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DIGITAL CASH: PRINCIPLES & PRACTICAL STEPS

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ABSTRACT

If the global economy encounters another severe adverse shock in coming years, will major central banks be able to provide sufficient monetary stimulus to preserve price stability and foster economic recovery? Our empirical analysis indicates that the Federal Reserve's QE3 program was not an effective form of monetary stimulus and that unconventional monetary policies undertaken in the Eurozone and in Japan have been similarly limited in impact. We then consider how digital cash could bolster the effectiveness of monetary policy, and we characterize some potential steps for implementing digital cash via public-private partnerships between the central bank and supervised financial institutions. Our analysis indicates that digital cash could significantly enhance the stability of the financial system.

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1. Introduction

A fundamental purpose of the monetary system is to provide a stable unit of account that facilitates the economic and financial decisions of households and businesses. Thus, as of a few decades ago, monetary economists were primarily concerned about how to prevent a recurrence of the "Great Inflation", i.e., the design of systematic and transparent monetary policy frameworks that would ensure low and stable rates of inflation.

More recently, however, a number of advanced economies have experienced protracted periods of relatively weak aggregate demand, with inflation falling persistently short of its stated objective and conventional monetary policy constrained by the effective lower bound (ELB) on nominal interest rates that arises from the zero interest rate on paper cash. Thus, at this juncture a crucial question is to how to ensure that major central banks can provide sufficient monetary stimulus to preserve price stability and foster economic recovery if the global economy faces another severe adverse shock in coming years.

In this paper, we begin by analyzing the recent experience with unconventional monetary policy tools, i..e, quantitative easing and forward guidance. Our empirical analysis indicates that the Federal Reserve's QE3 program did not have significant effects on U.S. nonfarm payrolls, GDP growth, or core inflation; likewise, the unconventional policies undertaken in recent years in the Eurozone and in Japan have had little or no impact on core inflation, which remains well below each central bank's inflation goal.

In light of those findings, we consider some basic design principles for digital cash, which could significantly bolster the effectiveness of monetary policy. Our analysis specifically examines approaches in which digital cash could be provided to the public through designated accounts held at supervised depository institutions, which would in turn hold part or all of those funds in segregated reserve accounts at the central bank. Such accounts could be used to make instant payments at practically zero cost and would be interest-bearing at essentially the same rate as other risk-free assets. The interest rate on digital cash would serve as the primary tool of monetary policy, thus facilitating a systematic and transparent monetary policy framework.

Next, we identify some practical near-term steps that could be taken to implement digital cash. In particular, the central bank could: (i) establish a real-time clearing and settlement system that facilitates efficient payments for consumers and businesses; (ii) facilitate the establishment of safe and liquid bank accounts that accrue roughly the same rate of return as short-term government securities; and (iii) implement a graduated system of fees on transfers between paper cash and digital cash. Such arrangements would effectively curtail incentives for financial arbitrage between paper cash and digital cash, thereby eliminating the ELB, while consumers and firms would still remain free to use paper cash if so desired.

Our analysis also considers the implications of digital cash for the stability of financial markets and institutions. In the current monetary system, recent evidence indicates that reducing the central bank's interest rate on reserves below zero may have detrimental effects on the supply of credit, because downward adjustment of bank deposit rates is hindered by disintermediation into paper cash.[1] By contrast, a well-designed system of digital cash could eliminate such disintermediation while insulating ordinary households and small businesses from incurring negative rates on their digital cash accounts.

Indeed, our analysis indicates that digital cash could significantly enhance the stability of the financial system. In a financial crisis, the central bank would be able to expand the supply of digital cash as needed to carry out its role as lender of last resort, while the interest rate on digital cash could be adjusted downward to discourage runs from other financial assets into digital cash. In effect, the central bank would ensure that the widening of risk spreads was offset by a corresponding drop in the risk-free interest rate, thereby keeping the cost of credit close to normal levels and helping to insulate the real economy from the financial crisis. Moreover, this approach would generate a relatively steep yield curve that would facilitate the expansion of bank credit and foster prudent risk-taking behavior -- precisely the opposite of QE programs and "lower for longer" forms of forward guidance.

Finally, it should be noted that an alternative approach to mitigating the ELB might be to raise the inflation goal by several percentage points. By increasing the normal level of nominal interest rates, the central bank would have more room to cut rates without being constrained by the ELB.[2] However, such an approach would push the average inflation rate up to levels last experienced a half-century ago, and the inflation target might well be transformed from a credible anchor into a political football. These factors are relevant in comparing this approach to the introduction of digital cash, which could eliminate the ELB and bolster the central bank's ability to foster true price stability.

The remainder of this paper is organized as follows. Section 2 gauges the effectiveness of unconventional tools. Section 3 considers the basic design features of digital cash. Section 4 examines its implications for the monetary policy framework. Section 5 highlights some near-term practical steps that central banks could take in the process of establishing digital cash. Section 6 reflects on financial stability issues. Section 7 concludes.

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[1] See Eggertsson, Juelsrud, Summers, and Wold (2019).

[2] See Blanchard et al. (2010), Ball (2014), and Ball et al. (2016).

