Digital Currencies and Fast Payment Systems: Disruption is Coming

Darrell Duffie
Graduate School of Business, Stanford University

PRELIMINARY DRAFT

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Abstract: I examine monetary policy implications and business strategy concerns related to the introduction of digital currencies and faster payment systems. Key issues include financial inclusion, payment system efficiency, control by central banks of monetary policy transmission, privacy and anti-monetary laundering, and competition for banking services.

Keywords: Digital currency, fast payment system, stablecoin.

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1 Introduction

New payment technologies are transforming monetary systems, commerce, and banking. Consumers are beginning to benefit from greater convenience, higher speed, and lower costs in making and receiving payments. At some point, because new payment methods will trigger greater competition for deposits, consumers will earn higher average returns on funds that would otherwise sit in low-interest accounts. Merchants will gain faster access to their sales revenues and give up less of those revenues to interchange fees. A subset of banks will contribute to this transformation by offering their clients more open and efficient access to the payment system. For some banks, however, the decision to disrupt profitable legacy deposit and payment franchises will be painful. Banks that are unwilling to upset their business models will mostly be left behind.

In some less developed regions of the world, the transformation in payments methodologies will lead to improved access to the payment system for many citizens that are currently unbanked. A decline in the acceptance of paper cash, however, could be problematic for certain parts of the population, even in some economies that are, in most respects, quite developed.

Cryptographic tokens known as stablecoins offer a powerful alternative to making payments on the rails of the commercial banking system. Central banks are wary of the heavy adoption of general-use private-market crypto-currencies, even if they are safely custodied and have a stable market value. Central bankers and other regulators may have two key concerns. First, depending on the design, crypto-currencies that can be secretly held and transacted on digital ledgers can be used for money laundering and other illegal applications. Second, again depending on the design, if a private crypto-currency were to achieve broad use, the transmission of central bank monetary policies into the economy could be affected, whether positively or negatively.

Most central banks are now doing research and development on their own digital currencies. But central banks will probably prioritize improvements in the speed and efficiency of general-use payment systems that are based on commercial bank deposits. Already, the United Kingdom and the Eurozone, among other countries, have introduced bank-based payment systems that offer almost instant transactions around the clock. Adoption of these fast payment systems is still in early stages. A new European Union directive, PSD2, requires banks to provide non-bank service providers with data that would allow those providers to offer payment and other services to the banks' customers. In the United States, however, many forms of payment take more than a day, competition for bank deposits remains weak, and alternative payment technologies are fragmented across bank and non-bank providers. The disruption of incumbents in the U.S. payment system will be slower, yet probably inevitable.

My objective here is to help clarify some of the key forces behind an ongoing transformation of the payment system that may disrupt some profitable banking franchises.

2 Token-based and account-based payment methods

In the typologies of Bech and Garrett (2017) and Kahn (2016), payment systems are token-based or account-based. In this context, the "token" refers to the payment asset, such as paper fiat currency or a cryptocurrency. Figure 1 is a schematic of a token-based transaction by which Alice pays \$8 to Bob the baker in exchange for a loaf of bread.

Cryptocurrency payments still comprise only a tiny fraction of total payments. At the core of cryptocurrency payments is some form of distributed (shared) digital ledger on which transactions are confirmed and stored using cryptographic methods. Depending on the specific distributed ledger technology (DLT),[1] transactions can be made almost instantly and at low cost. DLTs can be permissioned (maintained by a trusted third party) or open (also known as or "permissionless"). For example, Ripple and Corda are permissioned DLTs, whereas Bitcoin and Etherium[2] are open.

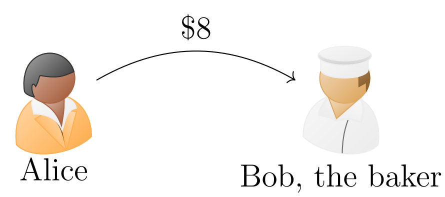

Figure 1: A schematic of a token-based transaction, by which Alice purchases a loaf of bread from Bob the baker. The token assets could be of various forms, including paper currency or a cryptocurrency.

The digital ledger technology underlying Bitcoin, the most widely used cryptocurrency, is not an efficient method for broad payment applications given the relatively long time necessary to conduct a large number of transactions. Moreover, Bitcoin itself has a volatile market value, further reducing its usefulness as a payment medium. As outlined by Calle and Zalles (2019), significant recent attention has focused on "stablecoins," cryptocurrencies with a market value that is the same or approximately the same as that of a native fiat currency. Stablecoins could be issued by central banks, commercial banks, or other entities. We will later discuss the construction and use of stablecoins in more detail.

