Reserves for All? Central Bank Digital Currency, Deposits, and Their (Non)-Equivalence*

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This paper offers a macroeconomic perspective on the "Reserves for All" (RFA) proposal to let the general public hold electronic central bank money and transact with it. I propose an equivalence result according to which a marginal substitution of outside money (e.g., RFA) for inside money (e.g., deposits) does not affect macroeconomic outcomes. I identify key conditions for equivalence and argue that these conditions likely are violated, implying that RFA would change macroeconomic outcomes. I also relate the analysis to common arguments found in discussions on RFA and point to inconsistencies and open questions.

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1. Introduction

Far into the 20th century central banks commonly offered accounts not only to a select group of financial institutions but also to nonbanks (Bank for International Settlements 2018). This liberal approach has given way to a monetary arrangement where the general public typically holds only one form of central-bank-issued money, namely cash. Access to electronic central bank money—"reserves"—generally is restricted to financial institutions with

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which the central bank interacts. When households or nonfinancial firms pay electronically, they use privately issued money (e.g., bank deposits), not central bank money.

The advantages and disadvantages of this monetary arrangement are the subject of an intensifying debate which takes place against the background of fundamental changes in the financial system (including technological innovations, the entrance of new players ["fintech" and "bigtech"], and new payment systems) as well as questions about the future of cash and interest in private digital tokens like Bitcoin (BIS 2018). At the same time, the debate testifies to a loss of trust in traditional banks after the recent financial crisis and an increasingly critical attitude toward their role in money and credit creation. While this attitude has only recently gained prominence in the political arena—most notably in the Swiss constitutional referendum on "Vollgeld" (sovereign money)[1]—it is much older and precedes the recent changes in technology and market structure (e.g., Knight et al. 1933; Fisher 1935; Tobin 1985).

In this paper, I offer a macroeconomic perspective on the implications of letting the general public access central bank money in electronic form—"Reserves for All" (RFA). Rather than emphasizing technological aspects, I focus on the key macroeconomic question of interest, namely the difference between bank-issued "inside" and central-bank-issued "outside" money (section 2).[2] In section 3, I lay out an equivalence result according to which a substitution of outside for inside money, possibly accompanied by transfers, is neutral: When a fiscal–monetary policy implements an equilibrium with

[1]On the Swiss "Vollgeld" initiative, see http://www.vollgeld-initiative.ch/english/. See http://www.sovereignmoney.eu and http://www.internationalmoneyreform.org for the policy discussion in other countries, including Iceland and the Netherlands.

[2]The working paper (Niepelt 2018) places the debate on central bank digital currency in a broader context. It relates RFA to other types of money (see also Bech and Garratt 2017; BIS 2018) and distinguishes it from central-bank-issued cryptocurrencies for retail use (see also Koning 2014; Andalfatto 2015; Barrdear and Kumhof 2016; Raskin and Yermack 2016; Berentsen and Schär 2018) or wholesale use (see also UBS 2016; Chapman et al. 2017; Monetary Authority of Singapore 2017; Payments Canada, Bank of Canada, and R3 2017; and BIS 2018). The working paper also discusses current RFA projects; see Mancini-Griffoli et al. (2018, p. VI) for an overview of central banks pursuing such projects.

inside money, then an alternative fiscal–monetary policy with more outside money and with transfers also implements an equilibrium, with less inside money but the same allocation and price system. This result suggests that the macroeconomic effects of RFA are negligible.

But, as I discuss in section 4, the equivalence proposition relies on conditions which are likely violated in real-world settings. Most importantly, these conditions relate to government (central bank) incentives. Against this background I assess in section 5 the plausibility of various suggested implications of RFA, including on financial stability, national saving and investment, and the conduct of monetary policy. I conclude in section 6 that some suggested implications are at odds with my analysis and that the policy discussion so far has been missing important elements.

2. Reserves for All

In the following, I consider arbitrary forms of centrally managed, electronic central bank money. The key aspect I am interested in is universal access, which is the possibility for the general public to hold electronic central bank money and directly transact with it.[3] The system I consider, then, is a system where reserves serve as unit of account, store of value, and means of payment not only for institutions in the financial sector, as they do today, but also for households and firms outside of that sector.

With this focus on universal access in mind, I do not take a stance on technical aspects such as whether payments would be made using a traditional payment system or a distributed ledger, and whether RFA would be held in a central bank account, an off-balance-sheet account managed by a service provider on the basis of a public–private partnership, or on a prepaid card. From a macroeconomic perspective, these considerations are of second order even if they are

[3]One might argue that electronic central bank money already serves today as means of payment for retail use because a customer payment from one commercial bank to another is settled with central bank money. However, the difference is that in the current system, customers must hold private bank deposits (and typically do so for an extended period) before they can use them to make a payment.

of first-order importance for many operational, legal, and technical questions.[4]

The proposal to make central-bank-issued digital money accessible to the general public in order to provide a partial substitute for cash and bank deposits dates back, at least, to Tobin (1985, 1987). Recent discussions include Groff (2013), Koning (2014), and Niepelt (2015).[5]

Tobin (1985) emphasizes the benefits for society of having access to an electronic means of payment (as opposed to cash only) and being able to rely on a robust payments system. He argues that institutional features that promote robustness—for example, deposit insurance—require regulatory limits on competition and asks how to "strike a balance between competitive efficiency and the protection of depositors" (p. 25). Against this background, he suggests that "deposited currency—100%-reserve deposits—payable in notes or coin on demand, transferable by order to third parties, secure against loss or theft, would be a perfect store of value in the unit of account" (p. 25).

