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The fragile triangle: Price stability, bank regulation and central bank reserves

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ABSTRACT

We outline how bank regulation and central bank reserves affect bank money creation, and how an examination of this link can contribute to the understanding of inflation risks. We suggest that as the tightening of bank capital regulation has come to an end and as banks maintain large central bank reserves, inflation risks are generally higher than currently assumed. While paying interest on reserves may be the easy solution, renouncing such payments, slowly reversing asset purchases, and setting temporary reserve requirements would make central bank reserves scarce again – with better monitoring incentives for banks and stronger mitigation of inflation risks.

1 Introduction

Identifying the drivers of inflation is a fundamental aspect of decision-making by market participants. It is also a key factor for central bankers when deciding about monetary policy. In this paper, we outline how bank regulation and central bank reserves affect money creation by banks, and what an understanding of this link can contribute to the formation of expectations about inflation risks.

We explore this link for three reasons. First, based on a long tradition in monetary theory, recent conceptual research suggests that this link should be part of the devices we use to think about a monetary economy.

Second, after a period in which bank capital requirements have been tightened, this process now appears to be coming to a provisional end. Together with the fact that banks hold large central bank reserves, this could, in principle, trigger major, continuing bank money growth with inflation risks. Hence, guaranteeing price stability in the presence of constant bank capital requirements and large central bank reserves is possible but will remain difficult. What we have here is a fragile triangle.

¹ This is a much extended policy brief based on the column “Another Disinflationary Force Vanishes: The Tightening of Bank Equity Capital Regulation” published on www.voxeu.org on February 10, 2021. We are grateful to Markus Althanns, Florian Böser, Hugo van Buggenum, Chiara Colesanti Senni, Charles Goodhart, Martin Hellwig, and Sebastian Zelzner for their helpful comments.

Third, there has recently been much debate about whether inflation — possibly even high inflation — is likely to return after the COVID-19 pandemic.² Many economists, such as Blanchard (2020), doubt this eventuality, as pandemic-driven uncertainty may for instance keep precautionary savings high and investment demand low. In the case of the US economy, Ball et al. (2021) argue that the risk of an inflationary spiral is low if fiscal expansion is temporary in nature and central bank policies are based on clear communication.³ However, the recent book by Goodhart and Pradhan (2020) paints a very different picture, suggesting that demographic developments such as the shrinking working-age population in China may trigger the return of inflation, with a vengeance.

As a contribution to this debate, we point out that the end of the tightening of bank capital regulation — in conjunction with the large reserves banks hold at central banks — poses an inflation risk that is left out of account in most studies. In a nutshell, the argument runs as follows: To start with, the financial crisis of 2007/2009 showed that banks were not well-capitalised enough to survive times of serious hardship. Bank regulators were urged to take action and so enforced stricter capital regulation after the crisis.

Why tighter capital requirements have acted as a disinflationary force over the last decade stems from two considerations. On the one hand, bank money creation in the form of deposit issuance is the flip side of banks' investment activities (i.e., loan financing and asset purchases). On the other, the tightening of bank capital regulation has resulted in banks reducing investment activities rather than issuing new equity to maintain their potential for investments and money creation, as bank equity has proved to be quite a sticky affair. Thus, stricter capital requirements have put downward pressure on bank money creation.

Our argument is consistent with the fact that since 2007/2009, the reaction of broad money supply was only a weak reaction to the enormous expansion of the monetary base. The strong increase in liquidity in the banking system through the expansion of central bank reserves did not translate into comparable strong money creation. Moreover, inflation remained persistently below the target postulated by the respective central banks. As we set out in Section 3, there are several reasons why this development took place. We suggest that tightening bank capital regulation is one of them.

As the strengthening of capital requirements now seems to be coming to an end, we can expect banks to have greater potential to engage in investments and private money creation. This effect is particularly relevant as potential liquidity constraints for money creation by banks are currently weakened by large reserve balances at central banks. Once economies return to normal, stable bank capital regulation and large central bank reserves may considerably revive the banks' appetite for a stronger expansion of their investment activities. In particular, small increases in bank equity funding, or situations where banks are already beyond regulatory bank equity requirements, would allow banks to considerably increase investments and asset purchases financed with bank deposits. In turn - together with negative supply shocks - this could tend to contribute to a weakening of the anchor for inflation expectations and to an upward pressure on inflation.

² See e.g. Blanchard and Pisani-Ferry (2020), Garicano et al. (2020), Miles and Scott (2020), and Rehn (2021).

³ Bonam and Smádu (2021) discuss what we can learn from past pandemics with regard to inflation dynamics.

We discuss potential remedies that might weaken the banks' incentives for strong money creation and, ultimately, mitigate the inflation risks associated with them. In particular, we inquire whether a reduction of central bank reserves, interest payments on reserves, or refraining from interest payments on reserves, coupled with liquidity regulation, can mitigate these risks.

Of course, the aim of this paper is only to outline the main line of argument, supported by some key facts. Thorough further conceptual and empirical work is needed to achieve a comprehensive assessment.

