

**MONEY AND MONETARY INSTITUTIONS AFTER THE CRISIS: CONFERENCE IN
MEMORY OF CURZIO GIANNINI; BANCA D'ITALIA, ROME, 10 DECEMBER 2013**

**EVOLUTION OF MONEY AND PAYMENT SYSTEMS: GOOD NEWS, BAD NEWS, AND
INTERESTING NEWS**

Curzio Giannini emphasized how the architecture of the financial system --- and, in particular, of payment systems and the technology of money --- evolves in response to crises, and how that frames monetary policy and financial stability more generally. That catalytic process is as powerful as ever today.

Thus, in his paper for this conference, Charles Kahn picks out how the response to the latest crisis is driving major changes in clearing systems, and adds his voice to those asking whether that risks leaving the financial system short of collateral. In commenting, I highlight the implications of a parallel set of reforms, some driven by the crisis, in central bank frameworks for providing liquidity to the payments system and, indeed, in the characteristics of central bank money itself. Those reforms offer some reassurance on the collateral issue and also on the separate question, signalled by Giannini in his book and by others some years ago¹, about whether the role of central banks could be rendered redundant by radical innovations in payments technology. Whatever the prospect a decade ago, that is more remote now.

In thinking about these issues, it is helpful to distinguish between four components of a currency area's payments architecture: the final settlement asset (for a long time, central bank money); the domain of private sector institutions that hold accounts at the central bank (often a subset of commercial banks); the mechanisms for making transfers amongst the banks (which may be in the private money markets or via the effect of customer payments, both settled across the central bank's books); and the means through which the central bank ensures that (solvent and viable) banks have sufficient liquidity to meet those

¹ See Benjamin M Friedman (1999), "The future of monetary policy: the central bank as an army with only a signal corps". The possible implications of technological reform are, as Franco Passacantando has pointed out, evoked in Curzio Giannini's book, "The Age of Central Banking", (English version 2011), page 257.

payment obligations (by providing reserves to the market as a whole, via bilateral intra-day liquidity provision, and via bilateral lender-of-last-resort lending broadly defined).

Evolution and reform can occur in each of those four dimensions, separately or together. For example, the advent of real-time gross-settlement (RTGS) systems 20-25 years ago was a shift in the third and fourth dimensions. By contrast, the latest reforms I shall focus on are in the first dimension (paying interest on bankers' reserves) and in the fourth (widening the collateral against which banks can borrow from the central bank).

Their significance comes from how the wholesale payments architecture and the broader monetary framework fit together. The following would probably be a reasonable characterisation of the set up in industrialized economies a decade or so ago:

- (1) A subset of banks held reserves with the central bank
- (2) Reserves did not pay any interest²; i.e. all types of central bank money were non-interest bearing
- (3) Settlement across the central bank's books was on a real-time gross settlement (RTGS) basis
- (4) Currency areas varied a lot in the level of reserves held by the banking system, whether required or voluntary
- (5) Where reserves were not sufficient to absorb payments shocks, central banks provided intra-day liquidity (IDL) to oil the payments machine free of charge, but in most countries against collateral (the US being the main, worrying exception)
- (6) The central bank injected reserves in to the system as a whole at (or close to) the policy rate (or, for longer-term lending, at close to the average expected policy rate)

² Or at least, in systems with required reserves, *excess* reserves did not pay any interest. That has been the Euro Area's system since its inception, whereas the previous Bundesbank system did not pay interest on required reserves.

- (7) The central bank charged a premium for end-of-day overnight bilateral lending needed to ‘close’ the payments day, in order to incentivize prudent payments management during the banking day
- (8) Central banks varied widely in the population of instruments eligible as collateral in IDL, term operations or overnight lending; and varied in whether the same or different collateral-sets applied to the three types of liquidity-provision.

That structure generally served society well during the crisis. But some fault lines were highlighted. And some innovations in the years both before and since the crisis broke—in particular, paying interest on reserves and accepting wider collateral—have altered the dynamics of the system. In this there is good news, bad news, and interesting news.

