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**Does central bank independence
reduce inflation at no real cost ?
A survey article***

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ABSTRACT

This is a review paper which explores the theoretical basis for and empirical evidence on the relationship between central bank independence (CBI) and macroeconomic performance. In the theoretical section, we briefly touch the rules versus discretion debate and use a simple stochastic model to illustrate dynamic inconsistencies in monetary policy making. In order to avoid the inflationary bias in monetary policy commitment technology that signals credibility could make society better off. The paper discusses two strands of theory which focus on CBI as a commitment device, namely the conservative-central-banker approach and the principal-agent approach. In the empirical section the stylized facts of CBI are discussed and subsequently questioned. To conclude the paper we examine possibilities for further research.

TABLE OF CONTENTS

INTRODUCTION	1
1. THEORETICAL UNDERPINNINGS OF CENTRAL BANK INDEPENDENCE AND CONSERVATISM	2
1.1. Time Inconsistency Revisited in a Stochastic Model	2
1.2. Looking for Commitment Technology	5
1.3. CBI and Delegation of Monetary Policy: Two Approaches	7
A. The Conservative-Central-Banker approach	7
B. The Principal-Agent Approach	10
2. CENTRAL BANK INDEPENDENCE: EMPIRICS AND TOPICS FOR FURTHER RESEARCH	12
2.1. Some Stylized Facts?	12
2.2. Topics for Further Research	16
A. Focus on Independence or Conservatism?	16
B. Richer Labour Market Dynamics	17
C. Open Economy Extensions	18
D. The Free Lunch Result	19
CONCLUSION	20
LIST OF REFERENCES	21

INTRODUCTION

A remarkably broad consensus of academics and policy makers have rallied around the idea that freeing monetary policy-making from all goals beyond price stability eases the attainment of price stability at little or no real cost. The erection of legal barriers to elected government control of monetary policy has been agreed to (if not already present) in all the member countries of the EU, most of the remaining OECD countries, and a growing number of both newly industrialising economies and former communist economies in transition.

It is the purpose of this review paper to examine whether the institutional setup of Central Bank Independence (CBI) is, apart from being very fashionable, also well founded, both theoretically and empirically.

In the first part, the theoretical foundations of CBI are reviewed and questioned. We briefly touch the rules versus discretion debate by discussing a simple stochastic model of time inconsistency. This "workhorse model" will be useful to discuss the tradeoff between credibility and flexibility when a rule is adopted. The issue of how to practically achieve credible commitment will also be dealt with. Subsequently, the model is used to explain why delegation of monetary policy to an independent and conservative central bank may be useful. Finally, we discuss some recent developments of the principal-agent approach.

In the second part, we discuss some empirical regularities of CBI and ask whether they are indeed as stylized as they are thought to be. To conclude, we discuss some shortcomings of the CBI concept, which at the same time offer possibilities for further research.

1.

THEORETICAL UNDERPINNINGS OF CENTRAL BANK INDEPENDENCE AND CONSERVATISM

In fact, the discussion of CBI has its roots in the rules versus discretion debate. The mere presence of an inflationary bias in monetary policy raises inflationary expectations and inflation as such. In order to remove the bias, we need "commitment technology", i.e. the policy maker needs to find a way to make its low inflation commitment credible.

1.1. Time Inconsistency Revisited in a Stochastic Model

The case for CBI starts with the notion of inflationary bias in monetary policy. Kydland and Prescott (1977) and Barro and Gordon (1983) have shown that discretionary monetary policy typically has an inflationary bias, when time inconsistency is present.

In fact, the problem of time inconsistency arises when an economic agent has an incentive to promise to take some action ex ante, but to take some other action ex post, even though there may be no extraneous shocks or new information that might otherwise lead it to alter its plans. However, other agents will anticipate that the agent will renege on its promises in this fashion and will alter their behaviour accordingly, leading to an inferior outcome. The analysis thus involves bringing in ideas from game theory into macroeconomics.

The simple stochastic macroeconomic model below is useful to discuss both the origin of this inflationary bias and the way how to avoid it. It will be shown that the adoption of a zero-inflation rule can remove the inflationary bias. But, on the other hand, stabilisation-minded governments may dislike the adoption of a such rule because of the greater output variability due to nonstabilisation. Not surprisingly, these topics are intimately linked to the rules versus discretion debate¹.

¹ Interesting references are Cukierman (1992) and Broadbent and Barro (1995).

