Monetary Economics and the Political Economy of Central Banking:

Inflation Targeting and Central Bank Independence Revisited[*] [**]

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Abstract

The canonical modern central bank targets inflation and is operationally independent. This paper analyses whether this central bank model make sense.

With flexible inflation targeting, the period loss function of the monetary authority trades off inflation volatility against output volatility. Flexible inflation targeting does not have robust microfoundations, nor is it compatible with the official mandates of those central banks that have price stability as their primary objective. For these. the operational expression of the pursuit of price stability is *lexicographic* inflation targeting.

There is a material risk that *flexible* inflation targeting will turn into *soft* inflation targeting. The combination of flexible inflation targeting with a view of the transmission mechanism that includes the Calvo-Woodford version of the New-Keynesian Phillips curve (which has a long-run exploitable trade-off between inflation and the output gap), seems almost purpose-built, to repeat the inflation accidents of the 1970s. One can only hope central bankers will be wise enough to resist this siren song.

Modern independent central banks, most notably the ECB, have a higher degree of operational independence than virtually any other agency to which the state has delegated some of its responsibilities. Such a high degree of operational independence implies that the only form of accountability the principal (the citizens through their elected representatives) can impose on the agent (the central bank) is *formal* accountability, that is, reporting obligations through which the principal can monitor the actions of the agent. There is effectively zero *substantive* accountability: no pay-off relevant consequences for the agent follow from the reporting duties and monitoring process imposed on them: the central bank cannot be 'touched'.

Lack of substantive accountability undermines the legitimacy of the agent and puts it at risk of a political backlash that could impair its operational independence. This risk is greater when, as in the case of the ECB, the central bank is actively engaged in 'mandate and mission creep'. To address these problems the paper makes a number of proposals for limiting the domain of unaccountability, by turning the operationally independent 'full-function' central bank into a minimalist operationally independent monetary authority.

Specifically, the monetary authority would be denied the following:
1. Any voice in the public policy debate on matters other than monetary policy and the institutional arrangements for conducting monetary policy. Specifically, the central bank would not hold forth, in its official capacity, on fiscal sustainability, social security reform, the minimum wage and other structural reforms - all areas beyond both the central bank's mandate and its domain of competency.
2. Any role in the supervision and regulation of banks, other financial institutions and financial markets.
3. Any ownership, control and management role in the interbank clearing and settlement systems. For instance, the ECB should divest itself of TARGET. The new TARGET owner/manager should have guaranteed access to ECB liquidity.
4. Any ownership, control and management role in the financial securities clearing and settlement systems. For instance, the ECB should not play an active role in the proposed TARGET2-Securities. The eventual TARGET2-Securities owner/manager should have guaranteed access to ECB liquidity.

5. Any active role in the prevention and mitigation of financial instability. The lender of last resort function should be performed by the financial regulator/supervisor, who would have an unlimited overdraft facility with the central bank, guaranteed by the Treasury.

Since the degree of operational independence of the ECB and many other central banks is well in excess of what is required for the proper discharge of functions (2) to (5), these proposals would limit the domain of unaccountability and increase the legitimacy of all the delegations of authority involved, including the (desirable) delegation of monetary policy to an operationally independent central bank, without any material efficiency costs.

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Introduction

There is a widespread consensus today, both among practicing and/or practical central bankers and among theoretical and applied monetary economists, that the canonical global best practice central bank is operationally independent[1] and targets inflation[2]. Historically, whenever a near-universal consensus takes hold of the economics profession, it tends to be at least half wrong. A concern that this may be happening in the areas of inflation targeting and central bank independence prompted the choice of subject for this inaugural lecture.

I. Inflation targeting

Inflation targeting – the pursuit of a low and stable rate of inflation over the medium-to-long term for some broadly based index of consumer prices or cost-of-living index - is best rationalised as the operational expression of the pursuit of the more fundamental objective of price stability. The first point I wish to make is that the buck stops right there: price stability must be viewed as a primitive objective of monetary policy - one that cannot be derived from more even more basic or fundamental objectives of efficiency and equity.

IA. The welfare economics foundations of price stability as a monetary policy objective

There have been many attempts to derive the optimality of price stability from generally accepted welfare economic considerations, that is, to provide microfoundations for price stability as an objective (or even the overriding objective) of monetary policy. These all failed. Conventional welfare economics considerations point in many different directions, but they do not point towards price stability as the natural objective of monetary policy.

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[1] See e.g. Cukierman, Webb and Neyapti (1992), Cukierman (2006), Alesina and Summers (1993), Posen (1993), McCallum (1995), Beetsma and Bovenberg (1997), Campillo and Miron (1997), Forder (1998), Blinder (1999), de Haan and Kooij (2000), Ozkan (2000), Posen (1993), Buiter (2004, 2005).
[2] See e.g. Federal Reserve Bank of Kansas City (1996), Bernanke and Woodford (2005).

IA1. Shoe-leather costs and the Bailey-Friedman optimal interest rate rule.

Central bank fiat money can be produced at effectively zero marginal cost. Economic efficiency considerations therefore point to the desirability of setting the pecuniary opportunity cost of holding central bank money equal to zero. Failure to do so would result in unnecessary 'shoe-leather costs' of active cash management (Allais (1947), Baumol (1952), Tobin (1956)).[3] The opportunity cost old holding central bank money is measured by the gap between the short default risk-free nominal interest rate, i, and the nominal interest rate on central bank money, i^M. So the venerable Bailey-Friedman optimal interest rate rule (for some reason often called the optimal quantity of money (OQM) rule) is $i = i^M$, which results in satiation with real money balances. One component of central bank money, currency, has a zero nominal interest rate. With $i^M = 0$, the Bailey-Friedman rule sets the short nominal interest equal to zero (Bailey (1956), Friedman (1969)). If the equilibrium real interest rate is positive, the OQM rule points to the optimality not of price stability but to of deflation, that is, negative inflation, at a rate equal to minus the equilibrium real interest rate.

IA2. Menu costs

Menu costs (real costs associated with changing prices, including prices measured in terms of central bank money) point to the desirability of stabilising those prices that are most costly to change. These are most likely to be money wages. Menu costs therefore point to stabilising the average money wage as the appropriate objective of monetary policy. With positive trend growth of labour productivity, this again implies that negative price inflation is optimal.

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[3] A positive gap between i and i^M would also cause a distortion by artificially raising the relative price of cash goods relative to credit goods (see Lucas and Stokey (1987)).

IA3. Indexation failures

When contracts or financial instruments are nominally denominated, unanticipated inflation can result in redistribution from creditors to debtors. Imperfect indexation of tax, subsidy and benefit schedules can cause inflation or deflation to create distortions and efficiency losses, and to have unintended and undesired distributional consequences. The obvious solution here is better indexation. Failing that, a second-best argument for price stability exists.

IA4. An incorrect New-Keynesian argument *for* price stability: relative price distortions

An influential strand in the New-Keynesian literature, associated notably with Woodford (2003), argues that there is indeed a case for price stability that can be derived from conventional welfare economic considerations. According to this view, price stability prevents *static relative price distortions* when wage and/or price contracts are staggered, overlapping and subject to nominal rigidities. The starting point of this literature is Calvo's (1983) model of price setting. This divides the universe of price setters into two groups. One consists of fully optimising, forward-looking monopolistically competitive price setters. The other consists of behaviourist plodders (or constrained price setters), who adopt an exceedingly simple heuristic or rule of thumb for updating the prices of their products.[4] I will call the inflation rate generated by the behaviourist plodders the *inflation heuristic*, and denote it by $\tilde{\pi}$. Aggregate inflation (reflecting the price-setting choices of both the optimising price setters and the behaviourist plodders) is denoted π.

It is easily appreciated that relative price distortions in the Calvo-Woodford universe are eliminated (relative price dispersion is optimal) when $\pi = \tilde{\pi}$, that is, when the aggregate rate of inflation equals the inflation heuristic generated by the behaviourist plodders –

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[4] In Calvo's model (Calvo (1983)) and in Woodford's development of it (Woodford (2003)), price setters each period are randomly allocated to either the fully flexible, optimising or the behaviourist price setters' camps.

whatever that inflation heuristic happens to be. How then does this prescription of *relative* price stability become an argument for stability of the general price level? The answer is that, like Calvo in his orginal model, Woodford assumes that the inflation heuristic is zero inflation: $\tilde{\pi} = 0$. In Woodford (2003), in Benigno and Woodford (2005), in Blanchard and Galli (2005) and in a slew of other publications, the assumption is made that that the behaviourist plodders keep their nominal prices constant, regardless of the economy-wide rate of inflation. In some versions the behaviourist plodders keep their money prices constant every period, and therefore also in the long run. Other versions of this model, analysed in Woodford (2003), imply that the inflation heuristic goes to zero only in the long run, although it still goes there regardless of the economy-wide average rate of inflation in the long run and outside it).[5]

The assumption that there exists a group of price setters who will keep their money prices constant, even when economy-wide inflation is roaring along, and even in a deterministic steady state, is bad economics. The assumption of too much rationality results in counterfactual economic behaviour. The assumption of too little rationality – zero learning and unbounded stupidity - also results in counterfactual economic behaviour. Calvo has since disowned this feature of his model, and has endowed the behaviourist plodders with enough information and rationality to rule out the anomalies of his original model (see Calvo, Celasun and Kumhof (2003), and also Buiter and Miller (1985), Gali, Gertler and Lopez-Salido (2001) and Buiter and Sibert (2006)).

The New-Keynesian paradigm therefore does not offer valid welfare economics or micro-foundations for price stability as an objective for monetary policy

IA5. An incorrect New-Keynesian argument *against* price stability: the long-run exploitable output-inflation trade-off or Old-Keynesian wine in New-Keynesian bottles

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[5] Woodford assumes a form of partial one-period-lagged indexation by the behaviourist plodders:
$\tilde{\pi} = \gamma \pi_{-1}$, $0 \leq \gamma < 1$.

The New-Keynesian approach has further implications for the optimal rate of inflation, based on the inefficiency of the natural rate of unemployment. Instead of pointing to price stability, these point to a positive rate of inflation as optimal. Like the previous argument *for* price stability based on the confusion of relative price stability and stability of the general price level, this one too is fatally flawed, and for essentially the same reason.

The New-Keynesian (Calvo-Woodford) Phillips curve can be approximated as follows:

$$\pi_t - \tilde{\pi}_t = \beta E_t(\pi_{t+1} - \tilde{\pi}_{t+1}) + \alpha\left(\pi_{t-1} - \tilde{\pi}_{t-1}\right) + \phi(y_t - y_t^*) + \eta(i_t - i_t^M)$$

$$(1)$$

$$0 \le \alpha, \beta \le 1, \ \phi > 0$$

In words: the current deviation of economy-wide inflation from the inflation heuristic depends on the expected future deviation, possibly also on the past deviation, and on the output gap - the difference between actual output y and potential output y^*. E_t means expectations formed at time t. The original Calvo (1983) model and the class of models developed in Woodford (2003), are the special case of (1) with $\alpha = 0$ and $0 < \beta < 1$. Calvo also has $\eta = 0$, Much of Woodford's analysis is restricted to the case where either $i = i^M$ or $\eta = 0$, so the Bailey-Friedman pecunairy opportunity cost of holding cash does not enter the Phillips curve.

The approximate social welfare function (evaluated at the deterministic steady state) of the Calvo-Woodford New-Keynesiam model is given by (2) and (3).

$$\Lambda_t = \sum_{j=0}^{\infty} \beta^j L_{t+j}$$

$$(2)$$

$$0 < \beta < 1$$

$$L_{t+j} = E_t\left[\left(\pi_{t+j} - \tilde{\pi}_{t+j}\right)^2 + \lambda(y_{t+j} - \hat{y}_{t+j})^2 + \ell(i_{t+j} - i_{t+j}^M)^2\right]$$

$$(3)$$

$$\lambda, \ell > 0$$

$$\hat{y} = y^* + \delta \tag{4}$$

where δ is the gap between the optimal or efficient level of output and the natural level of output (the level supported by perfect price flexibility). In the simplest models, δ is constant and, with monopolistic competition in the output market and without production or consumption subsidies, positive.

