DISCUSSION PAPER SERIES

No. 5043

IN PRAISE OF FISCAL RESTRAINT AND DEBT RULES. WHAT THE EURO ZONE MIGHT DO NOW

Andrew Hughes Hallett

INTERNATIONAL MACROECONOMICS

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP5043.asp**

ISSN 0265-8003

IN PRAISE OF FISCAL RESTRAINT AND DEBT RULES. WHAT THE EURO ZONE MIGHT DO NOW

Andrew Hughes Hallett, Vanderbilt University and CEPR

Discussion Paper No. 5043
May 2005

Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 5043

May 2005

ABSTRACT

In Praise of Fiscal Restraint and Debt Rules. What the Euro Zone Might Do Now*

This paper attempts to reconcile the need for flexibility in fiscal policy, with the need for credibility and consistency in monetary policies. The idea is to generate fewer conflicts between policies but greater discipline within them. We assume an independent central bank and restraints on the use of national fiscal policies. Using a theoretical model, we examine the consequences of assigning leadership to fiscal or monetary policies to exploit the implicit (rule based) coordination available under standard transmission mechanisms, but where priorities and targets differ between policy makers. This works best with fiscal leadership: we introduce a debt rule (with hard or soft targets) to precommit fiscal policies over the longer term, but use monetary independence to guarantee credibility and discipline in the short run stabilization policies. Compared to the uncoordinated solution now operating in Europe, inflation biases are lower and debt repayments higher for no loss in output volatility. That corresponds to the experience of the UK, our benchmark case, whose empirical reaction functions show fiscal leadership. Across ten OECD countries, these gains are estimated to be worth 2%-4% of GDP.

JEL Classification: E52, E61 and F42
Keywords: debt rule, institutional coordination, soft targets and Stackelberg leadership

Andrew Hughes Hallett
Economics Department
Vanderbilt University
Box No. 351819, Station B
Nashville, TN 37235
USA
Tel: (1 615) 322 2871
Fax: (1 615) 343 8495
Email: a.hugheshallett@vanderbilt.edu

*I am grateful for comments from Reinhard Neck and others at the Vienna and CESifo-LBI Conferences on the Sustainability of Public Debt, and to Mike Wickens, Peter Smith, Petra Geraats, and Sean Holly at Cambridge and York Universities. The policy response functions in section 4 were developed in conjunction with John Lewis of the Bank of Estonia; and the model used in section 5 is adapted from my work with Diana Weymark at Vanderbilt University. Neither is responsible for my interpretation of events.

Submitted 19 April 2005

1. Introduction:

Since the arrival of the Euro, the Stability Pact's 3% limit on fiscal deficits has been breached by 6 out of 12 Eurozone members and the Pact itself (in its original form) set aside following a decision in the European Court of Justice. The less controversial and less often quoted debt limit (at 60% of GDP) was breached by 9 of 12 members in 1999; and 6 of them still breach it in 2005, although there have been notable improvements in several cases. This record has raised understandable concerns about the degree of discipline and pre-commitment in fiscal policy, and the risks which that may pose in terms of undermining the credibility and focus of monetary policy[1].

Many suggestions have been made for reforming the Stability Pact, most of them directed at loosening the deficit constraint to produce "soft" targets in place of the old "hard" targets. A few have also suggested making the Pact debt sensitive. Fiscal restraints have always been justified on the basis that we need to preserve sustainable public finances (a debt target) *and* maintain the credibility of the policy mix (a deficit target). Concentrating on the deficit alone – to produce more flexibility by allowing a longer adjustment period, or wider deviations after a certain limit is breached – would simply return us to the short term (adjustment around the cycle) focus and political pressures of the old Pact. It does not preserve the longer run goal of sustainability.

Equally, it is not clear why policy makers would keep to a soft target regime when they could not keep to the hard target one. Obviously they would find it easier to do so. But whether they would also want, or be able to do so is quite another question – particularly if they find that the current framework lacks coordination, or if they need fiscal policy to counter spillovers and monetary policies that do not fit their specific circumstances. Is there an alternative to give them the *incentive* to restrain their fiscal policies? In view of past behaviour, credibility may depend on being able to demonstrate such an incentive.

[1] Dixit and Lambertini (2003) argue that monetary policies cannot be credibly pre-committed if fiscal policy is not also pre-committed in some way. Indeed, to achieve full credibility in fiscal policies when policy makers all face the obvious pressures of an electoral calendar, may have been the real motive behind adopting fiscal restraints in the first place.

The intention of the reforms agreed in March 2005 was, evidently, to produce a soft target version of the old regime without any change in the way that the ECB conducts monetary policy. In this paper I accept that premise, but add three important features. First, I introduce a debt rule in order to give fiscal policies a longer term focus – and the extra commitment and credibility which come from that. Second, I recast the policy game in a form that allows inter-policy coordination without the ECB having to surrender any of its ability to act independently. That frees fiscal policy from the need to react so strongly to spillovers or mismatched monetary policies. Third, I examine the incentive for upholding a new Stability Pact regime, hard or soft. Given the poor compliance record under the old pact, it will be crucial to restore "political ownership" to member governments in a new one. I argue that it is more important to establish an economic case for a new pact, rather than a legalistic or rule-based one, not least to make it coalition proof under peer review (Fatas et al, 2003).

Several authors have advocated replacing the deficit target with a debt rule[2], and they show how debt would then fall at prevailing growth rates. But they do not show whether that rule should include hard or soft targets, or whether governments would have more incentive to keep to a debt rule than to a deficit rule. In the model studied here, fiscal policy is set to achieve certain long term objectives: low debt, better public services, social equality or economic efficiency. The income stabilising aspects are left passive, to act through the automatic stabilisers inherent in any fiscal system. Monetary policy, meanwhile, is used to take care of any remaining output stabilisation around the cycle.

To draw a distinction between actively managed long run policies, and short run stabilisation restricted to the automatic stabilisers, is of course the recommendation in Taylor (2000). Marrying that to an activist monetary policy directed at cyclical stabilisation [in order to exploit the credibility of an independent, conservative central bank to underpin the short term policies] appears to be an innovation. It implies a leadership role for fiscal policy. That in turn allows fiscal and monetary policies to be better coordinated -- but without either losing their ability to act independently. In short, we

[2] Pisani-Ferry (2002), Calmfors and Corsetti (2003), CESifo (2003), Saraceno & Monperrus-Veroni (2004).

arrive at a Stackelberg solution which lies somewhere between the discretionary (but Pareto superior) cooperative solution, and the independent (but noncooperative) outcome (Figure 1). By shifting the focus onto long run objectives, at the expense of the short term, this set-up imposes a degree of fiscal pre-commitment (and potential for electoral punishment) because governments naturally wish to lead. But the regime remains non-cooperative; so there is no incentive to renege on earlier plans in the absence of changes in information. The policies will therefore be sustained by the government of the day.[3]

<Figure 1 about here>

2. Soft Targets and Fiscal Leadership

The argument in this paper is that fiscal policy lends itself naturally to longer term objectives, and that this provides an element of leadership which can be combined with independent monetary policies directed at shorter run (demand management) objectives to create an element of *rule-based* coordination between policies. Each policy would then be used according to comparative advantage[4]. The leadership role derives from the fact that fiscal policies typically have longer run targets (sustainability, low debt) and are not easily reversible (public services, social equality), and are not easily used for stabilisation if consistency is to be maintained. Moreover any policy, independent or not, must be conditioned on the state of the economy and other policies. Improved coordination follows from the fact that policies can be adjusted to reduce the constraints (externality costs) imposed by one set of policies on another. If the costs imposed on one policy are reduced, that policy can be relaxed which allows the first policy to be eased and not cause the externality in the first place. Less conflict and more favourable operating conditions would lead to a more efficient use of the policies and better outcomes. The key to a more effective use of instruments is comparative advantage: fiscal policy directed at the longer

[3] Stackelberg games, with fiscal policy leading, produce fiscal commitment: that is, subgame perfection with either strong or weak time consistency (Basar, 1989) because the leader knows his opponent follows and would compensate (according to the follower's own preferences) if the leader were to deviate from his announced path. To that extent, we have rules rather than discretion and commitment to the stabilization policies is assured by having an independent monetary authority; provided that the government does not try to relinquish fiscal leadership and they don't both try to lead at once (Brandsma and Hughes Hallett 1984).

