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Central Banks

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Summary and Keywords

The first CBs were private institutions that were given a monopoly over the issuance of currency by government in return for help in financing the budget and adherence to the rules of the gold standard. Under this standard the price of gold in terms of currency was fixed and the CB could issue or retire domestic currency only in line with gold inflows or outflows. Due to the scarcity of gold this system assured price stability as long as it functioned. Wars and depressions led to the replacement of the gold standard by the more flexible gold exchange standard. Along with restrictions on international capital flows this standard became a major pillar of the post-WWII Bretton Woods system. Under this system the U.S. dollar (USD) was pegged to gold, and other countries' exchange rates were pegged to the USD. In many developing economies CBs functioned as governmental development banks.

Following the world inflation of the 1970s and the collapse of the Bretton Woods system in 1971, eradication of inflation gradually became the explicit number one priority of CBs. The hyperinflationary experiences of the first half of the 20th century, which were mainly caused by over-utilization of the printing press to finance budgetary expenditures, convinced policymakers in developed economies, following Germany's lead, that the conduct of monetary policy should be delegated to instrument independent CBs, that governments should be prohibited from borrowing from them, and that the main goal of the CB should be price stability. During the late 1980s and the 1990s numerous CBs obtained instrument independence and started to operate on inflation targeting systems. Under this system the CB is expected to use interest rate policy to deliver a low inflation rate in the long run and to stabilize fluctuations in economic activity in the short and medium terms. In parallel the fixed exchange rates of the Bretton Woods system were replaced by flexible rates or dirty floats. The conjunction of more flexible rates and IT effectively moved the control over exchange rates from governments to CBs.

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The global financial crisis reminded policymakers that, of all public institutions, the CB has a comparative advantage in swiftly preventing the crisis from becoming a generalized panic that would seriously cripple the financial system. The crisis precipitated the financial stability motive into the forefront of CBs' policy concerns and revived the explicit recognition of the lender of last resort function of the CB in the face of shocks to the financial system. Although the financial stability objective appeared in CBs' charters, along with the price stability objective, also prior to the crisis, the crisis highlighted the critical importance of the supervisory and regulatory functions of CBs and other regulators. An important lesson from the crisis was that micro-prudential supervision and regulation should be supplemented with macro-prudential regulation and that the CB is the choice institution to perform this function. The crisis led CBs of major developed economies to reduce their policy rates to zero (and even to negative values in some cases) and to engage in large-scale asset purchases that bloat their balance sheets to this day. It also induced CBs of small open economies to supplement their interest rate policies with occasional foreign exchange interventions.

Keywords: gold standard, monetary independence, inflation targeting, macro-prudential, zero lower bound, quantitative easing

Introduction

Currently central banks (CBs) are, by historical standards, relatively autonomous public institutions in charge of monetary policy, price and financial stability, issuance of the currency, and, in many but not all countries, regulation and supervision of the banking system. Following the world inflation of the 1970s and the collapse of the Bretton Woods system in 1971, inflation gradually became the explicit number one priority of CBs. The global financial crisis (GFC), the ensuing stagnation, and recent deflationary pressures shifted some of the current focus back to financial stability and growth. Since they first appeared the functions, the independence, and the expectations from CBs changed substantially as technology, economic ideas, and outstanding economics and political challenges evolved over time.

The oldest CBs are the Riksbank (Sweden's CB) and the bank of England (BoE). Both started operations during the second half of the 17th century in order to act as bankers and debt managers for government and to provide a stable and flexible currency. The BoE Charter Act of 1844 gave the bank a formal monopoly on issuing notes. Mindful of the inflation that could result from the unrestrained issue of banknotes the Act prevented the bank from issuing new notes that were not matched by an increase in its gold reserve. The profits (or seignorage) from the note issue were to be paid to the Treasury. The Act provided a legal basis for the gold standard that, excluding periods of wars, assured price stability at least until the outbreak of World War I in 1914. It also provided a benchmark

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for the inter-wars gold exchange standard and the post-World War II Bretton Woods system. Sweden introduced the gold standard in 1873.

CBs originally came into being in order to facilitate the financing of government expenditures, particularly during wars, and to provide a flexible and stable currency. The provision of a stable currency requires financial as well as price stability. When the former was compromised by periodic financial crises and bank runs, CBs, in their capacity as monopoly providers of currency, came to the rescue. As a matter of fact, the founding of the Federal Reserve in 1913 was largely motivated by a desire to avoid financial panics, bank failures, and the associated violent fluctuations in interest rates.¹ In modern economies currency is provided by the CB as well as by private banks. The use of public funds to prevent bank failures is based on the view that currency is a public good. But the use of public money to prevent financial failures encourages excessive risk taking and is costly to taxpayers. A widely accepted principle to efficiently deal with this tradeoff is the Bagehot (1873) rule.

According to this more than century-old rule, in order to prevent an impending financial crisis, a CB should provide fully collateralized funds to illiquid financial institutions provided they are solvent. But it should not lend to insolvent institutions because such institutions are going to fail anyway. Lending to such institutions will only transfer their losses to the CB, and ultimately to taxpayers, without changing their ultimate fate. Although Bagehot's principle makes good sense, its practical application is complicated by the fact that it is usually hard to know in advance whether illiquidity problems are due to temporary reasons or to persistent insolvency problems. Moreover, as vividly illustrated by the recent GFC, a self-fulfilling financial panic may transform an initially illiquid but solvent financial institution into an insolvent one.²

During the first half of the 20th century, stability of the payment system was often compromised by high inflation caused by money financing of government expenditures particularly during and around wars. An extreme case is the post-WWI German hyperinflation that was fueled by the German government's extreme reliance on seignorage revenues.³ An important lesson learned from this and similar inflationary episodes was that there often is a tradeoff between using CB money to finance the budget and stability of the currency.⁴

This led more than half a century later to the wholesale interdictions of financing public budgets by means of borrowing from the CB. The prohibition on CB lending to the government is currently one of the basic pillars of the central bank independence (CBI) revolution that, in most countries, occurred between the mid-1980s and the beginning of the 21st century.⁵ Thus, although one of the main original functions of CBs was to facilitate government finances, this objective was largely abandoned in order to safeguard price stability. The fact that the post-WWII German Bundesbank was one of the first CBs to implement CBI is not accidental. Support of the German public for CBI and the associated separation between money creation and financing of the government

budget was fueled by painful memories of major hyperinflationary episodes, one after WWI and the other after WWII.

