The New York Fed's survey of primary dealers is helpful in disentangling the transmission mechanism of QE3. In particular, these surveys regularly elicited dealers' expectations regarding the likely timing of liftoff, i.e., the first hike to the target federal funds rate. As of early September 2012, just prior to the launch of QE3, the median projection of the primary dealers was that liftoff would occur in the third quarter of 2015. And that interest rate outlook remained stable over the subsequent two-year period until the end of QE3 in September 2014.[10] One key implication is that QE3 did not shift investors' perceptions regarding the likely path of the target federal funds rate, i.e., the QE3 program was *not* associated with any substantial signaling effects about the Fed's conventional monetary policy tool.

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[7] See Erceg and Levin (2014) and Levin (2014).
[8] Chung et al. (2019), pp. 27-28.
[9] Chung et al. (2011) gauged QE1 as having reduced the term premium by about 50bp, whereas the effects of QE2 were gauged at around 15bp.
[10] The median projection for liftoff was 2015:Q3 in almost all of the surveys conducted over that two-year period, except for the surveys conducted in late June 2013 (median = 2015:Q2) and in December 2014 and January 2015 (median = 2015:Q4).

The FOMC's decision to launch QE3 was informed by Fed staff assessments of its efficacy. Fortunately, since FOMC materials are routinely released to the public after a five-year interval, we can now take a look at the staff analysis that was sent to the FOMC just a few weeks beforehand. That analysis assumes a direct relationship between the anticipated size of the asset purchase program and the projected decline in the term premium: *"The staff's analysis...indicates that [asset purchases] affect term premiums and thus longer-term interest rates primarily via their effect on the private sector's expectations of the future path of the stock of longer-term securities that will be held by the Federal Reserve."*[11] This link was assumed to be approximately linear, and its proportionality factor was determined from event studies of QE1, which totalled about $1.7 trillion in asset purchases and reduced the 10-year term premium by about 50 basis points. Thus, in analyzing the prospective impact of QE3, Fed staff projected that the announcement of a $1 trillion program would cause the term premium to *"fall immediately by about 35 basis points."*

Thus, in assessing the actual efficacy of QE3, one key ingredient is to gauge the evolution of investors' expectations about its overall size. For this purpose, we can draw on the New York Fed's survey of primary dealers, which regularly elicited dealers' projections of the size and composition of the securities held in the Fed's System Open Market Account (SOMA). The regular survey was conducted a few days before the September 2012 FOMC meeting, and a special followup survey was performed a few days afterwards, indicating that the FOMC's initial announcement of QE3 caused primary dealers to ramp up their expectations of the Fed's total security holdings by about $500 billion. The release of the FOMC minutes three weeks later evidently led dealers to mark up their projections by an additional $300 billion, which remained stable for the next couple of months and then increased somewhat further in conjunction with the December 2012 FOMC meeting. By contrast, their projections about QE3 barely changed at all during the so-called "taper tantrum" episode of late spring 2013, which was triggered by the Fed Chair's testimony to the Joint Economic Committee (JEC) in late May and further magnified by the June FOMC meeting a few weeks later.

It should be noted that the actual term premium cannot be directly observed but can be inferred from the term structure of Treasury securities and the forward contracts on those securities. Thus, we use two distinct measures that are maintained and posted by Federal Reserve staff, namely, the series published by the Federal Reserve Board, which uses the methodology developed by Kim and Wright (2007), and the series published by the New York Fed, which uses the methodology of Adrian et al. (2011).

In gauging the impact of QE3 announcements, we follow the approach of Krishnamurthy and Jorgensen (2011) in analyzing the two-day change in the term premium (i.e., the day after the event minus the the day before the event). In particular, for each of the FOMC communications that shifted investors' expectations about the size of QE3, we can use the Fed staff's framework to obtain the predicted impact on the 10-year term premium, and then we can compare that prediction with the actual two-day change in the term premium. This approach enables us to disentangle the effects of QE3 from other economic and financial developments outside each two-day window that may have influenced the overall level of the term premium.[12]

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[11] Laforte et al. (2012), p.1.
[12] Hamilton (2019) highlights the upward trajectory of the term premium following the launch of QE3.

Table 1: Was QE3 Helpful or Counterproductive?