Figure 2 shows the analogous bank-account-based payment by Alice to Bob. Modern bank-account-based payment methods involve many different types of technologies, including direct bank transfers, paper checks, credit cards, debit cards, and many types of mobile payment

[1] For a summary of DLT designs and examples, see Natarajan, Krause, and Gradstein (2017).
[2] Live Etherium transactions can be viewed here.

applications (many of which also involve the use of card-based payments). By one means or another, and usually with many intermediate steps, a bank-account-based payment involves a reduction of the deposit liability of Alice's bank to Alice, and an increase in the deposit liability of Bob's bank to Bob. A token-based payment is conducted instead via a direct transfer of the payment asset.

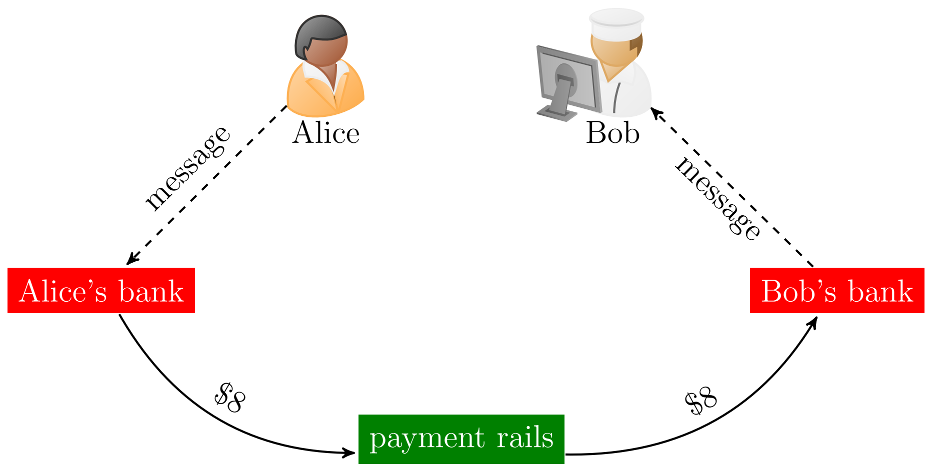

Figure 2: A schematic of a bank-account-based transaction, by which Alice purchases a loaf of bread from Bob the baker. Alice's deposit balance at her bank is reduced by $8 and Bob's balance at his bank is increased by $8, via a sequence of steps along "payment rails" that may be complex. Transactions can be fast or slow depending on the specific technology.

It is not clear yet whether DLT-based payment systems will be more efficient or less efficient in comparison with emerging upgrades of conventional bank-account-based payment systems. Committee on Payments and Market Infrastructures (2017) and Townsend (2019) raise a host of related questions. The distinction may become moot if bank-account-based payment systems eventually come to rely heavily on digital ledger technologies.

3 Central bank digital currencies

Increasingly in developed economies, paper currency payments are being replaced with electronic bank payments. For example, Figure 3 shows this trend in Sweden. This has raised concerns at Sweden's central bank, the Riksbank, over access to the payment system by those that have relied on paper currency. The Riksbank has responded by investigating the introduction a central bank digital currency (CBDC). As explained by Sveriges Riksbank (2018), the mooted "e-krona" could be a token-based cryptocurrency issued by the Riksbank or an account-based CBDC, by which essentially any Swedish person or firm would be given an account at the central bank. With such a general-use CBDC, essentially any payment in the

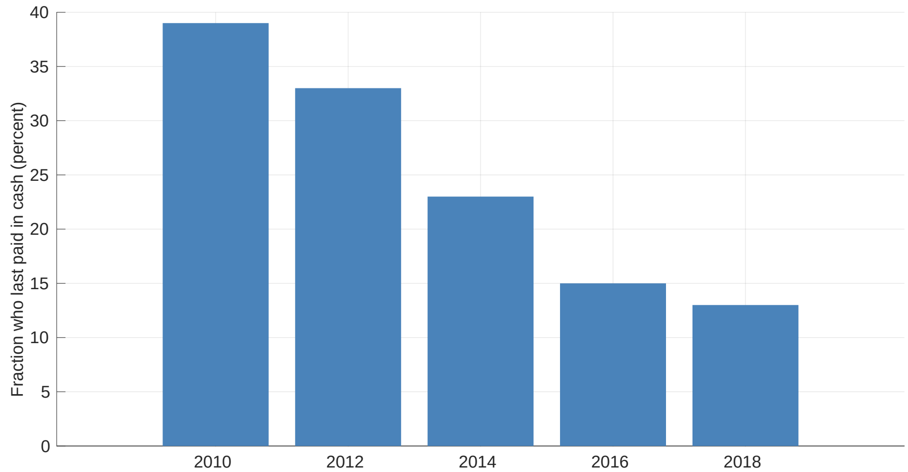

Figure 3: The fraction of individuals who reported that their most recent transaction was conducted with paper currency. Source: Riksbank eKrona Report (2018).