The Gold Standard

The early evolution of central banking was intimately linked to the gold standard. Under the gold standard the main function of the CB was to issue and retire paper money at a fixed price of gold. Due to the natural scarcity of gold this system assured long-term price stability and, excluding times of war when the standard was abandoned, prevented governments from borrowing at the CB. The monetary policies and the current accounts of countries that adhered to the gold standard were automatically linked through international trade and gold flows. A country with a current account deficit would lose gold to a surplus country. Under the rules of the gold standard the CB of the deficit country would retire notes leading to shrinkage of the money supply and deflation in that country. The gold inflow would force the CB of the surplus country to expand the money supply leading to inflation. As a consequence the deficit country would gradually become more competitive relatively to the surplus country reversing the original deficits and surpluses. This equilibrating process is known as the Hume price-specie flow mechanism.

In practice, during the heydays of the gold standard, the equilibrating process also operated to a large extent through the capital account. The shrinkage in the money supply due to the outflow of gold would raise the interest rate in the deficit country, inducing an inflow of capital that would reverse a substantial part of the gold outflow. The opposite would happen in the surplus country. Its interest rate would decrease due to the monetary expansion triggered by the gold inflow. This would lead to capital outflows that reversed some of the initial gold inflow of the surplus country. Thus, under the gold standard, current account imbalances were offset by equilibrating mechanisms that operated through the capital account as well as through differential changes in economic activities and the price levels of the two economies.

This hybrid equilibrating mechanism operates even in the absence of a gold coverage under a system in which CBs are committed to fixed pegs because the crucial factor is the commitment to fixed exchange rates. During the 19th century and the early 20th century this commitment was achieved by means of gold coverage. But, as demonstrated by the existence of long-lasting fixed pegs like the Hong Kong peg to the U.S. dollar (USD) and the irrevocably fixed exchange rates between members of a monetary union like the Euro Area (EA) it can be achieved also in its absence.

The automaticity of the gold standard made it an attractive device for maintaining price stability at the price of preventing governments from using the printing press as a source of finance for the budget. But during war times and major economic upheavals this constraint was deemed too costly by most governments and the gold standard was abandoned and reestablished several years later, often in watered down form. Thus after

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more than half a century Britain went off the gold standard with the outbreak of WWI in 1914. The intellectual appeal and good experience of the gold standard during pre-WWI normal times motivated Governor of the Bank of England, Montagu Norman, to attempt to restore it in the postwar period. But, having lost a large part of its gold reserves to the United States, Britain needed the cooperation of the United States to achieve this objective.

The Gold Exchange Standard

With the close involvement of Benjamin Strong, the powerful president of the Federal Reserve Bank of New York, Britain and the United States reestablished in 1925 a modified version of the gold standard, known as the gold exchange standard, at the prewar parity with gold. Under this standard, the U.S. dollar (USD) would, de facto, act as the ultimate backing for the inflated currencies of Britain, the rest of Europe, and the world. Britain, in particular, would keep its reserves not in gold, as it had before 1914, but mainly in USD, while the countries of Continental Europe, still struggling with the after-effects of the war, would keep their reserves, not in gold, but in sterling. This new scheme, in effect, permitted Britain to pyramid its inflated currency, sterling, and its credit, on top of dollars, while British client states could pyramid their currencies in turn, on top of sterling. It meant in effect, that only the United States would remain on a strict gold standard after 1925, and most other countries would redeem on paper currency (Engdahl, 2002).

Due to postwar domestic wage and price pressures, Britain's return to gold at the prewar parity reduced its competitiveness vis-à-vis France, Germany, and other European countries that depreciated their currencies relatively to their prewar parities with gold. This further depleted Britain's reserves (composed now of USD as well as of gold) and ultimately forced it to abandon the gold exchange standard in 1931.⁶ By contrast, between 1927 and 1932 France accumulated gold and sterilized most of the impact of this accumulation on the money supply. Irwin (2010) claims that, by creating an artificial shortage of international liquidity this "gold hoarding" put other countries under substantial deflationary pressures contributing to the severity of the Great Depression.

Monetary Policies and Institutions During the Great Depression

The immediate cause for Britain's 1931 abandonment of the gold exchange standard was a speculative attack on sterling. The more fundamental causes were the overvaluation of the pound caused by return to the prewar parity in 1925 along with the shrinkage of international trade following the outbreak of the Great Depression. With substantially higher gold reserves the United States continued to maintain the parity with gold for another couple of years. However, under the pressures of persistently mounting domestic unemployment and reduced economic activity Franklin Roosevelt suspended convertibility to gold in April 1933, by forbidding, through Executive Order 6102, most private holdings of gold. The immediate rationale behind the order was to bypass a legal constraint in the 1913 Federal Reserve Act that required 40% gold backing of Federal Reserve notes issued.⁷ The wider objective was to devalue the U.S. dollar (USD) in terms of gold and other currencies without abandoning the gold standard.

The Order effectively disconnected the market for monetary gold from the market for gold as a commodity. It required all persons to deliver on or before May 1, 1933, all but a small amount of gold coin, gold bullion, and gold certificates owned by them to the Federal Reserve, in exchange for \$20.67 per ounce. The price of gold for monetary international transactions was thereafter raised to \$35 an ounce. The resulting profit realized by the U.S. government provided initial funding for the Treasury Exchange Stabilization Fund (ESF) established by the Gold Reserve Act in 1934.

It is notable that all those changes were decided and implemented by the executive or legislative branches of government rather than by the CB. In particular, the Act empowered the Treasury rather than the Federal Reserve (Fed) to buy and sell foreign currency to "promote exchange rate stability and counter disorderly conditions in the foreign exchange market."⁸ The devaluation of gold by the United States reinforced a cycle of beggar thy neighbor policies largely triggered by the 1930 protectionist Smoot-Hawley Tariff Act and led to further reductions of international trade.⁹

It is widely accepted that the Great Depression was aggravated by a number of major policy mistakes on the part of the Fed. Motivated by a desire to safeguard its capital, the Fed refrained from acting as a lender of last resort. This led, during the early 1930s, to wholesale banking failures extinguishing more than a third of U.S. banks and to a stagnant and even decreasing money supply precisely when the financial system desperately needed liquidity (Friedman & Schwartz, 1963). Meltzer (2003) argues that this inaction was at least partly due to the use of faulty indicators for the tightness of monetary policy on the part of the Fed. In particular the Fed interpreted the absence of bank borrowings at the Fed and low nominal rates of interest as signals that monetary

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policy was expansionary. But in fact borrowings were low mainly because the economy was depressed and real rates were higher than nominal rates due to deflation.