If either $\eta = 0$ or $i = i^M$, the New-Keynesian Phillips curve (1) implies the following trade-off between the (deterministic) steady-state output gap and the (deterministic) steady-state excess of actual inflation over the inflation heuristic. All deterministic steady state values are denoted by overbars.

$$\overline{y - y^*} = \phi^{-1}\left[1 - (\alpha + \beta)\right]\overline{(\pi - \tilde{\pi})} \tag{5}$$

In the Calvo-Woodford model, the steady-state inflation heuristic is zero, that is, $\overline{\tilde{\pi}} = 0$, so the long-run Phillips curve becomes:

$$\overline{y} = \overline{y^*} + \phi^{-1}\left[1 - (\alpha + \beta)\right]\overline{\pi} \tag{6}$$

Therefore, unless $\alpha + \beta = 1$, there is a long-run, exploitable, inflation-output gap trade-off. The Calvo-Woodford model has $\alpha + \beta < 1$. Thus, if there are real inefficiencies (monopoly power, tax distortions) that make the efficient level of steady state output $\overline{\hat{y}}$, say, higher than the natural steady state level of output, $\overline{y^*}$, the authorities could set actual steady-state output equal to its efficient level by choosing the appropriate rate of steady-state inflation:

$$\overline{\pi} = \left(\overline{\hat{y} - y^*}\right)\phi\left[1 - (\alpha + \beta)\right]^{-1} > 0 \tag{7}$$

Woodford points out that although it is possible to keep actual output above its natural level, it will not be optimal to raise it all the way to its efficient level, given in (7), because of the welfare losses caused by the relative price distortions that occur whenever actual inflation

differs from the zero (the value of his long-run inflation heuristic). These welfare losses have to be balanced against the welfare gains from getting actual output closer to the efficient level of output. While logically correct, given the premise that wage and price setting is characterised by permanent irrationality, the conclusion is only as interesting as that premise.

Key to the existence of a long-run inflation-output trade-off in the New-Keynesian Phillips curve model is the relationship between the inflation heuristic and actual inflation - the re-incarnation in the New-Keynesian literature of the relationship between expected and actual inflation characteristic of the 1960s vintage expectations-augmented Old-Keynesian Phillips curves of Samuelson-Solow (1960) and Tobin (1968). In many ways, the Calvo (1983) and Woodford (2003) contributions are throwbacks to Phillips' original non-expectations-augmented Phillips curve (Phillips (1958) or to the pre-Phillips curves of Fisher (1926,1936)).

The theoretical work of Phelps (1967) and Friedman (1968) undermined the plausibility of a stable Phillips curve trade-off, especially across deterministic steady states. Lucas (1972, 1973) convinced much of the profession that the time it took to reach the long run was only as long as it took for rational price and wage setters to hone their expectations to filter out the systematic components of the inflation process (including the decision rules of the policy makers driving the inflation process). In a stationary economic environment, this learning period was bound to be shorter than the time it would take for the economy to reach the steady state.

It is ironic, and indeed rather disheartening, that after so many years of deserved disrepute, the behavioural anomalies that support a long-run non-vertical Phillips curve have once again crept into the debate about optimal inflation policy. It sets back the study of inflation dynamics by almost 40 years to the pre-Phelps/Friedman days. It is yet another

demonstration of the immaturity of economics as a scientific discipline: I would not expect *Nature* to publish an article in 2003 arguing that the earth is flat.

I don't know how much attention central bankers have paid to this resurrection, by an influential part of the monetary theory community, of the long-run exploitable Phillips curve trade-off. One can only hope that they have treated it with disdain and will continue to treat it thus. It would not be the first time that central bank monetary practice is ahead of monetary theory (see King (2005)).

IA6. The absence of microfoundations for price stability as an objective of monetary policy.

How worrying is the absence of welfare economic foundations for price stability as an objective, let alone the overriding objective, of monetary policy? One response is that it is a problem for conventional monetary economics, that is, for monetary theory, rather than for central banks entrusted with price stability as their primary mandate. According to this view there are valid, deep arguments for price stability, but conventional monetary economics simply does not have to toolkit to make them explicit or formalise them.

Sometimes this argument points to the widespread popular aversion to inflation as evidence that there must be serious costs associated with inflation: consumers and workers don't like inflation, ergo it must be costly. I have some sympathy with this position, but it must be pointed out, however, that the public's understanding of what inflation is and what it does appears to be very limited (see e.g. Shiller (1997)). There appears to be a widespread form of inflation illusion which leads households to believe that there exists an world in which the rate of inflation of the things they buy would have been lower but the rate of inflation of the things they sell would have been the same. People therefore feel 'robbed' by inflation: price inflation erodes the growth of real wages. While the rate of inflation of the general price level can indeed be uncoupled from the rate of inflation of nominal earnings for

an individual or small group of individuals, this is not possible for the labour force as a whole. Yet households everywhere object to bad price inflation while welcoming their own good earnings inflation.

Still, the view that the absence of microfoundations for price stability is mainly a problem for conventional economic theory has a very strong argument in its favour. This is that the most important costs of inflation are likely to be associated with the numéraire role of money, and not with its means of payment/medium or exchange role or its store of value role. The view that the numéraire role of money is its most importance one also chimes with the view of inflation not as inefficient or unfair, but as a sin, because it represents a corruption of weights and measures.

The importance of a stable numéraire makes sense only in a world of bounded rationality – a world in which conventional monetary theory is not comfortable.

IB. Price stability as the legitimate political mandate of monetary policy

When considering the targets or objectives of central banks it is necessary to distinguish between fundamental objectives and operational targets. Fundamental objectives or ultimate objectives of central banks are invariably imposed on the central bank by some legitimate political outside agency. They are typically written into laws or constitutions. In the case of the ECB, the Treaty on European Union is the source of the central bank's fundamental mandate and legitimacy. Ultimate objectives tend to be qualitative or categorical in nature, rather than quantitative or numerical. They are therefore not operational.

The operational objectives or targets of the central bank tend to be quantitative, numerical expressions of the ultimate mandate. This can, for instance, be a numerical inflation target (point, range or inequality) or a numerical exchange rate peg. Few central banks manage without at least one numerical operational target. The Fed is the best known of the central banks without any kind of

quantitative operational mandate. The operational target is often set by an elected political authority. The inflation target of the Bank of England is set by the Chancellor of the Exchequer. In New Zealand, the inflation target of the Reserve Bank of New Zealand is determined jointly by the Governor of the RBNZ and the Minister of Finance.

The ECB sets its own operational inflation target, or as it prefers to call it, its quantitative definition of price stability.[6] The Treaty and Protocols leave the question of who sets the operational monetary target completely open, and the ECB effectively took that power because the other obvious candidate, the Council of Ministers (Ecofin)), did not focus on the matter. It is something that could, in principle, be contested by the Council of Ministers. The matter would then have to be decided by the Treaty-nominated institution for resolving such disputes: the European Court of Justice.

Absent microfoundations/conventional welfare economics foundations, the case for price stability as an objective (let alone the primary objective) of monetary policy has to rest on the fact that this is the lawful and legitimate political mandate given to most central banks. Price stability is, by Law, Constitution or Treaty, the primary objective of the ECB, the Bank of England, the Bank of Japan, the Reserve Bank of New Zealand and the Sveriges Riksbank.[7]

The main outliers in terms of fundamental objectives are the Fed, the Bank of Canada, the Reserve Bank of Australia and Norges Bank, none of which have price stability as the single primary objective of monetary policy.[8]

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[6] Quoting from the ECB's website: *"While the Treaty clearly establishes the primary objective of the ECB, it does not give a precise definition of what is meant by price stability. The ECB's Governing Council has announced a quantitative definition of price stability: "Price stability is defined as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%." The Governing Council has also clarified that, in the pursuit of price stability, it aims to maintain inflation rates below, but close to, 2% over the medium term."* ECB http://www.ecb.int/mopo/strategy/pricestab/html/index.en.html .

[7] The Swiss National Bank is required by the Constitution and by Law to ensure price stability and, in so doing, to take due account of economic developments.

[8] The Fed is mandated by the Federal Reserve Act to pursue maximum employment, price stability and moderate long term interest rates as its fundamental objectives. The preamble of the Bank of Canada act directs the central bank *"to regulate credit and currency in the best interests of the economic life of the nation, to control and protect the external value of the national monetary unit and to mitigate by its influence fluctuations in the*

An inflation target is in many ways the natural operational target of monetary policy for those central banks that have price stability as their primary fundamental objective. However, some central banks that do not have price stability as their primary fundamental objective have also adopted inflation targeting as an operational practice. The Bank of Canada, the Reserve Bank of Australia and Norges Bank are examples. The Fed, under Chairman Bernanke, is likely to move quite swiftly towards the adoption of a *de-facto* numerical inflation target, although they are unlikely, for political reasons, to use the term 'inflation target'. Operational practice under Greenspan gradually acquired many of the features of flexible inflation targeting, the subject to which I turn next.

The position that price stability should be pursued by the central bank if it is the legitimate public mandate of the central bank – even it there are no good welfare economic foundations for such a mandate may not be comfortable for monetary theorists or central bankers, but I believe that it is all that's on offer at this point. It may be that *vox populi*, as embodied in legislation charging central banks with the pursuit of price stability as their primary mandate, is indeed wiser than the academic monetary economics of the past few hundred years, and that this legislation anticipates the future microfoundations of price stability, grounded in a formal numérairology. But we are not there yet. There is no positive economic theory of the numéraire, and therefore no welfare economics of the numéraire either.

IC. The siren song of flexible inflation targeting

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general level of production, trade, prices and employment, so far as may be possible within the scope of monetary action, and generally to promote the economic and financial welfare of Canada"; The Reserve Bank of Australia is mandated to pursue *"(a) the stability of the currency of Australia; (b) the maintenance of full employment in Australia; and (c) the economic prosperity and welfare of the people of Australia."* The opening paragraph of Norges Bank Regulation on Monetary Policy 2001 (see Norges Bank (2001)).states *"Monetary policy shall be aimed at stability in the Norwegian krone's national and international value, contributing to stable expectations concerning exchange rate developments. At the same time, monetary policy shall underpin fiscal policy by contributing to stable developments in output and employment."* It gets better after that, but two nominal objectives plus two real objectives amount to a challenging start.

Some of the world's leading central banks have been seduced by the siren song of 'flexible inflation targeting', as advocated by Svensson (1999, 2005), Woodford (2003) and many others.[9] The objective function of the monetary authority, which we shall denote by Λ_t (like the approximate social welfare function of the Calvo-Woodford New-Keynesian model) has 'period loss functions' given by the expectation of a weighted average of that period's squared deviation of inflation from its (constant) target level, π^* and that period's squared output gap:

$$L_{t+j} = E_t \left[\left(\pi_{t+j} - \pi^* \right)^2 + \lambda (y_{t+j} - y_{t+j}^*)^2 \right] \tag{8}$$

where $\lambda \geq 0$ is the relative weight put on output gap stabilisation.