Event	Term Premium on 10-Year Treasury Security *(basis points)*		
	Predicted Change	**Actual 2-Day Change**	
		FRBOG Measure	*FRBNY Measure*
Sept. 2012 FOMC Meeting (9/13/2012)	-17	+6	+17
Sept. 2012 FOMC Minutes (10/4/2012)	-11	+8	+15
Dec. 2012 FOMC Meeting (12/12/2012)	-3	+7	+11
May 2013 JEC Testimony (5/22/2013)	-2	+8	+11
June 2013 FOMC Meeting (6/19/2013)	+3	+21	+14

Notes: For each event, the second column indicates the predicted change in the term premium on a 10-year constant-maturity Treasury security, which is computed by applying the Federal Reserve Board staff's maintained assumption to the perceived shift in security holdings as indicated by Federal Reserve Bank of New York (FRBNY) surveys of primary dealers. The last two columns show the actual two-day change in the term premium for that event, as calculated by the staff of the Fed's Board of Governors (FRBOG) and the New York Fed (FRBNY), respectively.

As shown in Table 1, the Fed staff analysis implies that the initial announcement of QE3 in September 2012 (which led investors to anticipate purchases of about $500 billion) should have reduced the term premium by about 17 basis points, whereas in fact that announcement was associated with a substantial *increase* in the term premium. Similarly, the release of the September 2012 FOMC Minutes should have reduced the term premium by an additional 11 basis points, but instead generated a further *increase*. And the December 2012 FOMC meeting, which should have exerted downward pressure on the term premium, was also associated with an increase in the term premium. Evidently, the initial rollout of QE3 was not merely ineffectual but counterproductive, i.e., each of these three FOMC announcements exerted upward pressure on the term premium.

Table 1 also documents the upward shifts in the term premium -- totalling about 25 to 30 basis points – that were associated with the May 2013 JEC testimony and the June 2013 FOMC meeting. As noted above, investors' projections about the overall size of QE3 and the timing of liftoff hardly moved at all during this period. Rather, the surging term premium occurred in response to Fed communications about tapering the pace of asset purchases rather than simply ending the program. Such a taper was expected to have only minimal effects on the total amount of purchases, and hence the Fed staff's analytical framework indicated that it should not have substantial effects on the term premium. Thus, the Fed's leadership attributed the upward spike to transitory frictions and irrational market behavior, and hence this episode was labeled as the "taper tantrum", analogous to the tantrum of a ill-tempered child.

In retrospect, however, the phrase "taper tantrum" was an inapt characterization, because the upward shift in the term premium was not a transitory episode caused by market frictions but was in fact characteristic of the entire QE3 program. As noted by Hamilton (2019), the term premium started moving upwards

during the early stages of QE3, jumped 75 basis points in late spring 2013, and did not subside until QE3 ended in autumn 2014. Moreover, market participants specifically attributed these developments to the lack of clarity in FOMC communications. For example, the results of the New York Fed's June 2013 survey included the following summary: *"Most primary dealers stated that a change in perception of or heightened uncertainty about the FOMC's view of appropriate monetary policy were key factors that generated the rise in the 10-Treasury yield."*

Given that QE3 did not achieve its intended aim of reducing longer-term bond yields, it is not surprising that the program was ineffectual in spurring the U.S. economic recovery. As shown in the upper panel of Figure 2, QE3 had negligible effects on the growth of U.S. real GDP, which fluctuated within a relatively narrow range in 2013 and 2014. Likewise, QE3 had no apparent impact on core PCE inflation (the Fed's preferred measure of underlying inflation), which averaged about 1½ percent over this period, essentially the same as its average pace over preceding and subsequent years.[13]

The limited effectiveness of quantitative easing has also been underscored by the recent experiences of other major economies where conventional policy has been constrained by the ELB. For example, the Bank of Japan (BOJ) launched its quantitative and qualitative easing (QQE) program in April 2013 and initiated yield curve control in 2016, but Japanese core inflation (excluding food and energy prices) is still mired close to zero -- far below the BOJ's 2 percent inflation target. Similarly, the European Central Bank (ECB) engaged in a large-scale asset purchase program from early 2015 through late 2018, but core consumer inflation (excluding food, energy, alcohol, and tobacco) edged upwards only slightly and remains roughly a percentage point below the ECB's stated objective of keeping inflation "below but close to 2 percent over the medium run."

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[13] Levin and Loungani (2019) analyze a range of macroeconomic indicators and find no evidence of any statistical significant effects of QE3.

Figure 2: Did QE3 Affecct the Economic Recovery?