A third policy mistake was one of the reasons for the 1937–1938 recession. Observing the volume of reserves in the banking system and arguing that it would fuel inflation, the Fed Board—with the approval of the secretary of the Treasury, most financial experts, and many academics—doubled commercial bank reserve requirements in three steps during the second half of the 1930s in spite of the fact that, due to high unemployment, the risk of inflation was minor (Timberlake, 2008).

As is well known, the experience of the Great Depression led to the creation of Keynesian economics and of macroeconomics as a sub-discipline of economics. It led to the realization that, in countries whose currencies are linked through the gold standard, the price specie flow mechanism operates via changes in economic activity as well as through changes in inflation. In particular, the price level as well as the level of economic activity of a deficit country shrink while the opposite occurs in a surplus country. This insight carries over to any system of credibly fixed exchange rates independently of whether it is backed or not backed by gold.

In the United States the 1929 stock market crash and the ensuing bank failures triggered the creation of several new pieces of legislation that had a profound and lasting impact on monetary policymaking institutions. The most important among those are the creation, in 1933, of the Federal Deposit Insurance Corporation (FDIC) and the Glass-Steagall Act. The establishment of universal deposit insurance (up to a ceiling) through the FDIC largely neutralized bank runs by individual depositors. However, because large deposits by financial institutions were not insured this did not neutralize the incentive of such institutions to run on each other. This was an important factor in the recent global financial crisis (GFC). The Glass-Steagall Act set up a regulatory firewall between commercial and investment bank activities that lasted for over 50 years but was gradually eroded since the last decade of the 20th century.

The Bretton Woods System (BWS)

The United States emerged from WWII as the major economic power of the world.¹⁰ By contrast European belligerents were impoverished. There was, on both sides of the Atlantic, a desire to rebuild an international monetary order to replace the gold exchange system that ceased to operate during the war. In 1944 delegates from 44 countries met in Bretton Woods, New Hampshire, to create a new international monetary system. The main goals of the meeting were to create a foreign exchange rate system that would prevent competitive devaluations and promote economic growth along with price stability. The agreement also created two new international institutions: The International Monetary Fund (IMF), which was created to monitor exchange rates and lend reserve

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currencies to nations, and the World Bank (WB), which was set up to provide financial assistance for postwar reconstruction and developing countries.

Except for a small group of countries whose currencies were allowed to float, the agreement created a system of fixed but periodically adjustable exchange rates. The currencies of most countries were effectively pegged to the U.S. dollar (USD), which continued to be linked to gold at the prewar price of \$35 per ounce. The agreement made currencies convertible for trade and other current account transactions but not for capital account flows. Maintenance of the system required, therefore, the imposition of exchange controls that were monitored by the IMF.¹¹

For a bit over 20 years the United States enjoyed price stability and the BWS functioned reasonably well. As U.S. involvement in the Vietnam War deepened during the second half of the 1960s, U.S. inflation rose, and it developed deficits in the current account. This intensified a basic conflict between the world's increasing demand for international reserves and U.S. domestic policy needs and led to a continuous drain on U.S. gold reserves.¹² The Bretton Woods agreement ultimately succumbed to those pressures and was gradually dissolved between 1968 and 1973. President Nixon called for a temporary suspension of the dollar's convertibility to gold in 1971. Countries were then free to choose any exchange agreement, except repegging to gold. Finally, in 1973, major non-U.S. governments let their currencies float, putting an end to the Bretton Woods system and, more generally, to the operation of monetary standards directly or indirectly linked to gold.

Central Banks in Developing Countries

The majority of CBs in developing countries were created during the 20th century. Although the charters of those banks partly emulated those of more mature CBs like the Bank of England, the U.S. Federal Reserve, and the Banque de France actual policies often deviated from the letter of the law. During the Bretton Woods System (BWS) era, the currencies of developing countries were pegged to the currencies of countries that were directly or indirectly on the gold standard.

Unlike CBs in developed economies, the main task of CBs in developing countries was initially to directly support the development of agriculture, industry, general infrastructure, and other sectors by means of direct credits from the CB to various sectors of the economy. Due to underdeveloped capital markets and the low level of domestic savings, those CBs functioned mainly as development banks rather than as Western-type CBs. As a consequence, they were subservient to governments and often used as a source of seignorage revenues that fueled inflation.

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The Reserve Bank of India (RBI), which plays an important role in the development strategy of the Indian government, is one example of such a structure.¹³ The processes of development, globalization, and the spreading of central bank independence subsequently led to a narrowing of the gap in the functioning of CBs in developed and developing economies.

The Emergence of Central Bank Independence (CBI)

The collapse of the BWS triggered a search for alternative monetary anchors that would provide price and exchange rate stability.¹⁴ Many European countries (such as Austria, the Netherlands, Belgium, and Luxembourg) opted for pegging their currencies to the German mark, which, due to the conservativeness of the German Bundesbank (Buba), had a relatively good record on price stability. The charter of Buba, established in 1957, gave it a high level of instrument independence and stipulated that its main objective is the maintenance of price stability. Buba was supposed to also back up the economic policy of the German government but only as long as it did not jeopardize price stability.

There is little doubt that the high levels of independence and conservativeness that were bestowed on this postwar CB were a direct consequence of the two devastating hyperinflations that Germany experienced following WWI and WWII.¹⁵ The German Buba took its charter very seriously and used its mandate to deliver price stability even when this necessitated confronting the political establishment. During episodes of policy conflicts between the bank and the political establishment, the president and high officials of Buba effectively mobilized the anti-inflationary sentiments of the German public to prevail.

