A Note on Monetary Policy

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In the UK and other countries with developed financial markets, central banks set the short-term nominal interest rate for the currency they issue: the short-term interest rate is the monetary *instrument***.**

The first part of this note describes how the central bank interacts with financial markets and how its choices of interest rate are transmitted to the wider economy.

The second part discusses the financial crisis that began in 2008, and assesses how it has changed the nature of monetary policy and its application, in particular the use of *quantitative easing* and the large expansion of bank regulation. It concludes with a review of how UK monetary and fiscal policy has been affected by the Covid crisis and the invasion of Ukraine.

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January 2023

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1. Interest rate policy

1.1 The functions of banks

The business of banks (commercial banks) is to take deposits and to lend, and they make profits from the interest margin between the rate they charge for loans and the rate they pay to depositors. Many banks also offer other services such as managing investment funds and dealing in securities, although regulation in response to the financial crisis has now caused some separation of those activities from the basic banking function.

The other important role of banks is to operate the payments system. For this purpose, about half of private sector deposits in UK banks are *sight deposits* (current accounts) that may be withdrawn without notice when the account holder makes a payment (see the simplified balance sheet below). But loans are the largest component of banks' assets and they are *illiquid*: they may, for instance, be mortgage finance to householders or loans to businesses and cannot easily be sold if the bank needs to repay its depositors.

To cope with net withdrawals of deposits, banks therefore need *liquid assets*, the most liquid being currency (banknotes) and *reserves*. Reserves are the banks' own deposits held at the central bank (hence they appear as liabilities on the Bank of England's balance sheet) and they are liquid because they may be immediately withdrawn in the form of currency.

UK banks: consolidated account. Sterling balances, £ billions					
assets	Feb.06	Nov.22	liabilities	Feb.06	Nov.22
£ currency (vault cash)	5.7	9.6	private sector deposits	1668.7	3489.8
reserve deposits at BoE	0.8	950.2	public sector deposits	38.2	42.3
govt and private securities	126.5	344.5	repo loans from BoE	26.7	3.2
loans to UK private sector	1776.7	2851.6	*TFS loans from BoE		187.9
			capital and net other	176.1	432.7
	1909.7	4155.9		1909.7	4155.9
Bank of England (BoE), £ billions					
assets	Feb.06	Nov.22	liabilities	Feb.06	Nov.22
government securities	15.6	875.7	£ currency issued	36.9	86.9
repo lending to banks	26.7	3.2	bank reserve deposits	0.8	950.2
*TFS lending to banks		187.9	government deposits	0.8	5.3
			net other	3.8	24.4
	42.3	1066.8		42.3	1066.8

Simplified balance sheets for UK banks (£ sterling balances) and the Bank of England. The earlier date (Feb. 2006) is included to show the situation before interest was paid on reserve balances and before quantitative easing (QE).

The balances of UK banks shown here are for Monetary Financial Institutions, defined to include UK resident commercial banks and building societies. *Under the Term Funding Schemes (TFS), the BoE has granted 4-year lending to banks on advantageous terms, on condition that the banks increased their retail lending. The government securities purchased by the BoE under its QE programmes are included here in its balance sheet but they are channelled through a separate institution, the Asset Purchase Facility.

Data compiled from Bank of England 'Bankstats', tables B1.1.2, B2.1, B2.2, B2.2.1, B2.5.

As currency earns no interest, the banks keep stocks of 'vault cash' that are only a small fraction of their deposit liabilities (see balance sheet). They prefer to hold their liquidity in the form of reserves[1] which (since May 2006) earn interest at the Bank of England's official *Bank Rate* (3.5%, since December 2022) or interest-earning securities such as treasury bills and government bonds. These assets are liquid as they may easily be sold in financial markets or used as collateral security for loans from other institutions. The banks' holdings of reserves have increased markedly since 2009 as a result of the Bank's purchases of assets under its *quantitative easing* programmes (see section 2.2 below).

Now consider the banks' role in payments. When a payment is made by a bank transfer (using a debit card, for instance), the payer's bank deposit is debited by the amount of the payment and the payee's deposit is credited. This causes a debt between the banks: the paying bank owes the amount of the payment to the receiving bank.

The 'wholesale' debts between banks created by such retail payments are settled by transfers of their reserve deposits at the Bank of England; for instance, a bank that is a net receiver of retail deposits (liability) receives that amount of reserves (asset). Alternatively, the banks may choose to offset such transfers by other means such as transfers of assets, interbank loans that are secured on assets (usually in the form of 'repos' [2]) or unsecured interbank loans.

Note that these transactions are between the banks – one bank's loss of a deposit is another bank's gain – hence they do not cause any changes on the consolidated balance sheet of the banks shown above and are not relevant for monetary policy. The transactions that are of most interest here are those that involve the central bank.

1.2 The Bank of England's operations[3]

The next task is to analyse the operation of monetary policy. While the monetary systems of the major economies differ in some details, the principles are broadly similar and we use the UK as an example. We show that all transactions that involve the Bank of England involve changes in banks' reserve deposits, and explain how this implies that the interest rate paid by the Bank on reserves, or charged for borrowing reserves, is its primary monetary policy instrument.

As an example of a transaction, suppose that individuals decide to hold more currency (*i.e.* banknotes), as they regularly do during holiday seasons, and they draw on their bank deposits for this purpose. If the banks' stocks of 'vault cash' are insufficient to satisfy this demand, they must obtain currency from the Bank of England. On the above balance sheets, deposits at banks fall while the currency liability of the Bank of England rises.

The banks pay the Bank of England for this currency by drawing on their reserve deposits: the relevant bookkeeping entry is a reduction in bank reserves equal to the amount of the extra currency.

As another example, suppose the government receives a payment of tax which the payer draws from his deposit at a bank. If the government deposits this payment into its account at the Bank

[1] Some central banks oblige their banks to hold *required reserves* as a minimum ratio (*e.g.* 2%) of their short-term deposit liabilities. However, the ability to vary this ratio is not an additional tool of monetary policy in the UK and other countries where banks have large amounts of *excess* reserves. In contrast, in countries such as China and Turkey where the central bank controls the supply of excess reserves, variable required reserve ratios are used for this purpose alongside open-market operations (section 1.2). The Bank of England does not apply reserve requirements.

[2] Under a 'repo' or 'sale and repurchase agreement', the borrowing bank sells the lending bank a security (such as a government bond) with an agreement to repurchase it at a specified later date. Thus a repo amounts to a loan backed by collateral security. Interest is effected as the difference between the sale and repurchase price of the bond. Most repos are short-maturity and may be just overnight.

[3] Language: in the following, 'Bank of England' is sometimes shortened to 'Bank'; 'bank' (lower case 'b') always refers to commercial bank.

of England, this creates a debt of the bank to the Bank of England which is settled by a decrease in that bank's reserves. The opposite transactions take place when the government spends by drawing from its own Bank of England deposits.

Changes in banks' reserves at the Bank of England are the balancing entry whenever any of the central bank's other liabilities or assets change. The transactions described above are 'autonomous factors', *i.e.* they are not the result of choices made by the Bank itself.

However, the Bank can deliberately change the total amount of banks' reserves by open-market operations (OMO): the purchase or sale of securities such as government bonds in the market. An open-market sale reduces reserves as deposits in banks are withdrawn by the private-sector purchaser (*e.g.* a pension fund) to pay for the securities; an open-market purchase adds to reserves.

The large current amount of bank reserves (see balance sheet, page 1) is the result of the Bank's *quantitative easing* (QE) programmes which began in 2009. QE is the purchase of assets by the Bank, paid for by its own reserves (liabilities); it is essentially the same as open-market purchases (see further discussion of QE in section 2.2).

Since all Bank of England transactions involve changes in the amount of reserves, it follows that the Bank can never refuse to accept deposits (of reserves). Nor can it refuse to lend reserves: it must always ensure that, collectively, the banks are supplied with positive reserve balances, *i.e.* banks always have sufficient *liquidity*.

This is fundamentally because all financial assets denominated in £-sterling (UK pounds) are claims on reserve deposits at the Bank of England. Reserves are the 'money' that banks borrow and lend. Reserves are also unconditional claims to £-sterling currency which, by law, is only issued by the Bank of England.

If the Bank of England failed to provide reserves as needed, or even if there were a suspicion that some bank might be unable to satisfy demands for currency withdrawal, this could lead to a bank run, as happened to Northern Rock Bank in 2007.

Since the Bank of England cannot refuse to lend reserves, it has to choose the interest rate at which it lends. Likewise, since it must always accept banks' deposits of reserves, it has to set the interest rate that it pays on such deposits.

This choice of interest rate by the Bank is transmitted to the interbank market and to the wider economy, as explained in the following section. The short-term interest rate is thus the Bank's monetary policy instrument.