Note that (8) would be an appropriate representation of a 'dual mandate' loss function of the kind the Fed is often alleged to have (see e.g. Mishkin (2007a,b)). However, as is clear from the Federal Reserve Act, the Fed has a triple mandate, not a dual one: it has to target the real economy ('maximum employment'), a nominal objective ('price stability') and .the financial asset markets ('moderate long-term interest rates'). Somehow, the asset market objective has been lost sight of in the dual mandate interpretation of the Fed's objective function. Interpreting this to refer to nominal interest rates, and letting i^L be the long-term nominal interest rate and i^{L^*} the moderate level of the nominal long-term interest rate, the Fed's 'triple mandate' period loss function would be given by:

$$L_{t+j} = E_t \left[\left(\pi_{t+j} - \pi^* \right)^2 + \lambda (y_{t+j} - y_{t+j}^*)^2 + \varphi (i_{t+j}^L - i_{t+j}^{L^*})^2 \right]$$
$$\lambda, \varphi > 0 \tag{9}$$

The flexible inflation targeting period loss function (8) is a poor choice of objective function. First, it has no New-Keynesian welfare economics foundations. As is cleasr from equation (3)To have proper New-Keynesian welfare economics credentials, it should have the

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[9] For a more extensive discussion of these points, see Buiter (2006a).

inflation heuristic $\tilde{\pi}_t$ instead of a constant target inflation rate π^* in the period loss function

(8); potential output y^* should be replaced by the socially efficient level of output $\hat{y}$, and

there should be a term involving the opportunity cost of holding central bank money,

$(i - i^M)^2$.

Equation (8) is also a poor choice of objective function because it is incompatible with

the legal mandate given to many of the leading central banks, for whom price stability is the

primary or overriding objective. This includes the European Central Bank, the Bank of

England and the Bank of Japan. Only *subject to*, or *without prejudice to*, the price stability

objective being met, can the authorities legitimately pursue other objectives such as

employment, output or happiness. Such mandates imply *lexicographic* or *hierarchical*

inflation targeting, not *flexible* inflation targeting.

Any positive weight λ on the output gap in the period loss function would be too

large, because it would imply a trade-off in the authorities' preference ordering between

inflation and output stabilisation (relative to their target levels). The lexicographic point of

view rules out such a trade-off in preferences. A zero weight λ would, however, also not be

right, because output gap stabilisation *is* valued, as long as it does not come at the expense of

price stability. Since any trade-off (and no trade-off) in the objective function of the monetary

authority between price stability and output gap stability lacks both microfoundations and

political mandate legitimacy, the flexible inflation targeting objective function in **(2)** and (8)

is a non-starter. Whether such a trade-off exists in the economy, that is, in the constraints

faced by the monetary authority, is a completely separate issue, which is not addressed here.

In practice, the flexible inflation targeting literature has specialised the period loss

function (8) to:

$$L = \operatorname{Var} \pi + \lambda \operatorname{Var} y \qquad (10)$$

where *Var* denotes the (conditional) variance.

In fact (8) implies not (10) but

$$L = \operatorname{Var} \pi + \lambda \operatorname{Var} y$$
$$+ \lambda \operatorname{Var} y^* + \left(\operatorname{E}\pi - \pi^*\right)^2 + \lambda\left(\operatorname{E} y - \operatorname{E} y^*\right)^2 - 2\lambda \operatorname{Cov}(y, y^*) \qquad (11)$$

where Cov denotes the (conditional) covariance. To get from (8) or (11) to (10), it has to be

the case that the second line of (11) equals zero (or is independent of monetary policy). It is

not too unreasonable to argue that the variance of potential output, $\operatorname{Var} y^*$, is independent of

monetary policy, or even that the expected level of potential output, Ey^*, is independent of

monetary policy. That is not enough, however, to reduce the second line of (11) to zero (or to

make it independent of monetary policy). Conditions sufficient to ensure that are as follows:

(1) Either $\operatorname{E}\pi = \pi^*$ (there is no inflation target bias), or the inflation target bias cannot

be influenced by monetary policy.

(2) Either $\operatorname{E} y = \operatorname{E} y^*$ (there is no output gap bias), or the output gap bias is

independent of monetary policy.

(3) Either $\operatorname{Cov}(y, y^*) = 0$, or the covariance between output and potential output is

independent of monetary policy.

Assumption (3) is highly unlikely to be satisfied in most Old- or New-Keynesian

models. Either the self-equilibrating servomechanisms of the market economy or stabilisation

policy should make for a positive covariance. Assumption (2) is satisfied in the long run if

the economy has the long-run natural rate property; that is, if there is no unemployment-

inflation trade off or output-inflation trade off across deterministic steady states. It is not

necessarily satisfied in the short and medium term.

Assumption (1) is a necessary condition for effective inflation targeting, at any rate in

the long run. To assume that it is automatically satisfied, as replacing (8) or (11) by (10)

implies, is to assume away all the technical problems, commitment problems and other political complications associated with inflation targeting. It is true that many of the most popular New-Keynesian and Old-Keynesian analytical or calibrated numerical models used to study inflation targeting, have the property that there are few technical obstacles to meeting the inflation target on average. Indeed, when these models have the long-run natural rate property (and more enlightened New-Keynesian models do, including the ones proposed by Buiter and Miller (1985), Gali, Gertler and Lopez-Salido (2001), Calvo, Celasun and Kumhof (2003) and Buiter and Sibert (2006)) it will be true that, when the inflation rate is on average equal to the constant target rate of inflation, the output gap is on average equal to zero.

So, with the 'first moment' problems of inflation targeting and output gap targeting solved, the monetary policy maker is left with just the problem of choosing the optimal combination of the conditional second moments of inflation and output.

This result, however, rules only in Theoryland. It trivialises the central problem of inflation targeting, which is meeting the inflation target on average, going forward, that is, achieving a zero inflation bias. When $E\pi = \pi^*$, the key problem of the inflation-targeting monetary authority, that of creating a credible nominal anchor, is solved. This is difficult to achieve in practice, and can never be taken for granted: the first moment problem is also always the first-order problem. The second-moments period loss function (10), which assumes that there is no first-moments problem, is an misleading and dangerous construct to dangle in front of the monetary authorities: the second moments are of second-order importance unless the first-order first moments problem has indeed been solved.

The apparent similarity of Assumption (2), $E\,y = E\,y^*$ (no output gap bias) and Assumption (1), $E\,\pi = \pi^*$ (no inflation target bias) hides an important difference which can come back to haunt policy makers. For models with the (long-run) natural rate property, the servo-mechanisms of the market economy will tend to drive actual output towards potential

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output, at any rate in the long run, even without any policies designed to achieve that. There is no such built-in mechanism for ensuring that the actual rate of inflation will be driven towards the target rate of inflation, unless the policy authorities adopt rules (like the Taylor rule) that ensure that this will be the case: there may be a natural rate of unemployment, a natural level of output and even a natural real rate of interest, but there is no natural rate of inflation; the long-run equilibrium inflation rate in a fiat money economy is ultimately decided by the monetary authorities.

The belief that monetary policy could and should trade off *expected* inflation for the *expected* output gap was shattered by the combination of the intellectual brilliance of three Nobel Prize winning economists (Phelps, Friedman and Lucas) in the 1960s and 1970s, and a recalcitrant reality in the 1970s and 1980s. Likewise, the hubris that has led some leading central banks (but not the ECB or the Bank of England) to adopt the flexible inflation targeting objective function (10), will be shattered when it leads to an unintended and unexpected drift of the inflation rate above its target value. Indeed, there already is some evidence that *flexible* inflation targeting may have morphed into *soft* inflation targeting in a number of countries, including the US, Australia and New Zealand. The obvious and simple solution to this problem is to jettison flexible inflation targeting and to adopt *lexicographic inflation targeting* instead.[10]

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[10] The lexicographic ordering means that the monetary authority chooses a short nominal interest rate rule or a state-contingent sequence of short nominal interest rates to minimize first the following ('conservative central banker') objective function, defined just over deviations of inflation from its target rate: $\Lambda_t^{\pi} = \sum_{i=0}^{\infty} \beta^i E_t \left(\pi_{t+i} - \pi^* \right)^2$. If the optimal rule/state-contingent sequence is unique, that is the end of the matter. If there are multiple optimal rules/sequences, the authority chooses from among these the one that minimises the present discounted value of current and future expected squared output gaps, $\Lambda_t^{y} = \sum_{i=0}^{\infty} \beta^i E_t \left(y_{t+i} - \pi_{t+i}^* \right)^2$.

II. Central Bank Independence: limiting the domain of unaccountability

The reasons why so many central banks have been made operationally independent since the beginning of the 1990s are unclear. The received wisdom has it that, in a flexible inflation targeting framework, when the desired (efficient) level of output exceeds the natural level (the level consistent with any constant, fully anticipated rate of inflation), monetary policy suffers from a commitment problem resulting in an inflation bias. The optimal monetary policy is not time-consistent (see Kydland and Prescott (1977), Barro and Gordon (1983), Backus and Driffill (1985)). The delegation of monetary policy by the Principal (the government previously in charge of monetary policy, henceforth the Treasury) to an operationally independent Agent (the central bank) is assumed to solve this commitment problem.

McCallum (1995, 1997a,b) and Blinder (1999, 2006) question how the same government that could not credibly commit itself to the pursuit of a low inflation target when it was in charge of monetary policy, can credibly commit itself to creating an institution capable of producing that same low rate of inflation, and of leaving it alone to get on with the job.

The commitment problem identified by Kydland and Prescott and by Barro and Gordon need not be limited to the temptation for opportunistic exploitation of a short-run inflation-unemployment trade off. Very similar issues arise when there is a large stock of nominally denominated fixed-interest public debt outstanding. This creates an incentive for the Treasury to use unanticipated inflation to reduce the real value of the outstanding stock of public debt. The gains from doing so are greater the longer the duration of the debt. Also, in countries where seigniorage, the resources that can be appropriated by the issuance of base money, is a potentially important source of state revenue, there is a constant temptation for

the Treasury to extract the anticipated and the unanticipated inflation tax. This last channel is especially important in emerging markets and developing countries where conventional revenue bases are often weak and distortionary. Central bank independence is an attempt at institutional reform aimed at strengthening the central bank's defenses against opportunistic abuse of unanticipated inflation (through the short-run Phillips curve trade-off or through the nominal debt channel), against abusive use of the anticipated and unanticipated inflation tax, and against even more direct raids on its resources by the Treasury.

Like every delegation of authority, the delegation of monetary policy to an operationally independent central bank raises two questions. The first is how to incentivise the Agent (the central bank) to act in the interest of the Principal - the government (the proximate Principal) and the people (the ultimate Principal). The second problem concerns the legitimacy of the institution to which authority has been delegated.

In what follows I will take the operational independence of the monetary authority as a *datum*. I will argue that a high degree of operational independence has two unavoidable consequences. First, there are few if any effective means to structure the incentives faced by the central bank so as to align the interests of the central bank with those of the proximate or the ultimate Principals. Second, the central bank will be substantively unaccountable. This undermines the legitimacy of the institution.

Operationally independent central banks contribute to the democratic deficit, in the EU and elsewhere. I will focus on concrete proposals for minimising the damage done by the operationally independent monetary authority to democratic accountability and legitimacy. The risk of a political backlash against central bank independence, prompted in part by a growing recognition of the inherent unaccountability of operationally independent central banks, should make these proposals of interest also to central bankers, even where they involve a sever clipping of central bank wings.

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The proposals that follow aim to limit the domain of unaccountability by restricting the scope of the activities for which a high degree of operational independence is granted, and by preventing an unnecessary enlargement of the democratic deficit through central bank 'mandate and mission creep'. In one sentence I propose to turn the operationally independent full-function central bank into a minimalist operationally independent monetary authority.

