

Central Banking¹

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Abstract: This chapter describes the emergence of central banks and the evolution of their functions as resolutions to the monetary and financial crises of the nineteenth and the twentieth centuries. First, central banks have become bankers' bank to facilitate the settlement of inter-bank payments. Central bank money is the legal tender of all debts, including the banks issued debts that are used as means of payments by non financial agents. Second, the repetition of liquidity crises has led central banks to regulate and supervise the banking system. These policies prevent the chance that excessive risk taking by one bank would threaten the integrity of the payment system. However, because all crises cannot be avoided, central banks stand ready to lend in last resort if need be. Finally, central banks conduct monetary policy, i.e. they supply money to stabilize the unit of account and thereby provide a nominal anchor to the economy.

Keywords: Central banks, money, payment systems, lender of last resort, monetary policy

Introduction

Central banks perform several tasks. They provide settlement services to large-value payments, oversee banks for the sake of financial stability, act as lenders-of-last-resort and implement monetary policy. These tasks and their mode of operations have been repeatedly redefined in order to resolve specific monetary and financial crises. Actually, all major stages in the shaping of central bank functions have been responses to monetary or financial crises. The analysis of these crises and their competing interpretations is necessary to understand the functions that central banks need to incarnate and implement for a monetary economy to prosper.

¹ This text reflects the authors' opinion alone and neither the one of Banque de France, nor the European Central Bank.

The genesis of central banks as bankers' banks took place in 19th century England. Two opposing theoretical conceptions of money, the currency principle and the banking principle, implied radically different roles for central banks. For the former, strict convertibility of money into a *special commodity* of which the supply is independent of the government is an insurance against the secular manipulation of the unit of account to raise an inflation tax. The role of the central bank is to enforce convertibility of its bills into gold, as the Bank of England was assigned to in 1846. However, a repetition of liquidity crises in 1847, 1857 and 1866 demonstrated the need of flexibility in the supply of money.

Such flexibility is more consistent with the banking principle, whereby money is a *debt* that financial intermediaries endogenously issue as the counterpart to their credit operations. Yet, if the means of payments are debts issued by competing banks, payments between banks call for high powered money to settle interbank transactions. This is precisely the role of the money issued by the central bank, money that the sovereign designates as legal tender for all debts.

However, the trust of the economic agents in central bank money cannot be imposed by law. It is essentially to preserve this trust that central banks have developed their functions. They supervise the banks to ensure the integrity of the payment system and prevent liquidity crises. In the event of liquidity crises, they stand ready to lend in last resort. They conduct monetary policies to stabilize the unit of account and thereby provide a nominal anchor to the economy.

Section two explores the evolution of central bank attributes as a bankers' bank, relating them with the centralization of payments. Section three outlines how central banks have been committed to different monetary regimes from the gold standard to the present inflation targeting. It also points out the monetary doctrines underlying the different practices to deliver

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the nominal anchor that preserves trust in money. Finally section four raises some prospective issues that may require further evolution of central banks in the twenty-first century.

The centralization of payments and the emergence of central banks as bankers' banks

The idea of a central bank, i.e. a bankers' bank, was slow to emerge in monetary thinking. It was an offshoot of devastating financial crises that had become international in scope in the mid-nineteenth century. The expansion of industrial capitalism had intertwined credit networks, making contagion more virulent. In the crises of 1847, 1857 and 1866 the Bank Act of 1844, which had split the Bank of England in two departments, the issue and the banking departments, had to be *de facto* suspended, though no provision had been enacted to do so *de jure*. On the contrary, the Banque de France had acknowledged responsibility to the financial system earlier. However, in 1868, when Crédit Mobilier was still recovering from the 1866 crisis, the Banque de France refused to discount its paper. The French central bank was involved in a rivalry between the Rothschilds and the Pereire Brothers, owners of the Crédit Mobilier. By taking the side of Rothschilds to preserve the privilege of the *Haute Banque* against the emergence of modern commercial banking, the Banque de France failed to pursue the stability of the financial system as a whole in the circumstances, since it would have implied rescuing Crédit Mobilier.

The financial centers of the main European countries initially resented that the banks created to manage the public debt and to regulate currency should have superior status relative to other banks. Because bank money is a debt, it is the counterpart of credit. Because debts must be settled in other forms of debts, there is a hierarchy of debts and for that matter of the institutions that issue them. The central bank is the bank that issues the debt in which all other

debts are settled. The hierarchy of the banking system whereby the central bank issues the high powered money that can be used for the settlement of inter-bank debts appeared as a necessary condition for the integrity of the system of payments. The latter can allow means of payments issued as liabilities by competing commercial banks to coexist if three general rules are respected.

The first and foremost rule is the institution of *the unit of account*. In a decentralized market economy, market participants discover relative prices through nominal prices denominated in the unit of account. As long as it can be trusted over time, the monetary standard reduces transaction costs efficiently in avoiding offer prices to be announced in incompatible numeraires.

The second rule is that *issued debts can be made eligible to means of payments*, e.g. debts can circulate amongst third parties to redeem other debts and buy commodities. In a developed market economy, producers necessarily incur debts because they must buy resources, not least the human resource (pay wages), before they can sell their products. The quality of being accepted by third parties is *the liquidity of debts*, which in turn depends on the financial strength and the reputation of the issuer. The selection and verification of the liquidity of debts make the financial system hierarchical. Banks are financial agents specialized in the issuance of the most liquid debts.

The third rule is the one that makes the verification of debt liquidity a social process: *the settlement*. It is the process by which payments are made final, e.g. by which any kind of debt used as a means of payment in any private transaction proves that it can be transferred against a unanimously accepted form of money. Depending on the definition of the unit of account, the ultimate liquidity in a payment system can be a commodity minted by the sovereign (or a foreign currency), or it can be the liability of a financial institution empowered by society as a

whole or by its highest political authority, the sovereign. This institution is a central bank. It has become the paramount monetary institution.

How do the rules make a system? If the ultimate liquidity is the liability of the central bank, the unit of account is purely abstract.³ It is the name given to the numerical unit of liability issued by the central bank. Such are the “US dollar”, the “euro”, the “pound sterling”, the “yen”, and the “yuan” nowadays, to quote the most important world currencies. In that case all forms of money are issued as liabilities of a financial agent. The banking system is *hierarchical*. The central bank is the bankers’ bank because its liability is the means of settlement of all commercial bank debts.