Similarly, Tobin (1987) proposes "deposited currency accounts." He suggests (pp. 172–73) that "the government should make available to the public a medium with the convenience of deposits and the safety of currency, essentially currency on deposit," and he proposes different institutional arrangements to implement such a system. In one arrangement, "the Federal Reserve banks themselves could offer such deposits, a species of 'Federal Funds.' ... Transactions ... would be cleared through the Federal Reserve" although customer services could be provided, against a fee paid by the Federal Reserve banks, by private banks or post offices. (Today, only few such services presumably would be needed, due to the Internet.[6]) "Interest at a

[4]For a discussion of legal aspects pertaining to RFA under Swiss law, see Reiser and Wyss (2018).

[5]Groff (2013) envisions a form of digital cash that is available to users free of charge, subject to no transaction fees, bearing no interest. See also Motamedi (2014). Many additional contributions discuss RFA against the background of proposals to relax the effective lower bound on interest rates; see the discussion in section 5 and in the working paper.

[6]Tobin speculates that "computer capabilities should soon make it possible to withdraw conventional currency at any office or agency, and even to order payments to third parties by card or telephone."

rate sufficiently below the rates on Treasury securities to cover costs could be paid, and some costs could be charged to accountholders."

In an alternative arrangement envisioned by Tobin, "banks and other depository institutions could offer the same type of account, or indeed be required to do so. The deposited funds would be segregated from the other liabilities of the institution, and invested entirely in eligible assets dedicated solely to those liabilities. These would be Federal Funds or Treasury obligations of no more than three months maturity." Tobin discusses that deposited currency accounts would only have to be insured "against malfeasance by the agent or depository" but not against illiquidity or insolvency. "Thus, a part of the payments system would be secure without the help of deposit insurance."

Both before and after Tobin, many economists, central bankers, and practitioners have voiced concerns that the ability of commercial banks to "transform maturity" and create money causes fragility and instability, calling for the creation of narrow banks. Most prominently, in the 1930s, faculty from the University of Chicago proposed a "Chicago plan" to end fractional reserve banking and thus, to separate credit from money creation (Knight et al. 1933; Fisher 1935, 1936).[7] In response to the financial crisis of a decade ago, Kay (2009) argues that complex regulatory frameworks should make way for simple structural rules and a "firewall between retail deposits and other liabilities of banks." Kotlikoff and Goodman (2009) and Kotlikoff (2010) go further and propose a system of "limited purpose banking," in which financial intermediaries are reduced to managers of equity-financed mutual funds.[8] King (2016) proposes that all short-term bank liabilities should be covered by liquid assets and a central bank credit line which depends on the assets lodged at the central bank to serve as collateral when needed.[9]

[7]Benes and Kumhof (2012) revisit the Chicago plan and offer a quantitative assessment. Similar to the Chicago plan, the Swiss "Vollgeld" initiative proposed a complete ban on private money creation. The initiative was rejected in 2018.

[8]Melaschenko and Reynolds (2013) propose a resolution mechanism that shares features of equity financing.

[9]McMillan (2014) emphasizes that proposals to implement narrow banking restrictions pose the problem that regulators need to distinguish between financial and nonfinancial companies, which is not always trivial and could give rise to regulatory arbitrage. As a solution to this problem, McMillan (2014) proposes a

These proposed narrow banking arrangements differ from RFA because RFA does not directly constrain the business model of banks or their ability to create inside money. RFA simply provides the public with an electronic means of payment that serves as an alternative to deposits and other forms of private money. Of course, a complete migration of bank deposits to RFA would in effect create narrow banks. However, these banks would not be narrow due to a regulatory constraint but because bank deposits would no longer be commercially viable due to the introduction of RFA.

3. Equivalence

To organize the discussion of possible consequences of RFA, I propose an equivalence result according to which inside money is irrelevant from a macroeconomic point of view. An implication of the result is that the introduction of RFA and its substitution for inside money does not have macroeconomic consequences. After laying out the logic of the argument in this section, I turn in section 4 to a discussion of key assumptions underlying its validity. In section 5, I confront the findings with common arguments found in discussions on RFA.

The equivalence result is in the spirit of Modigliani and Miller (1958), Barro (1974), Wallace (1981), or Chamley and Polemarchakis (1984).[10] Its purpose is to provide a benchmark, not the most realistic description, in order to identify key conditions for equivalence and thus, potential sources of *non*-equivalence. The macroeconomic perspective I adopt leads me to emphasize the economy's aggregate balance sheet (or consolidated intertemporal budget constraint). This contrasts with partial equilibrium intuitions inspired by models in the tradition of Diamond and Dybvig (1983) which underlie many arguments in the debate.