My main focus is on the ECB, although *mutatis mutandis* my analysis and proposals apply to all operationally independent central banks. The focus on the ECB is natural, first, because, from a formal legal point of view, the ECB is the world's most independent central bank; second, because the ECB is most at risk of a political backlash against central bank independence. This is due to the way it interprets and expresses its operational independence, and to the determined way it engages in mandate and mission creep. Right from its birth as a monetary authority in 1999, the ECB has adopted advocacy roles in areas such as budgetary policy and structural reform, that are beyond its mandate and competence. More seriously, it has tried and continues to try to broaden the scope of its formal power and influence to areas beyond monetary policy – areas where a much smaller degree of operational independence is appropriate than that enjoyed by the ECB in the realm of monetary policy.

Millwall FC is a South London football club, somewhat challenged in the love-and-respect-in-the-wider-community-of-football departments. The response of its fans to this lack of appreciation has been their famous song: *"No One Likes Us - We Don't Care"*.

Central bankers are the Millwall supporters of the economic policy world. They are unloved and take pride in that. I would suggest that they may be too pleased with themselves and their situation. That they are unloved is in part the inevitable by-product of their core task: maintaining price stability. William McChesney Martin, Chairman of the Board of Governors of the Federal Reserve System 1951-1970, once described the Fed's role as "taking

away the punch bowl just as the party gets going." Being the party pooper is not the way to win a popularity contest.

The unpopularity of central banks and central bankers goes, however, well beyond what is the inevitably by-product of the proper discharge of their appointed monetary policy mandate. I believe that the substantively unaccountable nature of their power, the arrogance with which too often this power is exercised, and the persistent attempts of too many central banks at 'mandate and mission creep' are to blame also.

IIA. Central bank operational independence is not easy to achieve

Operational independence is the freedom or ability of a central bank to pursue its objectives (regardless of who sets them) as it sees fit, without interference or pressure from third parties. It is not a binary variable but a matter of degree.

Operational independence from an elected, sovereign government is not easily achieved. It requires *political independence*: the central bank cannot seek or take instructions from any government/state body or other institution/body. It requires *technical independence*: the central bank must have the tool(s) to do the job. It means that the central bank cannot be coerced or induced to extend permanent financial assistance to the government or to private agents – it cannot be raided by government or private actors. It requires *financial independence*, that is, a separate budget and a secure capital base. It requires *security of tenure and of terms of employment*; this can be achieved through a minimum term of office, removal from office only for incapacity or serious misconduct (and not for gross incompetence), and pay and other conditions of employment that cannot be manipulated by outsiders. Finally, it requires that there be some other independent body, e.g. a court, to settle disputes between the central bank and the government.

This list suggests that true operational independence is difficult to achieve and that, if it is achieved, the central bank is, almost by definition, not substantively accountable. In addition, central bankers do not face normal economic incentives for eliciting effort and enhancing performance.

As an illustration of the problems standing in the way of operational independence of the central bank, consider the issue of its financial independence. The ability of the central bank to pursue its price stability mandate or, operationally, to achieve its inflation target, is constrained by its financial resources. Unlike the Treasury, the central bank does not have the power to tax. The asymmetry is even stronger when hen one realises that among the entities the Treasury can tax is the central bank. Frequently, the Treasury is also the owner of the central bank. In the UK, for instance, the Treasury owns all the common stock of the Bank of England. This raises the question: how independent can you be of the party that owns you and is able to tax you at will?

The answer is that this depends on the ability of the Treasury to commit itself not to deplete the financial resources of the central bank, whether by calling for extraordinary dividends, through a forced share re-purchase, or by taxing the central bank. The credibility of that commitment is determined by the same political factors that prompted the delegation of monetary policy to an operationally independent central bank in the first place. It is an open issue.

Table 1 shows the stylised conventional financial balance sheet of a central bank:

Table 1 Central Bank Financial Balance Sheet	
Assets	**Liabilities**
D: Treasury debt	M: Base money
L: Private sector debt	N: Non-monetary liabilities
R: Foreign exchange reserves	

	W: Financial net worth or equity

Table 1 is useless as a guide to the resources the central bank has at its disposal, now and in the future, to pursue its inflation target. For instance, the central bank's financial net worth or equity, *W,* could be negative, without this necessarily implying that the central bank's financial viability or solvency are endangered, or even that the central bank is unable to support a low inflation target. To look at the fundamental resource constraint on the central bank we need its intertemporal budget constraint, shown in Table 2.

<div align="center">

Table 2
Central Bank Comprehensive Balance Sheet or Intertemporal Budget Constraint
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Assets	Liabilities
D: Treasury debt	*M*: Base money
L: Private sector debt	*N*: Non-monetary liabilities
R: Foreign exchange reserves	
S: Present discounted value of seigniorage profits (interest saved on non-interest-bearing monetary liabilities).	*E*: Present discounted value of cost of running central bank
	T: Present discounted value of taxes paid to Treasury
	$\overline{W}$: Comprehensive net worth or equity

While the central bank's financial net worth can be negative, its comprehensive net worth, $\overline{W}$, which equals its financial net worth, *W*, plus the present value of its future seigniorage profits, *S*, minus the present value of the central bank's running costs (salaries, materials, depreciation etc), *E*, minus the present value of the net payments (taxes) made by the central bank to the Treasury, *T*.

What can the central bank do when it gets raided by the Treasury? After it cuts its expenses to the bone, all it can do is to 'print money' to stay solvent. Increased money issuance will, sooner or later, lead to higher inflation. That means higher nominal interest

rates and therefore a higher value of central bank profits on its investment account (S) in Table 2. Financial solvency will have been restored (assuming that the central bank is not operating on the slippery slope of the seigniorage Laffer curve), but it may well be the case that the inflation rate necessary to restore financial solvency for the central bank is different from (and most likely higher than) the inflation target (see Buiter (2004, 2005, 2006), Ize (2004) and Sims (2004, 2005)). In that case the inflation target is not independently financeable by the central bank. It is not a problem today for the ECB, the Bank of England, the Fed or the Bank of Japan, but it is a problem is many emerging markets and developing countries. It could become a problem even for the central banks in the most advanced countries. In what follows, I assume that the central bank has the financial resources to support the inflation target.

IIB. The ECB *has* achieved a remarkable and unique degree of formal operational independence

There can be little doubt that the ECB is the central bank with the highest degree of formal or legal operational independence. Since it also sets its own operational objectives (medium term HICP inflation below but close to two percent per annum), it can also be characterized as the most independent central bank, when operational independence and target/goal independence are taken together (Eijffinger (2005)). The ECB's operational independence and its mandate are enshrined in the Treaty establishing the European Community and the associated Protocol. These can only be amended through a Treaty revision requiring the unanimous consent of the EU member states (currently 25 in number).

As regards formal, legal safeguards guaranteeing political independence, financial independence and security of tenure and conditions of employment, the ECB scores as high as or higher than any other central bank. Highly unusually, there is nothing in the Treaty and Protocol governing the ESCB and the ECB that permits the political authorities (in this case

the Council of the European Union) to repatriate, or take back, under extreme circumstances, the power to conduct monetary policy from the ECB. The Bank of England Act 1998 created the Treasury Reserve Powers for this purpose; the Reserve Bank of New Zealand Act 1989 contains a similar provision. Dispute resolution through the European Court of Justice provides a further safeguard for its operational independence.

There is just one potential chink in the ECB's operational independence armour. This relates to the ECB's *technical independence.* There is some question as to whether the ECB has the tools to do the job of ensuring price stability.

Responsibility for exchange rate policy is divided between the ECB and the Council of Ministers. There is no substantive problem for central bank independence from the power of the Council of Ministers, acting unanimously, to enter into formal exchange rate arrangements with non-EU countries. Joining a new Bretton Woods would clearly be a political decision, to be taken by the political leadership of the EU, not by the ECB.

However, the Council can also formulate *general orientations* for the exchange rate. Only a qualified majority is required for this. Divided responsibility for the exchange rate could make a mockery of central bank independence. Not surprisingly, the ECB asserts that it cannot be given binding exchange rate orientations without its consent, and it has good sense on its side. Every French minister of finance since 1999 and a number of other ministers of finance have begged to disagree, however. The issue has not yet been put to the test.

IIC. Central bank operational independence means absence of substantive accountability

IIC.1 Accountability: to whom, for what and in which form?

Formal accountability is the aspect of responsibility involving giving, *ex-post*, a statistical or judicial explanation for events, actions and outcomes. Such formal accountability

requires that those to whom account is given (the Principal) can properly monitor the actions of Agent. The Principal must have enough information to be able to make an informed judgment as to how well the party held to account has performed. Clear objectives for the Agent and the most complete possible information about the actions of the Agent are necessary for formal accountability to be possible.

Formal accountability requires openness and transparency, at least *ex-post*. Whether, in the case of the ECB, it is enough to know the objectives of the ECB and to observe the narrowly defined actions of the monetary authority (typically the interest rate decisions), or whether more detailed and comprehensive information about the actions of the ECB (such as individual voting records, if voting takes place) and greater procedural transparency (minutes) are also required, continues to be a subject of disagreement (see e.g. Buiter (1999) and Issing (1999)). It is my position that the relevant actions of the ECB are not just the current and past interest rate decisions, but also the individual votes that produce that interest rate decision, and the (attributed) arguments, opinions, views of the transmission mechanism and forecasts that helped shape past and present interest rate decisions and will help shape future decisions.

Substantive accountability means that, following such reporting, explanation and justification, *judgment (or other pleasant or unpleasant consequences) may follow*. There is substantive accountability if the reporting, explanation and justification is 'payoff-relevant' for the party doing the reporting, that is, if there can be punishments, sanctions or rewards for those deemed responsible for actions or outcomes. It is clear from its own website, that the ECB has a minimalist, interpretation of accountability as formal accountability only: it is the (written and oral) *reporting obligations* of the ECB to the European Parliament, the European Commission and the European Council.[11] The same holds for the Bank of England (which

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[11] See: http://www.ecb.int/ecb/orga/accountability/html/index.en.html. The website states "According to the Statute, the ECB is required to publish quarterly reports on the activities of the Eurosystem as well as a consolidated Weekly Financial Statement. In addition, it has to produce an Annual Report on its activities and on the monetary policy of the previous and the current year. The Annual Report has to be addressed to the European

also has oral reporting obligations towards the UK Parliament) and all other operationally independent central banks.

It is not surprising that truly operationally independent central banks have effectively no substantive accountability at all. Independence *has* to mean that those in charge of monetary policy cannot be fired except for incapacity or serious misconduct, and that financial remuneration and working conditions likewise cannot be used to reward or punish them.[12] It ought to mean also that monetary policy makers cannot be sued in civil courts or be dragged into criminal courts for actions taken in their capacity as monetary policy makers. In the advanced industrial countries we have not (yet) witnessed recourse to the law by those disgruntled with the conduct of monetary policy. The legal immunities and liabilities of central bankers in the performance of their monetary policy making tasks are, however, an uncharted area.

IID. Incentivising monetary policy makers through enhanced formal accountability when there is no substantive accountability

The absence of substantive accountability for central banks and individual central bankers means that it is difficult to provide them with the proper incentives to do the best possible job. While many central bankers may be motivated in their approach to the job by a sense of public service, by duty and by unflinching commitment to the central bank's

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Parliament, the EU Council, the European Commission and the European Council." Article 113.3 of the Treaty Establishing the European Community (Consolidated Version) states *"The ECB shall address an annual report on the activities of the ESCB and on the monetary policy of both the previous and current year to the European Parliament, the Council and the Commission, and also to the European Council. The President of the ECB shall present this report to the Council and to the European Parliament, which may hold a general debate on that basis. The President of the ECB and the other members of the Executive Board may, at the request of the European Parliament or on their own initiative, be heard by the competent committees of the European Parliament."*

[12] Governing Council members of the ECB, both Executive Board members and NCB Governors, can only be fired for incapacity and serious misconduct. This does not appear to include gross incompetence as a cause for dismissal. The Bank of England Act 1998, permits dismissal when an MPC member is *unable or unfit* to do the job. This would seem to be a weaker test than that of the ECB. In particular, 'unfit' would seem to include 'grossly incompetent'. Other causes for dismissal of MPC members include bankruptcy and a few other irrelevant odds and ends.

mandate, one would like to see these higher motives reinforced by such primitive but frequently more reliable motives as the desire for power, prestige, wealth, comfort and leisure. This problem is especially acute when the monetary policy decision is a group decision; it gets more severe the larger the monetary policy making committee.