Swedish economy could then be conducted by debiting the payer's account at the Riksbank in favor of the receiver's account at the Riksbank.

Central banks already issue digital currencies, in the form of electronic central bank deposits, but these are not for general use in the broad economy. Central bank deposits have generally been limited to banks.[3] Likewise, a central bank could issue cryptocurrency tokens that are restricted for use among a narrow subset of financial firms, and for certain "wholesale" applications at the core of the financial system such as large-value payment and settlements among a select set of financial institutions. Applications could include the settlement of large securities trades. Some central banks, notably the Bank of Canada and the Monetary Authority of Singapore, have already tested prototype token-based CBDC wholesale transactions.

Whether token-based or account-based, the introduction of a general-use digital currency by a major central bank could have a major impact on banking. Depending on the design, the use of commercial bank deposits as a payment medium could be severely cut back. Competition for bank deposits could also increase significantly, given the potential for application programming interfaces (APIs) that would allow rapid and inexpensive deposit transfers among banks. We will later come back to the theme of technology-induced disruption of bank deposit and payments franchises. In short, a general-use CBDC could become so popular that it could severely disrupt the business models of banks, with potentially strong political blowback on central banks. Central banks may be averse in other respects to having the large footprint on their economies that a general-use CBDC would likely create. Most central banks likely

[3]Some central banks such as the U.S. Federal Reserve System also provide central bank accounts to financial market infrastructures such as clearinghouses.

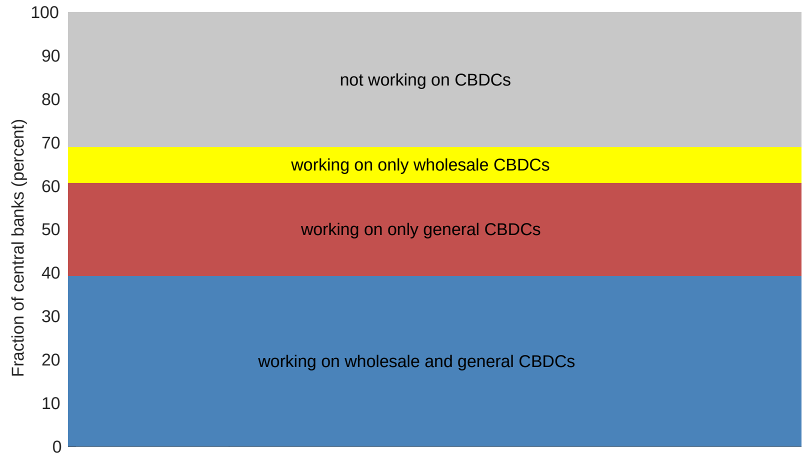

Figure 4: Most central banks are now working on digital currencies. Data source: CPMI survey of 80 central banks, Coeuré (2018).

hope that upgrades to the speed and efficiency of bank-account-based payment systems will be sufficient to serve most of the needs of their economies.

Some central banks, however, are apparently not yet confident of their stances in this regard. As reported by Barontini and Holden (2019), they are proceeding with caution. At least as a backstop, or in order to better understand new digital payment technologies, many central banks have been conducting research and development on CBDCs. Figure 4 shows, as of late 2018, that around 70% of the 80 central banks surveyed by the Committee on Payments and Market Infrastructure (CPMI) are conducting research and development on general-use CBDCs, wholesale CBDCs, or both types of CBDCs.[4]

4 Private stablecoins

A stablecoin is a DLT-based asset whose price, in terms of the native fiat currency, is constant or nearly constant. While yet to achieve significant use in the payment system, some privately issued stablecoins could offer gains in payment speed and efficiency over legacy bank-account-based payment systems. Like general-used CBDCs, heavy use of private stablecoins, depending on the specific design, could easily disrupt profitable bank franchises in deposits, payments, and credit cards, a topic covered later in this paper.