[4] Significantly, the older coordination literature identified comparative advantage as one of the main sources of coordination gains: see Currie et al (1989)

run goals of public finance, and the credibility of an independent monetary policy being used to underwrite the stabilisation effort (and hence the fiscal commitments).

However, there are automatic stabilisers in any fiscal policy framework, implying that monetary policy must condition itself on the longer term fiscal stance at each point. That puts monetary policy in a follower's role. This is helpful however, because it allows the economy to retain the benefits of an independent monetary policy; but secure a certain degree of coordination between the two sets of policy makers – active long term fiscal policies on one side, and short run (monetary) stabilisation policies on the other. Better coordination arises because an agreed leadership role reduces the externalities which independent, but self-interested agents would otherwise try to impose on one another. That allows Pareto improvements over the usual noncooperative solution, without reducing the central bank's ability to act independently on its shorter run objectives.

Second, we suppose that soft targets may work better for the following reasons. Policy making is less likely to be disabled by arguments over the precise definition and measurement of the target, or the arbitrary nature of a numerical limit. In addition, soft targets introduce some flexibility into policy making – so that the procyclicality of hard targets can be reduced, and the tendency of hard targets to block reforms because of their short run costs. Soft targets can also accommodate the positive effects of a deficit, and the desire to allow differences in national priorities when simplicity and fairness suggest uniform limits should be imposed in the long run. Like monetary policy, fiscal policy depends on achieving a balance between credibility and flexibility. All these points are equally applicable to debt or deficit targets of course. But debt limits are helpful because they focus on avoiding the ultimate risk, unsustainable public finances. Moreover, the soft target version allows policy makers to trade off good years against bad (in effect, because the target is a stock not a flow, producing a cyclically adjusted rule without the difficulty of calculating the adjustments). It is also easy to incorporate country differences, so that the restrictions are looser for those who are less of a threat to others. Finally, again because the target is a stock not a flow (and therefore more persistent), a debt rule gives policy makers a greater incentive to obey the pact: a) to preserve their

freedom of manoeuvre in the future; b) to save for a rainy day at the top of the cycle; c) because the persistence in such a target makes credibility and coordination gains possible.

The argument now proceeds in three steps. Institutional comparisons, using the UK as a benchmark. Empirical evidence: how monetary policy has reacted to fiscal policy in practice, and vice versa. Theoretical evidence: how coordination can emerge from fiscal leadership.

3. Institutional Comparisons:

This section develops institutional comparisons to show how long term fiscal goals can introduce the fiscal pre-commitment we need to generate rule-based coordination from our theoretical model. The comparisons themselves are between the Eurozone and the UK. However the UK is a benchmark: it is important only in so far as it shows that fiscal pre-commitment can be created by institutional means in practice.

The Eurozone: EMU, both in practice and in the underlying treaties, specifies very little about the intended relationship between fiscal and monetary policies. The main concern has always been the independence of monetary policy and the ECB. Article 107 of the Maastricht Treaty and Article 7 of the ESCB statutes guarantee the independence of the ECB and the decision making bodies responsible for monetary policy. Those articles also specify that the monetary authorities may not seek or take instructions from any government, government agency or European community organisation. Nor are those agencies allowed to influence the ECB's decisions; and Article 10.4 of the ESCB statutes requires that the proceedings of policy meetings at the ECB remain confidential. Finally the fact that the ECB was given price stability as its "primary objective" (Article 2, ESCB statutes) without a formal definition, when other objectives can be entertained only if they are "without prejudice to price stability", means that the Bank has target independence – both in defining what price stability shall mean, and in giving price stability a "clear priority....as the basis for economic conditions that foster growth,

employment and higher living standards", all of which are declared goals of the EU[5]. The ECB therefore has the freedom to set its own targets, but faces a mandate to pursue them with a close to lexographic ordering of price stability over the broader set of EU targets. Thus decisions may vary; but targets and priorities do not change with circumstances or the fiscal stance.

Since an independent ECB makes fiscal policy independent of the Bank, one would anticipate competitive (noncooperative) policy making here, with little coordination between the policies. Indeed there is very little room even for *implicit* coordination through information exchanges or some form of leadership. Any discussion that could be construed as taking instructions or attempted influence is ruled out, although the ECB president may attend ECOFIN meetings which could lead to a small information advantage. Monetary policy could still lead, but to go first would be difficult because an overriding price stability target means the ECB must stand ready to react to deviant fiscal policies if need be. Any leadership advantage would therefore be limited. Similarly price stability is defined over a horizon of 2 years, which is no longer (and probably shorter) than that underlying the fiscal decisions. Moreover, additional targets can only be considered in so far as they "affect or pose risks to price stability", again a short term response to fiscal policy or wage bargains. So an independent ECB has no strategic advantage, and very little information or institutional advantage over other policy makers. Nevertheless, frequent statements from the ECB that it needs the "unequivocal support of sound fiscal policies and responsible wage bargains" suggest that fiscal policy may have been intended to follow (the problem of compatibility with national priorities notwithstanding); and that the Stability Pact would have been a mechanism to force that. As it is, the ECB's capacity to lead is small and made weaker by an ineffective Stability Pact. A model of competitive policy making probably lies closer to the truth.

In The UK: the demand management role of fiscal policy was phased out in the 1980s. That role passed to monetary policies – with limited success in the earlier phases of monetary targeting, but with more success when formalized as an inflation targeting

[5] The quotes here are taken from Issing's (1999) explanation of how ECB policy making actually works.

regime with an independent Bank of England. In this period the role of fiscal policy was to provide "conditioning information" within which monetary management had to work. It was split into two parts. Short term stabilization of output/employment was left to the automatic stabilizers in the prevailing tax and expenditures regime. Discretionary adjustments would only be used in exceptional circumstances, if at all[6]. The rest of fiscal policy, being the larger part, was then directed at longer term objectives: microeconomic flexibility that would reduce the need for stabilizing interventions (since relative wage and price adjustments would do the job better) and provide the conditions for employment creation and growth (HMT 2003). Given that, the longer run goals of low debt, better public services and social equity could be attained. Moreover, as market flexibility improved, it became possible to focus more directly on the longer run goals.

According to the Treasury's own assessment, UK fiscal policy now leads monetary policy in two senses. First, fiscal policy is decided in advance of monetary or other policies (pp. 5, 63, 64, 74)[7], *and* with a longer time horizon (pp. 5, 42, 48, 61). Second, monetary policy is charged with controlling inflation and stabilizing output around the cycle – rather than steering the economy as such (pp. 61-63). Fiscal policy therefore sets the conditions within which monetary policy has to respond and achieve its own objectives (pp. 9, 15, 67-8). The short term fiscal interventions, now less than half the total and steadily declining (p. 48, box 5.3, section 6), are restricted to the automatic stabilizers - with effects that are known and predictable. The short run discretionary components have become negligible (p. 59, table 5.5), and the long run objectives of policy will always take precedence in cases of conflict (pp. 61, 63-8). Fiscal policy is therefore no longer used for fine tuning (pp. 11, 63), or for stabilization (pp. 1, 14). That

[6] This follows Taylor (2000). However, because of the trade-off between cyclical stability and budget stability (Fatas et al, 2003), it is likely to be successful only in markets with flexible wages and prices. As a result, automatic stabilizers stabilize about 30% of the UK cycle; the remaining 70% being left to monetary policy (HMT, 2003). The need for additional fiscal interventions is condidered unnecessary: first, because of the effectiveness of the forward looking, activist inflation targeting mechanism adopted at the Bank of England; and second, because the longer term expenditure and tax plans are constructed in nominal terms so that they can add to the stabilizing power of the automatic stabilizers in more serious booms or slumps.
[7] The page and other references in this section are all taken from HMT (2003).

burden is carried by interest rates, given the existing fiscal stance and its forward plans (pp. 1, 7, 11, 37).

