# Central banks and financial crises[*]

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# Outline

# Introduction

In this paper I draw lessons from the experience of the past year for the conduct of central banks in the pursuit of macroeconomic and financial stability. Modern central banks have three main tasks: (1) the pursuit of macroeconomic stability; (2) maintaining financial stability and (3) ensuring the proper functioning of the 'plumbing' of a monetary economy, that is, the payment, clearing and settlement systems. I focus on the first two of these, and on the degree to which they can be separated and compartmentalised, conceptually and institutionally. My thesis is that both monetary theory and the practice of central banking have failed to keep up with key developments in the financial systems of advanced market economies, and that as a result of this, many central banks were to varying degrees ill-prepared for the financial crisis that erupted on August 9, 2007.

The empirical illustrations will mainly be drawn mainly from the experience of three central banks, the Federal Reserve System (Fed), the Eurosystem (ECB) and the Bank of England (BoE), with occasional digressions into the experience of other central banks. Discussion of mainly Fed-related issues will account for well over one third of the paper, partly in deference to the location of the Jackson Hole Symposium, but mainly because I consider the performance of the Fed to have been by some significant margin the worst of the three central banks, as regards both macroeconomic stability and financial stability.

In many ways, August 2008 is far too early a date for a *post-mortem*. Both the financial crisis and dysfunctional macroeconomic performance are still with us and are likely to remain with us well into 2009: inflation and inflation expectations are above-target and rising (see Chart 1 and Charts 2a,b), output is falling further below potential (see Charts 3a,b) and there is a material risk of recession in the US, the UK and the euro area.[12] Nevertheless, I

[1] The official inflation targets are 2.0 percent *per annum* for the BoE and just below 2.0 percent for the ECB, both for the CPI. I assume the Fed's unofficial centre for its PCE deflator inflation comfort zone to be 1.5

believe that, although a final verdict may have to wait another couple of generations, there are some lessons that can and should be learnt right now, because they are highly relevant to policy choices the monetary authorities will face in the months and years immediately ahead. Such, in any case, have been the justifications for even earlier crisis post-mortems written by myself and others (see e.g. Buiter (2007f, 2008b) and Cecchetti (2008)).

Possibly because truly systemic financial crises have been few and far between in the advanced industrial countries since the Great Depression (the Nordic financial crisis of 1992/1993 is a notable exception (see Ingves and Lind (1996) and Bäckström (1997)), most central banks in the north Atlantic region - the region where the crisis started and has done the most damage - were not prepared for the storm that hit them. It is therefore not surprising that mistakes were made. The incidence and severity of the mistakes was not the same, however, for the three central banks. I find that the Fed performed worst as regards macroeconomic stability and as regards one of the two time dimensions of financial stability – minimising the likelihood and severity of *future* financial crises. As regards the other time dimension of financial stability, dealing with the *immediate* crisis, the Bank of England gets the wooden spoon.

I argue that three factors contribute to Fed's underachievement as regards macroeconomic stability. The first is institutional: the Fed is the least independent of the three central banks and, unlike the ECB and the BoE, has a regulatory and supervisory role; fear of political encroachment on what limited independence it has and cognitive regulatory

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percent. Given the recent historical wedge between US PCE and CPI inflation, this translates into an informal Fed CPI inflation target of just below 2.0 percent.

[2] The long-term inflation expectations data for the euro area should be taken with a pinch of salt. The reported euro area survey-based inflation expectations are the predictions of professional forecasters rather than those of a wider cross-section of the public, as is the case for the US and UK data (see European Central Bank (2008)). The euro area professional forecasters are either very trusting/gullible or know much more than the rest of us, as their 5-years ahead forecast flat-lines at the official target throughout the sample, despite a systematic overshooting of the target during the sample. Using market-based estimates of inflation expectations, either break-even inflation rates from nominal and index-linked public debt or inflation expectations extracted from inflation swaps, would not be informative during periods of illiquid and disorderly financial markets. Even if the markets for these instruments themselves remain liquid, the yields will be distorted by illiquidity elsewhere in the system.

capture by the financial sector make the Fed prone to over-react to signs of weakness in the real economy and to financial sector concerns.

The second is a sextet of technical and analytical errors: (1) misapplication of the 'Precautionary Principle'; (2) overestimation of the effect of house prices on economic activity; (3) mistaken focus on 'core' inflation; (4) failure to appreciate the magnitude of the macroeconomic and financial correction/adjustment required to achieve a sustainable external equilibrium and adequate national saving rate in the US following past excesses; (5) overestimation of the likely impact on the real economy of deleveraging in the financial sector; and (6) too little attention paid (especially during the asset market and credit boom that preceded the current crisis) to the behaviour of broad monetary and credit aggregates.

All three central banks have been too eager to blame repeated and persistent upwards inflation surprises on 'external factors beyond their control', specifically food, fuel and other commodity prices.

The third cause of the Fed's macroeconomic underachievement has been its tendency to use the main macroeconomic stability instrument, the Federal Funds target rate, to address financial stability problems. This was an error both because the official policy rate is a rather ineffective tool for addressing liquidity and insolvency issues and because more effective tools were available, or ought to have been. The ECB, and to some extent the BoE, have assigned the official policy rate to their price stability objective and have addressed the financial crisis with the liquidity management tools available to the lender of last resort and market maker of last resort.

The Bank of England made the worst job of handling the immediate financial crisis during the early months (until about November 2007). The ECB, partly as the result of an accident of history, did best as regards putting out fires.

None of the three central banks handled well the inherent tension between the two key dimensions of financial stability: the urgent short-term task of 'putting out fires', that is, managing the immediate crisis, and the vital long-run task of minimizing the likelihood and severity of future financial crises. Through their pricing of illiquid collateral, all three are likely to have engaged in behaviour that created unnecessary moral hazard, thus laying the foundations for future reckless lending and borrowing.

In the case of the Fed, the nature of the arrangements for pricing illiquid collateral offered by primary dealers invites abuse. In the case of the BoE and the ECB, the secrecy surrounding their pricing methodology and models, and their unwillingness to provide information about the pricing of specific types and items of collateral make one suspect the worst. Because these distorted arrangements (in the case of the Fed) and lack of transparency as regards actual pricing (for all three central banks) continue, it is likely that all three central banks continue to create avoidable moral hazard. The reason the Fed did worst in this area also, is probably again due to the fact that, unlike the ECB and the BoE, the Fed is a financial regulator and supervisor for the banking sector. Cognitive regulatory capture of the Fed by Wall Street resulted in excess sensitivity of the Fed not just to asset prices (the 'Greenspan-Bernanke put') but also to the concerns and fears of Wall Street more generally.

All three central banks have gone well beyond the provision of emergency liquidity to solvent but temporarily illiquid banks. All three have allowed themselves to be used as quasi-fiscal agents of the state, providing subsidies to banks and other highly leveraged institutions, and assisting in their recapitalisation, while keeping the resulting contingent exposure off the budget and balance sheet of the fiscal authorities. Such subservience to the fiscal authorities undermines the independence of the central banks even in the area of monetary policy.

In Section I, I discuss the principles of macroeconomic stability and in Section II the principles of financial stability. Section III reviews the records of the three central banks

during the past year, first as regards macroeconomic stability and then as regards financial stability. Section IV concludes.

# I. Macroeconomic stability

## I.1 Objectives

The macroeconomic stability objectives of the three central banks are not the same. Both the ECB and the BoE have a lexicographic or hierarchical preference ordering with price stability in pole position. Only *subject to* the price stability objective being met (for the BoE) or *without prejudice to* the price stability objective (for the ECB) can these central banks pursue other objectives, including growth and employment. In the UK, the operationalization of the price stability objective is the responsibility of the Chancellor of the Exchequer. It takes the form of a 2 percent annual target inflation rate for the headline consumer price index or CPI. The ECB sets its own operational inflation target, an annual rate of inflation for the CPI that is below but close to 2 percent in the medium term.

The Federal Reserve System (Fed) formally has a triple mandate: maximum employment, stable prices and moderate long-term interest rates.[3] The third of these is habitually ignored, leaving the Fed in practice with a dual mandate: maximum employment and stable prices. Unlike the lexicographic ordering of ECB and BoE objectives, the Fed's objective function can be interpreted as *symmetric* between price stability and real economic activity, in the sense that, in the central bank's objective function, one can be traded off for the other. This is captured well by the traditional flexible inflation targeting loss function $\Lambda$ shown in equations (1) and (2). Here $E_t$ is the conditional expectation operator at time $t$, $\pi$

[3] The Federal Reserve Act, Section 2a. Monetary Policy Objectives, states: "The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." [12 USC 225a. As added by act of November 16, 1977 (91 Stat. 1387) and amended by acts of October 27, 1978 (92 Stat. 1897); Aug. 23, 1988 (102 Stat. 1375); and Dec. 27, 2000 (114 Stat. 3028)].

is the rate of inflation, $\pi^*$ the (constant) target rate of inflation, $y$ real GDP (or minus the unemployment rate) and $y^N$ potential output or minus the natural rate of unemployment.

$$\Lambda_t = E_t \sum_{i=0}^{\infty} \left( \frac{1}{1+\delta} \right)^i L_{t+i} \qquad (1)$$
$$\delta > 0$$

$$L_{t+i} = \left( \pi_{t+i} - \pi^* \right)^2 + \omega \left( y_{t+i} - y_{t+i}^N \right)^2 \qquad (2)$$
$$\omega > 0$$

With a lexicographic ordering, the central bank can be viewed as first minimizing the loss function in (1) and (2) with the weight on the squared output gap, $\omega$, set equal to zero. If there is a unique policy rule that solves this problem, this is the optimal policy rule. If there is more than one solution, the policy authority chooses among these the one that minimizes something like $\Lambda_t^y = E_t \sum_{i=0}^{\infty} \left( \frac{1}{1+\delta} \right)^i \left( y_{t+i} - y_{t+i}^N \right)^2$

'Maximum employment' is not a well-defined concept. Recent Fed chairmen have interpreted it as something close to the natural rate of unemployment or the NAIRU (the non-accelerating inflation rate of unemployment). In employment space this translates into the maximum *sustainable* level or rate of employment. In output space it becomes the maximum *sustainable* output gap (excess of actual over potential GDP) or the maximum *sustainable* growth rate of GDP.

Price stability has not been given explicit numerical content by the Fed, the US Congress or any other authority. Since the Greenspan years, the Fed appears to have targeted a stable, low rate of inflation for the core personal consumption expenditure (PCE) deflator index. It has not always been clear whether the Fed actually targets core inflation or whether it targets headline inflation in the medium term and treats core inflation as the best predictor of medium-term headline inflation. As late as March 2005, the current Chairman of the Fed admitted to a 'comfort zone' for the core PCE deflator of 1 to 2 percent (Bernanke (2005)).

This is also consistent with the FOMC members' inflation forecasts at a three-year horizon. In what follows, I will treat the Fed's implicit inflation target as 1.5 percent for the headline PCE deflator or just below 2.0 percent for the headline CPI, given the usual wedge between PCE and CPI inflation rates.

The recent performance of the CPI inflation rates, of survey-based measures of 1-year and long-term inflation expectations and of real GDP growth rates for the US, the euro area and the UK are shown in Charts 1, 2a,b and 3a,b.

**Chart 1 here**

**Chart 2a here**

**Chart 2b here**

**Chart 3a here**

**Chart 3b here**

## I.2 Instruments

The key instrument of monetary policy for macroeconomic stabilisation policy is the short risk-free nominal rate of interest on non-monetary financial instruments, henceforth the official policy rate, denoted $i$. This is the Federal Funds target rate in the US, the inelegantly named Main Refinancing Operations Minimum Bid Rate of the ECB and Bank Rate in the UK. In principle, the nominal exchange rate (either a bilateral exchange rate or a multilateral index) could be used as the instrument of monetary policy instead of the official policy rate. In practice, all three countries have market-determined exchange rates.[4] I don't consider

[4] I can therefore avoid addressing the anomaly (putting it politely) of the exchange rate, foreign exchange reserves and foreign exchange market intervention being under Treasury authority in the US (with the Fed acting as agent for the Treasury), or of the Council of Ministers of the EU (or perhaps of the euro area?) being able to give 'exchange rate orientations' to the ECB. Clearly, in a world with unrestricted international mobility of financial capital, setting the exchange rate now and in the future effectively determines the domestic short risk-free nominal interest rate as a function of the foreign short risk-free nominal interest rate (there will be an exchange rate risk premium or discount unless the path of current and future exchange rates is deterministic). If the US Treasury were really determined to manage the exchange rate, the Fed would only have an interest rate-

sterilised foreign exchange market intervention (unilateral or internationally co-ordinated) to be a significant additional instrument of policy, unless foreign exchange markets were to become disorderly and illiquid - something that hasn't happened yet.

Reserve requirements on eligible deposits, when they are unremunerated, are best thought of as a quasi-fiscal tax. When remunerated, they can be viewed as part of a set of capital and liquidity requirements that can be used as financial stability instruments (see Section II below), but not as significant macroeconomic stabilisation instruments.

The non-negativity constraint on the official policy rate has not been an issue so far in the current crisis. With the Federal Funds target rate at 2.00 percent, it is by no means inconceivable that $i \geq 0$ could become a binding constraint on the Fed's interest rate policy before this crisis and cyclical downturn are over.[5]

In what follows, the official policy rate will be the only macroeconomic stabilisation instrument of the central bank I consider in detail.

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setting role left to the extent that the US economy is large enough to influence the world short risk-free nominal interest rate.

[5] The non-negativity constraint on the nominal yield of non-monetary securities is the result of (a) the arbitrage requirement that the yield on non-monetary instruments, $i$, cannot be less than the yield on monetary securities, $i^M$, that is, $i \geq i^M$ and (b) the practical problems of paying any interest at all on currency, that is, $i^M \approx 0$. This is because currency is a negotiable bearer bond. Paying interest, positive or negative, on negotiable bearer securities, while not impossible, is administratively awkward and costly. This problem does not occur in connection with the payment of interest, positive or negative, on the other component of the monetary base, bank reserves held with the central bank. Reserves held with the central bank are 'registered' financial instruments. The issuer knows the identity of the holder. Paying interest, at a positive or negative rate, on reserves held with the central bank is trivially simple and administratively costless. Charging a negative nominal interest rate on borrowing from the central bank (secured or unsecured, at the discount window or through open market operations) is also no more complicated than paying a positive nominal interest rate. If the practical reality that paying (negative) interest on currency is not feasible or too costly sets a zero floor under the official policy rate, this would, in my view be a good argument for doing away with currency altogether (see Buiter and Panigirtzoglou (2003)).

Various forms of E-money provide near-perfect substitutes for currency, even for low income households. The existence of currency is, because of the anonymity it provides, a boon mainly to the grey and black economy and to the outright criminal fraternity, including those engaged in tax evasion, money laundering and terrorist financing. The Fed has reduced its subsidisation of such illegality and criminality by restricting its largest denomination currency note to $100. The ECB practices no such restraint and competes aggressively for the criminal currency market with €200 and €500 denomination notes. When challenged on this, the ECB informs one that this is because in Spain people like to make housing transactions in cash. I am sure they do. With the collapse of the Spanish housing market, this argument for issuing euro notes in denominations larger than €20 at most, may now have lost whatever merit it had before.

Because economic behaviour (consumption, portfolio demand, investment, employment, production, price setting) is strongly influenced by expectations of the future, both directly and through the effect of these expectations on long-duration asset prices, it is not just past and current realisations of the official policy rate that drive outcomes, but the entire distribution of the contingent future sequence of official policy rates. The effect of a change in the current official policy rate is therefore the sum of the direct effect (holding constant expectations of future rates) and the indirect effect of a change in the current official policy rate on the distribution of the sequence of future contingent official policy rates. This leveraging of future expectations effectively permits future interest rates to be used as instruments multiple times: once at the date the actual official policy rate is set, $i(t_1)$, say, and through announcements or expectations of that official policy rate at dates before $t_1$. By abuse of certainty equivalence, I will summarise this announcement effect as $\left\{A_{t_1-j}\left(i_{t_1}\right); j \geq 1\right\}$, where $A_{t_1-j}\left(i_{t_1}\right)$ is the announcement of the period $t_1$ policy rate in period $t_1 - j$. 'Announcement' should be interpreted broadly to include all the hints, nudges, winks and other forms of verbal and non-verbal communication engaged in by the authorities.

This means that an opportunistic policy authority (one incapable of credible commitment to a specific contingent future policy rule) will be tempted to use announcements of future policy rates as independent instruments of policy, unconstrained by the commitment or consistency constraint that the announcement of the future official policy rate, or of the future rule for setting the official policy rate, be equal to the best available current guess about what the authorities will actually do at that future date, which can be expressed as $A_{t_1-j}\left(i_{t_1}\right) = E_{t_1-j}\left(i_{t_1}\right)$.

# II. Financial stability

I adopt a narrow view of financial stability. Sometimes financial instability is defined so broadly that it encompasses any inefficiency or imbalance in the financial system. In what follows, financial stability means (1) the absence of asset price bubbles; (2) the absence of illiquidity of financial institutions and financial markets that may threaten systemic stability; and (3) the absence of insolvency of financial institutions that may threaten systemic stability. I deal with the three in turn.

## II.1 Should central banks use the official policy rate to try to influence asset price bubbles?

The original Greenspan-Bernanke position that the official policy rate should not be used to tackle asset booms/bubbles is convincing (Greenspan (2002), Bernanke (2002), Bernanke and Gertler (2001)). To the extent that asset booms influence or help predict the distribution of future outcomes for the macroeconomic stability objectives (price stability or price stability and sustainable economic growth), they will, of course, already have been allowed for under the existing approaches to maintaining macroeconomic stability in the US, the euro area and the UK.

But the official policy rate should not be used to 'lean against the wind' of asset booms and bubbles beyond addressing their effect on or informational content about the objectives of macroeconomic stabilisation policy, that is, asset prices should not be targeted with the official policy rate 'in their own right'. First, this would 'overburden' the official policy rate, which is already fully engaged in the pursuit of price stability and, in the case of the US, in the pursuit of price stability and sustainable growth. Second, asset price bubbles are, by definition, driven by non-fundamental factors. Going after an asset bubble with the official policy rate – a fundamental determinant of asset prices – may well turn out to be like going after a rogue elephant with a pea shooter. It could require a very large peashooter (a

very large increase in the official policy rate) to have a material effect on an asset price bubble.

The collateral damage to the macroeconomic stability objectives caused by interest rate increases capable of subduing asset price bubbles would make hunting bubbles with the official policy rate an unattractive policy choice. Mundell's principle of effective market classification (Mundell (1962)) suggests that the official policy rate not be targeted at asset bubbles in their own right.

That, however, leaves a major asymmetry in the macroeconomic policy and financial stability framework. This asymmetry is not that the official policy rate responds more sharply to asset market price declines than to asset market price increases. Even if there were no 'Greenspan-Bernanke put', such asymmetry should be expected because asset price booms and busts are not symmetric. Asset price busts are sudden and involve sharp, extremely rapid asset price falls. Even the most extravagant asset price boom tends to be gradual in comparison. So an asymmetric response to an asymmetric phenomenon is justified. This does not mean that there has been no evidence of a 'Greenspan-Bernanke' put during the current crisis. I believe that phenomenon - excess sensitivity of the Federal Funds target rate to sudden declines in asset prices, and especially US stock prices - to be real, and will address the issue in Section III.2a below.

Operationally, the asymmetry is that there exists a panoply of liquidity-enhancing, credit-enhancing and capital-enhancing measures that can be activated during an asset market bust or a credit crunch, to enhance the availability of credit and capital and to lower its cost, but no corresponding liquidity- and credit-restraining and capital-diminishing instruments during a boom. When financial markets are disorderly, illiquid or have seized up completely, the lender of last resort and market maker of last resort (discussed in Section II.3) can spring into action.

Examples abound. Sensible proposals from the SEC in the US that require putting a range of off-balance sheet vehicles back on the balance sheets of commercial banks are waived or postponed for the duration of the financial crisis because implementation now would further squeeze the available capital of the banks. Given where we are, this makes sense, but where was the matching regulatory insistence on increasing capital and liquidity ratios during the good times?

We even have proposals now that mark-to-market accounting rules be suspended during periods of market illiquidity (see e.g. IIF (2008)). The argument is that illiquid asset markets undervalue assets compared to what their fundamental value would be in orderly markets, and that because of this fair value accounting and reporting rules are procyclical when asset markets are impaired and artificially depressed. The observation that mark-to-market behaviour is procyclical is correct, but suspending mark-to-market when markets are disorderly would introduce a further asymmetry, because orderly and technically efficient asset markets can produce valuations that depart from the fundamental valuation because of the presence of a bubble. There have been no calls for mark-to-market accounting and reporting standards to be suspended during asset price booms and bubbles.

Fundamentally, what drives this operational asymmetry is the fact that the authorities are unable or unwilling to let large highly leveraged financial institutions collapse. There is no matching inclination to expropriate, to subject to windfall taxes, to penalise financially or to restrain in other ways extraordinarily profitable financial institutions. This asymmetry creates incentives for excessive risk taking by the financial institutions concerned and has undesirable distributional consequences. It needs to be corrected. I believe a regulatory response is the only sensible one.

## II.2 Regulatory measures for restraining asset booms

I propose that any large and highly leveraged financial institution (commercial bank, investment bank, hedge fund, private equity fund, SIV, conduit, other SPV or off-balance sheet entity, currently in existence or yet to be created - whatever it calls itself, whatever it does and whatever its legal form -) be regulated according to the same set of principles aimed at restraining excessive credit growth and leverage during financial booms. Again, this regulation should apply to *all* institutions deemed too systemically important (too large or too interconnected) to fail.

Therefore, while I agree with the traditional Greenspan-Bernanke view that the official policy rate not be used to target asset market bubbles, or even to lean against the wind of asset booms, I do not agree that the best that can be done is for the authorities to clean up the mess after the bubble bursts.

### II.2a Leverage is the key

The asymmetries have to be corrected through regulatory measures, effectively by across-the board credit controls, probably in the form of enhanced capital and liquidity requirements. Every asset and credit boom in history has been characterised by rising, and ultimately excessive leverage, and by rising and ultimately excessive mismatch. Mismatch here means asset-liability mismatch or resources-exposure mismatch as regards maturity, liquidity, currency denomination, credit risk and other risk characteristics. The crisis we are now suffering the consequences of is no exception. Because mismatch only becomes a systemic issue if there is excessive leverage, and because increased leverage is largely motivated by a desire for increased mismatch by the leveraged entity, I will focus on leverage in what follows.

Leverage is a simple concept which may be very difficult to measure, as those struggling to quantify the concept of *embedded leverage* will know. In the words of the

Counterparty Risk Management Group II (2005), *"...leverage exists whenever an entity is exposed to changes in the value of an asset over time without having first disbursed cash equal to the value of that asset at the beginning of the period."* And: *"...the impact of leverage can only be understood by relating the underlying risk in a portfolio to the economic and funding structure of the portfolio as a whole."*

Traditional sources of leverage include borrowing, initial margin (some money up front - used in futures contracts) and no initial margin (no money up front - when exposure is achieved through derivatives).

I propose using simple measures of leverage, say a measure of gross exposure to book equity, as a metric for constraining *capital insolvency* risk (liabilities exceeding assets) of all large, highly leveraged institutions. Common risk-adjusted Basel II-type capital adequacy requirements and reporting requirements would be imposed on all large institutions whose leverage, according to this simple metric, exceeds a given value. These capital adequacy requirements would be varied (or vary automatically) in countercyclical fashion.

To address the second way financial entities can fail, what the CRMG calls *liquidity insolvency* (meaning they cannot meet their obligations as they become due because they run out of cash and are unable to raise new funds), I propose that minimal funding liquidity and market or asset liquidity requirements be imposed on, respectively, the liability side and the asset side of the balance sheets of all large leveraged financial institutions. These liquidity requirements would also be tightened and loosened in countercyclical fashion.

The regular Basel II capital requirements would provide a floor for the capital requirements imposed on all highly leveraged financial institutions above a certain threshold size. It is possible that Basel II will be revised soon to include minimum funding liquidity and asset liquidity requirements for banks and other highly leveraged financial institutions. If

not, national regulators should impose such minimum funding liquidity and asset liquidity requirements on all highly leveraged financial institutions above a threshold size.

Countercyclical variations in capital and liquidity requirements could either be imposed in a discretionary manner by the central bank or be built into the rule defining the capital or liquidity requirement itself. An example of such an *automatic financial stabiliser* is the proposal by Charles Goodhart and Avinash Persaud (Goodhart and Persaud (2008a,b)), to make the supplementary capital requirement for any given institution (over and above the Basel II requirement, which would set a common floor) an increasing function of the growth rate of that institution's balance sheet.

My wrinkle on this proposal (which Goodhart and Persaud propose for banks only) is that the same formula would apply to all highly leveraged financial institution above a given threshold size. The Goodhart-Persaud proposal makes the supplementary-capital-requirement-defining growth rate a weighted average (with declining weights) of the growth rate of the institution's assets over the past three years. The details don't matter much, however, as long as the criterion is easily monitored and penalises rapid expansion of balance sheets. A similar Goodhart-Persaud approach could be taken to liquidity requirements for highly-leveraged institutions. If the assets whose growth rate is taxed or penalised under this proposal are valued at their fair value (that is, marked-to-market where possible), its stabilising properties would be enhanced.

Finally, I would propose that all large leveraged institutions that are deemed too large, too interconnected, or simply too well-connected to fail, be made subject to a Special Resolution Regime along the lines that exist today for federally insured deposit-taking institutions through the FDIC. A concept of *regulatory insolvency*, which could bite before either capital insolvency or liquidity insolvency kicks in, must be developed that allows an official administrator to take control of any large, leveraged financial institution and/or to

engage in Prompt Corrective Action. The intervention of the administrator would be expected to impose serious penalties on existing shareholders, incumbent board and management and possibly on the creditors as well. The intervention should aim to save the institution, not its owners, managers or board, nor should it aim to 'make whole', that is, compensate in full, its creditors.

## II.3 Liquidity management: from lender of last resort to market maker of last resort

Liquidity management is central to the financial stability role of the central bank. Liquidity can be a property of economic agents and institutions or of financial instruments. *Funding liquidity* is the capacity of an economic agent or institution to attract external finance at short notice, subject to low transaction costs and at a financial cost that reflects the fundamental solvency of the agent or institution. It concerns the liability side of the balance sheet. *Market liquidity* is the capacity to sell a financial instruments at short notice, subject to low transaction costs and at a price close to its fundamental value. It concerns the asset side of the balance sheet. Both funding liquidity and market liquidity are continuous rather than binary concepts, that is, there can be varying degrees of liquidity.

Funding liquidity (a property of institutions) and market liquidity (a property of financial instruments or the markets they are traded in) are distinct but interdependent. This is immediately apparent when one recognises that access to external funds often requires collateral (secured lending); the costs of external funds certainly depend on the availability and quality of the collateral offered. The value of the assets offered as collateral depends on the market liquidity of the assets.

The central bank is unique because it can never encounter domestic-currency liquidity problems (domestic-currency funding illiquidity). This is because the monetary liabilities it issues, as agent of the state – the sovereign - provide unquestioned, ultimate domestic-

currency liquidity. Often this finds legal expression through legal tender status for the central bank's monetary liabilities. Central banks can, of course, encounter foreign-currency liquidity problems. The recent experience of Iceland is an example.

There is no such thing as a perfectly liquid private financial instrument or a private entity with perfect funding liquidity, since the liquidity of private entities and instruments is ultimately dependent on confidence and trust. Liquidity, both funding liquidity and market liquidity, is very much a fair weather friend: it is there when you don't need it, absent when you urgently need it. Although private agents may also lose confidence in the real value of the financial obligations of the state, including those of the central bank, the state is in the unique position of having the legitimate use of force at its disposal to back up its promises. The power to declare certain of your liabilities to be legal tender, the power to tax and the power to regulate (that is, to prescribe and proscribe behaviour) are unique to the state and its agents. The quality of private sector liquidity therefore cannot exceed that of central bank liquidity.

Funding illiquidity and market illiquidity interact in ways that can create a vicious downward spiral, well described in Spaventa (2008) and Adrian and Shin (2007a,b). Faced with the disappearance of normal sources of funding, banks or other financial institutions sell assets to raise liquidity to meet their maturing obligations. With illiquid asset markets, these assets sales can trigger a sharp decline in asset prices. Mark-to-market valuation, accounting and reporting requirements can cause capital ratios to fall below critical levels in other institutions, or may prompt margin calls. This prompts further asset sales that can turn the asset price decline into a collapse. Although these vicious circles can occur even in the absence of mark-to-market or fair value accounting and reporting, the adoption of such rules undoubtedly exacerbated the problem. The procyclicality of the Basel requirements (and especially of Basel II) (which began to be introduced just around the time the crisis erupted)

had, of course, been noted before (see e.g. Borio, Furfine and Lowe (2001), Goodhart (2004), Kashyap and Stein (2004) and Gordy and Howells (2004)).

## II.3a Funding liquidity, the relationships-oriented model of intermediation and the lender of last resort

Funding liquidity is central to the traditional 'relationships-oriented' model of financial capitalism (ROM) and the traditional lender of last resort (LLR) role of the central bank. In the traditional banking model, banks fund themselves through deposits (fixed market value claims withdrawable on demand and subject to a sequential service constraint - first come, first served). On the asset side of the balance sheet the traditional bank holds a small amount of liquid reserves, but mainly illiquid assets – loans to households or to businesses, partly secured (mortgages) partly unsecured. In the ideal-type ROM bank, loans are held to maturity (e.g. the 'originate to hold model' or mortgage finance). Even when loans mature, the borrowers tend to stay with the same bank for their future financial needs. Although deposits can be withdrawn on demand, depositors too tend to stick with the same bank, with which they often have a variety of other financial relations. The long-term relationships mitigate asymmetric information problems and permit the parties to invest in reputations and to build on trust. It inhibits risk-trading and makes entry difficult.

This combination of very short-maturity liabilities and long-maturity, illiquid assets is vulnerable to speculative attacks – bank runs. Such runs can occur, and be individually rational, even though the bank is solvent, in the sense that the value of the assets, if held to maturity, would be sufficient to pay off the depositors (and any other creditors). If the assets have to be liquidated prior to maturity, they would, however, be worthless (in milder versions the assets would be sold at a hefty discount on their fair value) and not all depositors would be made whole. This has been known since deposit-taking banks were first created. It has been formalised for instance in Diamond and Dybvig's famous paper (Diamond and Dybvig (1983), see also Diamond (2007)).

There are typically two equilibria. One equilibrium has no run on the bank. No depositor withdraws his deposits; this is because he believes that total withdrawals will not exceed the liquid reserves of the banks. This is confirmed in equilibrium. The other equilibrium has a run on the bank. Each depositor tries to withdraw his deposit because he believes that the withdrawals by other depositors will exceed the bank's liquid reserves. The bank fails.

Solutions to this problem take the form of deposit insurance, standstills (mandatory bank holidays until the run subsides) and lender of last resort (LLR) intervention. All three require state intervention. Private deposit insurance can only cope with runs on individual banks or on a subset of the banks. It cannot handle a run on all banks. A creditor (depositor) standstill - making it impossible to withdraw deposits - could be part of the deposit contract, to be invoked at the discretion of the bank. This would, however, create rather serious moral hazard and adverse selection problems, so a bank regulator/supervisor would be a more plausible party to which to delegate the authority to suspend the right to withdraw deposits. Lending to a single troubled bank can be and had been provided by other banks. Again this cannot work if a sufficiently large number of banks are faced with a run.

Individually rational bank runs don't require that be bank's liabilities be deposits. They are possible whenever funding sources are short-term and assets are of longer maturity and illiquid. When creditors to a bank refuse to renew maturing loans or credit lines, this is economically equivalent to a withdrawal of deposits. This applies to credit obtained in the interbank market or funds obtained by issuing debt instruments in the capital markets.