Figure 5 depicts the issuance of stablecoins by a bank.[5] In the illustrated transaction, Alice

[4]These data are as reported in a speech by Benoit Coeuré, Chair of the Committee on Payments and Market Infrastructures, on November 15, 2018.

[5]The design depicted in Figure 5 is inspired by, although not identical to, the design of the stablecoin known as Token X, developed by Token, Inc. Other stablecoins backed by commercial bank deposits include Tether,

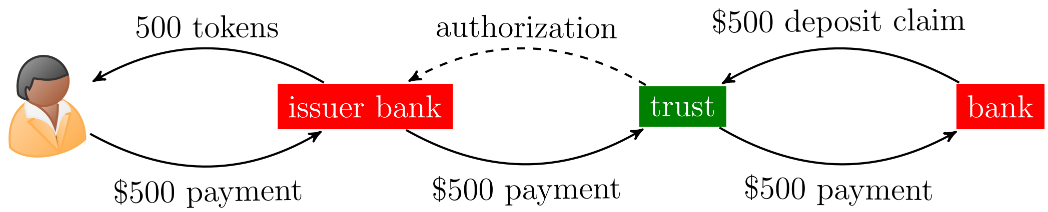

Figure 5: Private stablecoin issuance, by which Alice creates new stablecoins issued by a bank, and backed by bank deposits.

buys 500 newly created stablecoin tokens from the issuing bank for $500. Alice is now ready to use the stablecoins to make payments to others.

In order to create the stablecoins provided to Alice, the issuing bank makes a corresponding payment of $500 to a trust (or some other legal entity), which authorizes the issuance of the tokens and deposits the $500 in one or more other banks. The trust holds these deposits as collateral against the eventual obligation to redeem stablecoin tokens. These backing bank deposits may be insured against bank failure, for example by a government insurance scheme.[6] The collateralizing bank deposits can earn interest that is paid, in some combination, to the stablecoin technology provider, the bank issuing the stablecoins, and perhaps Alice herself. The stablecoin technology provider offers the necessary DLT and related software, including perhaps access to electronic exchanges where stablecoins can be traded for other financial or monetary assets. At any time, Alice has the contractual right to create additional stablecoins or to redeem some of her existing stock of stablecoins at any issuing bank at which she holds an account, for an equal quantity of dollars.

Although the issuing bank can conduct anti-money-laundering (AML) and other compliance checks on its own transactions with Alice, the payments that Alice makes with her stablecoins are only monitored for AML and other regulatory purposes to the extent that banks or compliance authorities have access to the digital ledger or exchanges on which the stablecoins are subsequently transferred. This may suggest the use of stablecoins that are kept only on bank-maintained or at least bank-monitored ledgers, in order to enable compliance with know-your-customer (KYC) and AML regulations.

If the technology depicted in Figure 5 is secure and efficient, if the trust holding the backing deposit assets is legally sound, and if the backing deposits are free of bank default risk, then the associated stablecoin would indeed have a stable market value. This is so because of the

TrueUSD, USD Coin, Paxos, and Gemini Dollar. For details, see Calle and Zalles (2019).

[6] In the United States, deposits are insured for up to $250,000 per account, and there is no limit on the number of different banks in which one can hold an insured account.

impact of arbitrage on the price of the stablecoin.

For example, suppose the native currency is dollars and that stablecoins can be created for one dollar each and redeemed for one dollar each. (Redemption of the stablecoins for a dollar each relies on the soundness of the trust and the backing deposits.) If the market value of the stablecoin on a financial exchange were to drop below one dollar, then Alice could buy stablecoins on that exchange and redeem them at her bank for one dollar each, netting an instant profit. Similarly, if stablecoins trade at a price above one dollar, Alice could create new stablecoins at her bank and sell them on the exchange for a profit. In practice, given small execution delays and technical costs, the arbitrage would not be worthwhile unless the price of the stablecoin departs nontrivially from one dollar. Generally, though, the price of such a well designed stablecoin would stay close to one dollar. Obviously, the security of the distributed ledger and associated communication services are also crucial to the stable value of the tokens. If Alice chooses to place her tokens in the custody of another service provider such as an exchange, she would also wish to assure the security of the custody service.

To this point, few (if any) actively used stablecoins have a reliably stable market value. In a recent case, for example, the crypto-currency known as Tether, which had been portrayed as a stablecoin, was discovered to be backed only in part by bank deposits and in part by a large loan to an affiliate of the technology provider.[7] Even prior to this event, journalists had reported concerns over the absence of public verification by reputable auditors of the backing of Tether by safe bank deposits.