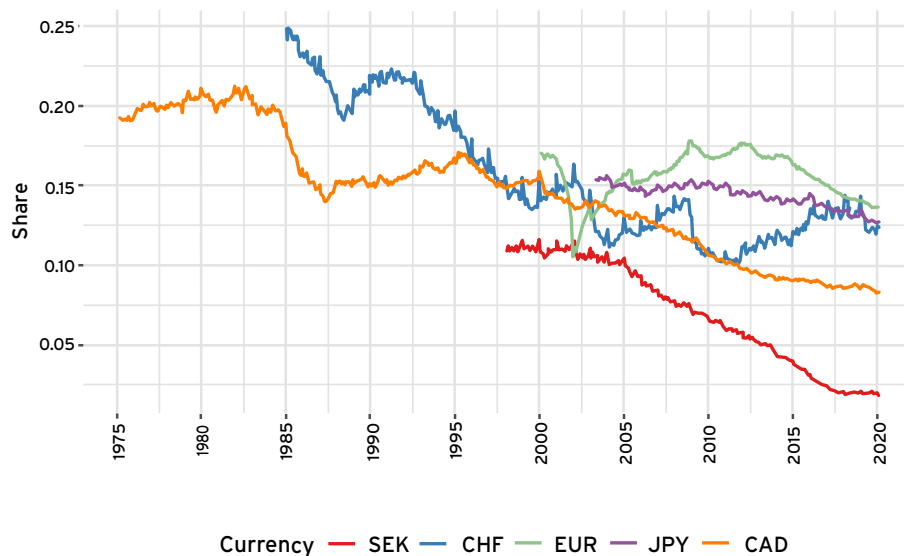
The remainder of the paper is organised as follows: In Section 2, we review the conceptual foundation of the current monetary system and outline how both bank regulation and central bank reserves can affect money creation by banks. In Section 3, we discuss the evolution of central bank reserves and money aggregates over the last fifteen years. In Section 4, we describe the evolution of bank regulation over the same period and outline the banks' reaction to the tightening of bank regulation, with particular reference to the stickiness of bank equity. From these observations, we conclude that bank capital regulation has acted as a disinflationary force. In Section 5, we discuss remedies that can be applied if the triangle — price stability, bank regulation, and central bank reserves — becomes more fragile.

2 Bank Money Creation: The Link between Inflation, Bank-capital Regulation, and Central Bank Reserves

2.1 OUR CURRENT MONETARY SYSTEM

In many modern economies, bank deposits are the predominant form of money available to the public. For instance, considering the narrowest monetary aggregate M1 for Sweden, Switzerland, the Euro Area, Japan, and Canada, we find that during the last two decades the share of cash has been historically low, never exceeding 20% (see Figure 1).

Figure 1 Share of cash in the narrowest monetary aggregate M1 for Sweden, Switzerland, the Euro Area, Japan, and Canada



Sources: European Central Bank, Bank of Canada, Bank of Japan, Sveriges Riksbank, Swiss National Bank; as of 07/04/2020

Hence, bank money creation in the form of deposit issuance is a fundamental element of our current monetary system and understanding the process of money creation by banks is important to properly assess the development of prices in the economy. We start from the current monetary architecture, which is organised hierarchically as private money creation necessitates public money creation (e.g., Faure and Gersbach 2021, and Hellwig 2018). Specifically, we have the following four pillars:

- The central bank issues cash in the form of banknotes and coins (physical central bank money), which serve as legal tender, and reserves (electronic central bank money).
- Commercial banks have the right to issue deposits when they grant loans or purchase assets. Deposits are claims on cash, so that deposit withdrawals are met with banknotes and coins. The money created by banks is called “bank money”. Bank money is continuously destroyed, e.g. when firms pay back bank loans.
- Interbank liabilities, e.g. deriving from interbank deposit flows created through payments in the economy, are settled with reserves to which only commercial banks have access.
- Commercial banks face a set of rules, such as capital or liquidity requirements, that ultimately limit the potential for investment activities and deposit issuance.⁴

The amount of bank money created and destroyed in this system and the forces steering bank money creation toward socially desirable levels is the subject of enduring academic debate.⁵ We next give a simple account of the way in which monetary policy can affect money creation. Then we examine the subtle link between bank regulation and money creation.

2.2 MONETARY POLICY

Monetary policy — the pricing, organisation, and execution of the provision of public money (cash and reserves) — has a direct influence on the banks’ willingness to issue deposits. While cash is needed to meet deposit withdrawals, reserves are needed to settle interbank liabilities following, say, from deposit transfers between banks. Thus, the less readily available, or the more costly, cash and reserves are for banks, the less attractive it is for them to finance new investments with deposits. Accordingly, the terms and conditions under which banks can borrow public money from the central bank, such as the interest rate or collateral requirements for reserve loans, play a central role in the decision of banks to issue deposits.

Two straightforward examples illustrate the importance of public money, in the form of cash and reserves, for the banks’ decision to engage in private money creation. Full-fledged general equilibrium models with money creation by banks can be found in Faure and Gersbach (2021) or Böser and Gersbach (2021).

In both examples we consider a bank that only grants loans L and is funded with deposits D and equity E . This bank decides to grant additional loan financing Δ , which also increases the bank’s deposit funding by the amount Δ .

⁴ In practice, of course, the monetary system has many more elements and the way the central bank implements its monetary policy requires subtle distinction. Also, it has changed since the financial crisis, as the system now operates with ample central bank reserves. An overview of the Fed’s current monetary policy tools is given in Ihrig et al. (2021) and Ryan and Whelan (2021). Hellwig (2018) provides a comprehensive analysis of today’s monetary system.

⁵ It has been the subject, for instance, of the discussions emerging from Gurley and Shaw (1960) and Tobin (1963) and many other contributions since then. The historical literature is discussed in Jakab and Kumhof (2015).