Lending to a solvent but illiquid bank to prevent a socially costly bank failure should satisfy Bagehot's dictum, which can be paraphrased as: lend freely, against collateral that will be good in the long run (even if it is not good today), and at a penalty rate (Bagehot (1873)). Taking collateral and charging a penalty rate is part of the LLR rule book to avoid skewing

incentives towards future excessive risk taking in lending and funding by the banks, that is, to avoid moral hazard.

The discount window is an example of a LLR facility (in the case of the Fed I will mean by this the primary discount window, in the case of the ECB the marginal lending facility and in the case of the BoE the standing lending facility).

The effective operation of LLR facility requires that the central bank determine all of the following:

1. The maturities of the loans and the total quantity of liquidity to be made available at each maturity.
2. The nature of the liquidity provided (e.g. central bank reserves or Treasury Bills).
3. The interest rates charged on the loans and the other financial terms of the loan contract.
4. The set of eligible counterparties (who has access to the LLR facility?).
5. The regulatory requirements imposed on the eligible counterparties.
6. Whether the loan is collateralised or unsecured.
7. The set of financial instruments eligible as collateral.
8. The valuation of the collateral when there is no appropriate market price (when the collateral is illiquid).
9. Any further haircut (discount) applied to the valuation of the collateral and any other fees or financial charges imposed on the collateral.

Items (3), (5), (8) and (9) jointly determine the cost to the borrower of access to the LLR facility, and thus the moral hazard created by the arrangement.

In the case of the discount window (which can be described as an LLR facility 'lite'), once points (1) to (9) have been determined, access to the facility is at the discretion of the borrower, that is, discount window borrowing is demand-driven. Strangely, and rather

unfortunately, use of discount window facilities has become stigmatised in both the US and the UK. I assume the same applies to use of the discount window facilities of the Eurosystem, but I have less directly relevant information for this case. This stigmatisation of the use of the discount window may be individually rational, because a would-be discount window borrower could reasonably fear that future access to private sources of funding might be compromised if use of the discount window is seen as a signal that the borrower is in trouble. While this would be an unfortunate equilibrium, it is unlikely to be a fatal problem for a discouraged discount window borrower: as long as the illiquid institution has a sufficient quantity of good collateral to be able to survive by using discount window funding (or through access to market-maker-of-last resort-facilities, discussed below in Section II.3b), discount window stigmatisation should not be a matter of corporate life or death.

LLR facilities other than the discount window tend not to be 'on demand'. They often involve borrowers whose solvency the central bank is not fully confident of. Such ad-hoc LLR facilities typically accept a wider range of collateral than the discount window, and the use of the facility is subject to bilateral negotiation between the would-be borrower and the central bank. The Treasury and the regulator, if this is not the central bank, may also be involved (this was the case with the LLR facility arranged by the BoE for Northern Rock in September 2007). Such ad-hoc LLR arrangements are often arranged in secret and kept confidential as long as possible. Even after the fact, when commercial confidentiality concerns no longer apply, the information needed to determine whether the LLR (and the Treasury) made proper use of public funds in rescue operations are often not made public. The terms on which deposit insurance was made available to Northern Rock by the UK Treasury and the terms on which Northern Rock could access the Liquidity Support Facility created by the BoE are still not in the public domain. There is no justification for such secrecy.

The LLR facilities (including the discount window) are only there to address liquidity issues, not solvency problems. Of course, future solvency is a probabilistic concept, not a binary one. When continued solvency is in question (discussed below in Section II.6), the central bank may be a party to a public-sector rescue and recapitalisation. The arrangement through which these facilities are made available may well look like an LLR facility 'on steroids'. The key difference with the regular LLR facility is that the resources made available through a normal LLR facility are not meant to be provided on terms that involve a subsidy to the borrower, its owners or its creditors. The risk-adjusted rate of return to the central bank on its LLR loans should cover its funding cost, essentially the interest rate on sovereign debt instruments of the relevant maturity. In a funding liquidity crisis, there is likely to be a wedge between the risk-adjusted cost of funds to the central bank and the (prohibitive) cost of obtaining funding from private sources. Under these conditions the central bank can provide liquidity to a borrower on terms that make it both subsidy-free and cheaper than what the liquidity-constrained borrower could obtain elsewhere. Such actions correct a market failure.

In the case of the UK, the discount window (the standing lending facility) is highly restrictive in the maturity of its loans (overnight only) and in the collateral it accepts (only sovereign and supranational securities, issued by an issuer rated Aa3 (on Moody's scale) or higher by two or more of the ratings agencies (Moody's, Standard and Poor's, and Fitch)).[6] The UK discount window therefore does not provide liquidity in any meaningful sense. It

[6] The complete list includes gilts (including gilt strips), sterling Treasury bills, Bank of England securities, HM Government non-sterling marketable debt, sterling-denominated securities issued by European Economic Area central governments and major international institutions, euro-denominated securities (including strips) issued by EEA central governments and central banks and major international institutions where they are eligible for use in Eurosystem credit operations, all domestic currency bonds issued by other sovereigns eligible for sale to the Bank. These sovereign and supranational securities are subject to the requirement that they are issued by an issuer rated Aa3 (on Moody's scale) or higher by two or more of the ratings agencies (Moody's, Standard and Poor's, and Fitch).

provides overnight liquidity in exchange for longer-term liquidity. It is of use only to banks that are caught short at the end of the trading day because of some technical glitch.

Because the Bank of England has no discount window in the normal sense of the word, it had to create one when Northern Rock, a private commercial bank engaged mainly in home lending, found itself faced with both a market liquidity and a funding liquidity problem in September 2007. The resulting construct, the Special Lending Facility, is just what a normal discount window ought to have been, and *is* in the US and the euro area.

Most central banks make, under special circumstances, unsecured loans to eligible counterparties as part of their LLR role, but these tend to be separate from the discount window. Also, as regards (2), discount window loans tend to be for central bank liquidity (reserves) rather than some other highly liquid instrument like Treasury Bills. With the longer-maturity (up to 3 months) discount window loans that are now available in the US (for eligible deposit-taking banks), there is, in principle, no reason why the Fed should not make TBs or Federal Reserve Bills (non-monetary liabilities of the Fed) available at the discount window. It certainly could make such non-reserve liquidity available at LLR facilities other than the discount window.

If a central bank engages in LLR loans to a solvent but illiquid bank, the central bank should expect to end up making a profit. It can extract this rent because the central bank is the only entity that is never illiquid (as regards domestic-currency obligations). It can always afford to hold good but illiquid assets till maturity. If the collateral offered is risky (specifically, subject to credit or default risk), the central bank can *ex-post* make a loss even if it *ex-ante* prices risky assets to properly reflect the risk of both the borrowing bank defaulting and the issuer of the collateral defaulting. I believe it is essential for a clear division of responsibilities between the central bank and the Treasury, and for proper public accountability for the use of public funds (to Congress/Parliament and to the electorate), that

any such losses be made good immediately by the Treasury. Ideally, all collateral offered to the central bank other than sovereign instruments should be exchanged immediately with the Treasury for sovereign debt instruments, at the valuation put on that collateral in the LLR transaction. This removes the risk that the central bank is (ab)used as a quasi-fiscal agent of the government.

To avoid regulatory arbitrage, any institutions eligible to access the discount window or any of the other LLR facilities of the central bank should be subject to a uniform regulatory regime. A special and key feature of such a common regulatory regime ought to be that access to LLR facilities only be granted to financial institutions for which there is a Special Resolution Regime which provides for Prompt Corrective Action and which establishes criteria under which the central bank, or a public agency working closely with the central bank, can declare a financial institution to be regulatorily insolvent before balance sheet insolvency or funding/liquidity insolvency can be established.

The SRR managed by the FDIC for federally insured deposit-taking banks is a model. The SRR would allow a public administrator to be appointed who can take over the management of the institution, dismiss the board and the management, suspend the voting rights of the shareholders, place the shareholders at the back of the queue of claimants to the value that can be realised from the institution by the administrator, transfer (part of) its assets or liabilities to other parties etc. Outright nationalisation would also have to be an option.

The need for such an SRR for all institutions eligible to access LLR facilities follows from the fact that it is impossible for the central to determine whether a would-be user of the LLR facility is merely illiquid or both illiquid and insolvent. Without the SRR, the existence of the LLR facility would encourage quasi-fiscal abuse of the central bank and would become a source of adverse selection and moral hazard.

## II.3b Market liquidity, the transactions-oriented model of intermediation and the market maker of last resort

The defining feature of the financial crisis that started on August 9, 2007 was not runs on banks or other financial institutions. A few of these did occur. Ignoring smaller regional and local banks, a classic depositors' bank run brought down Northern Rock in the UK (a mortgage lending bank that funded itself 75 percent in the wholesale markets), and runs were instrumental in killing off Bearn Stearns, a US investment bank and primary dealer, and IndyMac, a large US mortgage lending bank. These, however, were exceptional events.

The new and defining feature of the crisis was the sudden and comprehensive closure of a whole range of financial wholesale markets, including the asset-backed commercial paper (ABCP) markets, the auction-rate securities (ARS) market, other asset- backed securities (ABS) markets, including the markets for residential mortgage-backed securities (RMBS), and many other collateralised debt obligations (CDO) and collateralised loan obligations (CLO) markets (see Buiter (2007b, 2008b)). The unsecured inter-bank market became illiquid to the point that Libor now is the rate at which banks won't engage in unsecured lending to each other. The sudden increase in Libor rates at the beginning of August 2007 and the continuation of spreads over the overnight indexed swap (OIS) rate is shown for 3-month Libor, historically an important benchmark, in Chart 4.[7]

**Chart 4 here**

The fact that the Libor-OIS spreads look rather similar for the three monetary authorities (with the obvious exception of a few idiosyncratic early spikes upwards in the sterling spread, reflecting the BoE's late and belated conversion to the market-maker-of-last-resort cause) does not mean that all three did equally well in addressing the liquidity crunch in their jurisdiction. First, the magnitude of the challenge faced by each of the three may not

[7] The 3-months OIS rate is the fixed leg of a 3-month swap whose variable leg is the overnight secured lending rate. This can be interpreted (ignoring inflation risk premia) as the market's expectation of the official policy rate over a 3-month horizon.

have been the same. Second, the spreads are rather less interesting than the volumes of lending and borrowing that actually take place at these spreads. A 90-basis points spread with an active market is much less of a problem than a 90-basis points spread at which no-one transacts. Unfortunately, turnover data for the interbank markets are not in the public domain.

Third and most important, international financial integration ensures that liquidity can leak on a large scale between the jurisdictions of the national central banks, as long as the foreign exchange markets remain liquid, as they did for the major currencies. Unlike foreign branches, foreign subsidiaries of internationally active banks tend to have full access to the discount windows of their host central banks and they often also are eligible counterparties in the repos and other open market operations of their host central banks.

Subsidiaries of UK banks made use of Eurosystem and Fed liquidity facilities. Indeed UK parents used their euro area subsidiaries to obtain liquidity for themselves. At least one subsidiary of a Swiss bank accessed the Fed's discount window. Icelandic banks used their euro area subsidiaries to obtain euro liquidity etc.

The *de-facto* closure of many systemically important wholesale markets continues even now, a year since the start of the crisis. Over-the counter credit default swap (CDS) markets and exchange-traded CDS derivatives markets became disorderly, with spreads far exceeding any reasonable estimate of default risk; key players in the insurance of credit risk, the so-called Monolines, lost their triple-A ratings and became irrelevant to the functioning of these markets. The rating agencies, which had moved aggressively from rating sovereigns and large corporates into the much more lucrative business of rating complex structured products (as well as advising on the design of such instruments), lost all credibility in these new product lines. This underlines the fact that the minimum shared understanding and information required for organised markets to function no longer existed for many structured

products. One example: since August 2007 there has been just one new issue of RMBS in the UK (one for £500m in May 2008, by HBOS).

Central banks (outside the UK), in principle had the tools to address failing systemically important institutions – the LLR facilities. They did not have the tools to address failing, disorderly and illiquid markets. Central banks had developed and honed their skills during the era of traditional relationships-oriented financial intermediation centred around deposit-taking banks. Most were not prepared, institutionally and in mindset, to deal with the increasingly transactions-oriented financial intermediation that characterises modern financial sectors, especially in the US and the UK.

Fortunately, all that was required to meet the new reality were a number of extensions to and developments of existing open market operations, specifically in relation to the sale and repurchase operations (repos) used by central banks to engage in collateralised lending. The main extensions were: larger transactions volumes, longer maturities, a broader range of counterparties and a wider set of eligible collateral, including illiquid private securities. Increased scale and scope for outright purchases of securities by central banks, which could have been part of the new model, have not (yet) been used.

Central banks learnt fast to increase the scale and scope of their market-supporting operations. Unfortunately, they did not sufficiently heed Bagehot‘s admonition to provide liquidity only at a penalty rate. Not designing the financial incentives faced by their counterparties in these new facilities to minimize moral hazard has turned out to be the central banks’ Achilles heel in the current crisis. It will come back to haunt us in the next crisis.

Modern financial systems tend to be a convex combination of the tradition ROM and the transactions-oriented model of financial capitalism (TOM). The TOM (also called arms-length model or capital markets model) commoditises financial interactions and relationships

and trades the resulting financial instruments in OTC markets or in organised exchanges. Securitisation of mortgages is an example. This makes the illiquid liquid and the non-tradable tradable. Scope for risk-trading is greatly enhanced. This is, potentially, good news.

It also destroys information. The originator of the illiquid individual loan works for the Principal in the 'originate-and-hold-model'; he works an Agent of the Principal in the 'originate-to-distribute' model. This reduces the incentive to collect information on the creditworthiness of the ultimate borrower and to monitor the performance of the borrower over the life of the loan. Securitisation and resale then misplaces whatever information *is* collected: after a couple of transactions in RMBS, neither the buyer nor the seller has any idea about the creditworthiness of the underlying assets. This is the bad news. Inappropriate securitisation permitted, indeed encouraged, the subversion of ordinary bank lending standards that was an essential input in the subprime disaster in the US.

The TOM affects banks in two ways. First, it provides competition for banks as intermediaries, since non-financial corporates can issue securities in the capital markets instead of borrowing from the banks, thus potentially bypassing banks completely. Savers can buy these securities as alternatives to deposits or other forms of credit to banks. Second, banks turn their illiquid assets into liquid assets which they either sell on (to special purpose vehicles (SPVs) set up to warehouse RMBS, or to investors) or hold on their balance sheet in the expectation that they can be sold at short notice and at a predictable price close to fair value, i.e. that they are liquid.

It may seem that this commoditisation and marketisation of financial relationships that are the essence of the TOM would solve the banks' liquidity problem and would make even bank runs non-threatening. If the bank's assets can be sold in liquid markets, the cost of a deposit run or a 'strike' by other creditors need not be a fatal blow. Unfortunately, the liquidity of markets is not a deep, structural characteristic, but the endogenous outcome of the

interaction of many partially and poorly informed would-be buyers and sellers. Market liquidity can vanish at short notice, just like funding liquidity.

Bank runs have their analogue in the TOM world in the form of a market freeze, run, strike, seizure or paralysis (the terminology is not settled yet). A potential buyer of a security who has liquid resources available today, may refuse to buy the security (or accept it as collateral), even though he believes that the security has been issued by a solvent entity and will earn an appropriate risk-adjusted rate of return if held to maturity. This socially excessive hoarding of scarce liquid assets can be individually rational because the potential buyer believes that he may be illiquid in the next trading period (and may therefore have to sell the security next period), and that other potential buyers of the security may likewise be illiquid in the future or may strategically refuse to buy the security, to gain a competitive advantage or even to put him out of business. If the transaction is a repo, he would have to believe also that the party trying to sell the security to him today, may be illiquid in the future and unable to make good on his commitment.

It remains an open question whether this approach to market and funding illiquidity today as a result of fear of market and funding illiquidity tomorrow either needs to be iterated *ad infinitum* or requires a fear of insolvency at some future date to support a full-fledged individually rational but socially inefficient equilibrium. Charles Goodhart (2002) believes that without the threat of insolvency there can be no illiquidity (see also the excellent collection of readings in Goodhart and Illing (2002)). Strategic behaviour, Knightian uncertainty, bounded rationality and other behavioural economics approaches to modelling the transactions flows in financial markets, including the rules-of-thumb that lead to information cascades and herding behaviour, may offer a better chance of understanding,

predicting and correcting the market pathologies that lead to socially destructive hoarding of liquidity than relentlessly optimising models. The jury is still out on this one.[8]

Market illiquidity addresses the phenomenon that a financial instrument that is traded abundantly one day suddenly finds no buyers the next day at any price, or only at a price that represents a massive discount relative to its fundamental or fair value. That is, illiquidity is an endogenous outcome, a dysfunctional equilibrium in a market or game for which alternative liquid equilibria also exist, but have not materialised (or have not been coordinated on).

Market illiquidity is a form of market failure. Liquidity can be provided privately, by banks and other economic agents holding large amounts of inherently liquid assets (like central bank reserves or TBs). That would, however, be socially and privately inefficient. Maturity transformation and liquidity transformation are essential functions of financial intermediaries. Private financial entities should hold (or have access to, through credit lines,

[8] Macroeconomic theory, unfortunately, has as yet very little to contribute to the key policy issue of liquidity management. The popularity of complete contingents markets models in much of contemporary macroeconomics, both New Classical (e.g. Lucas (1975))), Lucas and Stokey (1989) and New Keynesian, (e.g. Woodford (2003)) means that in many (most?) of the most popular analytical and calibrated (I won't' call them empirical) macroeconomic dynamic stochastic general equilibrium models, the concept of liquidity makes no sense. Everything is perfectly liquid. Indeed, with complete contingent markets there is never any default in equilibrium, because every agent always satisfies his intertemporal budget constraint. All contracts are costlessly and instantaneously enforced. *Ad-hoc* cash-in-advance constraints on household purchases of commodities or on household purchases of commodities and securities don't create behaviour/outcomes that could be identified with liquidity constraints.

The legal constraint that labour is free (slavery and indentured labour are illegal) means that future labour income makes for very poor collateral, and that workers cannot credibly commit themselves not to leave an employer, should a more attractive employment opportunity come along. This can perhaps be characterised as a form of illiquidity, but it is a permanent, exogenous illiquidity, almost technological in nature. Much of the theoretical (partial equilibrium) work on illiquidity likewise deals with the consequences of different forms of exogenous illiquidity rather than with the endogenous illiquidity problem that suddenly paralysed many asset-backed securities markets starting in the summer of 2007.[8] The profession entered the crisis equipped with a set of models that did not even permit questions about market liquidity to be asked, let alone answered.

Much of macroeconomic theorising of the past thirty years now looks like a self-indulgent working and re-working to death of an uninteresting and practically unimportant special case. Instead of starting from the premise that markets are complete unless there are strong reasons for assuming otherwise, it would have been better to start from the position that markets don't exist unless very special institutional and informational conditions are satisfied. We would have a different, and quite possibly more relevant, economics if we had started from markets as the exception rather than the rule, and had paid equal attention to alternative formal and informal mechanisms for organising and coordinating economic activity. My personal view is that over the past 30 years, we have had rather too much Merton (1990) and rather too little Minsky (1982) in our thinking about the roles of money and finance in the business cycle.

swaps etc.) enough liquidity to manage their business during normal times, that is, when markets are liquid and orderly. They should not be expected to hoard enough liquid assets (or arrange liquid stand-by funding) during normal times to be able to survive on their own during abnormal times, when markets are disorderly and illiquid. That is what central banks are for.

Central banks can create any amount of domestic currency liquidity at little or no notice and at effectively zero marginal cost. It would be inefficient to privatise and decentralise the provision of emergency liquidity when there is an abundant source of free liquidity readily available.

Anne Sibert and I (Buiter and Sibert (2007a,b), see also Buiter (2007a,b,c,d)) have called the role of the central bank as provider of market liquidity during times when systemically important financial markets have become disorderly and illiquid, that of the *market maker of last resort* (MMLR).

The central bank as market maker of last resort either buys outright (through open market purchases) or accepts as collateral in repos and similar secured transactions, systemically important financial instruments that have become illiquid.[9] If no market price exists to value the illiquid securities, the central bank organises reverse auctions that act as value discovery mechanisms. There is no need for the central bank to know more about the value of the securities than the sellers, or indeed for the central bank to know anything at all.

The central bank should organise the auction because it has the liquid 'deep pockets'. A reverse Dutch auction, for instance, would be likely to be particularly punitive for the sellers of the illiquid securities. A second-lowest price (sealed bid) reverse auction would have other attractive properties. With so many Nobel-prizes and Nobel-prize calibre

[9] The label 'market maker of last resort' is more appropriate than the alternative 'buyer of last resort', because so much of the MMLR's activity turns out to be in collateralised transactions, especially repos, rather than in outright purchases. A repo is, of course a *sale and repurchase* transaction, so the label 'buyer of last resort' would not have been descriptively correct.

economists specialised in mechanism design, I don't think the expertise to design and run these auctions would be hard to find. The auctions to value the illiquid securities could be organised jointly by the central bank and the Treasury if, as I advocate, the Treasury would immediately take on its balance sheet any illiquid assets acquired in the auctions, either outright or as part of a repo or swap.

For the MMLR to function effectively, the central bank has to clarify all of the following:

1. The list of eligible instruments for outright purchase or for use in collateralised transactions like repos.
2. The nature of the liquidity provided (e.g. central bank reserves or Treasury Bills)
3. The set of eligible counterparties.
4. The regulatory requirements imposed on the eligible counterparties.
5. The valuation of the securities offered for outright purchase or as collateral, when there is no appropriate market price (when the collateral is illiquid).
6. Any haircut (discount) applied to the valuation of the securities and any other fees or financial charges imposed.

Items (4), (5) and (6) determine the effective penalty imposed by the MMLR for use of its facilities, and thus the severity of the moral hazard created by its existence. Unlike discount window access, which is at the initiative of the borrower, MMLR finance is not available on demand, even if (1) through (6) above have been determined. The policy authority (in practice the central bank), decides when to inject liquidity, on what scale and at what maturity.

Injecting large amounts of liquidity against illiquid collateral is easy. The key challenge for the central bank as market maker of last resort is the same as that faced by the central bank as lender of last resort. It is to make the effective performance of the MMLR

function during abnormal times, that is, when markets are disorderly and illiquid, compatible with providing the right incentives for risk taking when markets are orderly and liquid. This requires that liquidity must be made available only on terms that are punitive. It is here that all three central banks appear to have failed so far, albeit in varying degrees.

## II.4 The lender of last resort and market maker of last resort when foreign currency liquidity is the problem

So far, the argument has proceeded on the assumption that the central bank can provide the necessary liquidity effectively costlessly and at little or no notice. That, however, is true only for domestic-currency liquidity. For countries that have banking systems and other financial institutions that are internationally active and have significant amounts of foreign-currency-denominated exposure, a domestic-currency LLR and MMLR may not be sufficient. This is especially likely to be an issue if the country's banks or other systemically significant financial businesses have large short-maturity foreign currency liabilities and illiquid foreign currency assets. The example of Iceland comes to mind as do, to a lesser extent, Switzerland and the UK.

If the country in question has a domestic currency that is also a serious global reserve currency, the central bank is likely to be able to arrange swaps or credit lines with other central banks on a scale sufficient to enable it to act as a foreign-currency LLR and MMLR for its banking sector. At the moment there are only two serious global reserve currencies, the US dollar, with 63.3 percent of estimated global official foreign exchange reserves at the end of 2007, and the euro, with 26.5 percent (see Table 1).

**Table 1 here**

Sterling is a minor-league legacy global reserve currency with 4.7 percent, the yen is fading fast at 2.9 percent and Switzerland is a minute 0.2 percent.[10]

The Fed, the ECB and the Swiss National Bank have created swap lines of US dollars for Euro's and Swiss francs respectively, since the crisis started. These swap arrangements have recently been extended to cover the 2008 year-end period. The Central Bank of Iceland arranged, in May 2008, swap lines for €500mn each with the central banks of Norway, Denmark and Sweden. In the case of Iceland, one can see how such currency swaps could be useful in the discharge of the Central Bank of Iceland's LLR and MMLR function vis-a-vis a banking system with a large stock of short-maturity foreign currency liabilities and illiquid foreign currency assets.

The swaps between the Fed, the ECB and the SNB are less easily rationalised. Both the euro area- and the Switzerland-domiciled banks experienced a shortfall of liquidity of any and all kinds, not a specific shortage of US dollar liquidity. The foreign exchange markets had not seized up and become illiquid. Certainly, it was expensive for euro-area resident banks with maturing US dollar obligations to obtain US dollar liquidity through the swap markets, but that is no reason for official intervention (or ought not to be): expensive is not the same as illiquid. I therefore interpret these currency swap arrangements (unlike the swap arrangements put in place following 9/11) either as symbolic tokens of international cooperation (and more motion than action) or as unwarranted subsidies to euro area- and Switzerland-based banks needing US dollar liquidity.

## II.5 Macroeconomic stabilisation and liquidity management: interdependence and institutional arrangements

[10] The Switzerland-domiciled part of the Swiss banking system (as distinct from the foreign subsidiaries which may have access to LLR and MMLR facilities in their host countries) probably owes its competitive advantage less to conventional banking prowess as to the bank secrecy it provides to the global community of tax evaders and others interested in hiding their income and assets from their domestic authorities.

Macroeconomic stabilisation policy and liquidity management (including the LLR and MMLR arrangements and policies) cannot be logically or analytically separated or disentangled completely. Changes in the official policy rate affect output, employment and inflation, but also have an effect on funding liquidity and market liquidity. An artificially low official policy rate can boost bank profitability and help banks to recapitalise themselves. The current level of the Federal Funds target rate certainly has this effect. Discount window operations, repos, other open market purchases and indeed the whole panoply of LLR and MMLR arrangements and interventions strengthen the financial system, even for given contingent sequence of current and future official policy rates. This will boost aggregate demand and thus influences growth and inflation.

Nevertheless, I believe that the official policy rate has a clear comparative advantage as a macroeconomic stabilisation tool while liquidity management has a corresponding comparative advantage as a financial stabilisation tool. Mundell's principle of effective market classification (policies should be paired with the objectives on which they have the most influence) therefore suggests that, should we wish to assign each of these instruments to a particular target, the official policy rate be assigned to macroeconomic stability and liquidity management to financial stability (see Mundell (1962)).

Both the ECB and the BoE advocate the view that the official policy rate be assigned to the macroeconomic stability objective (for both central banks this is the price stability objective) and that it not be used to pursue financial stability objectives. Any impact of the official policy rate on financial stability will, in that view, have to be reflected in an appropriate adjustments in the scale and scope of liquidity management policies. Likewise, liquidity management policies (that is, LLR and MMLR actions) should be targeted at financial stability without undue concern for any impact they may have on price stability and

economic activity. If these effects (which are highly uncertain) turn out to be material, there will have to be an appropriate response in the contingent sequence of official policy rates.

Undoubtedly, to the unbridled dynamic stochastic optimiser, the joint pursuit of all objectives with all instruments has to dominate the assignment of the official policy rate to macroeconomic stability and of liquidity management to financial stability. I am with Mundell on this issue, partly because it makes both communication with the markets and accountability to Parliament/Congress and the electorate easier.

A case can even be made for taking the setting of the official policy rate out of the central bank completely. Obviously, as the source of ultimate domestic-currency liquidity, the central bank is the only agency that can manage liquidity. It will also have to *implement* the official policy rate decision, through appropriate money market actions. But it does not have to make the official policy rate *decision*. The knowledge, skills and personal qualities for setting the official policy rate would seem to be sufficiently different from those required for effective liquidity management, that assigning both tasks to the same body or housing them in the same institution is not at all self-evident.

In the UK, the institutional setting is ready-made for taking the Monetary Policy Committee out of the Bank of England. The Governor of the Bank of England could be a member, or even the chair of the MPC, but need not be either. The existing institutional arrangements in the US and the euro area would have to be modified significantly if the official policy rate decision were to be moved outside the central bank.

Through its liquidity management role and more generally through its LLR and MMLR functions, the central bank will inevitably play something of a de-facto supervisory and regulatory role vis-à-vis banks and other counterparties. Regulatory capture is therefore a constant threat and a frequent reality, as the case of the Fed, discussed below in Section III.2a(xii) makes clear. Moving the official policy rate setting decision out of the central

bank would make it less likely that the official policy rate would display the kind of excess sensitivity to financial sector concerns displayed by the Fed since Chairman Greenspan[11].

Regardless of whether the official policy rate-setting decision is taken out of the central bank, I consider it desirable that all three central banks change their procedures for setting the overnight rate. Chart 5 shows the spread between overnight Libor (an unsecured rate) and the official policy rate for the three central banks.

**Chart 5 here**

Similar pictures could be shown for the spread between the effective Federal Funds rate and the Federal Funds target rate and for spreads between the sterling and euro secured overnight rates and official policy rates.

The fact that the central banks are incapable of keeping the overnight rate close to the official policy rate is a direct result of the operating procedures in the overnight money markets (see Bank of England (2008a) and Clews (2005), European Central Bank (2006) and Federal Reserve System (2002)). Setting the official policy rate (like fixing any price or rate) ought to mean that the central bank is willing to lend reserves (against suitable collateral) on demand in any amount and at any time *at that rate*, and that it is willing to accept deposits in any amount and at any time *at that rate*. This would effectively peg the secured overnight lending and borrowing rate at the official policy rate. The overnight interbank rate could still depart from the official policy rate because of bank default risk on overnight unsecured loans, but that spread should be trivial almost always. Ideally, there would be a 24/7 fixed rate tender at the official policy rate during a maintenance period, and a 24/7 unlimited deposit facility at the official policy rate.

The deviations between the official policy rate and the overnight interbank rate that we observe for the Fed, the ECB and the Bank of England are the result of bizarre operating

[11] For a conflicting and very positive appraisal of the Greenspan years see Blinder and Reis (2005).

procedures – the vain pursuit by the central bank of the pipe dream of setting the price (the official policy rate) while imposing certain restrictions on the quantity (the reserves of the banking system and/or the amount of overnight liquidity provided).[12]

In the case of the UK, for instance, the commercial banks and other deposit-taking institutions that are eligible counterparties in repos, specify their planned reserve holdings just prior to a new reserve maintenance period (roughly the period between two successive scheduled MPC meetings). Those reserves earn the official policy rate. If actual reserves (averaged over the maintenance period) exceed the planned amount, the interest rate received by the banks on the excess is at the standing deposit facility rate, 100 basis points below the official policy rate. If banks' estimated reserves turn out to be insufficient and the banks have to borrow from the BoE to meet their liquidity needs, they have to do so at the standing lending facility rate, 100 basis points above the official policy rate, except on the last day of the maintenance period, when the penalty falls to 25 basis points. Compared to simply pegging the rate, the BoE's operating procedure is an example of making complicated something that really is very simple: setting a rate means supplying any amount demanded at that rate and accepting any amount offered at that rate.

If the central banks were to fix the overnight rate in the way I suggest, this would probably kill off the secured overnight interbank market, although not necessarily the unsecured overnight interbank market (overnight Libor), and certainly not the longer-maturity interbank market, secured and unsecured. The loss of the secured overnight market would not represent no social loss: it is redundant. Those who used to operate in it, now can engage in more socially productive labour. There is no right to life for redundant markets. If the prospect of killing the secured overnight market is too frightening, central banks could adjust the proposed procedure by lending any amount overnight (against good collateral) at

[12] In the case of the Fed, the legal restrictions on paying interest on reserves (about to be abolished) are a further obstacle to sensible practice.

the official policy rate plus a small margin and accepting overnight deposits in any amount at the official policy rate minus a small margin; twice the margin would just exceed the normal bid-ask spread in the secured private overnight interbank markets.

It does not help communication with the markets, or the division of a labour between interest rate policy and liquidity policy, if the monetary authority sets an official policy rate but there is no actual market rate, that is, no rate at which transactions actually take place, that corresponds to the official policy rate. Fortunately, the remedy is simple.