Third, given that consumers and firms may be credit constrained and that the impact of fiscal policy is often uncertain or subject to lags (pp. 19, 26, 48; Taylor, 2000), it makes sense for fiscal policy to be used consistently and in a way that is identified with the long term objectives. The UK has determined these objectives to be:

- Sustainable public finances in the long term; that is, low debt (40% of GDP) stabilised symmetrically over the cycle.
- A sustainable but improving delivery of public services; improved supply side efficiency; social and inter-generational equity; the alleviation of poverty.
- Recognition that the achievement of these objectives is often contractual and cannot be reversed once committed. The long lead times needed to build up such programmes mean that the necessary commitments must be made well in advance, and that frequent changes cannot be made.
- The formulation of clear numerical objectives consistent with these goals implies a transparent set of institutional rules; and a separation of these goals from stabilization around the cycle (to be achieved by automatic stabilizers and monetary policy).
- Public expenditures are planned with fixed three year expenditure limits which, when combined with decision and implementation lags of two years, means that the bulk of fiscal policy is planned with a horizon of up to five years – versus two years for inflation targeting at the Bank of England. In addition the Treasury smoothes taxes, having rejected the tax or expenditure regulators that could be used for short term stabilisation as being inconsistent with clarity, continuity and predictability. Fiscal policy remains focused on the medium to long term.

In short, it is the institutional structure which has delivered fiscal leadership in the UK. And since the discretionary elements are smaller than the automatic stabilizers, and declining, something else (monetary policy) must have taken up the burden of short run stabilization. This arrangement justifies our approach of setting up a Stackelberg game as

the benchmark case for achieving greater internal coordination, with endogenously chosen parameters for targets, independence and priorities.

4. Empirical Evidence: "Leadership with Separation"

The next step is to establish whether the European policy authorities have followed a "leadership with separation" model in practice, with the Eurozone adopting monetary leadership and the UK fiscal leadership. The difficulty here is that, although the asymmetry in anticipated responses between follower and leader – the follower expects no further changes from the leader after the follower chooses his reaction function, while the leader takes that reaction function into account – is clear enough in a theoretical model of a leadership game, the same asymmetry and zero restriction will not appear in the ex-post (observed) responses that emerge in the solution.[8] Since we do not have data on anticipations, this makes it hard to test for leadership directly. But we can use indirect tests based on the degree of competition, or otherwise, between instruments.

a) Monetary Responses in Britain and Europe: For monetary policy, it is widely argued that the authorities' decisions can best be modelled by a Taylor rule[9]

$$r_t = \rho r_{t-1} + \alpha E_t \pi_{t+j,t+k} + \beta gap_{t+h} \qquad \alpha, \beta, \rho \geq 0 \qquad (1)$$

where k, h represent the authorities' forecast horizon, and inflation is monitored over the interval t+j to t+k[10]. Normally $\alpha > 1$ will be required to avoid indeterminancy: that is, to avoid arbitrary variations in output or inflation as a result of unanchored expectations in the private sector (Woodford, 2003). The relative size of α and β then reveals the authorities' preference for inflation control over income stabilisation; and ρ their

[8] See Basar and Olsder (1999), Hughes Hallett (1984), Brandsma and Hughes Hallett (1984).

[9] One can argue that policy should be based on optimal rules. But it is hard to say that policy makers actually do optimise when the gains from doing so may be small; and when the uncertainties in their information or the economy's responses may be large. In practice, the Taylor rule approach has been found to fit central bank behaviour better.

[10] In principle, k and j may be positive or negative: positive if the policy rule is based on expected future inflation, to head off an anticipated problem over the interval t+j to t+k. But negative if interest rates are to follow a feedback rule to correct past mistakes in inflation control. Or both if $E\pi_{t-j,t+k}$ is used.

preference for gradualism. We set h=0, since in practice monetary policy appears to depend only on the inflation horizon (Dieppe et al, 2004).

In order to obtain an idea of the influence of fiscal policy on monetary policy in practice, I include Taylor rule estimates for the UK and the Eurozone in Table 1. It shows the rules since 1997 and 1999; that is since new monetary regimes were introduced in each case.

Table 1: Generalised Taylor Rules in the UK and EU-12
Dependent variable: central bank lending rate, r_t

	const	r_{t-1}	$\pi^e_{j,k}$	j, k	gap	pd	debt
1)	-1.72 (2.16)	0.711 (5.88)	1.394 (2.66)	+6, +18	0.540 (2.06)	-	-

For the UK, monthly data from 1997.06 – 2004.01

$\bar{R}^2$ =0.91, $F_{3,21}$ = 82.47 N = 29

2)	-2.52 (2.65)	0.629 (4.53)	2.023 (3.07)	+9, +21	1.203 (2.66)	-0.073 (1.13)	-

$\bar{R}^2$ = 0.90 $F_{4,20}$ = 54.5 N = 25

3)	-2.57 (2.59)	0.598 (4.38)	1.289 (0.66)	+9.+21	1.100 (1.53)	-0.067 (0.83)	0.043 (0.50)

$\bar{R}^2$ = 0.90 $F_{5,19}$ = 44.1 N = 25

For the Eurozone (EU-12), monthly data from 1999.01 – 2004.01

	const	r_{t-1}	$\pi^e_{j,k}$	j, k	gap	pd	debt
1)	-0.996 (0.76)	0.274 (1.04)	1.714 (3.89)	+9, +21	0.610 (1.77)	-	-

$\bar{R}^2$ = 0.82, $F_{3,11}$ = 22.2 N = 15

2)	0.952 (0.98)	0.254 (1.31)	0.577 (2.00)	-6,+6	0.368 (1.63)	0.392 (4.34)	-

$\bar{R}^2$ = 0.91 $F_{4,14}$ = 47.17 N = 19

3)	-13.67 (0.59)	0.274 (1.04)	1.110 (1.19)	-6, +6	0.341 (1.22)	0.463 (2.89)	0.191 (0.63)

$\bar{R}^2$ = 0.87 $F_{5,13}$ = 24.7 N = 19

Notation: j, k and $\pi^e_{j,k}$ represent the average inflation rate expected over the interval t+j to t+k: $E\pi_{t+j,t+k}$; gap = GDP – trend GDP; pd = primary deficit or surplus as a percentage of GDP (surplus >0); debt = debt/GDP ratio. **Estimation:** instrumented 2SLS; t-ratios in parentheses; j, k determined by search; and the output gap is obtained from a conventional HP filter to determine trend output.

b) Different types of leadership: Conventional wisdom suggests that Europe has either monetary leadership or independent policies; and hence policies which are either jointly dependent in the usual way, or which are complementary and mutually supporting. The latter implies monetary policy tends to expand/contract whenever fiscal policy needs to expand or contract – but not necessarily vice versa when money is expanding or contracting and is sufficient to control inflation on its own. That is a weak form of monetary leadership in which fiscal policies are an additional instrument for use in cases of particular difficulty, rather than a Nash game with potentially conflicting policy aims that need to be reconciled.

More generally, leadership implies complimentarity between policy instruments in the leader's reaction function; but conflicts (or competition) between them in the follower's responses[11]. Thus monetary leadership would imply complimentarity in the Taylor rule, but conflicts in the fiscal responses. And fiscal leadership would have complimentarity in the fiscal rule but conflicts in the monetary responses. Evidently, from section 3, our hypothesis should lead us to expect Stackelberg leadership (with fiscal policy leading) in the UK, but the opposite (monetary leadership, weak or strong) in the Eurozone.

c) Observed behaviour: The first equations in each panel of table 1 yield the standard results for monetary behaviour in both the UK and Eurozone. Both monetary authorities have targeted expected inflation more than the output gap since the late 1990s – and with horizons of 18-21 months ahead. The ECB has been more aggressive in this regard. But, contrary to conventional wisdom, it also appears to have been more sensitive to the output gap and to have had a longer horizon and less inertia if we ignore the fiscal effects.