When monetary policy is made by a committee, two further factors can adversely influence the quality of the decision making. The first is the problem of free riding and shirking by individual members whose incremental contribution to the joint product (the interest rate decision) cannot be identified clearly (see Blinder (1999, 2005, 2006), Sibert (2003, 2006), Mihov and Sibert (2006)). The second concerns some well-known problems and pathologies associated with small-group decision making, of which 'groupthink' is a well-known example. (see Sibert (2006); for a more optimistic perspective on group decision making see Blinder (1999, 2005), and Blinder and Morgan (2005)).

How can one incentivise monetary policy makers in operationally independent central banks to pull their finger out? The only consequences of poor individual performance (if it can be identified), are damage to reputation (shame and embarrassment), poorer prospects for honours and impaired career prospects following one's term of office with the monetary authority.

Employment prospects in the public sector or the prospect of honours would not be morally appropriate or even legitimate incentives to induce central bankers to put their shoulder to the wheel, but this does not mean they play no role. Post-central bank employment prospects in the private sector would, however, subject to the appropriate safeguards and purdah/cooling-off-periods, be a useful way of incentivising central bankers.

If we grant the assumption that the outside world's perception of one's competence is a major determinant of one's future employment prospects, it is essential that the most complete information about each monetary policy maker's contribution to the monetary

policy decision is publicly available. This is not an issue when monetary policy is made by one person, as is the case in New Zealand. It is an issue when monetary policy is made by a committee, as it is now in the majority of central banks. Revealing the individual votes of all members of a monetary policy committee as soon as practicable following a monetary policy decision, is an effective way of structuring incentives and represents a tiny step towards substantive accountability.

The obvious fact that a high degree of operational independence is inconsistent with substantive accountability should be recognised openly; lack of substantive accountability is a price one has to pay for operational independence. The sight and sound of the ECB describing itself as the most accountable central bank in the world, when the truth is zero substantive accountability and an absolutely minimal and utterly inadequate set of formal reporting duties, is not a pretty one. I also do not think it is politically sustainable. Either the ECB will become more open, or its independence will be taken from it.

IID. Limiting the domain of unaccountability

The absence of substantive accountability for delegated authority can be rationalised and defended when there are clear performance gains from the delegation in question. The legitimacy of the delegation is however, undermined when the range of actions and decisions that is delegated to a substantively unaccountable authority is greater than is strictly necessary. It is here that the ECB is especially vulnerable, because since it started operations in 1999 it has made two systematic mistakes. First, it has become a vocal and highly partisan participant in wider economic policy debates that are well beyond its mandate and competence. Second, it has tried and continues to try, to broaden the scope of its formal powers and responsibilities.

IID1. Central banks should stick to their knitting[13]

It was a mistake for the Treaty to grant the ECB an official, public (albeit only) advisory role in the process governing the admission of new Eurozone members. The institution has neither the political legitimacy nor the analytical competence to play such an important part in a quintessentially political and broad economic-analytical decision.

The issue is all the more serious because the 12 NCB Governors that are currently members of the ECB Governing Council face a potential conflict of interest when making recommendations on Eurozone enlargement. The reason is that, once the number of Eurozone member states exceeds 15, it will no longer be the case that each NCB Governor has a vote in each interest rate decision. Instead, they will rotate and thus have their voting power diluted. This potential loss of influence is largest for the smallest current Eurozone members, Luxembourg in particular, once the number of NCB governors reaches 22. If turkeys don't vote for Christmas, Eurozone NCB governors are less likely to vote for Eurozone enlargement.

It is also a mistake for central bankers to express, in their official capacities, views on what they consider to be necessary or desirable fiscal and structural reforms. Examples are social security reform and the minimum wage, subjects on which Alan Greenspan liked to pontificate when he was Chairman of the Board of Governors of the Federal Reserve System. It is not the job of any central banker to lecture, in an official capacity, the minister of finance on fiscal sustainability and budgetary restraint, or to hector the minister of the economy on the need for structural reform of factor markets, product markets and financial markets. This is not part of the mandate of central banks and it is not part of their areas of professional competence. The regrettable fact that the Treasury and the Ministry of the Economy tend to make the symmetric mistake of lecturing the operationally independent central bank on what

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[13] With thanks to Alan Blinder for this felicitous phrase.

they perceive to be its duties (which generally amounts to a plea for lower interest rates) does not justify the central bank's persistent transgressions.

There are but a few examples of central banks that do not engage in public advocacy on fiscal policy and structural reform matters. The only examples I am aware of are the Bank of England and the Reserve Bank of New Zealand.

Central bankers indeed have a duty to explain how their current and future interest rate decisions are contingent on economic developments that may include or may be influenced by, the actions of the fiscal authorities and the success or failure of structural reforms. The central bank should clarify what its reaction function is, given the economic environment in which they operate, which includes the fiscal authorities and the government and 'social partners' engaged in structural reforms.

Independent central bankers can, and where possible should, cooperate with and coordinate their actions with those of the fiscal authorities and with those charged with structural reform. If central banks, Treasury ministers and ministers of the Economy were to act cooperatively toward each other, and with credible commitment towards the private sector, good things may well happen. The reason this does not happen in the EU, or even in the Eurozone, is not a question of principle, but of logistics. There is no coordinated fiscal policy in the EU or in the Eurozone, so the pursuit of coordination between fiscal and monetary policy in the EU or in the Eurozone is simply not possible. Mr. Jean-Claude Juncker could have private breakfasts and/or public lunches with Mr Jean-Claude Trichet every day of the week, every week of the year, it would not bring monetary and fiscal policy coordination in the Eurozone an inch closer to realisation.

IID. From independent central bank to minimalist independent monetary authority

The only time central banks have the right and duty to speak out on issues beyond monetary policy narrowly defined, is when the independence of the central bank is threatened. Such occasions are few and far between. Unsustainable public finances are not a matter on which the central bank should speak out, even if they threaten to confront the central bank with the dilemma: live with a sovereign debt default or bail out the improvident government through monetisation that threatens the central bank's price stability mandate. The central bank's mandated course of action is clear: they should let the government default on its debt rather than monetise that debt in a way that undermines price stability.

The threat of systemic financial instability may make it desirable that any or all of the following speak out: the financial supervisor and regulator, the providers of clearing and settlement services and/or the lender of last resort. However, neither the supervision and regulation of financial institutions and markets, nor the provision of clearing and settlement services, nor the active part of the lender of last resort function need be the responsibility of the central bank. Because the degree of independence of an operationally independent monetary authority is much greater than what is desirable for the financial regulator/supervisor, the provider of clearing and settlement services and the lender of last resort, there is a strong accountability argument for not bestowing any of these functions on the central bank.

An independent monetary authority need have few of the functions historically associated with the central bank. To minimize the legitimacy problems inevitably associated with the complete lack of substantive accountability of the operationally independent central bank, I would favour stripping the monetary authority of all responsibilities and competencies other than the pursuit of price stability. This minimalist objective would be supported through a minimalist assignment of instruments to the monetary authority. It would have just the power to set some short-term nominal interest rate or, in a managed exchange rate regime,

to set the value of the nominal spot exchange rate. It would also be able to manage its portfolio as it sees fit. This could include portfolio operations traditionally described as sterilised or non-sterilised foreign exchange market intervention.

This implies, that I would deny the monetary authority the following functions:

1. Supervision and regulation of banks, other financial institutions and financial markets

2. Ownership, control and management of the interbank clearing and settlement systems (e.g. TARGET for the Eurozone and its proposed successor, TARGET2).[14]

3. Ownership, control and management of the financial securities clearing and settlement systems (e.g. the proposed TARGET2-Securities for the Eurozone)

4. An active role in the prevention and mitigation of financial instability (other than what is the natural by-product of the pursuit of price stability), including an active part in the discharge of the lender of last resort function.

It is possible to strip the monetary authority of an active role in all four areas without this having any material adverse effect on financial stability or on the efficiency of the financial intermediation, clearing and settlement processes. As there would be accountability gains from removing the monetary authority from all four areas, there is no reason not to proceed.

The ECB currently has no role in financial supervision and regulation. The Treaty and Protocol do not grant the ECB supervisory or regulatory powers, but neither do they role this out.[15] The ECB owns and runs TARGET, but is not granted a monopoly of clearing and

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[14] "TARGET stands for **T**rans-European **A**utomated **R**eal-time **G**ross settlement **E**xpress **T**ransfer system." "It is the Real Time Gross Settlement system for the euro, offered by the Eurosystem. It is used for the settlement of central bank operations, large-value euro interbank transfers as well as other euro payments. It provides real-time processing, settlement in central bank money and immediate finality. TARGET was created by interconnecting national euro real-time gross settlement (RTGS) systems and the ECB payment mechanism. It went live in January 1999." ECB Website, http://www.ecb.int/paym/target/html/index.en.html.

[15] Article 3.3 of the Protocol on the Statute of the European System of Central Banks and of the European Central Bank states: "In accordance with Article 105(5) of this Treaty, the ESCB shall contribute to the smooth

settlement services by the Treaty. It has ambitions for being the monopoly provider of Eurozone clearing and settlement facilities for securities.

IID1. Taking the monetary authority out of financial supervision and regulation

The ECB has always had ambitions to become the leading supervisor/regulator of banks and other financial institutions and of key financial markets in the Eurozone (Padoa Schioppa (1999)). There is a good case for an EU-wide (note, not just a Eurozone-wide) supervisor and regulator of banks and other financial institutions, especially as and when such institutions are established under European statutes. There is no case for the ECB fulfilling this role.

The prospect of the extreme degree of substantive unaccountability of Eurozone monetary policy being extended to financial supervision and regulation is a deeply unattractive one. This important but murky area is at the same time highly technical and deeply political. It involves often intense distributional conflict and fierce fights over property rights. Expertise in monetary policy is no qualification for that job. The notion that it should be discharged by an institution without any substantive accountability is unacceptable.

IID2. Taking the monetary authority out of the clearing and settlement business

The provision of clearing and settlement services is another example of an area where central banks often play a role, despite there being no fundamental efficiency argument for it. Real Time Gross Settlement (RTGS) systems process a country's large-value payments. Historically, they are the preserve of the central bank, which more often than not owns, runs

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conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system."

and oversees it. Examples include CHAPS for the UK, Fedwire for the US, BoJ Net for Japan and TARGET for the Eurozone.

The reason why an operationally independent central bank ought to divest itself of its national (in the case of the ECB regional) RTGS system ownership, management and operation is not that the central bank is doing a particularly poor job of running the RTGS system. It is that, if it were to do a poor job, it is excessively sheltered behind the operational independence shield of the central bank. There is no reason why the owner/manager/operator of the RTGS system should not be fired for doing a poor job. When the owner of the RTGS system is also the head of the operationally independent central bank, appropriate sanctions and incentives cannot be brought to bear on him/her.[16]

The ECB should "outsource" TARGET by spinning it off to another regulated entity (public or private) – one which has no monetary policy functions and much greater substantive accountability than the ECB. Instead the ECB's systematic mandate and mission creep is leading it to propose that its monopoly over the provision of euro clearing and settlement services through TARGET (and its successor TARGET2) be extended to clearing and settlement of Eurozone transactions in financial securities through a proposed TARGET2 – Securities, to be owned, controlled and run by the ESCB (see Norman (2006)).