2. Assessing Unconventional Monetary Policies

Paper cash pays zero interest and hence limits the extent to which a central bank can provide conventional monetary accommodation by reducing nominal interest rates in the face of weak aggregate demand and persistently low inflation. In the wake of the global financial crisis, major central banks became constrained by this effective lower bound (ELB) and deployed two basic forms of unconventional monetary policy: quantitative easing (QE) in the form of large-scale asset purchases, and forward guidance about the likely trajectory of short-term nominal interest rates. These unconventional policies were intended to provide monetary stimulus, thereby fostering the pace of economic recovery and bringing inflation back upwards to its stated objective; thus, such tools are intrinsically different from the emergency liquidity measures that a central bank may implement in serving as a lender of last resort during a financial crisis.

In deploying these unconventional policies, central bankers and other analysts were quite optimistic that implementing QE and forward guidance could substantially mitigate the severity of the ELB. However, their projections relied heavily on extrapolations from statistical patterns over preceding decades and on event studies of policy actions taken in the midst of the financial crisis. Consequently, such assessments were necessarily subject to a high degree of uncertainty.[3] With the passing of time, it has become increasingly evident that QE and forward guidance are subject to intrinsic limitations and hence have relatively muted benefits in providing monetary stimulus.[4]

The FOMC began providing specific forward guidance in its August 2011 statement, which indicated that the target federal funds rate was likely to remain unchanged "at least until mid-2013." That announcement was associated with a decline of about 10 basis points in the 2-year Treasury yield —roughly similar to a small surprise in conventional monetary policy during the pre-crisis period.[5] By contrast, subsequent revisions in the FOMC's forward guidance in January 2012 *("at least through mid-2014")* and in September 2012 *("at least through mid-2015")* were associated with very small reductions in the 2-year Treasury yield of about 4 basis points and 1 basis point, respectively. Finally, in December 2012 the FOMC reframed its forward guidance in terms of specific quantitative thresholds for unemployment and inflation. According to the Federal Reserve Bank of New York's survey of primary

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[3] For example, Hamilton and Wu (2012) noted: *"As should be clear from the description of the exercise, we are talking about a quite dramatically counterfactual event. If one considers the analogous forecasting equations,[this] would represent a 36σ event, obviously something so far removed from anything that was observed during the historical sample as to raise doubts about interpreting the parameter estimates as telling policymakers what would happen if they literally implemented a change of this size."*

[4] See Borio (2018), Greenlaw et al. (2018), and Hamilton (2018).

[5] See Williams (2013).

dealers, that reframing came as a surprise to financial market participants but had negligible effects on their expectations regarding the likely timing of liftoff from the ELB.

The Federal Reserve initiated its first round of large-scale asset purchases (QE1) during the most intense phase of the financial crisis. In particular, at the tail end of 2008 and the first half of 2009, the Fed purchased $1.35 trillion of agency debt and mortgage-backed securities, predominantly issued by Fannie Mae and Freddie Mac, with the specific aim of *"providing support to the mortgage and housing markets"* by reducing risk spreads on those securities.[6] QE1 also included $300 billion in purchases of Treasury securities. In 2010-11, the FOMC initiated purchases of an additional $600 billion in Treasuries (QE2) and a program to expand the average maturity of its Treasury holdings (often referred to as "Operation Twist"). Nonetheless, the recovery remained sluggish and inflation remained well below target.

The FOMC's third major round of asset purchases, commonly known as QE3, was launched in autumn 2012 and concluded about two years later. The Federal Reserve concluded all of its emergency lending programs during 2009-10, and measures of U.S. financial stress remained at low levels thereafter. Thus, the QE3 program was clearly aimed at providing additional monetary stimulus. Indeed, the FOMC specifically stated that QE3 was intended to push down longer-term bond yields, thereby fostering a more rapid economic recovery and pushing inflation upwards to the FOMC's 2 percent goal.

In explaining the rationale for launching QE3, Federal Reserve officials extensively cited the analysis of Chung et al. (2012), who conducted simulations of the FRB/US model to assess the benefits of QE.[7] That study indicated that a $600 billion asset purchase program would reduce the term premium by 20 basis points, expand nonfarm payrolls by about 700,000 new jobs, raise real GDP by nearly 1 percent, and push up core inflation by about 0.3 percent. Given that the FRB/US model is essentially linear, the predicted macroeconomic effects of QE3 (which comprised $1.9 trillion in purchases) would be roughly three times larger, i.e., reducing the term premium by 60-70 basis points, expanding nonfarm payrolls by 2 million jobs, raising real GDP by about 3 percent, and raising core inflation by nearly a percentage point.[8] Indeed, internal staff memos that were sent to the FOMC in 2012 (and which have been subsequently released to the public after a five-year time lag) used this methodology to quantify the likely benefits of the QE3 program.[9]

