

November 09, 2020

## Central Bank Digital Currency: A Literature Review

Francesca Carapella and Jean Flemming

Technological advances in recent years have led to a growing number of fast, electronic means of payment available to consumers for everyday transactions, raising questions for policymakers about the role of the public sector in providing a digital payment instrument for the modern economy. From a theoretical standpoint, the introduction of a central bank digital currency (CBDC) raises long-standing questions relating to the provision of public and private money (Gurley and Shaw 1960), and the ability of the central bank to use CBDC as a means for transmitting monetary policy directly to households (Tobin 1985). The theoretical literature on CBDC to date relates to these questions by focusing on the effect of introducing a CBDC (i) on commercial banks, and (ii) on monetary policy and financial stability, and the resulting welfare implications. Policymakers have also taken a keen interest in these questions, among others (Bank for International Settlements 2018).

Broadly, the literature that studies CBDC considers it to be a means of payment that can pay interest and that does not necessarily need to be held in an account at a commercial bank. Though there is no universally agreed-upon definition of CBDC by policymakers or academics, thus far the literature has studied the implications of a central bank liability held directly by the public<sup>1</sup>. The models and assumptions in the literature so far provide streamlined frameworks to answer questions about the effects of CBDC at the micro- and macro-levels, while abstracting from many of the complex design issues of interest to policymakers.<sup>2</sup>

### CBDC's Effect on Commercial Banks

The first strand of the literature asks how CBDC will affect commercial banks. Fundamentally, CBDC can serve as an interest-bearing substitute to commercial bank deposits. Faced with such a substitute, commercial banks may respond by changing the deposit rates they offer to savers and, because of the resulting impact on banks' funding cost, the terms of the loans they offer to borrowers. As a result, both the quantity of bank deposits and the volume of bank-intermediated lending may change with the introduction of a CBDC. In this respect, this strand of the literature can speak to the concern of some policymakers that the introduction of CBDC may replace banks' main source of funding and cause disintermediation of commercial banks, which in turn may lead to a decrease in their lending.

Andolfatto (2018) studies these effects on a monopoly bank. In his paper, when the CBDC is interest-bearing, the bank, which makes positive profits in equilibrium, raises the equilibrium deposit rate to be equal to the interest rate on CBDC, thus making depositors indifferent. An important result is that because CBDC induces more favorable contractual terms for depositors, it increases the demand for deposits, both through an intensive margin (existing depositors are encouraged to save more) and an extensive margin (individuals who otherwise would choose to be unbanked are encouraged to pay the cost of accessing the banking sector). Hence, the competitive pressure exerted by CBDC could actually end up expanding banks' depositor base. It is, however, possible that CBDC remuneration erodes "banks' franchise value" (profits) but this does not necessarily result in higher loan rates. To this point, Andolfatto argues that as long as banks are able to borrow reserves from the central bank, which in any corridor system is done via the central bank's lending facility, disintermediation can be avoided as banks can still make loans.<sup>3</sup>

Similar ideas to those in Andolfatto (2018) are further developed by Chiu et al. (2020), who also study the impact of CBDC on bank lending and model CBDC as an interest-bearing asset that competes with banks' deposits. The economic mechanism driving their baseline results is similar to that in Andolfatto (2018), as banks in their model are also imperfectly competitive. From a theoretical perspective, Chiu et al. (2020) go beyond Andolfatto (2018) in that they analyze the case where banks can hold CBDC to meet their reserve requirements and CBDC designs that consider policy tools different from fixing the rate of interest it pays. Calibrating their model to the US, Chiu et al. (2020) quantify the magnitude of the effect on lending from the introduction of a CBDC, finding it can increase by as much as 3.55% with a properly chosen remuneration rate. The specific change in lending depends on the region of the parameter space considered: if the interest rate on CBDC is below that on checkable deposits, there is no effect on banks' activities. If the interest rate on CBDC is higher than that on deposits, but not too high, then banks respond by increasing deposit rates and lending, as higher deposit rates result in a larger deposit base. If, however, the interest rate on CBDC is too high, banks scale down their deposits and loans.