Consider an economy with a positively sloped short-run aggregate supply curve²:

$$(1) \quad y_t = \alpha(p_t - E_{t-1}p_t) + \mu_t = \alpha(\pi_t - E_{t-1}\pi_t) + \mu_t$$

where $\pi_t = p_t - p_{t-1}$ and μ_t is an i.i.d. shock with zero mean and variance σ^2 occurring after private sector expectations are formed and before monetary policy is set. The natural rate of output is normalised to 0.

Assume that there are two kinds of agents involved: the wage-setters and the government. Wage setters choose the nominal wage every period, and government controls monetary policy³. In stage one of the game, wage setters sign optimal nominal wage contracts. They rationally take into account the expected stance of monetary policy next period when forming inflationary expectations. In stage two of the game, stochastic shocks occur which cannot be observed by wage setters. The government, however, observes both the nominal wage claims of wage setters and the realisations of the shock, and sets monetary policy accordingly.

Assuming common knowledge of the structure of the economy and perfect control over the inflation rate, the government sets inflation such that its social loss function is minimized. Government has an interest in keeping inflation down and in expanding the level of output. The motivation to stimulate output comes for instance from the fact that the natural rate of output is below its Walrasian level y^* , the bliss point of the government. We use a popular loss function, namely one that penalizes both the level of inflation and the deviation of output from its bliss point symmetrically and quadratically. The government's relative preference for output deviations is represented by some strictly positive and finite parameter δ .

$$(2) \quad L_t = \pi_t^2 + \delta(y_t - y^*)^2$$

² It does not really matter whether this short-term supply curve is based on informational imperfections (as in the New Classical Macro approach) or on nominal rigidities (as in the New Keynesian Macro approach). For our purposes, both approaches predict that disinflation is less costly when credibility is higher. For the less classical approaches see for instance Ball (1992).

³ In this section the government is assumed to have full control over monetary policy. To put it differently, the central bank is completely dependent on the government.

The best outcome which the government could systematically achieve is $y_t = \pi_t = 0$, which results in a social loss of δy^*^2 . However, the simple announcement of a zero inflation rule cannot be credible. Ex post, when expectations are formed the government has an incentive to deviate from its promise. To illustrate this, let us look for the reaction function of the government for a given level of $E_{t-1}\pi_t$ and μ_t .

$$(3) \quad \text{Min } \pi_t^2 + \delta[\alpha(\pi_t - E_{t-1}\pi_t) + \mu_t - y^*]^2 \quad \text{w.r.t. } \{\pi_t\}$$

Taking period t-1 expectations as given, the reaction function R^G (4) is derived from the first order condition of problem (3).

$$(4) \quad \pi_t = R^G(E_{t-1}\pi_t, \mu_t) = [\alpha^2\delta E_{t-1}\pi_t + \alpha\delta(y^* - \mu_t)]/(1 + \alpha^2\delta)$$

Why can the zero inflation rule not be credible to period t-1 wage setters? Suppose that it would be credible, i.e. $E_{t-1}\pi_t = 0$, and that there are no shocks. Then, the optimal reaction of the government is to set inflation equal to $\pi_t = R^G(0, 0) = \alpha\delta y^*/(1 + \alpha^2\delta)$. Thus, the initial forecast of the wage setters, namely $E_{t-1}\pi_t = 0$, will be systematically wrong, which is a difficult assumption to maintain.

Rational agents will therefore internalize the incentive of the government to renege on its promise and will therefore have higher inflation expectations (5), reflected in higher nominal wage claims. In equilibrium, the government will be entirely discouraged from trying to reduce the real wage below the target level of the wage setters and we will have a positive equilibrium rate of inflation due to the inconsistency of the government's optimal plans.

$$(5) \quad E_{t-1}\pi_t = \alpha\delta y^*$$

$$(6) \quad \pi_t^D = \alpha\delta y^* - \alpha\delta\mu_t/(1 + \alpha^2\delta)$$

Because of the noncredibility of the zero inflation promise, time consistent inflation will be the same as without the promise. Therefore, the realisation of the inflation rate in period t is denoted as the inflation outcome under the discretionary regime (6).