A Eurozone-wide platform for clearing and settling securities transactions is highly desirable, because it would lower transaction costs and promote further market integration. There is no efficiency argument for having the central bank provide the clearing and

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[16] My proposal that the central bank divest itself of ownership/management/operation of its national or regional RTGS system is not unheard of. At the SIBOS conference in Sydney, October 2006, Steve Barton, Senior Manager, Payments Systems and Liquidity, Banking and Market Services, Bank of England, discussed the idea of the Bank of England giving up running Britain's RTGS system. "In most cases central banks are the operators of the RTGS, but we are happy to review this," he said when discussing renewal of the system. This "may lead to a different proposal in the future." Quotes from NEWSMAKERS - CENTRAL BANKERS IN THE NEWS, Central Banking Publications, 31 October 2006.

settlement platform, however, and it is important for the political health of the European Union that any ECB attempt to muscle in on this activity be resisted. The body running TARGET (and the future TARGET2-Securities) needs access to the liquid liabilities of the ECB to fulfil its clearing and settlement role at least cost. It therefore needs an account with a generous balance at the ECB or an overdraft facility with the ECB. There is no logical or practical reason why the ECB should provide such clearing and settlement services itself.

IID3. Taking the monetary authority out of the financial stability business

Here I briefly develop the proposition that the monetary authority has no natural role in ensuring financial stability, other than what emerges naturally as the by-product of its pursuit of price stability. A three-step argument is used. The first step is that the scope and incidence of systemically important financial instability are limited. The second step is that the irreducible minimum financial stability role that does indeed exist for public sector institutions can be performed perfectly well without the active participation of the monetary authority. The third step is that if it can be done equally well without the monetary authority, it should be done without the monetary authority. The reason is that it is undesirable, from the point of view of substantive accountability and democratic legitimacy, to grant additional tasks and responsibilities to the operationally independent and therefore substantively unaccountable monetary authority.

Whatever set of institutions is charged with maintaining financial stability, a minimalist view of financial instability is essential.[17] The public authorities should act to prevent three kinds of pathologies. First, *disorderly markets*, including failures of clearing and settlement systems. Second, extreme credit and asset market booms and busts, where market valuations and the cost and availability of credit have become clearly detached from

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[17] What follows owes much to the papers of Allen and Wood (2005) and Howard (2006).

fundamentals. Third, defaults and bankruptcies that have material negative systemic externalities that outweigh the positive value of default and bankruptcy in the re-allocation of ownership and control rights in a market economy based on property rights and the rule of law.

Disorderly markets are rare. For instance, since the New Zealand dollar was floated in 1985, the policy of the Reserve Bank of New Zealand has been to intervene only during periods of "extreme market disorder" when the operation of the foreign exchange market itself is under threat. For this purpose, the Bank maintained foreign exchange reserves in a target range of SDR 1.45bn to 1.75bn. The Bank has never had to intervene for crisis management reasons during the past 21 years. While the event may be rare, the cost of event should it occur could well be high. The post 9/11 flooding of the world's inter-bank markets and money markets with central bank liquidity was clearly an appropriate precautionary measure.

Unlike disorderly markets, credit booms and busts are a common and integral part of both ancient and modern financial capitalism. The monetary authority has neither an obvious mandate for preventing or mitigating credit booms and asset price bubbles, nor a comparative advantage in doing so. Unless asset market or credit developments threaten the fulfilment, sooner or later, of the primary price stability mandate, where price stability is defined, appropriately, in terms of some consumer price index or cost-of-living index, asset market and credit booms are not a first-order concern of the monetary authority. If the conventional instrument of monetary policy (a short-term nominal interest rate) can be used to address asset market bubbles and credit booms without prejudice to the price stability target, now and in the future, the monetary authorities are indeed not only entitled, but mandated to do so.

I have serious doubts, however, about the effectiveness of the use of the central bank's policy rate in the pursuit of asset price stability and credit growth moderation, although sharp

cuts in the policy rate can help clean up the mess that results when asset bust follows asset boom and credit crunch follows credit glut. The reasons monetary policy should not target asset prices are straightforward.

First, monetary policy should not try to influence asset prices that reflect fundamentals, even if these asset prices move fast and furiously, as often they will. Second, monetary policy is not the appropriate tool for influencing asset price movements that are not driven by fundamentals, that is, monetary policy is not an effective tool for bursting or mitigating bubbles. You don't hunt bubbles with fundamentals. At most, if the monetary authorities are sufficiently confident that a given observed pattern of asset price movements does indeed represents a bubble, they should use open mouth operations (warnings about irrational exuberance or irrational despondency) to try and prick the bubble.

Credit control measures, such as tighter margin requirements, lower limits on loan-to-value ratios for housing credit, more demanding collateral requirements, higher downpayments for home purchases and durables purchases are the appropriate tools for dealing with credit growth deemed excessive. Taxing lending or borrowing (in a financially open economy, borrowing would make more sense as disintermediation tends to be harder for borrowers than for lenders) is another possible financial stabilisation tool. There is no reason, however, for the central bank to be involved in designing, implementing and administering any such measures. It is enough for the central bank to be informed, so it can make informed judgments about the implications of such credit control measures for the pursuit of its price own price stability mandate.

Systemically important defaults and bankruptcies in the financial sector no doubt occur, but have I trouble recalling any in the leading industrial countries since World War II. The bail-out of LTCM (with private money but facilitated through the good offices of the New York Fed) has been justified on the grounds that its failure would have created systemic

risk, through the exposure of systematically important banks to the institution and through the effect of the rapid liquidation of LTCM's positions on certain asset prices. I disagree, and had it been my call, I would have allowed it to fail. I do not believe that the failure of this highly leveraged betting facility for the extremely rich would have created systemically significant negative externalities. I find it hard to think of any single financial institution whose failure would be more systemically significant than the failure of, say, General Motors. And there is no financial stability argument for bailing out automobile manufacturers, no matter how large.

Given enough non-fundamental contagion effects, any (financial sector) default can become a systemically important issue. However, pure contagion effects can be addressed effectively by the authorities without foregoing the benefit of periodic large-scale defaults in the financial sector.

Some central banks, the ECB prominent among them, favour a definition of financial instability that encompasses just about any inefficiency in the financial intermediation process. Since financial intermediation, whether through long-term client relationships institutionalised through banks or through markets, is shot through with features that can be plausibly be interpreted as inefficiencies, it is easy, using this all-encompassing definition of financial instability, to paint a picture of pervasive financial instability and of even more comprehensive threats to financial stability. From this 'acquis', some prominent members of the ECB Executive Board have called for a greatly enhanced role of the central bank in financial supervision and regulation. This should be resisted. Financial sector inefficiency is not a financial stability issue. It represents, at most, an issue to be addressed by the regulator/supervisor, not by the monetary authority.;

IID4. Taking the monetary authority out of the lender-of-last-resort business

There exists a widespread atavistic notion that the monetary authority has to have a role in underpinning financial stability, because the central bank is the natural lender of last resort (Bagehot (1866, 1873)). It is true that, through its monopoly of the issuance of legal tender, the central bank can issue effectively unlimited amounts of default-risk-free financial liabilities of the highest liquidity at little or no notice and at little if any cost. This, however, is not sufficient to conclude that the central bank has to be the lender of last resort. All it implies is that the lender of last resort, whichever institutions plays that role, has to have very large overdraft facility with the central bank.

Financial stability requires the cooperation and coordination of the actions of the Treasury and the supervisor/regulator. There is no logically necessary role for the central bank. In the UK, for instance, the Bank of England could be taken out of the current three-party Memorandum of Understanding concerning financial stability between the UK Treasury, the Financial Services Authority (FSA) and the Bank of England.

The FSA is an essential player in the Financial Stability Team (FST) because it has the deep institution-specific information and knowledge only the supervisor/regulator has. The Treasury is an essential player because, through its capacity to tax, it is the agency with the deepest long-run non-inflationary pockets. The odds on it defaulting on *de jure* or *de facto* index-linked, that is, real, obligations, are therefore lower than for any other economic actor. If a serious bail-out through a large-scale recapitalisation is deemed necessary for financial stability, the Treasury is the only place to go for resources. Historically, the Bank of England is part of the FST because, through its legal tender monopoly, it is the agent with the short-term deep pockets. However, any agency with the appropriate degree of access to the resources of the central bank (through ample balances held with the central bank or through an (in principle) unlimited overdraft facility with the central bank, guaranteed by the

Treasury, could do the job done now by the Bank. The obvious agency in the UK to play the active part of the lender of last resort role is the FSA.

So, in the UK, the Bank of England could be stripped of its financial stability role without any adverse impact on financial stability, by bestowing on the FSA an unlimited overdraft facility with the Bank of England, guaranteed by the Treasury. The Bank of England would not be responsible for the use made of this overdraft facility, so the Bank's lack of substantive accountability would not matter. Since the FSA is significantly more substantively accountable than the Bank of England, accountability would be enhanced overall.

III. Conclusions

III.1 Inflation targeting

Flexible inflation targeting, the proposition that the monetary authorities should be willing to trade off price stability for output gap stability, threatens to undo the good achieved since the pursuit of price stability was first operationalised through the adoption of a numerical medium term inflation target. It has no foundations in welfare economics. It is incompatible with the mandate of every central bank that has price stability as its primary objective. It risks imparting an upward bias to inflation. It sets monetary policy design and implementation back to before 1989 – the year New Zealand first adopted inflation targeting. The solution is to drop flexible inflation targeting and replace is with *lexicographic* or *hierarchical* inflation targeting.

The influential Calvo-Woodford version of the *New-Keynesian Phillips curve* does not have the long-run natural rate property - it implies an exploitable long-run trade-off between inflation and unemployment (a positive long-run relation between inflation and output). This

sets back monetary economics about 40 years, to the days before the Nobel prize winning contributions of Phelps, Friedman and Lucas. The solution is not to use this construct.

III.2 Central bank independence: limiting the domain of unaccountability

Central bank operational independence is not easily established. It is an empirical question as to whether the inflation target is independently financeable by the central bank.

If a central bank can be made fully operationally independent, it is, by construction, not *substantively accountable*. At most *formal accountability* can exist - reporting duties without consequences, that is, monitoring without sanctions or rewards for the central bank as an institution, or for individual central bankers. As the world's most operationally independent central bank, the ECB has zero substantive accountability. It is therefore particularly unfortunate that it takes such a minimalist view of its reporting obligations – its formal accountability.

This lecture makes a number of concrete proposals for limiting the domain of substantive unaccountability, by stripping the central bank of responsibilities and powers that are not essential to its monetary policy role. The monetary authority should play no role in the supervision and regulation of financial institutions and markets, in the operation of clearing and settlement systems, or in the prevention and mitigation of financial instability. Its participation in these activities is neither necessary for efficiency nor desirable from the point of view of democratic accountability and legitimacy.

Specifically, as regards the ECB, I propose the following:

1. Do not create a role for ECB in the supervision and regulation of banks, other financial institutions and financial markets.

2. End the ownership, control and management by the ECB of the real time gross settlement system for the euro (TARGET).

3. Do not permit ownership, control and management by the ECB of the proposed Eurozone-wide financial securities clearing and settlement system ('TARGET 2 – Securities).

4. Remove the ECB from any active role in the prevention and mitigation of financial instability (other than what occurs as the natural by-product of its pursuit of price stability), including an active part in the discharge of the lender of last resort function. Grant any future EU-wide or Eurozone-wide financial regulator/supervisor (EFSA) an overdraft facility with the ECB, under the joint and several guarantee of the EU or Eurozone national fiscal authorities, to allow the EFSA to discharge the lender of last resort function.

The strength of the formal, legal guarantees of a central bank's independence may say little or nothing about the likelihood that this independence will be encroached on in the real world. The politics of the moment can overwhelm even constitution-based or Treaty-based guarantees. This is likely to be particularly relevant for the ECB.