The law of reflux, multilateral clearing systems and the emergence of central banks

Under free banking, i.e. when there were no central banks, commercial banks could issue notes and open deposit accounts against their assets over and above their reserves of species. Notes and deposits were convertible on demand in gold coins. Convertibility (into gold or silver) was the rule that validated bank money. The *law of reflux* was the settlement mechanism whereby convertibility limited the issuance of competing bank monies. It saved the use of species, while, at the same time, it vetted the quality of bank issued notes. A *free banking payment system* without central bank was conceivable as long as settlement in gold coins could be made viable. The law of reflux effectively centralized the relationships between interbank correspondents within multilateral clearing systems. The question arises of the *modus operandi* of the law of reflux, both historically and theoretically.

Historically, such a system was successful in Scotland in the late eighteenth century, because banks were few and highly capitalized. It also operated for a long time in the United States in the nineteenth century. Nevertheless, in the latter country, free banking was evolving under

³ It was not so when the ultimate liquidity was minted into a commodity, let us say gold. Debts used as means of payments had to be redeemed in gold coins.

acute tensions. Solving settlement crises induced the development of institutions called clearing houses. They were incomplete surrogates of central banks, as far as settlement issues were concerned.

Banks were competing to increase their market share in the discounting of trade bills, as a counterpart to which they issued bank notes. The law of reflux implied that a bank that issued too many notes would face a liquidity shortage when the redemption of excess notes at par would be exercised. Theoretically three mechanisms can be at work. First, the excess notes are immediately cancelled when customers demand redemption in species and the bank loses an equal amount of reserves. Second, the note owners prefer to buy other banks' notes. Therefore those banks increase their claims on the issuing bank in the interbank market, e.g. the exchange market for bank notes, which leads to a net settlement demand in species after clearing. The destruction of the excess notes arises via correspondent banks. Third, the notes remain active balances for future expenditures. In the latter case, a multiplier effect of payments arises and diffuses the excess issue on more banks, as long as more individuals buy the bank notes they prefer. However, the pressure to redeem the notes will eventually be exerted via the former mechanisms, either public demand for species or bank clearing.

The law of reflux was the process emphasized by the Banking School to advocate regulation of the *quality* of money counterparts rather than the *quantity* of money. Since the law of reflux restrained automatically the banks from their loss of ultimate liquidity, the proper oversight was to check that banks discounted good assets. Only solvency might be problematic, while the interplay of the banks would assume the regulation of liquidity. In their own interest, banks would maintain a ratio of liquidity that balances the marginal cost of relative illiquidity and the marginal gain of asset building. Reconstituting the optimal ratio of reserves to notes triggered an adjustment toward balance-sheet equilibrium. The payment system was theoretically viable. Macroeconomically, the optimal amount of bank money was determined

by the desired demand for specie and the general level of prices in terms of gold, which was actually largely independent from the banking system.

Such a system had functioned without a central bank. However, central banks progressively emerged as banks for banks in order to remedy two essential limits of self-organized non-hierarchical payment systems.

First, the law of reflux with 100 percent redemption in specie on a bilateral basis is a straitjacket that becomes incompatible with the needs of trade in a growing market economy. The monetary system was under various form of stress when the law of reflux failed to discipline a bank.

In the case where bank notes dominate, the failing banks suffer a discount in the value the notes they issued. The consequence is a fragmented payment system levying crippling information costs on the economy. People always wondered in which bank money they should have their income paid, with self-fulfilling prophecies often destroying many banks in time of stress. The payment system was plagued by recurring runs on weak banks with contagion making up bank panics.

The case where checkable deposit accounts dominate is different because the means of payments (the checks) are dissociated from the liquidity registered on the account. This form of money became prevalent in the second half of the nineteenth century, when banking business went beyond discounting trade bills to meet the financing needs of industrial capitalism. Banks became intermediaries. On the asset side, they made illiquid credit requiring investment in specific information whose quality depositors were not able to assess. On the liability side, they offered non-marketable deposits combined with the provision of payment services. This asymmetric information structure, coupled with network effects in the payment system, implied that valuing deposits at par in unit of accounts and securing their

convertibility at par into the base currency (e.g. into gold coins) made the most efficient contract.

However, in contrast with the mechanisms whereby bank notes dominated payment systems, pricing bank money in a crisis became impossible. The law of reflux could not work without an innovation in the technology of payments that allows a drastic saving of species. This innovation was *the multilateral clearing system*. It *ipso facto* differentiated the community of banks because some banks become clearing houses.

A clearing house is a centralized organization that introduces collective rationality into payment systems. Clearing houses appeared in the leading business centers of the United States in the midst of the free banking era (1838-1863). Free banking developed after the Second Bank of the U.S. lost its federal charter in 1836.⁴ It ended in 1863 while the civil war was raging, when the huge increase of liquidity needs induced the creation of the Comptroller of the Currency to regulate the quality of money. Clearing and settlement of the banks that were members of the system were made on the books of clearing houses. Clearing houses issued settlement certificates on behalf of their members who deposited reserves with them. Multilateral clearing and net settlement saved a huge amount of specie and reduced the cost of check collection.

Moreover, clearing houses managed to insulate the execution of payments at the time of liquidity stringency by suspending convertibility into species. As Goodfriend (1988) pointed out, they acted as *de facto* surrogates of central banks. The higher status of settlement money gave the clearing houses hierarchical authority over their members. The responsibility of preserving the integrity of payments among the club of retail banks led the clearing houses to guarantee the irrevocability of payments in return for the banks' compliance with restrictive

⁴ The Second Bank was chartered in 1818 after the expiration of the First Bank of the United States. It was closed by President Andrew Jackson, who accused the Bank of political corruption and fraud. Jacksonian democracy, which leaned toward libertarian policies, favored free banking.

obligations. The system of the Suffolk Bank in Boston, Massachusetts, was the first to reach such a degree of centralization while it was evolving from 1825 to 1861.

The second limit that required the emergence of central banks appeared in the incapacity of the large banks that acted as clearing houses to separate their profit maximization objectives from the interest of the community of banks participating in the clearing houses. In addition, in the case of the United States, the clearing houses did not protect non-member banks that were located outside large financial centers from liquidity crises.

The National Bank Act of 1863 aimed at homogenizing the quality of money by instituting a Comptroller of the Currency and granting national charter to banks that respected stipulated obligations. Despite the extension of regional clearing houses, the U.S. payment system remained vulnerable to bank panics until the paroxysm of the 1907 crisis. The financial debacle persuaded Congress to undertake a radical reform to provide the country with a single institution capable of securing the payment system under a dual mandate: supplying elastically unique settlement money and assuming the responsibility of a lender of last resort. In countries where a government-sponsored bank already existed for a long time or had been enacted in the wake of political unification (Germany and Italy), they took over the role of clearing houses more smoothly. In England and in France, the former bank of the sovereign already had a special role in the banking system and this role evolved, in spite of the financial community's resistance, to the one of banker's bank.