Between the end of the 1960s and the beginning of the 1980s the United States experienced a relatively high inflation period that became known as the great inflation (GI). At the origin the GI was fed by the Vietnam War and the oil shocks in 1973 and 1979 and aggravated by politically dominated, over-expansionary monetary policies under Fed chairman Burns. The GI was finally stabilized at great output cost by Chairman Paul Volcker at the beginning of the 1980s. Although it did not lead to dramatic changes in the Fed's charter, Volcker's disinflation and the subsequent tranquil Alan Greenspan era raised the Fed's prestige and its informal independence.¹⁶

In part stimulated by the price stability experience of Buba, many countries have substantially upgraded the independence of their CBs since the early 1990s. In particular, the Bank of England was granted legal independence in 1997 and the Riksbank in 1999. The charters of the European Central Bank (ECB) and of the national CBs within the European Monetary Union (EMU) were all patterned after the charter of the highly

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independent and conservative Buba.¹⁷ Central bank independence (CBI) was upgraded following the stabilization of inflation during the 1990s in many Latin American countries. Following the downfall of the Soviet Union in 1990, the new CBs of former socialist economies were made highly independent at the outset.¹⁸

In spite of some cross-country variations, the following broad practical consensus backed by academic work has emerged: The primary responsibility of the CB is to assure price stability and financial stability. In particular, the price stability objective is elevated to special status and, in a growing number of countries, is communicated to the public by preannouncing an inflation target. Without prejudice to the price stability objective the CB is expected to support the economic policies of government. To achieve its main objective the bank is given instrument independence but its goals are determined by government. The assignments of broad CB goals such as price and financial stability are invariably done by government. In most cases the numerical value of the inflation target is also set by government.¹⁹ Instrument independence includes the authority to set the interest rate, the monetary base and, in many cases, regulation of the banking system. In addition, government is prohibited from borrowing directly at the CB.

Delegation of authority to a non-elected institution is expected to be accompanied by accountability and transparency. It is noteworthy that those two buzzwords of modern monetary institutions were hardly on the agenda prior to the emergence of CBI as a widespread commitment device. When political authorities were in charge of monetary policy their incentive to raise questions about their own transparency and accountability was obviously lower.

Why Did Central Bank Independence Increase So Much During the 1990s?

The international trend toward higher central bank independence (CBI) was due to a combination of global and regional factors. Three main global factors underlie the trend toward higher CBI. One is the increased worldwide quest for price stability triggered by the stagflation of the 1970s, the disappearance of the Bretton Woods System (BWS), and the dismal economic performance of some high inflation countries, in Latin America and elsewhere. Unlike in the 1960s and 1970s, the accepted view during the 1980s and 1990s was that inflation and the associated uncertainties retard growth. The relatively good real performance of some low inflation countries like Germany and Japan until the 1980s supported this view.

The second factor is globalization, the gradual dismantling of controls on capital flows, and the associated widening of international capital markets. Those processes reinforced the quest for price stability and raised the importance of CBI as a signal of macroeconomic nominal responsibility to domestic and international investors. As argued by Maxfield (1998), this factor was particularly important in developing countries whose political establishments were anxious to establish smooth access to international capital markets. The removal of exchange controls made it more difficult to defend fixed pegs and forced a non negligible number of countries to adopt more flexible exchange rates. Interestingly, this raised the *actual* independence of CBs because under flexible exchange rates they could affect the exchange rate by means of interest rate policy, while under fixed pegs, the decision to adjust the peg was invariably made by treasury departments and governments. Relatedly, the International Monetary Fund (IMF) embraced the view that a high level of independence is a desirable institutional feature and actively promoted CB reform in many developing economies through conditionality and other means.

Third, the good track record of the highly independent Bundesbank demonstrated that CBI can function as an effective device for assuring nominal stability. In addition, the acceptance of the Maastricht Treaty by the European Union implied that in order to conform to the Treaty many countries in the Union had to upgrade the independence of their CB as a precondition for membership in the European Monetary Union (EMU). The fact that such a stipulation was introduced in the Treaty in the first place is related to the good record of the Bundesbank and to the central position of Germany within the Union.

Among the regional factors are: First, after successful stabilizations of inflation particularly in Latin America, policymakers were looking for institutional arrangements capable of reducing the likelihood of high and persistent inflation in the future. In view of the experience available at the time, raising CBI was a natural way to achieve this objective. Second, the upgrading of CBI and the creation of best practice Western-type central banks in the former socialist countries were part of a more general attempt by

these countries to create the institutional framework needed for the orderly functioning of a market economy. The fact that many of these new central banks were granted substantial de jure independence was no doubt motivated by evidence from the industrial economies suggesting that inflation and legal independence are negatively related and that independence and growth are either positively related or unrelated.²⁰

Underlying Doctrinal Aspects of Central Bank Independence and of Inflation Targeting

In the aftermath of the Great Depression and the ensuing Keynesian revolution, the focus of monetary policy shifted, after WWII, to stabilization of the real economy. The downward sloping Phillips curve initially estimated by Phillips (1958) was taken to represent a stable policy tradeoff between inflation and unemployment—and therefore a menu of possible choices confronting monetary and fiscal policymakers (Samuelson & Solow, 1960).

The empirically stable tradeoff between inflation and economic activity virtually disappeared during the great U.S. inflation of the 1970s. This led to the view, pioneered by Friedman (1968) and Phelps (1967, 1968) that the negative relation previously found between inflation and unemployment was due to slow adjustment of inflationary expectations following accelerations in actual inflation. However, in the long run, after expectations have adjusted to actual inflation, the rate of unemployment and economic activity are independent of the rate of inflation. Friedman (1968) dubbed this real level of economic activity “the natural rate of unemployment.” He proposed a mechanism based on slower adjustment of inflationary expectations by workers than by employers to explain why there is a short-term tradeoff between inflation and unemployment in spite of the notion that there is no such tradeoff in the long run: faster realization of the decrease in the real cost of labor due to an increase in inflation by employers induces them to partially offset this decrease (through increases in nominal wages) as they compete for workers. Because workers’ expectations lag behind those of employers, workers interpret the increases in nominal wages as an increase in real wages and are willing to supply more labor. This stimulates economic activity and increases employment. Subsequently Lucas (1972, 1973) developed a more symmetrical version of this mechanism based on the notion that, by blurring the difference between changes in inflation and changes in relative prices, positive inflationary shocks induce increases in the supply of all producers in the economy.