The ECB's operational independence and operational target independence is derived from a Treaty that is several hundred pages long and has a kitchen-sink quality – it covers everything from the sublime and important to the ridiculous and trivial. Few citizens of the EU consider themselves bound by every paragraph in it. The ECB's independence has extremely sturdy formal legal foundations, but in truth is only secure as long as (1) the EU-wide polity considers it to be politically legitimate and (2) the other EU institutions (especially the Council, the European Parliament and the Court) are willing to support it. Borrowing an image from that great political economist Stalin, the ECB does not have any divisions of its own.

There is a risk that the Eurozone central banking emperor, while clutching frantically to the fig leaf of formal, legalistic operational independence, could turn out to be wearing no politically legitimate clothes.

Appendix 1. The intertemporal budget constraints of the central bank and the treasury

The argument around Tables 2 and 3 is easily formalised and made precise with a stylized set of accounts for the central bank and the treasury (see also Buiter (2004), Sims (2004), (2005) and Ize (2005)).

The central bank has the monetary base M, (currency plus commercial bank reserves with the central bank) on the liability side of its financial balance sheet; it carries a zero nominal interest rate.[18] On the asset side it has the stock of international foreign exchange reserves, R^f, earning a risk-free nominal interest rate i^f and the stock of domestic credit, which consists of central bank holdings of nominal, interest-bearing treasury bills, D, earning a risk-free nominal interest rate i, and central bank claims on the private sector, L, with nominal interest rate i^L.[19] The stock of treasury debt held outside the central bank is B; it pays the risk-free nominal interest rate i; τ^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; τ^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; $\tau^g \equiv \tau^p + \tau^b$ is the real value of total treasury tax receipts; $h \geq 0$ is the real value of the transfer payments made by the central bank to the private sector ('helicopter drops'); I assume it to be a choice variable of the central bank; $\tau \equiv \tau^p - h$ is total real taxes net of transfer payments received by the state, that is, the consolidated treasury and central Bank; e is the value of the spot nominal exchange rate (the domestic currency price of foreign exchange); c^g is the real value of general government spending on goods and services and c^b the real value of central bank spending on goods and services; P is the general price

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[18] For simplicity, all of the monetary base is treated as non-interest bearing.
[19] For simplicity, I consider only short maturity bonds. Generalisations to longer maturities, index-linked debt or foreign-currency denominated debt are straightforward. In many transition countries and developing countries the central bank also holds private sector debt instruments among its assets and interest-bearing, non-monetary liabilities among its liabilities.

level; the distinction between producer and consumer price levels is ignored for simplicity, and public spending on goods and services is assumed to be public consumption only.

Equation (12) is the budget identity of the treasury and equation (13) that of the central bank.[20]

$$\frac{B_t + D_t}{P_t} \equiv c_t^g - \tau_t^p - \tau_t^b + (1 + i_{t,t-1})\left(\frac{B_{t-1} + D_{t-1}}{P_t}\right) \tag{12}$$

$$\frac{M_t - D_t - L_t - e_t R_t^f}{P_t} \equiv c_t^b + \tau_t^b + h_t + \frac{M_{t-1} - (1 + i_{t,t-1})D_{t-1} - (1 + i_{t,t-1}^L)L_{t-1} - (1 + i_{t,t-1}^f)e_t R_{t-1}^f}{P_t} \tag{13}$$

When there exist complete contingent claims markets, and the no-arbitrage condition is satisfied, the usual solvency constraints, ruling out Ponzi finance by both the government and the central bank, imply the following intertemporal budget constraints for the treasury (equation (14)) and for the central bank (equation (15)).[21]

$$B_{t-1} + D_{t-1} \le E_t \sum_{j=t}^{\infty} I_{j,t} P_j \left(\tau_j^p + \tau_j^b - c_j^g\right) \tag{14}$$

$$-\left(D_{t-1} + L_{t-1} + e_{t-1}R_{t-1}^f\right) \le E_t \sum_{j=t}^{\infty} I_{j,t} P_j \left(-c_j^b - \tau_j^b - h_j - s_j + \frac{\Delta M_j}{P_j}\right) \tag{15}$$

$$P_t s_t \equiv \left(i_t - i_t^L\right)L_{t-1} + \left[1 + i_t - \left(1 + i_t^f\right)\frac{e_t}{e_{t-1}}\right]e_{t-1}R_{t-1}^f . \tag{16}$$

Here $I_{j,t}$ is the nominal stochastic discount factor between periods j and t defined by

$$I_{t_1,t_0} = \prod_{k=t_0+1}^{t_1} I_{k,t-1} \quad \text{for } t_1 > t_0 \tag{17}$$
$$= 1 \qquad \text{for } t_1 = t_0$$

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[20] Note that the familiar proposition that the change in the monetary base equals domestic credit expansion plus the value of the change in the stock of foreign exchange reserves is correct if and only if the central bank makes no *after-tax* profits, that is, its before-tax profits, $i_t D_{t-1} + i_t^L L_{t-1} + e_t i_t^f R_{t-1}^f - P_t h_t$, are paid as taxes to the treasury: $\Delta M_t \equiv \Delta D_t + \Delta L_t + e_t \Delta R_t^f$ iff $P_t \tau_t^b \equiv i_t D_{t-1} + i_t^L L_{t-1} + e_t i_t^f R_{t-1}^f - P_t h_t$.

[21] The solvency constraint for the treasury is $\lim_{j \to \infty} E_t I_{j,t}\left(B_j + D_j\right) \le 0$, that for the central bank is

$\lim_{j \to \infty} E_t I_{j,t}\left(D_j + L_j + e_j R_j^f\right) \ge 0$.

The interpretation of $I_{j,t}$ is the price in terms of period t money of one unit of money in period $j \geq t$. There will in general be many possible states in period j, and period j money has a period t (forward) price for each state. Provided earlier dated information sets do not contain more information than later dated information sets, these stochastic discount factors satisfy the recursion property

$$E_{t_0}\left(I_{t_1,t_0}E_{t_1}I_{t_2,t_1}\right) = E_{t_0}I_{t_2,t_0} \quad \text{for } t_2 \geq t_1 \geq t_0 \tag{18}$$

Finally, the risk-free nominal interest rate in period t, the money price in period t of one unit of money in every state in period $t+1$ is defined by

$$\frac{1}{1+i_{t+1,t}} = E_t I_{t+1,t} \tag{19}$$

For future reference I also define recursively the real stochastic discount factor $R_{j,t}$ by

$$R_{t_1,t_0} = \prod_{k=t_0+1}^{t_1} R_{k,t-1} \quad \text{for } t_1 > t_0$$
$$= 1 \quad\quad\quad \text{for } t_1 = t_0$$

where

$$R_{t+1,t} = I_{t+1,t}(1+\pi_{t+1,t})$$

and the risk-free real rate of interest between periods t and $t+1$ is defined as

$$\frac{1}{1+r_{t+1,t}} = E_t R_{t+1,t}.$$

The expression s in (16) stands for the real value of the quasi-fiscal implicit interest subsidies made 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 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 $\left[1+i_t - \left(1+i_t^f\right)\dfrac{e_t}{e_{t-1}}\right]e_{t-1}R_{t-1}^f$

Summing (12) and (13) gives the budget identity of the state (the consolidated treasury and central bank), in equation (20); summing (14) and (15) given the intertemporal budget constraint of the state in equation (21).

$$M_t + B_t - L_t - e_t R_t^f \equiv P_t(c_t^g + c_t^b - \tau_t) + M_{t-1} + (1+i_t)B_{t-1} - (1+i_t^L)L_{t-1} - e_t(1+i_t^f)R_{t-1}^f \quad (20)$$

$$B_{t-1} - L_{t-1} - e_{t-1}R_{t-1}^f \leq \sum_{j=t}^{\infty} E_t I_{j,t} P_j \left(\tau_j - s_j - c_t^g - c_t^b + \frac{\Delta M_j}{P_j} \right) \quad (21)$$

The central bank's financial net worth, $W^{cb} = D + L + eR^f - M$, 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 monetary liabilities, M. Note that, in principle, there is nothing to prevent W^{cb} from being negative. Financial net worth excludes the present value of anticipated or planned future non-contractual outlays and revenues (the right-hand side of equation (15). It is therefore perfectly possible, for the central bank to survive and thrive with negative financial net worth. This might, however, require the central bank to raise so much real seigniorage, $\frac{\Delta M_j}{P_j}$, $j \geq t$, through current and future nominal base money issuance, that, given the demand function for real base money, unacceptable rates of inflation would result. The financial net worth of the treasury, $W^g \equiv -(D + B)$, is negative for most governments. The financial net worth of the state, $W^s \equiv W^g + W^b = L + eR^f - B - M$, is also likely to be negative for most countries. None of this need be a source of concern, unless the gap between the outstanding contractual non-monetary debt of the state and the present discounted value of the future primary (non-interest) surpluses of the state, $\tau_j - c_j^g - c_j^b - s_j$, $j \geq t$ is so large, that it either cannot be filled at all at all (the maximum value of the discounted future real seigniorage stream is too low) and the state defaults, or can only be closed at high rates of inflation.

The only intertemporal budget constraint that ought to matter, that is, the only one that would matter in a well-managed economy, is that of the consolidated treasury and central bank, given in equation (21). Its breakdown into the treasury's intertemporal budget constraint (equation (14)) and the central bank's intertemporal budget constraint (equation (15)) is without macroeconomic interest, unless there is a failure of cooperation and coordination between the monetary and fiscal authorities, that is, between the central bank and the treasury.

Appendix 2. Can central banks survive with 'negative equity'?

We can rewrite the intertemporal budget constraint of the central bank in (15) as follows:

$$
M_{t-1} - \left(D_{t-1} + L_{t-1} + e_{t-1}R_{t-1}^f \right)
$$
$$
\leq E_t \sum_{j=t}^{\infty} I_{j,t} P_j \left(-c_j^b - \tau_j^b - h_j - s_j \right) + E_t \sum_{j=t}^{\infty} I_{j,t} \left(\frac{i_{j,j-1}}{1+i_{j,j-1}} \right) M_{j-1} + \lim_{j\to\infty} E_t I_{j,t} M_j \qquad (22)^{22}
$$

On the left-hand side of (22) we have (minus) the equity of the central bank – the excess of its monetary liabilities over its financial assets. On the right-hand side of (22) we have $E_t \sum_{j=t}^{\infty} I_{j,t} \left(\frac{i_{j,j-1}}{1+i_{j,j-1}} \right) M_{j-1}$, the present discounted value of the future interest payments saved by the central bank because of its ability to issue non-interest-bearing monetary liabilities. On the right-hand side of (22) we also have the present value of the terminal stock of non-interest-bearing money, $\lim_{j\to\infty} E_t I_{j,t} M_j$.

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[22] Add M_{t-1} to both sides of (15); note that

$$
M_{t-1} + E_t \sum_{j=t}^{\infty} I_{j,t} \Delta M_j \equiv E_t \sum_{j=t}^{\infty} \left(I_{j-1,t} - I_{j,t} \right) M_{j-1} + \lim_{j\to\infty} E_t I_{j,t} M_j ; \text{ finally note that}
$$

$E_t I_{j,t} = E_t(I_{j-1,t} I_{j,j-1})$ and that $E_t I_{j,j-1} = \dfrac{1}{1+i_{j,j-1}}$.