Central banks and the regulation of payment systems in tranquil time

Since its emergence as bankers' bank, the central bank is the institution at the center of payment systems. It safeguards settlement, prevents systemic failures against operational risks (\$50 billion of liquidity injected a single day in November 1985 to offset the destruction of liquidity due to a computer break at the Bank of New York) and imposes safety rules on banks that are members of large-value payment systems.

Commercial banks may pertain to different clearing systems linked to retail payments or payments of securities and other financial transactions (including the national currency leg of foreign exchange transactions). But the balances, resulting from those payment services, contribute to build interbank positions. They must register on the books of the central bank for multilateral clearing and settlement in central bank money. To honor their settlement obligations, banks with net negative positions must secure central bank money by all means available before settlement time, depending on the technique of settlement (net end-of-day, or gross in real time). They can draw on their reserve account at the central bank, borrow overnight money from surplus banks, or use repo facilities with the central bank against eligible collateral. All those devices connect the central bank to the channels of liquidity provision to the whole banking system. From this unique posture, the central bank can draw superior information on the situations of banks regarding liquidity ease or stringency. They can detect anomalies in the interbank market, as they did on August 9, 2007 when they observed a spike in overnight interest rates.

In the last thirty years or so, payment flows generated by financial transactions have swelled ominously. High-value payments concentrate risks that have a strong likelihood of becoming systemic. As a result, central banks have reformed interbank payment systems to deal with credit and liquidity risks in order to guarantee final settlement, i.e., irrevocability of the payment for the beneficiaries whatever the situation of the payers. The central bank, which is the only player that can do so, guarantees unconditionally the payments it settles.

The path towards centralization of payments goes on unabated with the creation of wider range of private means of payments. Contrary to popular opinion, innovation in payment systems does not undermine central bank leadership in the control of money. It reinforces central bank power because more complex payments, ever larger volumes and shorter lead times increase systemic risk. Such risk in payment systems threatens trust in money at its

most fundamental level. Therefore the integrity of payment systems is much more than a merely technical issue. It must be seen as part of the broader objective of financial stability and the sustainability of the financial system.

The central bank in stressful time: the lender of last resort

Lending in last resort has been pinpointed the gist of the art of central banking. It was nonetheless long before being recognized as such. As early as 1802, Thornton had highlighted the responsibility of the Bank of England in supplying liquidity to sound banks in time of panic. But there was no follow-up to his advice. Recurring panics arose with ever more devastating outcomes. The Banking Act of 1844 worsened financial crises in making harder for the Bank of England to issue notes while losing gold reserves. *De facto*, the Bank Act was overruled with the suspension of convertibility in 1847, 1857 and 1866 without any complementary legislation. It permitted the Bank's banking department to expand its loans over the limit fixed by the gold stock in the issue department. But the easing in money markets was too late, too little. This unsatisfactory state of affairs prompted Bagehot (1873) to elaborate his doctrine that is defined below.

Indeed lending in last resort is an extraordinary operation that violates market rules. It is a unilateral and discretionary decision to provide potentially unlimited amounts of the ultimate means of payment/settlement to the money markets. It escapes market contracts and is therefore an act of sovereignty that keeps afloat debtors who otherwise would have failed to settle their debts. This operation allows other perfectly sound liabilities to perpetuate, whereas they would have been destroyed by the spillover of the failed debts. Therefore the economic impact of lender-of-last-resort interventions is ambivalent. On the one hand, it forestalls systemic risk, because the social cost of letting insolvency spread is higher than the private cost of the original failure. On the other hand, it can induce moral hazard if it strengthens

reckless behavior against which it provides collective insurance. The purpose of Bagehot's principles and prescriptions was to stop contagion while keeping moral hazard at bay.

According to Bagehot, the lender of last resort is concerned about the overall stability of the financial system, not by the fate of any particular financial firm. It must lend without limit to solvent but illiquid firms, who cannot borrow in the market because the mistrust of potential lenders dries up liquidity. Insolvent institutions must be sold to new owners for what they are worth. However, these objectives require operational principles to distinguish intrinsic insolvency from threats of failure due to liquidity stringency.

Bagehot (1873) proposed as a distinctive criterion the quality of the collateral presented by borrowers. The central bank should accept the collateral and evaluate the solvency of banks at pre-crisis value. Furthermore, to better safeguard against moral hazard, Bagehot insisted that the central bank should lend at punitive rates. This disposition would be both a risk premium for the central bank and a deterrent for borrowers. Finally central bank interventions in last resort should be made unpredictable. This is the constructive ambiguity that central bankers are fond of. It is an attribute of the radical discretion that is the essence of sovereignty.

Nowadays, banks have to comply with capital regulation and to accept the ongoing supervision of activity by either the central bank or an independent supervision authority. These requirements are counterparts of the "insurance" that the central bank would provide, as a lender of last resort, to insulate banks that have not taken excessive risks from crises that threaten the integrity of payments.

Failure to lend in last resort can have the most dramatic consequences. A prominent example is the Great Depression. The Wall Street crash of October 1929 had led to a scramble for liquidity. By year-end the deflation in equity prices had been communicated to primary commodities and durable-goods industries. The Federal Reserve lowered the discount rate from 6 percent in August 1929 to 2.5 percent in June 1930. But the money stock continued

shrinking unabated. According to Friedman and Schwartz (1963), it should have undertaken blanket open-market operations to avoid the seizure of the credit markets. After mid-1930, the financial crisis changed in nature and in magnitude. Three waves of extended bank failures, one every year wrecked the banking system completely, leading to the Bank Holiday in March 1933. A drastic change in regulation severed commercial banks from financial markets.

With the comeback of financial crises in deregulated financial systems, the lender of last resort has returned to fashion since the Penn Central failure in the US in 1970 and the secondary banking crisis in the UK in 1972. Since that time there have been innumerable banking and financial market crises worldwide that have solicited the interventions of central banks in last resort. There has been a diversification of such central bank interventions, ranging from securing the payment systems to, in recent history, spectacular interventions by the Federal Reserve System to restore confidence or attempt to limit the chances of financial crises before they occur.