The good and bad news: the resilience of real-time gross settlement, and residual large intra-day credit exposures

The good news, and it is very good news, is that without RTGS, and real-time delivery-versus-payment in core securities-settlement systems, the panic in 2007/8 and its consequences would have been far worse. On no day did the payment system cease to operate. That is because the big banks could make payments for customers and for their own account without taking even a moment’s exposure to each other. While central banks worried about whether the overnight money market would stay open (it did, just), they did not have to worry about whether the core wholesale payments system would seize up during the day, bringing the economy to a halt. This contribution of the financial system’s deep plumbing to preserving the most basic facet of stability has gone largely unremarked. But rather than celebrating past achievements, central bankers should take encouragement from the fact that their interventions in the infrastructure can make a big difference.

The bad news is that the crisis provided a nasty reminder of the large intra-day exposures that remain in some payment and settlement systems. In the UK, for example, more large overseas banks have been joining the core RTGS system in order to reduce their implicit, uncontrollable daylight exposures to their sterling clearing banks. This had begun before the crisis, and has accelerated since as more foreign banks have seen the force of the argument that they should be a direct member of the wholesale payments system settling in real time in central-bank money. But by far the worst case is in the dollar tri-party repo market, where there are enormous intra-day credit exposures between banks and dealers in the core secured-financing market. This serious fault line in the global financial system, which played a role in the crisis³, should be pursued with more vigour --- it had been highlighted as a priority before the crisis. The efforts to establish credible regimes for resolving financial firms of any size or complexity without taxpayer solvency support make this more important than ever. Solving the Too Big To Fail problem could be jeopardized the next time a large firm fails if central bankers are panicking about the treatment of vast unsecured intra-day credit exposures to a distressed bank or dealer.

More broadly, domestic and international policymakers need to take more interest in tiering in core payment and settlement systems, which typically entails unwanted credit exposures between correspondent banks and their ‘customers’. If the architecture itself is not improved, prudential supervisors should require that capital be held against daylight exposures⁴. That would help to change the incentives of private sector participants – although their incentives should already be strong given what they have learned from the Lehman episode about the risks of relying on bailouts in democracies.

In any case, the authorities should just fix the residual large intra-day exposures. The cure for the bad news is just to extend the scope of the good news. Arguably, as Charles Kahn implies, that would affect demand for collateral.

³ It was one factor in the inability of dealers to borrow against Treasury bonds in autumn 2008; and was a factor in the Federal Reserve choosing temporarily to finance the wind-down of the Lehman US broker dealer.

⁴ Arguably, that is the formal position now if regulatory requirements are intended to apply at all times, but it is certainly not applied in practice. To my knowledge, this point was first raised in the mid-1980s.

Interest on reserves and collateral shortage issues

So I will focus most of my remarks on the interesting news, which revolves around the effects of central banks paying interest on reserves and liberalizing their collateral policy.

Segmenting intra-day and overnight money markets

But first some important preliminary points. A striking feature of modern monetary systems is that, even though they have had the technology to do otherwise since the advent of RTGS, central banks choose to segment intra-day money from money held overnight (and longer). They do this by making no charge for intra-day liquidity --- whether through banks borrowing from them or drawing down reserves balances --- in contrast to the policy-rate of interest they charge for overnight liquidity. In other words, the unit of time for monetary policy is a day (consistent with a day being the unit of time in other debt contracts). Thus, whether a monetary maintenance period is one day or longer⁵, the level of reserves that a reserves bank must hold (on average in the case of the period-maintenance systems applying in the EA, US and UK⁶) is defined in terms of end-of-day balances.

That makes sense. The efficiency of settlements in the payments system is essentially a public good. By introducing an interest charge (or remuneration) on intra-day debit (credit) balances at the central bank, individual reserves banks would have an increased incentive to delay (their own and customer) out-going payments until after offsetting incoming payments were received. Collectively, that would delay payments generally, increasing the probability of operational gridlock late in the day. That would be costly in two ways. First, legitimate transactions would be impeded. Second, delayed payment could be misperceived as a signal of distress rather than of technical problems.

⁵ A 'maintenance period' is the period over which any (imposed or voluntary) target level of reserves must be achieved; eg overnight or on average over , say, a month.

⁶ Where the maintenance period is not aligned with the timetable for interest-rate decisions, technical problems arise in stabilizing market rates with the policy rate.