Brunnermeier and Niepelt (2019) also consider CBDC as an asset with the same liquidity properties as bank deposits. As in Andolfatto (2018), assuming the central bank lends to commercial banks, the introduction of a CBDC need not affect the equilibrium allocation. They show that if households' deposits are exchanged for CBDC, then there is no effect on the equilibrium allocation as long as (i) deposit liabilities are replaced by central bank loans to commercial banks and (ii) there is no effect on the constraints faced by households or the wealth distribution across households. Intuitively, if CBDC does not affect households' payoffs nor relaxes or tightens the constraints they face, the portfolio choices of each household, and in turn the distribution of wealth across households, will be unaffected. From the perspective of private banks, the equilibrium is unaffected only if the level of liabilities is unchanged. Thus, the authors state that this could be achieved by "render[ing] the central bank's implicit lender-of-last-resort guarantee explicit."

Fernandez-Villaverde et al. (2020a) build a model of bank runs in the spirit of Diamond and Dybvig (1983) to derive a related equivalence result. The authors characterize conditions such that CBDC replaces banks' deposits entirely, and show that in normal times the set of allocations achieved under private bank deposits is the same as that achieved under CBDC. Differently, in times of bank runs, they show that if the central bank is able to commit not to liquidate its long-term assets, the presence of CBDC can decrease the likelihood of runs, leading all depositors to hold CBDC instead of deposits in equilibrium. Under the assumptions of their model, despite the elimination of commercial bank deposits, the presence of CBDC does not lead to a decrease in lending as the central bank is assumed to have (indirect) access to the same investment technology as commercial banks.

Keister and Sanches (2019) explore the trade-off introduced by a CBDC between reduced lending by commercial banks and increased trade in a model of decentralized exchange in the spirit of Lagos and Wright (2005). They show that if CBDC is widely accepted for transactions, buyers will hold more of it, increasing trade between buyers and sellers, leading to higher quantities exchanged, and in turn, higher consumption. At the same time, consumers' portfolio choice implies lower deposit balances and in turn lower lending by banks, reducing investment. If the consumption effect through increased acceptance is larger than the investment effect through decreased lending, the introduction of a CBDC will increase welfare.

## CBDC's Effect on Monetary Policy and Financial Stability

The second strand of the literature asks what will be the effect of a CBDC on monetary policy and financial stability, and the resulting welfare implications. As a new form of central bank money, CBDC has the potential to affect central banks' wider policy objectives, either by acting as a new monetary policy tool or through its effects on the portfolio choices of households and the probability of bank runs. Crucial to these mechanisms is the flexibility provided by CBDC in responding to macroeconomic shocks.

Barrdear and Kumhof (2016) build a dynamic stochastic general equilibrium (DSGE) model with sticky prices and adjustment costs to study the long-run and cyclical effects of CBDC for the macroeconomy. Under the assumption that newly issued CBDC is exchanged one-for-one with government debt, they find that the introduction of CBDC decreases interest rates and distortionary taxes, thus increasing long-run GDP. Over the business cycle, counter-cyclical CBDC issuance can lead to a smaller fall in GDP in response to a liquidity demand shock. This shock leads to a flight to safety in which households demand more CBDC. If the central bank can increase the quantity of CBDC to satisfy this demand, the reduction in real economic activity is less severe, attenuating the decline in spending and therefore welfare.