1.2. Looking for Commitment Technology

If the commitment to a zero inflation rule would on the other hand be credible, the time consistent inflation rate would be lower by $\alpha\delta y^*$. So we would have lower trend inflation. The feedback coefficient stays the same as is shown in equation (7).

$$(7) \quad \pi_t^R = -\alpha\delta\mu_t/(1+\alpha^2\delta)$$

This is all very nice, but it raises an important practical question: how can we achieve such a credible commitment?

A. One possibility is that punishment strategies of private agents can induce a government with a long time horizon to build up a reputation for low inflation. In fact, the setup is then one of a repeated game, where the government carefully considers the short-run advantages of inflating against the resulting longer-term credibility problems. McCallum (1995) supports this line of reasoning and finds that it is inappropriate to presume that the authorities repeatedly engage in fruitless attempts to exploit predetermined but endogenous expectations. To put it differently, governments do care about their reputation. Still, the reputation argument can be relatively weak in countries with frequent elections.

B. Another way out would be to embed a zero inflation commitment in (constitutional) legislation, such that it is difficult to alter the stance of policy ex post when expectations are formed. This would be another way to lower the time consistent rate of inflation. One drawback of this approach is, however, that it leaves little scope for output stabilization.

Interestingly, there is a tradeoff between the credibility and flexibility, i.e. between the lowering of time consistent inflation and the possibility of stabilisation policy. How can we formalize this tradeoff? What will the government choose: rules or discretion? If it sticks to the discretionary regime (6), the expected loss will be

$$(8) \quad E_{t-1}L_t^D = \delta[(1+\alpha^2\delta)y^{*2} + \sigma^2/(1+\alpha^2\delta)]$$

Alternatively, if we have a zero inflation constitutional rule, inflation will be set at $\pi_t^R = -\alpha\delta\mu_t/(1+\alpha^2\delta)$. And, the expected loss will be

$$(9) \quad E_{t-1}L_t^R = \delta(y^{*2} + \sigma^2)$$

As a result, government will prefer the discretionary regime when $E_{t-1}L_t^D < E_{t-1}L_t^R$, that is when

$$(10) \quad y^{*2}(1+\alpha^2\delta) < \sigma^2$$

The intuition behind this result is straightforward: the larger the slope of the short-term Phillips curve, the further away the bliss point and the greater the preference of the government for output stimulation, the more we have an inflationary bias problem and a case against discretion⁴. The higher the variability of shocks, the more we have a case in favour of discretion.

Unfortunately, there is one further complication with the constitutional regime (7). If the private sector does not observe the realisation of μ_t while locking itself into wage contracts, it is difficult for them to see whether the authorities are really committed to the rule, or whether they are simply following discretionary policy. As a result, such a policy may not be sustainable in practice.

Of course, the arguments above are not very new. But they give rise to another theoretical possibility to milder the problem of time consistency, while taking into account the preferences of the government for output stabilization. More specifically, they bring us to the recent literature on central bank independence and conservatism.

⁴ We can think of other compelling reasons why an activist feedback policy may not be preferable. Brainard's (1967) model of structural uncertainty, for instance, provides an argument against discretion from a different perspective: given our imperfect knowledge about the structure of the economy, it is wise to err on the side of caution in policy intervention.

1.3. CBI and Delegation of Monetary Policy: Two Approaches

Two main strands of theory have added precision to the analytical argument for CBI. These are the conservative-central-banker approach of Rogoff (1985) and the principal-agent approach of Persson and Tabellini (1993) and Walsh (1995).

To begin with, let us briefly define what is meant with the concepts of central bank conservatism and central bank independence. Central bank conservatism denotes an aversion for inflation which is larger than the inflation aversion of society. As far as central bank independence is concerned, it is useful to introduce a distinction between goal independence and instrument independence⁵. A central bank that is given control over the control variables of monetary policy and allowed to use them has instrument independence; a central bank that sets its own policy goals has goal independence (Fischer, 1995).

A. The Conservative-Central-Banker Approach

In his seminal contribution, Kenneth Rogoff (1985) finds that it is socially optimal to delegate monetary policy to a conservative but not ultra-conservative central banker. Moreover, the independence of this central banker should be guaranteed. The central bank is given control over monetary policy and is granted independence to maximize its own utility function: it thus has both goal and instrument independence.

This results in improved overall performance, in which the time-consistent rate of inflation is on average lower and more stable. On the other hand, it suboptimally raises the variance of output when unanticipated disturbances are large, because the conservative central banker is less stabilisation-minded.

Let us now formalize these intuitive ideas. Assume the government's and the central bank's loss functions are respectively given by (11) and (12).