That sets the scene for some analysis of how the first innovation, the move by central banks to paying interest on reserves, affects behaviour on both sides of the segmentation I have described--i.e. the implementation of monetary policy in the overnight markets, and how banks manage their payments needs. Perhaps most important in terms of Curzio Giannini's interests, it may insulate the central bank's monetary role from technology-driven⁷ erosion in the demand for its money.

Paying interest on reserves: monetary policy

For monetary policy, paying the policy-rate of interest on reserves goes along, conceptually and often in practice, with a corridor system for establishing the central bank's policy rate in the overnight money markets. Provided it is perceived as riskless, the central bank can be the marginal player on both sides of the market --- promising to borrow (accept deposits) in unlimited amounts and promising to lend (against collateral) in unlimited amounts at (or close to) its policy rate. In those circumstances, monetary policy does not depend on spontaneous demand for zero-interest central bank money or on manufacturing demand through the imposition of legal reserve requirements.

For example, the Bank of England moved to this kind of system because, in the absence of reserves requirements, demand for zero-interest reserves was proving to be very low in the late 1990s and early 2000s. Given a penalty charge on overnight overdrafts, the central bank was having to conduct open-market operations multiple times each day to keep overnight rates broadly in line with the policy rate. Even so, the market rate was volatile due to uncertainty about (i) whether aggregate payment shocks⁸ would in fact be exactly offset, leaving the system as a whole square; and (ii) whether the overnight money market would distribute the reserves effectively, enabling each individual bank to balance its

⁷ TECHNICALLY THE TWO ARE DISTINCT ALTHOUGH NOT MUTUALLY EXCLUSIVE. THEY CAN BE COMBINED, AS IN THE UK SYSTEM SUMMARIZED BELOW OR EMPLOYED ALONE. WHERE REMUNERATING RESERVES IS USED ALONE IN A 'FLOOR SYSTEM', THE CENTRAL BANK CAN ESTABLISH AN OVERNIGHT MARKET RATE IN LINE WITH THE POLICY RATE SO LONG AS AT LEAST MEETS THE DEMAND FOR RESERVES.

⁸ The so-called autonomous factors, including in-flows from foreign central banks, government and others customers.

books. Consistent with Giannini's theory of the history of central banking, this was an instance of (a minor) crisis prompting reform. Before briefly explaining that reform, it is worth noting why this episode challenges the practicality of the proposition advanced by Benjamin Klein, in work given great weight by Giannini⁹, that provided private-bank deposits are required to be convertible into central bank money, the monetary authority will always be able to operate policy. In fact, if banks settle amongst themselves in central bank money but, because reserves bear no interest, want to hold zero balances at the close of business, the central bank can stabilize the overnight rate effectively only by granting overdraft finance free of charge, ie at no penalty to the policy rate. Such passive after-hours lending risks the central bank losing control of the risks on its balance sheet. The need, partly for political economy reasons, to control those risks places constraints on the parameters of a workable monetary framework¹⁰.

In the middle of the last decade, therefore, the Bank of England moved to a system where reserves are remunerated at the policy rate. This was recognized to be a momentous step at the time. Following the reforms, each reserves bank was required to choose at the beginning of each month the level of reserves it wanted to hold on average over a month-long maintenance period¹¹; and it earned the policy rate on reserves which were on average within a smallish range around its voluntarily chosen target, with penalties for missing, ie for falling outside the range, and also for going overdrawn (a negative balance) on any individual days within the maintenance period. On the final day of the maintenance period, the market rate was stabilized in line with the policy rate by a combination of the range for remunerating reserves at the policy rate and a narrow corridor formed by the central bank standing as the marginal borrower and lender overnight. The ECB's system is superficially similar, but the reserves targets are imposed and there is no range around each bank's reserves target, which means remunerating reserves

⁹ Benjamin Klein, "The competitive supply of money", 1974, p 442. For Giannini's discussion of Klein *op cit*, pp23-24 and 29-34.

¹⁰ I assume that there are political costs to incurring large losses on counterparty defaults..

¹¹ The past tense is used because the reserves-averaging system was suspended when Quantitative Easing injected reserves way above total demand, with the policy rate paid on whatever (positive) reserves balance an individual reserves bank holds. This puts a floor on rates provided each institution that holds balances with the central bank is within the reserves framework; that condition is not met in the US.

plays no role in establishing the policy rate. As described below, this has some implications for inter-maintenance-period payments smoothing.