## II.6. Central banks as quasi-fiscal agents: recapitalising insolvent banks

Whatever its legal or *de facto* degree of operational and goal independence, the central bank is part of the state and subject to the authority of the sovereign. Specifically, the state (through the Treasury) can tax the central bank, even if these taxes may have unusual names. In many countries, the Treasury owns the central bank. This is the case, for instance, in the UK, but not in the US or the euro area. As an agent and agency of the state, the central bank can engage in quasi-fiscal actions, that is, actions that are economically equivalent to levying taxes or paying subsidies. Examples are non-remunerated reserve requirements (a quasi-fiscal tax on banks), loans to the private sector at an interest rate that does not at least cover the central bank's risk-adjusted cost of non-monetary borrowing (a quasi-fiscal subsidy), accepting overvalued collateral (a quasi-fiscal subsidy) or outright purchases of securities at prices above fair value (a quasi-fiscal subsidy).

To determine how the use of the central bank as a quasi-fiscal agent of the state affects its ability to pursue its macroeconomic stability objectives, a little accounting is in order. In what follows, I disaggregate the familiar 'government budget constraint' into separate budget constraints for the central bank and the Treasury. I then derive the *intertemporal budget constraints* for the central bank and the Treasury, or their

'comprehensive balance sheets'. I then contrast the familiar conventional balance sheet of the central bank with its comprehensive balance sheet.

My stylised central bank has two financial liabilities: the non-interest-bearing and irredeemable monetary base $M \geq 0$ and its interest-bearing non-monetary liabilities (central bank Bills), $N \geq 0$, paying the risk-free one-period domestic nominal interest rate $i$.[13] On the asset side it has the stock of international foreign exchange reserves, $R^f$, earning a risk-free nominal interest rate in terms of foreign currency, $i^f$, and the stock of domestic credit, which consists of central bank holdings of nominal, interest-bearing Treasury bills, $D \geq 0$, earning a risk-free domestic-currency nominal interest rate $i$, and central bank claims on the private sector, $L \geq 0$, with domestic-currency nominal interest rate $i^L$. The stock of Treasury debt (all assumed to be denominated in domestic currency) held outside the central bank is $B$; it pays the risk-free nominal interest rate $i$; $T^p$ is the real value of the tax payments by the domestic private sector to the Treasury; it is a choice variable of the Treasury and can be positive or negative; $T^b$ is the real value of taxes paid by the central bank to the Treasury; it is a choice variable of the Treasury and can be positive or negative; a negative value for $T^b$ is a transfer from the Treasury to the central bank: the Treasury recapitalises the central bank; $T = T^p + T^b$ is the real value of total Treasury tax receipts; $P$ is the domestic general price level; $e$ is the value of the spot nominal exchange rate (the domestic currency price of foreign exchange); $C^g \geq 0$ is the real value of Treasury spending on goods and services and $C^b \geq 0$ the real value of central bank spending on goods and services. Public spending on goods and services is assumed to be for consumption only.

Equation (3) is the period budget identity of the Treasury and equation (4) that of the central bank.

[13] For descriptive realism, I assume $i^M = 0$.

$$\frac{B_t + D_t}{P_t} = C_t^g - T_t^p - T_t^b + (1+i_t)\left(\frac{B_{t-1} + D_{t-1}}{P_t}\right) \tag{3}$$

$$\begin{aligned}\frac{M_t + N_t - D_t - L_t - e_t R_t^f}{P_t} &= C_t^b + T_t^b \\ &+ \frac{M_{t-1} - (1+i_t)\left(D_{t-1} - N_{t-1}\right) - (1+i_t^L)L_{t-1} - (1+i_t^f)e_t R_{t-1}^f}{P_t}\end{aligned} \tag{4}$$

The solvency constraints of, respectively, the Treasury and central bank are given in equations (5) and (6):

$$\lim_{N\to\infty} E_t I_{N,t-1}\left(B_N + D_N\right) \le 0 \tag{5}$$

$$\lim_{N\to\infty} E_t I_{N,t-1}\left(D_N + L_N + e_N R_N^f - N_N\right) \ge 0 \tag{6}$$

where $I_{t_1,t_0}$ is the appropriate nominal stochastic discount factor between periods $t_0$ and $t_1$.

These solvency constraints, which rule out Ponzi finance by both the Treasury and the central bank, imply the following intertemporal budget constraints for the Treasury (equation (7)) and for the central bank (equation (8)).

$$B_{t-1} + D_{t-1} \le E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j (T_j^p + T_j^b - C_j^g) \tag{7}$$[14]

$$D_{t-1} + L_{t-1} + e_{t-1} R_{t-1}^f - N_{t-1} \le E_t \sum_{j=t}^{\infty} I_{j,t-1}\left(P_j\left(C_j^b + T_j^b + Q_j\right) - \Delta M_j\right) \tag{8}$$

where

$$P_j Q_j = (i_j - i_j^L)L_{j-1} + \left(1 + i_j - (1+i_j^f)\frac{e_j}{e_{j-1}}\right)e_{j-1}R_{j-1}^f \tag{9}$$

The expression $Q$ in equation (9) stands for the real value of the quasi-fiscal implicit interest subsidies paid by the central bank. If the rate of return on government debt exceeds that on loans to the private sector, there is an implicit subsidy to the private sector equal in

[14] Note that $E_t E_{t-1} I_{t,t-1} = E_{t-1} I_{t,t-1} = \frac{1}{1+i_t}$.

period $t$ to $\left(i_t - i_t^L\right)L_{t-1}$. If the rate of return on foreign exchange reserves is less than what would be implied by Uncovered Interest Parity (UIP), there is an implicit subsidy to the issuers of these reserves, given in period $t$ by $\left(1+i_t-(1+i_t^f)\frac{e_t}{e_{t-1}}\right)e_{t-1}R_{t-1}^f$.

When comparing the conventional balance sheet of the central bank to its comprehensive balance sheet or intertemporal budget constraint, it is helpful to rewrite (8) in the following equivalent form:

$$\begin{aligned}\frac{M_{t-1}}{1+i_t}-\left(D_{t-1}+L_{t-1}+e_{t-1}R_{t-1}^f-N_{t-1}\right)\\ \leq E_t\sum_{j=t}^{\infty}I_{j,t-1}\left[P_j\left(-C_j^b-T_j^b-Q_j\right)+\left(\frac{i_{j+1}}{1+i_{j+1}}\right)M_j\right]\end{aligned} \tag{10}$$

Summing (3) and (4) gives the period budget identity of the government (the consolidated Treasury and central bank), in equation (11); summing (5) and (6) gives the solvency constraint of the government in equation (12) and summing (7) and (8) gives the intertemporal budget constraint of the government in equation (13).

$$\begin{aligned}M_t+N_t+B_t-L_t-e_tR_t^f \equiv P_t(C_t^g+C_t^b-T_t)\\ +M_{t-1}+(1+i_t)\left(B_{t-1}+N_{t-1}\right)-(1+i_t^L)L_{t-1}-e_t(1+i_t^f)R_{t-1}^f\end{aligned} \tag{11}$$

$$\lim_{N\to\infty}E_tI_{N,t-1}\left(B_N+N_N-L_N-e_NR_N^f\right)\leq 0 \tag{12}$$

$$B_{t-1}+N_{t-1}-L_{t-1}-e_{t-1}R_{t-1}^f \leq E_t\sum_{j=t}^{\infty}I_{j,t-1}\left(P_j\left(T_j-Q_j-(C_j^g+C_j^b)\right)+\Delta M_j\right) \tag{13}$$

Consider the conventional financial balance sheet of the Central Bank in Table 2,

## Table 2 here

The Central Bank's conventional financial net worth or equity, $W^b=D+L+eR^f-N-\frac{M}{1+i}$, is the excess of the value of its financial assets (Treasury debt,

$D$, loans to the private sector, $L$ and foreign exchange reserves, $eR^f$) over its non-monetary liabilities $N$ and its monetary liabilities $M/(1+i)$.

On the left-hand side of (10) we have (minus) the conventionally measured equity of the central bank. On the right-hand side of (10) we can distinguish two terms. The first is $-E_t\sum_{j=t}^{\infty} I_{j,t-1}P_j\left(C_j^b+T_j^b+Q_j\right)$ - the present discounted value of current and future primary (non-interest) surpluses of the central bank. Important for what follows, this contains both the present value of the sequence of current and future transfer payments made by the Treasury to the central bank ($\{-T_j^b; j\geq t\}$ and (with a negative sign) the present value of the sequence of quasi-fiscal subsidies paid by the central bank $\{Q_j; j\geq t\}$. The second terms is $E_t\sum_{j=t}^{\infty} I_{j,t-1}\left(\frac{i_{j+1}}{1+i_{j+1}}\right)M_j$, one of the measures of central bank 'seigniorage' - the present discounted value of the future interest payments saved by the central bank through its ability to issue non-interest-bearing monetary liabilities. The other conventional measure of seigniorage, motivated by equation (8), is the present discounted value of future base money issuance: $E_t\sum_{j=t}^{\infty} I_{j,t-1}\Delta M_j$.

Even if the conventionally defined net worth or equity of the central bank is negative, that is, if $W_{t-1}^b\equiv D_{t-1}+L_{t-1}+e_{t-1}R_{t-1}^f-N_{t-1}-\frac{M_{t-1}}{1+i_t}<0$, the central bank can be solvent provided

$$W_{t-1}^b+E_t\sum_{j=t}^{\infty} I_{j,t-1}\left(\frac{i_{j+1}}{1+i_{j+1}}\right)M_j\geq E_t\sum_{j=t}^{\infty} I_{j,t-1}P_j\left(C_j^b+T_j^b+Q_j\right) \qquad (14)$$

Conventionally defined financial net worth or equity excludes the present value of anticipated or planned future non-contractual outlays and revenues (the right-hand side of equation (10)). It is therefore perfectly possible, for the central bank to survive and thrive with negative financial net worth. If there is a seigniorage Laffer curve, however, there

always exists a sufficient negative value for central bank conventional net worth, that would require the central bank to raise so much seigniorage in real terms, $\{\frac{\Delta M_j}{P_j}; j \geq t\}$, or $\left\{\left(\frac{i_{j+1}}{1+i_{j+1}}\right)M_j; j \geq t\right\}$ through current and future nominal base money issuance, that, given the demand function for real base money, unacceptable rates of inflation would result (see Buiter (2007e, 2008a). While the central bank can never go broke (that is, (14) will not be violated as long as the financial obligations imposed on the central bank are domestic-currency denominated and not index-linked), it could go broke if either foreign currency obligations or index-linked obligations were excessive. I will ignore the possibility of central bank default in what follows, but not the risk of excessive inflation being necessary to secure solvency without recapitalisation by the Treasury, if the central bank's conventional balance sheet were to take a sufficiently big hit..

This situation can arise, for instance, if the central bank is used as a quasi-fiscal agent to such an extent that the present discounted value of the quasi-fiscal subsidies it provides, $E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j Q_j$, is so large, that its ability to achieve its inflation objectives is impaired. In that case (if we rule out default of the central bank on its own non-monetary obligations, $N_{t-1}$, the only way to reconcile central bank solvency and the achievement of the inflation objectives would be a recapitalisation of the central bank by the Treasury, that is, a sufficient large increase in $-E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j T_j^b$.[15]

There are therefore in my views two reasons why the Fed or any other central bank should not act as a quasi-fiscal agent of the government, other than paying to the Treasury, as taxes, $T^b$, the profits it makes in the pursuit of its macroeconomic stability objectives and its

[15] Central bank current expenses $C^b$ can at most be cut to zero.

*appropriate* financial stability objectives. The appropriate financial stability objects are those that involve providing liquidity, at a cost covering the central bank's opportunity cost of non-monetary financing, to illiquid but solvent financial institutions.

The two reasons are, first, that acting as a quasi-fiscal agent may impair the central bank's ability to fulfil its macroeconomic stability mandate and, second, that it obscures responsibility and impedes accountability for what are in substance fiscal transfers. If the central bank allows itself to be used as an off-budget and off-balance-sheet special purpose vehicle of the Treasury, to hide contingent commitments and to disguise de-facto fiscal subsidies, it undermines its independence and legitimacy and impairs political accountability for the use of public funds – 'tax payers' money'.

## II.6a Some interesting central bank balance sheets

What do the conventional balance sheets look like in the case of the Fed, the BoE and the ECB/Eurosystem?

The data for the Fed are summarised in Table 3, those for the BoE in Table 4, for the ECB in Table 5 and for the Eurosystem in Table 6.

**Table 3 here**

**Table 4 here**

**Table 5 here**

**Table 6 here**

The data for the Fed are updated weekly in the Consolidated Statement of Condition of All Federal Reserve Banks. In Table 3, I have for simplicity lumped $2.1 bn worth of buildings and $40 bn worth of other assets together with claims on the private sector, *L*. The Federal Reserve System holds but small amounts of assets in the gold certificate account and SDR account as Foreign exchange reserves, *R*. The foreign exchange reserves of the US are

on the balance sheet of the Treasury rather than the Fed. As of February 2008, US Official Reserve Assets stood at $73.5 bn.[16] US gold reserves (8133.8 tonnes) were valued at around $ 261.5 billion in March 2008.

Table 3 shows that, as regards the size of its balance sheet, the Fed would be a medium-sized bank in the universe of internationally active US commercial banks, with assets of around $900bn and capital (which corresponds roughly to financial net worth or conventional equity) of about $40bn. By comparison, at the time of the run on the investment bank Bear Stearns (March 2008), that bank's assets were around $340bn. Citigroup's assets as of 31 December 2007 were just under $2,188bn (Citigroup is a universal bank, combining commercial banking and investment banking activities). With 2007 US GDP at around $14 trillion, the assets of the Fed are about 6.4% of annual US GDP.

At the end of January 2008, seasonally adjusted assets of domestically chartered commercial banks in the US stood at 9.6 trillion (more than ten times the assets of the Fed). Of that total, credit market assets were around 7.5 trillion. Equity (assets minus all other liabilities) was reported as 1.1 trillion.[17] Commercial banks exclude investment banks and other non-deposit taking banking institutions. The example of Bear Stearns has demonstrated that the primary dealers in the US are now all considered by the Fed and the Treasury to be too big, too systemically important and/or too interconnected to fail. The 1998 rescue of LTCM - admittedly without the use of any Fed financial resources or indeed of any public financial resources, but with the active 'good offices' of the Fed - suggests that large hedge funds too may fall in the 'too big or too interconnected to fail' category. We appear to have arrived at the point where any highly leveraged financial institution above a certain size is a

[16] Source: IMF http://www.imf.org/external/np/sta/ir/8802.pdf

[17] A footnote in the Federal Reserve Bulletin (2008) informs us that "This balancing item is not intended as a measure of equity capital for use in capital adequacy analysis. On a seasonally adjusted basis, this item reflects any differences in the seasonal patterns estimated for total assets and total liabilities." That is correct as regards the use of this measure in regulatory capital adequacy analysis. For economic analysis purposes it is, however, as close to W as we can get without a lot of detailed further work.

candidate for direct or indirect Fed financial support, should it, for whatever reason, be at risk of failing.[18]

Like its private sector fellow-banks, the Fed is quite highly leveraged, with assets just under 22 times capital. The vast majority of its liabilities are currency in circulation ($781bn out of a total monetary base of $812bn). Currency is not just non-interest-bearing but also *irredeemable*: having a $10 Federal Reserve note gives me a claim on the Fed for $10 worth of Federal Reserve notes, possibly in different denominations, but nothing else. Leverage is therefore not an issue for this highly unusual inherently liquid domestic-currency borrower, as long as the liabilities are denominated in US dollars and not index-linked.

The Bank of England, whose balance sheet is shown in Table 4, also has negligible foreign exchange reserves of its own. The bulk of the UK's foreign exchange reserves are owned directly by the Treasury. The shareholders' equity in the Bank of England is puny, just under £ 2billion. The size of its balance sheet grew a lot between early 2007 and March 2008, reflecting the loans made to Northern Rock as part of the government's rescue programme for that bank. The size of the balance sheet is around £100 bn, about 20 percent smaller than Northern Rock at its *acme*. Leverage is just under 50.

The size of the equity and the size of the balance sheet appear small in comparison to the possible exposure of the Bank of England to credit risk through its LLR and MMLR operations. Its total exposure to Northern Rock was, at its peak, around £25 bn. This exposure was, of course, secured against Northern Rock's prime mortgage assets. More important for the solvency of the Bank of England than this credit risk mitigation through collateral, is the fact that the central bank's monopoly of the issuance of irredeemable, non-interest-bearing legal tender means that leverage is not a constraint on solvency as long as most of the rest of the liabilities on its balance sheet are denominated in sterling and consists

[18] The example of the failure of the Amaranth Advisors LLC hedge fund in September 2006, suggests that AUM of US$9 billion is no longer 'large'.

of nominal, that is, non-index-linked, securities, as is indeed the case for the Bank of England.

The balance sheet of the ECB for end-year 2006 and 2007 is given in Table 5, that for the consolidated Eurosystem (the ECB and the 15 national central banks (NCBs) of the Eurosystem) as of 29 February 2008 in Table 6. The consolidated balance sheet of the Eurosystem is about 10 times the size of the balance sheet of the ECB, but the equity of the Eurosystem is about 17 times that of the ECB. Gearing of the Eurosystem is therefore quite low by central bank standards, with total assets just over 19 times capital.

Between the end of 2006 and end-February 2008, the Eurosystem expanded its balance sheet by €237bn. On the asset side, most of this increase was accounted for by a €67bn increase in claims on the euro area banking sector and a €150bn increase in other assets. Both items no doubt reflect the actions taken by the Eurosystem to relieve financial stress in the interbank markets and elsewhere in the euro area banking sector.

## II.6b How will the central banks finance future LLR- and MMLR-related expansions of their portfolios?

Both the Fed and the BoE have tiny balance sheets and minuscule equity or capital relative to the size of the likely financial calls that may be made on these institutions. For instance, the exposure of the Fed to the Delaware SPV used to house $30bn (face value) worth of Bearn Stearns' most toxic assets is $29bn. The Fed's total equity is around $40bn. Despite my earlier contention that there is nothing to prevent a central bank from living happily ever after with negative equity, I doubt whether the Fed would want to operate with its financial liabilities larger than its financial assets.

It is clear that the exercise of the LLR and MMLR functions may require a further rapid and large increase in $L$, central bank holdings of private sector securities. The central bank can always finance this increase in its exposure to the private financial sector by increasing the stock of base money, $M$ (presumably through an increase in bank reserves

with the central bank). If the economy is in a liquidity crunch, there is likely to be a large increase in liquidity preference which will cause this increase in reserves with the central bank to be hoarded rather than loaned out and spent. This increase in liquidity will therefore not be inflationary, as long as it is reversed promptly when the liquidity squeeze comes to an end.

Alternatively, the central bank could finance an expansion in its holdings of private securities by reducing its holdings of government securities. Once these get down to zero, the only option left is for the central bank to increase its non-monetary, interest-bearing liabilities, that is, through an issuance of Fed Bills, Bank of England Bills or ECB Bills (or even, Fed Bonds, Bank of England Bonds or ECB Bonds). As long as the central bank's claims on the private sector earn the central bank an appropriate risk-adjusted rate of return, issuing central bank bills or bonds to finance the acquisition of private securities will not weaken the solvency of the central bank *ex-ante*. But if a significant amount of its exposure to the private sector were to default, the central bank would have to be recapitalised by the Treasury or have recourse to monetary financing. In the conventional balance sheet of the central bank, the result of a recapitalisation would be an increase in *D*, that is, it would look like a Treasury Bill or Treasury Bond 'drop' on the central bank. It may well come to that in the US and the UK.

# III. How did the three central banks perform since August 2007?

## III.1 Macroeconomic stability

At the time the financial crisis erupted, in August 2007, all three central banks faced rising inflationary pressures and at least the prospect of weakening domestic activity. The evidence for weakening activity was clearest in the US. In the UK, real GDP growth in the third quarter of 2007 was still robust, although some of the survey data had begun to indicate

future weakness. In the euro area also, GDP growth was healthy. As late as August, the ECB was verbally signalling an increase in the policy rate for September or soon after.

Since then, inflationary pressures have risen in all three currency areas, and so have inflationary expectations. There has been a marked slowdown in GDP growth, first in the US, then in UK and most recently in the euro area. While it is not clear yet whether any of the three economies are in technical recession (using the arbitrary definition of two consecutive quarters of negative real GDP growth), there can be little doubt that all three are growing below capacity, with unemployment rising in the US and in the UK and, one expects, soon also in the euro area.

The monetary response to rather similar circumstances has, however, been very different in the three economies, as is clear from the summary in Table 7

**Table 7 here**

The Fed cut its official policy rate aggressively – by 325 basis points cumulatively so far. On September 18, 2007, the Fed cut the Federal Funds target by 50 basis points to 4.75 percent, with a further reduction of 25 basis points following on October 31. On December 11 there was a further 25 basis points cut, on 21 January 2008 a 75 basis points cut, on 30 January a 50 basis points cut, on 18 March a 75 basis points cut and on 30 April another 25 basis points cut. This brought the Federal Funds target to 2.00 percent, where it remains at the time of writing (10 August 2008). The Fed also reduced the 'discount window penalty', that is, the excess of the rate charged on overnight borrowing at the primary discount window over the Federal Funds target rate, from 100 bps to 50 bps on August 17, 2007 and to 25 bps on 18 March 2008. This cut in the discount rate penalty can be viewed as a liquidity management measure as well as a (second-order) macroeconomic policy measure. Finally, one of the Fed's rate cuts (the 75 basis points reduction on 21 January 2008), was at an

'unscheduled' meeting and was announced out of normal working hours, thus signalling a sense of urgency in one interpretation, a sense of panic in another.

The Bank of England kept its official policy rate at 5.75 percent until December 6, 2007, when it made a 25 basis points cut. Further 25 bps cuts followed on February 7, 2008 and April 10, 2008, so Bank Rate now stands at 5.00 percent. The discount rate (standing lending facility) penalty over Bank Rate stayed constant at 100bps. There were no meetings or policy announcements on unscheduled dates or at unusual times.

The ECB kept its official policy rate unchanged at 4.00 percent until 3rd July 2008 when it was raised to 4.25 percent, where it still stands. There has also been no change in the discount rate penalty: the marginal lending facility continues to stand at 100 basis points above the official policy rate. There were no meetings on unscheduled dates or announcements at non-standard hours. Unlike the other two central banks, the ECB repeatedly, between June 2007 and July 2008, talked tough about inflation and hinted at possible rate increases. This talk was matched by official policy rate action only on July 3, 2008.

The markedly different monetary policy actions of the Fed compared to the other two central banks can, in my view, not be explained satisfactorily with differences in objective functions (the Fed's dual mandate versus the ECB's and the BoE's lexicographic price stability mandate) or in economic circumstances. The slowdown in the US did come earlier than in the UK and in the euro area, but the inflationary pressures in the US were, if anything, stronger than in the UK and the euro area.

I conclude that the Fed over-reacted to the slowdown in economic activity. It cut the official policy rate too fast and too far and risked its reputation for being serious about inflation. I believe that part of the reason for these policy errors is a remarkable collection of analytical flaws that have become embedded in the Fed's view of the transmission

mechanism. These errors are shared by many FOMC members and by senior staff. They are worth outlining here, because they serve as a warning as to what can happen when the research and economic analysis underlying monetary policy making become too insular and inward-looking, and motivated more by the excessively self-referential internal dynamics of academic research programmes than by the problems and challenges likely to face the policy-making institution in the real world.

## III.1a The macroeconomic foibles of the Fed

There are some key flaws in the model of the transmission mechanism of monetary policy that shapes the thinking of a number of influential members of the FOMC. These relate to the application of the Precautionary Principle to monetary policy making, the wealth effect of a change in price of housing, the role of core inflation as a guide to future underlying inflation, the possibility of achieving a sustainable external balance for the US economy without going through a deep and/or prolonged recession, the effect of financial sector deleveraging on aggregate demand and the usefulness of the monetary aggregates as a source of information about macroeconomic and financial stability.

### III.1a(i) Risk management and the 'Precautionary Principle'

Under Governor Greenspan, so-called risk-based "decision theory" approaches became part of the common mind-set of the FOMC (see Greenspan (2005)). They continue to be influential in the Bernanke Fed. A clear articulation can be found in Mishkin (2008). At last year's Jackson Hole Symposium, Martin Feldstein (2007) also made an appeal to a risk-based decision theory approach to justify looking after the real economy first, through aggressive interest rate cuts, despite the obvious risk this posed to inflation and moral hazard.

Mishkin (2008) argued that the combination of non-linearities in the economy with both a higher degree of uncertainty and a high probability of extreme (including extremely bad) outcomes (so-called "fat tails") justified the Fed's focus on extreme risks. The extreme

risks he indentified where a financial instability/collapse-led sharp contraction in economic activity. This is the "precautionary principle" (PP) applied to monetary policy. At times of high uncertainty, policy should be timely, decisive and flexible and focused on the main risk.

Even where it is applied correctly, I don't think much of the PP. Except under very restrictive conditions, unlikely to be satisfied ever in the realm of economic policy making, I consider the behaviour it prescribes to be pathologically risk-averse. In its purest incarnation - under complete Knightian uncertainty - it amounts to a minimax strategy: you focus all your policy instruments on doing as well as you can in the worst possible outcome. Despite its axiomatic foundations, the minimax principle has never appealed to me either as a normative or a positive theory of decision under uncertainty.

But I don't have to fight the PP, or minimax, here. The application of the PP to the monetary policy choices made by the Fed in 2007 and 2008 is bogus. The PP came to the social sciences from the application of decision theory to regulatory decisions involving environmental risk (global warming, species extinction) or technological risk (genetically modified crops, nanotechnology). Its basic premise in these areas is *"... that one should not wait for conclusive evidence of a risk before putting control measures in place designed to protect the environment or consumers."*(Gollier and Treich (2003)). For instance, Principle 15 of the 1992 Rio Declaration states *"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation"*.

Attempts to make sense of the PP in a setting of sequential decision making under uncertainty lead to the conclusion that, for something like the Rio Declaration version of the PP to emerge as a normative guide to behaviour, all of the following must be present (see Collier and Treich (2003) from which the following sentence is paraphrased): a long time horizon, stock externalities, irreversibilities (physical and socio-economic), large

uncertainties and the possibility of future scientific progress (learning). Short-term policy should keep the option value of future learning alive. When the long-term effects of certain contingencies are unknown (but may be uncovered later on), it may be optimal to be more cautious in the early stages of the sequential management of risk.

I believe the analysis of Collier and Treich to be essentially correct. The question then becomes: what does this imply for whether the Fed, in the circumstances of the second half of 2007 and the first half of 2008, did the right thing when it cut the official policy rate from 5.25 percent to 2:00 percent rather than cutting it by less, keeping it constant or raising it? The Fed decided to give priority to minimising the risk of a sharp contraction in real economic activity. It accepted the risk of higher inflation. How does this square with the PP?

The answer is: not very well at all. There is no irreversibility involved in a sharp contraction in economic activity. Mishkin's rather vague 'non-linearities' are no substitute for the irreversibility required for the PP to apply. This is *not* like a catastrophic species extinction or a sudden melting of the polar ice caps. The crash of 1929 became the Great Depression of the 1930s because the authorities permitted the banking system to collapse and did not engage in sustained aggressive expansionary fiscal and monetary policy even when the unemployment rate reached almost 25 percent in 1933. In addition, the international trading system collapsed. The Fed as LLR and MMLR has effectively underwritten the balance sheet of all systemically important US banks (investment banks as well as commercial banks) with the rescue of Bear Stearns in March 2008. Current worries about the international trading system concern the absence of progress rather than the risk of a major outbreak of protectionism.

Most of all, should economic activity fall sharply and remain depressed for longer than is necessary to correct the fundamental imbalances in the US economy (the external

trade deficit, excessive household indebtedness and the low national saving rate), monetary and fiscal policy can be used aggressively *at that point in time* to remedy the problem. There is no need to act now to prevent some irreversible or even just costly-to-reverse catastrophy from occurring. Boosting demand through expansionary monetary and fiscal policy is not hard. It is indeed far too easy. We are also not buying time to uncover some new scientific fact that will allow us to improve the short-run inflation-unemployment trade off or to boost the resilience of the economy to future disinflationary policies. Cutting rates to support demand does not create or preserve option value.

If anything, the (weak) logic of the PP points to giving priority to fighting inflation rather than to preventing a sharp contraction of demand and output. Output contractions can be reversed easily through expansionary policies. High inflation, once it becomes embedded in inflationary expectations, may take a long time to squeeze out of the system again. Is the sacrifice ratio is at all unfriendly, the cumulative unemployment or output cost of achieving a sustained reduction in inflation could be large. The irreversibility argument (strictly, the costly reversal argument) supports erring on the side of caution by not letting inflation and inflationary expectations rise.

'Fat tails' and other decision theory jargon should only be arbitraged into the area of monetary policy if the substantive conditions are satisfied. They are not.[19] With existing policy tools, we can address a disastrous collapse in activity if, as and when it occurs. There is no need for preventive or precautionary action.

**III.1a(ii) Housing wealth isn't wealth**

This bold statement was put to me about ten years ago by Mervyn King, now Governor of the Bank of England, then Chief Economist of the Bank of England, shortly after I joined the Monetary Policy Committee of the Bank of England as an External Member in

[19] My cats, however, do have fat tails, so there may be new areas of application for the PP.

June 1997. Like most bold statements, the assertion is not quite correct; the correct statement is that a decline in house prices does not make you worse off, that is, it does not create a pure wealth effect on consumer demand.

The argument is elementary and applies to coconuts as well as to houses. When does a fall in the price of coconuts make you worse off? Answer: when you are a net exporter of coconuts, that is, when your endowment of coconuts exceeds your consumption of coconuts. A net importer of coconuts is better off when the price of coconuts falls. Someone who is just self-sufficient in coconuts is neither worse off nor better off.

Houses are no different from durable coconuts in this regard. The fundamental value of a house is the present discounted value of its current and future rentals, actual or imputed. Anyone who is 'long' housing, that is, anyone for whom the value of his home exceeds the present discounted value of the housing services he plans to consume over his remaining lifetime will be made worse off by a decline in house prices. Anyone 'short' housing will be better off. So the young and all those planning to trade up in the housing market are made better off by a decline in house prices. The old and all those planning to trade down in the housing market will be worse off.

Another way to put this is that landlords are worse off as a result of a decline in house prices, while current and future tenants are better off. On average, the inhabitants of a country own the houses they live in; on average, every tenant is his own landlord and vice versa. So there is no net housing wealth effect. You have to make a distributional argument to get an aggregate pure net wealth effect from a change in house prices. A formal statement of the proposition that a change in house prices has no wealth effect on private consumption demand can be found in Buiter (2008b,c). Informal statements abound (see e.g. Buchanan and Fiotakis (2004)).

Most econometric or calibrated numerical models I am familiar with treat housing wealth like the value of stocks and shares as a determinant of household consumption. They forget that households consume housing services (for which they pay or impute rent) but not stock services. An example is the FRB/US model. It is used frequently by participants in the debate on the implication of developments in the US housing market for US consumer demand. A recent example is Frederic S. Mishkin's (2007) paper "Housing and the Monetary Transmission Mechanism". The version of the FRB/US model Miskin uses *a-priori* constrains the wealth effects of housing wealth and other financial wealth to be the same. The long-run marginal propensity to consume out of non-human wealth (including housing wealth) is 0.038, that is, 3.8 percent. In several simulations, Mishkin increases the value of the long-run marginal propensity to consume out of housing wealth to 0.076, that is, 7.6 percent, while keeping the long-run marginal propensity to consume out of non-housing financial wealth at 0.038.