Example 1

First, we illustrate the need for reserves to settle interbank liabilities, which follows directly from the fact that the bank relies on deposit funding and deposits can be transferred among banks. For simplicity, we suppose that the deposit transfers — and thus the interbank liabilities — scale with the deposit funding. Therefore, the bank's demand for central bank reserves which can be borrowed via loans L^{CB} from the central bank grows with additional loan financing if the new loans are funded through the issuance of deposits. Formally, as illustrated in Figure 2, we assume that the bank holds the minimum amount of reserves $L^{CB} = R = \alpha D$, with $\alpha > 0$ required for the settlement of liabilities with other banks. Extending loan financing by amount Δ then also leads to an increase of the necessary reserves by amount $\alpha\Delta$ which has to be borrowed from the central bank.

Figure 2 Bank balance sheets with new loan financing and deposit transfers

Bank		=>	Bank	
Reserves R	CB Loans L^{CB}		Reserves $R+\alpha\Delta$	CB Loans $L^{CB}+\alpha\Delta$
Loans L	Deposits D		Loans $L+\Delta$	Deposits $D+\Delta$
	Equity E			Equity E

Example 2

Second, the bank must be prepared to accommodate cash deposit withdrawals in the form of banknotes and coins. Similar to reserves, cash can be borrowed from the central bank. Again, for simplicity, we say that the demand for cash on the side of the bank scales linearly with the amount of deposit funding. The bank's demand for cash then increases with additional loan financing if the latter is funded through the issuance of deposits. Formally, as illustrated in Figure 3, we assume that the bank holds the minimum amount of cash $L^{CB} = C = \beta D$, with $\beta > 0$ required to meet deposit withdrawals.

As we have seen in this section, private money creation by commercial banks requires public money creation by the central bank. Thus, monetary policy affects the banks' willingness to issue deposits through the terms and conditions governing the provision of cash and reserves. Due to the direct link between banks' investment activities and money creation, bank regulation can also affect the banks' incentives — or even their ability — to create money. We discuss this in the next subsection.

Figure 3 Bank balance sheets with new loan financing and deposit withdrawals

Bank		=>	Bank	
Cash C	CB Loans L^{CB}		Cash $C+\beta\Delta$	CB Loans $L^{CB}+\beta\Delta$
Loans L	Deposits D		Loans $L+\Delta$	Deposits $D+\Delta$
	Equity E			Equity E

2.3 Bank regulation

Typically, bank regulation is discussed in the context (a) of banks' risk-taking incentives and (b) of financial stability considerations.⁶ However, bank regulation also affects bank money creation by discouraging, or even restricting, new activities such as granting loans and purchasing assets from the private sector. Regulatory unweighted capital requirements, for example, limit banks' leverage and thus restrict, for a given

⁶ For a foundation of banking regulation for these purposes from a general equilibrium perspective, see Gersbach et al. (2015) and Gersbach and Rochet (2017).

equity financing of banks, the possibilities for engaging in new investment activities. Without new equity issuance, a tightening of bank-capital regulation will reduce the banks' opportunities for loan financing and asset purchases, and thus for bank money creation. Faure and Gersbach (2021) and Böser and Gersbach (2021) show analytically how capital requirements constrain money creation once bank equity is set or if it only changes slowly. This is illustrated again by two simple examples.

Example 3

Consider the same bank as before, which only grants loans L and is funded with deposits D and equity E . This bank decides to grant additional loan financing Δ , which leads to the creation of new deposits of the same amount. Accordingly, the bank's loan assets and the bank's deposit funding both grow by amount Δ . With the new loan financing activity of the bank, the money supply in the economy also increases, viz. by amount Δ . As the bank's balance sheet expands, but equity financing remains constant, the bank is operating under a greater leverage than before. Specifically, the bank's leverage increases from $\phi = L/E$ to $\phi = (L + \Delta)/E$, as illustrated in Figure 4.

If bank regulators impose capital requirements, this will lead to an upper bound for bank leverage, which we denote by ϕ^R . As for given equity financing the bank's activities must comply with the regulatory capital requirements (i.e., $\phi \leq \phi^R$), bank-capital regulation will impose a limit on the level of bank investments and thus on deposit issuance.

Figure 4 Bank balance sheets with new loan financing but without equity issuance

Bank	=>	Bank
Loans L		Loans $L+\Delta$
Deposits D		Deposits $D+\Delta$
Equity E		Equity E

Example 4

How additional equity issuance increases the scope for bank money creation is shown by a modified version of the previous example. Assume that the bank in question issues new equity of the amount of Δ and grants additional loan financing $x\Delta$ ($x > 1$), as illustrated in Figure 5. If bank deposits are the only medium of exchange in the economy and only depositors of the bank in question purchase the new equity shares, the overall stock of money in the economy will then increase by $(x - 1)\Delta$. Equity issuance reduces the money stock by Δ and new loans increase it by $x\Delta$. Based on the banks' equity issuance and loan financing, initial bank leverage $\phi = L/E$ changes to $\phi = (L + x\Delta)/(E + \Delta)$. Simple calculations indicate that the initial leverage can be maintained if additional loan financing is such that $x = L/E$.