The first type of intervention is illustrated by the response to the breakup of communication lines in interbank payment systems after the terrorist attack of September 11, 2001. The Fed injected liquidity massively both through the fed funds market and the discount window. Without this emergency supply the overnight money the interest rates would have gone through the roof. On the contrary, the overnight rate of interest fell almost to zero, which is an indication that the intervention was indeed unlimited. Each day for a whole week the Fed injected between \$36 billion and 81 billion against a daily average of \$ 5 billion in normal times. Other central banks acted in concert and emergency swap agreements were concluded between central banks in the main financial centers of the world.

Restoring confidence in distressed financial markets is a preoccupation well illustrated by the circumstances following the Long Term Capital Management (LTCM) episode in September

and October 1998. Since the end of August the shock wave of the Russian financial crisis had disoriented credit markets. Spreads had spiked unexpectedly, taking unawares hedge funds that had betted a reduction in spreads. Losses surged and the huge hedge fund LTCM, which was heavily leveraged, became insolvent. In an already stressed environment, confidence broke down in all segments of credit markets. The flight to quality concentrated on Treasury bills. By the end of September, private borrowers could not find any credit (Scholes, 2000).

The central bank was confronted with a dual problem: the direct impact of the LTCM debacle on the bank creditors on the one hand, and the general flight to liquidity on the other hand. To solve the first, it was necessary to consolidate LTCM debt. The second was a problem of mass psychology: How to reestablish trust in the midst of universal mistrust? The New York Fed was the coordinator in LTCM's rescue. It organized a bank consortium that took charge of the Fund's management to pilot an orderly reduction of its indebtedness and proceeded with a \$ 3.5 billion debt equity swap. To restore confidence the Fed decided on three interest rate cuts, each one of 25 basis points on September 29, October 15 and November 17. Fully anticipated, the first one had no impact. It even deepened the crisis which reached the foreign exchange market with the surge in the yen on October 8. The second one was crucial. Taken outside scheduled Federal Open Market Committee meetings, it was a complete surprise: an act of sheer sovereignty to handle an extraordinary situation. It struck market sentiment and had a dramatic effect. As long as they remained caught in the psychology of contagion, market participants were unable to price assets. They were obsessed with the immediate liquid value of their claims. Liquidity evaporated under the one-way selling pressure of asset holders who no longer had any confidence in the floor price of their securities. The sovereign decision of the central bank anchored the floor price of short term securities. It reinstated the benchmarks necessary for market evaluation of differentiated risks. The third intervention was a message of confirmation. It reassured the financial community in the conviction that the central bank

was determined to provide all the liquidity necessary to permit the well-functioning of financial intermediation.

Innovation in last resort lending was spectacularly pursued in since August 2007 after a global credit crisis in securitized market struck, following and propagating a surge of insolvency in the U.S. subprime mortgage market.

At the time of writing this text, it would be very presumptuous to assess the effectiveness of the 2007-2009 financial crisis management. The crisis and the scale of public interventions have escalated in parallel since August 2007. Moreover, it goes beyond the scope of this paper to give a detailed account of the crisis escalation and the series of central banks and fiscal authorities to avoid the collapse of the banking system. The Box lists the major steps taken by the Eurosystem and the Federal Reserve System from the beginning of the crisis to December 2008 when this text is completed. Central banks themselves have recorded and will continue to publish comprehensive descriptions of their initiatives and innovation to handle the crisis.⁵

The central banks have taken a number of unprecedented steps to tame the financial turmoil. Central banks world wide have extended their lending facilities and widened the range of collateral they accept. They modified their lending facility to fixed rate tenders with full allotment. They substituted the decentralized money markets that ceased to function by providing liquidity to banks on a bi-lateral basis. In these processes, they took on their balance sheet larger and larger amounts of risky assets. The Fed balance sheet has increased from USD 891 Billions in December 2007 to USD 2311 in December 2008. Moreover, the credit risk of the financial instruments piled in the Fed's asset has deteriorated drastically. Treasuries, which made up to 86 % of the Fed's assets at the end of 2007 now represent only 20 % of it.⁶ The other 80 % is composed mainly of Term Auction Credit, Commercial Paper

⁵ See in particular the CGFS papers 31: Central Bank operations in response to the financial turmoil.

⁶ Effectively some of the USD 680 billions distributed in the context of the Term Auction Facility by other central banks who have an SWAP agreement with the Fed may also of Sovereign debt as collateral.

and Foreign currency counterparts to the dollars lent by foreign central banks in agreement with the Fed as initiated when the Term Auction Facility was introduced in 12 December 2007 (see Box). This unprecedented asset structure implies a credit risk that may make the central bank technically insolvent, and therefore at the mercy of the fiscal authority.

Central banks also have repeatedly coordinated their crisis management actions (lowering interest rates together on 8 October 2008, extending the maturity of their liquidity provision, setting up currency swaps to extend the provision of dollars outside the US,...). This coordination of “lender of last resort” operations is however not new. Financial markets are typically integrated internationally and more typically so in times of financial stress. In the current crisis, the banks’ distress have happened or spread across major financial markets at each and every stages of the crisis. This echoes for instance the 1907 crisis resolution when the Banque de France lent gold to the Bank of England to allow her to provide enough emergency liquidity to the US banking system. While not new this stresses once more that that contagious nature of financial crises eventually require the coordination of central banks in for crisis management.

Last but not least, they slashed interest rates in order to facilitate the de-leveraging process now engaged by financial intermediaries, households and firms. It is meant to avoid credit crunches in the downward stages of the financial cycle. It was spectacular both after the turning point of the real estate bubble in 1991-93 and the stock market bubble in 2001-03. In both cases, US short-term interest rates were driven much lower and for much longer than the easing in monetary policy that would have been warranted by the arbitrage between the medium-run objectives of anchoring inflation expectations and of keeping economic activity close to potential. The stance of monetary policy was motivated by concern about the macroeconomic impact of financial distress. Risk management was then the primary objective

of US monetary policy. Turning to the 2007-2009 crisis, it is too early to assess the effectiveness of the changes in the monetary policy stance on economic activity.

Our inquiry into central bank policy as a bankers' bank leads to monetary policy. It highlights the consistency in all aspects of central bank behavior due to its pivotal position in the monetary system. The round-about dynamic between credit expansion and asset price appreciation in global financial systems entails a macroeconomic risk that is both endogenous and pro-cyclical. The central bank is the sole institution able to handle it.

Nominal anchor and monetary policy

The most well-known function of central banks is to conduct monetary policy. The objectives of monetary policy can include price stability, sustainable growth of output, full employment and financial stability. The monetary policy legal mandates of central banks may specify that price stability is the primary objective (Maastricht Treaty for the European Central Bank) or that sustainable growth is a side benefit of price stability, but they don't always do so (as in the case of the United States Federal Reserve Bank Act).