The basic intuition for the result is as follows: Inside money serves various functions in the nonbank sector. RFA, possibly accompanied

rule according to which *any* company's *financial* assets should always be financed by equity.

[10]For a textbook treatment of equivalence results, see Sargent (1987, 5.4).

by fiscal interventions, can also serve these functions, without redistributing resources or affecting incentives in the nonbank private sector. Inside and outside money thus can be substituted for each other, subject to appropriate fiscal interventions, without macroeconomic consequences.

Money serves as a unit of account, a means of payment, and a store of value. Since central bank money—cash or reserves at the central bank—serves as the unit of account, a substitution of outside for inside money does not affect the first function of money. I therefore focus on the role of money as a store of value or means of payment. Moreover, I restrict attention to inside money—bank deposits—that are not "backed" by outside money in the banks' balance sheets (that is, I focus on the deposits that drive the money multiplier above one). The share of inside money that is "backed" by outside money could be taken off the banks' balance sheets without macroeconomic consequences.

3.1 Store of Value

Money serves as a store of value because it is a financial claim. But this claim does not affect aggregate wealth. An economy's wealth comprises the assets in the consolidated balance sheet, representing the economy's productive capacity, endowments, and net external assets. The liability side of the consolidated balance sheet determines how this wealth is apportioned and distributed among the various sectors and agents in the economy, but it does not affect its size (cf. Modigliani and Miller 1958). Whether the central bank issues outside money or the banking sector issues inside money thus is irrelevant for aggregate wealth.

The composition of the stock of money might, however, be relevant from a distributive point of view. For example, inside and outside money may have different payment characteristics or tax treatments. These distributive implications of a substitution of outside for inside money can be sterilized by appropriate state-contingent transfers.[11]

[11] Of course, the transfers and their financing need to be nondistorting for equivalence to hold, cf. Barro (1979).

A counterargument emphasizes "crowding out," namely the fact that for given private-sector savings, additional public-sector debt issuance (including outside money issuance) reduces the share of private saving that funds physical investment. When inside money (which is an asset and a liability of the private sector) does not increase private-sector wealth but outside money (which is an asset of the private sector but a liability of the public sector) does, the counterargument asserts, that inside money creation is associated with a smaller wealth effect in the private sector than outside money creation. As a consequence, the effect on aggregate consumption and crowding out is lesser.

This counterargument neglects the fact that the economy's consolidated balance sheet includes the public sector. That is, the public sector's net worth is a component of national wealth. Since the private sector "owns" the public sector, as taxpayers ultimately are responsible for covering public-sector deficits, public debt (including outside money) does not increase private-sector net worth (Barro 1974), and this implies that inside and outside money do not have differential aggregate wealth effects. Of course, with heterogeneous groups in society (e.g., different cohorts), crowding out does occur to the extent that debt issuance and the associated change in the timing of taxation redistributes the tax burden across groups with different marginal propensities to save (Diamond 1965; Niepelt 2004). But this redistributive effect can be offset by appropriate transfers between the affected groups.

3.2 Means of Payment

To assess whether outside money can substitute for inside money as a means of payment, consider the extreme case of a complete replacement, namely a situation where all payments are made using central bank money. Holding velocity constant, this would require that the part of deposits currently used for payments (rather than held for life-cycle or precautionary reasons) was replaced by central bank money. As of 2019, the required injection of central bank money would be modest at most in many countries since banks hold substantial excess reserves. Relative to the situation before the financial crisis, however, when banks held few reserves in excess of what was

needed to settle *net* payments between them, the injection would have to be large.

The balance sheets of banks would reflect the money substitution on the asset and/or liability side. For example, banks could sell a corresponding amount of loans or other financial assets to the central bank in exchange for reserves. In effect, the deposits used for payments would be fully "backed" by reserves after the open market operation—a situation akin to having nonbanks directly use reserves as means of payment. (One can think of deposits and reserves being transferred to special-purpose vehicles, off banks' balance sheets, such that the public effectively holds claims vis-à-vis the central bank.) This approach would thus be reflected in an asset substitution and, possibly, a shrinking of bank balance sheets.

Another approach would rely on a substitution of banks' liabilities. Banks would swap deposits against central bank funding, but the banks' balance sheet length and the asset composition would remain unchanged. In effect, the substitution of RFA for deposits by nonbanks would be compensated by new central bank funding for banks.[12]

With either approach, the degree of "maturity transformation" in the banking sector would be reduced. This would have distributive implications because banks would suffer from lower spreads between the yields on their assets and liabilities. Specifically, banks would no longer be able to reap those benefits of liquidity provision to depositors, which fundamentally rely on the central bank's lender-of-last-resort (LOLR) support or on shifting costs to the deposit insurance system and other entities in the public sector.[13] To offset these implications, the central bank/government would have to refund to the banks the lost seigniorage profits. Banks' profit streams then would remain unchanged, as would the process of credit extension. Banks would continue to screen and select projects that receive financing before selling the loans on to the central bank or financing them with central bank funding. At no time would the central

[12]See BIS (2018, annex B) for an illustration of the associated changes in the balance sheets of banks, the central bank, and households.