U.S. Real GDP Growth

U.S. Core PCE Inflation
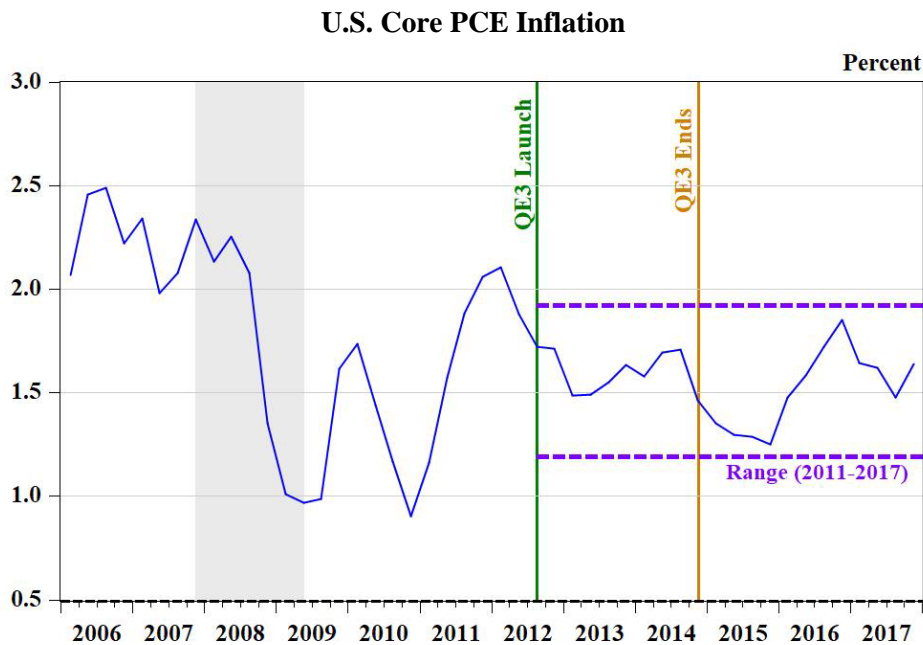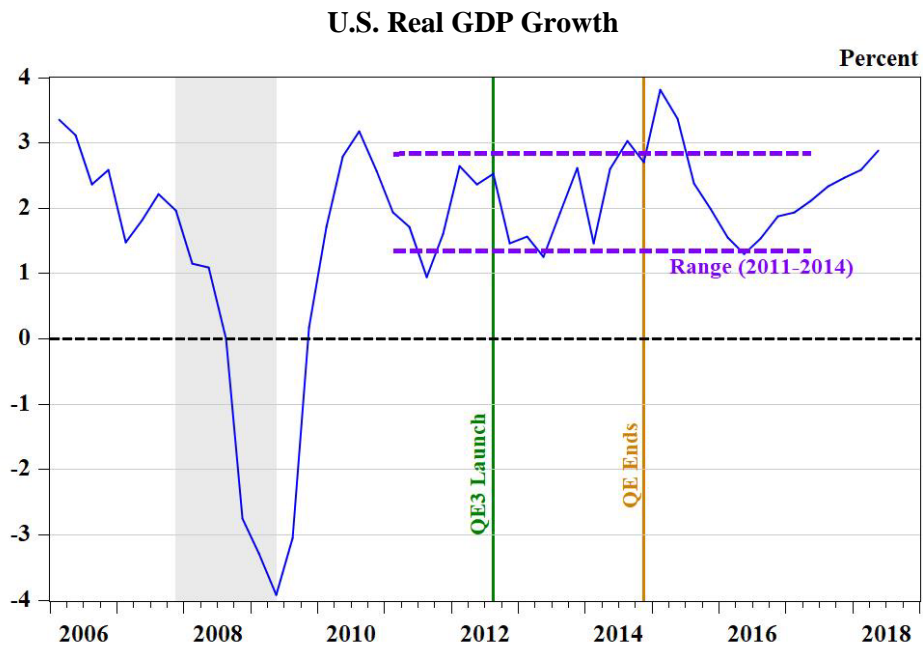
Notes: These two panels show the four-quarter average growth rates of real GDP and of the price index for personal consumption expenditures (PCE) excluding food and energy, as published by the Bureau of Economic Analysis, and the recession dates (shaded area) are determined by the NBER.

Design Principles for Digital Cash

In my joint work with Michael Bordo, we have emphasized that digital cash can fulfill the three basic functions of money, serving as a practically costless medium of exchange, a secure store of value, and a stable unit of account.[14] While private forms of money can fulfill some aspects of these functions, there are intrinsic reasons why households and nonfinancial firms should also have access to a fiduciary form of money issued by the central bank. First, central bank money serves as a unit of measure -- analogous to the inch or the meter -- that facilitates the economic decisions and financial plans of ordinary consumers and small businesses. Second, in an efficient monetary system, the medium of exchange should also serve as a secure store of value that bears the same rate of return as other risk-free assets such as U.S. Treasury bills; cf. Friedman (1960). By contrast, any purely private form of money (i.e., not backed by government authorities) is intrinsically subject to default risk and hence cannot serve as a reliable medium of exchange nor as a stable unit of account.