Subsequent work by Fernandez-Villaverde et al. (2020b) considers a model of bank runs à la Diamond and Dybvig (1983) in which banks can offer nominal contracts.<sup>4</sup> In their paper, CBDC is modeled as deposits held at the central bank. Their framework highlights an important trade-off: if a run on CBDC occurs, the central bank internalizes the effect on prices, and thus real consumption, from liquidating its assets to pay depositors. By increasing the price level in the case of a run, the central bank can effectively reduce the real value of withdrawals, thus preventing bank runs from occurring. This increase in the price level, however, comes at the cost of sacrificing inflation targeting. Even if the central bank is mandated to maintain price stability, it cannot do so in the case of a large enough run. In this case, the authors show that there is a positive probability of runs, and that a negative interest rate on CBDC during financial panics is optimal to keep inflation in check.

Williamson (2019) studies the role of a CBDC not only as an interest-bearing asset, but also as a means of payment alternative to cash, which is subject to theft, and to bank deposits, which are subject to limited commitment of the bank to honor deposit repayment. When households endogenously select into banked (i.e. deposit users) and unbanked (i.e. cash users), the introduction of a CBDC, which pays interest and is assumed to be immune to theft, can be Pareto improving and always increases welfare of at least unbanked households. The economic mechanism driving the welfare implications focuses on the interaction between the new monetary policy tool introduced by an interest-bearing CBDC and banks' limited commitment. Because banks' assets serve as collateral to secure deposit liabilities and relax their commitment friction, collateral assets play a key role in limiting the amount of liquidity banks can offer households. Interest payments on CBDC which are financed by an open market purchase of government bonds effectively reduce the availability of collateral assets to banks, tightening their collateral constraint and reducing their ability to issue

payment instruments in the form of deposits. Thus, despite increasing the welfare of unbanked households, who, by assumption, are no longer subject to theft, CBDC decreases the welfare of banked households unless they also choose to hold CBDC in their portfolios. With at least some households switching to CBDC, some of the transactions which were carried out with deposits and required banks to hold collateral are now carried out with CBDC. Banks' collateral assets are still available to issue deposits, hence, overall, the aggregate stock of collateral can support more transactions.

While also focusing on the liquidity properties of CBDC as a means of payment, Keister and Monnet (2020) study its effects on the set of feasible policies available to the government in periods of financial distress. If the financial conditions of banks are private information to each bank and its depositors, the introduction of a CBDC as an alternative means of payment to bank deposits but immune from the risk of bank runs (as the central bank does not perform maturity transformation) results in depositors withdrawing their funds from banks in times of stress and reallocating them into CBDC. By observing a large and sudden inflow of funds into its digital currency, the central bank can then infer the financial conditions of banks. This information might be crucial in designing an appropriate policy response in times of stress, the more so the faster a response is needed to be effective. By appropriately choosing the interest rate on CBDC to make it more attractive in times of stress, the central bank can more quickly infer the state of the financial system and respond more effectively. This allows the government to adopt policies that are welfare-improving over the best policies feasible without a CBDC.

## Considerations for future research

As with any new literature, many questions remain. We believe the most crucial question is which intrinsic features of CBDC as a means of payment and a store of value are important for households' portfolio choices as to which monies to use. Indeed, empirical studies of consumer payment choice such as Koulayev et al. (2016) show that individuals' preferences across means of payment are heterogeneous and not fully explained by demographic characteristics such as income and age. In order to fully understand the macroeconomic and microeconomic effects of introducing a CBDC in a theoretical framework, it is imperative to first understand consumer payment choice as CBDC will, first and foremost, expand the set of payment and savings options available to households.

To understand how heterogeneity in consumers' choices across means of payment determines the adoption of CBDC, it is crucial to identify whether CBDC could be a substitute for physical currency, deposits, or both. Cash and deposits share several characteristics, such as (near) immediate settlement upon payment; however, they differ in the level of anonymity and privacy of transactions and the risks involved in holding each. Williamson (2019) highlights one such trade-off between cash and deposits: the risk that a bank absconds with deposits and the risk of theft for physical cash. Andolfatto (2018) considers a fixed cost of opening an interest-bearing deposit account, while the use of cash is free but pays no interest. Given these trade-offs, Andolfatto and Williamson, respectively, allow for heterogeneity in income or preferences as a driver of payment choice, leading to a share of the population to be unbanked, that is, to hold only cash. In these models, the introduction of a CBDC can lead to greater financial inclusion by making deposits, either at commercial banks or in CBDC, more attractive, lowering the share of unbanked. Chiu et al. (2020) and Keister and Sanches (2019) consider heterogeneity across sellers -- some accept only cash (say, for small purchases) while others accept only deposits (for larger purchases) -- leading buyers to hold different means of payment depending on which type of purchase they will make.