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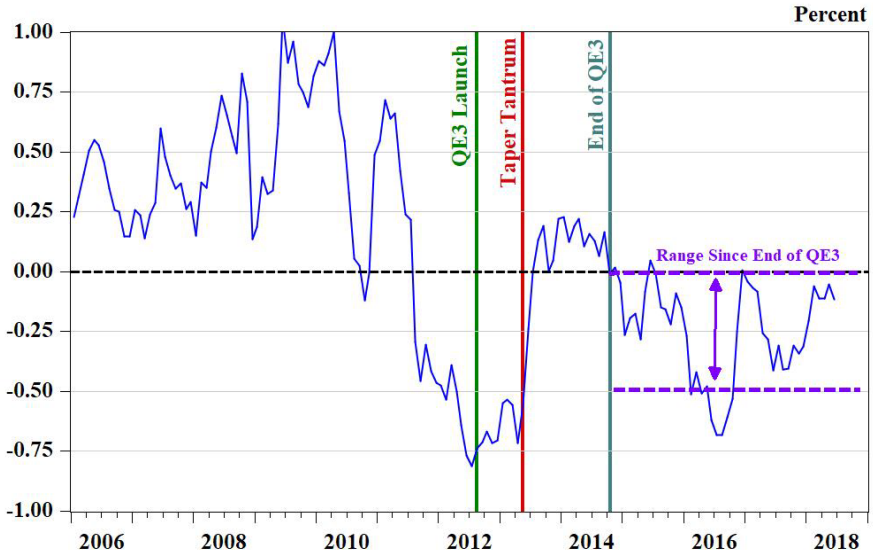
[6] https://www.federalreserve.gov/newsevents/pressreleases/monetary20081216b.htm

[7] See Bernanke (2012, 2014) and Yellen (2012, 2015).

[8] The FRBNY's parallel analysis by Chen et al. (2012) obtained much smaller effects of QE, roughly one-eighth those of Chung et al. (2012); however, those results were not cited by Bernanke (2012) or Yellen (2012).

[9] See the staff memos by Laforte et al. (2012) and Cambron et al. (2012), which were sent to the FOMC on August 28, 2012 and November 30, 2012, respectively.

Figure 1: The Term Premium on U.S. 10-Year Treasury Securities

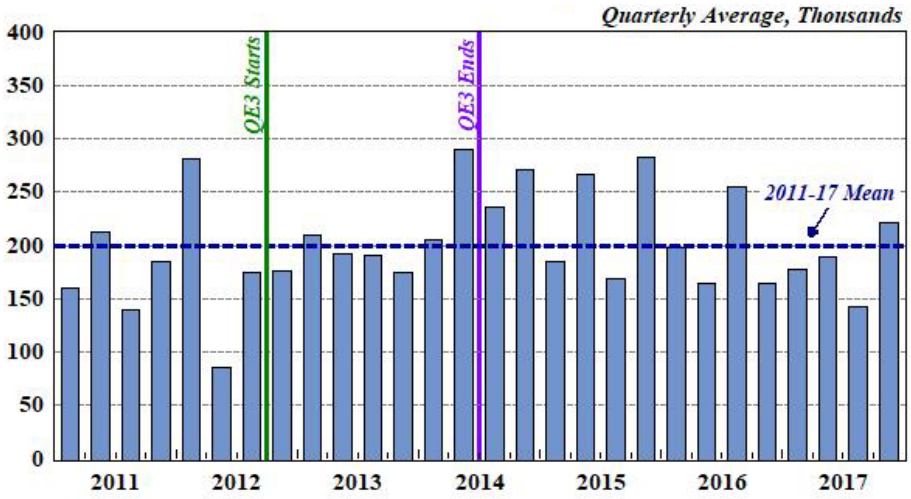


Source: Federal Reserve Board, authors' calculations.

Nonetheless, as shown in Figure 1, the term premium on 10-year U.S. Treasury securities was broadly stable during the second half of 2012 and the first quarter of 2013, even as the FOMC initiated QE3. The surveys of primary dealers conducted by the Federal Reserve Bank of New York indicate that the launch of QE3 was largely unanticipated prior to September 2012 and that over subsequent months financial market participants made large upward revisions to their assessments of its likely duration and cumulative size.

Any near-term effects from launching QE3 were subsequently swamped by the so-called "taper tantrum" in spring 2013. At that time, Fed officials suggested that the tantrum was a transitory phenomenon and that bond yields would quickly subside. However, the New York Fed's June 2013 survey indicated that most primary dealers attributed the tantrum to market confusion about the FOMC's policy strategy. And the term premium remained elevated over the subsequent year, even as investors made further upward revisions about the likely size of the Fed's balance sheet, and did not fall significantly until after the end of QE3 in late 2014.

Figure 2: Monthly Growth of U.S. Nonfarm Payrolls



Source: Bureau of Labor Statistics, authors' calculations.

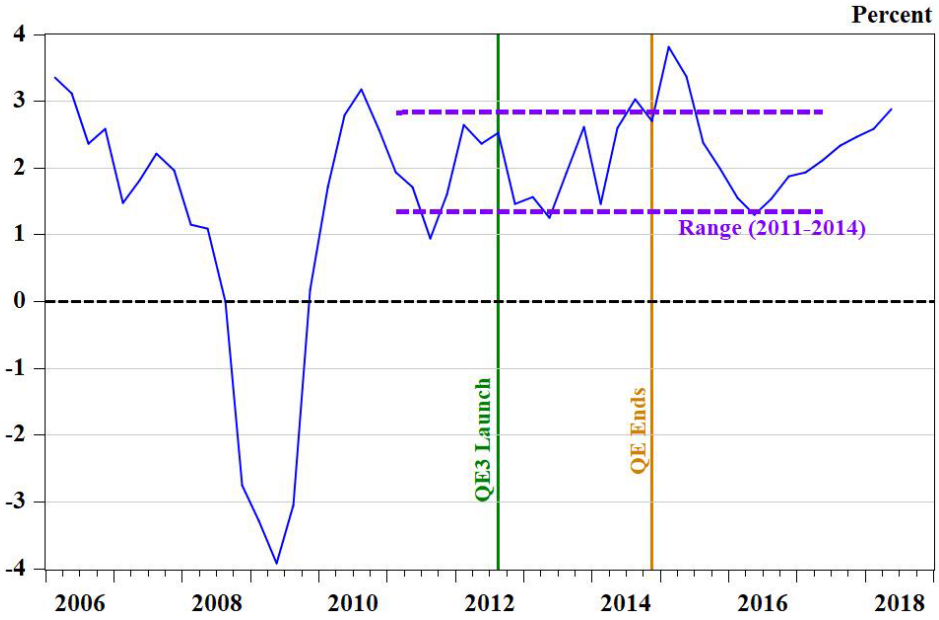
As shown in Figure 2, the launching of QE3 and the initiation of explicit forward guidance appear to have had only muted effects on the U.S. labor market. Growth in nonfarm payrolls during 2013-14 was practically identical to its average pace from 2011 to 2016, with no evident acceleration due to QE3 nor any apparent deceleration following the conclusion of QE3. employment, output, and inflation.