Other forms of backing for a cryptocurrency that are intended to stabilize its market value have included gold and other cryptocurrencies, as explained by Calle and Zalles (2019). A prototype stablecoin issued by JPMorgan, known as JPM Coin, is backed by the contractual commitment of JP Morgan to convert JPM Coin into fiat currency at a fixed exchange rate, on demand, just as though it is a deposit liability.

Theoretically, a stablecoin that is in sufficiently high demand for transactions services can have a stable price without any collateralizing assets, by virtue of actively managed expansions and contractions of the supply of tokens by a controlling authority. In practice, this approach relies heavily on trust among market participants in the price stabilization scheme.

5 Fast payment systems

In parallel with the development of cryptocurrency payment systems, banks, central banks, and payment-system utilities have been upgrading the speed and times of availability of conventional bank-account-based payment systems. This has been especially useful for retail applications

[7] See Levine (2019).

such as mobile payments, as explained by Hartmann, Hernandez, Plooij, and Vandeweyer (2017) and Bech, Shimizu, and Wong (2017). The global standard for a fast payment system is near real-time availability of the funds by payees on a "24/7" basis.

Examples of fast payment systems that are already popular include the Korean Electronic Banking System (established in 2001), the Bank of Mexico's Sistema de Pagos Electrónicos Interbancarios,[8] Swish (a private mobile payment system available in Sweden), and the United Kingdom's non-profit utility known as Faster Payments. In late 2018, the European Central Bank launched TARGET Instant Payment Settlement (TIPS), based on the SEPA Instant Credit Transfer platform, which offers 24/7 fast payments among participating European banks. In the United States, the private-sector Real-Time Payments System (RTP) is planned for release in 2020.

6 Impact of CBDCs on monetary policy

The introduction of a central bank digital currency has been analyzed relatively extensively by researchers for its potential impact on monetary policy transmission and financial stability.[9] There is little consensus in this literature with respect to the impact of a CBDC on monetary policy transmission, so I will summarize my own views on this issue.

A general-purpose CBDC that is designed for payments efficiency offers potentially significant technical improvements over conventional bank deposits as a payment asset. Such a CBDC would likely be relatively simpler to transfer than bank deposits, more creditworthy, and by construction have a perfectly stable market value. Assuming that all banks would accept and make CBDC payments on demand, cheaply and quickly on an intra-day basis, the ease with which transfers of funds among banks could be completed using common APIs would likely improve competition among banks for deposits. Segmentation of money markets could decline, given the lack of exclusivity to banks of access to central-bank money. The speed of transmission of monetary policy into market interest rates would likely increase. For example, a central bank would need to raise its policy rate less in order to achieve a given increase in average market interest rate, and that given average increase in rates would be achieved more rapidly. There would be less cross-sectional dispersion in rates across similar instruments.[10] The degree to which these effects apply would depend on the extent of remuneration of CBDC, if any,

[8]See Bech, Shimizu, and Wong (2017) for a discussion of these examples.

[9]The literature includes Barrdear and Kumhof (2016), Fatas and Weder di Mauro (2018), Bordo and Levin (2017), Brunnermeier and Niepelt (2019), CPMI Markets Committee (2018), Davoodalhosseini (2018), Meaning, Dyson, Barker, and Clayton (2018), Pfister (2017), and Zhu and Hendry (2019). Fama (1980) discusses the role of bank deposits as a payment asset, with respect to setting the price level.

[10]See Duffie and Krishnamurthy (2016) for a discussion of rate dispersion in the context of passthrough efficiency.

with interest. In principle, however, even an unremunerated CBDC would likely increase the efficiency of monetary policy transmission.

While a CBDC could in principle be assigned a negative interest rate, thus increasing the effectiveness of monetary policy in downturns, Rogoff (2016) and Pfister (2017) emphasize that this would be relatively effective only to the extent that large denomination physical currency has been removed from circulation.

With a CBDC, the central bank would have less control over the size of its balance sheet, although that need not be an important concern and is similar to the situation associated with paper currency.

In a serious banking crisis, there could be a flight to the CBDC, as a safe haven from the deposits of weaker banks. This would increase the importance of bank liquidity coverage regulations and, as explained by Pfister (2017), central bank crisis liquidity provision. Barrdear and Kumhof (2016) point to the financial-stability benefit of a CBDC, in terms of stabilizing the supply of general money during a period of shocks to private money demand and private money creation.

