

Monetary Economics and the Political Economy of Central Banking:

Inflation Targeting and Central Bank Independence Revisited^{* **}

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Introduction

There is a widespread consensus among practicing and practical central bankers as well as among theoretical and applied monetary economists, that the canonical global best practice central bank is operationally independent¹ and targets inflation². 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 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. 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.

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

Central bank fiat money can be produced at 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.³ The opportunity cost of holding central bank money is 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 (or 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.

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.

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), Buiters (2004, 2005).

² See e.g. Federal Reserve Bank of Kansas City (1996), Bernanke and Woodford (2005).

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

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* 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 static relative price distortions in the Calvo-Woodford universe are eliminated when $\pi = \tilde{\pi}$, that is, when the aggregate rate of inflation equals the inflation heuristic – whatever that inflation heuristic happens to be. How then does this prescription of static *relative* price stability become an argument for stability of the general price level? The answer is that, like Calvo in his original model, Woodford assumes that the inflation heuristic is zero inflation: $\tilde{\pi} = 0$, either all the time (e.g. in Woodford (2003), Benigno and Woodford (2005), Blanchard and Gallí (2005) and in a slew of other publications) or in the long run, (Woodford (2003)), 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. 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), Galí, Gertler and Lopez-Salido (2001)).

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

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.

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.

⁵ Woodford assumes a form of partial one-period-lagged indexation by the behaviourist plodders:

$$\tilde{\pi} = \gamma\pi_{-1}, \quad 0 \leq \gamma < 1.$$

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

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

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

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 is the conditional expectation operator 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 pecuniary 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-Keynesian model is given by (2) and (3).

$$\Lambda_t = \sum_{j=0}^{\infty} \beta^j L_{t+j} \quad (2)$$

$$0 < \beta < 1$$

$$L_{t+j} = E_t \left[\left(\pi_{t+j} - \tilde{\pi}_{t+j} \right)^2 + \lambda (y_{t+j} - \hat{y}_{t+j})^2 + \ell (i_{t+j} - i_{t+j}^M)^2 \right] \quad (3)$$

$$\lambda, \ell > 0$$

$$\hat{y} = y^* + \delta \quad (4)$$

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.

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

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

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

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 \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:

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

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.

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 reincarnation 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. Fortunately, central bank practice has not regressed along with New-Keynesian monetary theory (King (2005)).

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. 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.

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.

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.

IC. The siren song of flexible inflation targeting

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.⁶ 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:

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

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 (2007)). 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 (‘stable prices’) and a financial asset market objective (‘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:

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

$$\lambda, \varphi > 0$$

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 clear from equation (3) To have proper New-Keynesian welfare economics credentials, it should have the inflation heuristic $\tilde{\pi}_t$ instead of a constant target inflation rate π^* in the period loss function (8);

⁶ For a more extensive discussion of these points, see Buiter (2006).

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. 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.

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 **Error! Reference source not found.**, 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.⁷

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

⁷ 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:

$$\Lambda_t^\pi = \sum_{i=0}^{\infty} \beta^i E_t (\pi_{t+i} - \pi^*)^2 .$$

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,

$$\Lambda_t^y = \sum_{i=0}^{\infty} \beta^i E_t (y_{t+i} - \pi_{t+i}^*)^2 .$$

operationally independent Agent (the central bank) is assumed to solve this commitment problem.

McCallum (1995, 1997) 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. 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 not be substantively accountable. This threatens the legitimacy of the institution.

In what follows I will consider a concrete proposal 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 severe clipping of central bank wings.

The proposal aims to limit the domain of unaccountability by restricting the range and scope of the activities for which a high degree of operational independence is granted. I propose to turn the operationally independent full-function central bank into a minimalist operationally independent monetary authority and market maker of last resort.

My main focus is on the ECB, although *mutatis mutandis* my analysis and proposal applies to all operationally independent central banks. The focus on the ECB is natural, first, because, 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.