The argument for an effect of housing wealth on consumption other than the pure wealth effect, is that housing wealth is collateralisable. Households-consumers can borrow against the equity in their homes and use this to finance consumption. It is much more costly and indeed often impossible, to borrow against your expected future labour income. If households are credit-constrained, a boost to housing wealth would relax the credit constraint and temporarily boost consumption spending. The argument makes sense and is empirically supported (see e.g. Edelstein and Lum (2004)). Of course, the increased debt will have to be serviced, and eventually consumption will have to be brought down below the level it would have been at in the absence of the mortgage equity withdrawal. At market interest rates, the present value of current and future consumption will not be affected by the MEW channel. [20]

[20] In the previous statement I hold constant (independent of the individual household's consumption vs. saving decision) the future expected and actual sequence of after-tax labour income, profits, interest rates and asset prices. In a Keynesian, demand-constrained equilibrium, the aggregation of the individual consumption choices,

Ben Bernanke (2008), Don Kohn (2008), Fredric Mishkin (2007), Randall Kroszner (2007) and Charles Plosser (2007) all have made statements to the effect that the credit, MEW or collateral channel through which house prices affect consumer demand is *on top of* the normal (pure) wealth effect. This is incorrect. The benchmark should be that the credit, MEW or collateral effect is *instead of* the normal (pure) wealth effect. By overestimating the contractionary effect on consumer demand of the decline in house prices, the Fed may have been induced to cut rates too fast and too far.

There are channels other than private consumption through which a change in house prices affects aggregate demand. One obvious and empirically important one is household investment, including residential construction. A reduction in house prices that reflects the bursting of a bubble rather than a lower fundamental value of the property also produces a pure wealth effect (Buiter (2008b,c)). My criticism of the Fed's overestimation of the effect of house price changes on aggregate demand relates only to the pure wealth effect on consumption demand, not to the 'Tobin's *q*' effect of house prices on residential construction.

**III.1a(iii) The will-o'-the-wisp of 'core' inflation**

The only measure of core inflation I shall discuss is the one used by the Fed, that is, the inflation rate of the standard headline CPI or PCE deflator excluding food and energy prices. Other approaches to measuring core inflation, including the vast literature that attempts to extract trend inflation or some other measure of 'underlying' inflation using statistical methods in the time domain or frequency domain, including 'trimmed mean' measures and 'approximate band pass filters' will not be considered (see e.g. Bryan and Cecchetti (1994), Quah and Vahey (1995), Baxter and King (1999), Cogley (2002), Cogley and Sargent (2001, 2005)), Dolmas (2005), Rich and Steindel (2007).

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now and in the future, will in general affect the equilibrium levels of output, employment, interest rates and asset prices.

I assume that the price stability leg of the Fed's mandate refers to price stability, now and in the future, defined in terms of a representative basket of consumer goods and services that tries to approximate the cost of living of some mythical representative American. It is well-known that price stability, even in terms an ideal cost of living index, cannot be derived as an implication of standard microeconomic efficiency arguments. The Friedman rule gives you a zero pecuniary opportunity cost of holding cash balances as (one of) the optimality criteria, that is, $i = i^M$. When cash bears a zero rate of interest, this gives us a zero risk-free nominal interest rate as (part of) the optimal monetary rule. With a positive real interest rate, this gives us a negative optimal rate of inflation for consumer prices, something even the ECB is not contemplating.

Menu costs imply the desirability of minimising price changes for those goods and services for which menu costs are highest. Presumably this would call for stabilisation of money wages, since the cost of wage negotiations is likely to exceed that of most other forms of price setting. With positive labour productivity growth, a zero money wage inflation target would give us a negative optimal rate of producer price inflation.

New-Keynesian sticky price models of the Calvo-Woodford variety yield (in their simplest form) two distinct optimal inflation criteria, one for consumer prices and one for producer prices. Neither implies that stability of the sticky price sub-index is optimal.

Equations (15) and (16) below show the log-linear approximation at the deterministic steady state of the (negative of the) social welfare function (which equals the utility function of the representative household) and of the New-Keynesian Phillips curve in the simple sticky-price Woodford-Calvo model, when the natural rate is efficient (see Calvo (1983), Woodford (2003) and Buiter (2004)).

$$\Lambda_t = E_t \sum_{i=0}^{\infty} \left( \frac{1}{1+\delta} \right)^i \left( (\pi_{t+i} - \tilde{\pi}_{t+i})^2 + \omega \left( y_{t+i} - \hat{y}_{t+i} \right)^2 + \phi (i_{t+j} - i_{t+j}^M)^2 \right) \qquad (15)$$

$$\delta > 0,\ \omega > 0, \phi \geq 0$$

$$\pi_t - \tilde{\pi}_t = \beta E_t\left(\pi_{t+1} - \tilde{\pi}_{t+1}\right) + \gamma(y_t - \hat{y}_t) + \varphi(i_t - i_t^M) \qquad 0 < \beta < 1; \gamma > 0 \tag{16}$$

In the Calvo model of staggered overlapping price setting, in each period, a randomly selected fraction of the population of monopolistically competitive firms sets prices optimally. The remainder follows a simple rule of thumb or heuristic for its price. The inflation rate chosen by the constrained price setters in period $t$ is $\tilde{\pi}_t$. Optimality in this model requires

$$i_t = i_t^M \tag{17}$$

$$\pi_t = \tilde{\pi}_t \tag{18}$$

Equations (17) and (18) then imply that $y_t = \hat{y}_t$.

The requirement in (17) that the pecuniary opportunity cost of holding cash be zero is Friedman's misnamed Optimal Quantity of Money rule. The second optimality condition, given in (18), requires that the headline producer price inflation rate, $\pi$, be the same as the inflation rate of the constrained price setters, $\tilde{\pi}$. If in any given period the inflation rate of the constrained price setters is predetermined, then the second optimality requirement becomes the requirement that overall producer price inflation accommodates the inflation rate set by the constrained price setters, whatever this happens to be. Even if one identifies the inflation rate set by the constrained price setters with 'core' inflation (which would be a stretch), this New-Keynesian framework does not generate an optimal rate of inflation either for core inflation or for headline inflation. All it prescribes is a constant relative price of core to non-core goods and services.

Without luck or additional instruments (such as indirect taxes and subsidies driving a wedge between consumer and producer prices) it will not in general be possible to satisfy both the Friedman rule and the constant relative price rule (of free and constrained price setters). How then can this framework be used to rationalise (a) targeting Woodford-Calvo

'core' inflation and (b) aiming for stability of the Woodford-Calvo 'core' producer price level? Two steps are required. First, the Friedman rule is finessed or ignored. This requires either the counterfactual assumption that the interest rate on cash is not constrained to equal zero but can instead be set equal at all times to the interest rate on non-cash financial instruments (that is, (17) always holds, but $i$ remains free), or the assumption that the technology and preferences in this economy take the rarefied form required to make the demand for cash independent of its opportunity cost, in which case $\phi = \varphi = 0$. Second, the Woodford-Calvo 'core' inflation rate, which plays the role of target inflation rate in the social welfare function (15) is zero. This is the assumption Calvo made in his original paper (Calvo (1983)).

Clearly, the assumption that the constrained price setters will always keep their prices constant, regardless of the behaviour of prices and inflation in the rest of the economy is unreasonable. It assumes the absence of any kind of learning, no matter how partial and simplistic. It has strange implications, including the existence of a stable, exploitable inflation-unemployment trade-off or inflation-output gap trade-off across deterministic steady states. Calvo recognised the unpalatable properties of his unreasonable original price setting function in Calvo, Celasun and Kumhof (2007). An attractive alternative, in the spirit of John Flemming's (1976) theory of the 'gearing' of inflation expectations, would be to impose as a minimal rationality requirement the assumption that the inflation rate set by the constrained price setters is cointegrated with that of the unconstrained price setters or the headline inflation rate.

Because price stability cannot be rationalised as an objective of monetary policy using standard microeconomic efficiency arguments, I fall back on legal mandate/popular consensus justifications for price stability as an objective of monetary policy. In the US, the euro area and UK, stable prices or price stability is a legally mandated objective of monetary

policy. In the UK, the Chancellor defines the price index. It is the CPI (the harmonised version). In the euro area the ECB's Governing Council itself chooses the index used to measure price stability. Again, it is the CPI. In the US there is no such verifiable source of legitimacy for a particular index. I therefore appeal to what I believe the public at large understands by price stability, which is a constant cost of living.

I take it as given that the Fed's definition of price stability is to be operationalized through a representative cost of living index. This means that the Fed does not care intrinsically about core inflation (in the sense of the rate of inflation of a price index that excludes food and energy). Americans do eat, drink, drive cars, heat their homes and use air conditioning. The proper operational target implied by the price stability leg of the Fed's mandate is therefore headline inflation.

Core inflation is relevant to the price stability leg of the Fed's mandate to the extent that it is a superior predictor of future headline inflation, over the horizon that the Fed can influence headline inflation – a better predictor not only than headline inflation itself, but than any readily available set of predictors. After all, the monetary authority should not restrict itself to univariate predictor sets, let alone univariate predictor sets consisting of the price series itself and its components.

Non-core prices tend to be set in auction-type markets for commodities. They are flexible. Core goods and services tend to have prices that are subject to short-run Keynesian nominal rigidities. They are sticky. The core price index and its rate of inflation tend to be both less volatile and more persistent than the index of non-core prices and its rate of inflation, and also than the headline price index and its rate of inflation. However, the ratio of core to non-core prices or of the core price index to the headline price index *is* predictable, and so are the relative rates of inflation of the core and headline inflation indices. This is clear from Charts 6a and 6b. The phenomenon driving the increase in the ratio of headline to

core prices in recent years is well-understood. Newly emerging market economies like China, India and Vietnam have entered the global economy as demanders of non-core commodities and as suppliers of core goods and services. This phenomenon is systematic, persistent and ongoing.

**Chart 6 a here**

**Chart 6b here**

When core goods and services are subject to nominal price rigidities but non-core goods prices are flexible, a relative demand or supply shock that causes a permanent increase (decrease) in the relative price of non-core to core goods will, for a given path of nominal official policy rates, cause a temporary increase in the rate of headline inflation, as well as a temporary reduction in the rate of core inflation.

This pattern is clear from Charts 7a, b, c and d, which plot the difference between the headline inflation rate and the core inflation rate on the horizontal axis against the rate of headline inflation on the vertical axis. This is done, in Charts 7a and 7b, for the CPI over, respectively, the 1957-2008 period and the 1987-2008 period. It is repeated in Charts 7c and 7d for the PCE deflator over, respectively, the 1959-2008 and the 1987-2008 periods.

**Chart 7 a here**

**Chart 7b here**

**Chart 7c here**

**Chart 7d here**

Therefore, when there is a continuing upward movement in the relative price of non-core goods to core goods, core inflation will be poor predictor of future headline inflation for two reasons. First, even if headline inflation were unchanged and independent of the change in relative prices, core inflation would, for as long as the upward movement in the relative

price of non-core goods continued, be systematically below both non-core inflation and headline inflation. Second, for a given path of nominal interest rates, the increase in the relative price of non-core goods will temporarily raise headline inflation above the level it would have been if there had been no increase in the relative price of non-core goods to core goods and services. The implication is that for many years now (starting around the turn of the century), the Fed has missed the boat on the implications of the global increase in the relative price of non-core goods for the usefulness of core inflation as a predictor of future headline inflation. Medium-term inflationary pressures have been systematically higher than the Fed thought they were.

I am not arguing that the Fed has focused on core rather than on headline inflation *because* this permits it to take a more relaxed view of inflationary pressures. My argument is that because the Fed, for whatever reason, decided to focus on core rather than on headline inflation, and because for most of this decade there has been a persistent increase in the relative price of non-core goods to core goods and services, the Fed has, for most of this decade, underestimated the underlying inflationary pressures in the US.

Should the recent upward trend in non-core to core prices go into reverse, the opposite bias would result. With a global economic slowdown in the works, a cyclical decline in real commodity prices is quite likely for the next couple of years or so. Following the end of the incipient global cyclical correction, however, I expect that a full-speed resumption of commodity-biased demand growth and core goods and services-biased supply growth in key emerging markets will in all likelihood lead to a further trend increase in the relative price of non-core goods to non-core goods and services.

The other main lesson from the core inflation debacle is that those engaged in applied statistics should not leave their ears and eyes at home. Specifically, it pays to get up from the keyboard and monitor occasionally to open the window and look out to see whether a

structural break might be in the works that is not foreshadowed in any of the sample data at the statistician's disposal. Two-and-a-half billion Chinese and Indian consumers and producers entering the global economy might qualify as an epochal event capable of upsetting established historical statistical regularities.

Finally, a brief remark on the Fed's fondness for the PCE deflator. Communication with the wider public (all those not studying index numbers for a living) is made more complicated when the index in terms of which inflation and price stability are measured bears no obvious relationship to a reasonably intuitive concept like the cost of living. I believe the PCE deflator falls into this obscure category. Furthermore, being a price deflator (current-weighted), the PCE deflator (headline or core) will tend to produce inflation rates lower than the corresponding CPI index (which is base-weighted). Since 1987/01, the difference between the headline CPI and PCE deflator inflation rates has been 0.44 percent at an annual rate. The difference between the core CPI and PCE deflator inflation rates has been 0.45 percent. Over the longer period 1960/01-2008/03 the difference between the headline CPI and PCE inflation rates has been 0.47 percent, that between core CPI and PCE inflation rates 0.55 percent. This further reinforces the inflationary bias of the Fed's procedures.

**III.1a(iv) Is the external position of the US sustainable? If not, can it be corrected without a recession?**

The argument of this subsection is in two parts. First, the external positions of the US and the UK are unsustainable. Second, it is all but unavoidable that the US and the UK will have to go through prolonged and/or deep slowdowns in economic activity to achieve sustainable external balances and desirable national saving rates. Attempts to stimulate demand, whether through interest rate cuts or through tax stimuli like the £100bn fiscal package implemented in the US during the second quarter of 2008, are therefore counterproductive, as they delay a necessary adjustment. The additional employment and

growth achieved through such monetary and fiscal stimuli are unsustainable because they make an already unsustainable imbalance worse. If the Fed's real economic activity leg of its dual mandate refers to *sustainable* growth and sustainable employment, the interest rate cut stimuli provided since August 2007 are therefore in conflict with that mandate.

Almost the same conclusion is reached even if one is either not convinced or not bothered by the argument that the external position of the US economy is unsustainable. It is possible to reach pretty much the same conclusion as long as one subscribes to the argument that the US national saving rate is dangerously low for purely domestic reasons (providing for the comfortable retirement of an ageing population), and needs to be raised materially. Policies or shocks that raise the US national saving rate are highly unlikely to produce a matching increase in the US domestic investment rate, given the array of more profitable investment opportunities abroad.

**The unsustainability of the US and UK external balances**

Around the middle of 2007, when the financial crisis started, the US had an external primary deficit of about six percent of GDP (see Chart 8b).[21] The US is also a net external debtor (see Chart 8a). Its net international investment position is not easily or accurately marked to market, but something close to a negative 20 percent of GDP is probably a reasonable estimate.

## Chart 8a here

## Chart 8b here

Let $f_t$ be the ratio of end-of-period $t$ net external liabilities as a share of period $t$ GDP, $r_t$ the real rate of return paid during period $t$ on the beginning-of-period net foreign investment position, $g_t$ the growth rate of real GDP between periods $t-1$ and $t$ and $x_t$ the

[21] A nation's primary deficit is its current account deficit, excluding net foreign investment income.

external primary balance (the current account balance minus net foreign asset income or, roughly, the trade surplus plus net grant inflows) as a share of GDP. It follows that

$$f_t \equiv \left( \frac{1+r_t}{1+g_t} \right) f_{t-1} - x_t \tag{19}$$

The primary surplus that keeps constant net foreign liabilities as a share of GDP is

$$\overline{x}_t = \left( \frac{r_t - g_t}{1+g_t} \right) f_{t-1}.$$

I assume that the long-run growth rate of the net external liabilities is less than the long-run rate of return on the net external liabilities or, equivalently, that the present discounted value of the net external liabilities is non-positive in the long run (the usual national solvency constraint). The nation's intertemporal budget constraint then becomes the requirement that the existing net external liabilities should not exceed the present discounted value of current and future primary external surpluses. This can be written more compactly as follows:

$$\overline{x}_t^p \geq \left( \frac{r_t^p - g_t^p}{1+g_t^p} \right) f_{t-1} \tag{20}$$

Here $\overline{x}_t^p$ is the permanent trade surplus as a share of GDP and $r_t^p$ and $g_t^p$ are the permanent real rate of return paid on the net external liabilities and the permanent growth rate of real GDP respectively. 'Permanent' here is used in the sense of permanent income. Its approximate meaning is 'expected long-run average' (see Buiter and Grafe (2004)). All I need to make my point is that the US *is* a net external debtor and that the permanent real rate of return paid on US net external liabilities in the future will indeed in exceed the permanent growth rate of US real GDP. If this second assumption is not satisfied, the US can engage in external Ponzi finance forever. Possible, but not likely, especially following the ongoing crisis.

Given $r_t^p > g_t^p$ and $f_{t-1} > 0$, it follows that the US will have to generate, henceforth, a permanent external primary surplus: $x_t^p > 0$. Unless the US expects to be a permanent net recipient of foreign aid, this means that the US has to run a permanent trade surplus. From the position the US was in immediately prior to the crisis, this means that a permanent increase in the trade balance surplus as a share of GDP of *at least* six percentage points is required.

The UK is in a similar position, with a Net International Investment Position of around minus 27 percent of GDP in 2007 and a primary deficit of almost five percent of GDP. This can be seen in Charts 9a and 9b. Note that, unlike the USA and the euro area, where gross external assets and liabilities are just over 100 percent of GDP, in the UK both external assets and external liabilities are close to 500 percent of GDP. The characterisation of the UK as a hedge fund is only a mild exaggeration.

**Chart 9a here**

**Chart 9b here**

The euro area, like the US and the UK, has a small negative Net International Investment Position. Unlike the US and the UK, its primary balance has averaged close to zero since the creation of the euro. Charts 10a and 10b show the behaviour of the external assets, liabilities and investment income for the euro area.

**Chart 10a here**

**Chart 10b here**

The mid-2007 six percent of GDP US trade deficit was probably an overstatement of the structural trade deficit, because the US economy was operating above capacity. Since the middle of 2007, the US primary deficit has shrunk to about five percent of GDP. With the economy now operating with some excess capacity, this probably understates the structural

external deficit. I will assume that the US economy has to achieve at least a five percent of GDP permanent increase in the primary balance to achieve external solvency. The corresponding figure for the UK is probably about at least four percent of GDP. The euro area has been in rough structural balance for a number of years.

To say that the US needs a permanent five percent of GDP reduction in the external trade deficit is to say that the US needs a five percent fall in domestic absorption (the sum of private consumption, private investment and government spending on goods and services, or 'exhaustive' public spending) relative to GPD. This reduction in domestic absorption is also necessary to support a lasting depreciation of the US real exchange rate (an increase in the relative price of traded to non-traded goods). Such a depreciation of the real exchange rate is an essential part of the mechanism for shifting resources from the non-traded sectors (construction, domestic banking and financial services) to the tradable sectors (manufacturing, tourism, international banking and financial services, and other tradable services).

**The end of Ponzi finance for the US and the UK**

My belief that the US and the UK will have to achieve a large external primary balance correction to maintain external solvency is based on the assumption that, in the future, $r_t^p > g_t^p$, i.e. that permanent Ponzi finance (a growth rate of the debt permanently greater than the interest rate on the debt) will not be possible for the US or the UK.

I am therefore asserting that the future will, in this regard, be quite unlike the past. In the past couple of decades, as is clear from Charts 8b, 9b and 10b, both the US and the UK have been debtor nations that received a steady stream of payments from their creditors. As regards foreign asset income payments recorded in the balance of payments accounts, it looks therefore as through the US and the UK have not only been able, in the past, to engage in (temporary) Ponzi finance, they appear to have paid an effective negative nominal rate of

return on their net external liabilities: Net Foreign investment Income is positive for the US and the UK (zero for the euro area) even though the Net International Investment Position is negative for all three. If this could be sustained, it would be a form of 'über-Ponzi finance'.

The reliability of the data summarized in Charts 8a,b, 9a,b and 10a,b is much debated, and the interpretation of the anomaly of a net debtor getting paid by his creditors is disputed .(see e.g. Buiter (2006), Gourinchas and Rey. (2007) and Hausmann and Sturzenegger (2007)). Part of the reason the US, the UK and (to a lesser extent) the euro area have been able to earn a much higher rate of return on their external assets than the rate of return earned by foreigners on their investments in the US and the UK, is that the US and the UK (Wall Street and the City of London) have, first, been acting as bankers to the world, providing unique liquidity and security for investments made in or channelled through these countries and, second, (may) have been acting as venture capitalists to the world (Gourinchas and Rey (2007)), earning a much higher return on US FDI abroad than foreigners earned on FDI in the USA. I have my doubts about the reliability of the data on which this second mechanism is based, but not on the historical accuracy of the first. It is my belief that the north Atlantic region financial crisis will do great and lasting damage to the ability of the US and the UK to borrow cheaply and invest in assets yielding superior rates of return.

Wall Street and the City of London have traded on the liquidity of their institutions and markets. Their leading banks and other financial institutions have benefited from huge liquidity premia and risk spreads. These spreads reflected the perceived security of the investments that Wall Street and the City of London managed for clients or for their proprietary accounts. More fundamentally, it reflected global confidence and trust in the absence of malfeasance and gross incompetence. These valuable virtues and talents could be found only among the professionals in the heartland of financial capitalism.

These unique assets, including trust and confidence, have been damaged badly. Key markets and institutions became illiquid and continue to be so. Incompetence, unethical practices and, not infrequently, outright illegal behaviour are now associated in the minds of the global investing community with many of the former giants of global finance in Wall Street and the City of London. That is why I have no serious reservations about assuming that, even for the US and the UK, we will have $r_t^p > g_t^p$ in the future: for the first time in a long time, the external intertemporal budget constraint will bite.

The rest of the world is unlikely to continue to provide the US consumer (private or public) with credit on the terms of the past. The current financial crisis was made in the heartland of financial capitalism - on Wall Street, in the City of London, in Zurich and Frankfurt. It has revealed the deep rot in the heart of the financial system of the north Atlantic region. The old, lingering suspicion that self-regulation meant no regulation has been confirmed. Those who sold or tried to sell this corrupt financial system to the rest of the world have been exposed as frauds or fools. The rest of the world will not see the US (and the US dollar) or the UK (and sterling) or even the euro area and the euro as uniquely safe havens and as providers of uniquely safe and secure financial instruments. Risk premia for lending to the US and the UK are bound to increase significantly, even if there is no US dollar or sterling crisis. The position of New York and London as bankers to the world, and especially to the emerging markets, will be permanently impaired.

**How and when to boost the external balance**

If a large permanent decline in the ratio of domestic absorption to GDP is necessary, why wait, even if you could? Postponing the necessary adjustment will just raise the magnitude of the permanent correction that is eventually required. Five percentage points of GDP (a likely underestimate of the correction that is required) is already a very large permanent correction. Escalating that number further through inaction or, worse, through

actions aimed at boosting consumption demand in the short run, risks destroying the credibility of an eventual adjustment. In addition, the external constraint will, I believe, become binding very soon on both the US and the UK. The terms of access to external finance can be expected to worsen rapidly if durable adjustment measures are not implemented soon. In the UK, the authorities are not trying to prevent the in my view unavoidable and indeed necessary slowdown in economic activity that is the cyclical by-product of an increase in the national saving-investment balance. Unfortunately, in the US, they are doing just that.

I believe that the required permanent reduction in domestic absorption relative to GDP in the US ought to come mainly through a reduction in private consumption. Public spending on goods and services in the US is already low by international standards. Underfunded public services and substandard infrastructure also support the view that exhaustive public spending should not be cut significantly. US private investment rates are not particularly high, either by historical or by international standards. There is also the need to invest on a large scale in energy security, energy efficiency and other green ventures. While a cyclical weakening of energy prices can be expected, the trend is likely to be upwards. The US is far less energy-efficient in production and consumption than Europe or Japan, and much of the US stocks of productive equipment and consumer durables (including housing) will have to be scrapped or adapted to make them economically viable at the new high real energy prices. US investment rates, private and public, should therefore not fall.

That leaves private consumption as the domestic spending or absorption component to be lowered permanently by at least five percentage points of GDP. The argument that the US will have to go through a protracted and/or deep slowdown to achieve a sustainable external balance is not dependent on whether it is private or public consumption that needs to be cut.

The US national saving rate is astonishingly low, both by international and by historical standards, as is apparent from Table 8. Of the G7 countries, only the UK comes close to saving as little as the US. The belief that saving is unnecessary because capital gains will provide the desired increase in real financial wealth has been undermined by the successive implosions of all recent asset booms/bubbles, including the tech bubble (which burst late 2000) and the housing bubble (which burst at the end of 2006).

**Table 8 here**

It is logically possible that a country like the US can reduce consumption as a share of GDP by five percentage points or more without this causing a temporary slowdown in economic activity. Asset markets (including the real interest rate and the real exchange rate) could adjust promptly and by the right amount to provide the correct signals for a reallocation of resources from consumption to domestic and foreign investment and from the non-traded to the traded sectors. Prices of goods and services and factor prices could respond promptly to re-enforce these asset market signals. Real resource mobility between the traded and non-traded sectors could be high enough to permit a sizable intersectoral reallocation of labour and capital without the need for periods of idleness or inactivity.

Absent a supply-side miracle, however, I believe that the US economy is too Keynesian in the short run to produce such a seamless and painless change in the composition of domestic production and in source of demand for domestically produced goods and services. Most policies and events that raise the national saving rate will result in a temporary decline in effective demand, in slowing or negative growth and in rising unemployment. A boost to domestic capital formation would help sustain demand but would prevent the necessary correction of the external account. The re-orientation of domestic production towards tradables and the switch of global demand towards domestic goods will require time and idle resources in the US. There is no real prospect that this can be achieved

without the US economy passing through the valley of the shadow of rising excess capacity and unemployment.

It is therefore ironic, and to me incomprehensible, that leading economists who have argued for decades that US households need to save more (Martin Feldstein (2007) is a notable example, Larry Summers (2008) is another) would, as soon as the US consumer is at long last showing signs of wanting to save more (that is, consume less), propose fiscal and monetary measures aimed at stopping the US consumer from doing what (s)he ought to have been doing all along. This is a vivid example of St. Augustine's: *"Lord, give me chastity and virtue, but do not give it yet."* The fall in private consumption growth, and indeed in private consumption, should be welcomed, not fought.

The Chairman of the Fed also appears to dropped the qualifier 'sustainable' from the objectives of growth and employment. Statements by Chairman Bernanke like the following abound: *"We stand ready to take substantive additional action as needed to support growth and to provide additional insurance against downside risks."*(Bernanke (2008)). The omission of the word 'sustainable' in front of growth is no accident. The Fed has chosen to do all it can to maintain output and employment at the highest possible levels, with no regard to their sustainability.

**III.1a(v) How dangerous to the real economy is financial sector deleveraging?**

Consider the following stylized description of the financial system in the North Atlantic region in the 1920s and 1930s. Banks intermediate between households and non-financial corporations. There is a reasonable-size stock market, a bond market and a foreign exchange market. Banks are the only significant financial institutions – the financial sector is but one layer deep.

When the financial sector is but one layer deep, the collapse of the net worth of financial sector institutions and the contraction of the gross balance sheet of the financial

sector can seriously impair the entire intermediation process. The spillovers into the real economy – household spending and investment spending by non-financial corporates – are immediate and direct. This was the picture in the Great Depression of the 1930s. This is the world studied in depth by the current Fed Chairman, Ben Bernanke, but it is not the world we live in today.

Today, the financial sector is many layers deep. Most financial institutions interact mainly with other financial institutions rather than with households or non-financial enterprises. They lend and borrow from each other and invest in each others' contingent claims. Some of this financial activity is socially productive. Much of it is privately profitable but socially wasteful churning, driven by regulatory arbitrage and tax efficiency considerations. During periods of financial boom and bubble, useless financial products and pointless financial enterprises proliferate, often achieving enormous scale. Finance is, after all, trade in promises, and can be scaled almost costlessly, given optimism, confidence, trust and gullibility.

Interestingly, during the most recent leverage boom, many of the non-bank financial businesses that accounted for much of the increase in leverage, chose to hold a non-negligible part of their assets as bank deposits and also borrowed from banks on a sizable scale. So the growth of bank credit to non-bank financial entities and the growth of the broad monetary aggregates tracked the financial, credit and leverage boom quite well. We don't know whether this is a stable structural relationship or just a fragile co-movement between jointly endogenous variables. Still, it suggests that central banks that take their financial stability role seriously should pay attention to the broad monetary aggregates and to the behaviour of bank credit, even if these aggregates are useless in predicting inflation or real economic activity in real time (see e.g. Adalid and Detken (2007), and Greiber and Setzer (2007)).

The visible sign of this growth of intra-financial sector intermediation/churning is the growth of the gross balance sheets of the financial sector and the growth of leverage, both in the strict sense of, say, assets to equity ratios and in the looser sense of the ratio of gross financial sector assets or liabilities to GDP. During the 5 years preceding the credit crunch, this financial leverage was rising steadily, without much apparent impact on actual or potential GDP. If it had to be brought back to its 2002 level over, say, a five-year period, it is likely that no-one would notice much of an impact on real or potential GDP. The orderly, gradual destruction of 'inside' assets and liabilities need not have a material impact on the value of the 'outside' assets and on the rest of the real economy.

But financial sector deleveraging and leveraging are not a symmetric processes, in the same way that assets price booms and busts are not symmetric. Compared to the deleveraging phase, the increasing leverage phase is gradual. Rapid deleveraging creates positive, dysfunctional feedback between falling funding liquidity, distress sales of assets, low market liquidity, falling asset prices and further tightening of funding liquidity.

At some point, the deleveraging, even though it still involves almost exclusively the destruction of inside assets (and the matching inside liabilities) will impair the ability of the financial sector as a whole to supply finance to financial deficit units in the household sector and the non-financial corporate sector. Among the outside assets whose value collapses is the equity of the banks and other financial intermediaries. Given external (regulatory) and internal prudential lower limits on permissible or desirable capital ratios, these intermediaries are faced with the choice of reducing or suspending dividends, initiating rights issues or restricting lending to new or existing customers. Inevitably, lending is cut back and the financial crunch is transmitted to households and non-financial enterprises. The LLR and MMLR roles of the central bank, backed by the Treasury, are designed to prevent excessively speedy, destructive deleveraging. If it does that, there can be massive gradual deleveraging

in the financial sector, without commensurate impact on households and non-financial corporates.

**Inside and outside assets**

I believe that the Fed has consistently overestimated the effect of the overdue sharp contraction in the size of the financial sector balance sheet on the real economy. Much of this can, I believe, be attributed to a failure to distinguish carefully between inside and outside assets. All financial instruments are inside assets. If an inside asset loses value, there is a matching decline in an inside liability. Both should always be considered together. This has not been common practice.

Just one example. Even before August 9, 2007, Chairman Bernanke provided estimates of the loss the US banking sector was likely to suffer on its holdings of subprime mortgages due to write downs and write-offs on the underlying mortgages. For instance, on July 20, 2007 in testimony to Congress, Chairman Bernanke stated subprime-related losses could be up to $100bn out of a total subprime mortgage stock of around $2 trillion; there have been a number of higher estimates since then. Not once have I heard a member of the FOMC reflect on the corresponding gain on the balance sheets of the mortgage borrowers. Mortgages are inside assets/liabilities. So are securities backed by mortgages.

Consider a household that purchases for investment purposes a second home worth $400,000 with $100,000 of its own money and a non-recourse mortgage of $300,000 secured against the property.[22] Assume the price of the new home halves as soon as the purchase is completed. With negative equity of $100,000 the home owner chooses to default. The mortgage now is worth nothing. The bank forecloses, repossesses the house and sells it for $200,000, spending $50,000 in the process.