7 Disruption of banking franchises

Fast and efficient bank-account-based or cryptocurrency payment systems, including CBDCs, could place pressure on some profitable banking franchises. These new payment technologies, coupled with new open-banking rules such as PSD2, could increase competition among banks for deposits. Until now, banks have enjoyed substantial profits associated with large demand balances, about $12.5 trillion[11] in the United States alone, that offer low average interest rates.

Retail interest rates, in particular, are far below wholesale market interest rates, because of the imperfect competition among banks for deposits that is inherent in the costs to many depositors to monitor interest rates and move their deposits. The documented empirical evidence of this, for example Driscoll and Judson (2013) and Drechsler, Savov, and Schnabl (2017), is compelling. Figure 6 shows that the retail deposit rates offered by U.S. banks, even on long-term large deposits, have fallen far below the rates that the banks themselves earn on their central bank deposits. The central bank rate, known as interest on excess reserves (IOER), can be viewed as the "wholesale" overnight market interest rate available to banks.

New payment technologies will force banks to compete more aggressively for deposits. Some legacy banks may themselves become the disruptors. Or, "fintech" entrant banks or large technology firms could trigger changes in depositor behavior, such as the use of APIs, such as Alipay

[11] See Board of Governors of the Federal Reserve System, Assets and Liabilities of Commercial Banks in the United States.

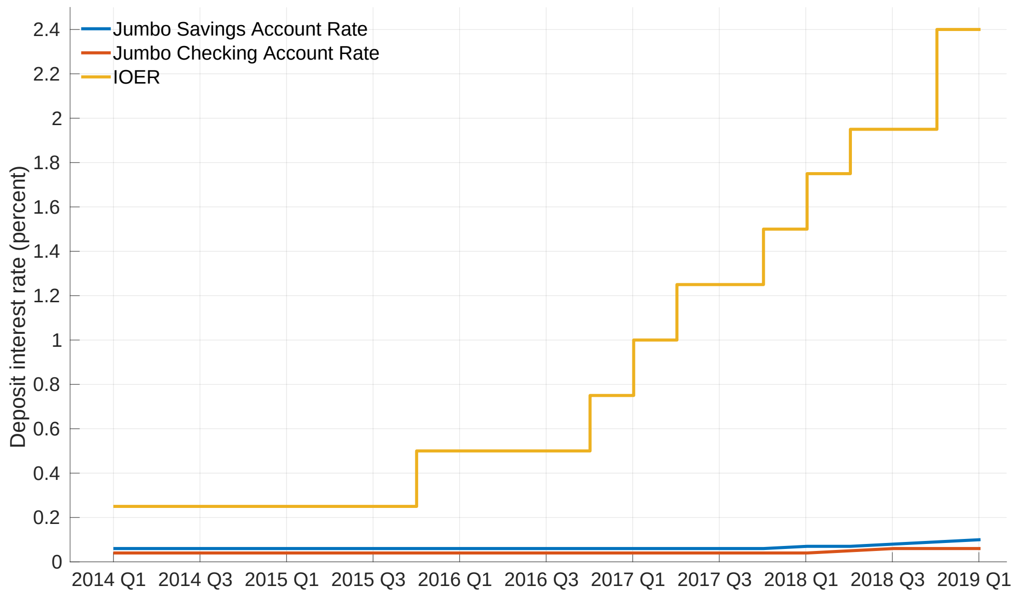

Figure 6: Data sources: U.S. Federal Reserve and Federal Deposit Insurance Corporation.

and WeChat Pay, which can be used to monitor and transfer funds and for the cross-provision of social, commercial, and other financial services and products. Total amounts held on deposit could be affected positively or negatively. In the model of Barrdear and Kumhof (2016), the introduction of a CBDC would increase total bank deposits through greater competition for deposits, complementarity effects with CBDCs, and the consequent increase in overall economic activity. In the same model, bank lending would also increase.

Andolfatto (2018) also finds that the introduction of a CBDC could increase bank deposits. Keister and Sanches (2018) and Ketterer and Andrade (2016), however, warn of potential adverse impacts on bank deposit franchises. Ketterer and Andrade (2016) describe two potential scenarios:

- Less disruptive: "The 'collaborative solution' means that incumbent banks will deal with the FinTech phenomena by integrating technological advances along three lines: (i) process optimization, cost cutting, and productivity enhancing efficiencies; (ii) better product design and superior costumer experiences or 'journeys;' and (iii) development and introduction of new products with segment-specific propositions. It follows, according to this view, that by updating and integrating technological innovations, incumbent banks will be able to protect their franchises and minimize disruption."