[13]In addition, banks might lose monopoly rents if deposit markets are noncompetitive. This effect would be absent if, in the scenario with central bank funding for banks, that funding would be priced equally to the deposit funding that banks received prior to the regime change.

bank be in the business of directly extending credit to the "real" economy.

Effectively, the modified balance sheet structure of banks and the compensating transfers from the central bank/government would render explicit what is implicit in the current monetary system, namely the deposit insurance and LOLR guarantees provided by the central bank and the government sector.[14]

One might argue that the guarantees of the central bank and the public sector are much smaller than suggested above, because assistance is granted only occasionally and not for all deposits. But the current monetary system relies on the perception in the nonbank sector that inside money constitutes a secure claim on central bank money—a perception that benefits banks and their customers. The deposit insurance system and, more importantly, actual LOLR assistance in crisis times, bank supervision, and various other types of assurances by government foster this perception of a fixed exchange rate between inside money in the regulated banking sector and outside money.[15] Equivalence would require a transfer whose size corresponds to the market value of the guarantees and assurances.

3.3 Equivalence Proposition

I have argued that a substitution of outside for inside money subject to unchanged interest rates and accompanied by appropriate transfers leaves macroeconomic outcomes unaffected as far as aggregate balance sheets and money's means-of-payment function are concerned.[16] I have not argued, however, that this substitution is consistent with optimality on the part of the parties that issue money,

[14]There are parallels to public debt whose dominant component in many countries is implicit. See Auerbach, Gokhale, and Kotlikoff (1994) for a theoretically sound approach to measuring public debt.

[15]Tobin (1985, p. 24) appears to subscribe to the view that implicit guarantees are substantial. He states that "deposit insurance ... is a massive extension and delegation of the government's monetary fiat—a blank check, so to speak, which might be an enormous obligation in some contingencies." Similarly, King (2016) argues that central banks are condemned to provide liquidity assistance to banks in crisis. He seems to doubt, however, that the "alchemy" that runs through the financial system to transform maturities and liquidity is well understood.

[16]The prices of commodities, financial claims, and "liquidity" in the two equilibriums are the same as well.

namely the central bank and commercial banks (see section 4). The equivalence proposition suggested by the preceding discussion thus is a conditional one.

Let M denote a sequence of outside money supply; N_i a sequence of "unbacked" inside money supply by bank i; $\tilde{N}_i$ the portion of the latter sequence effectively used for payments; and L_i a sequence of other liabilities of bank i.[17]

PROPOSITION. *Consider an "initial" fiscal–monetary policy with outside money $M^\star$ that supports an equilibrium with unbacked inside money $\{N_i^\star\}_i$, of which $\{\tilde{N}_i^\star\}_i$ is used for payments; and other bank liabilities $\{L_i^\star\}_i$.*

- *Fix a balance sheet structure of banks that differs from the structure in the initial equilibrium as follows: Banks' reserves increase by $\{\tilde{N}_i^\star\}_i$; "nonreserve" assets fall correspondingly; and $\{N_i^\star\}_i$ and $\{L_i^\star\}_i$ remain unchanged. Alternatively, bank assets remain unchanged; $\{N_i^\star\}_i$ falls to $\{N_i^\star - \tilde{N}_i^\star\}_i$ and $\{L_i^\star\}_i$ increases to $\{L_i^\star + \tilde{N}_i^\star\}_i$. In either case, the part of "unbacked" inside money drops to zero.*
- *Consider a "new" fiscal–monetary policy with outside money $M^\star + \sum_i \tilde{N}_i^\star$, additional central bank assets $\sum_i \tilde{N}_i^\star$, and additional transfers from the government to banks and, possibly, between groups in the private sector. The transfers assure that, subject to the initial equilibrium prices and returns and given the new balance sheets, all groups in the private sector, including banks, generate the same after-tax incomes as in the initial equilibrium.*
- *Suppose that RFA perform the same payment functions for nonbanks as deposits.*

Then, the new policy implements an equilibrium in the nonbank private sector, conditional on the new bank balance sheets. The allocation and prices in this equilibrium coincide with the allocation and prices in the initial equilibrium.

[17] Without loss of generality we abstract from different types of other liabilities. Similarly, we abstract from heterogeneity within bank assets other than "nonreserves" versus reserves.

The key intuition for the result is that the choice sets of all agents in the nonbank private sector remain unchanged after the regime change. The equilibrium choices of these agents therefore remain equilibrium choices. In the following, I refer to the new policy that implements the equilibrium with the initial allocation as the *equivalent policy*.

Note that an immediate implication of the proposition is that the introduction of RFA is neutral. Note also that the result can be extended to cover stochastic environments. When $\tilde{N}_i^\star$ is stochastic, then it suffices for the maximum of $\sum_i \tilde{N}_i^\star$ over all states of nature to be converted into central bank money. Insurance contracts between banks, or a money market together with side payments, can take care of the allocation of central bank money among banks.