1.3 Interest rate application: The corridor system

Until the end of 2008 when QE began to flood the banks with reserves, the Bank of England's interest rate choices were applied by means of a *corridor* system[4] (Figure 1(a)). The two rates set by the Bank were the rate paid on reserve deposits (the deposit facility) and a higher rate at which the Bank would lend to banks on demand via repos[5] (the lending facility).

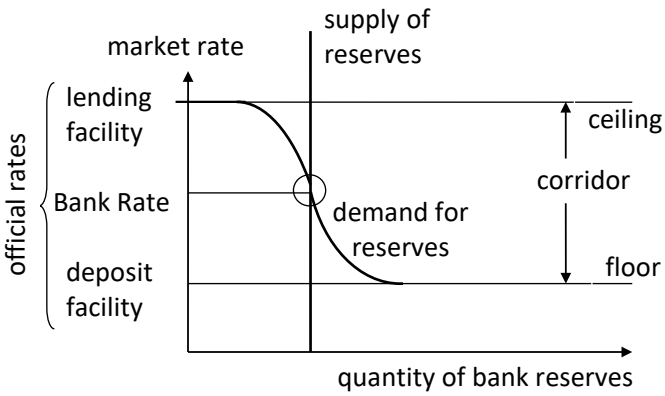

Figure 1(a). Stylised diagram of the application of Bank Rate: the corridor system

[4] A more complete description is Clews, R. et al. (2010) "The Bank's money market framework" , Bank of England Quarterly Bulletin, Dec. p.292-301.

[5] See footnote 2. Bank of England repo lending is shown on balance sheets as an asset of the Bank of England and a liability of the borrowing bank. Under standard accounting conventions, the borrowing bank's collateral security stays on its balance sheet during the tenure of the repo even though it is pledged to the Bank of England.

The effect of this arrangement was to confine the short-term interbank market rate to the *corridor* between the deposit rate (the *floor*) and the lending rate (the *ceiling*). If there were an overall surplus of reserves, the market rate would be equal to the floor rate: competition between banks would ensure that no solvent bank would pay more than the deposit rate for a short-term loan from another bank, and no bank would lend at a rate lower than the deposit rate. Conversely, an overall shortage of reserves would force banks to seek loans from the Bank of England's lending facility, causing the market rate to rise towards the ceiling.

Under the corridor system before 2009, the Bank of England attempted to ensure that the banks as a whole had just sufficient reserves to meet their demands which were assumed to be weakly elastic (the downward-sloping demand curve in Figure 1(a)).[6] It achieved this by using daily open-market operations to compensate for changes in reserves caused by autonomous factors. A shortage of reserves was satisfied by open-market purchases, while a surplus called for open-market sales. The object of this behaviour was to keep the market rate close to Bank Rate, which was then the official policy rate at the mid-point of the corridor.

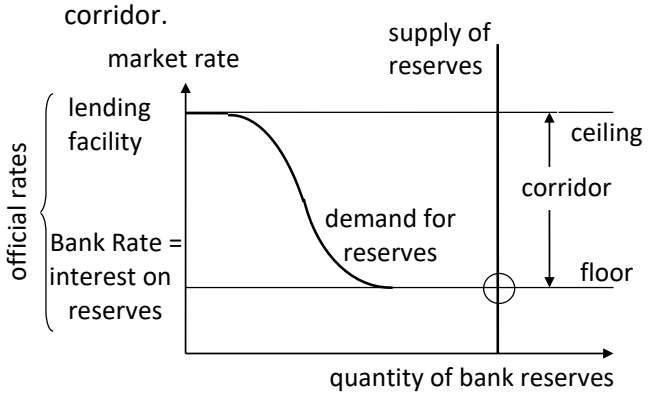

Figure 1(b). Stylised diagram of the application of Bank Rate: the floor system

This changed in 2009 when QE created a large increase in reserves, causing the interbank market rate to fall towards the interest rate paid by the Bank on reserves (Figure 1(b)). The Bank thus moved to a *floor* method of applying its interest rate policy, which it still operates today. Bank Rate is now the name given to the rate paid on reserves, currently 3.5%. Given that banks have large reserve balances, short-term lending between banks also takes place at interbank rates close to Bank Rate as shown in Figure 2.

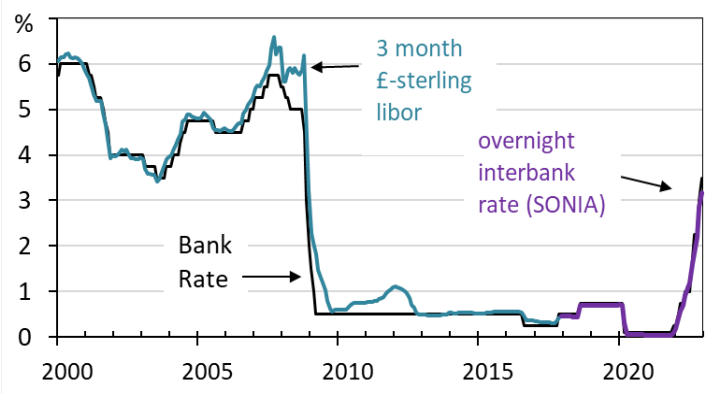

Figure 2. Bank Rate and interbank rates.
libor = London Interbank Offer Rate, for unsecured lending[7]. Source: Bank of England

Thus, Bank Rate is the marginal cost of funds to the banks: it is the rate at which banks know they can always borrow short-term funds from other banks (provided they are viewed as solvent).

The other consequence of the banks' current large holdings of reserves is the irrelevance of the Bank's pre-2009 routine open-market operations to supply reserves, and those operations have been suspended. However, the Bank still offers repo lending to banks at a rate above Bank Rate (provided they have sufficient collateral that is

[6] In countries such as China that impose reserve requirements and still operate a corridor system, the central bank needs to ensure that banks have sufficient *excess* reserves, *i.e.* the excess over the reserve requirement.

[7] Interbank rates became detached from Bank Rate during the financial crisis 2007-09, reflecting lack of trust between the banks. For instance, three-month libor reached 1.5% above Bank Rate in late 2008 (Figure 2). During 2011, UK libor rates rose again, which may have reflected the UK banks' exposure to some eurozone banks that were in difficulty.

Sterling and other currency Libor rates are being phased out because of the decline of the unsecured interbank market on which they are based.

acceptable to the Bank[8]), but this 'lender-of-last-resort' facility for individual banks in difficulty is little used at present.

All central banks apply monetary policy by some variant of the corridor or the floor system (although there are cases where market fragmentation or uncompetitive behaviour amongst the banks has caused interbank rates to diverge from policy rates). As an example, in the eurozone, the rate paid by the ECB for excess reserves (the rate on its 'deposit facility') is currently 2.0% (since December 2022), and its lending rate is 2.5% (its 'main refinancing rate'). Given that the ECB has also been doing QE, eurozone banks have large excess reserves and the 2.0% rate paid on those reserves is therefore the relevant policy rate. The overnight market interbank rate (€STR) stays close to this rate and is currently 1.9%. Although the ECB's two-rate structure looks like a corridor system, it is effectively a floor system because, given the banks large reserve holdings, the lending rate is largely irrelevant.

1.4 The banks' retail rate decisions

Deposits and interbank borrowing are alternative sources of funds for the banks. So, as competitive profit maximisers, they set the rate offered on deposits at some margin below Bank Rate to cover administration and transactions costs. For sight deposits (current accounts, used for transactions), the margin must also cover liquidity risk: the risk that the deposit is withdrawn without notice.

Similarly, the rate charged by banks for their lending to individual and corporate borrowers exceeds Bank Rate by a margin to cover transactions costs, default risk and the cost of holding capital to support the loan. In other words, banks set their retail lending and deposit rates at appropriate margins above and below the official Bank Rate set by the central bank. When Bank Rate changes, the banks' retail rates normally change approximately in parallel (Fig. 3 displays this pattern up to 2008 and during 2022).

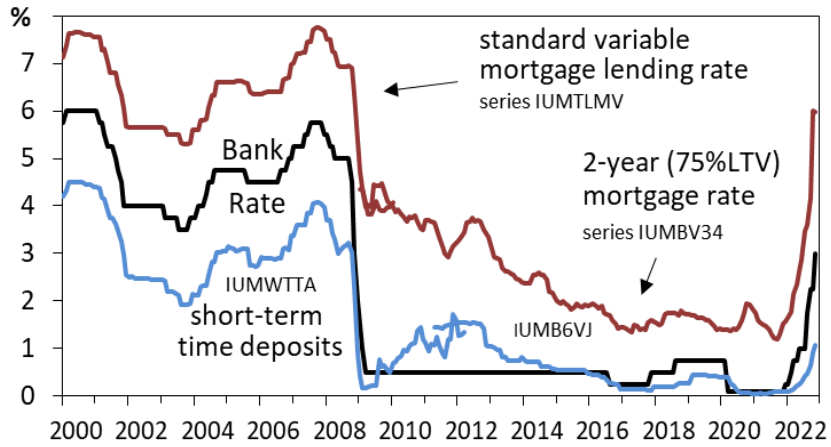

Figure 3. Retail deposit and lending rates
Source: Bank of England

A consequence of the central bank's commitment to supply banks with reserves (liquidity) as needed is that the banks' retail lending decisions are not dependent on their having sufficient deposits. They know they can normally fund their lending by borrowing in the interbank market at rates close to Bank Rate, so they do not wait for deposits before lending, as is implied by the textbook 'money multiplier' theory (see appendix).