⁵ Grilli e.a. (1991) made a distinction between political and economic independence. Actually, Fischer's distinction between goal and instrument independence is completely analogous.

$$(11) \quad L_t^G = \pi_t^2 + \delta_G(y_t - y^*)^2$$

$$(12) \quad L_t^{CB} = \pi_t^2 + \delta_{CB}(y_t - y^*)^2$$

The conservative central banker will select the inflation rate

$$(6') \quad \pi_t^{CB} = \alpha \delta_{CB} y^* - \alpha \delta_{CB} \mu_t / (1 + \alpha^2 \delta_{CB})$$

Hence, there will be lower trend inflation and less stabilisation than the government would unilaterally choose under discretion. What is the expected loss to the government under this strategy? From (6') we can derive $E_{t-1} \pi_t^{CB} = \alpha \delta_{CB} y^*$. From (1) and (6') we have

$$(13) \quad y_t = \mu_t / (1 + \alpha^2 \delta_{CB})$$

Substituting (6') and (13) into (11) and taking expectations yields

$$(14) \quad E_{t-1} L_t = E_{t-1} \{ [\alpha \delta_{CB} y^* - \alpha \delta_{CB} \mu_t / (1 + \alpha^2 \delta_{CB})]^2 + \delta_G [\mu_t / (1 + \alpha^2 \delta_{CB}) - y^*]^2 \} \\ = (\alpha^2 \delta_{CB}^2 + \delta_G) y^{*2} + (\alpha^2 \delta_{CB}^2 + \delta_G) \sigma^2 / (1 + \alpha^2 \delta_{CB})^2$$

What can we say about the optimal degree of conservatism of the central bank? In other words, what is the optimal δ_{CB} ? Partially differentiating (14) with respect to δ_{CB} yields

$$(15) \quad \partial(E_{t-1} L_t) / \partial \delta_{CB} = 2 \delta_{CB} \alpha^2 y^{*2} + 2 \alpha^2 (\delta_{CB} - \delta_G) \sigma^2 / (1 + \alpha^2 \delta_{CB})^3$$

$$(15a) \quad \partial(E_{t-1} L_t) / \partial \delta_{CB} \Big|_{\delta_{CB}=0} < 0$$

$$(15b) \quad \partial(E_{t-1} L_t) / \partial \delta_{CB} \Big|_{\delta_{CB}=\delta_G} > 0$$

As Rogoff shows in his 1985 paper, there must exist an optimal δ_{CB}^* which minimizes the government's loss function. Furthermore, the optimal δ_{CB}^* will lie in the open interval $]0, \delta_G [$ because of (15a) and (15b). The intuition behind δ_{CB}^* being strictly positive is that it is not welfare maximising to have an ultra-conservative central bank in an environment with frequent stochastic shocks. The intuition δ_{CB}^* being strictly smaller than δ_G is that it is socially optimal to delegate monetary policy to a conservative central banker (with a larger inflation aversion than society) in order to deal with the time-inconsistency problem.

Lohmann (1992) suggests an interesting extension. She examines the optimal design of a central banking institution that lends credibility to a low-inflation stance of monetary policy, while allowing for flexible policy responses to unforeseen extreme shocks. In her proposed institution the policy-maker does not grant full independence but only partial independence to a conservative central banker. The advantage of this approach is that time consistent inflation is reduced, while the deadweight loss induced by an otherwise unacceptably faint response to extreme output shocks will be lower.

What is the intuition behind this result? Thanks to partial independence the policy-maker retains the option to override the central banker's decision when monetary policy is too conservative in times of extreme shocks, such as oil shocks, wars, stock market crashes and the like. The central banker internalizes this risk and will therefore rationally relax its conservatism in order to avoid to be overridden. In other words, the conservative central bank sets monetary policy independently in normal times. But in extreme situations the flexible escape clause induces the central banker to accommodate the policy-maker's ex post demands in order to avoid to be overridden. In fact, a nonlinear policy rule will be followed. The larger the output shock, the more the central banker will relax its conservatism. And, in equilibrium the central banker will not be overridden.

The conservative-central-banker approach has an interesting empirical basis. In many countries of the EU, the idea of central bank independence has become popular. And, motivated by the succes of the conservative Bundesbank in maintaining low inflation rates, central banks are designed in such a way that they are characterized not only by independence but also by large inflation aversion.