4. Non-equivalence

The result proposed in section 3 suggests three key conditions that have to be satisfied for equivalence to prevail and, thus, for a substitution of outside for inside money to have no macroeconomic consequences. One condition relates to information, the other two to incentives.

4.1 Information

On a fundamental level, money is a substitute for a public monitoring system—a recordkeeping device (Kocherlakota 1998). Since these records can be kept in a decentralized, bank-run system or in a centralized, central-bank-run system, the recordkeeping function per se does not undermine the equivalence claim. The acquisition of information, however, might be more difficult in a centralized system. When weighing whether to create inside money or not, banks base their decisions on "knowledge of the particular circumstances of time and place" (Hayek 1945); this knowledge could be difficult to convey in time to a central decisionmaker (the central bank) even if the latter had local agents that collected the information on its behalf.

Convincing as this reasoning appears at first sight, it depends on the assumption that price signals on functioning markets cannot

fully convey local information. But it is not clear why this should be the case with RFA. After all, a monetary system with RFA would not constitute a step toward an economy that does not respond to supply and demand shocks. Price signals from the (interbank) market for reserves would continue to communicate information to the central bank as they do today, and private agents would continue to be able to respond to these signals.[18]

If the information acquisition capacity of the economy nevertheless suffered with less inside money creation, how large would the effects be? It seems likely that the marginal loss of local knowledge would accelerate with an increasing substitution of outside for inside money that is, the information related cost of the substitution would be convex. A marginal substitution of RFA for inside money therefore would have minor macroeconomic implications.[19]

4.2 Bank Incentives

A general argument against the irrelevance of a firm's liability structure relates to the fact that this structure affects the incentives of owners or managers (for an overview, see Tirole 2006). Similarly, changes in the balance sheet structure of banks might undermine, or strengthen, incentives and this might affect the equilibrium allocation.

Most importantly, the incentives for banks to exert sufficient screening and monitoring efforts might suffer. A substitution of reserves for loans on the asset side of banks' balance sheets might give rise to an "originate-to-distribute" business model in which banks extend credit to nonbanks before selling the loan to the central bank. This might reduce incentives to carefully screen projects and could have important negative medium- and long-term effects on the economy's development. It could also affect the wealth distribution

[18] If RFA crowded out deposits, the interbank market for reserves might dry up. But other market participants would continue to trade reserves.

[19] If the convexity assumption were correct, it would imply that the information-processing capacity of an economy with inside money and some RFA significantly exceeded the capacity in an economy where inside money has been banned.

between the public and private sector (central bank versus commercial banks).[20]

How strong these effects would be, and whether they would indeed result in weaker incentives, is unclear. On the one hand, this would depend on the regulatory framework. After all, depositors do not currently play any meaningful monitoring role but rely on the efforts of public bodies such as the central bank, the banking supervisor, the deposit insurance agency, and the consumer protection agency. These actors would continue to be active in their present roles. Moreover, the central bank would have even stronger incentives than today to supervise banks' lending practices, as it would acquire (or accept as collateral) more bank loans than in the present system.[21]

On the other hand, the effect on incentives would depend on how banks responded to the new environment. For example, banks might seek nondeposit funding on capital markets rather than shedding "nonreserve" assets in order to retain or increase their loan market shares, and this could strengthen market-imposed discipline.

While there is a case to be made for changed incentives as a consequence of modified bank balance sheets, the implications are far from clear. What *is* clear, however, is that neutrality is not ruled out a priori. Consider, for instance, the case where the central bank provides funding to banks corresponding to their deposit outflows into RFA. If the central bank provided this funding subject to exactly the same conditions as those under which banks previously attracted deposit funding, then the market environment for banks would effectively be unchanged and, accordingly, their choices would not alter either (see Brunnermeier and Niepelt 2019). Note that this conclusion holds independently of whether deposit markets are competitive or not.

[20]Incentives would similarly be negatively affected if banks continued to keep the loans on their balance sheets and used them as collateral for central bank funding rather than financing their assets with deposits.

[21]The central bank might require additional resources to expand its supervisory activities.

4.3 Government Incentives

The equivalence proposition envisions an exogenous new fiscal–monetary policy. It thus abstracts from politico-economic frictions and assumes commitment. Both assumptions are unrealistic.

I have argued above that a neutral change of fiscal–monetary policy would render implicit government guarantees provided under the current monetary arrangement explicit. But it is unlikely that the beneficiaries of these guarantees, once made explicit, would continue to muster the same political support. In other words, the equivalent fiscal–monetary policy most likely would not be an equilibrium policy. In the new politico-economic equilibrium, the support by the central bank and other government bodies could rise or fall and, as a consequence, payment-related services could become cheaper or more expensive.

Which of these two outcomes would be more likely depends, among other factors, on the degree of competition in the banking system. When competition is intense, bank customers rather than shareholders benefit from the implicit subsidies under the current regime, and less opaqueness coupled with the political influence of, e.g., small and medium-sized enterprises might strengthen the political support for subsidies. When competition is mild, in contrast, such that the shareholders of banks are the major beneficiaries of central bank support, then it seems more likely that rendering that support explicit would weaken the political backing. As a consequence, payment-related services would become more expensive. This would be associated with lower distortions, however.