Likewise, QE3 had no visible impact on the broader U.S. economy, as evident in Figures 3 and 4. Real GDP growth remained in a narrow range of about 1½ to 2¾ percent from 2011 thru 2016; the only exception was a temporary pickup in the first half of 2015, well after the conclusion of the QE3 program. Likewise, core PCE inflation—the Fed's preferred measure of underlying inflation--averaged just over 1.5 percent during 2013-14, little different from its average pace over preceding and subsequent years.

Evidently, the transmission mechanism of QE is fundamentally different from that of conventional monetary policy. A long empirical literature has documented that an unanticipated shift in the target federal funds rate has a significant impact on output and employment within a few months and a peak effect within a few quarters.[10] By contrast, the launch of QE3 in autumn 2012 (which was almost entirely unanticipated prior to late August) had no visible impact on nonfarm payrolls or real GDP growth in 2013-2014.

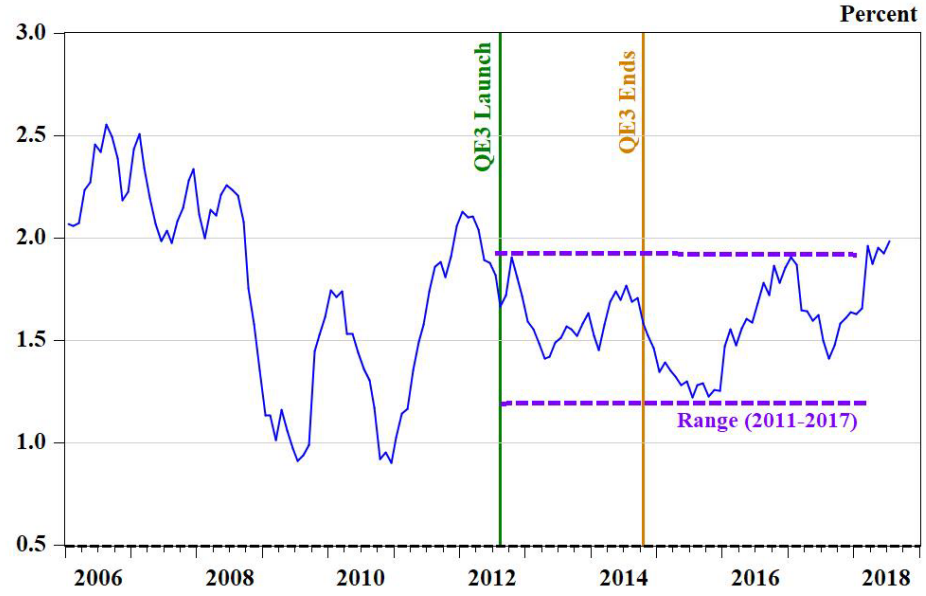
[10] See the seminal contributions of Sims (1980), Christiano, Eichenbaum, and Evans (1999), and Romer and Romer (2000).

Figure 3: U.S. Real GDP Growth



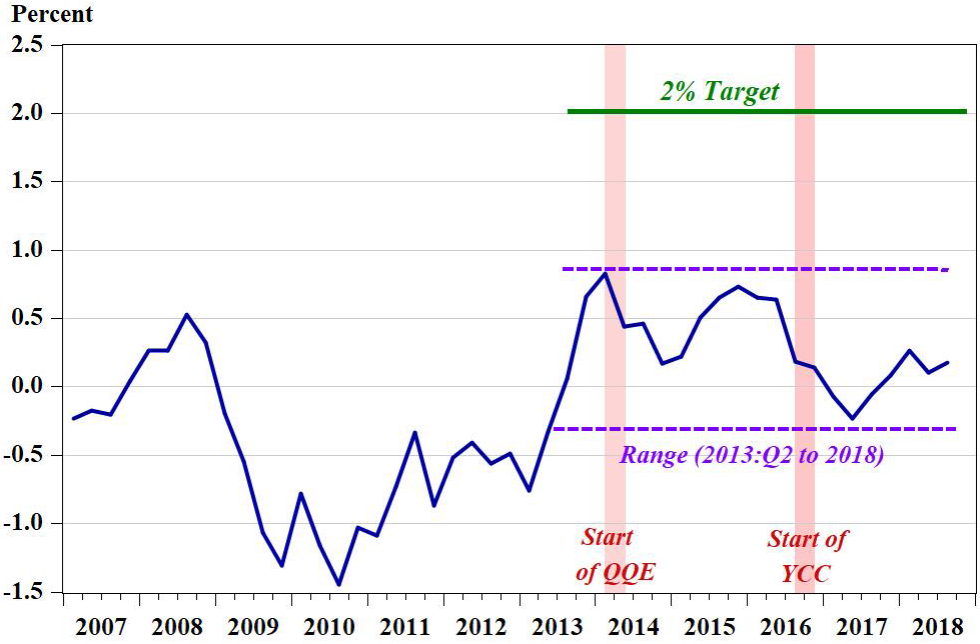
Source: Bureau of Economic Analysis, authors' calculations.