Avenues for future work include further exploring how the intrinsic features of CBDC as a means of payment and store of value affect the set of feasible allocations in the economy and, in turn, affect its value to heterogeneous households.

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1. See Adrian and Mancini Griffoli (2019) for a description of an alternative design, the "synthetic CBDC". [Return to text](#)
  2. These include, but are not limited to, the choice between token and account-based CBDCs, ledger design and access, programmability, privacy, and handling of offline transactions. [Return to text](#)
  3. In monetary policy implementation frameworks based on a corridor system, the target for the short-term interest rate is typically set within the corridor established by the discount rate (or interest rate charged by the central bank's lending facility) as the ceiling and the interest rate on reserves deposited at the central bank as the floor (or interest rate paid by the central bank's deposit facility). [Return to text](#)
  4. Nominal contracts are promises to pay a future amount that is not indexed to the price level. [Return to text](#)

**Please cite this note as:**

Carapella, Francesca, and Jean Flemming (2020). "Central Bank Digital Currency: A Literature Review," FEDS Notes. Washington: Board of Governors of the Federal Reserve System, November 09, 2020, <https://doi.org/10.17016/2380-7172.2790>.

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Last Update: November 09, 2020



2020年11月9日

## 中央银行数字货币：文献综述

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近年来，技术的进步导致越来越多的快速电子支付方式可供消费者用于日常交易，这使决策者对公共部门在为现代经济提供数字支付工具方面的作用提出了质疑。从理论上讲，中央银行数字货币（CBDC）的引入提出了与提供公共和私人货币有关的长期问题（Gurley and Shaw 1960），以及中央银行使用CBDC作为手段的能力。直接将货币政策传递给家庭的方法（Tobin 1985）。迄今为止，关于CBDC的理论文献都集中在引入CBDC的影响上，这些问题包括（i）对商业银行，以及（ii）对货币政策和金融稳定性的影响，以及由此带来的福利影响。

广泛地讲，研究CBDC的文献认为这是一种可以支付利息的付款方式，不一定需要将其保存在商业银行的帐户中。尽管决策者或学者尚未就CBDC达成一致的定義，但迄今为止，文献已研究了公众直接持有的中央银行负债的含义<sup>1</sup>。迄今为止，文献中的模型和假设提供了精简的框架，以回答有关CBDC在微观和宏观层面的影响的问题，同时从决策者所关心的许多复杂设计问题中抽象出来。<sup>2</sup>

### CBDC对商业银行的影响

文献的第一部分询问CBDC将如何影响商业银行。从根本上说，CBDC可以代替商业银行存款的计息。面对这样的替代方案，商业银行可能会通过更改提供给储户的存款利率以及由于对银行融资成本产生的影响，来改变提供给借款人的贷款条款。结果，随着CBDC的推出，银行存款的数量和银行中介贷款的数量都可能发生变化。在这方面，这一系列文献可以引起一些决策者的关注，即引入CBDC可能会取代银行的主要资金来源，并导致商业银行的中介化，从而可能导致其贷款减少。