Non-equivalence could also arise for other reasons, specifically those related to lack of commitment (see Kydland and Prescott 1982). The equilibrium fiscal–monetary policy under the current policy regime with inside money *is* time consistent, by definition, and reflects the ex post incentive compatibility constraints faced by political decisionmakers. Private money creation puts the central bank at a second-mover disadvantage, effectively forcing it to serve as LOLR during liquidity crises to safeguard the payment system, or even as provider of bailout funds in solvency crises.[22]

[22]Liquidity and financial support for banks need not result in excess profits in the financial sector. Depending on the degree of competition, bank customers

An equivalent policy with more outside money that implements the same equilibrium allocation would imply a different time path of state variables—for instance, balance sheet positions—and this different time path would not necessarily satisfy the political incentive compatibility constraints. If it violated only one of the constraints, then the equivalent policy would not constitute an equilibrium policy. As a consequence, the envisioned regime change would not be neutral.[23]

Yet another source of potential non-equivalence concerns the central bank's asset management. As discussed previously, one type of equivalent fiscal–monetary policy involves central bank asset purchases from the banking sector but no direct interventions of the central bank in the process of credit allocation. That the central bank would find it politically feasible and ex post incentive compatible to restrain itself in this manner is questionable. More likely, an extension of the central bank balance sheet would lead policymakers to impose additional constraints on the central bank—for instance, to require the bank's investment policy to meet certain "ethical," "social," "ecological," or other standards. Credit extension would become more politicized, and this might change aggregate investment (see, for example, Kaminska 2017; Cecchetti and Schoenholtz 2018).

In conclusion, the political support for the equivalent fiscal–monetary policy would likely differ from the support that policy under the current regime enjoys. As a consequence, the equivalent policy would not be implemented in equilibrium. Without a formal model, it is difficult to gauge what the equilibrium policy in a regime with RFA would look like. But it appears likely that less opaqueness would give rise to reduced transfers and fewer distortions.[24] At the

may be the main beneficiaries. Nevertheless, such support distorts prices, with negative welfare implications.

[23]See Gonzalez-Eiras and Niepelt (2015) for an analysis of the conditions for equivalence of policy regimes and how these conditions relate to the evolution of state variables in politico-economic equilibrium.

[24]One might argue that distortions are minimized (maybe to the point that the ex ante optimal Ramsey (1927) policy becomes implementable) when inside money creation is completely outlawed, as proposed by the sovereign money movement. There is reason to be skeptical. Putting a complete stop to inside money creation would likely not be enforceable. Banks and their clients would

same time, political interference with the credit allocation process would likely increase.

5. Other Implications

In this section, I review common arguments in the debate on RFA against the background of the discussion in sections 3 and 4.

5.1 Financial Stability

Many commentators argue that the risk of bank runs—sudden withdrawals of deposits—could increase when bank customers have the option to convert deposits into RFA rather than just cash.[25] But this argument is difficult to reconcile with the analytical framework used so far; after all, the equivalence result states that the regime change does *not* affect the allocation, whether this allocation is state contingent or not. A common intuition based on partial equilibrium models in the spirit of Diamond and Dybvig (1983) does not apply, because the aggregate liquidity supply under the regime change in question is endogenous—the central bank's balance sheet expands when deposits migrate into RFA, whether this migration occurs slowly or rapidly.

When deposits in the current system are implicitly or explicitly guaranteed by the central bank, then there is no reason to run in the first place, and even if depositors do run, the macroeconomic consequences are minor, as the central bank steps in and the guarantees come to bear. The same mechanism would continue to operate under

search for, and find, ways to circumvent the legal prohibition and as a result, the central bank might completely lose control over the money supply. The equilibrium policy would become irrelevant.

A fundamental problem at the source of non-enforceability is the difficulty to define money and what it means to make a payment. "Moneyness" reflects social conventions. Suppose that deposits were outlawed but banks and their customers started to use other bank liabilities with limited price and credit risk as a means of payment. If this practice were outlawed as well, would it also be forbidden to exchange bank liabilities directly, or would that be considered a "payment"?

[25] RFA would not increase the risk of runs from one bank to another, as it would not affect the feasibility of transfers between deposit accounts. In the Single Euro Payments Area (SEPA), payments up to EUR 15,000 are executed within 10 seconds; see http://www.europeanpaymentscouncil.eu on the SEPA Instant Credit Transfer scheme.

the new regime, but on a smaller scale because some inside money would have been converted into outside money. In fact, after a complete substitution of RFA for deposits, bank runs would become impossible (Brunnermeier and Niepelt 2019).