Figure 5 Bank balance sheets with new loan financing and equity issuance

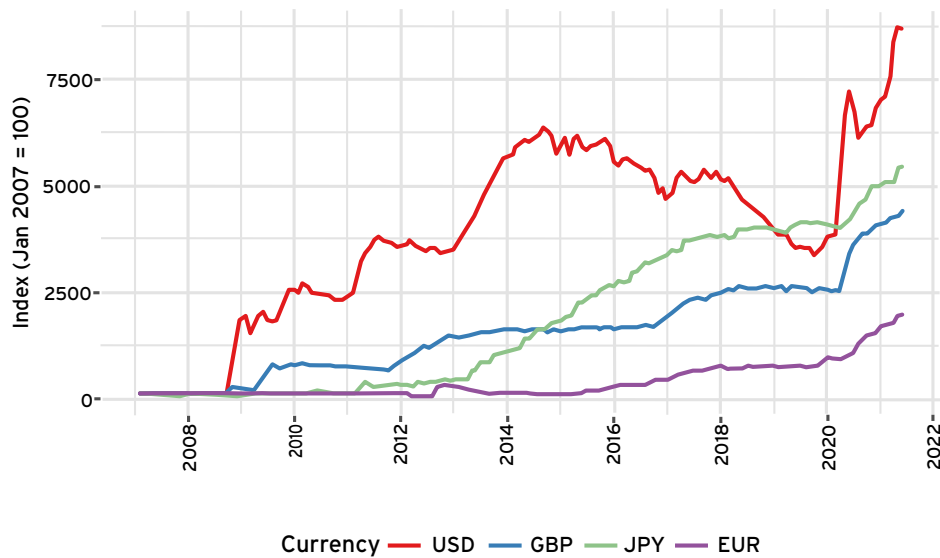
Bank	=>	Bank
Loans L		Loans $L+x\Delta$
Deposits D		Deposits $D+(x-1)\Delta$
Equity E		Equity $E+\Delta$

The last two examples illustrate the fact that bank regulation can — but need not — constrain bank money creation. Specifically, if banks can (and want to) issue new equity, they can always maintain their potential for new investments and deposit issuance.

3. Monetary Policy in Retrospect

Since the financial crisis of 2007/2009, central bank reserves of the banking systems in many currency areas such as the Euro Area have been rising strongly, albeit to different degrees and not always monotonically. Expansive monetary policies, in the form of exceptional liquidity assistance, large-scale asset purchases (so-called “Quantitative Easing”) or massive interventions in foreign exchange markets, entailed that banks are now maintaining large reserve balances at central banks. The measures adopted by central banks in the COVID-19 pandemic have led to a further increase in the level of central bank reserves as shown in Figure 6.

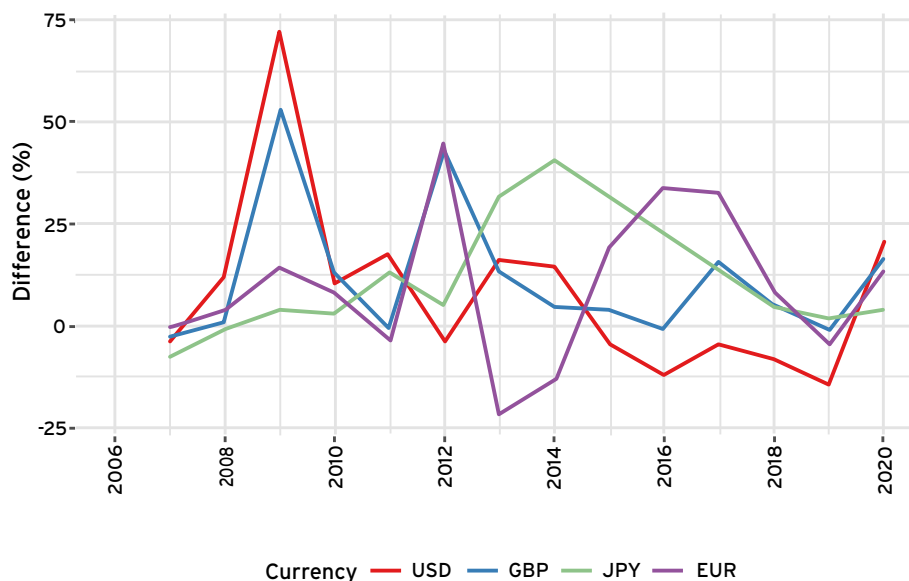
Figure 6 Total reserve balances maintained by private banks at the Federal Reserve Banks (USD), the Bank of England (GBP), the Bank of Japan (JPY), and the European Central Bank (EUR)



Sources: Bank of Japan, Bank of England, European Central Bank, Federal Reserve; as of 17/06/2021

In principle, large central bank reserves reduce the banks’ concerns about liquidity shortages as they can now settle interbank liabilities (e.g., following from deposit outflows or reduction of borrowing from other banks), meet deposit withdrawals (when converted into cash), or compensate a reduction of other funding possibilities more easily. In the absence of other constraints, large reserve balances at the central bank allow banks to strongly increase lending and asset purchases while funding these investments through deposit issuance. With large central bank reserves, the amount of money (in terms of M_1 , M_2 , M_3) could, in principle, increase strongly. However, since the financial crisis of 2007/2009, the monetary base multiplier, which relates the broad money stock to the monetary base, has decreased significantly in many countries. On average, as displayed in Figure 7, the monetary aggregates have been increasing at a much lower rate than the monetary base. Furthermore, for many countries, inflation has persistently deviated downward from the target set by the respective central bank in the aftermath of the financial crisis in 2007/2009.

Figure 7 Difference between M0 growth rate and M3 growth rate for the United States, United Kingdom, Japan, and Euro Area



Sources: Bank of Japan, Bank of England, European Central Bank, Federal Reserve; as of 17/06/2021

The reasons why the money stock grew at a much lower rate than the monetary base are manifold. Debt-overhang problems and other structural changes may have lowered the profitability of loan financing and deposit issuance. In general, however, it is difficult to assess whether the weakness in bank loan and deposit creation was driven by demand or supply; for an assessment, see Mian and Sufi (2018). Furthermore, central banks, for instance the Federal Reserve, started to pay interest rates on reserves, which provided incentives for banks to use reserves as a safe financial investment rather than for the expansion of loan financing and deposit creation.⁷ We argue that the tightening of bank capital regulation in the years after the financial crisis of 2007/2009 may have contributed to this. The next section fills in the details.