- More disruptive: "If access to CBM [central bank money] becomes available to competitors outside the banking industry (e.g., FinTech firms), the possibility of a 'true' disruption

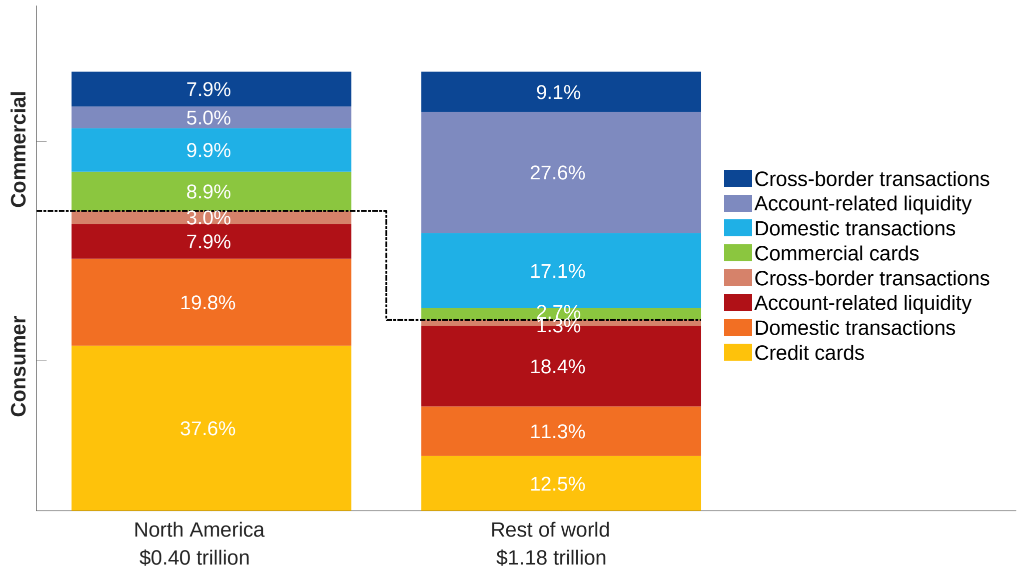

Figure 7: Data source: McKinsey (2017).

(i.e., a shift in the paradigm of the financial services industry that implies a change in the nature in which its basic units of business are organized) could become real."

Going beyond deposit franchises, Figure 7, based on estimates by McKinsey (2017), illustrates the large payments-related revenues that are also subject to disruption by the entrance of alternative technologies and payment service providers. In North America, currently large credit card interchange fees and bank revenues associated payment fees and account liquidity could be squeezed. Even if these banking revenues remain relatively stable or growing in absolute terms, entrant technology firms could capture significant market shares. This has already happened in China, where Tencent and Ant Financial have made serious inroads into the fraction of payments handled by banks. U.S. consumer payment revenues are much larger than their European analogues, due in significant part to the European Union's regulatory caps on card interchange fees. Technology entrants into the U.S. payments sphere include firms such as Amazon, Apple, Facebook, and Google. Financial Innovation Now, an alliance organization whose current members are Amazon, Apple, Google, Intuit, Paypal, Square, and Stripe, sent a comment letter to Congress outlining its approach to improving the efficiency of payments in the United States.

8 Concluding remarks

The availability of powerful new payments technologies leave official-sector actors, especially central banks, facing a range of policy decisions, regarding the potential introduction and form of CBDCs, regulations of private cryptocurrencies, and the implementation and regulation of various forms of fast payment systems. The main cost-benefit dimensions include (i) privacy and anti-money laundering, (ii) transaction efficiency, (iii) monetary policy transmission, (iv) financial stability, (v) the competitiveness and profitability of banking, and (vi) financial inclusion.

I believe that much faster payment technologies of some form will dominate developed market economies and some emerging-market economies within, say, 10 years. These new technologies can be based on next-generation bank-account-based payment systems, central bank digital currencies (whether account-based or token based), or private cryptocurrencies. Large bank business franchises will probably be disrupted in any case, whether by non-banks technology firms, entrant fintech banks, or legacy banks themselves.

Most developed-market central banks will likely show a preference for increasing the efficiency of bank-account-based payment systems over the deployment of CBDCs. Broad use of private cryptocurrencies will probably not be preferred by policy makers unless this occurs as part of the bank-based payment system.