Figure 4: U.S. Core PCE Inflation



Source: Bureau of Economic Analysis, authors' calculations.

Figure 5: Japanese Core-Core CPI Inflation
(excluding food, energy, and VAT effects)



Source: Japan Statistics Bureau, authors' calculations.

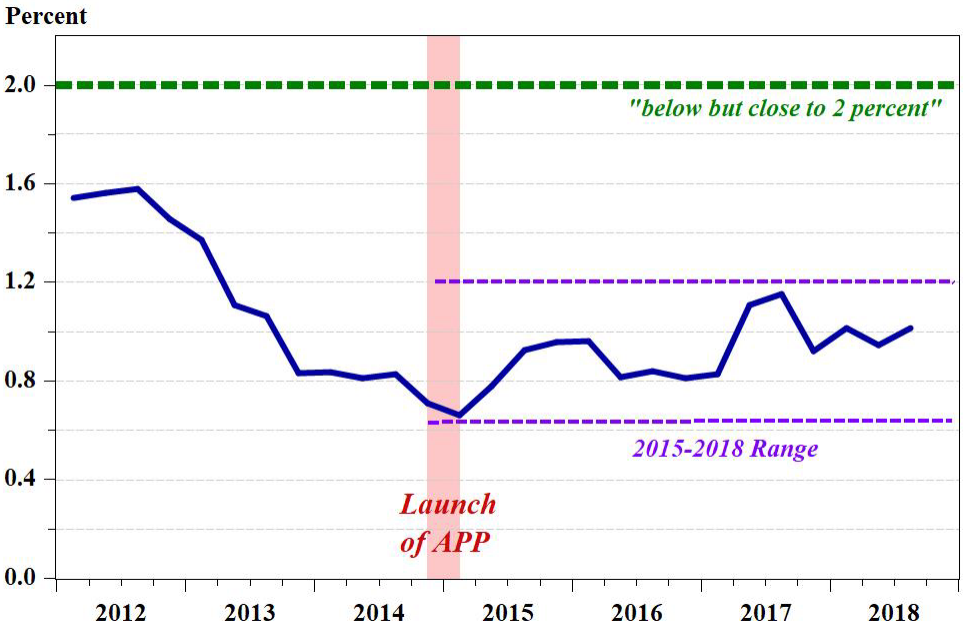
Further evidence on the muted effectiveness of unconventional monetary stimulus can be obtained by considering the recent experiences of other major economies where conventional policy has been constrained by the ELB. For example, the Bank of Japan (BOJ) launched its quantitative and qualitative easing (QQE) program in April 2013 and augmented that program in September 2016 by initiating yield curve control (YCC).[11] Under QQE the BOJ's securities holdings have expanded by about ¥400 trillion, equivalent to roughly 80 percent of Japanese GDP. As shown in Figure 5, however, Japanese core-core inflation (excluding food and energy prices and the direct effects of the 2014 VAT hike) has remained far below the BOJ's 2 percent inflation target. Indeed, over the past year this indicator and other BOJ measures of underlying inflation in Japan have been mired close to zero.

The European Central Bank (ECB) announced its asset purchase program (APP) in late 2014 and initiated large-scale securities purchases—including government securities, corporate bonds, covered bonds, and asset-backed securities—in March 2015. Since that time, the ECB's asset purchases have totalled about 2.5 trillion euros, equivalent to about 15 percent of eurozone GDP. The ECB has specifically stated that this program was intended to *"address the risks of too prolonged a period of low inflation."* [12]

[11] https://www.boj.or.jp/en/mopo/outline/qqe.htm/

[12] https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html

Figure 6: Eurozone Core Inflation
(excluding food, energy, alcohol, and tobacco)



Source: European Central Bank, authors' calculations.

As shown in Figure 6, eurozone core inflation (i.e., the 12-month change in the harmonized index of consumer prices excluding food, energy, alcohol, and tobacco) has crept upwards to around 1.1 percent in 2018 (an increment of 0.3 percent from its level about five years ago) but remains far below the ECB's objective of keeping inflation *"below but close to 2 percent over the medium run."*

3. Design Principles

With an appropriate design, digital cash could 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.[13]

A. Medium of Exchange

Digital cash can serve as legal tender, usable for all public and private payment transactions. In the case of fiduciary currency, increasing returns and network externalities provide a strong rationale for currency to be issued by a public authority, as emphasized by classical economists. The same essential reasoning holds for digital cash.