The disappearance of the Phillips curve during the great inflation of the 1970s and its subsequent costly stabilization by Volcker cemented the view that money is neutral in the long run and reoriented the focus of CB policies toward price stability.²¹ Inevitably this led to the conclusion that monetary policy should focus mainly on delivering price stability in

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the long run. In parallel the idea that price stability can be assured via central bank independence took hold during the eighties and led subsequently to the worldwide upgrades in the autonomy of central banks previously described.

The intellectual revolution triggered by the KPBG (Kydland & Prescott, 1977; Barro & Gordon, 1983) inflation bias story further helped cement a consensus that trying to use money to raise output beyond its full information, flexible price magnitude is ineffective and only leads to socially harmful inflation. By offering a relatively simple theory of the prisoner's dilemma aspects of the interaction between monetary policymakers and individuals in the economy, the inflation bias model provided academic credence for the claim that monetary policy should be delegated to a sufficiently independent CB and helped spread this notion internationally.²²

Volcker's disinflation was followed, within several years, by a great moderation in the variabilities of both output and inflation. This moderation, which lasted from the end of the 1980s until the bursting of the U.S. subprime bubble in 2008, revived the view that, although monetary policy cannot affect real variables in the long run, it could be used in the short and medium terms to stabilize the real business cycle without endangering the long-term stability of prices. This view was operationalized, in many countries, by means of inflation targeting (IT). Taylor (1993) was probably the first to formulate an explicit IT rule in order to describe the actual policy followed by Fed chairman Greenspan. This rule postulated that the short-term interest rate is a linear function of the output and inflation gaps and of the expected rate of inflation. Here the first gap is the deviation of inflation from a (low) inflation target and the second gap is the deviation of actual from potential output.

In a series of publications dating from the late 1990s and the first decade of the 21st century, New Keynesians academics provided general equilibrium micro foundations for IT interest rate rules (Clarida, Gali, & Gertler, 1999; Woodford, 2003; and Gali, 2008 are prominent examples). In this micro founded version monetary policy is able to affect economic activity in the short and intermediate runs in spite of long-run neutrality due to sluggish and staggered adjustments of prices and wages. This view provided academic support and respectability to the IT regimes that many CBs instituted in parallel to the CBI revolution.²³

Under an IT regime an independent CB picks the short-term interest rate (taking the structure of the economy and of inflationary expectations as given) so as to minimize a weighted linear combination of the social costs of the inflation and output gaps. The New Keynesian literature shows that this leads to interest rate rules that depend on the inflation and output gaps and on inflationary expectations.

In summary, after 20 years of gradual changes between the early 1970s and the early 1990s, CBI cum IT have replaced the gold exchange standard as a device for committing to price stability.

Immediate Reactions of Monetary Policy to the Global Financial Crisis

Up to the eruption of the U.S. subprime crisis in 2008 conventional wisdom concerning monetary policy was that²⁴:

1. The real interest rate is the main policy instrument and a sufficient statistic for the stance of monetary policy;²⁵
2. The CB should lean against bubbles only to the extent that they push actual inflation away from the inflation target;
3. Under inflation targeting (IT), financial stability and prudential considerations took a back seat. One institutional manifestation of this approach was the transfer of financial supervision from the Bank of England to a separate agency: the Financial Services Authority (FSA) during the second half of the 1990; and
4. Relatedly, precious little attention was devoted, at least by mainstream academics, to systemic financial risks.

The global financial crisis (GFC) reminded monetary policymakers that during a financial crisis, of all public institutions, the CB has a comparative advantage in swiftly preventing the crisis from becoming a generalized panic that would seriously cripple the financial system. The main reason for this comparative advantage is that financial crises are characterized by sudden huge increases in excess demand for liquidity. Due to its monopoly over the creation of high-powered money, the CB is the choice institution for satisfying this craving for liquidity before it destroys or seriously cripples the financial system. Following the demise of Lehman Brothers in September 2008 this fact was quickly recognized by Federal Reserve chair Ben Bernanke, who, as a scholar, developed the view that a critical factor in the severity and persistence of the Great Depression was the collapse of the credit mechanism, and hence of the real economy, caused by massive banking failures (Bernanke, 1983).²⁶ The Fed reacted so vigorously that within six months of Lehman's collapse its balance sheet had more than doubled, putting the yearly rate of expansion of its balance sheet over those six months at an all-time record of 420% per year. By comparison, during the previous nine years the average annual rate of expansion of the Fed's balance sheet was a meager 6.25%. Some observers have even argued that, since the burst of the subprime crisis, the Fed has been acting as market maker of first resort rather than as the classical Bagehot lender of last resort (Humphrey, 2010).

This dramatic policy shift was soon to be followed by a number of operational changes in both the implicit and explicit IT procedures followed during the preceding great moderation years. Within less than six months of Lehman's event the zero lower bound (ZLB) on the short-term policy rate became effective, forcing the Fed to supplement interest rate policy by means of quantitative easing programs.²⁷ In parallel, the conduct of

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expansionary open market operations shifted to longer term maturities and higher risk securities.

Initially European banks were affected by the U.S. subprime crisis mainly through their international financial linkages with the United States. Some of them had to be rescued but this was done more by the respective fiscal authorities than by the European Central Bank (ECB). Although the ECB did eventually reduce its policy rate, the reduction path lagged behind that of the Fed. However, in the wake of the ongoing Greek and other PIIGS countries sovereign debt problems, the highly conservative ECB inaugurated a long-term refinancing operation.²⁸ This lending facility was aimed at providing substantial long-term (up to three years) credit to banks within the Euro area. From the collapse of Lehman Brothers until May 2011 the ECB balance sheet expanded at the rather modest rate of about 2.46% per annum. The much higher rate of expansion of the Fed's balance sheet over the same period reflects the higher conservativeness of the ECB as well as the fact that, although it had worldwide ramifications, the subprime crisis started in the United States.