[22] To avoid getting hoist immediately on my own 'housing wealth isn't wealth' petard, assume that the value of the first home equals the present value of the remaining lifetime housing services the homeowner plans to consume. At the end of the exercise, the reader can decide for him or herself whether this economy contains a non-home-owning renter who may be better off as the result of the fall in the price of the second home.

The loss of net wealth as a result of the price collapse and the subsequent default and repossession is $250,000: the $200,000 reduction in the value of the house and the $50,000 repossession costs (lawyers, bailiffs etc). The homeowner loses $100,000: his original, pre-price collapse equity in the house - the difference between what he paid for the house and the value of the mortgage he took out. The bank loses $150,000: the sum of the $100,000 excess of the value of the mortgage over the post-collapse price of the house and the $50,000 real foreclosure costs. The $300,000 mortgage is an inside asset - an asset to the bank and a liability to the homeowner-borrower. When it gets wiped out, the borrower gains (by no longer having to service the debt) what the lender loses.

The legal event of default and foreclosure, however, is certainly not neutral. In this case it triggers a repossession procedure that uses up $50,000 of real resources. This waste of real resources would, however, constitute aggregate demand in a Keynesian-digging-holes-and-filling-them-again sense, a form of private provision of pointless public works.

Continuing the example, how does the redistribution, following the default, of $100,000 from the bank to the defaulting borrower - the write-off of the excess of the face value of the mortgage over the new low value of the house - affect aggregate demand? There is one transmission channel that suggests it is likely that demand would have been weaker if, following the default, the lender had continued recourse to the borrower (say, through a lien on the borrower's future income or assets). The homeowner-borrower is likely to have a higher marginal propensity to spend out of current resources than the owners of the bank - residential mortgage borrowers are more likely to be liquidity-constrained than the shareholders of the mortgage lender. This transmission channel has, as far as I can determine, never been mentioned by any FOMC member.

Finally, we have to allow for the effect of the mortgage default on the willingness and ability of the bank to make new loans and to roll over existing loans. Clearly, the write-off or

write-down of the mortgage will put pressure on the bank's capital. The bank can respond by reducing its dividends, by issuing additional equity or by curtailing lending. The greatest threat to economic activity undoubtedly comes from curtailing new lending and the refusal to renew maturing loans.

The magnitude of the effect on demand of a cut in bank lending depends on whom the banks are lending to and what the borrower uses the funds for. If the banks are lending to other financial intermediaries, that are, directly or indirectly, lending back to our banks, then there can be a graceful contraction of the credit pyramid, a multi-layered de-leveraging without much effect on the real economy. If bank A lends $1 trillion to bank B, which then uses that $1 trillion to buy bonds issued by bank A, there could be a lot of gross de-leveraging without any substantive impact on anything that matters. With a few more non-bank intermediaries interposed between banks A and B, such intra-financial sector lending and borrowing (often involving complex structured products) has represented a growing share of bank and financial sector business this past decade.

In our non-Modigliani-Miller world, financial structure matters. We cannot just 'net out' inside financial assets and liabilities – they are an essential part of the transmission mechanism. But there also is no excuse for ignoring half of the distributional effects inherent in changing valuations of inside assets and liabilities. If their public statements are anything to go by, the Fed and the FOMC have systematically overestimated the effects of declining inside financial asset valuations on aggregate demand.

**III.1a(vi) Disdain for the monetary aggregates**

Monetary targeting for macroeconomic stability died because the velocity of circulation of any monetary aggregate turned out to be unpredictable and unstable. Even so, the decision to cease publishing M3 statistics effective 23 March 2006 was extraordinary. The reason given was: *"M3 does not appear to convey any additional information about*

*economic activity that is not already embodied in the M2 aggregate. The role of M3 in the policy process has diminished greatly over time. Consequently, the costs of collecting the data and publishing M3 now appear to outweigh the benefits."*

Information is probably the purest of all pure public goods. The cost-benefit analysis argument against its continued publication, free of charge to the ultimate user, by a public entity like the Fed, is completely unconvincing. Broad monetary aggregates, including M3 and their counterparts on the asset side of the banking sector's balance sheet are in any case informative for those interested in banking sector leverage and other financial stability issues, including asset market booms and bubbles (see e.g. Ferguson (2005), Adalid and Detken (2007) and Greiber and Setzer (2007)). The decision to discontinue the collection and publication of M3 data supports the view that the Fed took its eye off the credit boom ball just as it was assuming epic proportions.

The decision to discontinue publication of the M3 series also smacks of intellectual hubris; effectively, the Fed is saying: *we* don't find these data useful. Therefore *you* shall not have them free of charge any longer.

## III.1b The world imports inflation

All three central banks have tried to absolve themselves of blame for the recent bouts of inflation in their jurisdictions by attributing much or most of it to factors beyond their control – global relative price shocks, global supply shocks, global inflation or global commodity price inflation. A prominent use of this fig-leaf can be found in the open letter to the Chancellor of the Exchequer by Mervyn King, Governor of the Bank of England, in May 2008.[23].The gist of the Governor's analysis was: it's all global commodity prices - something beyond our control.

[23] The open letter procedure is a useful part of the communication and accountability framework of the Bank of England. It requires the Governor to write an open letter to the Chancellor whenever the inflation rate departs by more than 1 percent from its target (in either direction). In that open letter, the Governor, on behalf of the

I will quote him at length, so there is no risk of distortion:

*"Inflation has risen sharply this year, from 2.1% in December to 3.3% in May. That rise can be accounted for by large and, until recently, unanticipated increases in the prices of food, fuel, gas and electricity. These components alone account for 1.1 percentage points of the 1.2 percentage points increase in the CPI inflation rate since last December. Those sharp price changes reflect developments in the global balance of demand and supply for foods and energy. In the year to May:*

- *world agricultural prices increased by 60% and UK retail food prices by 8%.*
- *oil prices rose by more than 80% to average $123 a barrel and UK retail fuel prices increased by 20%*
- *wholesale gas prices increased by 160% and UK household electricity and gas bills by around 10%*

*The global nature of these price changes in evident in inflation rates not only in the UK but also overseas, although the timing of their impact on consumer prices differs across countries. In May, HICP inflation in the euro area was 3.7% and US CPI inflation was 4.2%."*

Later on in the open letter the Governor amplifies the argument that this increase in inflation has nothing to do with the Bank of England:

*"There are good reasons to expect the period of above-target inflation we are experiencing now to be temporary. We are seeing a change in commodity, energy and import prices relative to the prices of other goods and services. Although this clearly raises the price level, it is not the same as continuing inflation. There is not a generalised rise in prices and wages caused by rapid growth in the amount of money spent in the economy. In contrast to past episodes of rising inflation, money spending is increasing at a normal rate. In the year to 2008 Q1, it rose by 5½%, in line with the average rate of increase since 1997 - a period in which inflation has been low and stable. Moreover, in recent months the growth rate of the broad money supply has eased and credit conditions have tightened. This will restrain the growth of money spending in the future."* (emphasis in the original).

Very similar statements have been made by President Jean-Claude Trichet of the ECB and Chairman Ben Bernanke. Here is a quote from the August 7, 2008 Introductory statement before the press conference by President Trichet:

*"...annual HICP inflation has remained considerably above the level consistent with price stability since last autumn, reaching 4.0% in June 2008 and, according to Eurostat's flash estimate, 4.1% in July. This worrying level of inflation rates results largely from both direct*

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Monetary Policy Committee (MPC) gives the reasons for the undershoot or overshoot of the inflation target, what the MPC plans to do about it, how long it is expected to take until inflation is back on target and how all this is consistent with the Bank's official mandate. The current inflation target is an annual inflation rate of 2 percent for the Consumer Price Index (CPI). With actual year-on-year inflation at 3.3 percent in May 2008, an open letter (the second since the creation of the MPC in 1997) was due

*and indirect effects of past sharp increases in energy and food prices at the global level."* (Trichet (2008)).

Ditto for Chairman Bernanke (2008),

*"Inflation has remained high, largely reflecting sharp increases in the prices of globally traded commodities."* and, in the same speech,

*"Rapidly rising prices for globally traded commodities have been the major source of the relatively high rates of inflation we have experienced in recent years, underscoring the importance for policy of both forecasting commodity price changes and understanding the factors that drive those changes."*

This analysis makes no sense. Except at high frequencies, inflation can be targeted and controlled by the monetary authority and is therefore the responsibility of the monetary authority. Supply shocks or demand shocks make the volatility of actual headline inflation around the target higher, but should not create a bias. The only obvious caveat is that the economy in question have a floating effective exchange rate. This is the case for the UK and the euro area. The US is hampered somewhat in its monetary autonomy by the fact that the Gulf Cooperation Council members and some other countries continue to peg to the US dollar, and by the fact that the exchange rate with the US dollar of the Chinese Yuan continues to be managed in a rather unhelpful manner by the Chinese authorities. Although the Yuan appreciated vis-a-vis the US dollar by more than 10 percent in 2007 and by more than 7 per cent so far this year, it is clearly not a market-determined exchange rate.

If we add together the statements by the world's central bank heads (from the industrial countries, from the commodity-importing emerging markets and from the commodity exporting emerging markets) on the origins of their countries' inflation during the past couple of years, we must conclude that interplanetary trade is now a fact: the world is importing inflation from somewhere else.

Consider the following stylised view of the inflation process in an open economy. The consumer price level, as measured by the CPI, say, is a weighted average of a price index for core goods and services and a price index for non-core goods and services. Core goods

and services have sticky prices - these are the prices that account for Keynesian nominal rigidities (money wages and prices that are inflexible in the short run) and make monetary policy interesting. Non-core goods are commodities traded in technically efficient auction markets. It includes oil, gas and coal, metals and agricultural commodities, both those that are used for food production and those that provide raw materials for industrial processing, including bio fuels. The prices of non-core goods are flexible.

I will treat the long-run equilibrium relative price of core and non-core goods and services as determined by the rest of the world. In the short run, nominal rigidities can, however, drive the domestic relative price away from the global relative price.

I also make domestic potential output of core goods and services a decreasing function of the relative price of non-core goods to that of core goods and services. The effect of an increase in real commodity prices on productive potential in the industrial countries is empirically well-established. A recent study by the OECD (2008) suggests that the steady-state effect of a $120 per barrel oil price could be to lower the steady-state path of US potential output by about 4 percentage points, and that of the euro area by about half that (reflecting the lower euro area energy-intensity of GDP). The short-and medium-term effect on the growth rate of potential output in the US of the real energy price increase would be about 0.2 percent per annum, and half that in the euro area. Negative effects on potential output of the higher cost of capital since the summer of 2007 could magnify the negative potential growth rate effects, according to the OECD study, to minus 0.3 percent per annum for both the US and the (more capital-intensive) euro area.

I also treat the world (foreign currency) price of non-core goods as exogenous. It simplifies the analysis, but is not necessary for the conclusions, if we assume that the country produces only core goods and services and imports all non-core goods. Non-core goods are both consumed directly and used as imported raw materials and intermediate inputs in the

production of core goods and services. The weight of non-core goods in the CPI, which I will denote $\mu$, represents both the direct weight of non-core goods in the consumption basket and the indirect influence of core goods prices as a variable cost component in the production of core goods and services. I haven't seen any up-to-date input-output matrices for the US, the euro area and the UK, so I will have to punt on $\mu$. For illustrative purposes, I assume that $\mu$ = 0.25 for the UK and $\mu$ = 0.10 for the US and the euro area.

The inflation rate is the proportional rate of change of the CPI. If $\pi$ is the CPI inflation rate, $\pi^c$ the core inflation rate and $\pi^n$ the non-core inflation rate, then:

$$\pi = (1-\mu)\pi^c + \mu\pi^n \tag{21}$$

The inflation rate of non-core goods measured in domestic currency prices is the sum of the world rate of inflation of non-core goods $\pi^f$ and the proportional rate of depreciation of the currency's nominal exchange rate, $\varepsilon$. That is,

$$\pi^n = \pi^f + \varepsilon \tag{22}$$

By assumption, the central bank has no influence on the world rate of inflation of non-core goods, $\pi^f$ . The same cannot be said, however, for the value of the nominal exchange rate. High global inflation need not be imported if the currency is permitted to appreciate. In the UK, between end of the summer of 2007 and the time of Governor King's open letter in May 2008, sterling's effective exchange rate depreciated by 12 percent, reinforcing rather than offsetting the domestic inflationary effect of global price increases. The heads of our three central banks appear to treat the nominal exchange rate as exogenous – independent of monetary policy.[24]

The values of $\mu$ are probably quite reasonable, but the one-for-one instantaneous *structural* pass-through assumed in equation (22) for exchange rate depreciation on the domestic currency prices of non-core goods is somewhat over the top, at any rate in the short

[24] Perhaps the Treasury sets it? See footnote 4.

run. But it is a reasonable benchmark for medium- and long-term analysis. In the short run, one add a little distributed lag for descriptive realism, reflecting pricing-to-market behaviour etc.

Core inflation, which can be identified with domestically generated inflation in the simplest version of this approach, depends on such things as the inflation rate of unit labour costs and of unit rental costs plus the growth rate of the mark-up. For simplicity, I will assume that core inflation depends on the domestic output gap, $y - \hat{y}$, on expected future headline inflation, $E_t\pi_{t+1}$ and on past core inflation, so core inflation is driven by the following process:

$$\pi_t^c = \gamma(y_t - \hat{y}_t) + \beta E_t\pi_{t+1} + (1-\beta)\pi_{t-1}^c \qquad \gamma > 0,\ 0 < \beta \leq 1 \tag{23}$$

Monetary policy influences core inflation through two channels: by raising interest rates and expectations of future policy rates, it can lower output and thus the output gap. And if past, current and anticipated future actions influence expectations of future CPI inflation, that too will reduce inflation today, through the (headline) expectations channel.

It is true that an increase in the relative price of non-core goods to core goods and services means, given a sticky nominal price of core goods and services, an increase in the general price level but not, in and of itself, ongoing inflation. That is arithmetic. An increase in the global relative price of commodities will therefore show up as a one-period increase in $\pi^f + \varepsilon$ (or, more realistically, as a temporary increase in the rate of import price inflation measured in domestic currency). With the domestic currency price of core goods and services given in the short run, the only way to have an increase in the relative price of non-core goods is to have an increase in the domestic currency price of non-core goods. The level of the CPI therefore increases. This one-off increase in the general price level will show up in real time as a temporary increase in CPI inflation. If there is a sequence of such relative price

increases, there will be a sequence of such temporary increases in CPI inflation, which will rather look like, but is not, ongoing inflation.

Of course, as time passes even sticky Keynesian prices become unstuck. The nominal price of core goods and services can and does adjust. It can even adjust in a downward direction, as the spectacular declines in IT-related product prices illustrate on a daily basis. Whether the medium-term and longer-term increase in the relative price of non-core goods and services will continue to be reflected in a higher CPI, or will instead be associated with a constant CPI or even a declining CPI, is determined by domestic monetary policy.

Furthermore, an increase in the relative price of non-core goods to core goods and services does more than cause a one-off increase in the price level. As argued above, and as supported by many empirical studies, including the recent OECD (2008) study cited above, it reduces potential output or productive capacity by making an input that is complementary with labour and capital more expensive.[25] Letting $\frac{P^n}{P^c}$ denote the relative price of non-core and core goods, I write this as:

$$\hat{y}_t = \bar{\hat{y}}_t - \eta \frac{P_t^n}{P_t^c} \qquad (24)$$
$$\eta > 0$$

In addition, if labour supply is responsive to the real consumption wage, then the adverse change in the terms of trade that is the other side of the increase in the relative price of non-core goods to core goods and services will reduce the full-employment supply of labour, and this too will reduce productive capacity. Thus, unless actual output (aggregate demand) falls by more than potential output as a result of the adverse terms of trade change, the output gap will increase and the increase in the relative price of non-core goods will create domestic inflationary pressures on core goods and services.

[25] Complementary in the sense that an increase in the energy input raises the marginal products of labour and capital.

Clearly, the adverse terms of trade change will lower the real value of consumption demand, measured in terms of the consumption basket, if claims on domestic GDP (capital and labour income) are owned mainly by domestic consumers. It lowers the purchasing power of domestic output over the domestic consumption bundle. Real income measured in consumer goods falls, so real consumption measured in consumer goods should fall. But even if the increase in the relative price of non-core goods is expected to be permanent, real consumption measured in terms of the consumption bundle is unlikely to fall by a greater percentage than the decline in the real consumption value of domestic production. With homothetic preferences, a permanent deterioration in the terms of trade will not change consumption measured in terms of GDP units. If the period utility function is Cobb-Douglas between domestic output and imports, the adverse terms of trade shock lowers potential output but does not reduce domestic consumption demand for domestic output.

Unless investment demand, public spending and export demand fall in terms of domestic output, aggregate demand (actual GDP) will not fall. The output gap therefore increases as a result of an increase in the relative price of non-core goods to goods and services. Domestic inflationary pressures rise. Interest rates have to rise to achieve the same inflation trajectory. This inflationary impact of the increase in the relative price of commodities appears to be ignored by the Governor, the President and the Chairman.

### III.1c False comfort from limited 'pass-through' of inflation expectations into earnings growth?

Both the Fed and the BoE (less so the ECB) take comfort from the fact that earnings growth has remained moderate despite the increase in inflation expectations, based on both break-even inflation calculations (or the inflation swap market) and on survey-based expectations. For instance, in the exchange of letters between the Governor of the BoE and the Chancellor in May 2008, it was noted by the Chancellor that, although median inflation

expectations for the coming year had risen to 4.3% in the Bank's own survey, earnings growth (including bonuses) is running at only 3.9 percent.

However, this observation does not mean that, inflation expectations are not translated, *ceteris paribus*, one-for-one into higher wage settlements or into higher actual inflation. Time series analysis (earning growth is not rising) is not the same as counterfactual analysis (earnings growth would have been the same if inflation expectations had not risen).

It is certainly possible that the global processes that have depressed the share of labour income in GDP in most industrial countries during the past 10 years (China and India entering the global markets as producers of goods and services that are frequently competitive with those produced by the labour force in the advanced industrial countries, increased cross-border labour mobility, legal constraints weakening labour unions etc.) have not yet run their course and that labour's share will continue to decline. Arithmetically, a decrease in labour's share in GDP *is* an increase in the mark-up of the GDP deflator on unit labour costs. So if an increase in the expected rate of (consumer price) inflation coincided with a reduction in labour's share of GDP because of structural factors (and if no other determinant of earnings growth changed), unit labour cost growth could well rise (in a time-series sense) by less than the increase in expected inflation or might even decline. The price inflation process (on the GDP deflator definition) would, however, include the growth rate of the mark-up on unit labour costs, and would show the full impact of the increase in expected inflation (even in a time-series sense).

Clearly, the GDP deflator is not quite the same as the core price index, but qualitatively, the point remains valid, that a declining equilibrium share of labour will be offset, in the price inflation process, by a rising equilibrium mark-up on unit labour cost and that this can distort the interpretation of simple correlations between inflation expectations and earnings growth.

## III.2 Financial Stability: LLR, MMLR and Quasi-fiscal actions

### III.2a The Fed

The Fed, as soon as the crisis hit, injected liquidity into the markets at maturities from overnight to 3-months. The amounts injected were somewhere between those of the Bank of England (allowing for differences in the size of the US and UK economies) and those of the ECB.

#### III.2a(i) Extending the maturity of discount window loans

On August 17, 2007 the Fed extended the maturity of loans at the discount window from overnight to up to one month. On March 16, 2008, it further extended the maximum term for discount window lending to 90 days. These were helpful measures, permitting the provision of liquidity at the maturities it was actually needed

#### III.2a(ii) The TAF

On December 12, 2007, the Fed announced the creation of a temporary term auction facility (TAF). This allows a depository institution to place a bid for a one-month advance from its local Federal Reserve Bank at an interest rate that is determined as the result of an auction. The TAF allows the Fed to inject term funds through a broader range of counterparties and against a broader range of collateral than open market operations. When the normal open market operations counterparties are hoarding funds, and the unsecured interbank market is not disseminating liquidity provisions efficiently throughout the banking sector, this facility is clearly helpful.

#### III.2a(iii) International currency swaps

Also on December 12, the Fed announced swap lines with the European Central Bank and the Swiss National Bank of $20 billion and $4 billion, respectively. On March 11, 2008, these swap lines were increased to $30 billion and $6 billion, respectively. This, I have suggested earlier, represents the either the confusion of motion with action or an unwarranted

subsidy to the private banks able to gain access to this foreign exchange rather than having to acquire it more expensively through the private swap markets. Banks in the euro area and Switzerland were not liquid in euros/Swiss francs but short of US dollars because the foreign exchange markets had become illiquid. These banks were short of liquidity – full stop – that is, short of liquidity in any currency.

This is unlike the case of Iceland, where the Central Bank on 16th May 2008 arranged swaps for euros with the three Scandinavian central banks. Since the Icelandic banking system is very large relative to the size of the economy and has much of its balance sheet (including a large amount of short-term liabilities) denominated in foreign currencies rather than in Icelandic kroner, the effective performance of the LLR and MMLR functions requires the central bank to have access to foreign currency liquidity. With no-one interested in being long Icelandic kroner, the swap facilities are an essential line of defense for the Icelandic LLR/MMLR

**III.2a(iv) The TSLF**

On March 11, 2008 the Fed announced that it would expand its existing overnight securities lending program for primary dealers by creating a Term Securities Lending Facility (TSLF). Under the TSLF, the Fed will lend up to $200 billion of Treasury securities held by the System Open Market Account to primary dealers secured for a term of 28 days by a pledge of other collateral. The Facility was extended beyond the 2008 year-end in July 2008, and the maturity of the loans was increased to three months. The first TSLF auction took place on March 27, with $75 billion offered for a term of 28 days, too late to be helpful to Bear Stearns, for which the Fed had to provide extraordinary LLR support on March 14. The price is set through a single-price auction.[26]

[26] The TSLF is a single-price auction, where accepted dealer bids will be awarded at the same fee rate, which equal to the lowest fee rate at which any bid was accepted. Dealers may submit two bids for the basket of eligible general Treasury collateral at each auction.

The range of collateral is quite wide: all Schedule 2 collateral plus agency collateralized-mortgage obligations (CMOs) and AAA/Aaa-rated commercial mortgage-backed securities (CMBS), in addition to the AAA/Aaa-rated private-label residential mortgage backed securities (RMBS) and OMO-eligible collateral.[27] Until the creation of the Primary Dealer Credit Facility (PDCF, see below) the Fed could not lend cash directly to primary dealers. Instead it lends highly liquid Treasury bills which the primary dealers then can convert into cash. This facility extends both the term of the loans from the Fed to available to primary dealers and the range of eligible collateral. In principle this is a useful arrangement for addressing a liquidity crisis. The design, however, has one huge flaw.

An extraordinary feature of the arrangement is that the collateral offered by the primary dealers is valued by the clearing bank acting as agent for the primary dealer.[28] Apparently this is a standard feature of the dealings between the Fed and the primary dealers. Primary dealers cannot access the Fed directly, but do so through a clearing bank – their dealer. As long as the clearing bank which acts as agent for the primary dealer in the transaction is willing to price the security (say, by using an internal model), the Fed will accept it as collateral at that price. The usual haircuts etc. will, of course, be applied to these valuations.

This arrangement is far too cosy for the primary dealer and its clearer. The incentive for collusion between the primary dealer and the clearer, to offer pig's ear collateral but value it as silk purse collateral, will be hard to resist. This invites adverse selection: the Fed is likely to find itself with overpriced, substandard collateral. Offering access to this adverse selection mechanism today creates moral hazard in the future. It does so by creating

[27] Schedule 1 collateral is all collateral eligible for tri-party repurchase agreements arranged by the Open Market Trading Desk (that is, all collateral acceptable in regular Fed open market operations). Schedule 2 collateral is all Schedule 1 collateral plus AAA/Aaa-rated Private-Label Residential MBS, AAA/Aaa-rated Commercial MBS, Agency CMOs and other AAA/Aaa-rated ABS.

[28] It is revalued daily to ensure that, should the value of the collateral have declined, the primary dealer puts up the additional collateral required to restore the required level of collateralisation. With a well-designed revaluation mechanism, such 'margin calls' do, of course, make sense.

incentives for future reckless lending and investment by primary dealers aware of these future opportunities for dumping bad investments on the Fed as good collateral through the TSLF.

**III.2a(v) The PDCF**

On March 16, 2008, the Primary Dealer Credit Facility (PDCF) was established, for a minimum period of six months. This again was too late to be helpful in addressing the Bear Stearns crisis. Primary dealers of the Federal Reserve Bank of New York are eligible to participate in the PDCF via their clearing banks. It is an overnight loan facility that provides funding to primary dealers in exchange for a specified range of eligible collateral, including all collateral eligible for tri-party repurchase agreements arranged by the Federal Reserve Bank of New York (that is, all collateral eligible for pledge in open market operations), as well as all investment-grade corporate securities, municipal securities, mortgage-backed securities and asset-backed securities for which a price is available from the primary dealer's clearing bank. The rate charged is the one at the primary discount window to depositary institutions for overnight liquidity, currently 25 bps over the Federal Funds target rate.

This facility effectively extends overnight borrowing at the Fed's primary discount window to primary dealers, at the standard primary discount window rate. Note again the extraordinary valuation mechanism put in place for securities offered as collateral: "*The pledged collateral will be valued by the clearing banks based on a range of pricing services.*"[29] This is the same 'adverse-selection-today-leading-to-moral-hazard-tomorrow-machine' created by the Fed for use with the TSLF.

**III.2a(vi) Bear Stearns**

On 14 March 2008, the Fed agreed to lend US$29 billion to Bear Stearns through JPMorgan Chase (on a non-recourse basis). Bear Stearns is an investment bank and a primary dealer. It was not regulated by the Fed (which only regulates depositary institutions)

[29] http://www.newyorkfed.org/markets/pdcf_terms.html.

but by the SEC. Bear Stearns was deemed too systemically important (probably by being too interconnected rather than too big) to fail.

It is not clear why Bear Stearns could not have borrowed at the regular Fed primary discount window. It is true that investment banks had not done so since the Great Depression, but it would have been quite consistent with the Fed's legislative mandate. The Federal Reserve Act (1913) allows the Federal Reserve to lend, in a crisis, to just about any institution, organisation or individual, and against any collateral the Fed deems fit (see also Small and Clouse (2004)).

Specifically, if the Board of Governors of the Federal Reserve System determines that there are *"unusual and exigent circumstances"* and at least five (out of seven) governors vote to authorize lending under Section 13(3) of the Federal Reserve Act, the Federal Reserve can discount for individuals, partnerships and corporations (IPCs) *"notes, drafts and bills of exchange indorsed or otherwise secured to the satisfaction of the Federal Reserve bank…"*.

The combination of the restriction of "unusual and exigent circumstances" and the further restriction that the Federal Reserve can discount only to IPCs "unable to secure adequate credit accommodations from other banking institutions", fits the description of a credit crunch/liquidity crisis like a glove. So why did the Fed not determine before March 14 that there were "unusual and exigent circumstances" that would have allowed Bear Stearns (or indeed individual US citizens) direct access to the discount window?

It is also a mystery why a *special resolution regime* analogous to that administered by the FDIC for insured depositary institutions (discussed in Section II.3a) did not exist for Bear Stearns. The experience of LTCM in 1998 should have made it clear to the Fed that there were institutions other than deposit-taking banks that might be too systemically significant to fail, precisely because, like Bear Stearns, their death throes might, through last-throw-of-the-dice asset liquidations, cause illiquid asset prices to collapse and set in motion a dangerous

chain reaction of cumulative market illiquidity and funding illiquidity. An SRR could have ring-fenced the balance sheet of Bear Stearns and permitted the analogue of *Prompt Corrective Action* to be implemented. The entire top management could have been fired without any golden handshakes. If necessary, regulatory insolvency could have been declared for Bear Stearns. The shareholders would have lost their voting power and would have had to take their place in line, behind all other claimants. Outright nationalisation of Bear Stearns could have created the same superior alignment of incentives.

Instead we have a $10 per share payment for the shareholders, what looks like a sweetheart deal for JPMorgan Chase, and a $29 billion exposure for the US tax payer to an SPV in Delaware, which has $30 bn of Bear Stearns' most toxic assets on its balance sheet. Only $1bn of JPMorgan Chase money stands between losses on the assets and the $29 billion 'loan with equity upside' provided by the Fed.

**III.2a(vii) Bear Stearns' bail-out as an example of confusing the LLR and MMLR functions**

The rescue of Bear Stearns represents the confusion of the lender-of-last-resort role of the traditional central bank and the market-maker-of-last-resort role of the modern central bank. Bear Stearns was an investment bank. No investment bank is systemically important in the sense that no investment bank performs tasks that cannot be performed readily and with comparable effectiveness by other institutions. Even the primary dealer and broker roles of Bear Stearns could have been taken over promptly by the other primary dealers and brokers.

Bear Stearns was rescued because it was 'too interconnected to fail'. It was feared that, in a last desperate attempt to stave off insolvency, Bear Stearns would have unloaded large quantities of illiquid securities in dysfunctional, illiquid securities markets. This would have caused a further dramatic decline in the market prices of these securities. With mark-to-

market accounting and through margin calls linked to these valuations, further sales of illiquid securities by distressed financial institutions would have been triggered. The losses associated with these 'panic sales' would have reduced the capital of other financial institutions, requiring them to cut or eliminate dividends, raise new capital, cut new lending or reduce their investments. A vicious cycle could have been triggered of forced sales into illiquid markets triggering funding liquidity problems elsewhere, necessitating further liquidations of illiquid asset holdings.

This chain of events is possible and may even have been plausible at the time. The solution, however, is to truncate the vicious downward spiral of market illiquidity and funding illiquidity right at the point where Bear Stearns was distress-selling its illiquid assets. By acting as MMLR - either by buying these securities outright or by accepting them as collateral at the facilities like the TAF (extended to include investment banks as eligible counterparties), the TSLF or the PDCF - the central bank could have put a floor under the prices of these securities and would thus have prevented a vicious downward spiral of market and funding illiquidity. Whether Bear Stearns would have been able to survive with the valuations of their assets realised at these TSLF-type or PDCF-type facilities, would no longer have been systemically relevant.

The arrangements for acting as MMLR for investment banks did not, unfortunately, exist when Bearn Stearns collapsed. Now that they do, they should be kept alive, on a stand-by or as-needed basis. They may have to be expanded to include other highly leveraged financial institutions that are too interconnected to fail. As *quid pro quo*, all institutions eligible for MMLR (and/or LLR) support should be subject to common regulatory requirements, including a common special resolution regime. Combined with a proper punitive pricing of securities offered for outright purchase or as collateral, moral hazard will be minimized.

**III.2a(viii) Fannie and Freddie**

On Sunday, July 13 2008 the Fed, in a coordinated action with the Treasury, announced that it would provide the two GSEs, Fannie Mae and Freddie Mac, with access to the discount window on same terms as commercial banks. The announcement was not very informative as regards the exact conditions of access:

*"The Board of Governors of the Federal Reserve System announced Sunday that it has granted the Federal Reserve Bank of New York the authority to lend to Fannie Mae and Freddie Mac should such lending prove necessary. Any lending would be at the primary credit rate and collateralized by U.S. government and federal agency securities. ...."*

It isn't clear from this whether the two GSEs have access only to overnight collateral (at a rate 25 basis points over the Federal Funds target rate) or are able to obtain loans of up to 3-month maturity, as commercial banks can.

As long as the collateral the Fed accepts from Fannie and Freddie consists of US government and federal agency securities only, the expansion of the set of eligible discount window counterparties to include Fannie and Freddie does not represent a material quasi-fiscal abuse of the Fed. If at some future date the maturity of the loans extended to Fannie and Freddie at the discount window were to be longer than overnight, and if lower quality collateral were to be accepted and not priced appropriately, Fannie's and Freddie's access to the discount window could become a conduit for quasi-fiscal subsidies.