One potential means of issuing digital cash would be in the form of electronic tokens, analogous to paper cash and stored-value debit cards. Under a token-based approach, however, verification might well be time-consuming and inefficient (as with other uses of distributed ledger technology). Moreover, there would be no intrinsic limit on the size and scope of fraud, and hence hackers could potentially undermine the entire payments system.

Another potential approach might be for individuals and firms to have digital cash accounts at the central bank itself. Such an approach is reminiscent of an earlier era when some private individuals held accounts at the Bank of England. Nonetheless, it seems undesirable for the central bank to start competing directly with commercial banks in attracting deposits, especially in cases where the central bank also regulates and supervises those banks. Such an approach would also raise a host of concerns about privacy and bureaucratic inefficiencies and could pose risks to financial stability, e.g., depositors shifting their funds from commercial banks to the central bank at the onset of a financial crisis.[14]

Such drawbacks could be avoided by providing digital cash to the public via designated accounts held at supervised depository institutions, which would in turn 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 transactions 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.

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[13] See Bordo and Levin (2017) for a comprehensive discussion of design principles for digital cash.

[14] See Keister and Sanchez (2018).

Individuals and firms would remain free to hold funds at private financial institutions and to make payment transactions using private forms of payment or paper cash. However, once digital cash becomes convenient and ubiquitous, the demand for paper currency would be likely to diminish quite rapidly.

B. Store of Value

In an efficient monetary system, the medium of exchange serves as a secure store of value that bears the same rate of return as other risk-free assets, i.e., the opportunity cost of holding money should be essentially zero; cf. Friedman (1960). Indeed, this feature is a fundamental basis for public sector involvement in the provision of money, whether through issuance of central bank currency or official backing of privately-issued forms of money. By contrast, any purely private form of money (i.e., not backed by the government) is intrinsically subject to default risk and hence cannot serve as a reliable medium of exchange nor as a stable unit of account.

Of course, paper cash pays no interest and hence is a deficient store of value under most circumstances. For example, with an inflation target of 2 percent, the real value of paper currency (i.e., its purchasing power in terms of consumer goods and services) declines steadily over time. Moreover, that "inflation tax" is highly regressive, because paper currency is mostly used by ordinary families and small businesses, whereas wealthy individuals and large corporations can hold funds in highly liquid interest-bearing accounts (such as money market funds). And of course, raising the inflation target to 4 or 5 percent would impose an even higher and more regressive inflation tax.

In contrast, digital cash accounts could bear interest at essentially the same rate as Treasury bills, thereby serving as a secure store of value. Such an arrangement would be a natural extension of the current system in major advanced economies, where the central bank pays interest on the reserves of commercial banks; indeed, the Federal Reserve issues interest-bearing liabilities to a much wider array of financial counterparties thru its reverse repo facility. In effect, digital cash accounts may be viewed as tightening the link between the interest that banks earn on their reserves and the interest that they pay to ordinary depositors.

With this design, the interest rate on digital cash could serve as the central bank's primary monetary policy tool. During normal times, this interest rate would be positive. But in the face of a severe adverse shock, the central bank would be able to cut the digital cash interest rate below zero to foster economic recovery and preserve price stability; cf. Goodfriend (2016). As discussed below, such a system could insulate ordinary households and small businesses from incurring negative rates on their digital cash accounts.

C. Unit of Account

Providing a stable unit of account facilitates the economic and financial decisions of individuals and firms. A digital cash system would accomplish this by adjusting the digital cash interest rate. Indeed, because the digital cash interest rate could be adjusted downward as needed, there would no longer be a compelling rationale for the central bank to target a positive average rate of inflation. Thus, the monetary policy framework could foster *true price stability*, i.e. the real value of digital cash would remain stable over time as measured in terms of a general index of consumer prices.[15]

Of course, any abrupt change in the central bank's inflation objective could be disruptive due to nominal rigidities in wage and price setting; see Taylor (1983) and Bordo et al. (2007). Consequently, the transition from a positive inflation target to a stable price level would need to be carefully planned and managed to ensure that it would be well understood by the public and fully incorporated into the plans of households and firms.

4. The Monetary Policy Framework

Digital cash could facilitate the systematic and transparent conduct of monetary policy, thereby facilitating the effectiveness of the monetary transmission mechanism and enhancing the central bank's accountability to elected officials and the public.

A. Transparency

To facilitate transparency and public accountability, the interest rate on digital cash could serve as the primary tool of monetary policy. In particular, policymakers would be able to push market interest rates below zero in response to a severe adverse shock, and hence the central bank would be able to provide an appropriate degree of monetary accommodation without resorting to QE.

Thus, the central bank's balance sheet could become very transparent. In particular, the central bank could hold short-term government securities in the same quantity as its liabilities of digital cash. Since QE would no longer be necessary, the size of the central bank's balance sheet could simply reflect the demand for digital cash, while the maturity composition of government debt held by the public could be determined by the fiscal authorities and not the central bank.

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[15] This design for digital cash embeds the most appealing features of the classical gold standard while avoiding its pitfalls. Indeed, the general price level was not stable during that era (Bordo 1984). It also resonates with Alfred Marshall's tabular standard, Irving Fisher's compensated dollar, and Knut Wicksell's plan to use interest rate adjustments to foster price stability.

The central bank'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. The spread between the digital cash interest rate and interest rates on short-term government securities would be negligible due to practically costless arbitrage between these risk-free assets. With the obsolescence of paper currency, the central bank would no longer generate substantial seigniorage and would simply cover its expenses via miniscule fees on payment transactions.