4 The Disinflationary Force of Bank Capital Regulation after the Financial Crisis 2007/2009

Of course, as the last decades have shown, the relation between the growth of bank money and inflation is unstable and depends on the macroeconomic environment. The dominating New Keynesian framework to design and examine monetary policy does not even consider bank money creation.⁸ On the one extreme, in a liquidity trap and when market participants use bank deposits significantly as a saving instrument in a low interest environment, or if output is quite below potential output, higher bank money creation has little or no effect on inflation.⁹ The same happens if there are strong complementary disinflationary forces, as at the beginning of the COVID-19 pandemic. On the other hand, when these circumstances are not present, or not present anymore, permanently stronger bank money creation will have inflationary consequences, in particular if it happens jointly with negative supply shocks.

⁷ Since a large amount of these reserves originated from asset purchases of central banks via the banking system, some of the reserves may have been unwanted reserves (see Ryan and Whelan 2021). These authors also present a micro-simulation model to explain the low money multiplier.

⁸ See Clarida et al. (1999), Woodford (2003) for the foundations and recent work of Gersbach et al. (2021) on forward guidance in this framework.

⁹ Since commercial bank money may also be interpreted as a form of asset-backed money, higher bank money creation may even be disinflationary (see Andolfatto et al. 2016 and van Buggenum 2021).

Based on our previous reasoning, we argue that the strengthening of capital requirements in the years after the financial crisis of 2007/2009 also acted as a disinflationary force. In particular, higher capital requirements and sticky bank equity have jointly contributed to moderate bank money creation despite ample central bank reserves, as otherwise, banks would have had difficulties fulfilling capital requirements. These two forces most likely had a dampening effect on inflation.¹⁰ The issuance of a significant amount of new equity, however, would have enabled banks to maintain their potential for new investments funded through deposit issuance and would have led to fewer dampening effects from inflation.

In the following, we present facts for the tightening of bank capital regulation over the last decade and the stickiness of bank equity. Figures 8, 9, and 10 show that in the years since the financial crisis 2007/2009, bank regulators have enforced stricter risk-based capital requirements and leverage ratios. In addition, bank equity has been quite sticky. This has been demonstrated in several papers, such as Coimbra and Rey (2017) and Boyarchenko and Mueller (2019), and is illustrated in Figure 11.

This empirical observation is in line with the theoretical literature on bank equity issuance. From the owner perspective of a bank, there are significant costs associated with the issuance of new equity, as existing shareholders may, for example, oppose the dilution of their shares.¹¹ A sizeable body of theoretical literature addresses bank capital structure decisions, the way they are impacted by regulatory requirements (see e.g. Gersbach et al. 2015), and the way these models can provide quantitative assessments of debt and equity issuance (see e.g. Hugonnier and Morellec 2017). It is unlikely that the barriers to new equity issuance will change significantly after the COVID-19 pandemic. Thus, as the tightening of capital requirements seems to be coming to an end, the disinflationary force of bank capital regulation will vanish. We cannot rely on it after the pandemic.

Figure 8 Initial Basel III Tier 1 risk-based capital ratio (by region)

Consistent sample of G-SIBs, weighted average



Note: The graph shows the fully phased-in initial Basel III framework up to and including end-2018 and the actual framework in place for end June 2019

Note: see Financial Stability Board (2020)

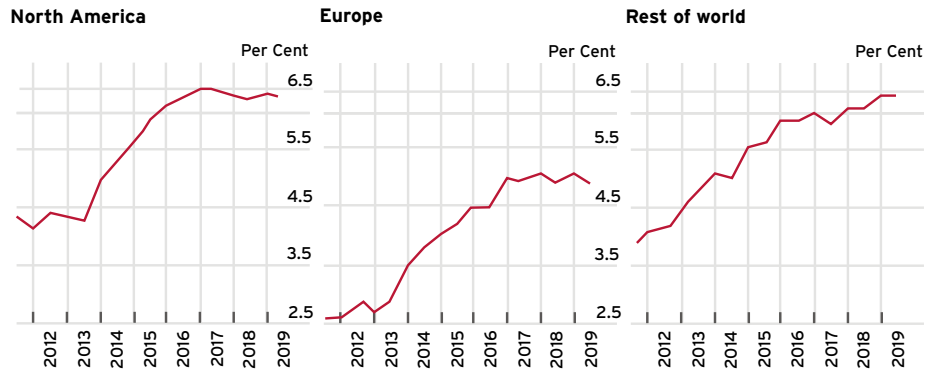
Source: Basel Committee on Banking Supervision

¹⁰ These two forces may also have had a slightly negative effect on aggregate supply.

¹¹ For empirical evidence, see Goetz et al. (2020).

Figure 9 Fully phased-in final Basel III leverage ratio (by region)

Consistent sample of G-SIBs, weighted average

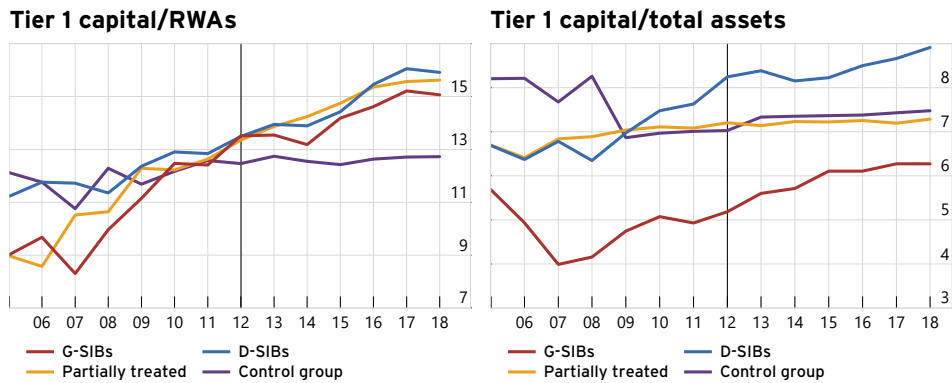


Note: Data points from H1 2011 to H2 2012 use the original (2010) definition of the leverage ratio. Data points from H1 2013 to H1 2017 use the 2014 definition of the leverage ratio. The data points for H1 2013 use an approximation for the initial definition of the Basel III leverage ratio exposure where gross instead of adjusted gross securities financing transaction values are used. Data points from H2 2017 onwards use the final definition of the leverage ratio to the extent data are available.