This is not, I believe, an idle concern. The Fed's opening of the discount window to the two GSEs was announced at the same time as some potentially very large-scale contingent quasi-fiscal commitments by the Treasury to these organisations, including debt guarantees and the possibility of additional equity injections. There also is the worrying matter that, even though Fannie and Freddie now have access to the discount window, there is no special resolution regime for the two GSEs to constrain the incentives for excessive risk taking created by access to the discount window.

**III.2a(ix) Lowering the discount window penalty**

In Section III.1, I listed the lowering (in two steps) of the discount rate penalty from 100 to 25 basis points as a stabilisation policy measure, although it is unlikely to have had more than a negligible effect, except possibly as 'mood music': it represents the marginal cost of external finance only for a negligible set of financial institutions.

The discount rate penalty reductions should, however, be included in the financial stability section as an essentially quasi-fiscal measure. On August 17, 2007, there were no US financial institutions for whom the difference between able to borrow at the discount rate at 5.75 percent rather than at 6.25 percent represented the difference between survival and insolvency; neither would it make a material difference to banks considering retrenchment in their lending activity to the real economy or to other financial institutions. This reduction in the discount window penalty margin was of interest only to institutions already willing and able to borrow there (because they had the kind of collateral normally expected at the discount window). It was an infra-marginal subsidy to such banks – a straight transfer to their shareholders from the US tax payers. It also will have boosted moral hazard to a limited degree by lowering the penalty for future illiquidity.

**III.2a(x) Interest on reserves**

Reserves held by commercial banks with the Fed are currently non-remunerated. As I pointed out in Section II.5, this hampers the Fed in keeping the effective Federal Funds rate close to the Federal Funds target. Commercial banks have little incentive to hold excess reserves with the central bank. If there is excess liquidity in the overnight interbank market, banks will try to lend it out overnight at any positive rate rather than holding it at a zero overnight rate as excess reserves with the Fed. Clearly it makes sense for interest to be paid on excess reserves at an overnight rate equal to the Federal Funds target rate. Under existing legislation, the Fed will have the authority to pay interest on reserves starting in October 2011. The Fed has asked Congress for this date to be brought forward.

The proposal clearly makes sense, but if interest at the Federal Funds target rate is paid on both required and excess reserves, the proposed policy change represents a quasi fiscal tax cut benefiting the shareholders of the banks. In a first-best world, the Fed would not collect quasi-fiscal taxes through unremunerated reserves. However, to correct this problem now, as a one-off, would look like a further reward to the banks for past imprudent behaviour and would also be distributionally unfair. The Fed should insist that interest be paid only on excess reserves held by the commercial banks, with zero interest on required reserves. Once the dust has settled, the question of the appropriate way to tax the commercial banks and fund the Fed can be addressed at leisure.

**III.2a(xi) Limiting the damage of the current crisis versus worsening the prospects for the next crisis**

There can be little doubt that the Fed has done many things right as regards dealing with the immediate liquidity crisis. First, it used its existing facilities to accommodate the increased demand for liquidity. It extended the maturity of its discount window loans. It widened the range of collateral it would accept in repos and at the discount window. It created additional term facilities for existing counterparties through the TAF. It increased the range of eligible counterparties by creating the TSLF and the PDCF and it extended discount window access to Fannie and Freddie. It also stopped a run on investment banks by bailing out Bear Stearns.

However, the way in which some of these 'putting-out-fires-manoeuvres' were executed seems to have been designed to maximise bad incentives for future reckless lending and borrowing by the institutions affected by them. Between the TAF, the TSLF, the PDCF, the rescue of Bear Stearns and the opening of the discount window to the two GSEs, the Fed and the US tax payer have effectively underwritten directly all of the 'household name' US banking system – commercial banks and investment banks – and probably also, indirectly, most of the other large highly leveraged institutions.

This was done without the extraction of any significant quid-pro-quo and without proportional and appropriate pain for shareholders, directors, top managers and creditors of the institutions that benefited. The privilege of access to Fed resources was extended without a matching expansion of the regulatory constraints traditionally put on counterparties enjoying this access. Specifically, the new beneficiaries been made subject to a Special Resolution Regime analogous to that managed by the FDIC for federally insured commercial banks.

The valuation of the collateral for the TSLF and the PDCF by the clearer acting for the borrowing primary dealer seems designed to maximise adverse selection. The discount rate cuts were infra-marginal transfer payments from the tax payers to the shareholders of banks already using or planning to use the discount window facilities. Asking for the decision to pay interest on bank reserves to be brought forward without insisting that required reserved remain non-remunerated likewise represents an unnecessary boon for the banking sector.

**III.2a(xii) Cognitive regulatory capture of the Fed by vested interests**

In each of the instances where the Fed maximised moral hazard and adverse selection, obviously superior alternatives were available – and not just with the benefit of hindsight. Why did the Fed not choose these alternatives? I believe a key reason is that the Fed listens to Wall Street and believes what it hears; at any rate, the Fed acts as if it believes what Wall Street tells it. Wall Street tells the Fed about its pain, what its pain means for the economy at large and what the Fed ought to do about it. Wall Street's pain was indeed great – deservedly so in many cases. Wall Street engaged in special pleading by exaggerating the impact on the wider economy of the rapid deleveraging (contraction of the size of the balance sheets) that was taking place. Wall Street wanted large rate cuts fast to assist it in its solvency repairs,

not just to improve its liquidity, and Wall Street wanted the provision of ample liquidity against overvalued collateral. Why did Wall Street get what it wanted?

Throughout the 12 months of the crisis, it is difficult to avoid the impression that the Fed is too close to the financial markets and leading financial institutions, and too responsive to their special pleadings, to make the right decisions for the economy as a whole. Historically, the same behaviour has characterised the Greenspan Fed. It came as something of a surprise to me that the Bernanke Fed, if not quite a clone of the Greenspan Fed, displays the same excess sensitivity to Wall Street concerns.

The main recent evidence of Fed excess sensitivity to Wall Street concerns are, in addition to the list of quasi-fiscal features of the liquidity-enhancing measures listed in Section III.2a(xi), (1) the excessive cumulative magnitude of cuts in the official policy rate since August 2007 (325 basis points), and especially the 75 basis points cut on January 21/22 2008.

As regards the 'panic cut', the only 'news' that could have prompted the decision on 21 January, 2008 to implement a Federal Funds target rate cut of 75 bps, at an unscheduled meeting, and to announce that cut out of normal working hours the next day was the high-frequency movement in stock prices and the palpable fear in the financial sector that the stock market rout in Europe on Monday 21th January 2008 (a US stock market holiday) and at the end of the previous week, would spill over into the US markets.[30]

To me, both the cumulative magnitude of the official policy rate cuts and their timing provide support for what used to be called the 'Greenspan put' hypothesis, but should now be called the 'Greenspan-Bernanke put' or 'Fed put' hypothesis.[31] A complete definition of the 'Greenspan-Bernanke put' is as follows: it is the aggressive response of the official policy

[30] Apparently the French central bank President had not bothered to inform his US counterpart, that a possible reason behind the stock market rout in Europe could be the manifestation of the stock sales prompted by the discovery at the Société Generale bank of the Kerviel exploits. If true it is extraordinary.

[31] The term was coined as a characterisation of the interest rate cuts in October and November 1998 following the collapse of Long Term Capital Management (LTCM).

rate to a sharp decline in asset prices (especially stock prices) and other manifestations of financial sector distress, even when the asset price falls and financial distress (a) are unlikely to cause future economic activity to weaken by more than required to meet the Fed's mandate and (b) do not convey new information about future economic activity or inflation that would warrant interest rate cuts of the magnitude actually implemented.

Mr Greenspan and many other 'put deniers' are correct in drawing attention to the identification problems associated with establishing the occurrence of a 'Greenspan-Bernanke put'. The mere fact that a cut in the policy rate supports the stock market does not mean that the value of the stock market is of any inherent concern to the policy maker. This is because of the causal and predictive roles of asset price changes. Falling stock market prices reduce wealth and weaken corporate investment; falling house prices reduce the collateral value of residential property and weaken housing investment. Forward-looking stock prices can anticipate future fundamental developments and thus be a source of news.

Nevertheless, looking at the available data as a historian, and constructing plausible counterfactuals as a 'laboratory economist', it seems pretty evident to me, that the Fed under both Greenspan and Bernanke has cut rates more vigorously in response to sharp falls in stock prices than can be rationalised with the causal effects of stock prices on household spending and private investment, or with the predictive content of unexpected changes in stock prices.

Both the1998 LTCM and the January 21/22, 2008 episodes suggest that the Fed has been co-opted by Wall Street - that the Fed has effectively internalised the objectives, concerns, world view and fears of the financial community. This socialisation into a partial and often highly distorted perception of reality is unhealthy and dangerous.

It can be called *cognitive regulatory capture (or cognitive state capture),* because it is not achieved by special interests buying, blackmailing or bribing their way towards control of

the legislature, the executive, the legislature or some important regulator or agency, like the Fed, but instead through those in charge of the relevant state entity internalising, as if by osmosis, the objectives, interests and perception of reality of the vested interest they are meant to regulate and supervise in the public interest.

The literature on regulatory capture, and its big brother, state capture, is vast (see e.g. Stigler (1971), Levine and Forrence (1990), Laffont and Tirole (1991), Hellman et. al. (2000) and Hanson and Yosifon (2003)). Capture occurs when bureaucrats, regulators, judges or politicians instead of serving the public interest as they are mandated to do, end up acting systematically to favour specific vested interests – often the very interests they were supposed to control or restrain in the public interest. The phenomenon is theoretically plausible and empirically well documented. Its application to the Fed is also not new. There is a long-standing debate as to whether the behaviour of the Fed during the 1930s can be explained as the result of regulatory capture (see e.g. Epstein and Ferguson (1984) and Philip et. al. (1991)).

The conventional choice-theoretic public choice approach to regulatory capture stresses the importance of collective action and free rider considerations in explaining regulatory capture (see Olsen (1965)). Vested interests have a concentrated financial stake in the outcomes of the decisions of the regulator. The general public individually have less at stake and are harder to organise. I prefer a more social-psychological, small group behaviour-based explanation of the phenomenon. Whatever the mechanism, few regulators have succeeded in escaping in a lasting manner their capture by the regulated industry. I consider the hypothesis that there has been regulatory capture of the Fed by Wall Street during the Greenspan years, and that this is continuing into the present, to be consistent with the observed facts.

There is little room for doubt, in my view, that the Fed under Greenspan treated the stability, well-being and profitability of the financial sector as an objective in its own right, regardless of whether this contributed to the Fed's legal macroeconomic mandate of maximum employment and stable prices or to its financial stability mandate. Although the Bernanke Fed has but a short track record, its too often rather panicky and exaggerated reactions and actions since August 2007 suggest that it also may have a distorted and exaggerated view of the importance of the financial sector for macroeconomic stability.

**III.2b The ECB**

The ECB immediately injected liquidity both overnight and at longer maturities on a very large scale indeed, but, at least as regards interbank spreads, with limited success (see Chart 4), and also with no greater degree of success than the Fed or the BoE (but see Section II3b for a caution about the interpretation of the similarity in Libor-OIS spreads). The ECB's injection of € 95 billion into the Eurosystem's money markets on August 9, 2007, is viewed by many as marking the start of the crisis.[32]

As regards the effectiveness of its liquidity-enhancing open market interventions on the immediate crisis (as opposed to the likelihood and severity of future crises) the ECB has been both lucky and smart. It was lucky because, as part of the compromise that created the supranational European Central Bank, the set of eligible collateral for open market operations and at the discount window and the set of eligible counterparties, were defined as the union rather than the intersection of the previous national sets of eligible collateral and eligible counterparties.[33]

As a result, the ECB could accept as collateral in its repos and at the discount window a very large set of securities, including private securities (even equity) and asset-backed

[32] Short-term credit markets froze up after the French bank BNP Paribas suspended withdrawals from three investment funds/hedge funds it owned, citing problems in the US sub-prime mortgage sector. BNP said it could not value the assets in the funds, because the markets for pricing the assets had disappeared.
[33] Eleven countries joined together to form the Eurosystem on January 1, 1999. There are 15 euro area members now and 16 on January 1, 2009 when Slovakia joins.

securities like residential mortgage-backed securities. The ratings requirements were also very loose compared to those of the Bank of England and even those of the Fed: eligible securities had to be rated at least in the single A category. The only dimension in which the ECB's eligible collateral was more restricted than the Bank of England's was that the ECB only accepts euro-denominated securities. More than 8000 banks were subject to the minimum reserve requirements of the Eurosystem and are therefore are eligible counterparties for Eurosystem open market operations and have access to its discount window.

The ECB was smart in using the available liquidity instruments quite aggressively, injecting above-normal amounts of liquidity against a wide range of collateral at longer maturities (and mopping most of it up again in the overnight market). It is important to note that injecting *X* amount of liquidity at the 3-month maturity and taking *X* amount of liquidity out at the overnight maturity is not neutral if the intensity of the liquidity crunch is not uniform across maturities. The liquidity crunch that started in August 2007 clearly was not. Maturities of around 1 month were crucial for end-of-year reasons and maturities from 3 months to a year were crucial because that was where the markets had seized up completely. The ECB consciously tried to influence Euribor-OIS spreads to the extent that it interpreted these as reflecting illiquidity and liquidity risk rather than credit risk.

No major Euro Area bank has failed so far. Some small German banks fell victim to unwise investments in the ABS markets, and some fairly small hedge funds failed, but no institution of systemic importance was jolted to the point that a special-purpose LLR rescue mission had to be organised.

I have one concern about the nature of the ECB's liquidity-oriented open market operations and about its collateral policy at the discount window. This concerns the pricing of illiquid collateral offered by banks. We know the interest rates and fees charged for these

operations, and the haircuts applied to the valuations. But we don't know the valuations themselves. The ECB uses market prices when a functioning market exists. For some of the assets it accepts as collateral there is no market benchmark.

The ECB does not make the mistake the Fed makes in its pricing of the collateral offered at the PDCF and TSLF. The ECB *itself* determines the price/valuation of the collateral when there is no market price. But the ECB does not tell us what these prices are, nor does it put in the public domain the models or methodologies it uses to price the illiquid securities. Requests to ECB Governing Council members and to ECB and NCB officials to publish the models used to price illiquid securities and to publish, with an appropriate delay to deal with commercial sensitivity, the actual valuations of specific, individual items of collateral have fallen on deaf ears.

There is therefore a risk that banks use the ECB as lender of first resort rather than last resort, if the banks can dump low-grade collateral on the Fed and have it valued as high-grade collateral.[34] Since at least the beginning of 2008, persistent market talk has it that Spanish and Dutch banks may be in that game, getting an effective subsidy from the ECB and becoming overly dependent on the ECB as the funding source of first choice.

Late May 2008, Fitch Ratings reported that Spanish banks had, during recent months, created ABS, structured to be eligible for use as collateral with the ECB (strictly, with the NCBs that make up the Eurosystem), that were riskier than the ABS structures they put together before the crisis. Accepting higher-credit risk collateral need not imply a subsidy from the Eurosystem to the banks, as long as the valuation or pricing of these securities for collateral purposes reflects the higher degree of credit risk attached to them. One wonders whether such risk-sensitive pricing is actually taking place, especially when ECB officials

[34] The probability of default on a collateralised loan like a repo is the joint probability of both the borrowing bank defaulting and the issuer of the security used as collateral defaulting. The probability of such a double default will be low but not zero under current circumstances. It may be quite high, when RMBS are offered as collateral, if the borrowing bank is also the bank that originated the mortgages backing the RMBS.

publicly worry about the creditworthiness of securities accepted as collateral by the ECB when it provides liquidity to the markets or at the discount window.

As long as the risk-adjusted rate of return the ECB gets on its loans is appropriate, there is nothing inherently wrong with the ECB taking credit risk onto its balance sheet. But if it routinely values the mortgage-backed securities offered by the Spanish banks as if the mortgages backing the securities were virtually free of default risk, then the ECB is bound to be overvaluing the collateral it is offered. In the first half of 2008, Spanish commercial banks, heavily exposed to the Spanish construction and housing sector, are reported to have repoed at least € 46 bn worth of their (often illiquid) assets in exchange for ECB liquidity. Participants in these repo transactions have told me that no mortgages offered, directly or indirectly, to the Eurosystem as collateral have been priced at less than 95 cents on the euro. This seems generous given the dire straits the Spanish economy, and especially the housing and construction sector, now are in. Of course, haircuts are (as always) applied to these valuations.

It is essential that all the information required to verify whether the pricing of collateral accepted by the Eurosystem is subsidy-free be in the public domain. That information is not available today.

Because part of the collateral offered the Eurosystem is subject to default risk, there could be a case for concern even if *ex-ante*, the default risk is appropriately priced. In the event a default occurs (that is, if both the counterparty borrowing from the Eurosystem defaults and at the same time the issuer of the collateral defaults), the Eurosystem will suffer a capital loss. In practice, it would be one of the NCBs of the euro area that would suffer the loss rather than the ECB, as repos are conducted by the NCBs.

Although the ECB's balance sheet is small and its capital tiny, the consolidated Eurosystem has a huge balance sheet and a large amount of capital (see Table 6). The

balance sheet could probably stand a fair-sized capital loss. But there always is a capital loss so large that it would threaten the ability of the Eurosystem to remain solvent while adhering to its price stability mandate. The ECB/Eurosystem would need to be recapitalised, but by which national fiscal authorities and in which proportions? Unlike the Fed and the Bank of England, where it is clear which fiscal authority stands behind the central bank, that is, stands ready to recapitalise the central bank should the need arise, the fiscal vacuum within which the ECB, and to some degree the rest of the Eurosystem also, operate, leaves a question mark behind the question: who would bail out the ECB?

This question may not yet be urgent now, because even euro-area banks with large cross-border activities still tend to have fairly clear national identities. But this is changing. Banca Antonveneto, the fourth largest Italian bank, is owned by ABN-AMRO, a Dutch bank which is now in turn owned by Royal Bank of Scotland (UK), Fortis (Belgium) and Santander (Spain). Would the Italian Treasury bail out Banca Antonveneto? Soon there will be banks incorporated not under national banking statutes but under European Law, as *Societas Europaea*. One large German financial group with banking interests, Allianz, has already done so. Given this uncertainty, it may be understandable that ECB officials are more concerned than Fed and Bank of England officials about carrying credit risk on the Eurosystem's balance sheet.

Although the ECB has done well in its MMLR function, albeit with the major caveat as regards the pricing of illiquid collateral, its LLR ability has not yet been tested. This is perhaps just as well. The ECB has no formal supervisory or regulatory role vis-a-vis euro area banks. The Treaty neither rules out such a role nor does it require one. In practice, no regulatory and supervisory role for the ECB has as yet evolved. Banking sector regulation and supervision in the euro area is a mess. In some countries the central bank is regulator and supervisor. Spain, France, Ireland and the Netherlands are examples. In others the central

bank shares these roles with another agency. Germany is an example with the Bundesbank and Federal Banking Supervisory Office (FBSO) sharing supervisory responsibilities. In yet other countries the central bank has no regulatory and supervisory role at all. Austria and Belgium are examples.

Since the crisis started, the ECB has complained regularly, and at times even publicly, about the lack of information it has at its disposal about potentially systemically important individual institutions. In the case of some euro area national regulators, there even exist legal obstacles to sharing information with the ECB. Compared to the Fed and the Bank of England, the ECB is therefore very close to the Bank of England which, when the crisis started, had essentially no individual institution-specific information at its disposal. The Fed, with its (shared) regulatory and supervisory role, has better information.

On the other hand, the ECB appears much less moved by the special pleading emanating from the euro area financial sector than the Fed appears to be by Wall Street. This is not surprising. Without a supervisory or regulatory role over euro area financial institutions and markets, regulatory capture is less likely.

**III.2c The Bank of England**

As regards the fulfilment of its LLR and MMLR functions, the Bank of England missed the boat completely at the beginning of the crisis. This state of affairs lasted till about November 2007. Indeed, the Governor of the BoE did not, as far as I have been able to ascertain, use in public the words 'credit crunch', 'liquidity crisis' or equivalent words until March 26, 2008 (King (2008)).

The UK turned out, when the run on Northern Rock started on September 15, 2007, to have no effective deposit insurance scheme. The amounts insured were rather low (up to £30,000) and had a 10 percent deductible after the first £2000. Worse, it could take up to six

months to get your money out, even if it was insured. This is supposed to be corrected by new legislation and institutional reform.

The Bank of England also turned out to be hopelessly (and quite unnecessarily) confused about what its legal powers and constraints were in the exercise of its LLR role. The Governor, for instance, argued on September 20, 2007, before the House of Commons Treasury Committee, that legislation introduced under an EU directive (the Market Abuse Directive) prevented covert support to individual institutions. There was no legal basis for that belief. These errors of judgement stopped the BoE from offering covert support to Northern Rock. Finally, there was no Special Resolution Regime for banks in the UK. There was therefore just the choice between the regular corporate insolvency regime and nationalisation. On February 18, 2008, the Chancellor announced the nationalisation of Northern Rock.

The BoE's performance as lender of last resort, including its covert role in orchestrating private sector support for individual troubled institutions, was much more effective when Bradford & Bingley (a British mortgage lender whose exposure to the wholesale markets was second only to that of Northern Rock) got into heavy weather with a rights issue in May and June 2008.[35] Neither Northern Rock nor Bradford & Bingley were in any sense systemically important institutions, but when HBOS, the 4th largest UK banking group by market capitalisation experienced trouble with its £4billion rights issue (announced in April 2008), during June and July 2008, systemic stability was clearly at stake. The Bank of England and the banking and financial sector regulator, the Financial Services Authority (FSA), helped keep the underwriters on board.

As noted earlier, both at its discount window (the standing lending facility) and in repos, the BoE only accepted (and accepts) the narrowest possible kind of collateral (UK

[35] Bradford & Bingley's £400m cash call closed on Friday, August 15, 2008. The six high street banks that, at the prompting of the BoE and the FSA had agreed to underwrite the rights issue, are likely to be left with sizeable unplanned stakes in B&B.

sovereign debt or better). This made it impossible for the BoE to offer effective liquidity support when markets froze.

For a long time, the Bank of England spoke in public as if it believed that what the banks were facing was essentially a solvency problem, with no material contribution to the financial distress coming from illiquid markets and from illiquid but solvent institutions (see e.g. the paper submitted to the Treasury Committee by Mervyn King on 12 September 2007, the day before the Northern Rock crisis blew up (King (2007)).

When the crisis started, the Bank of England injected liquidity on a modest scale, at first only in the overnight interbank market. Rather late in the day, on September 19, 2007, it reversed this policy and offered to repo at 3-month maturity, and against a wider than usual range of eligible collateral, including prime mortgages, but subject to an interest rate floor 100 basis points above Bank Rate, that is, effectively at a penalty rate, regardless of the quality of the collateral. No one came forward to take advantage of this facility; fear of being stigmatised may have been as important a deterrent as the penalty rate charged.

The Bank was extremely reluctant to try to influence, let alone target, interest rates at maturities longer than the overnight rate. It is true that, when markets are orderly and liquid, the authorities cannot independently set more than one rate on the yield curve. When the BoE sets the overnight rate, this leaves rates at all longer maturities to be market-determined, that is, driven by fundamentals such as market expectations of future official policy rates and default risk premia. When markets are disorderly and illiquid, however, there is a term structure of liquidity risk premia in addition to a term structure of default-risk-free interest rate and a term structure of default risk premia. It is the responsibility of the central bank, as MMLR, to provide the public good of liquidity in the amounts required to eliminate (most of) the liquidity risk premia at the maturities that matter (anything between overnight and one year).

Early in the crisis, the Bank of England's public statements suggested that it interpreted most the spread between Libor and the OIS rate at various maturities as default risk spreads rather than, at least in part, as liquidity risk spreads. Later during the crisis, in February 2008, the BoE published, in the February Inflation Report (Bank of England (2008)), a decomposition of the 1-year Libor-OIS spread between a default risk measure (extracted from CDS spreads) and a liquidity premium (the residual). It concluded that although early in the crisis most of the Libor-OIS spread was due to liquidity premia, towards the end of the sample period the importance of default risk premia had increased significantly.

The decomposition is, unfortunately, flawed because the CDS market throughout the crisis has itself been affected significantly by illiquidity. The paper is, however, of interest as evidence of the evolving and changing views of the BoE as to the empirical relevance of liquidity crises. This changing view was also reflected in an evolving policy response. The Bank of England gradually began to act as a MMLR.

At the end of 2007, the Bank initiated a number of special auctions at one-month and three-month maturities against a wider range of collateral, including prime mortgages and securities backed by mortgages.

On April 21, 2008 the Bank announced the creation of the Special Liquidity Scheme (SLS), in the first instance for £100bn, which would lend Treasury bills for one year to banks against collateral that included RMBS, covered bonds (that is, collateralised bonds) and asset ABS based on credit card receivables. Technically, the arrangement was described as a swap, although it can fairly be described as a one-year collateralised loan of Treasury bills to the banks. It is similar to the TSLF created for primary dealers in the US, although the maturity of the loans is longer (one year as against one month in the US).

The Bank of England has made much of the fact that the SLS will only accept as collateral securities backed by 'old' mortgages, that is, mortgages issued before the end of 2007. The facility is meant to solve the 'stock overhang' problem but not to encourage the banks to engage in new mortgage lending using the same kind of RMBS that have become illiquid. It is, however, not obvious that without the government (not necessarily the Bank of England) lending a hand, securitisation of new mortgages will get off the ground any time soon.

Accepting new mortgage-backed securities as collateral in repos might help revive sensible forms of securitisation, if the mortgages backing the securities satisfy certain verifiable criteria (loan to value limits, income and financial health verification for borrowers, no track record of loan default etc.). It is true that in the UK, and *a-fortiori* in the US, there was, prior to the summer of 2007, securitisation of home loans that ought never to have been made, including most of the US subprime loans. But the fact that, since the crisis started, there has been just one new residential mortgage-backed issue in the markets in the UK, suggests that the securitisation baby has been thrown out with the subprime bathwater. These securities should, of course, be valued aggressively if offered as collateral in repos, to avoid subsidies to home lenders or home borrowers.

The Bank of England itself determines the valuation of any illiquid assets offered as collateral in the SLF. This should help it avoid the adverse selection problem created by the Fed with its PDCF and TSLF. The haircuts and other terms of the SLS were also quite punitive, judging from the howls of anguish emanating from the banking community, who nevertheless make ample use of the Facility. As with the Fed and the ECB, the Bank of England does not make public any information about the actual pricing of specific collateral or about the models used to set these prices. Without that information, we cannot be sure there is no subsidy to the banks involved in the arrangement. There can also be no proper

accountability of the Bank to Parliament or to the public for the management of public funds involved.

It is clear that the so-called Tripartite Arrangement between the Treasury, the Bank of England and the FSA did not work. It is also clear, however, that these are the three parties that must be involved and must cooperate to achieve financial stability. The central bank has the short-term liquid deep pockets and the market knowledge. The Treasury, backed by the tax payer, has the long-term deep non-inflationary pockets. The FSA has the individual institution-specific knowledge. The problems in the UK had more to do with failures in the legal framework (deposit insurance, lender of last resort immunities, the insolvency regime and SRR for banks) than with poor communication and cooperation between the central bank, the regulator and the Treasury.

# IV Conclusion

Following a 15 year vacation in inflation targeting land with hardly a hint of systemic financial instability, the central banks in the north Atlantic region were, in the middle of 2007 faced with the unpleasing combination of a systemic financial crisis, rising inflation and weakening economic activity. Fighting three wars at the same time was not something the central banking community was prepared for. The performance of the central banks considered in this paper, the Fed, the ECB and the Bank of England, ranged, not surprisingly, from not too bad (the ECB) to not very good at all (the Fed).

As regards macroeconomic stability, the interest rate decisions of the Fed are hard to rationalise in terms of its official mandate (sustainable growth/employment and price stability). This is not the case for the ECB and the Bank of England, with their lexicographic price stability mandates. The excessively aggressive interest rate cuts of the Fed reflect political pressures (the Fed is the least operationally independent of the three central bank),

excess sensitivity to financial sector concerns (reflecting cognitive regulatory capture) and flaws in the understanding of the transmission mechanism by key members of the FOMC.

As regards financial stability, an ideal central bank would have combined the concern about moral hazard of the Bank of England with the broad sets of eligible counterparties and eligible instruments that enabled the ECB, right from the start of the crisis, to be an effective market maker of last resort, and the institution-specific knowledge that made the Fed an effective lender of last resort. The reality has been that the Bank of England mismanaged liquidity provision as market maker of last resort and as lender of last resort early in the crisis and the Fed has created moral hazard in an unprecedented way. Until the public is informed in detail about the way the three central banks price the illiquid collateral they are offered (at the discount window, in repos and at any of the many facilities and schemes that have been created), there has to be a concern that all three central banks (and therefore indirectly the tax payers and beneficiaries of other public spending) are subsidising the banks through these LLR and MMLR facilities. This concern is most acute as regards the Fed, whose valuation procedures at the TSLF and PDCF are an open invitation to adverse selection.

As regards the desirability of institutionally combining or separating the roles of the central bank (as lender of last resort and market maker of last resort) and that of regulator and supervisor for the financial sector, we are between a rock and a hard place. A regulator and supervisor (like the Fed) is more likely to have the institution-specific information necessary for the effective performance of the LLR role. However, regulatory capture of the regulator/supervisor is likely.

Central banks without regulatory or supervisory responsibilities like the Bank of England (for the time being) and the ECB are less likely to be captured by vested financial sector interests. But they are also less likely to be well-informed about possible liquidity or solvency problems in systemically important financial institutions. There is unlikely to be a

fully satisfactory solution to the problem of providing central banks with the information necessary for effective discharge of their LLR responsibility without at the same time exposing them to the risk of regulatory capture. The best safeguard against capture are openness and accountability. It is therefore most disturbing that all three central banks are pathologically secretive about the terms on which financial support is made available to struggling institutions and counterparties.

Taking the official policy rate-setting decision away the central bank may reduce the damage caused by regulatory capture of the central bank by financial sector interests. Moving the rate setting authority out of the central bank could therefore be especially desirable if the central bank sis given supervisory and regulatory powers.

The market maker of last resort has the same position in relation to market liquidity for a transactions-oriented system of financial intermediation, as is held by the lender of last resort in relation to funding liquidity for a relationships-oriented system of financial intermediation. The central bank is the natural entity to fulfil both the LLR and MMLR functions.

There is an efficiency-based case for government intervention to support illiquid markets or instruments and to support illiquid but solvent financial institutions that are deemed systemically important. As the source of ultimate domestic-currency liquidity, the central bank is the natural agency for performing both the market maker of last resort and the lender of last resort function. Liquidity is a public good that can be provided privately, but only inefficiently.

There is also an efficiency-based case for government intervention to support insolvent financial institutions that are deemed systemically important. This, however, should not be the responsibility of the central bank.

The central bank should not be required to provide subsidies, either through liquidity support or any other way, to institutions known to be insolvent. If institutions deemed to be solvent turn out to be insolvent, and if the central bank as a result of financial exposure to such institutions suffers a loss, this should be compensated forthwith by the Treasury, whenever such a loss would impair the ability of the central bank to pursue its macroeconomic stability objectives.

It would be even better if any securities purchased outright by the central bank or accepted as collateral in repos and other secured transactions that are not completely free of default risk, were to be transferred immediately to the balance sheet of the Treasury (say through a swap for Treasury Bills, at the valuation put on these risky securities when they were acquired by the central bank). That way, the division of labour and responsibilities between liquidity management and insolvency management (or bail outs) is clear. Each institution can be held accountable to Parliament/Congress for its mandate. If the central bank plays a quasi-fiscal role, that clarity, transparency and accountability becomes impaired.

Central banks can effectively perform their market maker of last resort function by expanding traditional open market operations and repos. This means increasing the volumes of their outright purchases or loans and extending their maturity, at least up to a year in the case of repos. It means extending the range of eligible counterparties to include all institutions deemed systemically important (too large or too interconnected) to fail. It also means extending the range of securities eligible for outright purchase or for use as collateral to include illiquid private securities.