However, if we allow monetary policies to react to changes in fiscal stance, we get more plausible results (the lower equations). Here we see that UK monetary decisions may take fiscal policy into account, but the effect is not strong or well defined. However this model of monetary behaviour does imply more activist policies, a longer forecast horizon (up to 2 years as the Bank of England claims) and greater attention to the output gap – the

[11] This weak form of leadership also allows independence between instruments in the leader's policy rule.

acknowledged symmetry in the UK's policy rule. And most important, to the extent that fiscal policy is an influence, it is as a substitute (competitor) for monetary policy – fiscal deficits lead to higher interest rates. This is the Stackelberg part of their interaction when fiscal policy leads – though the effect is weak, most likely because we have only 25 observations to estimate this part of the relationship. The lack of influence of the debt ratio is easily understood, however. Since that is a declared long run objective of fiscal policy, it would not be necessary for monetary policy to take it into consideration. So, if anything, the upshot is some evidence in favour of Stackelberg follower behaviour in monetary policy, easing the competition (externalities) between policy instruments.

The ECB results look quite different. Once fiscal effects are included, the concentration on inflation control is much reduced (it comes close to indeterminancy and may not even be significant) and the forecast horizon shrinks to 6 months. Moreover, a feedback element, to correct past mistakes, comes in. At the same time, output stabilisation becomes less important and less significant, which implies symmetric targeting goes out. Instead monetary policy now appears to react to fiscal policy, but with the "wrong" sign: the larger the primary deficit, the looser monetary policy. In this case therefore, the policies are acting as complements – circumstances that would call for a primary deficit will also produce a relaxation of monetary policy. Thus we have evidence of monetary leadership, of the type where fiscal policy is used as an additional policy instrument.

d) Fiscal Reaction Functions in the UK and Eurozone

We turn now to the fiscal policy responses. A number of analysts have hypothesised that fiscal policy responses can best be modelled by means of a "fiscal Taylor rule":

$$d_t = a_t + \gamma gap_t + sd \qquad \gamma>0 \qquad (2)$$

where sd = structural deficit ratio, d_t is the actual deficit ratio (d>0 denotes a surplus)[12], and a_t represents other factors such as the influence of monetary policy, existing or anticipated inflation, the debt burden, discretionary fiscal interventions. The coefficient γ then gives a measure of an economy's automatic stabilisers. The European Commission,

[12] The Commission actually defines d>0 to be a deficit. They therefore expect γ to be negative. See Taylor (2000), Galli and Perotti (2003), Turrini and in 't Veld (2004) for similar formulations of a fiscal rule.

for example, estimates $\gamma \approx ½$ for Europe – a little more in countries with an extensive social security system, a little less elsewhere (European Commission, 2002). And a similar relationship is thought to underlie UK fiscal policy (HMT 2003: boxes 5.2, 6.2).

The signs of the remaining factors in a_t are not so clear. The debt burden should increase current deficits, unless a systematic debt reduction programme is underway. Inflation should have a positive impact on the deficit ratio if fiscal policy is used for stabilisation purposes, but no effect otherwise. Finally, the output gap should also have a positive impact on the deficit ratio if the latter is being used for stabilisation purposes – in which case interest rates should be negatively correlated with the size of the deficit since monetary policies focussed on inflation and fiscal policies focussed on short run stabilisation would otherwise conflict. Conversely, a negative association with the output gap, but a positive one with interest rates, would imply no automatic stabiliser effects but mutually supporting policies: i.e higher interest rates go with tighter fiscal policies. That implies complementary policies and closer coordination.

Table 2 contains our estimates of the fiscal policy reaction functions for the UK and the Eurozone. Higher debt increases the surplus ratio in the UK, but has no effect in the Euro area.[13] So, while the UK evidently has had a systematic debt reduction programme, no such efforts have been made in that direction in Europe. Inflation, on the other hand, has had no apparent effect on the UK deficits (inflation was consistently insignificant in the UK equation), but a negative effect in Europe. Similarly the output gap produces a negative reaction in Europe, but a positive one in the UK. These two variables indicate that fiscal policy has been used for output stabilisation in the UK – consistent with allowing automatic stabilisers do the job – but for purposes other than that in the Eurozone. This result fits in neatly with Europe's evident inability to save for a rainy day in the upturn, *and* with her inability to stabilise in the downturn because of the Stability Pact constraints[14]. But a value of $\gamma \geq 1$ means that the UK has had a commitment to

[13] Introducing debt into the Eurozone equation produces a highly insignificant negative coefficient, and halves the significance of all the others. It has no independent influence on Eurozone deficits therefore.
[14] See Buti et al (2003). The presence of debt in the UK fiscal rule indicates that long run sustainability has been a primary target in the UK, but not in the Eurozone (meaning saving for a rainy day would not occur).

something beyond stabilisation: e.g. public services or debt management. It shows those commitments can be funded better in good times without reversals in bad times.

Table 2: Fiscal Policy Reaction Functions[15]

For the UK, sample period 1997q3 – 2004q2

$$d_t = -0.444 + 0.845\ debt_t + 0.0685\ r_t + 1.076\ gap_t \qquad \bar{R}^2 = 0.78, \quad F_{3,24} = 33.23$$
$$(0.37) \quad (7.64) \qquad (0.30) \qquad (1.72) \qquad N = 28$$

For the Eurozone, sample period 1999q1 – 2004q2

$$d_t = 3.36 + 1.477\, d_{t-1} - 0.740\ \pi^e_{+9,21} - 0.207\ r_t - 0.337\ gap_t \qquad \bar{R}^2 = 0.93,\ F_{4,11} = 54.55$$
$$(2.96) \quad (9.66) \qquad (2.21) \qquad (1.16) \qquad (2.18) \qquad N = 16$$

Key: d_t = gross deficit/GDP (%), where d<0 denotes a deficit; $debt_t$ = debt/GDP (%); r_t is the central bank lending rate; $\pi^e_{j,k}$ and gap_t as in table 1. **Estimation method**: instrumented 2SLS; linear interpolation for quarterly deficit figures; and t-ratios in parentheses. **Note:** At current debt, interest rates and inflation targets, these estimates imply a structural deficit of about 0.1% for the UK and 2.6% for the Eurozone.

Consequently the UK appears to use fiscal policy for stabilisation in a minor way as claimed, while the Euro economies seem not to use fiscal policy in that way at all. Confirmation of this comes from the responses to interest rate changes, which are positive but small and statistically insignificant in the UK; but negative and significant in Europe. That implies British fiscal policies are chosen independently of monetary policy, as claimed in our Stackelberg interpretation of the Treasury's strategy. But if there is an association, fiscal and monetary policies are compliments and hence weakly coordinated. That suggests leadership. Moreover, since monetary and fiscal policies are substitutes in the monetary rule, but independent or complements in the fiscal rule, fiscal policy must be the policy exercising leadership.

[15] Increasing the sample size back to 1994 when, according to some, the new fiscal regime really took shape, makes no material difference to our estimates of the UK equation. Similarly, replacing primary with gross deficits makes little difference. That confirms fiscal discipline was seen in terms of the overall deficit.

In the Eurozone, the opposite holds. There monetary and fiscal policies are (weakly) competitive in the fiscal rule, but complements in the monetary rule. That suggests weak monetary leadership – or, more likely, a straightforward noncooperative game since the complimentarity in table 1 is numerically small (if significant); since the authorities have evidently taken a short run view (primary deficits drive European monetary reactions, not debt levels; likewise the monetary target appears to be current, not future inflation); and since the instrument conflicts are more marked.

5. Theoretical Evidence: A Model of Fiscal Leadership

5.1 The Economic Model and Policy Constraints

The key question now is: would governments actually want to pursue fiscal leadership? Do they have an incentive to do so; and would there be a clear advantage in terms of overall economic performance if they did? More important, would the fiscal leadership with separation model still be advantageous if fiscal policy was limited by a debt rule – either in the form of "hard" targets as in the original Stability Pact, or with "soft" targets?