B. Systematic Policy

The central bank's strategy for adjusting the digital cash interest rate could be expressed using a simple benchmark as follows:

$$i_t = \tilde{\pi}_t + r_t^* + \alpha(\tilde{p}_t - p^*) + \beta(p_t - p^*) + \delta(y_t - y_t^*)$$

This formulation is essentially a variant of the Taylor Rule that is oriented towards stabilizing the price level rather than the inflation rate. In particular, the central bank uses the digital cash interest rate (i_t) to keep the actual price level (p_t) stable at its target level (p^*). The digital cash interest rate also reacts to deviations in a core measure of the price level ($\tilde{p}_t$) and to deviations of real GDP from its potential ($y_t - y_t^*$).

As in the Taylor rule, this specification can be viewed as a benchmark for adjusting the real interest rate in response to fluctuations in economic activity and prices. In particular, the *ex post* real interest rate is given by the nominal interest rate (i_t) adjusted for core inflation ($\tilde{\pi}_t$). When the price level is on target and output is at potential, then the real interest rate is set at its equilibrium value (r_t^*).

5. Practical Steps

In light of these design principles, it's natural to ask whether digital cash is truly feasible in large advanced economies, and if so, over what timeframe? Rather than decades or centuries, our analysis indicates that the essential steps could be taken by 2020, although further refinements could take place over subsequent years. In particular, the central bank could: (i) establish a real-time clearing and settlement system that facilitates efficient payments for consumers and businesses; (ii) facilitate the establishment of safe and liquid bank accounts that accrue essentially the same rate of return as short-term government securities; and (iii) implement a graduated system of fees on transfers between paper cash and digital cash.

A. Real-Time Clearing & Settlement

As noted above, a key feature of digital cash would be to serve as an ***efficient medium of exchange***. In particular, real-time clearing and settlement would be crucial for facilitating secure payments and would eliminate counterparty risks by finalizing such transactions within minutes rather than hours or days.

For example, a task force commissioned by the Federal Reserve concluded last year that *"broad access to settlement services will help level the playing field and enhance competition among providers of faster payments services."* That task force called on the Federal Reserve to *"begin efforts immediately"* on a real-time payment system that would be implemented *"by 2020."*[16]

While a two-year timeframe might seem overly ambitious, the recent experience in Europe demonstrates that such a timeframe is indeed practical. Following about nine months of consultations with financial institutions and other stakeholders, the European Central Bank (ECB) reached a decision in June 2017 to establish a new system called Target Instant Payments Settlement (TIPS). The logistical details have been worked out over the past fifteen months, and the new system came online in late 2018.[17]

Moreover, the ECB's new system embodies the principle that digital cash payments can be secure, rapid, and practically costless. This system provides final and irrevocable settlements of instant payments in euros, with operations on a cost-recovery (i.e., not-for-profit) basis. In particular, entry is costless and account maintenance is free of charges, and each payment transaction is subject to a miniscule fee of 0.2 eurocents (€0.002) or less.

In light of such considerations, the Federal Reserve recently issued a federal register notice calling for public comments on the possibility of developing a real-time interbank settlement service along with tools for performing real-time transfers between Federal Reserve accounts.[18] Following its review of that public input, the Federal Reserve Board could decide to move forward expeditiously in carrying out the recommendations of its Faster Payments task force to establish a secure and efficient system of instant payments.

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[16] The Federal Reserve's Faster Payments Task Force was created in 2015 as a broad and inclusive group of stakeholders with representatives from financial institutions, payment providers, businesses, consumer groups, public agencies, and other experts. Its conclusions are posted at: *https://fedpaymentsimprovement.org/wp-content/uploads/faster-payments-task-force-final-report-part-two.pdf*.

[17] *https://www.ecb.europa.eu/paym/target/tips/html/index.en.html*

[18] *https://www.federalreserve.gov/newsevents/pressreleases/other20181003a.htm*

B. Interest-Bearing Digital Cash

Another key design principle is that digital cash could serve as a ***secure store of value*** that would bear the same rate of return as other risk-free assets, thereby eliminating the opportunity cost of holding money. In effect, consumers and businesses would be able to receive essentially the same interest on checkable deposits and other current accounts that commercial banks receive on reserves held at the central bank, that is, the interest rate on reserves (IOR) less a very small margin to cover operating costs.

While interest-bearing digital cash might seem like a dramatic new development, in fact the Federal Reserve has already implemented measures that are essentially similar. A wide range of financial institutions (e.g., money market funds) can earn interest on overnight repo transactions with the Federal Reserve Bank of New York.[19] Moreover, the Federal Reserve Banks now have authority to maintain segregated deposit accounts for systemically important financial market utilities (FMUs) so that the customers of those FMUs may rest assured that their funds are secure, liquid, and interest-bearing.[20]

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 the deposit accounts of American families and small businesses.

One approach to fostering 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

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[19] Information about the design of the Federal Reserve's reverse repo facility and the expanded range of counterparties is available at *https://www.newyorkfed.org/markets/rrp_faq.html*.

[20] 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)*.

community banks specialize in "relationship banking" with small businesses and local residents.