Banks' decisions over whether to lend, how much to lend and at what interest margin, can be based mainly on the perceived default risk. The banks can perform 'liability management': lend and then find the necessary funds (liabilities), rather than 'asset management': receive deposits then seek suitable assets (loans or investments).

However, for some banks that had become over-reliant on short-term interbank market funding before the financial crisis, this practice broke down dramatically after the crisis struck in 2007-08, when the quality of their loans fell under

[8] This raises the question of what happens when banks run low on liquid assets that the central bank accepts as eligible collateral for its repo loans. During the financial crisis, many banks became illiquid and the major central banks were forced to reduce the quality of the collateral assets against which they lent. It can be argued that central bank lending against illiquid assets amounts to solvency support; see section 2.1.

suspicion. These doubts about the quality of banks' assets made financial institutions generally less willing to lend in the interbank market. Starved of continuing funding, some banks needed lender-of-last-resort assistance from their central banks and bailouts from their governments (see section 2.1).

Banks' operations in current practice are neither pure liability management nor asset management but a mixture of the two: lending and borrowing decisions are made simultaneously, along with the decisions about interest rates offered and charged.

At the end of 2008, Bank Rate was rapidly reduced from 5% to 0.5% to stimulate economic activity in response to the financial crisis. This changed the relationship between Bank Rate and retail rates: retail rates fell less than Bank Rate (Figure 3). For several years after 2008, lending margins remained higher than before the crisis, while banks tried to attract deposits with interest rates that sometimes exceeded Bank Rate. This indicates a change in the banks' attitude to risk together with tighter regulations (section 2.3).

In contrast to the banks' aggressive expansion of lending up to 2007, they have since then been keener to fund a high proportion of their lending from deposits rather than by interbank borrowing. They are also bound by increasingly onerous minimum regulatory levels of liquid assets and capital.

Since the beginning of 2022, Bank Rate has been rising fast in response to the sudden rapid rise in inflation (see Section 2.4), with retail deposit and lending rates following suit.

1.5 The effects of changes in the interest rate: the transmission mechanism of monetary policy

Under current monetary regimes, the objective of monetary policy is a target for inflation. The UK's inflation target is 2% (year-on-year growth in the consumer price index, CPI) with a margin of error of ± 1 %; the European Central Bank has a 2% inflation target 'over the medium term'.

The central bank may also be instructed to aim for high economic growth and employment, as in the US, but a single instrument (the interest rate) cannot target more than one objective at the same time. Raising growth would call for lower interest rates, while reducing inflation would require higher interest rates. In practice, even though central banks are always conscious of the wider effects of their interest rate choices, the main focus is on inflation.

For that purpose, it is helpful for the central bank to have knowledge of the 'transmission mechanism': the channels by which its interest rate policy choices affect inflation. The general understanding is that changes in interest rate affect aggregate demand: a reduction in interest rate tends to raise demand, and vice versa. Then higher demand implies higher real output or higher inflation or both, depending on the amount of spare capacity in the economy (the 'output gap') and where higher real output may be temporary as described by Phillips Curve theory.

However, there is considerable uncertainty in the magnitude and timing of the response to interest rate changes: the peak of the response of inflation to a change in the short-term interest rate may be lagged by 18 months or more. There are also other influences on demand which are not easily measurable or predictable such as 'habits' and 'confidence', and the response may depend on the position in the business cycle. In recessions, when individuals and firms are less confident about their future incomes, they are naturally reluctant to incur further debt. Lower rates may then have little effect on spending.

Consider the consequences of a *reduction* in the Bank of England's official Bank Rate. Most bank loans in the UK are at interest rates that are variable or fixed for a short period, such as mortgage loans for house purchases, consumer credit, and overdraft loans which are a common source of finance for smaller firms. Hence a fall in Bank Rate is quickly reflected in lending rates which tends to cause an increase in borrowing, both for consumption and investment. An interest

rate cut also reduces the reward to saving, which also encourages spending.[9]

Another important influence on demand is the *wealth effect*. When interest rates fall, the prices of both physical and financial assets rise. Financial assets such as bills and bonds are claims to fixed future nominal amounts of cash; hence their market values rise to bring the yield on these assets into line with the lower rate of interest. Alternatively stated, the fall in the discount rate leads to a higher present value. For physical assets such as property, prices rise as demand rises due to the lower cost of borrowing. Higher asset values give individuals and firms more confidence about spending and also provide increased collateral security for borrowing.

A further influence on aggregate demand works through the foreign exchange market: a lower £-sterling interest rate tends to deter investment in £-sterling assets, thus reducing the foreign exchange value of the currency which may stimulate the demand for exports. However, this linkage is unreliable because there are many other influences on the supply and demand for foreign currency assets and thus the exchange rate.

These are the main channels whereby interest rates may influence aggregate demand. However, there is another matter that needs attention: Bank Rate is a short-term rate while much expenditure, particularly for investment, is dependent on longer-term rates. We must consider how the *yield curve* (a chart showing interest rates on debt of different maturities) is influenced by *expectations* of future short-term rates.

1.6 Long-term rates and real rates of interest

The *pure expectations hypothesis* of the term structure of interest rates states that the interest rate for a (risk-free, zero-coupon) loan of maturity T years is an average of current and expected future short-term rates over the T-year period.[10] The very short-term rate is set by the central bank (Bank Rate is an overnight rate) according to its monetary policy objective: it should be chosen at a level to cause the inflation rate to converge towards its target. Therefore, an important influence on long-term rates is the expectation of future inflation. If that expectation is revised upwards, this raises the expectation of higher Bank Rates in the future which, in turn, raises current long-term rates.

The expectations hypothesis also implies that, when Bank Rate changes, this can cause changes in long-term rates in either direction. If a change in Bank Rate is fully anticipated, it does not affect expectations and longer-term rates are therefore unaffected. But if a Bank Rate change leads to revised expectations of future Bank Rates, this is new information and longer-term rates also change. An unexpected fall in Bank Rate would cause longer-term rates also to fall; a fall in Bank Rate that is smaller than anticipated would cause longer-term rates to rise.

There are many sources of information that have the potential to cause a revision of expectations of the future path of Bank Rate. If, for instance, the governor of the Bank of England makes a statement implying that Bank Rate will be lower in

[9] While this is believed to be the dominant effect on saving of a reduction in the interest rate, a lower rate could cause *greater* saving and less spending, if savers want to maintain a given income stream from their interest payments. The outcome depends on the relative magnitudes of the 'income and substitution' effects in standard microeconomic theory of intertemporal choice.

[10] While the expectations hypothesis is valuable for explaining the term structure of interest rates, there are other influences. The rates for government bonds, for instance, are influenced by the supply of bonds by the government and the demand for them by investors; thus purchases of bonds under QE are supposed to have raised bond prices and reduced their yields (section 2.2). Yields on bonds also include a premium for default risk, which can be large for 'junk' corporate bonds and even some government bonds. Yields on long maturity bonds may also include a 'term premium' to compensate for the higher sensitivity of their price to interest rate changes.

the future and this statement is believed, then long-term rates fall. This connection has sometimes been deliberately exploited in the US and the UK as 'forward guidance': *i.e.* the central bank's attempt to hold down long-term rates by making explicit promises that, subject to conditions, the policy interest rate will not rise during some specified future period.

The observed general pattern is that long-term rates follow short-term rates (Figure 4) as would be predicted by the expectations hypothesis. Over time, a lower Bank Rate is associated with lower interest rates across the term structure, and lower interest rates tend to stimulate demand and inflation, albeit with a high degree of uncertainty.