The monetary policy function of central banks relates directly to the *unit of account* attribute of monies. Economic agents engage in current and inter-temporal exchanges at nominal prices, i.e., at prices expressed in terms of the unit of account. Monetary policy therefore consists of issuing money in a quantity that would stabilize the value of the unit of account, hence avoiding both inflation and deflation of the general price level. The central banks aim at providing a nominal anchor for economic agents to set prices in their current and in their planned transactions.

Monetary policy doctrines

Monetary policy, concerned with the money supply and the value of the unit of account, has always been the object of intense debates among economists and commentators of public

policies. Throughout history, the main axis of division in this debate opposes those who consider that money is essentially exogenous and to those who consider that money is essentially endogenous. For the former, *discretion* in the supply of money should be avoided because it tends to be used by the political power to raise an inflation tax that spoils the people and destabilizes the economy. For the latter, *rules* of money supply, such as strict convertibility into species, lack the flexibility to accommodate changes in the money needed for the economy's growth. Interestingly, the doctrine underlying the current consensus that dominates the conceptualization of monetary policy and of which a prominent example is inflation targeting claims that it strikes a balance between rules and discretion (Goodfriend, 2007; Woodford, 2003; Bernanke and Mishkin, 1997).

The *quantity theory of money* is a milestone of the debate on monetary policy. First expressed by Cantillon (1755) and Hume (1752), the quantity theory implies that increases in the supply of money are eventually reflected in higher prices with no effects on output. An important consequence of the quantity theory is that monetary policy should strictly focus on prices stabilization because anyhow, manipulating money supply can only affect prices. In line with the quantity theory, the Currency School of nineteenth century England considered that only strict convertibility of bank notes into gold would prevent over-issuance of notes and inflation. A century later, while the straitjacket of strict convertibility into gold was no more an essential feature of the monetary system, Milton Friedman and other monetarists argued that the supply of money should follow strict rules, e.g. increase the money supply at a pre-announced, k-percent rate. Authorities should not use monetary policy to fine tune the business cycle, because, although money was not neutral in the short run, the transmission from changes in the money stock to output and prices "took long and variable lags". As a result, fine tuning policies paradoxically risked introducing volatility, in complete opposition to their objective.

These views have been opposed by economists who believed that the money stock would evolve endogenously in response to changes in the liquidity needs of the economy. An important consequence of the endogenous character of money implies that strict rules of money supply can abruptly curtail transactions and growth. Monetary policy authorities should therefore have *discretion* in supplying liquidity.

To start with, the Banking School advocates considered that the bank notes in circulation were secured by their counterparts on the asset side of bank's balance sheet. The law of reflux would warrant that, as credit (at the time Merchant's bills) was reimbursed to banks with bank notes, over-issuance was prevented. In addition, the major flaw of strict convertibility lay in the mis-match between the amount of money needed for economic growth and the stock of metal available for minting money. With neither flexible nominal prices nor rapidly adjusting velocity of money, the nineteenth century saw a repetition of monetary crises where the shortage of metal limited the expansion of output. These crises pointed to the need to free money supply from the corset of strict convertibility.

Wicksell (1907, 1935) is the first to introduce the notion that the supply of money should depend on the rhythm at which production capacity grows. The money interest rate, set by the monetary authority, ought to be equal to the real interest rate, which itself reflects the expected return on newly produced capital goods. This approach of monetary policy can avoid both over expansion of money, credit and, henceforth, inflation, and a contraction of credit and deflation. The central bank should accommodate the private sector demand for liquidity at the chosen level of money interest rate. It is easy to understand that, in this conceptual framework, non contingent rules of money supply turn out to be destabilizing because the real rate can change over time with economic circumstances.

However, it took another two major monetary crises, in the 1930s and in the 1970s before the Wicksellian approach became the dominant monetary policy doctrine. The notion that

monetary policy (as well as fiscal policy) should be articulated in order to stabilize the business cycle became popular largely because of the trauma of the 1930s Great Depression and its interpretation⁷ by Keynes. From World War II to the mid-1970s the common wisdom had been that monetary policy (and fiscal policy) may have to stimulate demand and let inflation increase so that real wages would permit full employment. In the event of a slowdown of the business cycle, monetary and fiscal policies should stabilize output by exploiting the tradeoff between inflation and unemployment (what became known as the Philips curve).

However, the experience of the 1970's Great Inflation discarded the fine tuning policies of Keynesian inspiration. Besides, in spite of their success in stabilizing inflation in Germany and Switzerland, monetarist approaches (e.g. targeting a fixed rate of growth for money aggregates) appeared difficult to generalize because of the instability of money demand.

On the conceptual front, the increasing importance of expectation formation in the analysis of macroeconomic policies led the Rational Expectation School to argue that monetary policy may actually be neutral even in the short run. Kydland and Prescott (1977) demonstrated that, as long as agents believe that the central bank would try to exploit an inflation-unemployment tradeoff, the economy would converge to higher inflation because the expectation of eventual stimulating monetary policy would induce higher wages and prices, in order for agents to preserve their purchasing power. Issues with the credibility of the central bank's anti-inflation commitment led economists and policy makers to consider that independence of central banks from governments could be desirable. However, this independence, which freed central banks from the influence of elected governments, also called for the development of monetary policy frameworks that would enhance their accountability.

⁷ Keynes' interpretation of the Great Depression was exactly opposite to the one of the monetarist. He stressed in particular that, beyond a certain threshold, increasing the money supply would have no effect on the level of

These considerations led to a new consensus of monetary policymaking, which ingredients include a credible commitment to low inflation, flexibility of money supply in the pursuit of this objective, and an effort of transparency in the communication of monetary policy decisions. This consensus is exemplified by, but not exclusive to, *inflation targeting*.

An inflation targeting central bank announces a target level for inflation and engineers the monetary policy that would drive inflation near this level. The inflation target is either a point or a range that sets a low and positive level of inflation for a given consumer price index, and the horizons vary, across countries, from a couple of years to the business cycle or indefinite. This preannouncement helps anchor inflation expectations and provides a benchmark against which the central bank can be held accountable.