In monetary terms, the effect of paying the policy-rate of interest on reserves is to make reserves and Treasury Bills close(r) substitutes. Thus, to underline the contrast with the past, in normal circumstances monetary policy no longer works by buying Treasury Bills¹² in order to force zero-yielding money onto the hands of the market, and thereby influence the structure of interest rates indirectly. The implementation of policy does not rely on estimating demand-for-base-money equations, or on iterative open-market operations trying to match supply and demand. Rather, the central bank just sets the risk-free interest rate, and demand for reserves is determined by payment-system and related liquidity-insurance needs.

Two broad points follow. First, and the really big point here in terms of engaging with Giannini's interests, is that even if technology were to revolutionize payments, eroding demand for bank notes and the desire of commercial banks to settle claims amongst themselves in central bank money, the central bank would still be able to act as the 'monetary' authority, in the sense of establishing the risk-free interest rate and steering nominal trends, provided its liabilities remained the economy's unit of account¹³. An interesting question is whether that should leave central banks less interested in payments innovations. I hope not, and I think Giannini would have agreed, because the central bank surely has a wider mission to maintain trust in the monetary system broadly defined. I will return to that in my conclusions.

Second, once remunerated, demand for reserves increases *if* they are in fact valuable as the final settlement asset, because the tax on holding reserves has been removed. And it turns out that they are valuable, because the key remaining difference between reserves and Treasury Bills is that although bills

¹² Treasury Bill purchases are used here as the benchmark operating model, because buying longer-term government bonds can be regarded as combining monetary policy with debt management, and buying private sector paper can be regarded as involving credit policy. Lending secured against those assets with appropriate haircutting is different.

¹³ CENTRAL BANKERS HAD GRASPED THIS SINCE AT LEAST THE MID-1990s, BEFORE THE DEBATE ABOUT THE IMPLICATIONS OF NEW TECHNOLOGY TOOK OFF.

(and other instruments) can be exchanged for reserves, a balance at the central bank can be used instantly without frictions. Market transactions to convert bills into reserves are subject to delay and uncertainty, which increases during periods of system-wide or idiosyncratic stress, leaving banks with a risk of finding themselves (or being perceived as) scrambling for liquidity. That risk was viewed to be low before the crisis, but plausibly would now be thought much higher, increasing demand for reserves in the future as the ultimate store of liquidity. If so, the reserves requirements employed by some central banks may be an unnecessary relic of a perceived need to impose demand in a previous world where reserves were not remunerated. And with the introduction of the Liquidity Coverage Ratio, the case for reserves requirements as a proxy prudential measure is much weaker. When I discuss the ‘collateral shortage’ issue, therefore, I shall assume away reserves requirements in order to focus on the free choices banks would likely make.

Paying interest on reserves: the payments system

For the payment system, the effects of paying interest on reserves depend on a central bank's collateral policy.

Banks' management of both day-to-day and intra-day payments shocks is affected by the higher balances induced by remunerated reserves. In a system of reserves-averaging over, say, a month-long maintenance period, banks can more easily smooth day-to-day payments shocks by running down their balance on some days and holding higher-than-target balances on others. Compared with the ECB's point-reserves target system, the capacity to smooth does not erode as the end of the maintenance period approaches in a system with a target range.

More interesting, with higher reserves balances banks can meet more of their intra-day payments needs by running down (or up) their reserves balance during the day. In principle, only if a reserves balance is held at (or through the day approaches) zero, does a bank need to make use of IDL. This means that the size of central banks' intra-day balance sheets is likely to be closer to the size of their end-of-day balance sheets,

whereas in the past there could be vast differences. Anecdotally, use of IDL has indeed declined in the main currency-area payment systems since reserves balances swelled enormously (due to Quantitative Easing in the US and UK, and full-allotment long-term repos in the Euro Area), but it has not declined to zero. The reasons for the persistence of IDL warrant research, especially outside the euro area, where I assume the distribution of reserves balances is heavily skewed to banks domiciled in northern member states. Is it, for example, due to inefficiencies within banks, with one team responsible for overnight balances and another for payments? Certainly my experience during the initial phases of the crisis was that few senior bankers seemed to understand how the liquidity system they relied upon—and were at the core of -- fitted together. But, in any case, aggregate reserves balances will one day return to more normal levels as extraordinary monetary interventions run off. Looking ahead, surely demand for reserves will be higher in the ‘new normal’ than before the crisis, but it will be interesting to see how high, and in particular to see the preference for meeting payments needs from reserves relative to IDL.