To answer these questions, we extend a model used in Hughes Hallett and Weymark (2002; 2004a,b; 2005) to examine the problem of monetary policy design when there are interactions with fiscal policy. For exposition purposes, we suppress the spillovers between countries and focus on the following three equations to represent the economic structure of any one country:[16]

$$\pi_t = \pi_t^e + \alpha y_t + u_t \qquad (3)$$

$$y_t = \beta(m_t - \pi_t) + \gamma g_t + \varepsilon_t \qquad (4)$$

$$g_t = m_t + s(by_t - \tau_t) \qquad (5)$$

where π_t is inflation in period t, y_t is the growth in output (relative to trend) in period t, and π_t^e represents the rate of inflation that rational agents expect will prevail in period t conditional on the information available at the time expectations are formed. Next,

[16] Technically, we assume a blockwise orthogonalisation of the traditional multicountry model to produce independent semi-reduced forms for each country. The disturbance terms may therefore contain foreign variables, but they will have zero means so long as those countries remain on their long run (equilibrium) growth paths on average (all variables being defined as deviations from their equilibrium growth paths).

m_t, g_t, and τ_t represent the growth in the money supply, government expenditures, and tax revenues in period *t*; and u_t and ε_t are random disturbances which are distributed independently with zero mean and constant variance. *All* variables are defined as deviations from their long run equilibrium values, and we treat trend budget variables as pre-committed and balanced. Deviations from the trend budget are the only discretionary fiscal policy choices available therefore. The coefficients α, β, γ, *s*, and *b* are all positive by assumption. The assumption that γ is positive is sometimes controversial.[17] However, the short-run impact multipliers derived from Taylor's (1993) multi-country estimation provide empirical support for this assumption (as does HMT 2003).

According to (3), inflation is increasing in the rate of inflation predicted by private agents and in output growth. Equation (4) indicates that both monetary and fiscal policies have an impact on the output gap. The microfoundations of the aggregate supply equation (3), originally derived by Lucas (1972, 1973), are well-known. McCallum (1989) shows that aggregate demand equations like (4) can be derived from a standard, multi-period utility-maximisation problem.

Equation (5) describes the government's budget constraint. In earlier papers, we allowed *discretionary* tax revenues to be used for redistributive purposes only, but permitted *discretionary* expenditures for enhancing output. We further assumed that there were two types of agents, rich and poor, and that only the rich use their savings to buy government bonds. On this view, *b* would be the proportion of pre-tax income (output) going to the rich and *s* the proportion of after-tax income that the rich allocate to saving. Tax revenues, τ_t, can then be used by the government to redistribute income from rich to poor, either directly or via public services. This fiscal structure therefore has output-enhancing expenditures g_t and discretionary transfers τ_t. Both are financed by aggregate

[17] Barro (1981) argues that government purchases have a contractionary impact on output. Our model, by contrast, treats fiscal policy as important because: (i) fiscal policy is widely used to achieve redistributive and public service objectives; (ii) governments cannot pre-commit monetary policy with any credibility if fiscal policy is not pre-committed (Dixit and Lambertini, 2003); and (iii) Central Banks, and the ECB in particular, worry intensely about the impact of fiscal policy on inflation and financial stability (Dixit 2001).

tax revenues; that is, from discretionary and trend revenues. Expenditures above those revenues must be financed by the sale of bonds.

5.2 An alternative interpretation: debt management

We could, however, take a completely different interpretation of equation (5). It remains the government's budget constraint. But we could define b to be the current public debt to GDP ratio; τ_t to be the revenues that the government proposes to devote to paying down the existing stock of debt in period t; and s to be the proportion of any remaining increase in the debt stock (after transfers to pay it down) that the government expects to pay out in current expenditures this period. It is not immediately obvious that a government could spend anything out of an existing, and hence previously committed stock of debt. However, if b=B/Y where B is the absolute stock of debt and Y the absolute level of national income, then $\dot{b} = [\dot{B} - b\dot{Y}]/Y$ where $\dot{x}$ denotes the change in x per unit of time. But $b\dot{Y} = by_t$ since y_t is, by definition, the deviation of Y_t from its own steady state path. Hence by_t represents the amount of additional debt that could be created (and spent) without the debt to GDP ratio rising, when national income rises or falls.[18] We now suppose governments spend only a proportion s of that, after taking into account the revenues they plan to use to pay the debt stock down. This is a convenient formulation since it allows us to introduce a debt target into the government's objectives such that the value of τ_t is chosen to reduce the debt ratio from b to some other level, θ say. That can be done as a "soft" rule or a "hard" rule, as we show next. The implication however, is that $s(by_t - \tau_t)$ represents only that part of the increase in debt that the government plans to spend for short term or stabilisation purposes. This follows from equations (4) and (5). The rest will be used for public expenditures, investment, structural reform, or other long term commitments. We might therefore regard s as the proportion of new fiscal policy expenditures going to automatic stabilisers (in the absence of discretionary stabilisation), and 1-s as the proportion going to longer term goals. Thus we should expect s to be about 0.5 for the average Euro economy; or 0.33 for an economy like the UK (HMT 2003).

[18] Governments may of course actually decide to create increases in debt which are larger or smaller than that, depending on whether they choose to make τ_t negative or positive.

Given this interpretation, we can solve for π_t^e, π_t and y_t from (3) and (4). That yields the following reduced forms:

$$\pi_t(g_t, m_t) = (1+\alpha\beta)^{-1}[\alpha\beta m_t + \alpha\gamma g_t + m_t^e + \frac{\gamma}{\beta} g_t^e + \alpha\varepsilon_t + u_t] \tag{6}$$

$$y_t(g_t, m_t) = (1+\alpha\beta)^{-1}[\beta m_t + \gamma g_t - \beta m_t^e - \gamma g_t^e + \varepsilon_t - \beta u_t]. \tag{7}$$

Solving for τ_t using (5) and (7), then yields

$$\tau_t(g_t, m_t) = [s(1+\alpha\beta)]^{-1}[(1+\alpha\beta + sb\beta)m_t - (1+\alpha\beta - sb\gamma)g_t$$

$$- sb\beta m_t^e - sb\gamma g_t^e + sb(\varepsilon_t - \beta u_t)] \tag{8}$$

5.3 Government and Central Bank Objectives

In our formulation, we allow for the possibility that the government and an independent central bank may differ in their objectives in some significant way. In particular, we assume that the government cares about inflation stabilization, output growth, and the provision of public services or public debt; whereas the central bank, if left to itself, would be concerned only with the first two objectives directly[19], and possibly only the first one. We also assume that the government has been elected by majority vote, so that the government's loss function reflects society's preferences to a significant extent.

Formally, the government's loss function is given by

$$L_t^g = \frac{1}{2}(\pi_t - \hat{\pi})^2 - \lambda_1^g y_t + \frac{\lambda_2^g}{2}[(b-\theta)y_t - \tau_t]^2 \tag{9}$$

where $\hat{\pi}$ is the government's inflation target, λ_1^g is the relative weight or importance that the government assigns to output growth,[20] and λ_2^g is the relative weight which it assigns

[19] Since the central bank has no instruments to control debt itself, it can only react to poor fiscal discipline indirectly: e.g. to the extent that its inflation objective is compromised, where it does have an instrument.

[20] Barro and Gordon (1983) also adopt a linear output target. In the delegation literature, the output component in the government's loss function is usually represented as quadratic to reflect an output *stability* objective. In our model, the quadratic term in debt allows monetary and fiscal policy to play a stabilization role as well as pick a position on the economy's output-inflation trade-off.

to the debt rule. The parameter θ represents the target value for the debt to GDP ratio which the government would, ideally, like to reach: hence $(b-\theta)y_t$ becomes the target for its discretionary revenues τ_t. All other variables are as previously defined. We can regard large values of λ_2^g, $\lambda_2^g > \max[1, \lambda_1^g]$ say, as a "hard" debt rule; and smaller values, $\lambda_2^g < \min[1, \lambda_1^g]$, as a "soft" debt rule.