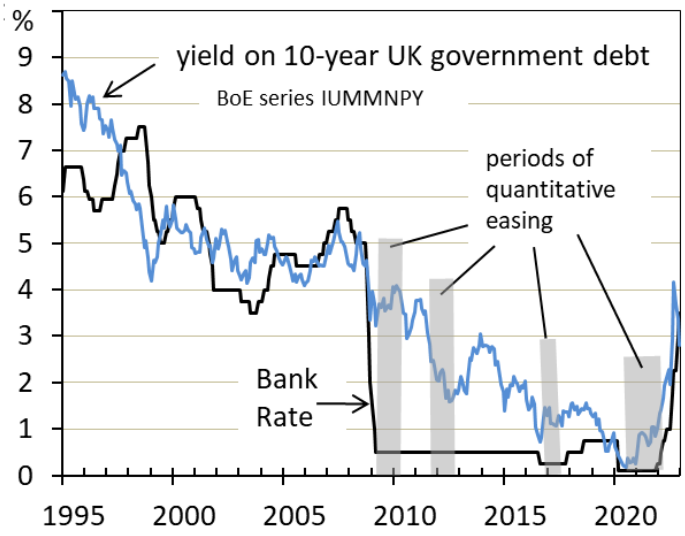

Figure 4. Two points on the £-sterling yield curve: Bank Rate and the yield on 10-year UK government debt.

Source: Bank of England

Finally, note that the analysis so far has been about nominal interest rates, which measure the extra amount of currency units earned per year when lending, whereas real interest rates – nominal rates adjusted for inflation – are often thought to be more relevant. In most macroeconomic theory, there is assumed to be a long-run real natural rate of interest which is consistent with output equal to potential output under stable inflation. Then, if the actual real rate is less than the natural real rate, this should stimulate consumption and investment.

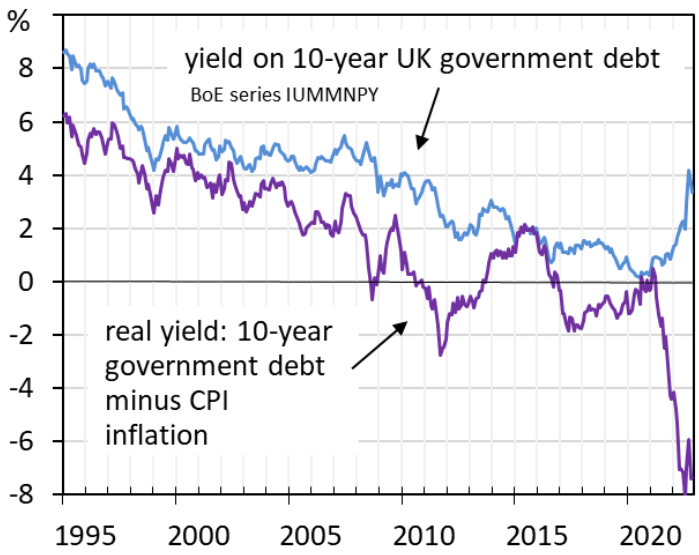

Figure 5. long-term nominal and real yields

Source: Bank of England; Office for National Statistics

However, this theory is not well supported by evidence, particularly since the financial crisis. Despite real rates in the UK that have been negative for much of the period since 2008 (Figure 5), there was no dramatic increase in UK output or inflation, until the sudden burst of inflation in 2001-02, and similar observations may be made for other countries. But this may be because the natural real rate, which is unobservable and hard to estimate, has itself fallen towards zero. It is commonly accepted that there has been a secular decline in the natural real rate in developed countries since the 1980s.[11]

This presents a dilemma for the Bank of England and other central banks. Suppose the natural real rate is 0% and inflation is also 0%, then UK monetary policy only becomes stimulatory when Bank Rate is reduced below 0%. However, Bank Rate cannot fall far below zero, otherwise banks could gain by holding (zero-earning) currency instead of (negative-earning) reserve deposits.

This zero lower bound (ZLB) on nominal interest rates (or slightly-negative lower bound), implies that if the natural real rate is indeed as low as 0%, there is little scope for monetary stimulus by the

[11] See, for instance, Hong, Sungi and Hannah G. Shell (2019), 'The Global Decline of the Natural Rate of Interest and Implications for Monetary Policy' Federal Reserve Bank of St louis, Economic Synopses, No.4.

usual method of reducing official (nominal) interest rates.

In practice, from the experiences of Japan and the eurozone, it seems that even negative policy rates may fail to provide any significant monetary stimulus. Indeed, it may be that the usual expansionary responses to a lower policy rate (section 1.5) are negligible or even reversed as that rate descends below the ZLB.

Given these limitations of stimulus by interest rate policy, we explain in section 2.2 below how quantitative easing has become a common method for central banks to provide stimulus.

Meanwhile, we turn to the question of how the Bank of England should choose the path of Bank Rate that is appropriate for achieving its inflation objective.

1.7 The central bank's choice of interest rate and central bank independence

Many central banks are now *independent* (the Bank of England has been formally independent since 1997). This means that the government chooses the *objective* of monetary policy, usually specified as an inflation target as described above, and the task of the central bank is to choose a time path for Bank Rate that is most likely to achieve that objective.

However, as there are lags in the responses to interest rate changes, the practice of the central bank might be described as *inflation forecast targeting*. The Bank of England, for instance, uses its macroeconomic model to forecast inflation up to 2 years ahead (Figure 6) and, if the mean 2-year forecast differs from the target, Bank Rate should be adjusted accordingly.[12] In practice, while inflation forecasts can be used as a guide, the choice of central bank policy relies on judgement. In the UK this judgement is the work of the Bank of England's monetary policy committee.

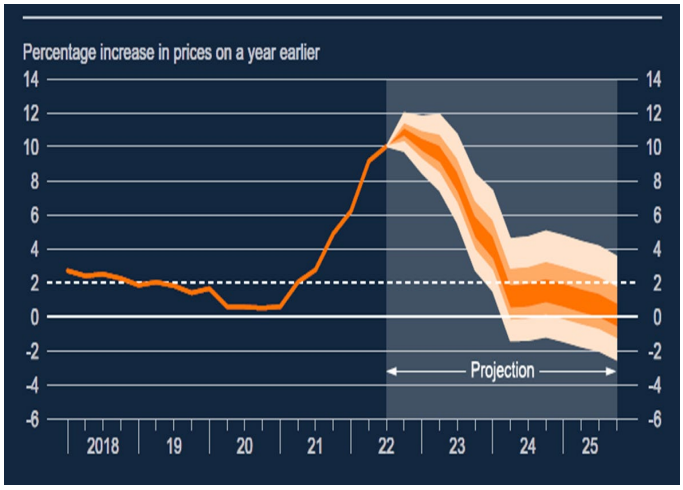

Figure 6. Bank of England forecasts of CPI (consumer price index) inflation. Note the wide uncertainty (the 'fan chart' includes 90% of the probability distribution).

Source: Bank of England monetary policy report, November 2022

The rationale for central bank independence is to insulate monetary policy choices from political motives. For example, if the government were setting interest rates, it might be tempted to hold rates down ahead of an election in order to stimulate spending, disregarding the longer-term potential consequence of inflation.

Moreover, a government might tolerate some inflation because this can help its finances. Government bonds are obligations to repay fixed nominal amounts in the future, hence inflation reduces the real value of government debt (provided the debt is in domestic-currency and

[12] Much research has been directed towards devising 'monetary policy rules' to aid central banks in their choices of optimal interest rates to reach a given target. One such rule is the Taylor rule: $r - \dot{p} = r^* + 0.5(y - \overline{y}) + 0.5(\dot{p} - \dot{p}^*)$ where r is the central bank's policy rate (Bank Rate), $\dot{p}$ is the inflation rate, r^* is the long-run equilibrium real rate of interest, y is real output, $\overline{y}$ is the natural rate of real output and $\dot{p}^*$ is the inflation target. This indicates that r should be set so that that the real rate of interest $r - \dot{p}$ is above (below) its long-run level when output is above (below) its long-run level and/or inflation is above (below) target. While there is evidence that the Taylor rule may have been a reasonable *description* of past central bank interest rate policy, it is not used by central banks as a *prescription* to guide their choices, one problem being the measurement of $\overline{y}$ and r^*.

non-indexed; 25% of UK government debt Is currently indexed to inflation).

But this inflationary debt write-off requires inflation expectations to be low when the government borrows (by selling fixed-interest bonds); if high inflation were expected, bond interest rates would also be high to reflect this, making the borrowing expensive. And this strategy of using inflation to reduce the debt burden cannot be repeated indefinitely, because when expectations of inflation catch up with the new higher rate of actual inflation, higher interest rates will indeed make borrowing more expensive, negating the advantage.

Another financial benefit of inflation for the government is that it raises the demand to hold currency (banknotes). All central bank profits are passed to the government, and because currency earns no interest, an increase in the currency issue provides income to the government (known as *seigniorage*). All banknotes are effectively indefinite interest-free loans to the government via the central bank.

Given that these incentives may tempt the government towards loose monetary policy, the essential justification for central bank independence is to give *credibility* to policy. If monetary policy is insulated from such incentives, people are more likely to believe that the inflation target will be achieved.