Whether or not a reserves bank is indifferent between IDL and holding a reserves balance sufficiently high to absorb all payments shocks with high probability will depend on whether the collateral eligible in IDL is the same as or different from collateral eligible in the central bank's open market operations. One way or another, banks have to borrow their reserves from the central bank. What they need to absorb payments shocks can be borrowed for a short time each day via IDL, or for a longer period via open-market operations. A case for a central bank employing different collateral sets is that, in contrast to periodic longer-term operations, the central bank has no time to assess counterparty creditworthiness when extending IDL, so the collateral should be of the highest quality. If the eligible collateral is different, the demand for reserves depends on, inter alia, market perceptions of the relative toughness of valuations and haircuts for the collateral in the longer-term operations. In some systems, however, including the ECB's, the two sets are identical. This brings me, finally, to Charles Kahn's points and the wider debate about collateral shortages.

Collateral shortages

The developments outlined above in central banks' operating frameworks will interact with other forces shaping the demand for collateral, including the following:

- the Liquidity Coverage Ratio (LCR) will require banks to hold more high-quality liquid assets
- regulatory constraints on banks' short-term borrowing (e.g. from tax incentive in the LCR and the limits in the prospective Net Stable Funding Ratio) will tend to increase demand for collateral from banks as some creditors seek alternative ways of obtaining economic seniority; ie taking collateral will substitute for being able to let funding run off
- the introduction of credible resolution regimes may also drive higher demand for banks to provide collateral, unless --- as they should be --- banks are restructured to have pure holding companies, whose bond holders will (after group equity holders) absorb losses *before* the unsecured, uninsured creditors of operating-banks and other subsidiaries
- greater, mandated use of clearing houses might increase demand for collateral, depending on the extent to which multilateral netting offsets that.

At present, it is hard for anyone to argue that the demand for collateral within the banking system is problematic given the scale of reserves injection by central banks --- especially as those reserves have been provided against a wide range of non-government bond collateral or by buying government bonds from non-banks. But that is an artifact of central banks' exceptional operations while policy rates are at the zero-bound. What about when monetary conditions return to normal, and the level of reserves holdings is lower?

The answer depends on the combination of the two reforms I am highlighting. First, what will be the demand for reserves; will it be much higher than before the crisis? That seems likely, as already discussed. The central bank must then provide, ie lend, those increased reserves to the market; both sides

of its balance sheet increase. Second, what collateral will central banks take in their main 're-financing' operations through which the reserves are injected; and will the terms leave banks indifferent between holding reserves and using IDL (or overnight borrowing)?

The wider the collateral and the more generous the terms, the more banks would want to lock in financing inventory via the central bank¹⁴; and, thus, the greater the collateral transformation ---into reserves--- via the central banks' operations and the greater the (true) liquidity of the banking system. That would be due to an implicit subsidy. But even without any subsidy from soft terms, aggregate demand for financing illiquid collateral via central bank OMOs might be high if banks perceived private sources of term financing as being unreliable relative to a predictable central bank. The greater the proportion of total reserves injected by longer-term lending operations (at the expected policy rate), the more potent that effect would tend to be.

Summarising, paying interest on reserves generates higher demand for central bank money and so will increase central bank lending to the banking system; and, with a wider set of eligible-collateral instruments, that lending is likely to be provided against the least liquid collateral. From the perspective of the banking industry as a whole, the effect would be an increase in collateral-transformation via central banks' operations. Whether central banks should prefer to be a contingent liquidity backstop or a structural provider of collateral-transformation services is beyond the scope of these comments¹⁵; at the least, central banks need robust risk management, looking very carefully at the composition of collateral bundles. But, in the spirit of Giannini's view of the role of crises in the evolution of the financial system, these forces will prospectively go some way to meeting increased demand for high-quality collateral with

¹⁴ Thus, in the run up to the crisis, there was a perception in the market that the ECB's valuations of asset-backed securities (ABS) were high, and its haircuts low. In consequence, much of the industry financed portfolios of ABS via the ECB. Although ECB sets reserve requirements and thus ostensibly controls the total amount of financing routinely available from it, banks could probably shape the size and structure of the relevant parts of their group balance sheet to generate a reserves requirement broadly in line with the portfolios they wanted to finance.