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, longer an Agent that is in any meaningful sense answerable to the Principal. It is more like a Trustee in a fiduciary relationship with a Beneficiary. However, this Trustee cannot be sanctioned or disciplined by anyone, other than possibly the Courts (the ECJ in the case of the ECB). 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 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 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. 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.

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

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

Table 2	
Central Bank Comprehensive Balance Sheet or Intertemporal Budget Constraint	
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
	$\bar{W} = W + S - E - T$
	Comprehensive net worth or equity

While the central bank's financial net worth can be negative, its comprehensive net worth cannot, that is, $\bar{W} = W + S - E - T \geq 0$

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 present value of central bank profits, S , on its comprehensive balance sheet 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.

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 27 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 common 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. It may ultimately have to be adjudicated by the European Court of Justice.

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)).

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. The same holds for the Bank of England (which 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. 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 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 minimal and inadequate 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 knitting⁸

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.

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 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.

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 and financial stability, is when the independence of the central bank is threatened.

⁸ With thanks to Alan Blinder for this felicitous phrase.

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, the lender of last resort (LoLR) and the market maker of last resort (MMLR). 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 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 and the role of market maker of last resort. 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, to engage in open market operations (OMOs) and determine the eligible collateral and counterparties in its OMOs and its discount window operations.

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

1. Supervision and regulation of banks, other financial institutions and financial markets other than those markets where the monetary authority, through its open market operations, is an active participant.
2. Ownership, control and management of the interbank clearing and settlement systems (e.g. TARGET for the Eurozone and its proposed successor, TARGET2).
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 LoLR role.

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.

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. The ECB owns and runs TARGET, but is not granted a monopoly of clearing and settlement services by the Treaty. It has ambitions for being the monopoly provider of Eurozone clearing and settlement facilities for securities. For reasons of space, I shall only make a few additional remarks about the monetary authority and the LoLR function.

IID3. Taking the lender of last resort role from the monetary authority, while leaving it the market maker of last resort role

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 LoLR (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 active LoLR. All it implies is that the LoLR, whichever institution plays that role, needs to have an open-ended, uncapped overdraft facility/credit line with the central bank.

Solvency of systemically important banks and other financial institutions is the responsibility of the supervisor/regulator and the Treasury – the supervisor/regulator because he is the only entity with the individual institution-specific knowledge and the Treasury because it is the only entity with the long-term non-inflationary deep pockets, because of its capacity to tax. *Funding liquidity* is a property of persons and institutions. It is the ability to obtain external funds. Funding liquidity for banks and other financial institutions can be provided by the supervisor/regulator even if that supervisor/regulator is not the central bank, provided he has uncapped and open-ended access to the resources of the central bank, guaranteed by the Treasury. The cooperation and coordination of the actions of the Treasury and the supervisor/regulator are therefore required to deal with individual financial institutions that are in trouble. There is no need for an active role for the central bank in this LoLR process.

Leaving the monetary authority in charge of the market-maker-of-last-resort-function

Market liquidity is a property of assets; it measures the ease and speed with which a security can be sold without incurring large transaction costs and without a large effect on its price. The liquidity of private securities is fragile; lack of trust and confidence in the solvency of counterparties or fear of future illiquidity can cause market liquidity to vanish. The market liquidity of private securities is subject to an intertemporal network externality: A's willingness to use his liquid resources to buy B's or C's asset today depends on A's assessment of the probability that A will be able to sell the asset again in the future, promptly, without incurring high transaction costs and without a significant discount, to B or C, should A need liquidity in the future. This creates scope for multiple equilibria with varying degrees of liquidity. The monetary liabilities of the central bank have unquestioned, intrinsic liquidity. So when there is 'market failure', that is, a low liquidity equilibrium is established, it is the duty of the central bank to provide the public good of liquidity, which it can produce at zero incremental cost.

The central bank must be present in the (overnight) interbank market to set the policy rate. It also accepts a range of public and private securities as collateral in its repo and reverse repo operations. Because of its open market operations, the central bank is always present and active in the money markets and in many other systemically important financial markets. This makes the central bank the natural, indeed unavoidable, MMLR, or securities buyer of last resort, whenever normally liquid securities become illiquid. To avoid moral hazard, any illiquid securities acquired by the central bank from private counterparties should be valued through a punitive auction mechanism, e.g. a reverse Dutch auction. Even a minimalist monetary authority therefore has to contribute to financial stability through its MMLR role.