The second approach, namely the principal-agent approach, provides us with an important tool to achieve the desired inflation aversion of a central banker.-

B. The Principal-Agent Approach

Up till now we focused on the government's choice of a central banker, viewing the government as choosing from a population of potential bankers with differing preferences over inflation and output deviations. Once chosen, the central banker is granted complete (goal and instrument) independence.

Changing slightly the institutional setup, the government can directly affect the central banker's objective function in many ways. Lohmann (1992) showed that the central banker will behave differently if there is a possibility of being overridden. Also, Rogoff (1985) argued that the central bank's adherence to the rule may be enhanced by linking its budget to the success of reaching the target.

The principal-agent approach, also referred to as the contracting or targeting approach, elaborates on this way of thinking. In this framework the central bank has no goal independence but does have instrument independence, and the central banker will be held accountable for the outcome of monetary policy. There will be definite consequences of failing to achieve well-specified goals.

The inflationary-bias problem is solved by structuring a contract (i.e. an incentive scheme) that imposes costs on the central banker when inflation deviates from the optimal level.

In a recent paper, Walsh (1995) shows how the government can determine an optimal incentive structure for the central bank. The central bank is viewed as the government's agent having private information on the realization of shocks. The central bank tries to maximise an objective function that depends, in part, on contingent transfers from the government. He finds that the optimal transfer function resembles an inflation-targeting rule⁶, when the central bank cares about its transfer income and about social welfare. More generally, when the central bank only cares about its transfer income, the optimal contract takes the form of a contingent inflation-targeting rule. The target is contingent on the observed signal on aggregate supply disturbances. Walsh suggests that the inflation bias can be reduced in this way while still preserving the advantages of discretion.

⁶ The inflation penalty is linear in inflation.

This line of reasoning is not accepted by McCallum (1995). The problem of time inconsistency is not resolved by sticking to this approach, essentially because the government still has to enforce the contract. The government has exactly the same incentive not to enforce the contract as in any inflationary bias model. He argues that if the absence of precommitment technology is really a problem, then this must also be true for the consolidated CB-government identity as a whole. This is an interesting theoretical objection. In fact, it suggests that we need to look further, namely for commitment technology which is fully insulated from any political process. Waller (1995) finds McCallum's criticism of performance contracts too strong: "While it is correct to say that a perfect commitment technology or institutional design does not exist (for example, even the US Constitution is not a perfect commitment to liberty because we can change it anytime we want), it is possible to make the costs of renegeing on promises more costly and thus make monetary policy more credible."

Clearly, the principal agent strand of the literature has also the smell of realism. Recently, attempts have been made in this direction in New Zealand, where the central banker's employment is made contingent on achieving prespecified inflation targets (cfr. the New Zealand Reserve Bank Act of 1989). And the approach can also be applied to Canada and the UK, provided that the penalty for excess inflation is interpreted as a loss of reputation.

2.

CENTRAL BANK INDEPENDENCE:

EMPIRICS AND TOPICS FOR FURTHER RESEARCH

Roughly, the empirical work has been concentrated on the measurement of central bank independence and the positive examination of its effects on macroeconomic performance. In a nutshell, CBI is thought to lower inflation and inflation variability, while having no measurable effect on real performance.

2.1. Some Stylized Facts?

What are the empirical regularities observed in most CBI studies? In fact, there are three more or less stylized facts.

CBIF1. The degree of CBI varies considerably across countries.

CBIF2. Greater CBI lowers both the equilibrium path and the variability of inflation.

CBIF3. Greater CBI yields no significant measurable effects on the real economy.

In the table below an index of Alesina and Summers (1993) is used, which was constructed by averaging an index of Alesina (1988) and one of Grilli e.a. (1991). The former chiefly concentrates on political independence depending on the institutional relationship between the CB and the executive, the procedure to nominate and dismiss the head of the CB, the role of government officials on the CB board, and the frequency of contracts between the executive and the bank. The latter also includes some economic independence variables, such as the extent to which the CB is required to finance the government deficit. The index of Alesina and Summers is increasing in CBI.