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Appendix: Classification and examples of digital currencies

Figure 8, an adaptation of the "'money flower" of Bech and Garrett (2017), is a Venn diagram that illustrates the classification of currencies by whether or not they are digital, central-bank issued, widely accessible, and token-based. For example, the red-shaded section represents currencies that are digital, widely accessible, not issued by central banks, and not token-based. Figure 9 shows some corresponding examples of digital currencies.

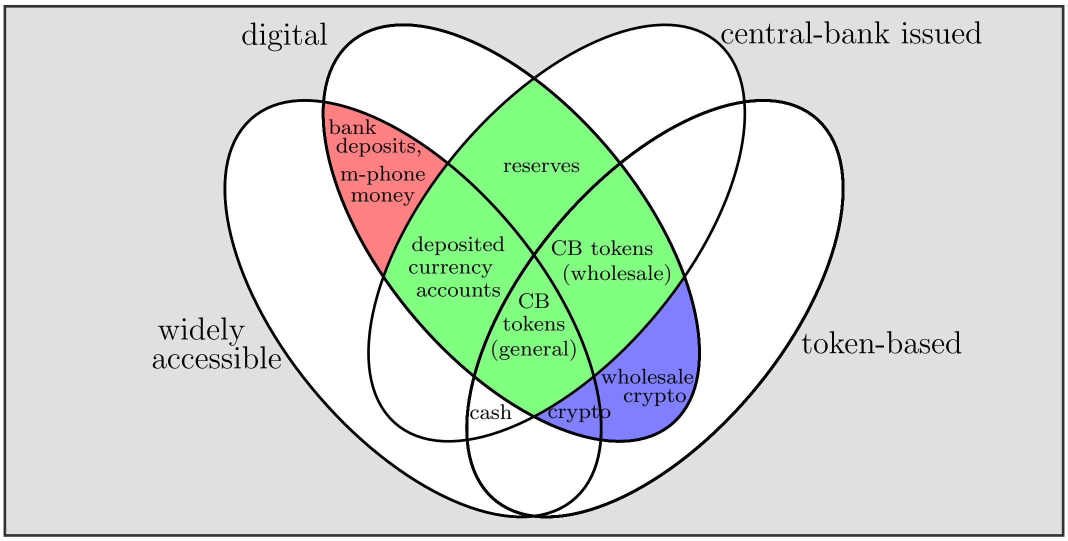

Figure 8: Digital petals of the money flower. Adapted from the "money flower" of Bech and Garrett (2017).

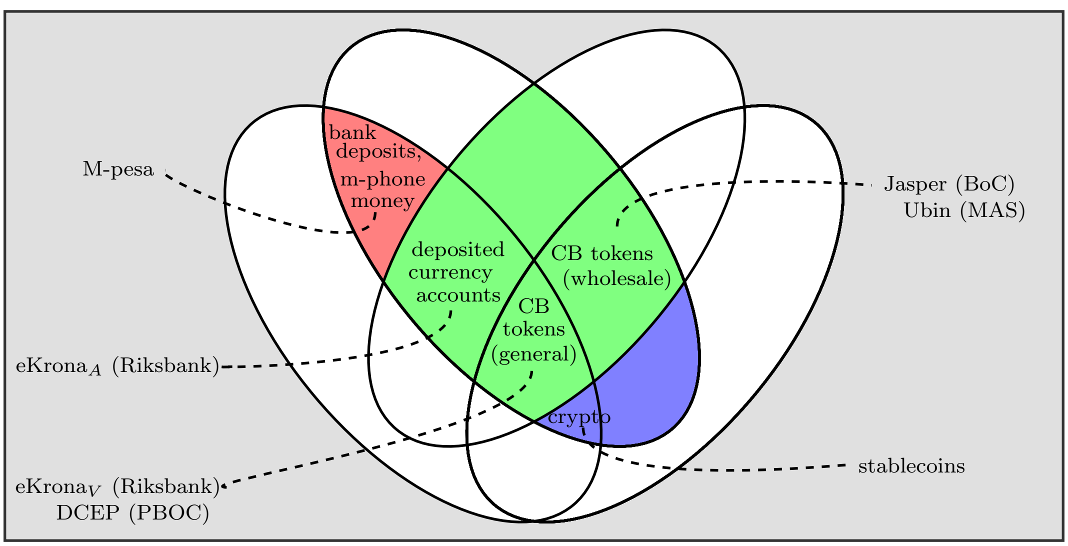

Figure 9: Illustrative and emergent digital money. Adapted from Bech and Garrett (2017) and CPMI Markets Committee (2018).