III. Conclusions

There are no conventional welfare economics foundations for price stability as an objective, let alone the overriding objective, of monetary policy. This may be more of a problem for modern economic theory than for central bankers committed to price stability.

The operational expression of the legal mandates of the ECB and the Bank of England is hierarchical or lexicographic inflation targeting, not flexible inflation targeting. The Fed's triple mandate implies a generalised flexible inflation targeting objective function for the

monetary authority, including a real economy objective, an inflation target and a long-term interest rate objective.

The higher the degree of operational independence of a central bank, the lower its substantive accountability. The ECB effectively has zero substantive accountability.

To address the legitimacy problems created by the absence of substantive accountability, the central bank should be reduced to a minimalist monetary authority. It should just have two objectives: First, the pursuit of price stability in the medium and long term. Second, to contribute to financial stability through the provision of market liquidity, especially under disorderly market conditions. The monetary authority has to be the market maker of last resort in systemically important financial markets. It need not play an active role in the provision of funding liquidity to individual banks and other financial institutions, that is, it need not play any active role in the lender of last resort process.

References

Alesina, A., and L. H. Summers (1993), Central bank independence and macroeconomic performance: some comparative evidence, *Journal of Money, Credit and Banking* 25, 151-162.

Backus, D. and J. Driffill (1985), "Inflation and Reputation", *American Economic Review*, June, pp. 530-38.

Bagehot, W. (1866), "What a Panic Is and How It Might Be Mitigated", *The Economist* 24 (May 12): 554-55. Reprinted in M. Collins, ed. *Central Banking in History*. Vol. 7. Aldershot, England: Edward Elgar, 1993.

Bagehot, W. (1873), *Lombard Street, a Description of the Money Market*. London: Kegan Paul. Rpt., London: John Murray, 1920.

Bailey, M. J. (1956), "The Welfare Costs of Inflationary Finance," *Journal of Political Economy*, vol. 64, no. 2, April, pp. 93-110.

Barro, R. J. and D. B. Gordon (1983), "A positive theory of monetary policy in a natural-rate model", *Journal of Political Economy*, 91, 4, pp. 589-610.

Beetsma, R., and L. Bovenberg (1997), Central bank independence and public debt policy, *Journal of Economic Dynamics and Control* 21, 873-94.

Benigno, P. and M. Woodford (2005), "Inflation Stabilization and Welfare: The Case of a Distorted Steady State", *Journal of the European Economic Association*, Volume 3, Issue 6, pp. 1185-1236.

Bernanke, B. S. and M. Woodford eds. (2005), *The Inflation-Targeting Debate*, National Bureau of Economic Research Studies in Business Cycles, Volume 32, The University of Chicago Press, Chicago and London.

Blanchard, O. and J. Gali (2005), "Real Wage Rigidities and the New Keynesian Model", NBER Working Paper 11806, November.

Blinder, A. S. (1999), *Central Banking in Theory and Practice*, Cambridge, MA: MIT Press.

Blinder, A. (2005), "Monetary Policy by Committee: Why and How?," prepared for workshop at De Nederlandsche Bank, November 28.

Blinder, A. S. and J. Morgan (2005), "Are Two Heads Better than One? Monetary Policy by Committee," *Journal of Money, Credit, and Banking*, October, pp. 789-812.

Blinder, A. S. (2006), "Monetary Policy Today: Sixteen Questions and about Twelve Answers," paper prepared for Bank of Spain conference, Madrid, June 2006, forthcoming in conference volume.

Buiter, W. H. (1999), "Alice in Euroland." *Journal of common market studies* 37, no. 2, pp. 181-209.

Buiter, W. H. (2004), "Two naked emperors? Concerns about the Stability and Growth pact and second thoughts about Central Bank independence", *Fiscal Studies*, Vol. 25(3), pp. 249-77.