This is important because the expectation of inflation exerts a strong influence on actual inflation. Sellers of goods tend to build the expected rate of inflation into their prices, and inflation expectations are built into wage agreements. This leads to *persistence* in the observed time path of inflation. Successful control of inflation is therefore enhanced if the central bank gains a reputation for meeting its target.

Is full independence for the central bank possible? It is hard to ensure that the individuals who make up the monetary policy committee are insulated from political influence. This is especially relevant to the European Central Bank, whose governing council contains the governors of all the 20 national central banks of the eurozone. By treaty, the ECB should be strictly independent of national interests, but the political dimension is always present and tensions may arise.

The ECB's choice of the euro interest rate is supposedly designed to achieve the 2% euro inflation target. Yet, as inflation rates differ across the eurozone countries, the single official euro interest rate can never be appropriate for all. In practice, the ECB tries to steer the *average* inflation rate across countries towards the target, and since Germany is the largest eurozone economy, the ECB's choices of the euro interest rate may suit Germany better than other countries. However, the negative 0.5% interest policy rate for the euro that prevailed from 2019 to July 2022 was widely criticised in Germany for penalising savers and hurting pension funds.

Whether or not central banks can be or should be wholly independent, independence does seem to have been helpful in reducing inflation in developed Western economies from the high levels of the 1970s and 1980s.

Since 2010, the greater problem has been the opposite condition of *too low* inflation; indeed, there was concern, notably in 2015 and in 2020, that it could become negative (deflation). Deflation is a problem because it *raises* the real value of debts which reduces demand (through the wealth effect, section 1.5). Deflation was a key feature of the Great Depression of the 1930s.

In 2020 the inflation rate in the UK, the US and the eurozone was well below the 2% target, despite central bank interest rates being close to zero (negative in the eurozone), a condition that was likely connected with the Covid-induced recession.

As there was no scope for significant further stimulus to demand by means of lower interest rates, central banks returned to quantitative easing (section 2.2, below).

Since 2021, there has been a sudden resurgence of high inflation (section 2.4).

2. The financial crisis and consequences

2.1 The financial crisis

The financial crisis that began in 2007 entailed widespread distress amongst banks, large increases in government debts and recession in most major economies. It also brought change in the application of monetary policy and the regulatory environment in which that policy operates. This section presents some background to the crisis, and outlines the responses of the authorities to reinforce the financial system and combat the recession. This is followed by a discussion of important consequences: the widespread use of quantitative easing (section 2.2) and the large expansion of bank regulation (section 2.3). The final section (2.4) presents some remarks on the covid epidemic of 2020.

By late 2007, it became clear that some banks had been lending too freely and too cheaply, particularly for home loans, driving up the prices of houses and other assets to unsustainable heights (Figure 7). In both the US and the UK,

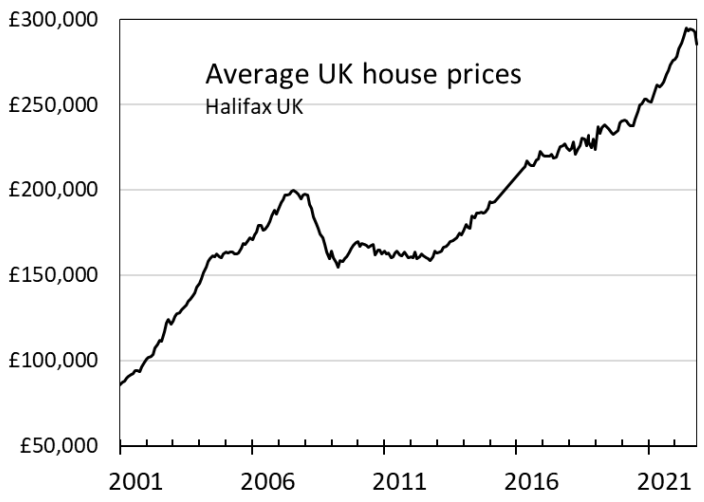

Figure 7. UK house prices

borrowers could obtain a mortgage loan of value up to six times their annual income and up to 125% of the value of the secured property. When house prices started falling and significant numbers of loans began to default (initially in the 'subprime' market in the US) there was a widespread fall in confidence and several banks had to be recapitalised or 'bailed out' by governments.

A factor which drove this expansion in lending and also played a major part in the banking collapse was *securitisation*, whereby a bank pools together a large number of individual loans to create an *asset-backed security*. This may then be divided into *tranches* with a prescribed priority order of pay-out when some of the underlying loans default on payments. In a simple structure containing three tranches that might be labelled *senior*, *mezzanine* and *equity*, the first losses are borne by the equity tranche and the mezzanine tranche only becomes impaired when losses exceed the entire value of the equity tranche. Similarly, the senior tranche only suffers if losses exceed the amounts of the mezzanine and the equity tranches, making it much more secure than the individual assets of the original pool.

The senior tranche is thus *credit-enhanced*, gaining a high rating from a credit rating agency and becoming an attractive investment to institutions such as pension funds. This process enabled banks to turn risky illiquid loans into assets that could be sold or used as collateral for funding in the financial markets, freeing up cash for further lending. Under existing bank regulations, it also enabled institutions that owned senior tranches to increase their leverage, by holding smaller amounts of regulatory capital than if they held the original assets.

The outstanding global value of these asset-backed securities (ABS) reached around $10 trillion in mid-2007[13], with banks in most developed countries involved as originators of the securities, or buyers, or both. As the market expanded, more complex financial instruments were introduced such as *collateralized debt obligations* which are assets created by combining and securitising several intermediate (mezzanine) tranches of previous securitisations. As these new

[13] Estimate from Bank of England Stability Report, October 2007.

assets were hard to value, they had the effect of concealing risk. When the market in these assets ceased to function, many were written down to a fraction of their face values, earning the label 'toxic assets'.

During 2008, the deterioration in the value of banks' assets led to doubts about the solvency of many banks including several of the world's largest. As a result, banks became reluctant to lend both to their retail customers and to other banks. The sudden reduction in the availability of credit, accompanied in the UK and the US by sharp falls in property prices, was a major contributor to recession[14] in all large economies.

Faced with a potential disruption of payments systems, central banks gave support to vulnerable banks, by providing liquidity for longer periods and against lower quality collateral. And governments provided banks with new capital, in some cases amounting to partial or complete nationalisation.

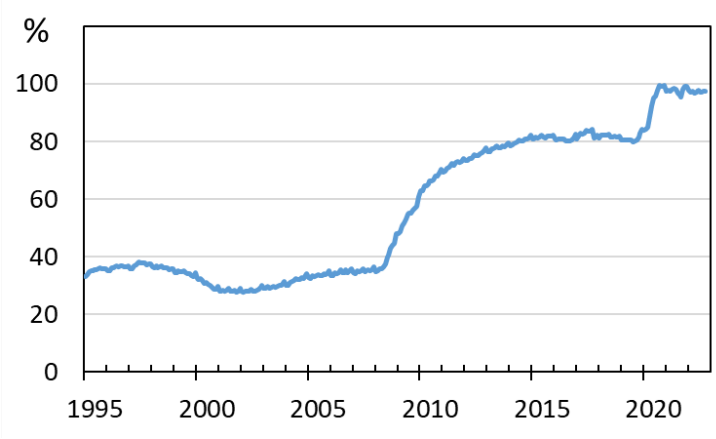

Figure 8. UK debt to GDP ratio

Source: Office for National Statistics, December 2022. Debt is 'Public Sector Net Debt' (PSND)

Fiscal expansion to provide 'Keynesian' stimulus and ease the recession was another response, but the scope for higher government spending or for tax reduction was limited because of high debt. Government debts had already risen sharply at the beginning of the crisis because of the recession-induced reduction in tax revenue and increased welfare spending (the 'automatic stabilisers') and because of the support given to the banks (Figure 8). In the UK, after the initial stimulus, this growth in debt was deliberately moderated by the 'austerity' policy of lower government spending and lower budget deficits during the period 2012-19, causing government debt to level off at about 80% of GDP (Figure 8). But this attempt to hold down debt/GDP came to an abrupt halt in 2020 when spending on the Covid crisis (section 2.4) caused a further rapid rise.

The monetary response to the earlier financial crisis had been a rapid reduction in interest rates towards zero in late 2008. The intention was to provide the greatest stimulus to demand given that there was no prospect of inflation at that time. More recently, some central banks even reduced their policy rates below zero: the European Central Bank rate on excess reserve deposits fell to -0.5% in 2017 and that of the Bank of Japan to -0.1% in 2016.

But given the zero lower (ZLB) on official interest rates (or slightly-negative lower bound: see section 1.6), there was limited scope for further reductions in official rates, and the major central banks then turned to other stimulatory measures, in particular *quantitative easing*.