Inflation targeting has been portrayed as a compromise between rules and discretion. Bernanke and Mishkin (1997) actually used the term “*constrained discretion*” to describe the monetary policy strategy of inflation targeting. They argue that commitment of the central bank to keep inflation near a preannounced inflation target provides a nominal anchor for economic agents. The latter can therefore engage in nominal contracts even at relatively long horizons, e.g., a mortgage interest rate, with a fair assessment of the real purchasing power of future flows of income and payments. The inflation target is also a benchmark to evaluate the monetary policy performance of the central bank. It is a discipline device that should prevent, and so far that has prevented the inflation bias allegedly inherent to unconstrained discretion in the conduct of monetary policy.

However, an inflation target does not provide prescriptions for money supply. The later has to be decided by the central bank with the aim of keeping inflation close to its target. A good framework to analyze such monetary policy decisions is to consider a benchmark interest rate

interest rates (the liquidity trap). His policy recommendation was instead to manage demand through active fiscal policy.

rule, whereby the central bank increases the real interest rate proportionally to deviations of inflation from the inflation target in order to weigh on demand and bring back inflation to the target. Likewise, one can conceive that the central bank should increase the interest rate when it observes tensions on prices, as measured, for instance by an output gap, i.e. the demand-supply gap. Taylor (1993) has actually showed that a contingent interest rate rule such that the real interest rate increases equally to inflation and to the output gap provided a good model of effective monetary policy in the US. This framework is also fully consistent to a Wicksellian approach to monetary policy, where the central bank sets its monetary instrument, the interest rate, in reference to a neutral interest rate (Woodford, 2003).

Such lean “against the wind” state contingent policy rules provide benchmarks to evaluate the stance of monetary policy by comparing the interest rate to a contingent hypothetical rate that is fully consistent with aiming at bringing inflation back to its official target level. Moreover, interest rules that depend on the output gap, and conceivably other indicators of tensions on prices, can indicate whether the current stance of monetary policy tends to counteract these tensions or, on the contrary, accommodate them (Woodford, 2003).

However, inflation targeting is better described by a framework for the conduct of policy than by a strict rule. For one, inflation targets are often defined as ranges and it is generally understood that point targets are indicative of the region where inflation should be, approximately. Inflation can be expected to be close to the target, on average on the business cycle and as close as possible to the target, but it can deviate temporarily because of specific supply shocks, e.g. to energy or food prices. In addition, inflation targeting does not provide a strict operational rule (Goodfriend, 2007). The central bank can adjust the stance of monetary policy and the rate of growth in the money stock to accommodate either changes in the velocity of money or unexpected shocks that could harm the other objectives of monetary policy such as stabilizing output and employment at their maximal non-inflationary levels.

Finally, the central bank ought to acknowledge the uncertainty of the environment in which it operates. This uncertainty may entail temporary deviations of the monetary policy stance from the one required under a baseline scenario to prevent the risks of less likely outcome, typically a crisis on financial markets, which occurrence would imply prolonged economic unrest. This risk management approach to monetary policy, which has been formulated by Alan Greenspan (2004), has been particularly useful to describe the reaction of monetary policies to changes in the economic outlook that are outside the scope of standard macroeconomic models. In particular, the financial crises that we discussed in the previous section led central banks to alter the path of interest rates to restore confidence on financial markets. The risk management doctrine clarifies that such loosening of monetary policy stance are temporary and would not deter the central bank from its objective of price stability, defined over the longer run.

The success of the new monetary policy consensus seems remarkable insofar as muting inflation⁸ did not entail higher variability of output and employment. However, one decade is a relatively short period to assess the robustness of this approach to monetary policy to guard against future monetary and financial crises, a point we come back to, in light of the 2007-2009 crisis, in the last section of this chapter.

Although this does not have a core role in the doctrinal debates about monetary policy, it should be stressed that, in the real world, a vast majority of central banks enforce convertibility into the currency that is central to a region or to the world. It is therefore essential to make a distinction between the central bank that dominates the international monetary system and the vast majority of central banks on the periphery. Metallic standards also constitute monetary policy regimes where the value of the higher powered currency is set externally, in the interplay of supply of and demand for the reference metal.

For central banks at the periphery, the value of the currency remains largely defined in terms of an external object over which the central bank has little control. The pound sterling, the US dollar or the basket of currencies chosen to peg the domestic currency may change value similarly, although for entirely different reasons, as precious metals have at the time of the gold standard and earlier. Hence, the value of the domestic currency hinges on the country's ability to maintain enough reserves in the center's currencies to sustain the credibility of the peg.

The implementation of monetary policy has also evolved with major innovations in the technology of payments and of financial instruments more generally. This evolution starts centuries before the emergence of central banks as the institutions in charge of monetary policies.

Control of the unit of account in earlier times/under metallic standards

For centuries Europe's monies worked under dualist systems. Units of accounts were separated from coins in use. Defined in old coins that no longer circulated, they became abstract units. Dualist systems were established in which the sovereign could change the value of the unit of account in terms of the galaxy of coins without having to alter the latter.⁹ Whenever the king devalued the unit of account, he increased the purchasing power of the coins in use, because prices were slow to adjust. He did so to increase the money supply, but also to alleviate the burden of the public debt that was denominated in the unit of account. Monetary conditions were highly dependent on the availability of metal.¹⁰

⁸ For instance, the Bank of England announced an inflation target of 2.5 percent in 1992. UK inflation was brought from 5 percent in 1991 to 2 percent in 1993 and close to its 2.5 percent since then.

⁹ In France the "*livre tournois*" goes back to Charlemagne around 800. In Great Britain the "*pound sterling*" originates in a Norman silver penny brought in with the conquest of 1066.

¹⁰ For instance, the dualist system worked to mitigate the destructive forces of deflation in the terrible era that encompassed 150 years from the Black Plague of 1348 to the end of the fifteenth century. However in the sixteenth century the inflow of silver from the Potosi in Peru launched a long inflation exacerbated by the manipulation of the units of accounts that the sovereigns indulged in their rivalries for the supremacy in Europe.

In the seventeenth century, the Nation States' eagerness to build large scale factories required the immobilization of savings in long-run investments. However, when the unit of account was depreciated, hoarders of species gained at the expense of creditors holding nominal claims. In England, the silversmiths, who were acquainted with the Stuarts, speculated on the recurrent devaluations of the pound sterling and on the debasement of species. They aggravated the monetary chaos by exporting the best coins. The Orange revolution of 1688 promoted a drastic change spurred by the need to finance the 1689 Spanish Succession war. In 1694 the merchants created the Bank of England and lent its entire capital of 1.2 million pounds to the king. In return the Bank was granted the right to discount bills and issue notes that later became legal tender.