But, following the increases in demand for liquidity induced by the persistence of the sovereign Greek debt crisis the rate of expansion of the ECB's balance sheet accelerated dramatically. It increased to a whopping 70.88% per annum over the May 2011 to March 2012 period. As a result of this acceleration the ECB balance sheet roughly doubled between Lehman's collapse and March 2012. Thus, in the face of an acute crisis within its own jurisdiction, even the highly conservative ECB had to react with substantial liquidity injections. Finally, following the Fed's example, the ECB announced in January 2015 a massive quantitative easing program designed to revive the fragile Euro Area economy.²⁹

The Impact of the Global Financial Crisis on Monetary Policy and Institutions

The global financial crisis (GFC) led to numerous changes in the policies, relative emphasis on alternative objectives, policy instruments, and tasks of major CBs. It precipitated the financial stability motive into the forefront of central banks' policy concerns and revived the explicit recognition of the lender of last resort function of the CB in the face of shocks to the financial system. Although the financial stability motive was (at least implicitly) present, along with the price stability motive, also prior to the crisis, the crisis highlighted the critical importance of the supervisory and regulatory functions of central banks and other regulators.³⁰

An important lesson from the crisis was that micro-prudential supervision and regulation should be supplemented with macro-prudential regulation and that the CB is the top choice institution to perform such a function. Prior to the GFC the bulk of regulatory

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activities was aimed at assuring the viability of individual financial institutions at the micro level. One of the devices used to achieve this objective was the imposition of minimal capital requirements under the Basel II agreement.

The GFC demonstrated that, in the face of a generalized panic fed by excessive past increases in aggregate credit, micro regulation does not suffice because it does not take into consideration the tendency of most financial institutions to err in the same direction and to shift from large credit expansions to substantial credit contractions simultaneously. This led to the realization that micro-prudential regulation should be supplemented by macro-prudential regulation that is able to take preventive measures against undesirable aggregate financial developments. This led, in the post-crisis era, to the imposition of stricter regulation on systemically important financial institutions (SIFIs) because insolvency of such an institution is likely to induce non-negligible adverse ramifications for the rest of the financial system and force government to bail it out at the expense of taxpayers.

By inducing major CBs to quickly reach the zero lower bound (ZLB) the GFC opened the door for substantial quantitative easing operations and triggered a still ongoing process of regulatory reforms. U.S. policy rates reached the zero bound in late 2008 and were supplemented by huge quantitative easing programs. During the first quarter of 2009 the Bank of England (BoE) base rate was reduced to 0.5%, and it was reduced further to 0.25% in August 2016. Although it did not react with the same immediacy and amplitude, the more conservative European Central Bank (ECB) engaged on a similar path after a while and, as of 2014, even moved its policy rate into negative territory.

The crisis led to the development and utilization of nonconventional policy instruments on a large scale. The most prominent among those are quantitative easing, direct liquidity injections into the private banking system, negative interest rates, and foreign exchange (forex) interventions. It intensified both practical and academic research on the interactions between traditional monetary policy aimed at price stability and monetary, financial, and regulatory policies aimed at preserving the stability of the financial system. In countries directly hit by the crisis (like the United States in the face of the subprime crisis or the ECB in face of the Greek sovereign debt crisis), CBs had two distinct functions. The more immediate function was to quickly inject large quantities of liquidity in order to prevent a total arrest of financial intermediation. But after some measure of financial stability has been reestablished the longer term issue confronting policymakers and reformers in the affected countries was how to change regulation both within and outside CBs so as to reduce the likelihood of future crises.

Until the eruption of the subprime crisis most Western CBs practiced standard inflation targeting. This changed dramatically following the downfall of Lehman Brothers in September 2008. In spite of huge liquidity injections and policy rates in the vicinity of the zero bound, excessive inflation ceased to be an issue and remains subdued in both the United States and Europe. As a matter of fact, during 2015 and 2016 the central banks of

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those big players became concerned with negative inflation gaps (inflation below target and even in the negative range).

The expansionary policies of the big blocks led both directly and indirectly to a new tradeoff, this time between limiting the impact of the financial crisis on the real economy and the formation of bubbles in real estate and financial assets. In particular, the sustained expansionary policies of the Fed and of the ECB induced CBs in many smaller countries to follow suit, leading to investment booms in real estate and financial markets of those and other countries. Prior to the crisis the extent to which monetary policy should take the risk of bubbles in those markets was controversial.³¹ Following the experience of the last several years many CBs do give some weight to that consideration even though they do not appear explicitly in their charters.

The GFC led to a far-reaching, still ongoing, process of regulatory reform aimed at identifying systemic risk early on, closing pre-crisis regulatory loopholes, and, particularly in the European case, devising regulatory institutions that would be able to deal effectively with the international dimensions of systemic risks.³² Major pieces of legislation/resolutions in this context are the July 2010 Dodd-Frank Act in the United States and the creation of a European Banking union by the head of states of the European Union (EU) in June 2012. In both cases the respective central banks (the Fed in the United States and the ECB in the Euro Area) were charged with the supervision and regulation of systemic risks and, in parallel, given more authority in comparison to the pre-crisis era. Similarly, in the United Kingdom an independent Financial Policy Committee charged with monitoring and reducing systemic risks was created in April 2013 within the BoE. In all three cases the CB was given a major role in the supervision and regulation of SIFIs, reflecting the emerging consensus that the CB has a comparative advantage in the monitoring of macro-prudential risks.³³ In summary, since 2008 the financial stability motive has been a main mover of monetary policy in the United States and subsequently in Europe and some emerging markets.

Foreign Exchange (Forex) Interventions in the Crisis's Aftermath

In normal times the CB can influence the nominal and, due to temporary stickiness of wages and prices, the real exchange rate and external competitiveness by adjusting its policy rate without intervening in the foreign exchange market. But since the outbreak of the global financial crisis (GFC) such interventions have become more common. Forex market interventions are not new. They have been used by central banks of emerging markets as a device for ironing out “excessive fluctuations” in exchange rates long before the GFC. For several decades prior to the crisis China pegged its currency to the U.S. dollar (USD) in order to maintain the competitiveness of its exports. But the zero interest

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rate and quantitative easing (QE) policies of the United States and, more recently, the European Central Bank (ECB) negative policy rate added a new dimension to such interventions.

To preserve their competitiveness, small open economies such as Switzerland, Israel, the Czech Republic, and a few others reacted to the expansionary monetary policies of the big blocks by lowering their policy rates, often in conjunction with forex interventions designed to stem the appreciation of their currencies. The potential importance of such interventions gradually increased as their policy rates approached the zero lower bound (ZLB). In small open economies an important transmission channel of monetary policy operates through the exchange rate. Once the ZLB is reached the relative importance of foreign exchange purchases as a device for moderation of appreciation rises. Some countries like Israel have initially used this instrument to build up forex reserves and occasionally to iron out excessive appreciation tendencies.