2.2 Quantitative easing

Quantitative easing (QE) is the purchase by the central bank of bonds in the secondary market, which it pays for with its own reserve liabilities. The seller of the bonds (for instance, some non-bank financial institution such as an insurance company) receives a deposit in its bank and the bank, in turn, receives a claim on the central bank in the form of reserves.

The use of QE became widespread after the financial crisis in 2007-8 when policy rates were reduced close to zero in all major economies, leaving little scope for further reductions, while further stimulus was thought necessary. QE has been practised periodically since then, and was massively increased during 2020 in the attempt to

[14] A common but arbitrary definition of recession is two successive quarters of negative real economic growth.

raise inflation rates and to offset the Covid recession.

In the UK, the Bank of England bought a total of £435bn over 3 periods during 2009-2016 (Figure 4), mostly of UK government bonds. After that, it kept its stock of bonds at this value by borrowing anew as its holdings matured. Then in March 2020, it began a large new QE programme to stimulate demand during the Covid crisis. This continued until December 2021, when the Bank's government debt holdings reached £895bn (Figure 9). The Bank of England currently owns about 34% of total UK government debt (June 2022).

In the US, the Federal Reserve used Large Scale Asset Purchases to acquire around $4 trillion of assets between 2008 and 2014. These purchases were split roughly 60:40 between government bonds and mortgage-backed securities. Since the Covid crisis, the Fed's holding of assets has risen to $5.7tr (January 2022). The Fed is now 'tapering' its asset purchases with the expectation of no further increase in its net QE asset holdings from March 2022.

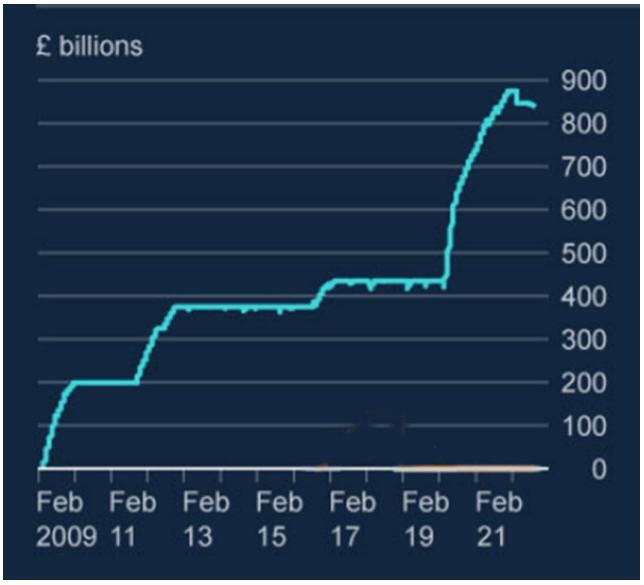

Figure 9. Government debt held at the Bank of England (Asset Purchase Facility) resulting from Quantitative Easing

Source: Asset Purchase Facility Quarterly Report, Q3 2021

In the eurozone, the ECB began QE later than the UK and the US, purchasing a total of €2.5 trillion of assets between October 2014 and December 2018, (in practice, the purchases were mostly made by the national central banks of the eurozone countries, not the ECB, and the assets purchased were mainly the respective countries' own government bonds). Since the onset of the Covid crisis, the ECB's QE programmes have been accelerated and total assets acquired has now reached €5.4tr (December 2022).

The country that has conducted the largest amount of QE relative to GDP is Japan. After restarting QE in 2013, and with recent Covid-related increases in asset purchases, the Japanese central bank asset holding is now ¥520tr (US$4.5tr) or 124% of GDP (December 2022).

The main channel by which QE is thought to have been effective is via a reduction in medium and longer-term rates of interest. QE causes greater demand for government debt, raising its price and reducing its yield (see footnote 10). For example, the 1% fall in yields on long-dated UK government bonds on the introduction of the first QE programme in 2009 (Figure 4) was arguably caused by QE. Corporate yields also fell as investors sought substitutes for the bonds bought by the Bank of England (the 'portfolio balance' effect). While monetary policy in 'normal' times is the choice of Bank Rate which is an overnight interest rate, QE may thus provide the central bank with an additional instrument: influence over longer-term interest rates.

Lower long-term rates are helpful to businesses that can finance themselves by issuing debt. A more important channel may be the 'wealth effect' (section 1.5), whereby the raised prices of bonds and other assets stimulate spending. Another possible channel is that lower yields tend to weaken the foreign exchange value of the currency.

While the early programmes of QE may have succeeded in stimulating economic activity, yields on government debt and other assets soon reached low levels in all developed economies,

particularly the eurozone and Japan (see Fig.4 for the UK), leading to doubts about the usefulness of continuing QE. Nonetheless, QE was restarted in 2020 as a response to the Covid pandemic.

Another channel by which it was hoped that QE would stimulate spending was that the banks' new reserve deposits (created to pay for the central bank's asset purchases) would encourage them to increase their lending. However, banks' lending decisions are generally focused on the potential profitability of lending opportunities than on their supply of funds (section 1.4), and there is little evidence that this channel was effective (see also the appendix on monetary base control).

It has always been the intention of the Bank of England eventually to reverse QE, selling its stocks of government debt back into the market, which should raise long-term rates. In the US, in 2018, the Federal Reserve stopped reissuing debt as its QE assets matured, thus allowing its stock of assets to fall. But with the Covid pandemic, this agenda was temporarily overturned in favour of a large increase in QE.

Also, the programme of 'austerity' which had been holding back government spending was relaxed in favour of a large increase in fiscal stimulus, despite high and rising government debt levels.

2.3 Bank regulation

Another response to the financial crisis has been a large increase in regulation, with the objective of preventing future bank failures and their consequences.

The failure of any firm implies losses for creditors, job losses for employees, and the interruption of production. The failure of a bank is potentially more serious because banks operate the payments system (section 1.1). If one bank is unable to process payments, this can lead to chains of failed payments and to the weakening of other banks. Widespread breakdown of the payments system would be disastrous for the economy.

Thus, while the failure of a few non-financial firms and small banks might be tolerated, there is a strong case for government and/or central bank intervention to prevent the failure of large banks; large banks may be considered as 'too large to fail' (TLTF). Indeed, as discussed above, governments of all major economies provided financial support ('bailout') to a number of banks after the onset of the financial crisis in 2007-08.

If government bailout were unavailable, a bank's shareholders might be more inclined to ensure that the bank carries prudent levels of capital relative to their risky assets, in order to be able to absorb losses (capital *aka* 'equity' or 'net worth' is the shareholders' claim on the bank). However, knowing that they can expect bailout in the event of failure, bank owners have the *moral hazard* incentive to operate with lower levels of capital. Then if the bank makes a profit, shareholders gain a high return on their capital; if the bank makes a loss that absorbs all its capital, the loss is borne by the government. This is the rationale for regulation that forces banks to have minimum levels of capital, and a brief description of the Basel rules now follows.

The first set of international regulations, the Basel I capital rules[15], was agreed in 1988 and widely implemented by 1993. Banks' assets were subdivided into classes, with each class assigned a weight according to its perceived risk (*e.g.* lending to business 100%, mortgage loans 50%, government bonds 0%). Each bank was obliged to hold a minimum value of capital as a ratio (8%) of the total risk-weighted assets, where the main components of 'capital' are shareholders' equity (Tier 1) and subordinated debt (Tier 2).

After much revision and amendment, Basel I was supplanted by Basel II in 2004-2008, the main changes being in the definitions of permissible capital and the methods of assessing risk weights, in particular, the inclusion of the Internal Ratings-

[15] The Basel Accords are the work of the Basel Committee on Banking Supervision, a subdivision of the Bank for International Settlements (BIS). Members of the Basel Committee are central bank governors, including the governor of the Bank of England.

Based Approach (IRB). Under IRB, banks use their own estimates of probabilities of defaults and losses to determine the risk weights on their various assets.

Clearly, these rules failed to prevent the crisis. Later developments, implemented generally by 2018, have included raised capital ratios and made them dependent on bank size and the state of the business cycle: during periods of high economic growth, banks are required to have more capital which is then available to absorb losses in the downturn.

Further regulatory ratios have also been added, notably the Liquidity Coverage Ratio (LCR). Besides being *solvent*, a bank must be *liquid* (see section 1.1) in order that it can make payments from its customers' deposits as and when required. It must have sufficient reserves (deposits at the central bank) and other liquid assets (such as government bonds and bills) that are immediately saleable or acceptable as collateral for (repo) borrowing from other financial institutions or the central bank.