However in 1694-95 an inflationary spike was a bad omen for the acceptance of the Bank of England's notes. A hot debate raged about the means to restore the trust in money. On one side, the Chancellor Lowndes advocated another devaluation of the Sterling. On the other side, Locke pleaded for a complete re-coinage, which would entail getting rid of debased species entirely. This deflationary solution was finally accepted by the king. It entailed a terrible recession in 1697-98 and provoked a huge loss for the Crown. Nonetheless the chosen ratio of gold to silver was 15.9 against 15 in Continental Europe. It attracted species from abroad and put the newly-founded United Kingdom on a *de facto* gold standard. The dualist system was replaced by the convertibility rule that was only suspended during the wars against France, starting in 1797 and lasting beyond the Vienna treaty of 1815 to the complete monetary recovery in 1821.

The gold standard became an international monetary order much later. Meanwhile gold and silver coexisted as long as Central Europe was on silver and France was the bimetallic center of the system. It was not until 1871 that the new German Empire adopted the gold standard.

Not long after France decided to abandon silver coinage and the United States to redeem the greenbacks issued in the Civil War in gold. In 1880 the world was on the gold standard.

The international monetary stability that prevailed until World War I is another example of the importance of hierarchy in payment systems, though this time at the international level, with a central role for the Bank of England. The gold standard was in essence a *key currency* system legitimated by gold convertibility. Sterling bills of exchange were the universal means of payment in international trade, while long-run capital exports from the City were negatively correlated with investment cycles in UK. Since the rule of convertibility was everywhere considered as an intangible common good over national policy objectives, short-run capital flows were stabilizing. Banks all over the world held deposits in London because they discounted sterling bills and received sterling payments. Therefore sterling was *primum inter pares*. In handling its rate to keep the ratio of gold reserves to notes close to the required level, the Bank of England *ipso facto* regulated international liquidity, because all other countries kept their exchange rates against sterling within gold points.

The working of convertibility was so entrenched in the minds of people that trust in the nominal value of contracts was never shattered. In times of stress, such as the Baring crisis of 1890 and the crisis of 1907, ad hoc cooperation between the Banque de France and the Bank of England, in the form of gold loans by the former to the latter, helped to build up international rescues that retrieved confidence.

The City of London centralized the market for international bills of exchange. The bank rate had a paramount influence on other countries via the discount houses in London. It is why the financial conditions in London summed up the degree of tightness in world liquidity. Liquid balances of foreign banks in London were highly sensitive to bank rate. The latter triggered stabilizing capital flows and synchronized the business cycle.

Monetary policy implementation in purely fiat monetary systems

The implementation of monetary policy since *World War II* is fundamentally different in the sense that money has effectively lost its physical, metallic reference. The high-powered money issued by the central bank has become purely fiat with the suspension of convertibility of dollars into Gold in 1971. However, even before 1971, the convertibility into gold has had only a very marginal role in the conduct of monetary policies. The gold standard had been replaced by a gold exchange standard in the 1930s. Under the *exchange* standard, only monetary authorities could exchange gold for currencies among themselves. The system was put under pressure in the 1960s as financial markets became progressively convinced that the US treasury could not sustain an artificially low peg of dollars into gold. Bickering arose on both sides of the Atlantic while European central banks had begun accumulating excess dollar reserves. In 1965, president de Gaulle of France accused the US of buying cheaply French assets and ordered the Banque de France to sell dollar reserves against Fort Knox gold at the official rate of \$35 an ounce.

The growing abstraction of money takes the form of new means of payments and savings instruments that become nearly as liquid as the more traditional deposits that are used for payments. These evolutions led to the definition and the measurement of several monetary aggregates (e.g., M1, M2 and M3). This multiplication of operational definitions of money reflects the increasing difficulty of identifying the relevant set of financial instruments that best reflect the liquidity available in the economy.

Central banks use mainly *three instruments* to influence the pace of money creation in the economy. *Reserve requirements* are a first type of instrument. By law, central banks stipulates that banks keep a fraction of their balance sheets (typically a specified money aggregate), in reserve at their account at the central bank. The reserve requirement ratio can be used to affect

the cost of issuing deposits.¹¹ Given that the central banks often choose to pay no or a low interest rate on the reserve, the cost of issuing any liability subject to reserve is directly affected by the level of reserve and their opportunity cost.

The second type of monetary policy instruments are *standing facilities* (also called discount windows) for banks to obtain liquidity in a bilateral transaction with the central bank. The interest rate of these transactions is typically called the *discount rate*. This rate can be superior to the money market interest rate so that these standing facilities are essentially insurance in case of unforeseen liquidity shortages. However, the discount window has been and still can be the foremost channel of central bank liquidity to the banking sector in countries where decentralized money markets are not mature.

The last major instrument of monetary policy is *open market operations*. These operations take different forms. The European Central Bank organizes regular auctions where it provides reserve at a target interest rate. The Federal Reserve directly purchases and sells public sector securities against central bank money so as to achieve a certain overnight interest rate.

These three instruments are used to a various degree to control money supply. However, open market operations are not usually described in terms of the interest rate they are meant to achieve, rather than in terms of the resulting level of monetary aggregates. One reason of this development is that the unpredictable rhythm of financial innovation alters the link between money growth and inflation. Another is that the control of monetary aggregates may require volatile short-term interest rates, as experienced in the US between 1979 and 1982. And, targeting larger monetary aggregates, while less conducive of financial instability, largely reflect the evolution of deposits, on which the central bank has a much looser grip.

¹¹ A prominent example of such implementation of monetary policy is the ongoing increase of required reserve ratio in mainland China. The People's Bank of China increased its reserve requirement ratio nearly every month in 2007 in order to contain the expansion of credit and deposit, while, at the same time limiting increases in interest rates.

Effectively, the level of the target interest rate has progressively become the dominant operational instrument of monetary policy. While the amount of liquidity exchanged by central banks is relatively small in comparison with the overall amounts of debt securities, the monopoly of the central bank over the supply of monetary base guarantees that the overnight interest rate rarely deviates from the target interest rate of the central bank for more than a day. Hence, at the frequency that is relevant for production, consumption and financial planning, i.e., over months or years, the central bank does control the level of short-term interest rates. Moreover, because this control of the cost of liquidity is ongoing, the central bank both controls the short end of the yield curve and influences the full maturity spectrum through the market expectations of future short-term rates.

Central banks therefore need to pick a level for this interest rate and explain the reason for this choice to market participants and the market at large. The conceptual framework used to decide on the level of short-term interest rate and the supply of central bank money is precisely the object of the monetary doctrines above discussed.