Note: see Financial Stability Board (2020)

Source: Basel Committee on Banking Supervision

Figure 10 Evolution of risk-weighted and unweighted capital ratios for banks



Notes: The chart illustrates how risk-weighted and unweighted capital ratios have evolved for D-SIBs, G-SIBs, partially-treated banks (banks that are neither G-SIBs nor D-SIBs but have one of the following three TBTF characteristics as documented by member authorities: some HLA requirements, some recovery and resolution requirements and some TLAC requirements), and banks in the control group. All banks above a size threshold of USD10bn applied. RWAs: risk-weighted assets

Note: see Financial Stability Board (2020)

Source: SNL

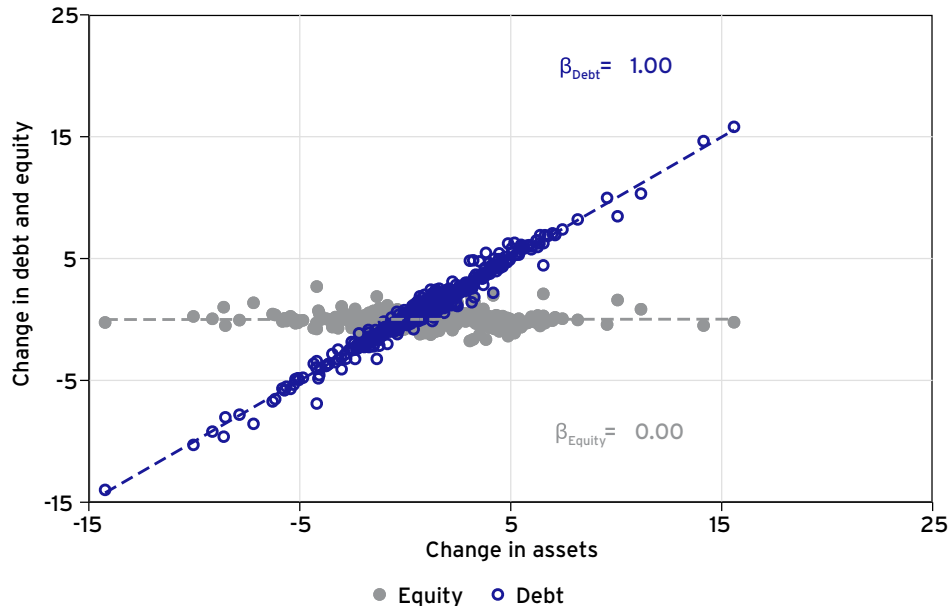
5 Remedies

The above arguments show that when the tightening of bank equity regulation comes to an end, we may have to worry about banks holding large reserves — and worry more than we did before. In particular, banks are less constrained by capital requirements when deciding about new investment activities and deposit issuance. Notably, small increases in bank equity funding, or situations where banks are far beyond regulatory bank equity requirements, will allow banks to increase investments and asset purchases financed with bank deposits considerably, if these investments are expected to be profitable.

In restricting the banks' appetite for money creation, liquidity requirements may play a more important role than in the years after the financial crisis of 2007/2009. However, as banks maintain large reserve balances at central banks, it will be necessary to find effective liquidity constraints for banks. In the following, we outline three

potential remedies that could reduce the risk of banks engaging strongly in money creation, if capital regulation is not further strengthened and thus can no longer exert disinflationary pressure.¹²

Figure 11 Relationship between year-over-year changes in total assets, total liabilities, and total financial equity for monetary financial institutions (including the monetary authority and central banks sector)



Source: see “Corporate Credit Provision” (Boyarchenko and Mueller 2019)

5.1 Reduction of reserve balances

To incentivise banks to refrain from exacerbated money creation, central banks can start by halting and slowly reversing the unconventional measures adopted, such as large-scale asset purchases. Selling previously acquired assets would reduce the reserve balances that banks maintain at central banks. Over time, it would thus again become important for banks to borrow additional liquidity in the form of reserves and cash from the central bank to settle interbank liabilities and meet deposit withdrawals.

Central banks’ willingness to reduce reserve balances by selling assets may depend on whether inflation and economic activity rise jointly. Should inflation return while economic activity remains sluggish, central banks would face a trade-off and might decide not to reverse their unconventional policy measures as this might counteract other objectives, such as keeping long-term interest rates at low levels, maintaining financial stability, or devaluing their own currency. Nevertheless, new assessments highlight the dangers of continuing asset purchases, as this may cause future problems in terms of inflation or threaten central bank independence, with no major current benefit in terms of economic growth and employment, for instance (see e.g. House of Lords Economic Affairs Committee 2019).

¹² Of course, the use of the remedies will also depend on the central bank’s interest rate policy and vice versa (to a certain extent).