Andolfatto（2018）研究了这些对垄断银行的影响。在他的论文中，当CBDC计息时，在平衡中获得正利润的银行将平衡存款利率提高到与CBDC上的利率相等，从而使存款人无动于衷。一个重要的结果是，由于CBDC为存款人引入了更优惠的合同条款，因此通过高额保证金（鼓励现有存款人储蓄更多）和广泛的保证金（否则会选择不提供银行服务的个人）增加了存款需求。鼓励支付进入银行部门的费用）。因此，CBDC施加的竞争压力实际上可能最终会扩大银行的储户基础。但是，CBDC的薪酬有可能侵蚀“银行的特许权价值”（利润），但这并不一定会导致更高的贷款利率。至此，安道尔法托认为，只要银行能够从中央银行借入准备金（在任何走廊系统中都是通过中央银行的贷款工具完成的），由于银行仍然可以发放贷款，因此可以避免中间货币的贬值。<sup>3</sup>

Chiu等人进一步发展了与Andolfatto（2018）中类似的想法。（2020年），他还研究了CBDC对银行贷款的影响，并将CBDC建模为与银行存款竞争的有息资产。推动其基准结果的经济机制与Andolfatto（2018）中的机制相似，因为其模型中的银行也具有不完全竞争性。从理论上讲，Chiu等。（2020）超越了Andolfatto（2018），因为他们分析了银行可以持有CBDC来满足其准备金要求的情况，并且CBDC的设计考虑了政策工具而不是确定其支付的利率。Chiu等人在美国校准他们的模型。（2020年）量化了引入CBDC对贷款的影响程度，发现它可以增加多达3倍。55%用适当选择报酬率。贷款的具体变化取决于所考虑的参数空间区域：如果CBDC的利率低于可检查存款的利率，则对银行的活动没有影响。如果CBDC的利率高于存款利率，但又不太高，则银行会通过提高存款利率和放贷来应对，因为更高的存款利率会导致更大的存款基础。但是，如果CBDC的利率过高，则银行会缩减其存贷款规模。然后银行会通过提高存款利率和放贷来应对，因为更高的存款利率会导致更大的存款基础。但是，如果CBDC的利率过高，则银行会缩减其存贷款规模。

Brunnermeier和Niepelt（2019）也将CBDC视为具有与银行存款相同的流动性的资产。如Andolfatto（2018）所述，假设中央银行向商业银行贷款，那么引入CBDC并不需要影响均衡分配。他们表明，如果将居民的存款换成CBDC，则只要（i）存款负债由中央银行对商业银行的贷款代替，并且（ii）对面临的约束没有影响，均衡分配就不会受到影响。按家庭或家庭之间的财富分配。直觉上，如果CBDC既不影响家庭的收益，也不放松或收紧他们所面临的约束，则每个家庭的投资组合选择以及家庭之间的财富分配都不会受到影响。从私人银行的角度来看，仅当负债水平不变时，均衡才不会受到影响。因此，作者指出，这可以通过“显式提供中央银行隐性的最后贷款人担保”来实现。

Fernandez-Villaverde等。（2020a）本着Diamond and Dybvig（1983）的精神建立了一个银行挤兑模型，以得出相关的等价结果。作者描述了这样的条件：CBDC完全替代了银行的存款，并表明在正常情况下，在私人银行存款下实现的分配集与在CBDC下实现的分配集相同。不同的是，在银行挤兑期间，他们表明，如果中央银行能够承诺不清算其长期资产，CBDC的存在会降低挤兑的可能性，从而导致所有储户都持有CBDC而不是使存款处于均衡状态。在其模型的假设下，尽管消除了商业银行存款，

Keister和Sanches (2019) 本着Lagos和Wright (2005) 的精神, 探索了CBDC在分散交易模式下商业银行减少贷款与增加贸易之间的权衡取舍。他们表明, 如果CBDC交易被广泛接受, 则买方将持有更多的CBDC, 从而增加了买卖双方之间的贸易, 从而导致交换的交易量增加, 进而导致消费量增加。同时, 消费者的投资组合选择意味着较低的存款余额, 进而降低了银行的贷款, 从而减少了投资。如果通过增加接受程度产生的消费效应大于通过减少贷款产生的投资效应, 那么引入CBDC将会增加福利。