Regulatory instruments should be used to address financial asset market bubbles and credit booms. Specifically, supplementary capital requirements and liquidity requirements should be imposed on all systemically important highly leveraged institutions – commercial banks, investment banks, hedge funds, private equity funds or whatever else they are called

or will be called. These supplementary capital and liquidity requirements could either be managed by the central bank in counter-cyclical fashion or be structured as automatic financial stabilisers, say by making them increasing functions of the recent historical growth rates of the value of each firm's assets.

To minimise moral hazard (incentives for excessive risk-taking in the future) all institutions that are eligible counterparties in MMLR operations and/or users of LLR facilities should be regulated according to common principles and should be subject to a common Special Resolution Regime allowing for Prompt Corrective Action, including the condition of regulatory insolvency and the possibility of nationalisation.

All securities purchased outright or accepted as collateral should be priced punitively to minimize moral hazard. If necessary, the central bank should organise reverse auctions to price securities for which there is no market benchmark.

The creation and proliferation of obscure and opaque financial instruments can be discouraged through the creation of a positive list (regularly updated) of securities that will be accepted by the central bank as collateral at its MMLR and LLR facilities. Securities that don't appear on the list can be expected to trade at a discount relative to those who do.

Finally, for those whose attention span is the reciprocal of the length of this paper, some dos and don'ts for central banks

Assign specific tools to specific tasks or objectives

1. Assign the official policy rate to the macroeconomic stability objective(s).
    - Do not use the official policy rate as a liquidity management tool or as a quasi-fiscal tool to recapitalise banks and other highly leveraged entities.
2. Assign regulatory instruments to the damping of asset price bubbles.

- Do not use the official policy rate to target asset price bubbles in their own right.

3. Assign liquidity management tools, including the lender-of-last-resort and market-maker-of-last-resort instruments, to the pursuit of financial stability for counterparties believed to be solvent.
4. Use explicit fiscal tools (taxes and subsidies) and on-budget and on-balance sheet fiscal resources for strengthening the capital adequacy of systemically important institutions.
    - Do not use the central bank as a quasi-fiscal agent of the Treasury.
5. Use regulatory instruments and the punitive pricing of liquidity to mitigate moral hazard.

This past year has been the first since I left the Monetary Policy Committee of the Bank of England that I really would have liked to be a central banker.

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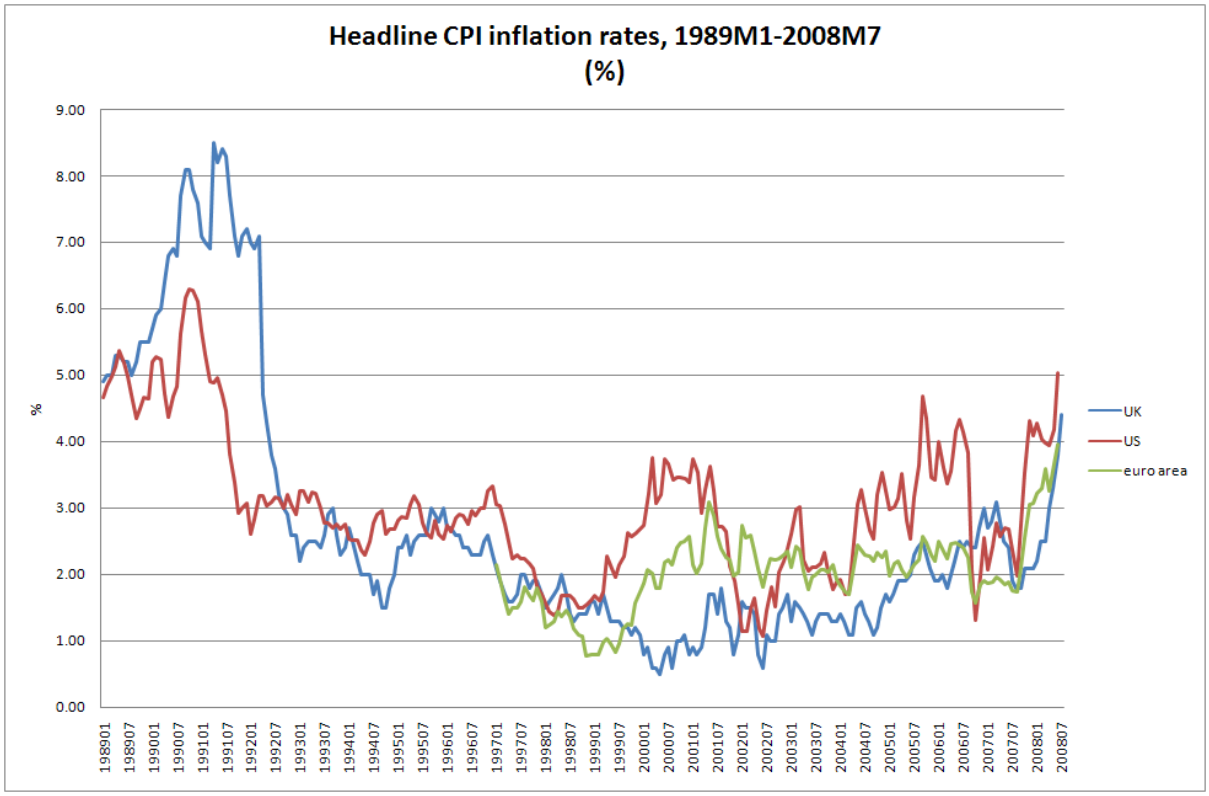
## Chart 1

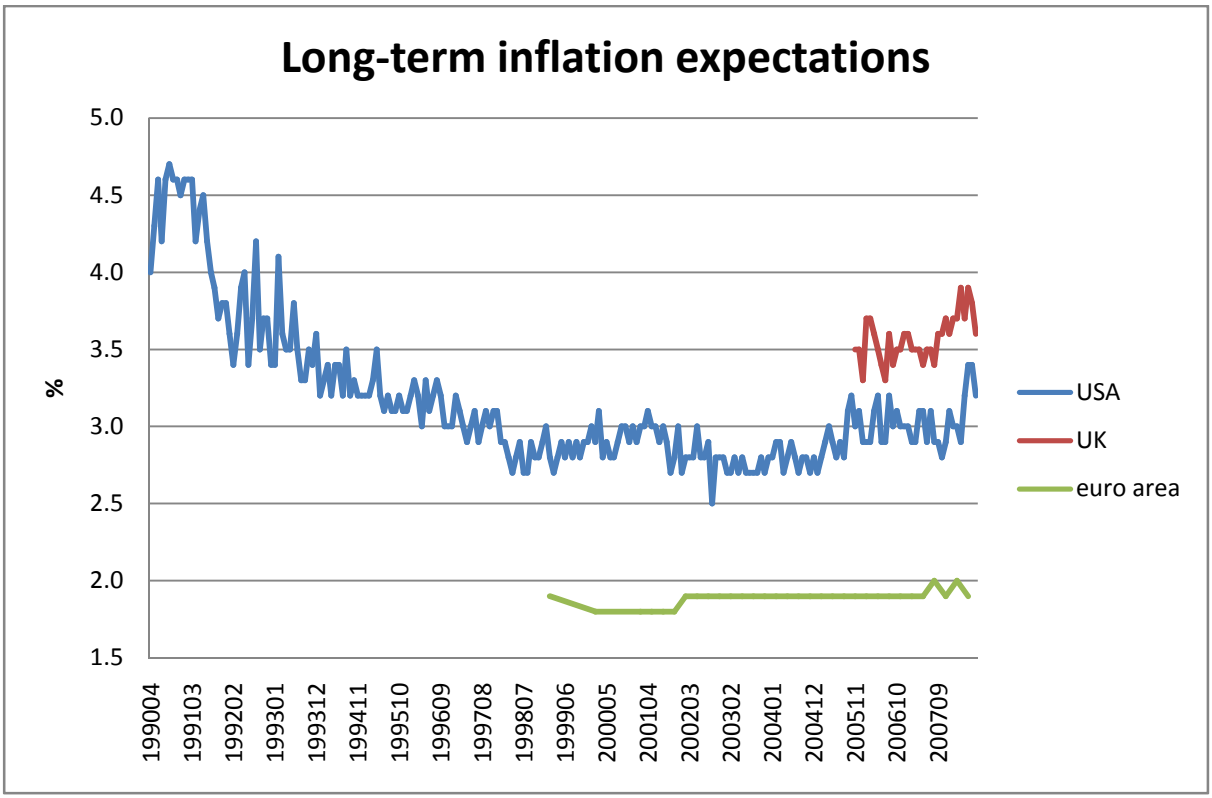



% change month on same month one year earlier
Source: UK: ONS
euro area: Eurostat
USA: BEA

## Chart 2a


Source: UK: Bank of England Bank of England/GfK NOP Inflation Attitudes Survey (median)
USA: University of Michigan Survey (median)
Euro area: ECB survey of professional forecasters (mean).

**Chart 2b**




Sources. USA: The University of Michigan 5-10 Yr Expectations: Annual Chg in Prices: Median Increase (%).
UK: YouGov\CitiGroup Inflation expectations 5-10 years ahead. Median Increase (%)
Euro area: ECB Survey of Professional Forecasters five years ahead forecast. Mean Increase (%)

**Chart 3a**

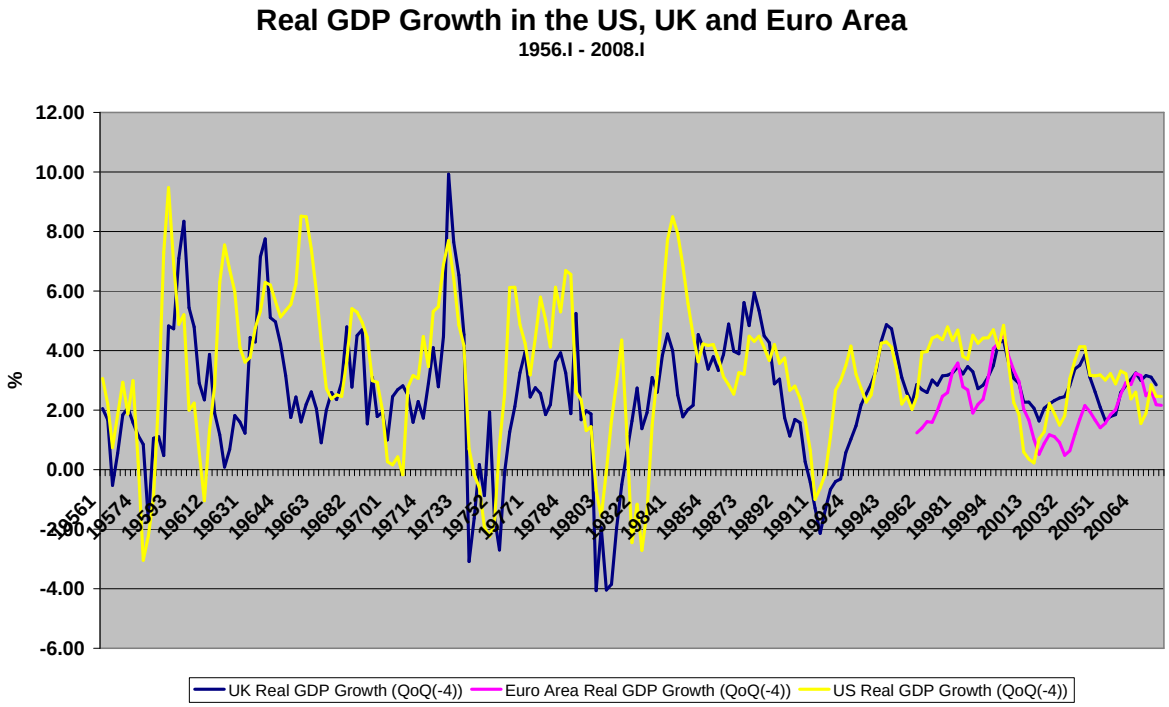
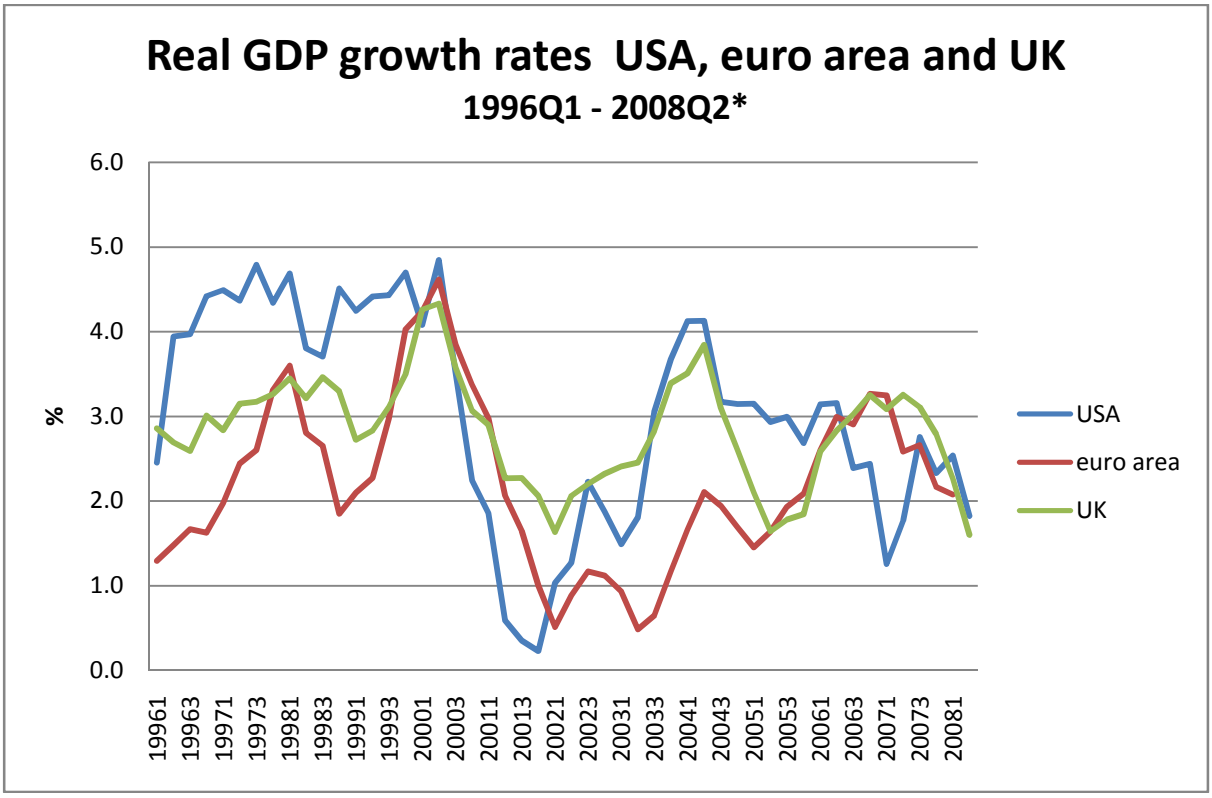


**Chart 3b**




Source: UK and euro area: Eurostat
US: Bureau of Economic Analysis
Notes: quarter on same quarter one year earlier; * for euro area, data end in 2008Q1.

**Chart 4**

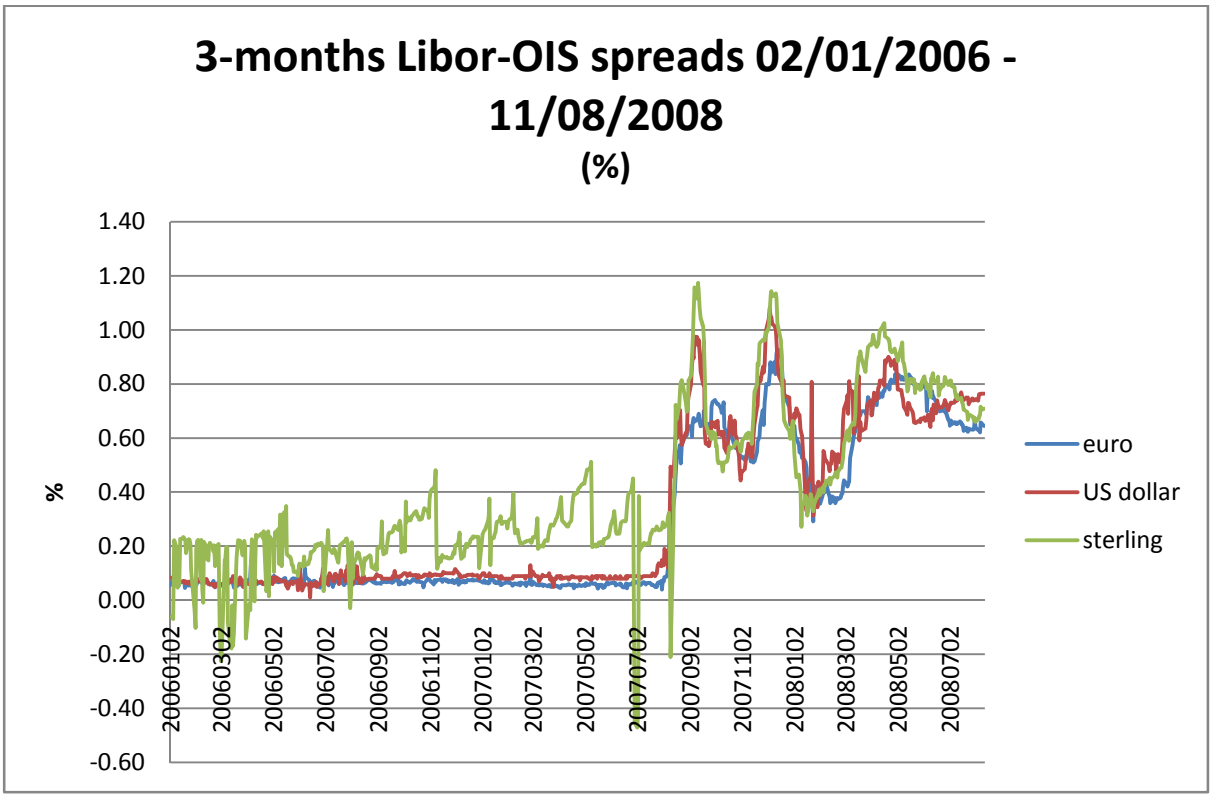


**Chart 5**

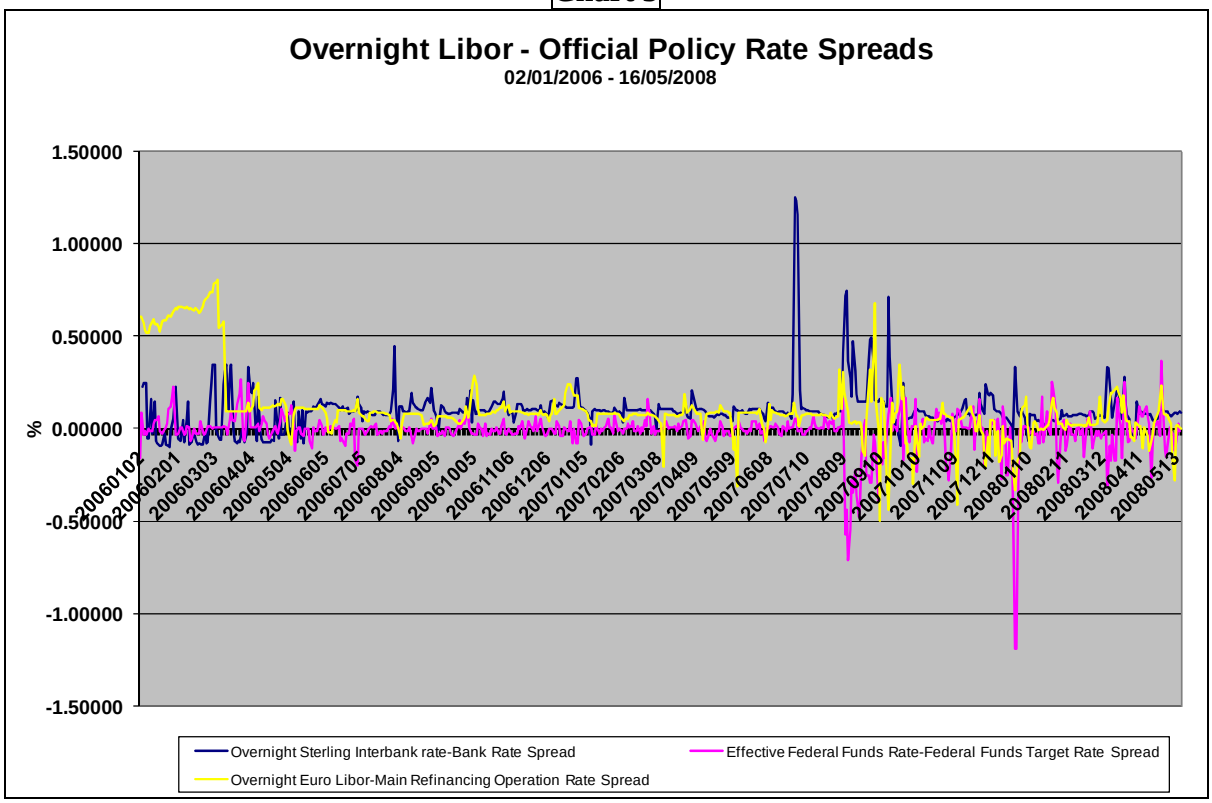
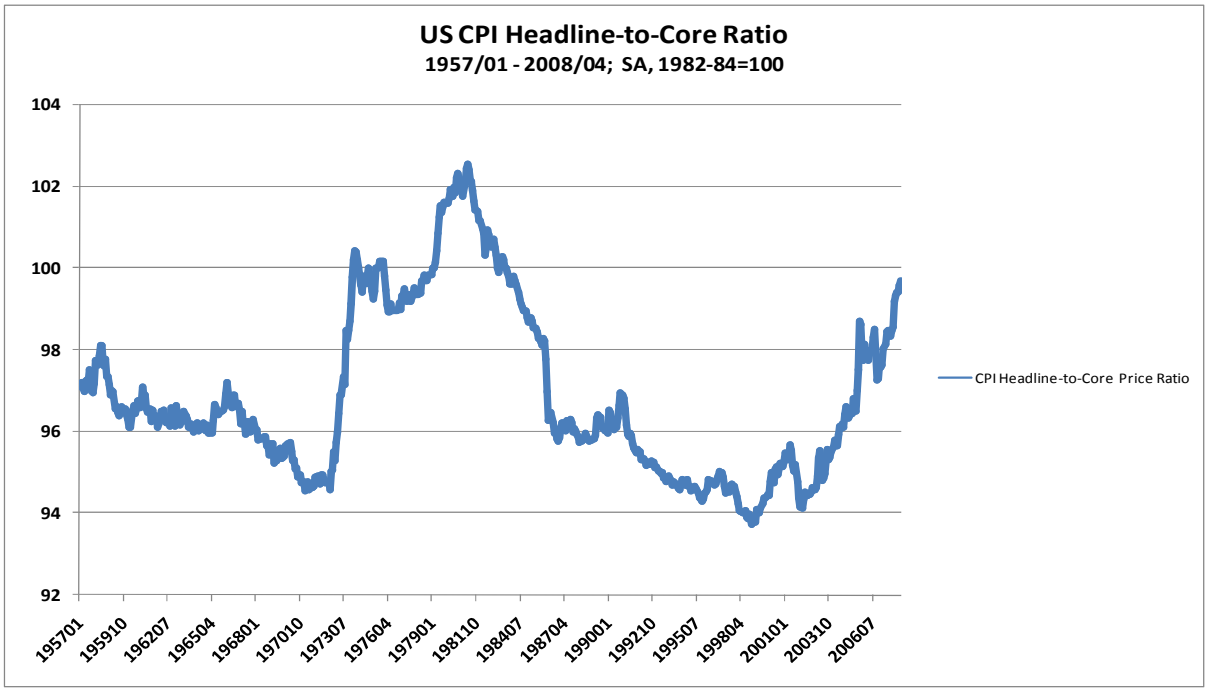
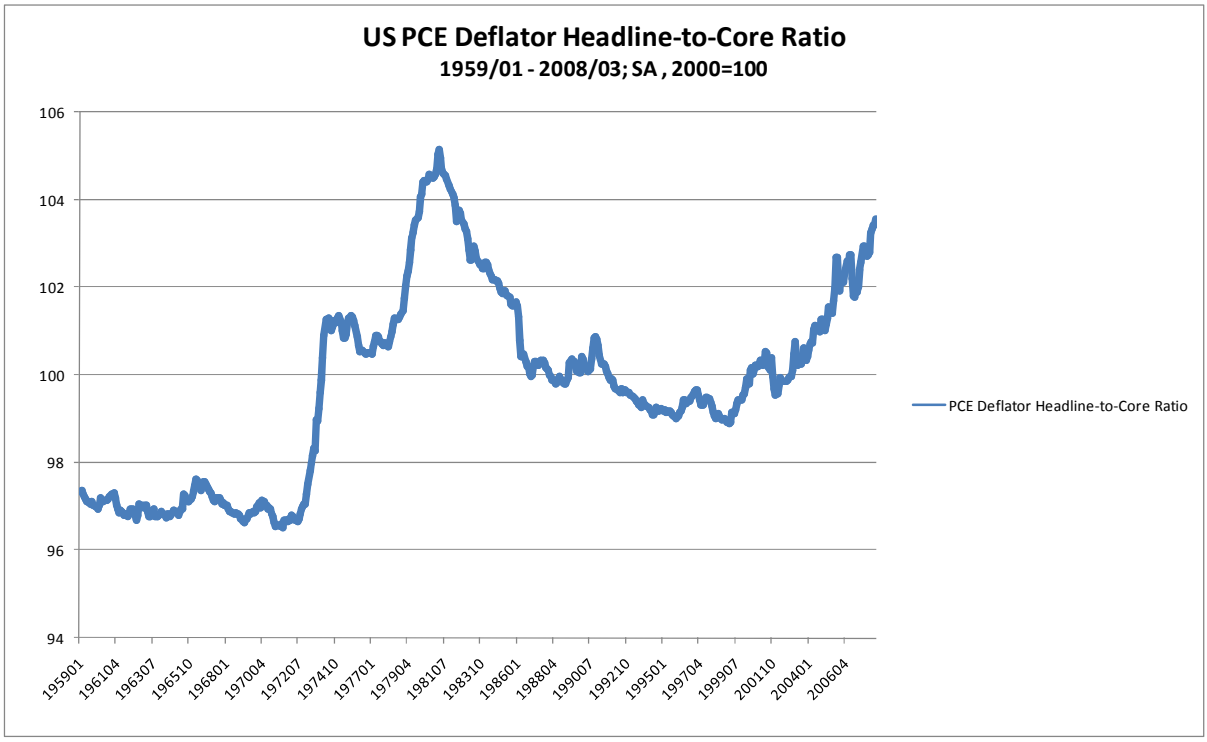