Our analysis indicates that digital cash should be provided through designated accounts held at supervised depository institutions, which would hold part or all of those funds in segregated reserve accounts at the central bank. This approach would foster competition among digital cash providers and protect the privacy of individual transactions while facilitating appropriate law enforcement. In effect, the provision of digital cash would be similar to that of many other public goods such as water, electricity, and transportation.

Under this approach, payment transaction could be transmitted instantaneously and securely at practically zero cost, simply debiting the payer's digital cash account and crediting the payee's digital cash account. The scope and scale of fraudulent transactions could be mitigated by straightforward and convenient methods such as two-step identity verification.

Digital cash accounts could bear interest at essentially the same rate as Treasury bills, thereby serving as a secure store of value. This would tighten the link between the interest that banks earn on their reserves and the interest that they pay to ordinary depositors, thereby strengthening the monetary transmission mechanism. Moreover, such an arrangement would be a natural extension of the current monetary system, in which the Federal Reserve pays interest on the reserves of commercial banks, issues interest-bearing liabilities to a wider array of financial counterparties thru its reverse repo facility, and maintains segregated accounts on behalf of the customers of systemically important financial market utilities.[15]

The interest rate on digital cash would serve as the FOMC's key monetary policy tool. During normal times, this interest rate would be positive. But in the face of a severe adverse shock, the FOMC would be able to cut the digital cash interest rate below zero to foster economic recovery and preserve price stability. As discussed below, such a system would appropriately insulate ordinary households and small businesses from incurring negative rates on their digital cash accounts.

In effect, the Federal Reserve would be able to provide an appropriate degree of monetary stimulus without resorting to QE, and hence its balance sheet would become very transparent. In particular, the Fed could simply hold short-term Treasuries in the same quantity as its liabilities of digital cash. The Fed's operating procedures would be correspondingly transparent: It would engage in purchases and sales of Treasury securities to adjust the supply of digital cash in line with movements in demand for digital cash.

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[14] See Bordo and Levin (2017, 2019).

[15] For example, segregated reserve accounts at the Federal Reserve Bank of Chicago have been created to hold the funds of customers of the Chicago Mercantile Exchange *(*http://www.cmegroup.com/notices/ clearing/2017/03/Chadv17-107.html*)* and the initial margin accounts of customers of ICE Clear Credit *(*https://www.theice.com/publicdocs/clear_credit/circulars/Circular_2017_015_FINAL.pdf*)*.

Mitigating the ELB

It would be inappropriate to abolish paper currency; rather, individuals and businesses should remain free to continue using it for the foreseeable future. As digital cash becomes ubiquitous, however, demand for paper cash is likely to diminish rapidly. After all, paper currency is inefficient and costly: sorting and cleaning it at the bank, supplying it to ATMs, maintaining cash registers and safes at retail stores, using armored cars for transport, and ensuring that no cash is lost or stolen at any point in this cycle. In contrast, digital cash can be used instantly at practically no cost at all. Thus, as digital cash comes into widespread use, it seems reasonable to expect that paper currency will rapidly become obsolescent, just like typewriters and audiotapes.

But if paper cash is not abolished, then how can the Federal Reserve eliminate the ELB? Some analysts have proposed a time-varying exchange rate between paper currency and digital cash. But such an approach would impose a severe burden on ordinary households and small businesses and would be fundamentally inconsistent with the notion that the Fed should provide a stable unit of account.

Thus, a far superior approach would be to eliminate the ELB by curtailing incentives for financial arbitrage between paper cash and digital cash, in effect, introducing "sand in the wheels." In particular, the Fed could establish a graduated system of fees for transfers between paper cash and digital cash. Small transfers – say, up to $100 per week for an individual or $10,000 for a small business – would be completely exempt from such fees. Moderately larger transfers would be subject to a nominal fee (e.g., 2-3%), roughly similar to the size of withdrawal fees at many ATMs and cash service fees incurred by many small businesses. And the largest transfers (say, over $5,000) would be subject to an even larger fee (e.g., 5-10%). These arrangements would effectively eliminate the ELB while ordinary consumers and small businesses would remain free to use paper cash if so desired.