In order to obtain the central bank's intertemporal budget constraint (15), I assumed (see footnote (39)) that $\lim_{j \to \infty} E_t I_{j,t} \left(D_j + L_j + e_j R_j^f \right) \geq 0$, that is, the present value of the terminal net non-monetary liabilities had to be non-negative. I did not impose the condition $\lim_{j \to \infty} E_t I_{j,t} \left(D_j + L_j + e_j R_j^f - M_j \right) \geq 0$, that is, that the present value of the terminal total net liabilities, monetary and non-monetary had to be non-negative. The reason is that the monetary 'liabilities' of the central bank are not in any meaningful sense liabilities of the central bank. The owner (holder) of currency notes worth X units of currency have a claim on the central bank for currency notes worth X units of currency – nothing more. The monetary liabilities of the central bank are irredeemable or inconvertible into anything other than the same amount of itself. While in most well-behaved economies, $\lim_{j \to \infty} E_t I_{j,t} M_j = 0$, this will not be the case, for instance, in a permanent liquidity trap where $\lim_{j \to \infty} E_t I_{j,t} M_j = \lim_{j \to \infty} E_t M_j \neq 0$ unless the monetary authorities adopt a policy of (asymptotically) demonetising the economy. This will be the case, for instance, in the efficient stationary liquidity trap equilibrium of the Bailey-Friedman Optimal Quantity of Money rule, where the nominal interest is kept at zero throughout and the nominal stock of base money shrinks at a proportional rate equal to the real interest rate and the rate of time preference.

Consider for simplicity the case where the present value of the terminal money stock is zero. Even if the conventionally defined net worth or equity of the central bank is negative, that is, if $M_{t-1} - (D_{t-1} + L_{t-1} + e_{t-1} R_{t-1}^f) > 0$, the central bank can be solvent provided

$$M_{t-1} - \left(D_{t-1} + L_{t-1} + e_{t-1} R_{t-1}^f \right) \leq E_t \sum_{j=t}^{\infty} I_{j,t} P_j \left(-c_j^b - \tau_j^b - h_j - s_j \right) + E_t \sum_{j=t}^{\infty} I_{j,t} \left(\frac{i_{j,j-1}}{1+i_{j,j-1}} \right) M_{j-1}.$$

Whether this is consistent with the pursuit of the externally imposed or self-imposed inflation target is something we will consider in Appendix 3.

Appendix 3. Is the inflation target independently financeable by the central bank?

I consider here whether and under what conditions the inflation target is consistent with the central bank's intertemporal budget constraint. Consider a simplified, closed economy macroeconomic model, tagged on to the accounting framework developed in the previous Subsection. There are no international reserves, $R_t^f = 0$, no central bank loans to the private sector, $L_t = 0$, and therefore no quasi-fiscal subsidies by the central bank, $s_t = 0$.

The intertemporal budget constraints of the central bank and of the consolidated central bank and treasury are for this simplified closed economy:

$$-D_{t-1} \le \sum_{j=t}^{\infty} E_t I_{j,t} P_j \left(-c_j^b - \tau_j^b - h_j + \frac{\Delta M_j}{M_j} \frac{M_j}{P_j} \right) \tag{23}$$

and

$$B_{t-1} \le \sum_{j=t}^{\infty} E_t I_{j,t} P_j \left(\tau_j - c_t^g - c_t^b + \frac{\Delta M_j}{M_j} \frac{M_j}{P_j} \right) \tag{24}$$

Let the real value of the stock of domestic credit be $d_t = \dfrac{D_t}{P_t}$ and the real stock of money balances $m_t = \dfrac{M_t}{P_t}$.

We can re-write the central bank's intertemporal budget constraint as:

$$-d_{t-1} \le \sum_{j=t}^{\infty} E_t R_{j,t} \left(-c_j^b - \tau_j^b - h_j + \frac{\Delta M_j}{M_j} m_j \right) \tag{25}$$

The rest of the economy is a simple non-stochastic one-commodity endowment economy with a representative infinite-lived household with a time-additive objective function and a subjective discount factor $\beta = \dfrac{1}{1+\rho} < 1$. Period utility is the natural logarithm of a Cobb-Douglas function of consumption and real money balances. There is full price flexibility. Real money balances are an argument in the household's utility function. The

demand for real money balances and the Euler equation for private consumption, c, are as follows:

$$m_t = \alpha \left(\frac{1+i_{t+1}}{i_{t+1}} \right) c_t; \quad 1 > \alpha > 0, i_{t+1} \geq 0 \qquad (26)$$

$$c_{t+1} = \left(\frac{1+r_{t+1}}{1+\rho} \right) c_t \qquad (27)$$

where the one-period real interest rate $r_{t,t-1}$ is defined by

$$1 + r_{t,t-1} = \frac{1+i_{t,t-1}}{1+\pi_{t,t-1}}$$

Equilibrium is given by:

$$y_t = c_t + c_t^g + c_t^b \qquad (28)$$

I consider a simple stationary benchmark with $y_t = \overline{y} > c_t^g + c_t^b$, $c_t^g = \overline{c}^g$ and $c_t^b = \overline{c}^b$. It follows that in equilibrium:

$$c_t = \overline{c} = \overline{y} - \overline{c}^g - \overline{c}^b \quad c_t = \overline{c} = \overline{y} - \overline{c}^g - \overline{c}^b \qquad (29)$$

$$r_{t+1} = \rho \qquad (30)$$

$$\pi_{t+1} = \frac{\Delta M_{t+1}}{M_t} \qquad (31)$$

I want to consider which constant rate(s) of inflation, $\overline{\pi}$, this economy can support, with a central bank whose intertemporal budget constraint is given by equation (25). Without loss of generality for our purposes, we also assume that the real value of the taxes imposed on the central bank by the treasury is constant, $\tau_t^b = \overline{\tau}^b$ and that the real value of the payments by the central bank to the public is constant, $h_t = \overline{h}$.[23] It follows that the central bank's intertemporal budget constraint can be rewritten as follows:

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[23] We can interpret $\overline{\tau}_t^b$ as the permanent value of treasury taxes on the central bank, that is, as that constant real tax whose present discounted value is the same as the present discounted value of the actual (not necessary

$$-d_{t-1} + \frac{\overline{\tau}^b}{\rho} + \left(\frac{\overline{c}^b + \overline{h}}{\rho} \right) \leq \sigma(\overline{\pi}) \tag{32}$$

where

$$\sigma(\overline{\pi}) = \frac{\alpha \overline{c}(1+\rho)(1+\overline{\pi})\overline{\pi}}{\rho[\rho+(1+\rho)\overline{\pi}]}$$

with

$$\sigma'(\overline{\pi}) = \frac{\alpha \overline{c}(1+\rho)\left[\rho(1+2\overline{\pi}) + (1+\rho)\overline{\pi}^2) \right]}{\rho[\rho+(1+\rho)\overline{\pi}]^2} > 0 \text{ for } \overline{\pi} > \frac{-\rho}{1+\rho} \tag{33}$$

24

The interpretation of $\sigma(\overline{\pi})$ is the capitalised value of long-run real seigniorage revenue.

If the value of the inflation target, π^*, is less than the value of the lowest constant inflation rate that is consistent with the central bank's intertemporal budget constraint, for given values of $d_{t-1}, \overline{c}^b \geq 0$, $\overline{\tau}^b$ and $\overline{h} \geq 0$, the central bank cannot achieve the inflation target, because doing so would bankrupt it. The most it could do would be to set both $\overline{h}$ and $\overline{c}^b$ equal to zero: there would be no central bank-initiated helicopter drops of money and central bank staff would not get paid. If that is not enough to cause the weak inequality in (32) to be satisfied with $\overline{\pi} = \pi^*$, I will call this a situation where the inflation target is not *independently financeable* by the central bank. The value of the central bank's holdings of treasury debt,

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constant) sequence of taxes. So $\overline{\tau}_t^b \equiv \left[\sum\limits_{j=t}^{\infty} \prod\limits_{s=t}^{j} \left(\frac{1}{1+r_s} \right) \right]^{-1} \sum\limits_{j=t}^{\infty} \prod\limits_{s=t}^{j} \left(\frac{1}{1+r_s} \right) \tau_j^b$. We can also define the

permanent or long-run real interest rate in period t, $\overline{r}_t$, as that constant real interest rate that satisfies

$\frac{1}{\overline{r}_t} = \sum\limits_{j=t}^{\infty} \prod\limits_{s=t}^{j} \left(\frac{1}{1+\overline{r}_t} \right) = \sum\limits_{j=t}^{\infty} \prod\limits_{s=t}^{j} \left(\frac{1}{1+r_s} \right)$, if $\overline{r}_t > 0$. Using this convention, the intertemporal budget constraint

of, say, the central bank can always be written as $-d_{t-1} + \frac{\overline{\tau}_t^b}{\overline{r}_t} + \left(\frac{\overline{c}_t^b + \overline{h}_t}{\overline{r}_t} \right) \leq \sigma(\overline{\pi})$, with (constant) permanent

flows of revenues being discounted using (constant) permanent discount rates.
[24] For the 'double logarithmic' money demand function there is no long-run 'seigniorage Laffer curve'. A higher inflation rate will increase steady-state real seigniorage revenue.

d_{t-1}, is determined by history; the net tax paid by the central bank to the treasury, $\bar{\tau}^b$ is determined unilaterally by the treasury.

If the treasury decides to support the central bank in the pursuit of the inflation objective, the inflation target is *jointly financeable* by the central bank and the treasury, as long as the consolidated intertemporal budget constraint of the treasury and the central bank can be satisfied with the seigniorage revenue generated by the implementation of the inflation target. Let the real stock of treasury debt held outside the central bank be $b_t \equiv B_t / P_t$, remember that taxes net of transfers of the consolidated treasury and central bank are $\tau = \tau^p - h$ and assuming for simplicity that treasury spending, like central bank spending is constant, the intertemporal budget constraint of the state is given by:

$$b_{t-1} + \frac{\bar{c}^g + \bar{c}^b - \bar{\tau}}{\rho} \le \sigma(\bar{\pi}) \tag{34}$$

If (34) is not satisfied with $\bar{\pi} = \pi^*$, the inflation target is *not financeable*, even with cooperation between treasury and central bank. The inflation target in that case is not feasible. If (34) is satisfied with $\bar{\pi} = \pi^*$, the inflation target is financeable by the consolidated treasury and central bank – that is, the inflation target is feasible with cooperation between treasury and central bank. Note that the feasibility condition for the inflation target, equation (34), is independent of $\bar{\tau}^b$ (which is a transfer payment within the consolidated treasury and central bank) and of d_{t-1} which is an internal liability/asset within the consolidated treasury and central bank. What matters is the net debt of the consolidated treasury and central bank, b_{t-1}, and the taxes net of transfers of the consolidated treasury and central bank, $\bar{\tau}$. If the feasibility condition (34) is satisfied, the treasury can always provide the central bank with the resources it requires to implement the inflation target. All it has to do is reduce taxes on the

central bank (or increase transfer payments to the central bank), in an amount sufficient to ensure that equation (32) is also satisfied.[25]

If (34) is satisfied with $\bar{\pi} = \pi^*$, but (32) is satisfied with $\bar{\pi} = \pi^*$, but (32) is not, then the inflation target is only financeable by the treasury and central bank jointly, not independently by the central bank.

This discussion supports the view that the central bank should not have operational target independence (freedom to choose a quantitative inflation target) even when it has operational independence (the freedom to set the short nominal interest rate as it sees fit), simply because it does no have financial independence. Therefore, one reason the treasury (that is, the government) should set the inflation target, is that only the treasury can make sure that the central bank has enough resources, other than through seigniorage, to make the inflation target financeable by the central bank. The treasury, through its ability to tax the central bank, is effectively constrained only by the consolidated intertemporal budget constrained in (34), even though formally it faces the intertemporal budget constraint given in equation (35):

$$b_{t-1} + d_{t-1} \leq \frac{\bar{\tau}^p + \bar{\tau}^b - \bar{c}^g}{\rho} \tag{35}$$

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[25] This could be achieved through a one-off capital transfer rather than through a sequence of current transfers.

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