The last fifteen years have seen a large convergence in the conduct of monetary policy. Explicit inflation targeting was first introduced in New Zealand, Canada, the UK and Sweden in the early 1990s. More than twenty countries have adopted it since (see Crowe and Meade, 2007, for a list). The European Central Bank, that conducts monetary policy for, at the time this article is published, fifteen European countries, has a quantified inflation objective that has a level close to the inflation targets of inflation targeting countries. The case of the US Federal Reserve Bank stands out because it has a dual mandate of price stability and full employment. However, some observers have argued that US monetary policy can be considered to aim at keeping inflation at a small positive level (Goodfriend, 2007).

Central banks announce and explain changes in the level of the short-term interest rate with reference to inflationary and deflationary pressures that follow from the degree of tensions

demand puts on the productive capacity of the economy. Changes in the price of liquidity are hence typically associated with the risks of both inflation and economic activity though the path of inflation is always sustainable at the low level of the explicit or implicit inflation target. This approach to monetary policy succeeds in providing a nominal anchor although money has become a purely abstract concept that, potentially, can grow or shrink without limit. Central banks tie the price of liquidity, the nominal interest rate, through a state contingent rule, to the degree of tensions on the economy's productive capacity. An explicit nominal anchor is pursued, and, to a very large extent, achieved, through tailoring the money supply to the economy changing need for liquidity.

Looking forward: the challenges¹² of the 2007-20?? financial crisis and beyond

As we have shown in this text, structural changes, technological developments and the occurrence of new crises constantly raise new challenges for central banks. We therefore now turn to what we consider to be major threats for central banks at the current juncture.

While we are still, at the time of writing this text, in the midst of the largest financial crisis since the 1930s, it is essential to realize that the extension of the lender of last resort interventions taken by central banks since August 2007 have avoided the collapse of the banking systems. In our view, this shows that central bankers have learned from past financial

¹² This conclusion focuses on the current financial crisis. There however other important challenges. First, means of payments have been evolving for a long time from coins, to notes, checks, plastic cards and electronic transfers. E-money poses several new forms of risk because it uses open networks to communicate instructions and transfer value, in contrast to the closed nature of the interbank market. Open networks can remain efficient only if they maintain a critical mass of users while they may collapse suddenly if would-be users anticipate that this threshold will not be reached. In that event, losing customers trigger a self-fulfilling flight from the network. Chaos could then spread through interconnection between networks. The control by the central bank of the degree of liquidity in the economy would be severely hampered if issuers of e-monies were freed from the reserves and supervision requirements that apply to banks. Second, while there is a broad agreement that monetary policies have contributed to general stabilization of inflation since 1995, this remarkable performance may also result from globalization. The world-wide organization of production may indeed diminish the traditional bottlenecks that translated tensions on local factors of production into local inflation pressure. As a consequence, central banks may need to reconsider the geographic base of supply and demand in analyzing inflation tensions and envisage international coordination of monetary policies.

crises that such a collapse should be avoided at all costs. In spite of the scale of the financial crisis, we can still reasonably expect that the de-leveraging phase now engaged would trigger “only” the most severe recession since 1945, with unemployment rising “only” by 2 to 4 %, not so much higher than the levels visited in the early 1990s, and nowhere near the Great Depression levels (when unemployment reached 25 % in the US).

However, the strength of the de-leveraging tide should not be underestimated. It encompasses bank and non-bank financial intermediaries, households and non financial firms. Monetary authorities should in particular avoid that a self-fulfilling debt deflation spiral (Fisher, 1933) takes off. Given the willingness of the private sector to downsize its leverage, we risk an increase in precautionary savings that would put downward pressure on prices. This in turn can reduce income and increase real interest rates to a point where a larger proportion of income is used to reduce debts. At a point, bankruptcies may become the only way out of debt.

On the income side, stimulating demand either via income transfer to households with the highest propensity to spend (i.e. low income households) and public investment programs, preferably with a positive effect on long term productivity (i.e. infrastructure and research). On the debt dynamic side, public policies should aim at lowering the effective interest rates on private debt, if possible, below the growth rate of nominal income. Otherwise, the de-leveraging process can be prolonged indefinitely, or work through bankruptcies, with dire social costs.

We believe that these principles have inspired the design of the current crisis management policies and we are confident that further steps in these policies will be taken if warranted by the evolution of the crisis.

Looking beyond, the current financial crisis constitutes dramatic evidence that the economy remains vulnerable to the self-fulfilling dynamic of credit expansion and asset price

appreciation. Against this background, the single focus of monetary authorities on the stability of good and service prices, while asset prices have become widely volatile, may put them off the mark of their objectives of nominal, financial and real stability. More generally, economists and central banks have to identify whether taming asset price volatility is desirable, whether it can be tackled by traditional supervision policies only or whether it should also become an objective of monetary policy. In the latter case, the design of an operational framework that would take asset price volatility into account is warranted.

This aggiornamento of the central bank missions should improve the economy's resilience to the destabilizing impact of financial innovations. The last waves of financial crises (around 1990 and in 2007-20??) have all been fueled by excessive credit growth, which itself relied on some form of financial innovations. In the case of the current crisis, securitization and credit risk transfers have seriously hampered the effectiveness of bank supervision while it led to a dramatic increase in leverage of both financial intermediaries and households. This leverage increase has been located in part in a "shadow banking system", which escaped capital requirements of bank regulations. For instance, the leverage of GSEs (Fannie Mae and Freddy Mac) have become higher than 60, i.e. five times as high as the maximum leverage tolerated for commercial banks.

We can reasonably expect that future bank regulation will increase its perimeter to include shadow banks. However, the historical perspective reminds us that the next wave of financial innovation is likely to facilitate yet another way to increase leverage in the next optimistic phase of the asset price / economic cycle. This is why we may need to set up principles of macro-prudential policies that would set up contingent policies to counter the acceleration of credit growth away from its long term trend. Such policies would lean against the wind of the credit cycle.

In case of a broad agreement in favor of assigning central banks the objective of fighting this source of financial instability, economists will have to design the appropriate policy instruments. Indeed, as exemplified by the current crisis, financial instability may arise in spite of an impressive record of price stability. Moreover, the interest rate can be powerless to counter speculative dynamics, while, at the same time, very costly for non-speculative investment.

A second instrument, such as, for instance, contingent capital adequacy ratios may be necessary to allow central banks to pursue both objectives. Possibly, central bankers will come up with a more desirable solution to limit financial instability. In any event, financial and monetary crises have repeatedly transformed the mandate of central banks and the 2007-20?? Crisis should be no exception.

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