5.2 Paying interest on reserves

Paying interest on reserves would also help to control bank money creation. Since, at the moment, the interest on holding reserves is close to zero at the Federal Reserve, and zero or even negative at other central banks, this solution is less relevant today. However, if the economies return to higher interest rates, this issue will become important again.

One argument in favour of interest payments on reserve deposits is the famous efficiency argument contending that otherwise, banks will face opportunity costs for holding central bank reserves (see Tolley 1957 and Friedman 1960). More importantly, such interest payments are another way of incentivising banks to refrain from extensive money creation. With interest on reserves, banks will be motivated to hold reserve deposits at central banks as an asset, instead of using reserves solely for operational purposes, such as the settlement of interbank liabilities when they expand loan financing, or asset purchases and corresponding money creation.¹³ In other words, from a commercial bank's perspective, interest-bearing reserves compete with other assets like loans and bonds, for instance. In principle, central banks can steer bank money creation, and ultimately inflation, through an appropriate interest rate on reserve deposits. For instance, Hall and Reis (2016) propose various interest rate schedules on central bank reserves that can be adopted by central banks to control inflation.

However, paying interest on reserve deposits raises several delicate issues. First, it will continuously increase both the stock of reserves and the interest paid on it. Hence, this strategy may lead into a trap, ultimately making it difficult to control bank money creation by banks if the profitability of loans and returns on other assets recovers sufficiently. For instance, small errors in setting the interest rate on reserves may cause large changes in money creation, or avoiding inflation through paying interest rates on reserves may conflict with setting short-term interest rates to stabilise demand or supply shocks. Finally, if the central bank makes large losses on its assets and lacks fiscal backing, the growth trend on reserves may become permanent and would weaken the low inflation expectation anchor.

Second, interest payments on reserve deposits, which are the central bank's liabilities, increase the government's debt burden and reduce seignorage (see Goodhart 2021). More specifically, interest-bearing reserves decrease the taxpayers' claim on central bank profits to the benefit of private banks.

Third, our current research (Böser and Gersbach 2021) shows how monetary policy may also play an important role with regard to banks' monitoring activities. In times of tight reserve balances, collateral requirements in central bank lending facilities can improve monitoring incentives beyond standard capital requirements. This is called the "collateral leverage channel". Based on the collateral leverage channel, a monetary policy that keeps central bank reserves at low levels may be essential in incentivising banks to monitor borrowers properly.¹⁴ Hence, a monetary policy leading to large central bank reserves can undermine the banks' incentives to monitor borrowers.

A fundamental question is thus whether there are better options than interest payments on reserves to limit money creation by banks.

¹³ Of course, banks always want to hold some level of reserves to deal with uncertainties in reserve inflows and outflows.

¹⁴ Other issues pertaining to interest payments on reserves are discussed in Ireland (2019).

5.3 No interest rates on reserves and liquidity regulations

If central banks do not pay interest on reserves once we return to normal times, commercial banks will have even stronger and more immediate incentives to use reserves for operational purposes, such as settling interbank liabilities, which increase with deposit-financed loans and asset purchases. As a consequence, money creation may become excessive and significant inflation risk would arise. To avoid such a rise of inflation when interest payments on reserves are abolished, central banks must apply other measures, at least until the monetary system operates with significantly less reserves. On the one hand, they could reverse their unconventional measures, but a fast reversal might be problematic if selling some of the previously acquired assets conflicts with other monetary policy objectives, as discussed above. On the other hand, central banks could introduce liquidity constraints for banks by imposing sufficiently high reserve requirements as a complementary measure, for instance.

We note that liquidity regulation is also part of bank regulation. Since the financial crisis of 2007/2009, new types of liquidity regulation have been developed and implemented. Prominent examples are the Net Stable Funding Ratio (NSFR) and the Liquidity Coverage Ratio (LCR), which both require banks to hold more liquid assets, such as central bank reserves. While the NSFR aims to limit maturity transformation by matching the term structure of assets and liabilities, the LCR requires banks to prepare for times of hardship entailing major liquidity needs by holding a sufficient amount of liquid assets. As these liquidity regulations are being implemented, the coming years will show the extent to which they de facto tighten liquidity constraints on banks and to which they can act as a substitute for (missing) liquidity constraints originating from collateral requirements in central bank lending facilities.

5.4 Note on remedies

Note that the first remedy — reduction of central bank reserves — can be combined with the second and the third. Which of the three potential remedies — or feasible combinations thereof — is most likely to mitigate inflation risks is not obvious a priori and depends on how strong the recovery from the pandemic will be. While continuing to pay interest on reserves appears to be the easiest solution, going through a sequence of measures — stopping the payment of interest on reserves, slowly reversing asset purchases, temporarily imposing stronger reserve requirements — is more difficult in the short term. However, following this sequence of measures would institute a return to the situation in which banks face liquidity constraints due to scarce central bank reserves, with high monitoring incentives and stronger mitigation of inflation risks.

Conclusion

The role of bank capital regulation in bank money creation and inflation is often overlooked. Based on our conceptual research and recent data, we argue that the strengthening of capital requirements in the years immediately after the financial crisis of 2007/2009 acted as a disinflationary force. In combination with sticky bank equity, these stricter capital requirements reduced the banks' potential for new investments and money creation, putting downward pressure on inflation. As the tightening of bank capital regulation has ended and banks hold a large amount of central bank reserves, this disinflationary force will disappear, so that the risk of weakening anchors for inflation expectations and inflation after the COVID-19 pandemic may be greater than is commonly assumed. The current manifestation of the triangle structure — price stability, capital regulation, and central bank reserves — is fragile. Hence, it will be important to avoid strong and continuing money creation and to mitigate the inflation risks associated with it. While paying interest on reserves may be the easier solution, refraining from such payment, slowly reversing asset purchasing, and temporarily setting reserve requirements would make for a return to times in which

central bank reserves are scarce, thus involving better monitoring incentives for banks and stronger mitigation of inflation risks. Of course, the aim of this article is only to outline a main line of argument, supported by some key facts. Thorough further conceptual and empirical work is needed to achieve a comprehensive assessment.