A narrow bank could operate under the same legal arrangements as as any other commercial bank. Moreover, a narrow bank would presumably have no need for deposit insurance coverage or access to the central bank's discount window, since its deposits would be inherently safe and liquid. In the United States, the only step that hinges on the Federal Reserve's approval would be the creation of an account at a Federal Reserve Bank in which the narrow bank would hold its funds and accrue interest on those reserves.

To the extent that policymakers may have substantive concerns about the establishment of narrow banks, it could be helpful to initiate a transparent and inclusive consultative process to gather input from a wide array of stakeholders, including financial institutions, community groups, and other stakeholders. If such a task force concluded that narrow banks would indeed be beneficial to the general public, then the central bank could move forward expeditiously to facilitate their creation and thereby facilitate the goal of ensuring that the medium of exchange also serves as a secure store of value.

C. Mitigating the ELB

Given the limited effectiveness of unconventional monetary policies, what steps could be taken to mitigate or eliminate the ELB on nominal interest rates? As noted above, one potential option for doing so might be to raise the inflation target to 4 or 5 percent or perhaps even higher. However, raising the inflation target to mitigate the ELB might be viewed as fitting the old adage of "throwing out the baby with the bath water." After all, most central banks now have legal mandates that specifically refer to fostering stable prices, and in many cases such mandates were instituted to prevent inflation from returning to the elevated levels of the 1970s. Moreover, such a marked departure from price stability would complicate the decisions and plans of ordinary families and businesses, perhaps leading to widespread adoption of inflation indexation clauses that would in turn undermine the central bank's ability to keep inflation stable. Finally, concerns about excessive and volatile inflation might become the subject of election debates, transforming the inflation target from a credible anchor into a political football.

By contrast, a carefully designed system of digital cash could eliminate the ELB. It would not be necessary or appropriate to abolish paper currency; rather, individuals and businesses would remain free to use it for legitimate purposes.[21] But paper cash is inefficient and costly at every stage of retail use: supplying ATMs, maintaining cash registers, using armored cars for transport, and sorting and cleaning paper cash prior to its recirculation. By comparison, digital cash can be used instantly at practically no cost at all. Thus, as digital cash comes into

[21] See Rogoff (2016).

widespread use, it seems inevitable that paper cash would fall into disuse and become practically extinct, just like typewriters and audiocassette tapes.

To eliminate the ELB, central banks 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 – could be completely exempt from such fees, and somewhat larger transfers would be subject to a nominal fee (e.g., 2-3%), roughly similar to the size of withdrawal fees at many ATMs, while very large transfers (say, over $5,000) could be subject to an even bigger fee (e.g., 5-10%). Such arrangements would effectively curtail incentives for arbitrage between paper cash and digital cash, thereby eliminating the ELB, while consumers and firms would still remain free to use paper cash if so desired.

Finally, the monetary system 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.[22] Of course, individuals and businesses might hold multiple digital cash accounts at various financial institution banks; in such instances, one of those accounts could be designated as the user's "primary" digital cash account, and the exemption would only apply to the funds held in that account.

With this design, the central bank 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 would be to influence the incentives of wealthy investors and large financial firms—not to penalize moderate account balances that facilitate day-to-day payment transactions.

6. <u>Financial Stability</u>

In a financial crisis, the central bank could fulfill its role as lender of last resort by expanding the stock of digital cash as needed to provide emergency liquidity to supervised financial institutions. Alternatively, the central bank could extend such emergency liquidity to another public agency such as a bank regulator or the deposit insurance fund. Legal safeguards could be established to ensure that such emergency actions would not undermine the central bank's ability to carry out its fundamental commitment to price stability.

Moreover, the central bank could reduce the digital cash interest rate below zero if needed, thereby preventing runs from other financial assets into digital cash. In effect, the central

[22] 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.

bank would ensure that the widening of risk spreads was offset by a corresponding drop in the risk-free interest rate, thereby keeping the cost of short-term credit (e.g., commercial paper and bank lending rates) fairly close to normal levels. Moreover, this policy strategy would generate a steep yield curve that would facilitate the expansion of bank credit and foster prudent risk-taking -- precisely the opposite of QE and "lower for longer" forward guidance that encourage search-for-yield behavior. Thus, digital cash would be likely to foster a more rapid V-shaped recovery, in contrast to the U-shaped recoveries seen in many advanced economies over the past decade.

7. Conclusions

Although memories of the financial crisis are gradually receding, the global economy remains turbulent and unpredictable. And in coming years, conventional monetary policy is very likely to be constrained by the ELB on nominal interest rates. For example, in the United States the "new normal" for the federal funds rate may well be less than 3 percent – markedly lower than its level prior to the last recession. Moreover, a clear lesson from recent experience is that unconventional monetary policy tools are complex and opaque and have relatively muted effects on macroeconomic outcomes.

In light of these considerations, our analysis indicates that digital cash could bolster the effectiveness of monetary policy. Digital cash could be provided to the public through accounts at supervised financial institutions, which would hold part or all of those funds in segregated reserve accounts at the central bank. With a carefully designed approach, digital cash could serve as a practically costless medium of exchange, a secure store of value, and a stable unit of account. In the near term, central banks could take practical steps in this direction by launching instant payments and by encouraging the establishment of narrow banks. Over time, as digital cash becomes ubiquitous, the central bank could establish a graduated system of fees that would limit arbitrage between digital cash and paper cash. Such steps could boost the effectiveness of monetary policy and help ensure the central bank's ability to carry out its legal mandate.

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