The objectives of the central bank, however, may be quite different from those of the government. We model them as follows:

$$L_t^{cb} = \frac{1}{2}(\pi - \hat{\pi})^2 - (1-\delta)\lambda^{cb} y_t - \delta\lambda_1^g y_t + \frac{\delta\lambda_2^g}{2}[(b-\theta)y_t - \tau_t]^2 \qquad (10)$$

where $0 \leq \delta \leq 1$, and λ^{cb} is the weight which the central bank assigns to output growth. The parameter δ measures the degree to which the central bank is forced to take the government's objectives into account. The closer δ is to 0, the greater is the independence of the central bank in making its choices. And the lower λ^{cb}, the greater is the degree of conservatism in those choices.

In (9) we have defined the government's inflation target as $\hat{\pi}$. The fact that the same inflation target appears in (10) would be correct for cases where the bank has instrument independence but not target independence. However it is easy to relax that assumption and allow the central bank to choose its own target, as the ECB does. But, as we show in the appendix, there is no advantage in doing so since the government would simply adjust its parameters to compensate. Hence, only if the bank is free to choose the value of λ^{cb} as well, do we get an extra advantage. Yet even that will not be enough to outweigh the advantages to be gained from fiscal leadership – for reasons noted in Section 6.

A second feature is that (9) and (10) specify symmetric inflation targets around $\hat{\pi}$. Symmetric inflation targets are particularly emphasized as being required of both monetary policy and the fiscal authorities (HMT 2003). We have therefore specified both to be features of the government and central bank objective functions here. However it is not clear that symmetry has been a feature of European policy making in practice; and the

ECB has acquired a reputation for being more concerned to tighten monetary policy when $\pi > \hat{\pi}$, than loosen it when $\pi < \hat{\pi}$. Consequently, rather than symmetry in the output gap target, we have specified asymmetric penalties which tighten the debt rule in recessions, but weaken it in a boom (when the debt ratio will be falling anyway). That might not be ideal since it introduces an element of pro-cyclicality. On the other hand, it brings the rule closer to reality. And it captures the policy makers' revealed preference for an inequality constraint (even if it makes saving for a rainy day less likely).

5.4 Institutional Design and Policy Choices

We characterize the strategic interaction between the government and the central bank as a two-stage non-cooperative game in which the structure of the model and the objective functions are common knowledge. In the first stage, the government chooses the institutional parameters δ and λ^{cb}. The second stage is a Stackelberg game in which fiscal policy takes on a leadership role. In this stage, the government and the monetary authority set their policy instruments, given the δ and λ^{cb} values determined at the previous stage. Private agents understand the game and form rational expectations for future prices in the second stage. Formally, the policy game runs thus:

Stage 1

The government solves the problem:

$$\min_{\delta,\lambda^{cb}} EL^g(g_t, m_t, \delta, \lambda^{cb}) = E\left\{\tfrac{1}{2}[\pi_t(g_t, m_t) - \hat{\pi}]^2 - \lambda_1^2[y_t(g_t, m_t)]\right\}$$
$$+ \frac{\lambda_2^g}{2} E[(b-\theta)y_t(g_t, m_t) - \tau_t(g_t, m_t)]^2 \qquad (11)$$

where $L^g(g_t, m_t, \delta, \lambda^{cb})$ is (9) evaluated at $(g_t, m_t, \delta, \lambda^{cb})$, and E denotes expectations.

Stage 2

1. Private agents form rational expectations about future prices π_t^e before the shocks u_t and ε_t are realized.
2. The shocks u_t and ε_t are realized and observed by the government and by the central bank.
3. The government chooses g_t, before m_t is chosen by the central bank, to minimize $L^g(g_t, m_t, \bar{\delta}, \bar{\lambda}^{cb})$ where $\bar{\delta}$ and $\bar{\lambda}^{cb}$ are at the values determined at stage 1.
4. The central bank then chooses m_t, taking g_t as given, to minimize

$$L^{cb}(g_t, m_t, \bar{\delta}, \bar{\lambda}^{cb}) = \frac{(1-\bar{\delta})}{2}[\pi_t(g_t, m_t) - \hat{\pi}]^2 - (1-\bar{\delta})\bar{\lambda}^{cb}[y_t(g_t, m_t)] + \bar{\delta}L^g(g_t, m_t, \bar{\delta}, \bar{\lambda}^{cb}) \quad (12)$$

We solve this game by solving the second stage (for the policy choices) first; and then substituting the results back into (11) to determine the optimal operating parameters δ and λ^{cb}. From stage 2, we get

$$\pi_t(\delta, \lambda^{cb}) = \hat{\pi} + \frac{(1-\delta)\beta(\phi - \eta\Lambda)\lambda^{cb} + \delta(\beta\phi + \gamma\Lambda)\lambda_1^g}{\alpha[\beta(\phi - \eta\Lambda) + \delta\Lambda(\beta\eta + \gamma)]} \quad (13)$$

$$y_t(\delta, \lambda^{cb}) = -u_t / \alpha\,, \quad (14)$$

$$\tau_t(\delta, \lambda^{cb}) = \frac{(1-\delta)\beta s(\beta\eta + \gamma)(\lambda^{cb} - \lambda_1^g)}{[\beta(\phi - \eta\Lambda) + \delta\Lambda(\beta\eta + \gamma)]\lambda_2^9} - \frac{(b-\theta)u_t}{\alpha} \quad (15)$$

where $$\eta = \frac{\partial m_t}{\partial g_t} = \frac{-\alpha^2\gamma\beta s^2 + \delta\phi\Lambda\lambda_2^g}{(\alpha\beta s)^2 + \delta\Lambda^2\lambda_2^g}\,, \quad (16)$$

$$\phi = 1 + \alpha\beta - \gamma\theta s\,, \quad (17)$$

and $$\Lambda = 1 + \alpha\beta + \beta\theta s\,. \quad (18)$$

Evidently Λ is positive. We assume ϕ to be positive as well. One would certainly expect ϕ>0 since, with θ<1 and s<1, fiscal policy would otherwise have to have such a strong impact on national income that, together with a Phillips curve that is sufficiently flat and weak monetary transmissions, government expenditures can simultaneously boost output and be transferred to pay debt down without worsening the budget (or debt) at the same time: γ>(1+αβ)/(θs). In practice, with s ≈ 0.5 as noted above and debt limited to 50% of GDP, this would require fiscal multipliers in excess of 4 or 5. That is hardly plausible. In fact numerical estimates for ten of the larger OECD economies place ϕ very close to unity, rather than negative.[21] Nevertheless, the conflict that this reveals within fiscal policy is important. In order to get ϕ<0, output has to be capable of growing fast enough to generate sufficient revenues to boost output when needed ***and*** to pay down the debt. If

[21] See Table 4, appendix B.

that is not possible, one will come at the expense of the other. That underlines the natural pro-cyclicality of *any* fiscal restraint under "normal" parameter values.[22]

Substituting (13)-(15) back into (11), we can now get the stage 1 solution from:

$$\min_{\delta,\lambda^{cb}} EL^g(\delta,\lambda^{cb}) = \frac{1}{2}\left\{\frac{(1-\delta)\beta(\phi-\eta\Lambda)\lambda^{cb}+\delta(\beta\phi+\gamma\Lambda)\lambda_1^g}{\alpha[\beta(\phi-\eta\Lambda)+\delta\Lambda(\beta\eta+\gamma)]}\right\}^2$$

$$+\frac{\lambda_2^g}{2}\left\{\frac{(1-\delta)\beta s(\beta\eta+\gamma)(\lambda^{cb}-\lambda_1^g)}{[\beta(\phi-\eta\Lambda)+\delta\Lambda(\beta\eta+\gamma)]\lambda_2^g}\right\}^2. \qquad (19)$$

This part of the problem has first order conditions:

$$(1-\delta)(\phi-\eta\Lambda)\lambda_2^g\left\{(1-\delta)\beta(\phi-\eta\Lambda)\lambda^{cb}+\delta(\beta\phi+\gamma\Lambda)\lambda_1^g\right\}$$
$$-(1-\delta)^2(\beta\eta+\gamma)^2\alpha^2 s^2\beta(\lambda_1^g-\lambda^{cb})=0 \qquad (20)$$

and $\left\{(1-\delta)\beta(\phi-\eta\Lambda)\lambda^{cb}+\delta(\beta\phi+\gamma\Lambda)\lambda_1^g\right\}(\lambda_1^g-\lambda^{cb})\left\{\delta(1-\delta)\Lambda\Omega+(\phi-\eta\Lambda)\right\}\lambda_2^g$

$$-(1-\delta)(\beta\eta+\gamma)\alpha^2 s^2\beta\left\{(\beta\eta+\gamma)-(1-\delta)\beta\Omega\right\}(\lambda_1^g-\lambda^{cb})^2=0. \qquad (21)$$

where $\Omega=\partial\eta/\partial\delta$. There are two real-valued solutions which satisfy this pair of first-order conditions.[23] Both are satisfied when δ = 1 and $\lambda^{cb}=\lambda_1^g$. That solution describes a fully dependent central bank, which is not appropriate in the Eurozone case. And it is inferior to the second solution: $\delta=\lambda^{cb}=0$. In that solution, the central bank is fully independent and exclusively concerned with the economy's inflation performance.