References

- Andolfatto, D, A Berentsen and C Waller (2016), Monetary policy with asset-backed money, *Journal of Economic Theory*, 164(C):166-186.
- Ball, L, G Gopinath, D Leigh, P Mishra, and A Spilimbergo (2021), [US inflation: Set for take-off?](https://www.voxeu.org) *www.voxeu.org*, 7 May 2021.
- Blanchard, O (2020), [Is there deflation or inflation in our future?](https://www.voxeu.org) *www.voxeu.org*, 24 April 2020.
- Blanchard, O and J Pisani-Ferry (2020), [Monetisation: Do not panic](https://www.voxeu.org), *www.voxeu.org*, 10 April 2020.
- Bonam, D and A Smādu (2021). “The long-run effects of pandemics on inflation: Will this time be different?” *Economic Letters*, in press.
- Böser, F and H Gersbach (2021), “Leverage constraints and bank monitoring: Bank regulation versus monetary policy”, CER-ETH Working Paper, 2021-06.
- Boyarchenko, N and P Mueller (2019), “Corporate credit provision”, Federal Reserve Bank of New York Staff Report, 895.
- van Buggenum, H (2021), “Risk, inside money, and the real economy”, Discussion Paper 2021-020, Tilburg University, Center for Economic Research.
- Clarida, R, J Gali, and M Gertler (1999), The science of monetary policy: A New Keynesian perspective, *Journal of Economic Literature*, 37(4):1661-1707.
- Coimbra, N and H Rey (2017), *Financial Cycles with Heterogeneous Intermediaries*, National Bureau of Economic Research Working Paper, 23245.
- Faure, S and H Gersbach (2021), On the money creation approach to banking, *Annals of Finance*, 17:265-318.
- Financial Stability Board (2020), “Evaluation of the effects of too-big-to-fail reforms: Consultation report”, Basel.
- Friedman, M (1960), *A Program for Monetary Stability*, New York, Fordham University Press.
- Garicano, L, J Saa-Requejo, and T Santos (2020), Tackling inflation if it reappears, *www.voxeu.org*, 6 October 2020.
- Gersbach, H, H Haller, and J Müller (2015), The macroeconomics of Modigliani-Miller, *Journal of Economic Theory*, 157(C):1081-1113.
- Gersbach, H, Y Liu, and M Tischhauser (2021), Versatile forward guidance: Escaping or switching? *Journal of Economic Dynamics and Control*, 127 (forthcoming).

- Gersbach, H and J-C Rochet (2017), Capital regulation and credit fluctuations, *Journal of Monetary Economics*, 90:113–124.
- Goetz, M, L Laeven, and R Levine (2020), “Do bank insiders impede equity issuances?” NBER Working Paper, 27442.
- Goodhart, C (2021), Letter: A simple solution to worrisome debt levels, *Financial Times*, 19 January 2021.
- Goodhart, C and M Pradhan (2020), *The Great Demographic Reversal: Ageing Societies, Waning Inequality, and an Inflation Revival*, Springer Nature.
- Gurley, J G, and E S Shaw (1960), *Money in a Theory of Finance*, Brookings Institution, Washington, D.C.
- Hall, R E and R Reis (2016), “Achieving price stability by manipulating the central bank’s payment on reserves”, National Bureau of Economic Research.
- Hellwig, M (2018), “Bargeld, Giralgeld, Vollgeld: Zur Diskussion um das Geldwesen nach der Finanzkrise”, Discussion Paper, Max Planck Institute for Research on Collective Goods, No. 10.
- House of Lords Economic Affairs Committee (2019), “Quantitative easing: A dangerous addiction?” Report of Session, 2019-21, HL Paper 42, published 16 July 2021.
- Hugonnier, J and E Morellec (2017), Bank capital, liquid reserves, and insolvency risk, *Journal of Financial Economics*, 125:266–285.
- Ihrig, J, Z Senuz, and G Weinbach (2021), “The Fed’s ‘ample reserves’ approach to implementing monetary policy”, FEDS Working Paper, 2020-22.
- Ireland, P (2019), Interest on reserves: History and rationale, complications and risks, *Cato Journal*, 39(2).
- Jakab, Z and M Kumhof (2015), “Banks are not intermediaries of loanable funds - and why this matters”, Bank of England Working Paper, 529.
- Mian, A and A Sufi (2018), Finance and business cycles: The credit-driven household demand channel, *Journal of Economic Perspectives*, 32(3):31–58.
- Miles, D and A Scott (2020), [Will inflation make a comeback after the crisis ends?](https://www.voxeu.org), *www.voxeu.org*, 4 April 2020.
- Rehn, O (2021), [Will inflation make a comeback as populations age?](https://www.voxeu.org) *www.voxeu.org*, 13 January 2021.
- Ryan, E and K Whelan (2021), “A model of QE, reserve demand and the money multiplier”, DEPR Discussion Paper, 15882.
- Tobin, J (1963), “Commercial banks as creators of ‘money’”, Cowles Foundation Discussion Paper, 159.
- Tolley, J (1957), Providing for growth of the money supply, *Journal of Political Economy*, 65 (6):465–485.
- Woodford, M (2003), *Interests and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press, Princeton, NJ.

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