## CBDC对货币政策和金融稳定的影响

文献的第二部分询问了CBDC对货币政策和金融稳定的影响以及由此带来的福利影响。作为中央银行货币的一种新形式, CBDC可能通过充当新的货币政策工具或通过其对家庭投资组合选择和银行挤兑可能性的影响来影响中央银行更广泛的政策目标。这些机制至关重要, 是CBDC在应对宏观经济冲击时具有灵活性。

Barrdear和Kumhof (2016) 建立了具有粘性和调整成本的动态随机一般均衡 (DSGE) 模型, 以研究CBDC对宏观经济的长期和周期性影响。在新发行的CBDC与政府债务进行一对一交换的假设下, 他们发现CBDC的引入降低了利率和扭曲性税收, 从而提高了长期GDP。在整个商业周期中, 反周期CBDC发行会导致流动性需求冲击导致GDP下降幅度较小。这种冲击导致人们逃往安全, 家庭需要更多的CBDC。如果中央银行可以增加CBDC的数量来满足这一需求, 那么实际经济活动的减少就不会那么严重, 从而减少了支出的下降, 从而减轻了福利的下降。

Fernandez-Villaverde等人的后续工作。(2020b) 认为银行经营的模型如Ia Diamond and Dybvig (1983), 其中银行可以提供名义合同。<sup>4</sup>在他们的论文中, CBDC被建模为存放在中央银行的存款。他们的框架强调了一个重要的权衡: 如果发生对CBDC的挤兑, 中央银行会从清算其资产到支付存款人的角度内化对价格的影响, 从而对实际消费产生影响。通过在奔跑的情况下提高价格水平, 中央银行可以有效降低提款的实际价值, 从而防止发生银行奔跑。但是, 价格水平的上涨是以牺牲通胀目标为代价的。即使中央银行被授权维持价格稳定, 但在运行足够大的情况下也不能这样做。在这种情况下, 作者表明, 出现挤兑的可能性是正的, 而在金融恐慌期间, CBDC的负利率是控制通货膨胀的最佳选择。

威廉姆森 (Williamson (2019)) 研究了CBDC的作用, 不仅将其作为一种计息资产, 而且还可以将其作为现金的替代支付方式 (易受盗窃) 和银行存款 (受银行的有限承诺) 偿还押金。当家庭内生地选择有银行 (即存款用户) 和无银行 (即现金用户) 的家庭时, 引入CBDC不仅可以提高利息, 而且可以防止盗窃, 这可以帕累托改善, 并且至少可以增加至少无银行家庭的福利。带来福利影响的经济机制侧重于有息CBDC引入的新货币政策工具与银行的有限承诺之间的相互作用。由于银行的资产可作为抵押, 以确保存款负债和缓解承诺摩擦, 抵押资产在限制银行可以向家庭提供的流动性数量方面起着关键作用。通过公开市场购买政府债券为CBDC支付利息, 有效地减少了银行抵押资产的可利用性, 收紧了其抵押约束, 并降低了以存款形式发行支付工具的能力。因此, 尽管非银行家庭的福利有所增加, 但假设他们不再受到盗窃之害, CBDC会降低银行家庭的福利, 除非他们也选择将CBDC纳入其投资组合。随着至少一些家庭转入CBDC, 一些以存款进行的交易和要求银行持有抵押品的交易现在由CBDC进行。银行的抵押资产仍可用于发行存款, 因此, 总体而言,

Keister和Monnet (2020) 在关注作为支付手段的CBDC的流动性特性的同时, 研究了其对财政困难时期政府可用的一系列可行政策的影响。如果银行的财务状况是每家银行及其储户的私人信息, 那么引入CBDC作为银行存款的另一种支付方式, 但不受银行挤兑风险的影响 (因为中央银行不进行到期日转换) 储户在压力大时从银行提取资金, 然后将其重新分配到CBDC。通过观察大量突然流入其数字货币的资金, 中央银行可以推断出银行的财务状况。在面临压力时, 这些信息对于设计适当的政策响应可能至关重要, 越多, 则需要更快的响应才能有效。通过选择适当的利率上CBDC, 使其在有压力的时候更有吸引力, 央行可以更快速更有效地推断出金融体系和响应的状态。这使政府可以在没有CBDC的情况下, 采用可行的最佳政策来改善福利。