Finally, the Fed could insulate ordinary households and small businesses from incurring negative rates on moderate levels of digital cash balances. For example, an individual might hold funds in a single digital cash account, and moderate balances in that account (e.g., up to $5,000) could be exempt from negative rates, while balances exceeding that limit would be subject to the negative interest rate.[16] Of course, individuals and businesses would also be free to hold multiple digital cash accounts at various financial institution banks; in such instances, one of those accounts would need to be designated as the user's "primary" digital cash account, and the exemption would only apply to the funds held in that particular account.

With this design, the Federal Reserve would be able to effectively foster economic recovery and price stability without imposing implicit taxes or fees on the digital cash balances held by ordinary households and small businesses. After all, the crux of the rationale for cutting the digital cash interest rate below zero is to influence the incentives of wealthy investors and large financial firms—not to penalize moderate account balances that facilitate day-to-day payment transactions.

Some analysts have expressed concerns about the possibility that investors might run from other assets into digital cash in the event of a financial crisis. But such concerns neglect the fact that the FOMC would be able to reduce the digital cash interest rate below zero if needed. In effect, a widening of credit risk spreads would be reflected by a corresponding drop in the risk-free interest rate rather than a surge in private lending rates (which would remain close to normal levels). Moreover, this approach would generate a steep yield curve that would in turn facilitate the expansion of bank credit and foster prudent

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[16] In effect, the yield on digital cash accounts would be analogous to that of U.S. Treasury Inflation Protected Securities (TIPS), which provide compensation for positive inflation but never shrink in nominal value.

risk-taking -- precisely the opposite of QE and "lower for longer" forward guidance that encourage search-for-yield behavior. Thus, digital cash would foster more rapid V-shaped recoveries instead of the U-shaped recovery of the U.S. economy over the past decade.

Practical Steps

In light of these design principles, it's natural to ask whether digital cash is truly feasible in the United States, and if so, over what timeframe? Rather than decades or centuries, our analysis indicates that the Federal Reserve could take the essential steps by 2020, although further refinements would surely take place in subsequent years. In particular, the Federal Reserve should move promptly to: (i) establish a real-time clearing and settlement system that facilitates efficient payments for consumers and businesses, and (ii) facilitate the establishment of safe and liquid bank accounts that accrue essentially the same rate of return as Treasury bills.

In a competitive banking system, it would be reasonable to expect that the interest rate on liquid deposits would roughly match or exceed the IOR. After all, commercial banks are only required to hold a small fraction of their liquid deposits as reserves at the Federal Reserve (which accrue the IOR), and they can earn a higher return by lending out the rest of those funds or investing in Treasury securities and other safe assets. In fact, however, most checkable deposits earn little or no interest, and even short-term savings accounts accrue interest at a rate far below that of IOR. In effect, a substantial portion of banks' current profit margin is being earned by paying non-competitive rates on those deposit accounts.

One simple way for the Federal Reserve to foster a more competitive banking system would be to encourage the establishment of narrow banks. The business model of a narrow bank is remarkably simple and transparent, because such a bank would hold 100% of its deposits as reserves at the Federal Reserve. Thus, such deposits would accrue interest at essentially the same rate as IOR (less a small margin to cover the bank's operating costs). Narrow banks could significantly enhance the competitiveness of the banking system without displacing most conventional banks. After all, huge banks obtain the bulk of their funding from wholesale markets and earn profits from managing complex portfolios, while community banks specialize in "relationship banking" with small businesses and local residents. Finally, narrow banks would operate under the same legal arrangements as other commercial banks, namely, a charter from a state banking agency or the Treasury Department. But a narrow bank would have no need for FDIC insurance or access to the Fed's discount window, since its deposits would be inherently safe and liquid.

Conclusion

Although memories of the financial crisis are gradually receding, the global economy remains turbulent and unpredictable. Moreover, the "new normal" for the target federal funds rate is now expected to be around 3 percent – markedly lower than its level preceding that crisis – and hence the ELB is very likely to reemerge as a binding constraint on conventional monetary policy in coming years. And a clear lesson from recent experience is that QE and other unconventional monetary policy tools are complex, opaque and ineffectual.

Therefore, an urgent priority for the Federal Reserve is to move ahead with the provision of digital cash as a means of mitigating the ELB. Digital cash should be provided to the public through accounts at supervised financial institutions, which hold part or all of those funds in segregated reserve accounts at the central bank. In the near term, the Federal Reserve can take practical steps in this direction by implementing a real-time payment system and by encouraging the establishment of narrow banks. This approach will ensure that monetary policy will be systematic, transparent and effective during normal times and in responding to severe adverse shocks.

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