Table. CBI, inflation and real economic growth

	CBI	inflation level	inflation var	growth level	growth var
Spain	1.5	8.5	27.8	4.2	9.4
New Zealand	1	7.6	21.9	3.0	5.4
Australia	2.0	6.4	20.8	4.0	4.6
Italy	1.75	7.3	34.3	4.0	5.7
United Kingdom	2	6.7	23.5	2.4	4.0
France	2	6.1	20.9	3.9	4.0
Denmark	2.5	6.5	11.5	3.3	6.7
Belgium	2	4.1	10.8	3.1	4.9
Norway	2	6.1	11.7	4.0	2.3
Sweden	2	6.1	14.0	2.9	3.3
Canada	2.5	4.5	12.8	4.1	4.3
The Netherlands	2.5	4.2	8.4	3.4	7.0
Japan	2.5	4.9	19.6	6.7	12.3
United States	3.5	4.1	10.5	3.0	5.3
Germany	4	3.0	5.5	3.4	5.6
Switzerland	4	3.2	6.1	2.7	8.6

Source: Alesina and Summers (1993). Notes: CBI refers to the index of Alesina and Summers (1993); all variables refer to the sample period 1955-1988.

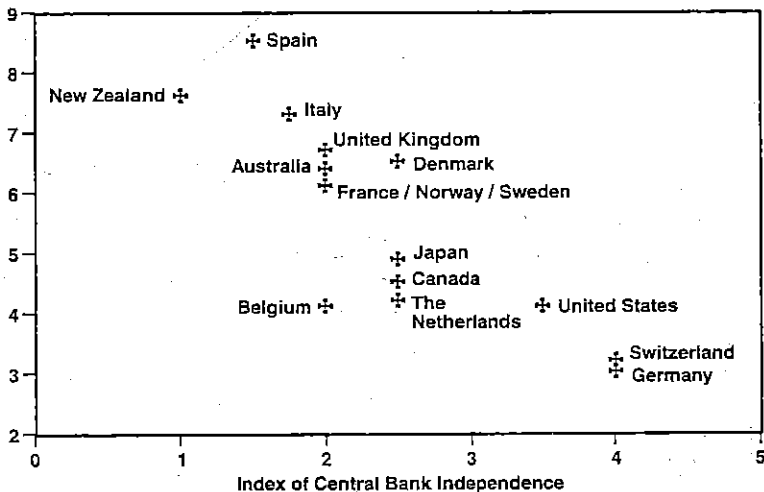
Although the index is to some extent arbitrary⁷, it confirms CBIF1 with Germany and Switzerland having the most independent CBs and with Australia, Spain and New Zealand having the most dependent CBs. The rankings are relevant for the period 1955-88.

⁷ Measured CBI remains quite arbitrary due to the arbitrary selection of criteria, the arbitrary weights to different factors and even the arbitrary averaging of different indices. Perhaps it would therefore be useful to introduce some practical criteria (e.g. the frequency of turnover of CB governors) as suggested by Cukierman (1992), Cukierman and Webb (1994) and Eijffinger and van Keulen (1994). Also, the legal measures do not always reflect the actual degree of independence. Moreover, we can think of models of imperfect information where it is not actual independence but perceived independence that really matters.

Chart. CBI and the level of inflation

Average Inflation: 1955-1988

Percent



Source: Alesina and Summers (1993)

The chart above illustrates CBIF2. The higher the index of CBI, the lower the average inflation rate. Actually, this is a well known empirical finding confirmed by most empirical studies. Heylen and Van Poeck (1995) find that benefits from greater CBI are not invariant across countries. Countries with strong left-wing parties and instable governments are found to have higher marginal benefits from greater CBI.

Nevertheless, it is difficult to establish causality between CBI and inflation levels. As a matter of fact, it is even reasonable to believe that the correlation may be spurious. In an interesting paper Posen (1994) finds that the negative correlation is not a reflection of advantageous credibility effects. He offers suggestive evidence that the current framework needs revision. Later on we will come back to this point.

As far as the CBI/inflation variability relationship is concerned, there is much less agreement. Alesina and Summers (1993) find that both the level of inflation and its variability are reduced by greater CBI⁸. Other authors, however, do confirm the CBI/inflation level relation but reject

⁸ This negative correlation between CBI and inflation variability can be easily explained by referring to the positive relation between the level of inflation and its variability.

the CBI/inflation variability result (see Grilli e.a. 1991, Cukierman 1992, Eijffinger and van Keulen 1994).