As of September 2011 the Swiss National Bank (SNB) introduced a one-sided peg on the Euro/SF exchange rate at 1.2 and effectively defended it till January 2015 when the ECB announced a large quantitative easing program. This policy led to a substantial increase in Switzerland's forex reserves, which, as of late 2015, were at a level similar to that of the country's GDP. The SNB's extreme reliance on forex interventions is directly related to the GFC. As a safe haven currency, the Swiss franc tended to appreciate during the frequent panics experienced during the GFC, eroding the competitiveness of Swiss exports. Having reached the ZLB relatively early, the SNB found it expedient to rely relatively heavily on forex interventions. It is notable that, once the ZLB is reached, the need to sterilize such interventions diminishes, implying that they become similar to the quantitative easing operations practiced by the Fed and the ECB.³⁴

Concluding Remarks and Open Issues

Modern CBs in developed economies differ in many respects from their original 17th-century ancestors. One fundamental difference is that during most periods prior to the 20th century a major function of CBs was to help finance governments' expenditures, while, excluding war times, modern CBs are prohibited from lending to government. On the other hand, although the instruments and the independence of CBs have changed a lot over time, their fundamental objectives during the last 200 years were and still are to safeguard the stability of the currency and of the financial system. In modern terms this translates into domestic as well as international price and financial stability.

During normal times price stability requires a commitment to limit the rate of growth of the money supply. Under the gold standard and some of its subsequent variations this commitment was implemented by the gold cover of currency in combination with the rarity of gold. Since the late 20th century, this commitment has been implemented by independent CBs whose main objective is to maintain price stability. Recognizing that,

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due to price and wage stickiness, monetary policy can temporarily affect output, many modern CBs practice flexible inflation targeting (IT). By allowing CBs to converge toward the inflation target only gradually, this system makes it possible to attain long-term price stability while engaging in medium-term stabilization of economic activity.

During financial crises and widespread panics characterized by sudden extreme increases in the demand for liquidity, modern CBs act as firefighters by supplying large amounts of liquidity to the private sector. But, in their capacity as regulators, they are expected to monitor and regulate the financial system so as to prevent financial crises in the first place.³⁵ Recent evidence suggests that financial crises are more likely following substantial buildups of leverage (Borio & Drehmann, 2009; Reinhart & Rogoff, 2009; Shularick & Taylor, 2012). On the other hand, credit buildup is an important financing bloodline for investment and growth. This creates a tradeoff between reducing the likelihood of crises and growth. More regulation reduces the likelihood of crises but also reduces credit for useful economic activities. As of yet there is no definite consensus about the optimal form and extent of regulation.

Being well aware of the fact that the Great Depression was aggravated by the reluctance of the Fed to act as a lender of last resort, Chairman Bernanke and the Federal Open Market Committee (FOMC) engaged in huge quantitative easing operations between Lehman's collapse and the end of 2014. Since 2015 the ECB has embarked on a similar path. Some policymakers and economists initially worried that this huge amount of liquidity would rekindle the fires of inflation.³⁶ But reality dispelled this view. Inflation in the United States has mostly been below the 2% internationally accepted target, and inflation in the Euro Area was even negative during 2015 and 2016. A basic reason for the tameness of inflation is a substantial and persistent post-crisis slowdown in credit growth along with a reluctance to use fiscal policy in order to revive the economy.³⁷

In order to avert financial meltdowns, CBs and fiscal authorities in the United States, the United Kingdom, and some other countries had to bail out financial institutions. Bailouts confront monetary and fiscal policymakers with a tough tradeoff between letting a financial panic spread and planting the seeds of the next crisis by inducing moral hazard on the part of financial institutions. This dilemma is particularly acute in the case of systemically important financial institutions (SIFI), whose failure is more likely to spread to the entire financial system as was the case when the Fed and the U.S. Treasury reluctantly decided that they could not bail out Lehman Brothers in the absence of approval by Congress.³⁸ Post-crisis new regulation attempts to ameliorate this tradeoff by requiring SIFI to prepare "living wills" that provide blueprints for the orderly disposition of their assets if needed.

Flexible inflation targeting requires that, without prejudice to long run price stability, CBs are supposed to engage in anticyclical monetary policy. One of the channels through which such a policy operates is the external competitiveness channel. In particular the CB is supposed to utilize expansionary monetary policy in order to raise external competitiveness by means of currency depreciation when the economy is depressed.

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When all CBs operate in this manner they at least partly neutralize each other's expansionary effects on domestic outputs and contribute jointly to a reduction of international trade. This mechanism, sometimes labeled "a currency war," bears a non-negligible resemblance to the current policies of the many CBs whose interest rates are at the zero lower bound or even in the negative range.³⁹

More than a hundred years ago Wicksell (1936) coined the natural rate of interest concept. This is the real rate at which the economy operates at its potential level and prices are stable. The corresponding operational definition of the natural rate is the rate at which the output and inflation gaps are both zero. Given that it strives toward price and output stability, a flexible inflation targeter is equivalent to a CB that gradually aims to converge toward the natural rate.

Since the late 1990s, both long- and short-term riskless interest rates have been on a long downward trend that was reinforced by CBs' expansionary policy actions following the outbreak of the global financial crisis (Bean, Broda, Takatoshi, & Kroszner, 2015). The increasing prevalence and persistence of negative rates raises the possibility that currently the natural rate is negative. Recent zero and even negative interest rates imply that the zero lower bound may interfere with CBs' ability to move their economies toward the natural rate.⁴⁰ If that is indeed the case, one way to avoid the problem is to release the constraint implied by the zero lower bound by credibly raising the inflation target. However it appears that, after the successful operation of the 2% inflation target regime during the great moderation period, most policymakers are reluctant to raise the inflation target.

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Notes:

(1.) Details on the early histories of the BoE, the Riksbank, and the Federal Reserve appear in *The Bank of England: History and Functions* (1970), Wetterberg (2009), and Meltzer (2003).

(2.) Details appear in Cukierman (2016b).

(3.) Detailed factual accounts of the German hyperinflation appear in Bresciani Turrone (1937) and in Holtfrerich (1986). Cukierman (1988) documents the German government's reliance on seignorage revenues and provides a political economy explanation for this tendency.