¹⁵ For example, demand for reserves will be higher if banks worry about stigma in borrowing from the discount window. It will be lower if, like the Bank of England, the central bank charges a premium on lending at term maturities against riskier collateral.

the best possible asset, central bank money. Bluntly, if there is a markedly higher demand for high-quality collateral, central banks may find themselves supplying it.

For the non-banking sector, the position is subtly different. To the extent that the central bank supplies reserves by buying assets (directly or indirectly) from the non-bank private sector, the sellers (say insurance companies) are exchanging what may be liquid securities for deposits with private-sector banks (broad money). Whether that affects their perception of their liquidity depends on the view they take of the riskiness of banks. The more risky they think banks are, the more they will try either to shed bank deposits or to reduce their need for liquidity by reducing the risks (and thus exposure to liquidity shocks) in their underlying business. In current circumstances, that is a relatively unexplored dimension of QE. Looking ahead to the new normal, however, it points to central banks injecting reserves via secured lending (repos) rather than outright purchases, because then the collateral transformation afforded to bank counterparties increases the capacity of the banks themselves to offer collateral-transformation services to the rest of the economy.

Summing up

Central banks need to determine their framework for payments and the implementation of monetary policy together as a coherent whole. Although the segmentation between intra-day money and overnight money makes sense, reserves-averaging brings them somewhat closer together as a bank can borrow from itself free of charge within the reserves maintenance period. By moving to pay interest at the policy rate on end-of-day reserves holdings, central banks reduce the tax on holding their money. Narrowly, this removes the need for reserves requirements to generate demand and provide a fulcrum for monetary policy. More profoundly, the associated leap to being the marginal player on both sides of the overnight money market means the central bank can set monetary policy absent demand for its money. That immunizes one of the central bank's two core roles from innovations in payments technology, provided

its liabilities comprise the economy's unit of account. Whether the role as lender of last resort would survive if central bank money was not the final settlement asset is perhaps less clear. My best guess is that even in a hypothetical 'moneyless' economy, the unit of account would be chosen in a way that made it a latent settlement-asset of last resort, in which case the LOLR function would persist too. In practice, however, events during the crisis have underpinned the role of central bank money as the final settlement asset given the frictions in financing even against the security of treasury bonds in stressed circumstances.

If the utility of central bank money has been highlighted by the crisis, so has banking-system stability as a necessary condition for broader monetary stability. Given that nearly all payments are made with commercial bank money, it is remarkable to have lived through a period in which that was overlooked or taken for granted. Giannini reflected the views of many central bankers when he stressed that as lenders of last resort, central banks have to be involved in banking supervision to some degree. Fortunately, they remained engaged throughout in the safety and soundness of the payments architecture. That served society well, in particular through the operation of RTGS systems, but the work of eliminating stability-threatening intra-day credit exposures is incomplete.

More generally, in determining their payments-cum-monetary operating frameworks, central banks make decisions---on eligible collateral, and access to their balance sheets---that affect credit conditions, including via effects on collateral shortages. Many have revolutionized their collateral policy during the crisis, making it more time-consistent¹⁶. **{DELETION AND AMENDMENT}** IN PRINCIPLE, THAT ENABLES central banks to offset *any* incipient shortage of high-quality collateral by buying or lending against illiquid securities. SIMILARLY, PAYING THE POLICY-RATE OF INTEREST ON RESERVES 'LIBERATES' CENTRAL BANKS TO USE THE INJECTION OF RESERVES AS A POLICY TOOL IN ADDITION TO SETTING THE SHORT-TERM INTEREST RATE. In contemplating whether to USE THESE NEW DEGREES OF FREEDOM, they must take care not to

¹⁶ For a discussion of time-consistent collateral policy, see Tucker (2009), "The repertoire of official sector interventions in the financial system: last resort lending, market-making, and capital".

make first-order allocative decisions a prime purpose of policy, as that properly lies in the realm of political choice. For those like the late Curzio Giannini and myself who take a broad view of the role of central banks in preserving monetary and financial stability, those boundaries to central banking have to be well-defined , enjoy wide support in society, and be observed.