Continuing with CBIF3, there seem to be no measurable costs in terms of macroeconomic performance (see Table). Alesina and Summers (1993) found no correlation between CBI and the level and variability of real economic variables such as GDP growth, unemployment and real interest rates. Eijffinger e.a. (1994) confirm the neutrality result with respect to growth using paneldata for 10 OECD countries. Cukierman e.a. (1993) found that there is no significant effect on growth, even after controlling for other factors⁹. Over a larger sample though (including developing countries) there is a positive correlation between CBI and growth. Still, the positive correlation for LDCs remains questionable, because there may be other factors at work. For example, LDCs with independent central banks generally perform better on the fiscal side.

To sum up, CBI is thought to reduce the level of inflation without any large benefits or costs in terms of real macroeconomic performance. Consequently, such a free lunch result strongly suggests that independence is a desirable element in the institutional design of the CB. We will come back to this point when discussing possible endogeneity problems.

These empirical results are not consistent with Rogoff's (1985) model, which implies that CBs trade off between inflation and output variability. Due to the neutrality result, the prediction of greater CBI leading to greater output variability is not supported by the data.

How can we possibly explain then that CBI is neutral for the real economy? Alesina and Gatti (1995) distinguish between two sources of output variability in order to provide theoretical foundation of the free lunch result. In addition to economic variability due to exogenous shocks they identify policy-induced output variability originating from electoral uncertainty about the future course of policy.

CBI affects these two sources of variability in offsetting ways: economic variability increases due to the lack of stabilisation on behalf of the monetary authorities, but policy-induced

⁹ Such as initial GDP to remove the convergence effect on growth, changes in terms of trade and initial enrollment rates for primary and secondary education.

variability may be reduced by insulating monetary policy from politics. Thus, the overall effect on output variability is ambiguous and ultimately a matter of empirics. And, since the empirical results support the neutrality result (that is at least for the OECD countries) the magnitude of the two sources of variability could be equal and opposite.

Moreover, if the positive correlation between CBI and growth in the developing countries is not spurious, then the nonneutrality of CBI to their real economy can be explained by the presence of predominant policy-induced uncertainty in LDCs. Cukierman and Webb (1994) empirically support this line of reasoning.

2.2. Topics for Further Research

Let us now proceed with the discussion of some possible extensions of the relationship between central bank characteristics and macroeconomic performance.

A. Focus on Conservatism or on Independence?

Probably, the importance of CBI for low inflation is slightly overemphasized. Obviously, the mere independence of a central bank is not a guarantee for price stability. It may rather be the inflation aversion of the agent or the degree of conservatism which matters. For example, the Rogoff (1985) result with respect to the lower time consistent rate of inflation is not due to CBI only but due to both CBI and conservatism.

As a side remark, a central bank can be too independent. Lohmann (1992), for instance, strengthened the argument for partial independence by relying on the large deadweight loss in case of nonstabilisation to extreme output shocks. Fischer (1995) also warns against excess independence because of the resulting loss of benefits from the coordination of monetary and fiscal policy.

CBI can even be considered as an endogenous variable. Public aversion to inflation may lie at the basis of the creation of an independent CB. For instance, the experience of a hyperinflation in Germany may have raised the German public aversion to inflation and its propensity to have an independent central bank committed to price stability. The case of New Zealand is also an instructive example, because the 1989 legislation making their CB more independent was

based on the experience of high inflation rates in the 1980s.

To sum up, the negative correlation between CBI and average inflation rates does not provide evidence of causality. The establishment of an independent CB could just be the formalization of a public aversion to inflation. If this is true, then the aversion to inflation is the primary causal factor behind the low inflation result. CBI is just a side effect implied by a culture of monetary stability.

In spite of all this, independence and conservatism are often interchanged in both the empirical and the theoretical literature. A stronger focus on the effects of conservatism would be an appealing topic for further research.

B. Richer Labour Market Dynamics

A richer specification of the labour market would probably be even more welcome. Usually, a simple Lucasian price surprise aggregate supply curve is assumed with a constant natural rate of output and unemployment.

It is my guess that the analysis would yield qualitatively different results once we allow for persistence in the labour market. Insider (using Lindbeck and Snower's framework) and outsider (using Layard, Nickell and Jackman's framework) theories of the labour market describe labour market dynamics resulting in hysteresis after a sequence of negative shocks. Such a setup is probably more realistic for most European countries and it may produce some interesting results. For example, an ultra-conservative central bank may decide to relax its policy when reacting to a negative shock. Otherwise, the resulting increase in the short-term NAIRU due to hysteresis effects may result in inflation taking off much easier. Once more (cfr. Lohmann, 1992), conservatism is relaxed as the rational outcome of an optimization exercise.