The aim of the LCR is for banks to hold 'high-quality liquid assets' (HQLA: mainly reserves and government bonds) equal to 100% of projected maximum outflows over a period of 30 days. These outflows are specified as percentages (run-off rates) applied to each class of liability. For instance, the run-off rate for deposits is between 5% and 25%, depending on the perceived likelihood of withdrawal, and 100% for unsecured interbank borrowing of less than 30 days maturity.

Note that *illiquidity* may imply *insolvency* and *vice-versa*. If a bank is short of liquid assets, it may try to satisfy deposit withdrawals by selling some illiquid assets. But such sales, especially if undertaken quickly, may raise less than the book value of the assets, reducing the value of the bank's equity and moving the bank towards insolvency. Conversely, if doubts arise about a bank's solvency, depositors tend to withdraw their deposits, reducing the bank's liquidity. Thus, either *illiquidity* or *insolvency* may be the root cause of a bank's failure. They tend to occur together.

Another innovation is the Net Stable Funding Ratio (NSFR) which requires a bank to hold long-term liabilities (*e.g.* capital and time deposits) equal to the value of its illiquid assets. Finally, the Leverage Ratio sets a minimum ratio of capital to total assets (Basel sets a ratio of 3%; national regulators may set a higher ratio).

All these ratios involve many arbitrary parameters such as the capital risk-weights, the LCR run-off rates and the allowable proportions of different sorts of capital and liquid assets. Reporting requirements are onerous and compliance and monitoring are expensive. Moreover, there is overlap between the different ratios. A bank that satisfies the NSFR will also tend to satisfy the LCR. And the capital ratio and leverage ratio both set minimum capital levels. The reason for the leverage ratio is that the ratio of capital to risk-weighted assets might be treating some assets, such as zero-weighted government debt, too leniently.

As a final observation, note that regulation is continuously changing: under the latest version, Basel III, there are several new and revised standards for which the deadline for implementation is January 2023. In addition, there are national regulations such as the wide-ranging Dodd-Frank Act in the US which, amongst other things, prohibits banks from trading on their own account. In Britain, the application of the Vickers report stipulates that banks must 'ring-fence' their retail banking activity from other activities such as investment banking.

Has all this regulation made banks safer? Probably, but its complexity and continuous change makes banks less efficient and hinders their normal business of accepting deposits and lending. The predictable result is disintermediation: the shifting of financial intermediation into the less regulated 'shadow banking' sector.

2.4 The Covid crisis and the invasion of Ukraine[16]

Twelve years after the financial crisis of 2007-08, the world faced the Covid pandemic. Like other governments, the UK government spent large amounts in 2020-21 to support the health service, to avert hardship and to mitigate the damage to the economy. Those who lost their incomes because of 'lock-down' restrictions were paid under the 'furlough' scheme, and businesses were assisted by grants and loan guarantees.

During 2021, the second year of the crisis, although sporadic 'waves' of infection continued, the increasing use of vaccination reduced the need for restrictions, allowing economies to recover lost output. However, the policy responses to the pandemic have left serious economic problems.

As in all developed economies, Covid-induced government spending in the UK has led to high levels of debt/GDP, in a reversal of the 'austerity' policy of the years before 2020 that was designed to bring down debt accumulated during the financial crisis (see Fig. 8). The government's ability to finance its spending was helped by the Bank of England's latest QE programme, begun in March 2020 (see Fig.9), under which the Bank was buying government bonds almost as fast as the government was issuing them. Crucially, this action succeeded in holding down long-term interest rates through most of 2020 (10-year government bond yields were typically only 0.3%), helping to ensure that government debt remained manageable.

At the time, the Bank insisted[17] that its massive bond-buying programme was not driven by the government's bond sales, *i.e.* it was not providing *monetary finance* for the government. Rather, said the Bank, its motive was to fulfil its mandate to control inflation which, during 2020, was below the 2% target (Fig. 10)

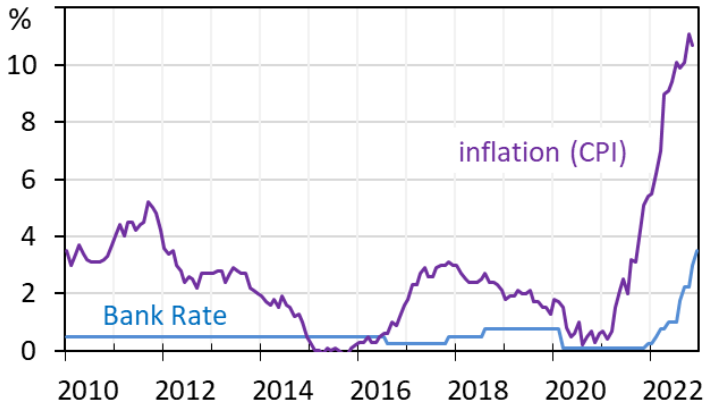

Figure 10: UK inflation and Bank Rate

Even though the Bank was indirectly financing much of the government's new spending, it maintained that this did not imply *fiscal dominance* of monetary policy. This is important because if the bank were to admit that its bond-buying was driven by the government's bond sales, this would cast doubt on its independence, which is the doctrine that has underpinned inflation control for the past 30-40 years (section 1.7).

From early 2021, UK inflation started to rise, reaching 5.4% (CPI) by January 2022, far above the 2% target.[18] The Bank finally responded in December 2021 with a modest rise in Bank Rate from 0.1% to 0.25%, while its latest QE programme of bond purchases finished on schedule at the end of 2021.

At the time the Bank took the view[19] that this higher inflation was temporary and it would fall back as the post-COVID excess demand for goods subsided and supply bottlenecks eased. Thus small increases in Bank Rate were all that was necessary, argued the Bank.

[16] Parts of this section are reproduced from J. Whittaker, "The UK government's COVID spending may lead to inflation", The Conversation, November 26 2020.

[17] Speech by Andrew Bailey, Bank of England governor, reported in the Financial Times 5 April 2020

[18] Note that inflation is not a very effective way of reducing the burden of government debt in the UK at present (see section 1.7), because most debt is either index-linked or owned by the Bank of England as a result of QE.

[19] "Bank of England will have to act to contain inflation - Bailey" , Reuters, October 17, 2021.

In the event, inflation continued to rise, reaching over 10% by July 2022 (Fig. 10), driven by rising international costs of energy, also rising costs of commodities such as grain and fertiliser, and of shipping. In part this was an ongoing result of supply disruptions caused by the Covid pandemic, with China notably prolonging lock-downs throughout the year. From February 2022, supply constraints were severely exacerbated by the invasion of Ukraine and the reduction in Russian exports of gas and oil to the West.

Another consequence of Covid was a shrinkage of the labour force, because significant numbers of workers that had been laid off did not return to the labour market. As demand for goods and services recovered, unemployment fell below 4%, a level not seen in the UK since the 1970s. The 'tight' labour market also led to rising wages, adding to the 'cost-push' on inflation. Since mid-2022, this has been reinforced by industrial action (strikes) across several sectors, with higher inflation frequently cited as justification for wage increases. The implication is that inflation may persist even if increases in international supply prices subside, due to this 'wage-price spiral' feedback loop: higher prices of goods call for higher wages which raise prices.

During 2022, the Bank of England responded to sharply rising inflation by increasing Bank Rate, reaching 3.5% by December 2022. However, this rate of rise is small compared with the rise in inflation (Fig. 10). With the real interest rate now around -8% (end 2022, measured as Bank Rate less inflation), it appears that monetary policy remains ultra-stimulatory. Although inflation (measured as year-on-year increases in consumer prices) will fall somewhat as the supply-driven increases of early 2022 no longer contribute to the figures, it can be argued that Bank Rate needs to be considerably higher to prevent inflation becoming entrenched.[20]

Why is the Bank so hesitant to raise interest rates?

First, the Bank does not want to weaken economic growth any further. Secondly, it is well aware of the distress that higher rates cause for borrowers. Already, during 2022, the cost of mortgage borrowing has more than doubled (Fig. 3), causing hardship for those refinancing their housing loans. And the biggest borrower in the land, the UK government, is now paying around £87bn per year interest on its large £2.4tr debt.

It is the coincidence of inflation with high government debt that presents such a dilemma both for the Bank and for the government. High interest rates are necessary to contain inflation. And the government needs to raise taxes and/or reduce spending in order to control its finances. But both of these actions tend to depress economic growth, which is widely expected to be negative during 2023.[21]

All major western economies are facing similar problems. And while it is clear that the long era of falling interest rates is finally over, there remains more than the usual uncertainty about the future path of interest rates, inflation and government debts.

[20] See Huw Pill (January 9 2023) "UK monetary policy outlook", speech given at the Money Market Association of New York University (Money Marketeers) Event, New York.