**Chart 6a**



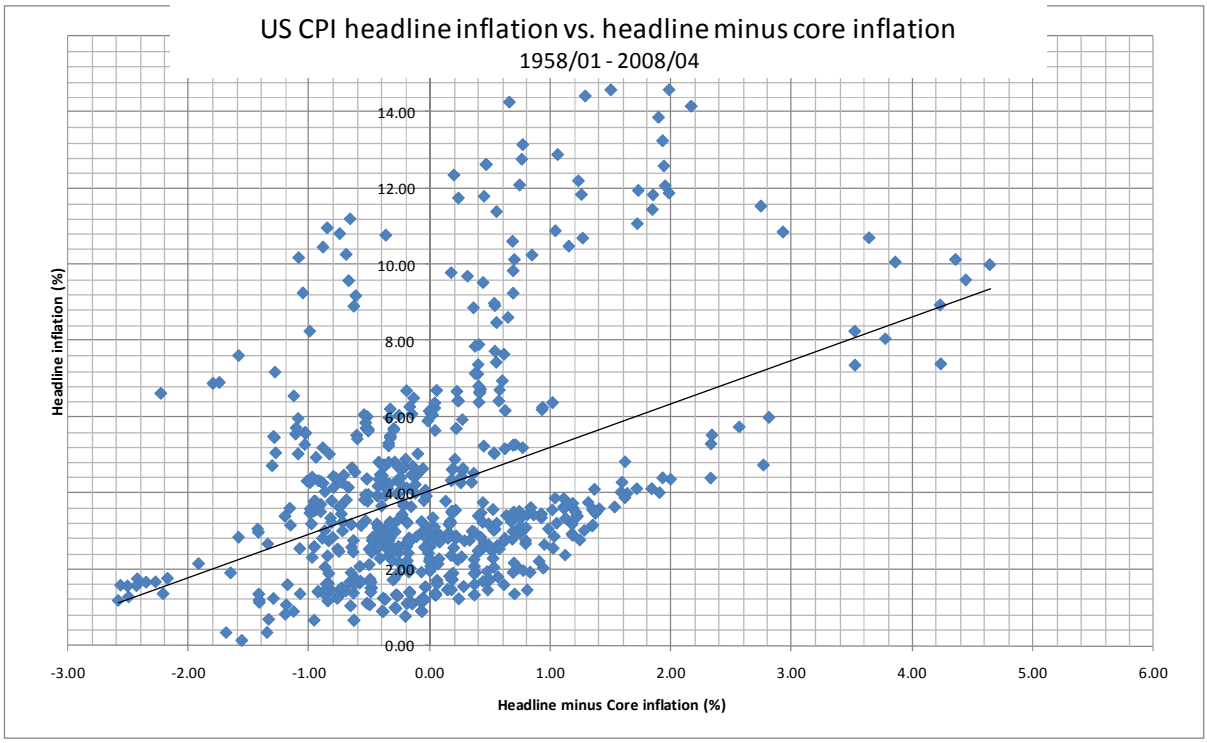

Source: Bureau of Labor Statistics

## Chart 6b



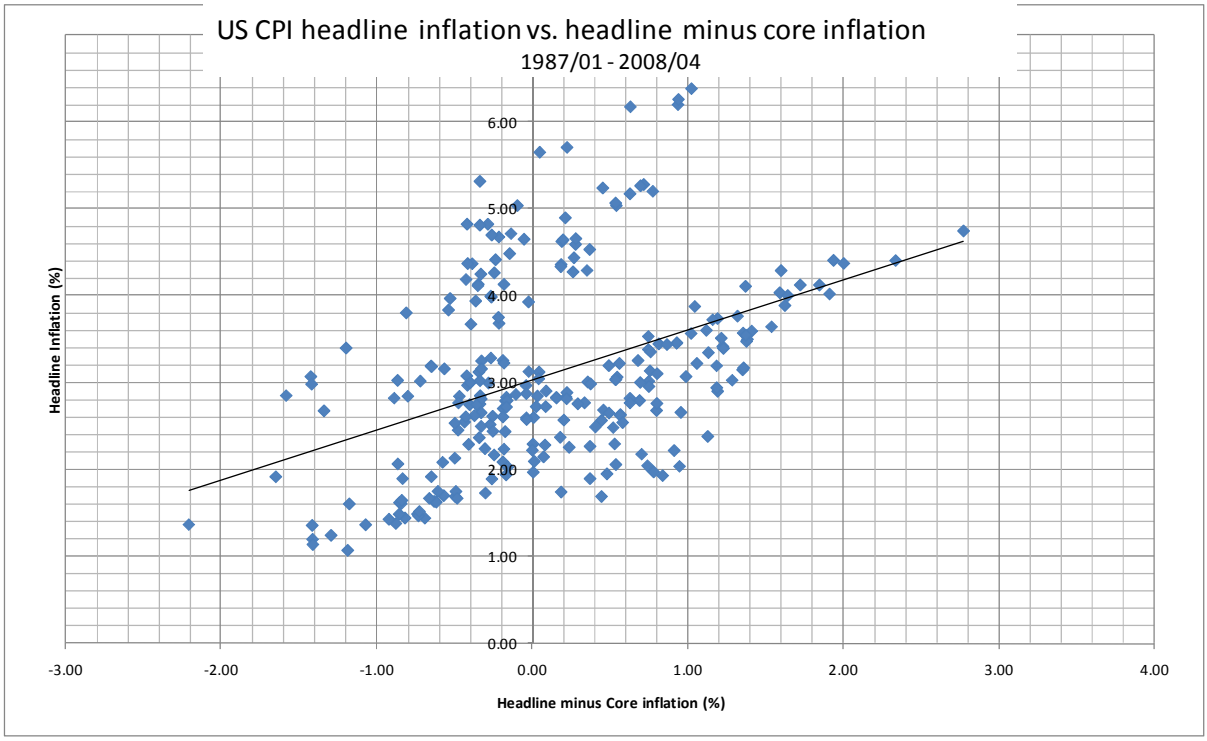

**Source: Bureau of Economic Analysis**

## Chart 7a



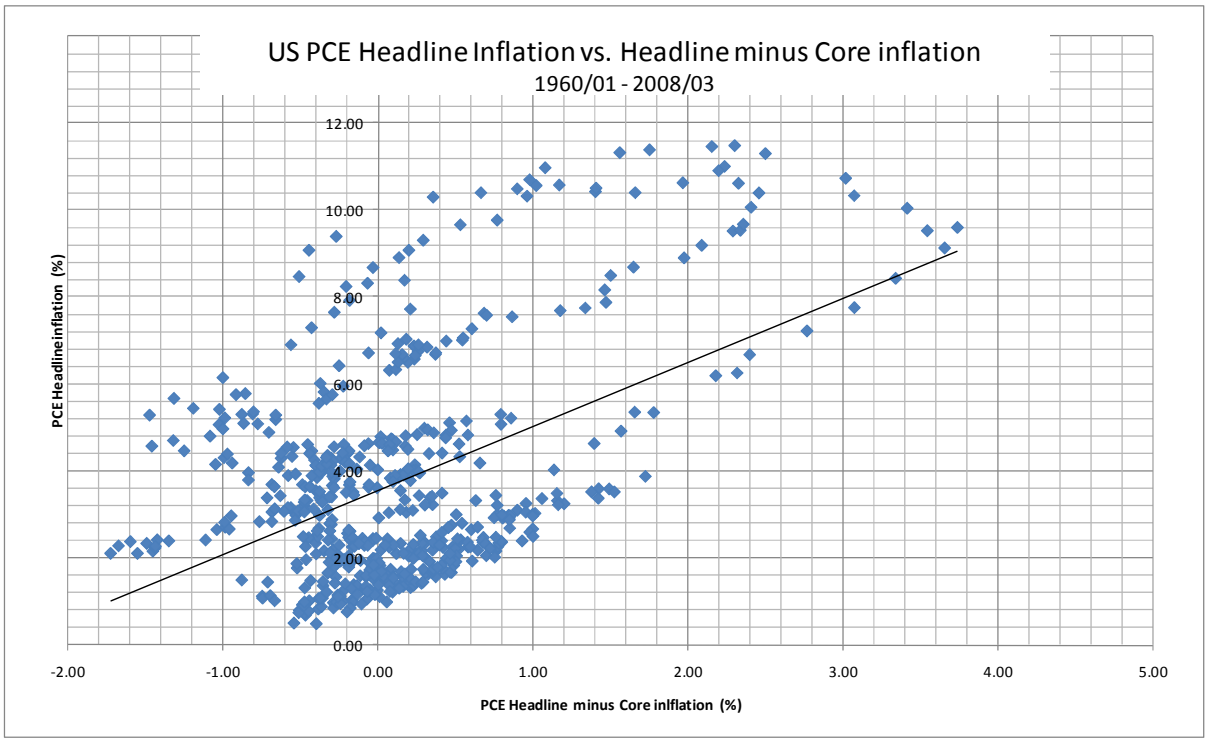

**Source: Bureau of Labor Statistics**

## Chart 7b



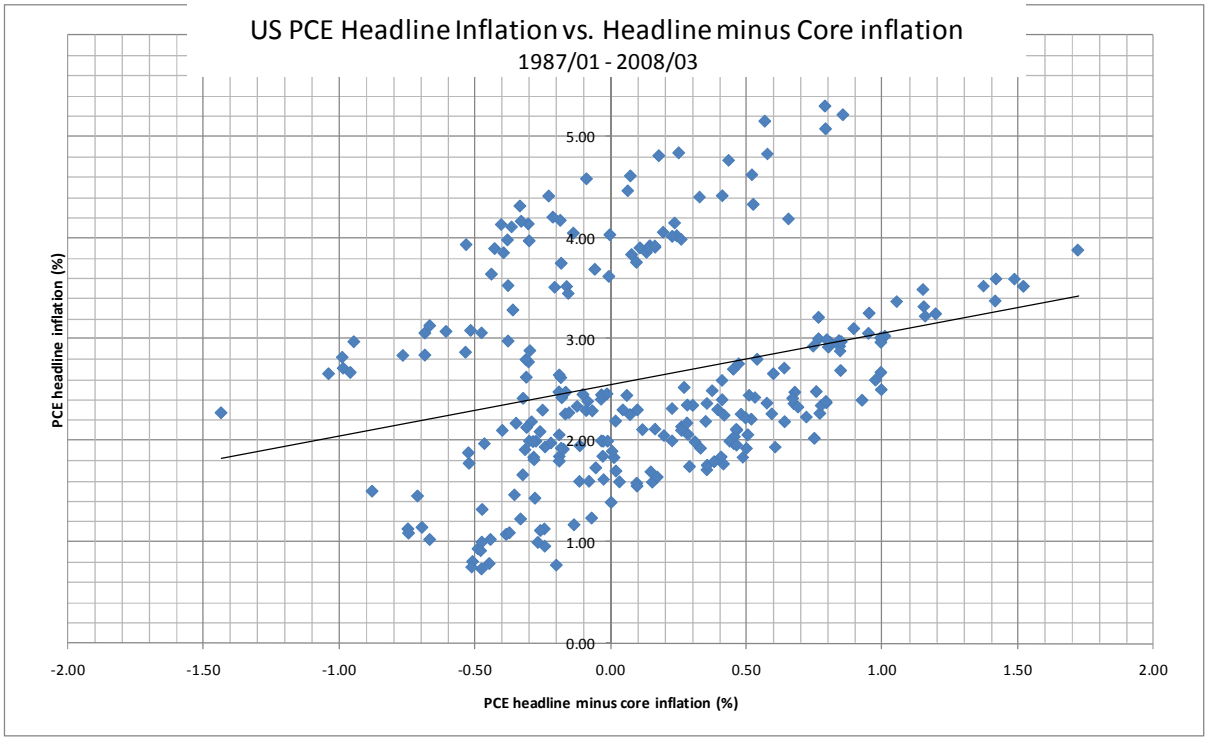

**Source: Bureau of Labor Statistics**

## Table 7c



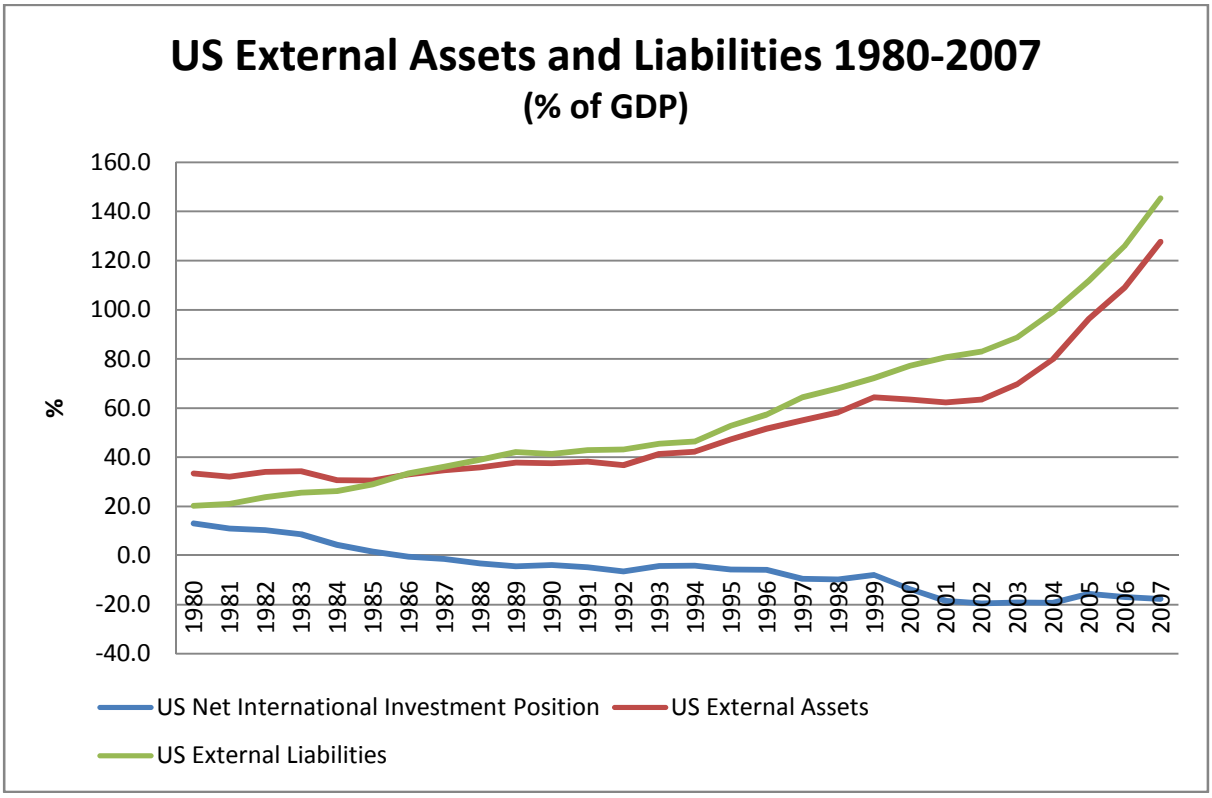

**Source: Bureau of Economic Analysis**

**Table 7d**



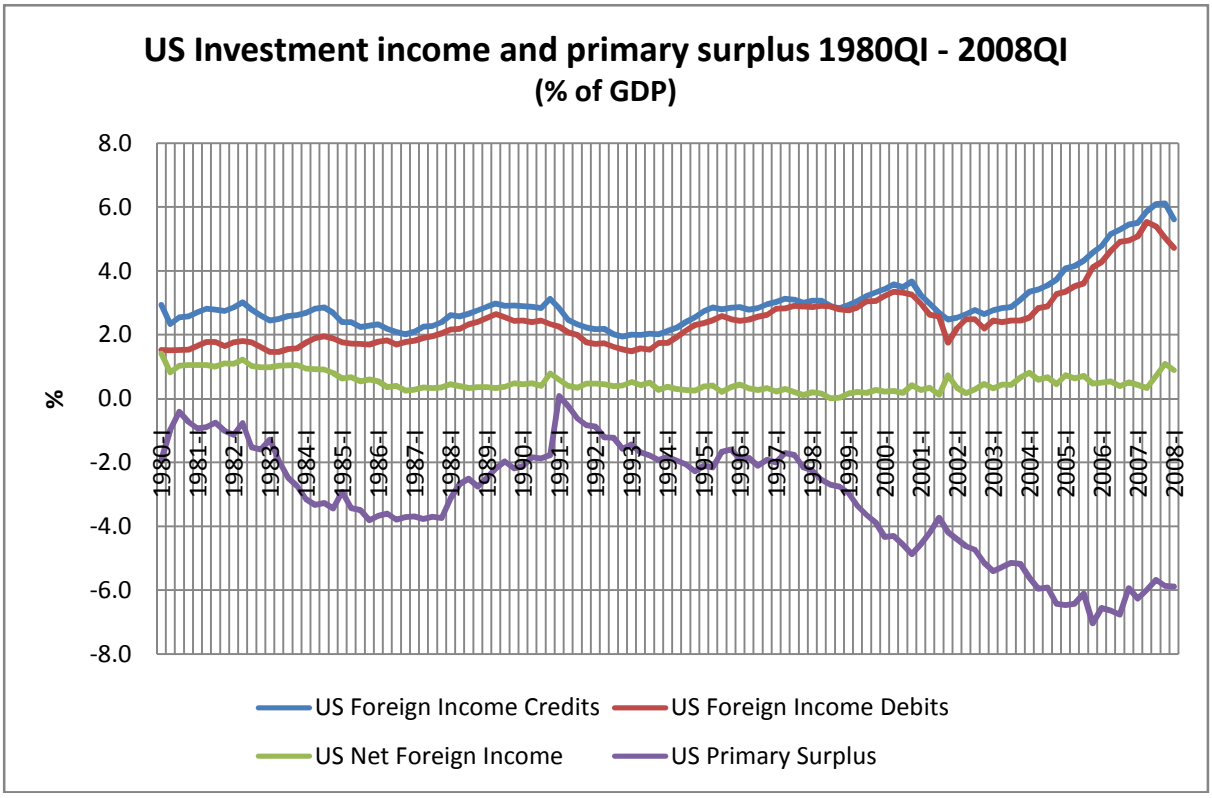

**Source: Bureau of Economic Analysis**

**Chart 8a**



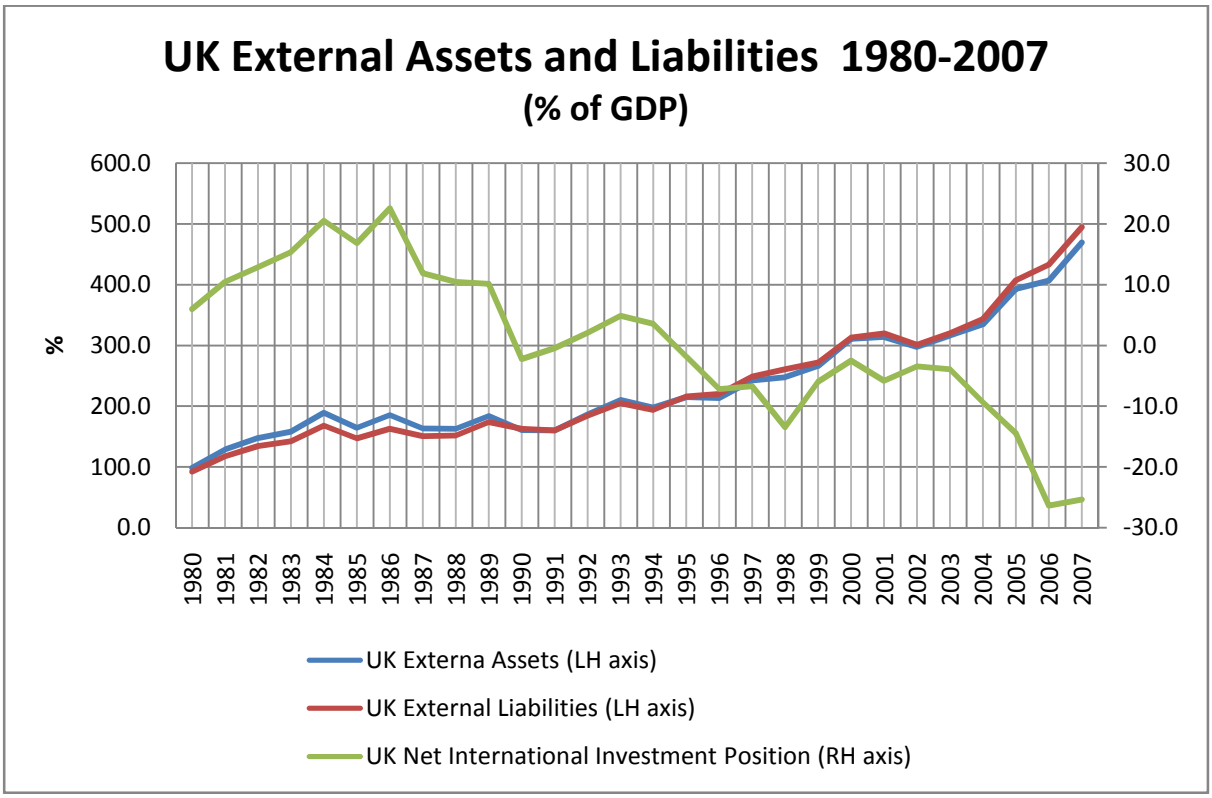

Source: Bureau of Economic Analysis

**Chart 8b**



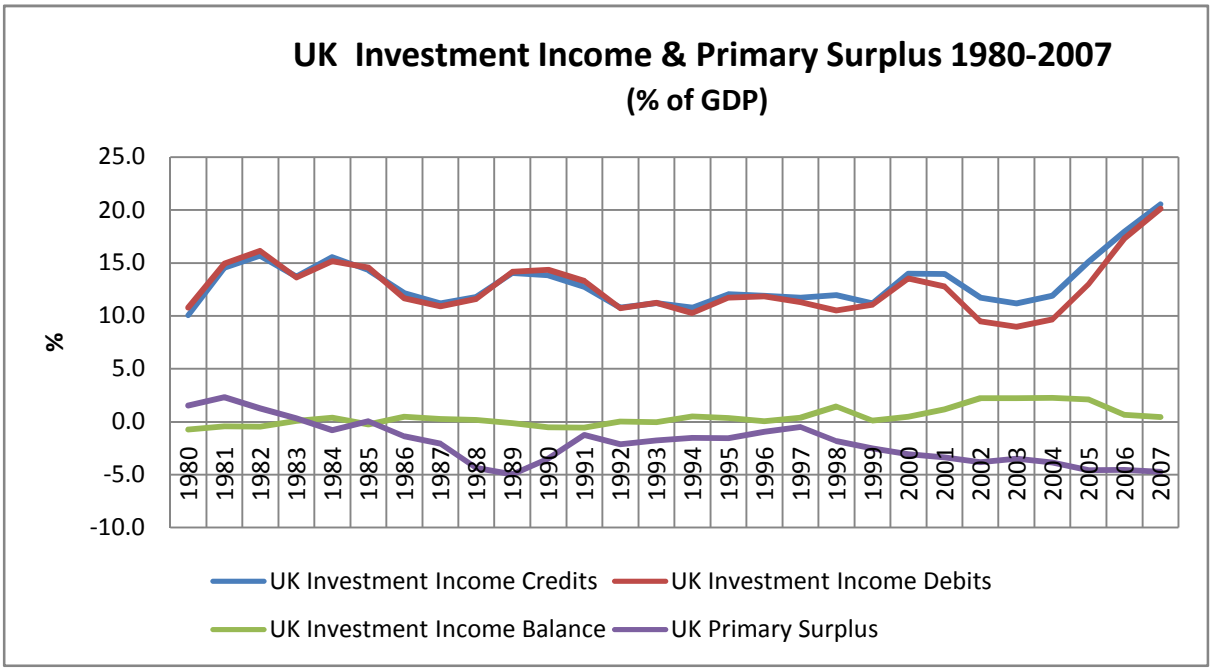

Source: Bureau of Economic Analysis

**Chart 9a**



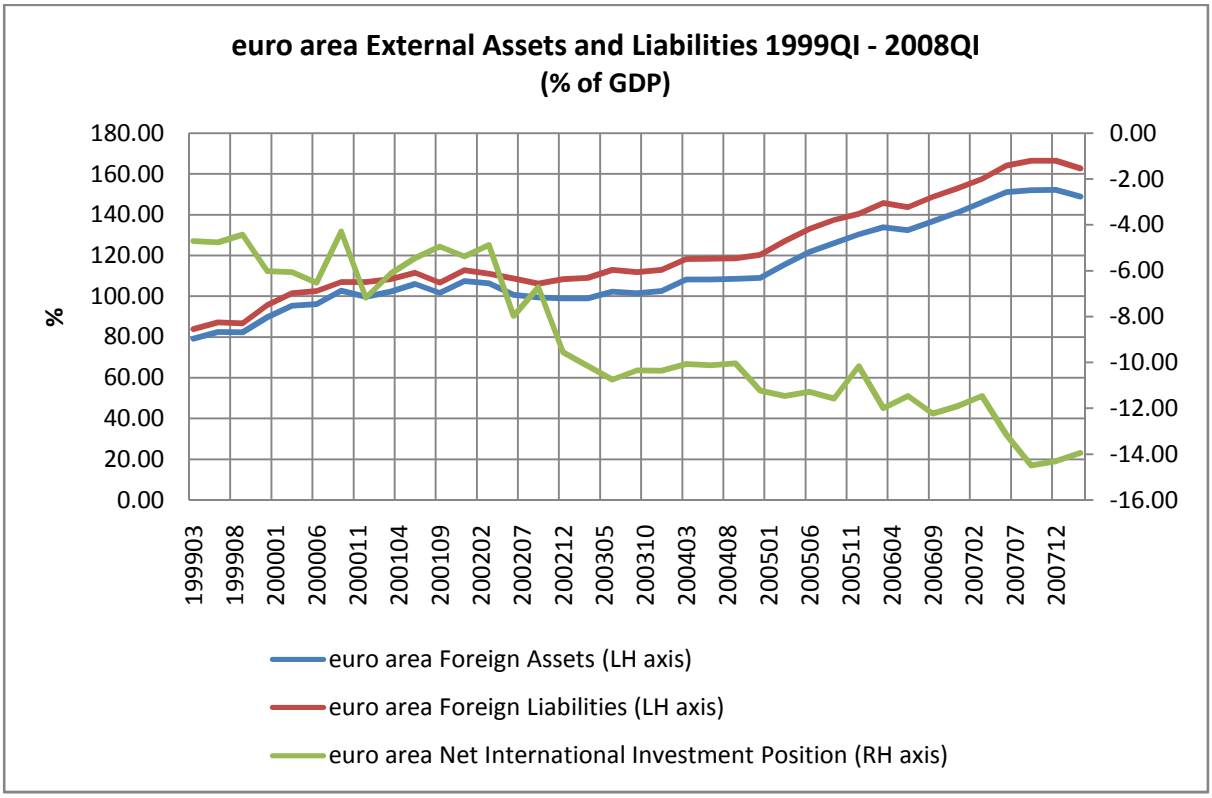

Source: Office of National Statistics

**Chart 9b**



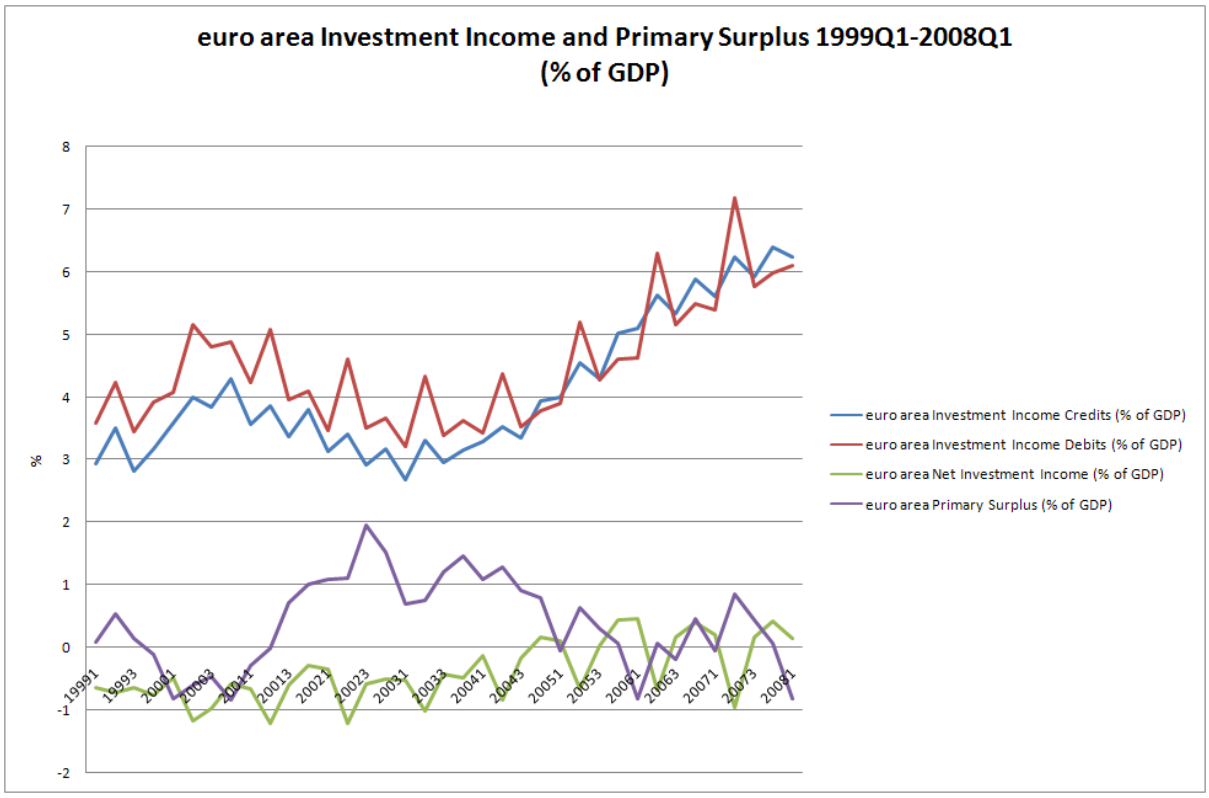

Source: Office of National Statistics

**Chart 10a**




Source: Eurostat and ECB

**Chart 10b**




Source: Eurostat and ECB

**Table 1**

## Currency composition of official foreign exchange reserves

| | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 | '04 | '05 | '06 | '07 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| US dollar | 59.00% | 62.10% | 65.20% | 69.30% | 70.90% | 70.50% | 70.70% | 66.50% | 65.80% | 65.90% | 66.40% | 65.70% | 63.30% |
| Euro | | | | | 17.90% | 18.80% | 19.80% | 24.20% | 25.30% | 24.90% | 24.30% | 25.20% | 26.50% |
| German mark | 15.80% | 14.70% | 14.50% | 13.80% | | | | | | | | | |
| Pound sterling | 2.10% | 2.70% | 2.60% | 2.70% | 2.90% | 2.80% | 2.70% | 2.90% | 2.60% | 3.30% | 3.60% | 4.20% | 4.70% |
| Japanese yen | 6.80% | 6.70% | 5.80% | 6.20% | 6.40% | 6.30% | 5.20% | 4.50% | 4.10% | 3.90% | 3.70% | 3.20% | 2.90% |
| French franc | 2.40% | 1.80% | 1.40% | 1.60% | | | | | | | | | |
| Swiss franc | 0.30% | 0.20% | 0.40% | 0.30% | 0.20% | 0.30% | 0.30% | 0.40% | 0.20% | 0.20% | 0.10% | 0.20% | 0.20% |
| Other | 13.60% | 11.70% | 10.20% | 6.10% | 1.60% | 1.40% | 1.20% | 1.40% | 1.90% | 1.80% | 1.90% | 1.50% | 1.80% |

Sources:1995-1999, 2006-2007 IMF: Currency Composition of Official Foreign Exchange Reserves

:1999-2005, ECB: The Accumulation of Foreign Reserves

Source: Wikipedia

| **Table 2**<br><br>**Central Bank Conventional Financial Balance Sheet** | |
|---|---|
| **Assets** | **Liabilities** |
| $D$ | $\frac{M}{1+i}$ |
| $L$ | $N$ |
| $eR^f$ | |
| | $W^b$ |

**Table 3**

| **Conventional Financial Balance Sheet of the Federal Reserve System**<br><br>12 March 2008, US$ bn | |
|---|---|
| **Assets** | **Liabilities** |
| $D$: 703.4 | $M$: 811.9 |
| $L$: 182.2 | $N$: 47.4 |
| $R$: 13.0 | |
| | $W$: 39.7 |

**Table 4**

| Conventional Balance sheet of the Bank of England (£ billion) | | | | |
|---|---|---|---|---|
| | | June 1, 2006 | 24-Dec-07 | 12-Mar-08 |
| | **Liabilities** | 82 | 102 | 97 |
| *M:* | Notes in circulation | 38 | 45 | 41 |
| | Reserves balances | 22 | 26 | 21 |
| *N:* | Other | 20 | 30 | 33 |
| *W*[b]*:* | Equity | 2 | 2 | 2 |
| | | | | |
| | **Assets** | 82 | 102 | 97 |
| *D:* | Advances to HM Government | 13 | 13 | 7 |
| *L&D:* | Securities acquired via market transactions | 8 | 7 | 9 |
| *L:* | Short-term market operations & reverse repos with BoE Counterparties | 12 | 44 | 43 |
| | Other assets | 33 | 38 | 38 |

Source: *Financial Statistics*

**Table 5**

| **Conventional Balance sheet of the European Central Bank (€ billion)** | | | |
|---|---|---|---|
| | | 31 December 2006 | 31 December 2007 |
| | **Liabilities** | 106 | 126 |
| *M:* | Notes in circulation | 50 | 54 |
| *N:* | Other | 56 | 72 |
| $W^b$*:* | Equity | 4 | 4 |
| | | | |
| | **Assets** | 106 | 126 |
| *D:* | | 54 | 71 |
| *L* | Other Assets | 10 | 11 |
| | Claims on euro area residents in forex | 3 | 4 |
| *R:* | Gold and forex | 40 | 39 |

Source: European Central Bank (2008a),

**Table 6**

| **Conventional Balance sheet of the Eurosystem (€ billion)** | | | |
|---|---|---|---|
| | | 22 December 2006 | 29 February 2008 |
| | **Liabilities** | 1142 | 1379 |
| *M:* | | 805 | 887 |
| *N:* | Other | 273 | 421 |
| $W^b$*:* | Equity | 64 | 71 |
| | | | |
| | **Assets** | 1142 | 1379 |
| *D:* | Euro-denominated government debt | 40 | 39 |
| *L* | Euro-denominated claims on Euro Area credit institutions | 452 | 519 |
| | Other Assets | 330 | 480 |
| *R:* | Gold and forex | 321 | 340 |

Source: European Central Bank (2008b),

## Table 7

## Monetary policy actions since August 2007 by the Fed, ECB and BoE

- Official policy rate
  - Fed: -325 bps (current level: 2.00%)
  - ECB: +25 bps (current level: 4.25%)
  - BoE: -75 bps (current level: 5.00%)
  -
- Unscheduled meetings, out-of-hours announcements
  - Fed: one for OPR (21/22 Jan.)
  - ECB: none
  - BoE: none
  -
- Discount rate penalty
  - Fed: -75 bps (current level: 25 bps)
  - ECB: ±0 bps (current level: 100bps)
  - BoE: ±0 bps (current level: 100bps)
  -
- Open mouth operations
  - ECB: repeated hints at/threats of OPR increases that did not materialise until July 2008 ('talk loudly & carry a little stick')
  -

## Table 8

**Gross national saving rates for the G7**

**Percent of nominal GDP**

| | 1990 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|
| Canada | 17.3 | 23.6 | 22.2 | 21.2 | 21.4 | 22.8 | 23.7 | 24.3 | .. |
| France | 20.8 | 21.6 | 21.3 | 19.8 | 19.1 | 19.0 | 18.5 | 19.1 | 19.3 |
| Germany | 25.3 | 20.2 | 19.5 | 19.4 | 19.5 | 21.5 | 21.8 | 23.0 | 25.2 |
| Italy | 20.8 | 20.6 | 20.9 | 20.8 | 19.8 | 20.3 | 19.6 | 19.6 | 19.7 |
| Japan | 33.2 | 27.5 | 25.8 | 25.2 | 25.4 | 25.8 | 26.8 | 26.6 | .. |
| United Kingdom | 16.5 | 15.4 | 15.6 | 15.8 | 15.7 | 15.9 | 15.1 | 14.9 | .. |
| United States | 15.3 | 17.7 | 16.1 | 13.9 | 12.9 | 13.4 | 13.5 | 13.7 | .. |

*Note:* Based on SNA93 or ESA95 except Turkey that reports on SNA68 basis.

*Source:* OECD

National accounts of OECD countries database.