Also, the examination of indexation mechanisms in the labour market is necessary, since larger indexation elasticities yield a lower inflationary bias. Consequently, the case for CBI would (*ceteris paribus*) be weakened in countries with pervasive indexation mechanisms.

C. Open Economy Extensions

Standard analysis considers some simultaneous monetary policy games. In case of interdependent countries with positive monetary spillover effects Canzoneri and Gray (1985) find that countries typically under-expand their money supplies in reaction to a negative common supply shock. The noncooperative solution is too conservative and not rational for the group as a whole. Monetary policy coordination among interdependent countries on the other hand would yield optimal adjustment to shocks.

As an extension, it would be worthwhile to discuss a Stackleberg game in conservatism. During the so-called "institutional design phase" a leading central bank sets the optimal degree of conservatism, and a number of following central banks set conservatism according to their reaction function. Such a framework would allow us to analyse how countries "import" and "export" conservatism.

Second, some signalling games in open economies with moderately independent central banks could be examined. For example, countries with a large quantity of government debt may find it necessary to signal ultra-conservatism in view of the default risk on government debt stock. In case of very open economies this ultra-conservatism may be signalled by adopting a nominal exchange rate anchor to a strong currency.

Imperfect information may be another reason why a government may induce a moderately independent central bank to signal ultra-conservatism. Consider for example the following setup. We have an moderately independent central bank that is conservative and a government that is willing to build up a conservative reputation by adhering to fiscal restraint. The public has imperfect information and does not know the type of the government. In equilibrium the central bank needs to signal ultra-conservatism (an "over-shooting" result) in order to make its conservatism credible to the public. Only in this way the public will realize that the government's efforts are genuine and that this government is not willing to use the legal possibility to override the moderately independent central bank.

On the whole, there is scope for further research on the relationship between government debt, exchange rate regimes and the signalling of central bank conservatism in open economies.

Third, the recent principal-agent approach needs further exploration in an open economy context. For example, how can we make sure that member countries of a monetary union continually respect the rules of the game? Recently, the German Minister of Finance Theo Waigel has suggested that sanctions should be introduced in order to avoid that the norms are no longer respected after the introduction of the European Monetary Union. Is this meaningful and feasible? IMF-conditionality can be seen as another application of the principal-agent approach. How should the rules linked to the IMF credit facilities be structured in order to induce monetary restraint in developing countries? Finally, there is also the question of whether optimal incentive schemes should include inflation targets or price-level targets.

D. The Free Lunch Result

A final possibility for further research would be to examine the free lunch result more closely by providing microfoundations. It is commonly believed that in the long run low inflation is conducive to economic growth. What would happen if we introduce some supply side effects of inflation in one of the more recent models of economic growth? This leads us to another interesting question, namely what can we say about the effects of institutional design on economic growth?

CONCLUSION

We began this review with the question whether the fashionable concept of central bank independence has a solid theoretical and empirical foundation. Probably the answer to this question is as ambiguous as the results of the literature itself.

As far as theory goes, we have shown that CBI provides society with a commitment device and thus a possibility to lower time consistent rate of inflation. In order to remove the inflationary bias in monetary policy its delegation to an independent and conservative but not ultra-conservative central bank offers us an interesting possibility. Imposing a well-specified contract on the central banker is another one.

Unfortunately, theory is not unambiguous about causality between CBI and inflation. The delegation approach stresses for example that the low inflation result is caused by both conservatism (but not ultra-conservatism) and independence.

Furthermore, theory does not claim that central banks should be granted full independence. Partial independence may be welfare maximizing since large deadweight losses due to nonstabilization to extreme shocks can be avoided. Also, as a result of the development of the recent principal-agent approach to central banking there is the issue of what kind of independence the central bank should be granted: only instrument independence or both instrument and goal independence?

As far as the empirical work is concerned, research has been done on the measurement of CBI and on the positive examination of its effects on macroeconomic performance. CBI is thought to lower inflation and inflation variability, while having no measurable effect on real macroeconomic performance. But, again, the matter of causality leaves us with questions.

In addition to the further exploration of the issue of causality it may be worthwhile to introduce other extensions. A richer story of the labour market, a larger emphasis on the openness of the economy and a closer examination of the free lunch result by adding microfoundations would be appealing topics for further research.

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