[21] See, for instance, Bank of England Monetary Policy Report , November 2022

Appendix: monetary base control

In typical textbook treatments of monetary policy, the central bank chooses the value of the monetary base M0, defined as currency (banknotes) issued by the central bank plus the banks' reserve deposits at the central bank. The central bank controls the monetary base by using open-market operations to adjust the supply of bank reserves (see section 1.3). In this description, M0 is the central bank's *instrument* rather than the interest rate, and the *money supply* M (defined as currency plus deposits in banks[22]) is assumed to be *caused* by the monetary base via a reliable 'money multiplier' relationship.

Then, under the assumptions of the *quantity theory of money*, an increase in the money supply is supposed to cause a proportional increase in nominal output. Formally, this is a statement that the velocity of money in the equation MV=PY stays constant, where V is velocity, M is the money supply, P is the price level and Y is real output. Thus, the money multiplier and the quantity theory together imply that accurate control of inflation could be achieved by setting the rate of growth of monetary base, M0.

The point of this appendix is to show that this is a poor description of reality. Further, it would not be *possible* for the central bank to operate by setting M0. Essentially, this is because bank deposits are claims to currency which only the central bank can supply. Hence, in order to ensure that banks can honour their obligations to convert deposits into currency, the central bank *must* stand ready to issue whatever quantity of currency (or reserves) is demanded *i.e.* lend to the banks on demand; it must also accept deposits of its own currency without limit. The central bank cannot *choose* the quantity of currency it issues and must therefore set the interest rate for its lending, and the rate at which it rewards reserve deposits.

In more detail, the money multiplier theory is as follows. With the central bank setting the value of the monetary base, it is no longer lending to banks on demand (providing *liquidity* = new monetary base), and banks are therefore presumed to keep enough excess reserves to satisfy withdrawals of their customers' deposits. The amount of this desired fractional reserve would be based on the observed statistics of deposit withdrawals, balanced against the loss of income from foregone lending. In this scenario, the wholesale (interbank) interest rate becomes market-determined at a value that equates the given stock of reserves with banks' demands for it,

This is similar to the corridor system described above in section 1.3. But in that system, the supply of reserves is adjusted so as to meet the demand at the chosen market interest rate: the interest rate is the policy instrument. In contrast, under monetary base control, the monetary base is the policy instrument and the interest rate is supposed to adjust according to the given reserve supply.

To reproduce a typical textbook presentation of the money multiplier, suppose that for every £100 of their money, individuals choose to hold £5 as currency and £95 as a bank deposit. Of this £95, suppose banks' required reserves and desired excess reserves together are £5. Then £100 of money is associated with £10 of monetary base: the money multiplier is 10. When the central bank wants to raise the money supply, it raises the monetary base by buying government bonds from the private sector in exchange for new reserves (an open-market purchase).[23] The money supply is

[22] There are several definitions of 'money': M1 is currency + short-term deposits, M2 is M1 + medium term deposits etc. The reported measure in the UK is M4 – 'broad money' – which also includes long-term deposits in banks and building societies. For this discussion we can think of money as being M4.

[23] In this description, the tools of monetary management are open market operations by which the central bank changes the monetary base, the required reserve ratio which affects the value of the multiplier, and the central bank's 'discount' rate for 'last resort lending' which affects the multiplier by influencing the amount of excess reserves that banks choose to hold.

then supposed to rise through the 'deposit expansion' process, as follows.

When the central bank buys government bonds, deposits in banks rise and this is reflected as an increase in excess reserves. Banks now have more reserves than they want, so they find willing borrowers and they lend. But people borrow for the purpose of paying for goods and services, which will cause an increase in the deposits of sellers of the goods and services; alternatively, a seller might use the payment to repay a loan.

Either way, banks will again find they have more reserves than they want which then causes more lending. Each time the same initial reserves are lent and re-deposited, a proportion is kept as currency (5%, in the above example), and a further proportion (another 5%) is absorbed as required reserves and desired excess reserves, and it is therefore unavailable for lending. In this way, deposits and the money supply continue to increase by decreasing amounts, as is laboriously described in many textbooks. The expansion process terminates when the money supply (e.g. M4) has risen by the 'multiplier' (10 in the above example) multiplied by the injection of new reserves.

The money multiplier does not work

One problem with this process is that banks do not have a pool of approved borrowers waiting until the banks have funds to lend. As mentioned above (section 1.4), banks may offer credit when a potentially profitable lending opportunity arises then find the funds, borrowing in the interbank market if necessary.

Clear evidence that this multiplier process is not operating has been provided by the Bank of England's QE programmes. According to the multiplier, M4 should have remained roughly proportional to M0, whereas the growth rate of the monetary base (M0) caused by the QE purchases has been massively greater than the growth rate of broad money (M4).[24] Also, contrary to the quantity theory, Figure 11 shows no indication of a correlation between inflation and M4 growth.

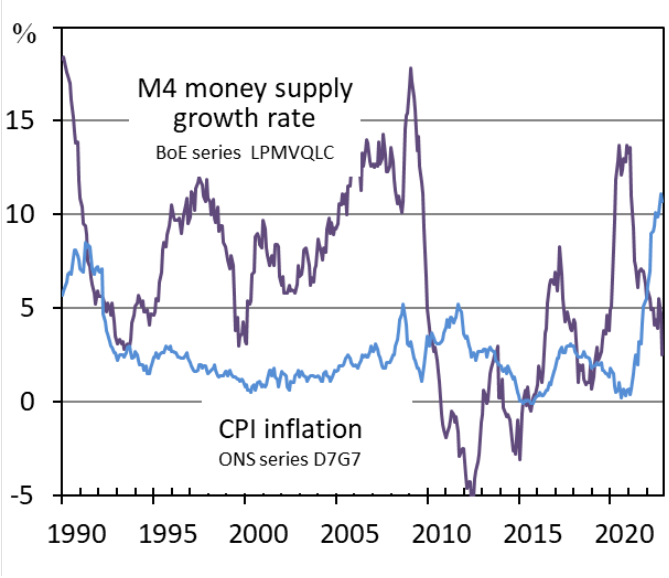

Figure 11. UK money supply growth and inflation

source: Bank of England; Office for National Statistics

There are two reasons why the banks are content to hold on to their large stocks of reserves: first, under the floor system of interest rate application described in section 1.3, reserves earn the market rate of interest; second, since 2015, the Liquidity Coverage Ratio rules (see section 2.3) have required banks to carry minimum levels of statutory liquid assets, of which reserves are the major component

A more obvious problem with the money multiplier would arise in the opposite case of a *shortage* of reserves (admittedly, an unrealistic scenario given today's large reserve holdings, and it would need large open-market sales to bring this about). If an individual bank found its reserves falling below its desired level, its reaction would be to acquire reserves by selling other assets. If banks collectively suffered a reduction in their reserves, competition to raise funds by selling assets would cause a rise in interest rates, particularly when those assets became increasingly less liquid. The likely end result of this

[24] Note the large increase in reserves (the main component of M0) in the banks' balance sheet between February 2006 and October 2019 (section 1.1), as compared with the much smaller proportional increase in private sector deposits (M4).

general shortage of reserves would be doubt amongst depositors about the banks' ability to pay.

Even if banks generally were holding large stocks of excess reserves, and even if the central bank never attempts to *reduce* the monetary base, there will always be a non-zero probability that net currency withdrawals will exceed the banks' aggregate excess reserves and vault currency. If this happened, banks would no longer be able to pay out currency to their depositors, immediately causing a loss of confidence in the banks and breakdown of the payments system.

Hence, in the absence of access to central bank lending, the only way for banks to be wholly confident of meeting all possible withdrawals of currency would be for them to hold reserves at least equal to their short-term liabilities. This arrangement, known as 100% reserve banking, would be a radical departure from current practice.

It might then be argued that the central bank could set the amount of monetary base but undertake to lend extra reserves only in an emergency or truly 'last resort' situation. But the only consistent criterion for identifying such an emergency would be *if there were a shortage of reserves*. As soon as banks became confident of such support, at whatever interest rate the central bank may choose, excess reserve holdings could be reduced close to zero, and we revert to the present system in which the interest rate for central bank lending (or for rewarding reserves) is the monetary control instrument.

The upshot is that the central bank *cannot* fix the monetary base. Unless the central bank is prepared to let banks fail because of a shortage of reserves, it *must* provide reserves on demand: it must finance reserve shortages *in full* against whatever collateral the banks are able to offer. In doing so, it cannot avoid setting its interest rate for this finance: Bank Rate in the UK.

Of course, this does not prevent the central bank from *targeting* the monetary base. The central bank may target any variable, meaning that it chooses the path of its interest rate instrument over time in attempt to achieve some desired value or range of values of the target variable. Monetary base targeting (and money supply targeting) has indeed been practiced from time to time by various central banks in the belief that this was a good method of achieving some desired inflation rate. The prevalent current practice is rather to target the inflation rate itself.