Out of these two possibilities, the solution which yields the lowest welfare loss, as measured by the government's (society's) loss function, can be identified by comparing (19) to the expected loss that would be suffered under the alternative institutional arrangement. Substituting δ = 1 and $\lambda^{cb}=\lambda_1^g$ into (19) results in

$$EL^g=\frac{(\lambda_1^g)^2}{2\alpha^2} \qquad (22)$$

[22]Formally $\partial\{(b-\theta)y_t-\tau_t]/\partial g_t=\phi/(1+\alpha\beta)$, which implies the gap between the debt adjustment needed, and the pay down allocated, will rise as more funds are used for stabilisation if $\phi>0$.

[23] Because η is a function of δ, (21) is quartic in δ. This polynomial has four distinct roots, of which only two are real-valued. The complete solution may be found in Hughes Hallett and Weymark (2002).

But substituting $\delta = \lambda^{cb} = 0$ into the right-hand-side of (19) yields

$$EL^g = 0. \tag{23}$$

Consequently our results show that, when there is fiscal leadership, society's welfare loss (as measured by (19)) is minimized when the government appoints independent central bankers who are concerned only with the achievement of a mandated inflation target and completely disregard the impact their policies may have on output.

However, our results also indicate that fiscal leadership with an independent central bank will be beneficial under more general conditions. When $\delta = 0$, $\beta\eta + \gamma = 0$ and the externalities between policy makers are neutralised.[24] As a result, (19) will become

$$EL^g = \frac{1}{2}\left\{\frac{\lambda^{cb}}{\alpha}\right\}^2 \tag{24}$$

for any value of λ^{cb}. Hence an independent central bank will always produce better results than a dependent one so long as it is more conservative than the government ($\lambda^{cb} < \lambda_1^g$), *irrespective* of the latter's commitment to the debt rule (λ_2^g). A conservative central bank will therefore be best, but any bank more conservative than the government will do if the debt rule is to be effective.

A more interesting question is whether fiscal leadership with an independent central bank also produces better outcomes, from society's perspective, than those obtained in a simultaneous move game without leadership – the model generally favoured in Europe. In the simultaneous move game, the solution to the stage 1 minimisation problem is

$$\delta = \frac{\beta\phi^2\lambda^{cb}\lambda_2^g + \alpha^2\gamma^2 s^2\beta(\lambda^{cb} - \lambda_1^g)}{\beta\phi^2\lambda^{cb}\lambda_2^g + \alpha^2\gamma^2\beta(\lambda^{cb} - \lambda_1^g) - \phi(\beta\phi + \gamma\Lambda)\lambda_1^g\lambda_2^g} \tag{25}$$

and society's welfare loss will then be

[24] Because $\beta\eta + \gamma = (\partial y / \partial m)\partial m / \partial g + \partial y / \partial g$, and the central bank has already taken the impact of its decisions on the government's decisions (also zero in this case) into account.

$$\mathrm{EL}^{g} = \frac{1}{2}\left\{\frac{\lambda_1^{g}}{\alpha}\right\}\left\{\frac{(\alpha\gamma s)^2}{(\alpha\gamma s)^2 + \phi^2\lambda_2^{g}}\right\} \qquad (26)^{25}$$

That is always smaller than the loss incurred when fiscal leadership is combined with a *dependent* central bank. However, the optimal degree of conservatism for an *independent* central bank, in this case, is obtained by setting δ = 0 in (25) to yield:

$$\lambda^{cb*} = \frac{(\alpha\gamma s)^2\lambda_1^{g}}{(\alpha\gamma s)^2 + \phi^2\lambda_2^{g}} \qquad (27)$$

It is straightforward to show that (24) is always less than (26) as long as

$$\lambda^{cb} < [\lambda_1^{g}\lambda^{cb*}]^{1/2} \qquad (28)$$

It is also evident that $\lambda^{cb*} < \lambda_1^{g}$ holds for *any* degree of commitment to the debt rule, $\lambda_2^{g} > 0$, however small. Consequently, fiscal leadership with any value $\lambda^{cb} < \lambda^{cb*}$ will always produce better outcomes, from society's point of view, than any simultaneous move game between central bank and government. This is important because many inflation targeting regimes, such as those operated by the Bank of England, the Swedish Riksbank, and the Reserve Bank of New Zealand, operate with fiscal leadership; while several others, notably the European Central Bank and the US Federal Reserve System do not. They are better characterized as being engaged in simultaneous move game with their governments.

5.5 The gains from Fiscal Leadership

Finally, where do these leadership gains come from? Substituting δ = 0 and $\lambda^{cb} = 0$ into (13)-(15) yields

$$\pi_t = \hat{\pi}, \qquad y_t = -u_t/\alpha, \qquad \text{and} \qquad \tau_t = -(b-\theta)u_t/\alpha \qquad (29).$$

as final outcomes. By contrast, the outcomes for the simultaneous move policy game are

$$\pi_t^* = \hat{\pi} + \frac{\alpha(\gamma s)^2}{[(\alpha\gamma s)^2 + \phi^2\lambda_2^{g}]} = \hat{\pi} + \lambda^{cb*}/\alpha \qquad (30)$$

$$y_t^* = -u_t/\alpha \qquad (31)$$

[25] Hughes Hallett and Weymark (2002, 2004a) derive these results in detail.

$$\tau_t^* = \frac{\gamma s(\lambda^{cb*} - \lambda_1^g)}{\phi \lambda_2^g} - \frac{(b-\theta)u_t}{\alpha} \tag{32}$$

Comparing the two sets of outcomes, we have five conclusions. These conclusions are the main results of this paper:

a). Fiscal leadership eliminates the inflationary bias and results in lower inflation without any loss in output or output volatility. The proximate cause of this surprising result is that optimisation under fiscal leadership leads to higher taxes and larger debt repayments.[26]

b).The deeper reason is that there is a self-limiting aspect to the long run design of fiscal policy. Unless the effect of fiscal policy on output is so large as to generate savings/taxes that could finance both fiscal expansions *and* debt repayments, each expansion designed to increase output would be accompanied by a greater burden of debt. Hence, in order to preserve the long run sustainability of its finances, the government is forced to raise taxes, and this takes some of the inflationary pressure off the central bank when fiscal expansions are called for. As a result the bank is less likely to tighten monetary policy and externalities are reduced on both sides. That is what generates better coordination between the policy makers, noted in section 6. But this can only happen if the government has a genuine commitment to long run goals (sustainable public finances, and a debt rule in this case) since only then will the leader take into account the predictable reactions (of the follower) to any short run deviations by the leader. The follower therefore knows the leader is not likely to sacrifice his longer run goals by making such deviations (and anyway has the opportunity to clear up the mess, according to the follower's preferences, if the leader does so). If we lose this leadership aspect, both players will end up behaving like followers in the sense that each will fail to account for the responses of the other to any deviation beyond the original optimal policy choices or reaction function. Thus, in the short run under simultaneous moves, each player fails to consider the predictable response, and costs, which the externalities he imposes on his rival would create. The ability to coordinate would be lost, and the outcomes worse for both. We show this formally in section 6 and appendix A. Leadership accounts for those responses and extra costs by construction.