Buiter, W. H. (2005), "New developments in monetary economics: two ghosts, two eccentricities, a fallacy, a mirage and a mythos", Royal Economic Society 2004 Hahn Lecture, *The Economic Journal*, Conference Papers, Vol. 115, No. 502, March 2005, pp. C1-C31.

Buiter, W. H. (2006), "How Robust is the New Conventional Wisdom in Monetary Policy? The surprising fragility of the theoretical foundations of inflation targeting and central bank independence", mimeo, European Institute, London School of Economics and Political Science, June 2006. Paper presented at the 2006 Central Bank Governors' Symposium "Challenges to Monetary Theory", at the Bank of England, on June 23 2006.

Buiter, W. H. and M. H. Miller (1985), "Costs and benefits of an anti-inflationary policy: questions and issues", in A. Argy and J. Nevile (eds.), *Inflation and Unemployment: Theory, Experience and Policy Making*, London, George Allen & Unwin, pp. 11-38. Reprinted in W. H. Buiter, *Macroeconomic Theory and Stabilisation Policy*, Michigan University Press, pp. 200-227.

Calvo, G. (1983), "Staggered Contracts in a Utility-Maximizing Framework", *Journal of Monetary Economics*, September.

Calvo, G., O. Celasun and M. Kumhof (2003), "Inflation inertia and credible disinflation: the open economy case", NBER, Working Paper 9557, March.

Campillo, M. and J. Miron. (1997), Why does inflation differ across countries?, in Romer C.D., Romer D.H. (Eds.), *Reducing Inflation: Motivation and Strategy*, University of Chicago Press, Chicago.

Cukierman, A. (2006), "Central bank Independence and Monetary Policymaking Institutions: Past, Present and Future", Central Bank of Chile Working Papers N°360, April.

Cukierman, A., S. B. Webb and B. Neyapti (1992), Measuring the independence of Central Banks and its effects on policy outcomes, *World Bank Economic Review* 6, 353-398.

Eijffinger, Sylvester (2005), *The European Central Bank: Credibility, Transparency, and Centralization*, The MIT Press, Cambridge, Massachusetts, 2005.

Federal Reserve Bank of Kansas City (1996), *Achieving Price Stability; A Symposium Sponsored by The Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 29-31, 1996.*

Fisher, I. (1926), "A Statistical Relation Between Unemployment and Price Changes", *International Labor Review*, June, 13(6), pp. 785-92.

Fisher, I. (1932), "Changes in the Wholesale Price Index in Relation to Factory Employment", *Journal of the American Statistical Association*, September, 31, pp. 496-506.

Forder, J. (1998), Central bank independence: conceptual clarifications and interim assessments, *Oxford Economic Papers* 50, 307-334.

Friedman, M. (1968), "The Role of Monetary Policy." *American Economic Review* 58, no. 1, pp. 1-17.

Friedman, M. (1969), "The Optimum Quantity of Money", in Milton Friedman, *The Optimum Quantity of Money and Other Essays*, Aldine Publishing Company, Chicago, Illinois, pp. 1-50.

Gali, J, M. Gertler and J. David Lopez-Salido (2001), "European Inflation Dynamics", *European Economic Review*, 45 pp. 1237 – 1270.

Haan J. de, and W. Kooij, "Does Central Bank Independence Really Matter? New Evidence for Developing Countries Using a New Indicator", *Journal of Banking and Finance*, 24, 2000, 643-664.

Issing O. (1999), "The Eurosystem is Transparent and Accountable, or Willem in Wonderland," *Journal of Common Market Studies*, 37, 3 pp.503-519.

Ize, A. (2005), "Capitalising Central Banks: A Net Worth Approach", IMF Working Paper, WP/05/15, January 2005

King, M. (2005), "Monetary Policy: Practice Ahead of Theory", Mais Lecture, Bank of England.

Kydland, F. E. and E. C. Prescott (1977), "Rules rather than discretion: the inconsistency of optimal plans", *Journal of Political Economy*, 85, 3, June, pp. 473-491.