(4.) This tradeoff may disappear in the aftermath of financial crises like the recent subprime crisis, during which the equity capital of many financial institutions is wiped out. Thus the monetary injections of the Federal Reserve and the U.S. Troubled Assets Relief Program (TARP) program enacted in October 2008 prevented further failures of financial institutions without triggering inflation. This is discussed in some detail later. But, excluding episodes of financial crises, sustained use of the inflation tax to finance the budget invariably leads to inflation.

(5.) The drive toward CBI is discussed later.

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(6.) A colorful account of the economic and political role Montagu Norman, who was governor of the Bank of England between 1920 and 1944, played in the formation of the gold exchange standard and in attempts to avert some of the financial panic at the start of the Great Depression appear in Einzig (1932).

(7.) By the late 1920s, the Federal Reserve had almost hit the limit of allowable credit that could be backed by the gold in its possession. If gold could not be legally owned, then it could not be legally redeemed and would, therefore, not constrain the central bank's notes issue.

(8.) A comprehensive treatise of the role of gold during the Great Depression appears in Eichengreen (1992).

(9.) A single country or a small group of countries can improve their competitive positions by means of devaluations. Conventional wisdom is that this device cannot be simultaneously used by all countries because the competition-enhancing effect of devaluation by each country is offset by the devaluations of all the others. On the other hand, under the strict rules of the gold standard, devaluations against gold by all countries raise the value of gold. This stimulates additional gold production and operates in the opposite direction by raising world money supply and aggregate demand. But this money supply response does not necessarily operate under a system of fixed pegs that are not tied to gold unless all or most of the national central banks decide to raise their money supplies in a coordinated manner.

(10.) In the immediate aftermath of the war, the share of the United States in world GDP was about 50%.

(11.) The primary designers of the system were John Maynard Keynes, of the United Kingdom, and Harry Dexter White, the chief international economist of the U.S. Treasury Department. Keynes's plan was to establish a global central bank. White's plan limited the powers and resources of each country. In the end, the adopted plan took ideas from both, leaning more toward White's plan.

(12.) This conflict, also known as Triffin's dilemma, was first pointed out by Robert Triffin. Details appear in Triffin (1960) and Garber (1993).

(13.) A brief history of the RBI appears online.

(14.) This section and the following two sections partially draw on Cukierman (2008).

(15.) Conservativeness and independence are not identical. Higher conservativeness means that the importance given to price stability relative to other objectives is higher. Higher independence means that the CB is less dependent on government in decisions about the setting of its instruments, financial matters, and internal appointments. In addition, the prohibition on directly lending to government is stronger.

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(16.) Detailed discussions of the GI and its stabilization appear in Bordo and Orphanides (2013).

(17.) The ECB started to operate in January 1999.

(18.) Detailed accounts of the CBI revolution in the former socialist economies and in Latin America appear, respectively, in Cukierman, Miller, and Neyapti (2002) and Gutierrez (2003). More recent global evidence on CBI appears in Laurens, Arnone, and Segalotto (2009).

(19.) The classic reference on the distinction between instrument and goal independence is Debelle and Fischer (1994). In a few cases like the European Central Bank and the Banco Central de Chile, the bank is even given some limited goal independence in the sense that it is free to determine its own inflation target.

(20.) Empirical evidence on the relation between growth and CBI appears in Cukierman, Kalaitzidakis, Summers, and Webb (1993).

(21.) A recent detailed account of the inflation of the 1970s and of its stabilization appears in Bordo and Orphanides (2013).

(22.) An exposition of the inflation bias hypothesis appears *inter alia* in chapter 3 of Cukierman (1998).

(23.) The United Kingdom introduced IT at the beginning of the 1990s. Although it formally introduced IT only in 2012, U.S. monetary policy was implicitly adhering to such a system already under Chairman Greenspan.

(24.) This section and the next two sections partially draw on Cukierman (2013a).

(25.) The real rate is defined as the nominal rate of interest for a given maturity minus expected inflation for the same maturity.

(26.) Bernanke took the work of Friedman and Schwartz (1963) as a point of departure but he stressed credit, rather than money, contraction as the main culprit. Although those two nominal stocks normally move together this is not necessarily the case during panics and banking failures.

(27.) Reduction of the CB short-term interest rate below zero is limited by the fact that in the negative range the public has an incentive to convert its deposits with banks into cash. Quantitative easing refers to operations in which the CB injects liquidity into the economy by buying securities on the open market.

(28.) PIIGS refers to Portugal, Ireland, Italy, Greece, and Spain.

(29.) Up to that time the ECB injected liquidity mainly via direct term loans to the banking system rather than through quantitative easing operations in which the CB buys securities on the open market.

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(30.) As is the case with CBs, the independence of financial regulators from political and private interests is an important public good (Cukierman, 2013b).

(31.) A pre-crisis discussion of this issue appears in Goodhart (2001).

(32.) Goodhart (2010) contains an early account of those reforms.

(33.) A post-crisis academic treatment of financial regulation appears in Goodhart and Tsomocos (2012).

(34.) In the presence of sterilization the CB offsets the impact of forex intervention on the monetary base by open market operations. In normal times sterilization is used to avoid conflicts between the interest rate policy of the CB and its intervention policy. However, once the policy rate becomes stuck at the ZLB this conflict is attenuated because the target interest rate of the CB is below the ZLB in the first place.

(35.) Obviously, because the CB is usually not the only regulator, this statement refers only to those parts of the financial system that are regulated by the CB. Masciandaro and Volpicella (2016) document the substantial cross-country variation in regulatory institutions.

(36.) A notable example is Issing (2012).

(37.) Cukierman (2016b) attributes this slowdown mostly to a reluctance to lend on the part of banks in spite of huge excess reserves and discusses reasons for this reluctance.

(38.) Cukierman (2016b) discusses the political economy behind this decision. Cukierman and Izhakian (2015) argue that the decision not to bail out Lehman after bailing out a number of other financial institutions substantially aggravated the simmering crisis by raising bailout uncertainty.

(39.) This is reminiscent of the competitive devaluations with respect to gold during the Great Depression. A fuller discussion of the similarities and differences between monetary policy responses during the recent crisis and the Great Depression appears in Cukierman (2011).

(40.) Estimates by Laubach and Williams (2015) and Curdia (2015) imply that, since the outbreak of the crisis, the natural rate has been in the negative range more frequently than in the past and that this is likely to persist. A critical appraisal of those results appears in Taylor and Wieland (2016) and in Cukierman (2016a).

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