However, since the discussion in section 3 abstracted from physical differences between electronic money and cash (because it only considered one type of outside money), the equivalence proposition may not fully apply to the issue of *differential* run risk for RFA as opposed to cash.[26] If such differential run risk exists, is it higher with RFA? One group of commentators suggests that this is the case (e.g., Tolle 2016). The basic idea is that with RFA it becomes easier to shift funds, and this increases the elasticity of deposit demand. Others are skeptical. Koning (2018), for instance, retorts that during a confidence crisis bank customers would no longer have to queue to withdraw cash, LOLR support would be provided much more quickly, and large cash holders would continue to shift funds into treasury bills, not into electronic central bank money. As a consequence, the risk of bank runs would decrease rather than increase.[27]

Sveriges Riksbank (2017, 2018) similarly expects the introduction of an e-krona to have limited effects on financial stability, as the Riksbank would continue to engage in the usual LOLR policies. It does see the risk, however, that the substitution of outside

[26]The discussion also abstracted from the fact that real-world deposit insurance schemes are capped; the systems may not be financially sound; and filing a claim is burdensome. Moreover, capital flight abroad offers investors another margin of adjustment. Under these circumstances, the equivalence result only holds if the various contingencies introduced by these features are reflected in contingent transfers between the private sector and the central bank.

[27]Koning (2018) argues that, in a world with digital currency, "in the event of a panic, customer redemption requests will be instantaneously granted by the bank facing the run. But that same speed also works in favor of the bank, since a request to the central bank for a top-up of digital currency could be filled in just a few seconds. Since all depositors get what they want when they want, no lineups are created. And so the viral nature of the panic is reduced. ... In a traditional economy where banknotes circulate, CFOs and the rich don't generally flee into paper money during a crisis, but into short-term t-bills. ... Likewise, in an economy where digital currency circulates, CFOs are unlikely to convert deposits into barren digital currency during stress, but will shift into t-bills. The upshot is that banks are not more susceptible to large deposit shifts thanks to the introduction of digital currency—they always were susceptible to digital bank runs thanks to the presence of short-term government debt."

for inside money could reduce bank profits and thereby affect banks' stability. This argument assumes that the hidden transfers present in the current system would no longer be present in a system where the central bank's guarantees are made explicit. As I argued in section 4, this is indeed likely.

Financial stability could also be affected if, in response to the regime change, banks deviated from the "equivalent" balance sheets and business practices that would prevail if the equivalence result fully applied. For example, if banks chose to seek more funding on bond markets, then this could subject them to increased run or rollover risk, with negative effects on financial stability. If, on the other hand, they relied more strongly or even exclusively on equity financing, effectively turning themselves into funds, then financial stability could be strengthened (see Kotlikoff and Goodman 2009; Kotlikoff 2010).

5.2 Credit

Many commentators also suggest that the substitution of outside for inside money could reduce the volume of credit, with important macroeconomic consequences for investment and growth. According to this argument, the fact that many banks rely on deposits to finance their assets suggests that less deposit funding would reduce the flow of credit extended by these banks.

This argument disregards both liability substitution and securitization: Deposits may be replaced by other forms of bank funding, and loans might be sold to investors—these two possibilities are exactly what the equivalence result suggests.[28] Under the assumptions underlying the equivalence result, banks continue to originate loans even when they have no, or less, deposit funding but they sell the loans to the central bank in exchange for reserves or they receive central bank financing as a substitute for deposits.

As discussed in section 4, the incentive effects of the modified bank balance sheets could lead banks to change their screening and

[28] Empirically, the relative importance of bank lending varies across developed economies, in spite of similar institutional environments. This suggests that capital market financing and bank lending indeed are partly substitutable as theoretical considerations imply.

monitoring efforts. But if lenders adopted an originate-to-distribute business model, they would likely ease credit standards and originate *more* rather than fewer loans. However, as also mentioned in section 4, political interference with the central bank's asset management or refinancing of bank loans could distort the credit allocation mechanism.

Another argument relates to collateral. When equivalence relies on banks receiving central bank funding as a substitute for lost deposits, then it is critical whether such central bank funding would require collateral. If collateral were scarce, then this could undermine equivalence. Even if banks were able to produce the necessary collateral, this would reduce the amount of collateral available to other private-sector agents (see, for example, Kaminska 2017; BIS 2018), again potentially undermining equivalence.

But should the central bank require collateral? According to the logic of the equivalence result, there is no need. The states of nature in which banks would not service their debts vis-à-vis the central bank would be the very states in which banks did not service their debts vis-à-vis depositors before the regime change and, thus, the very states in which under the equivalent policy the central bank receives transfers from the depositors. That is, the central bank would perfectly be hedged against possible losses from its new exposure to banks and there would be no need for additional collateral (Brunnermeier and Niepelt 2019).

5.3 Monetary Policy

According to the equivalence result, an equivalent fiscal–monetary policy *can* in principle be implemented. In line with this argument, Sveriges Riksbank (2017) expects limited effects on monetary policy (of the basic e-krona version) and Dyson and Meaning (2018) argue that "with careful design choices, a CBDC [central bank digital currency] need not be disruptive to the conduct of monetary policy."