Lucas, R. E., Jr. (1972), "Econometric Testing of the Natural Rate Hypothesis." In *The Econometrics of Price Determination*, edited by Otto Eckstein. Reprinted in Lucas, Robert E., Jr. *Studies in Business Cycle Theory*. 1981.

Lucas, R. E., Jr. (1973), "Some international evidence on output-inflation tradeoffs", *American Economic Review*, 63, June, pp. 326-34.

Lucas, R. E. Jr and Nancy Stokey (1987), "Money and interest in a cash-in-advance economy", *Econometrica*, 55, pp. 491-513.

McCallum, B. T. (1995), "Two fallacies concerning central bank independence", *American Economic Review*, Papers and Proceedings, vol. 85 (May), pp. 207-211.

McCallum, B. T. (1997b), "Crucial Issues Concerning Central Bank Independence," *Journal of Monetary Economics*, 39, February, pp. 99-112.

Mihov, I. and A. C. Sibert (2006), "Credibility and Flexibility with Monetary Policy Committees," *Journal of Money, Credit and Banking* 38, Feb. 2006, 23 – 46.

Mishkin, F. S. (2007b), "Monetary Policy and the Dual Mandate", Remarks made at Bridgewater College, Bridgewater, Virginia, April 10. <http://www.federalreserve.gov/boarddocs/speeches/2007/20070410/default.htm>

Ozkan, F.G. (2000), Who wants an independent Central Bank: monetary policy making and politics, *The Scandinavian Journal of Economics* 102, pp. 621-643.

Phelps, E. S. (1967), "Phillips Curves, Expectations of Inflation and Optimal Employment over Time." *Economica* NS 34, no. 3, pp. 254-81.

Phillips, A. W. H. (1958), "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957." *Economica* NS 25, no. 2 (1958): 283-99.

Posen, A. (1993), Why Central Bank independence does not cause low inflation: there is no institutional fix for politics' in R O'Brien (ed.), *Finance and the International Economy*, 7, Oxford University Press, Oxford.

Samuelson, P. A., and R. M. Solow (1960), "Analytical Aspects of Anti-Inflation Policy." *American Economic Review* 50, no. 2, pp. 177-94.

Sibert, A. (2003), "Monetary Policy Committees: Individual and Collective Reputations," *Review of Economic Studies* 70, Jul. 2003, 649-666.

Sibert, A. (2006) "[Central Banking by Committee](#)," *International Finance*, forthcoming, online version De Nederlandsche Bank Working Paper no. 91, Feb.

Sims, C. A. (2004): "Fiscal Aspects of Central Bank Independence," Chapter 4, p.103-116, in *European Monetary Integration*, Hans-Werner Sinn, Mika Widgrén, and Marko Köthenbürger, editors, MIT Press.

Sims, C. A. (2005), "Limits to Inflation Targeting", Chapter 7 in *The Inflation-Targeting Debate*, Ben S. Bernanke and Michael Woodford, editors, NBER Studies in Business Cycles Volume 32, p. 283-310.

Svensson, L. E. O. (1999). "Inflation Targeting as a Monetary Policy Rule," *Journal of Monetary Economics* 43(3, June): 607-654.

Svensson, L. E. O. (2005). "Optimal Inflation Targeting: Further Developments of Inflation Targeting," paper presented at Sveriges Riksbank conference, "Inflation Targeting: Implementation, Communication, and Effectiveness," Stockholm, June.

Tobin, J. (1968), "Phillips Curve Algebra", in James Tobin, *Essays in Economics, Volume 2, Consumption and Econometrics*, pp. 11-15, MIT Press, 1987, 77, Cambridge Mass; adapted from Tobin's "Discussion" of papers at a *Symposium on Inflation: Its Causes, Consequences and Control*, 1968, Stephen W. Rousseas ed. pp. 48-54 and from Tobin's "Comment", *Brookings Papers on Economic Activity*, 1971:2, pp. 512-14.

Woodford, M. (2003), *Interest & Prices; Foundations of a Theory of Monetary Policy*, Princeton University Press, Princeton and Oxford.