## 未来研究的注意事项

与任何新文献一样, 仍然存在许多问题。我们认为, 最关键的问题是, 作为支付手段和价值存储方式的CBDC的哪些内在特征对于家庭使用哪些资金的投资组合选择至关重要。的确, 诸如Koulayev等人的消费者支付选择的实证研究。

(2016年) 表明, 个人在支付方式上的偏好是异类的, 不能由收入和年龄等人口特征完全解释。为了在理论框架中充分理解引入CBDC的宏观经济和微观经济影响, 必须首先了解消费者的支付选择, 因为CBDC首先将扩大家庭可用的支付和储蓄选择范围。

为了了解消费者在支付方式上的选择异质性如何决定采用CBDC, 至关重要的是确定CBDC是否可以替代实物货币, 存款或两者。现金和存款具有几个特点, 例如 (接近) 付款后立即结清; 但是, 它们在匿名性和交易隐私级别以及持有每项交易涉及的风险方面有所不同。威廉姆森 (Williamson (2019)) 强调了现金与存款之间的一种权衡: 银行潜逃存款的风险和盗窃实物现金的风险。Andolfatto (2018) 认为开设计息存款账户的固定成本, 而现金的使用是免费的, 但不支付利息。考虑到这些折衷, 分别是Andolfatto和Williamson, 允许收入或偏好的异质性作为支付选择的驱动力, 导致一部分人口没有银行账户, 即仅持有现金。在这些模型中, 引入CBDC可以通过增加在商业银行或CBDC中的存款的吸引力来提高金融普惠性, 从而降低未开户银行的份额。Chiu等。(2020) 和Keister and Sanches (2019) 考虑了卖方之间的异质性-有些只接受现金 (例如, 用于小额购买), 而另一些只接受定金 (用于较大的购买)-导致买方持有不同的付款方式, 具体取决于他们将进行的购买类型。无论是在商业银行还是在CBDC中, 更具吸引力, 从而降低了无银行业务的份额。Chiu等。(2020) 和Keister and Sanches (2019) 考虑了卖方之间的异质性-有些只接受现金 (例如, 用于小额购买), 而另一些只接受定金 (用于较大的购买)-导致买方持有不同的付款方式, 具体取决于他们将进行的购买类型。无论是在商业银行还是在CBDC中, 更具吸引力, 从而降低了无银行业务的份额。Chiu等。(2020) 和Keister and

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未来工作的途径包括进一步探索CBDC作为支付和价值存储手段的内在特征如何影响经济中可行的配置集，进而影响其对异类家庭的价值。

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1.有关替代设计“合成CBDC”的说明，请参阅Adrian和Mancini Griffoli (2019)。 [返回文字](#)

2.这些包括但不限于在令牌和基于帐户的CBDC之间进行选择，分类账设计和访问，可编程性，隐私和脱机交易的处理。 [返回文字](#)

3.在基于走廊系统的货币政策实施框架中，短期利率的目标通常是在以折现率（或中央银行贷款工具收取的利率）为上限和上限的走廊内确定的。存入中央银行作为底数的准备金的利率（或由中央银行的存款工具支付的利率）。 [返回文字](#)

4.标称合同是承诺将支付未按价格水平标明的未来金额。 [返回文字](#)

### 请将此注释引用为：

Carapella, Francesca和Jean Flemming (2020)。“中央银行数字货币：文献综述”，FEDS注释。华盛顿：美联储理事会，2020年11月9日，<https://doi.org/10.17016/2380-7172.2790>。

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最后更新：2020年11月9日