As argued in section 4, however, it is questionable whether the equivalent policy would actually be chosen in politico-economic equilibrium. This is especially true if the introduction of RFA went hand in hand with another, inherently unrelated, regime change, namely

the abolition of cash or the imposition of restrictions or taxes on cash use.[29]

In the current regime, banks cannot lower the deposit rate significantly below zero without risking large-scale cash withdrawals and, thus, the stability of the institution. The effective lower bound on the deposit rate implies, in turn, an effective lower bound on the central bank's policy rate unless the central bank accepts a compression of the interest rate spread earned by financial institutions, with negative consequences for bank profitability and, potentially, financial stability. The introduction of RFA would change this bound. If RFA were non-interest bearing, the lower bound would rise because holding RFA is less costly for investors than holding (and insuring) cash. If RFA were interest bearing, in contrast, then this would relax or even abolish the lower bound if interest rates on RFA could be lowered below zero and cash use would be taxed or restricted. This would dramatically change the choice set of monetary policymakers and thereby undermine the equivalence result.

That the equilibrium policy under the new regime would alter the equilibrium allocation could be positive or negative. Bordo and Levin (2017) argue that interest on RFA (dependent on the state of the business cycle) in combination with cash use restrictions could "free" the economy from the lower bound and thereby allow monetary policy to focus on price rather than inflation stability (price-level targeting) and on implementing the Friedman (1969) rule. That is, Bordo and Levin (2017) emphasize the upside potential of more powerful Ramsey policies.[30] However, the more powerful monetary policy toolkit could also induce policymakers to overreach themselves and, as a consequence, act in a destabilizing rather than stabilizing manner. In addition, a more powerful monetary policy toolkit would bear the risk of increased political pressure on monetary policy and, thus, rising politicization of central banking.

[29]Goodfriend (2000), Kahn, McAndrews, and Roberds (2005), Buiter (2009a, 2009b), Kimball (2013), Kaminska (2014), Rogoff (2016), and McAndrews (2017), among others, discuss potential costs, benefits, and alternatives to restrictions on cash use.

[30]If RFA did not pay interest, then the effective lower bound would likely rise because holding RFA would dominate holding cash, which also is nominally risk free but less convenient.

5.4 Structural Changes

More generally, the introduction of RFA could give rise to many structural changes whose implications far exceed the scope of the equivalence result.[31] Maybe most importantly, RFA could affect competition in the banking sector. If, as argued by Drechsler, Savov, and Schnabl (2018), "market power allows banks to charge depositors a spread by paying deposit rates that are low and insensitive to market rates," then granting the general public access to reserves would likely increase the efficiency of financial intermediation and the efficacy of monetary policy.[32] However, RFA could also lead to reduced variety in payment solutions when the greater role played by outside money leads the government to demand more standardization. And depending on banks' responses to their changed funding situation, consolidation in the banking sector might increase further, undermining competition.

RFA might also affect the resiliency of the payment system.[33] Under the current regime, consolidation and system integration (due to economies of scale) enhance the system's technological fragility (BIS 2018). The introduction of a parallel payment system accompanying RFA could counteract that trend and offer significant gains from diversification. It goes without saying that the abolition of cash would be counterproductive from a resilience point of view.

Still other arguments relate to financial inclusion or government oversight over the payment system (see, for example, BIS 2018). Moreover, RFA could help reduce tax distortions if the regime change were accompanied by a reduction of (tax-funded) deposit insurance schemes and bailouts.

Last but not least, the introduction of RFA would end what appears to be an awkward situation in countries where the government prohibits citizens from using cash—the only legal tender accessible to the general public—for larger transactions, thereby

[31] See also the contributions in the special issue of the Sveriges Riksbank's *Economic Review* (2018:3) on the e-krona.

[32] According to BIS (2018), interest-paying RFA would have an impact on the transmission of policy rates.

[33] Of course, other interventions which are not related to RFA may also affect, and improve, resiliency.

essentially forcing them to use privately issued money instead.[34] Opening the central bank's balance sheet to the public would constitute a more liberal approach than restricting access to financial institutions.

6. Conclusion

The proposal to issue digital central bank money for use by the general public (Reserves for All—RFA) seems to divide the opinions of finance practitioners and central bank representatives.[35] A typical line of argument put forward by the skeptics emphasizes that the traditional approach has served the public and the financial system well, and that RFA could have disruptive effects. But the "traditional approach" has evolved over the years and will continue to evolve; and in the absence of a clear counterfactual, it is difficult to assess whether it really has worked "well."

I have argued in this paper that from a macroeconomic point of view, RFA need not have disruptive effects. However, the conditions for an introduction of RFA to be neutral are restrictive and unlikely to be satisfied in real-world settings. Macroeconomic consequences of RFA might well occur in other areas or have different signs than what is typically suggested. For example, RFA could *increase* the incentive to extend credit but might *reduce* run risk. Moreover, RFA would likely change the political support for the implicit financial assistance that banks and their customers enjoy under the current regime. This suggests that the discussion about digital central bank money could benefit from well-articulated, coherent formal models that clarify equivalence relations as well as sources of non-equivalence. This paper as well as the formal analysis in Brunnermeier and Niepelt (2019) offer steps in that direction.

[34] See Sveriges Riksbank (2017, 2018) on the role of cash as legal tender, and how this role is increasingly undermined by contracts and exceptions.

[35] For a recent cautionary view, see Fatás and Weder di Mauro (2018). For a more optimistic assessment, see Dyson and Meaning (2018).

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