---

[26] Taxes are lower under simultaneous moves because $\lambda^{cb} < \lambda_1^g$. So $E\tau = 0$ in (29) vs. $E\tau_t^* \leq 0$ in (32).

c). These results hold independently of the commitment to the debt rule (λ_2^g) or its target value (θ); and independently of the government's preference to stabilise or spend (λ_1^g, s); and of the economy's transmission parameters (α,β,γ) or its initial state (b).

d). Since $E\tau_t^* < 0$ in (32), but $E\tau_t = 0$ in (29), the simultaneous moves regime will always end up increasing debt levels. It will eventually exceed any limit set for the debt ratio therefore. Fiscal leadership will do neither of these things. In fact the simultaneous move regime always leads to larger fiscal expansions if money financing is small[27]: the expected value of $s(by_t^* - \tau_t^*)$ in (5) is zero under fiscal leadership, but $\phi\lambda^{cb*}/(\alpha^2\gamma) > 0$ under simultaneous moves (as expected since the monetary policy externalities would be larger). And since revenues are lower, budget deficits are also larger. Hence the gains from fiscal leadership are not just better outcomes. It also implies less expansionary budgets and tighter public expenditure controls. The ECB should find that a preferable environment.

e). The simultaneous moves regime will approach fiscal leadership as the debt rule becomes progressively "harder": $EL^g \to 0$, $\lambda^{cb*} \to 0$; $\pi_t^* \to \hat{\pi}$, and $E\tau_t^* \to 0$, as $\lambda_2^g \to \infty$.

5.6 The Gains from Leadership are Robust

It is easy to check that the superiority of the leadership with separation model is robust. The degree of that superiority is given by EL^g from (26). Direct calculations then show:

$$\partial EL^g / \partial s > 0; \quad \partial EL^g / \partial \lambda_2^g < 0; \quad \partial EL^g / \partial \theta > 0; \quad \text{and} \quad \partial EL^g / \partial \lambda_1^g > 0.$$

These results confirm our conclusions a) and b) above; and imply that spending out of any increase in debt exaggerates the inferiority of the simultaneous moves regime; that an increasing commitment to a debt target will make it converge on the leadership regime; that tightening the debt target will reduce that inferiority; and that a greater priority on output stabilisation increases the cost of simultaneous moves. Finally, inserting (26) into (30)-(32) shows a harder debt rule increases debt repayments but reduces inflation; but has the opposite effect with a greater preference for stabilisation.

---

[27] $m_t \approx 0$; see Appendix C. This result still holds when β>γ even if monetary financing is allowed (also if the central bank is conservative, or the government liberal, when β<γ).

6. The Coordination Effect

One of the central issues in the coordination literature is whether there are institutional arrangements that yield Pareto improvements over standard noncooperative outcomes.[28] When such institutions exist, they may be viewed as a coordination device.

In our model, the central bank is independent. Without further institutional restraints, interactions between an independent central bank and the government would lead to noncooperative outcomes. But if the government is committed to long term leadership in the manner we have described, the policy game will become an example of rule-based coordination in which both parties can gain without any reduction in the central bank's independence. However, that is not to say that both parties gain equally. If the inflation target is strengthened after fiscal policy is set, the leadership gains to the government will be less (Hughes Hallett and Viegi, 2002). This is an important point because it implies that granting leadership to a central bank whose inflation aversion is already greater than the government's, or whose commitment is greater, can produce no additional gains. In our model, it is the impact of optimisation on debt repayments that produces most of the coordination gains associated with fiscal leadership. For that reason, granting leadership to a central bank that cannot influence debt repayments directly, but puts a higher priority on inflation control, will bring smaller gains from society's point of view than the other way around (whatever it may do for the central bank). We demonstrate these points formally in Appendix A.

Finally, given the structure of a Stackelberg game, there is no incentive to reoptimise for either party – so long as the government remains committed to long term leadership rather than short term demand management – unless both parties agree to reduce their independence through discretionary coordination.[29] That is a general result: it holds for any model where inflation and output both depend on both monetary and fiscal policy,

[28]Currie et al (1989),Currie and Levine(1991),Hughes Hallett(1992,1998),Hughes Hallett and Viegi (2002).
[29] This supplies the political economy of our results. We need no precommitment beyond leadership (the Stackelberg game supplies subgame perfection: see note 3) and no punishment beyond electoral results. The former will hold so long as governments have a natural commitment to maintaining sustainable public finances, public services (health, education, defence), or social equity, all long run "contractural" issues. The latter will then arise from the political competition inherent in any democracy.

and where inflation is targeted to some degree by both players (Hughes Hallett and Viegi, 2002; Demertzis et al 2004). Thus, although Pareto improvements over no cooperation may not emerge for both parties in all Stackelberg games, they always do so in problems of the kind discussed here. Our results are therefore robust.

Empirical Evidence: Whether or not these results are of practical importance is an empirical matter. In Table 3 we compute the expected losses under the simultaneous move and fiscal leadership regimes for ten countries when both fiscal policy and the central bank are constructed optimally. The data we have used is from 1998, the year in which the Eurozone was created. The data itself, and its sources, are summarized in Appendix B.

The countries selected fall into three groups:
(a) Eurozone countries, with independently set fiscal and monetary policies and target independence: France, Germany, Italy and the Netherlands;
(b) Explicit inflation targeters with fiscal leadership: Sweden, New Zealand, and the UK;
(c) Federalists, with joint inflation and stabilisation objectives: US, Canada, Switzerland.

In the first group, monetary policy is conducted at the European level and fiscal policy at the national level. Policy interactions in this group can be characterized in terms of a simultaneous move game, with target as well as instrument independence for both sets of policy authorities. It is perhaps arguable that the Eurozone has adopted a monetary leadership regime; but the empirical evidence for that was weak, and the fiscal constraints that could have ensured such leadership were widely ignored.

The second group of countries has adopted explicit, and mostly publicly announced, inflation targets. Central banks in these countries have been granted instrument independence but not target independence. The government either sets, or helps set, the inflation target. In each case the government has adopted longer term (supply side) fiscal policies, leaving active demand management to monetary policy. These are clear cases in which there is both fiscal leadership and instrument independence for the central bank.

The third group represents a set of more flexible economies, with *implicit* inflation targeting and a statutory concern for stabilisation; also federalism in fiscal policy and independence at the Central Bank, and therefore no declared leadership in either fiscal or monetary policies. This provides a useful benchmark for the other two groups.

The performance of the different fiscal regimes is reported in Table 3. Column 1 shows the losses under a dependent central bank in welfare units; leadership or not. Column 2 reflects the losses that would be incurred under government leadership with an independent central bank that directs monetary policy exclusively towards the achievement of the inflation target (i.e.with $\delta = \lambda^{cb} = 0$). The third column gives the minimum loss associated with a simultaneous decision-making version of the same game.

Table 3: Expected Losses Under Fiscal Leadership and Other Strategies

	Full Dependence $\delta = 1$ $\lambda^{cb} = \lambda_1^g$	Fiscal Leadership $\delta = 0;\ \lambda_1^g = 1$ $\lambda^{cb} = 0$	Simultaneous Moves $\delta = 0;\ \lambda_1^g = 1$ $\lambda^{cb} = \lambda^{cb*}$	Growth Rate Equivalents Lost (%)
France	5.78	0.00	0.0406	4.06
Germany	16.14	0.00	0.0149	1.49
Italy	1.28	0.00	0.0725	7.25
Netherlands	1.28	0.00	0.1020	10.20
Sweden	4.51	0.00	0.0161	1.61
New Zealand	8.40	0.00	0.0074	0.74
UK	3.37	0.00	0.0060	0.60
USA	6.46	0.00	0.0330	3.30
Canada	12.50	0.00	0.0429	4.29
Switzerland	4.79	0.00	0.0195	1.95

Evidently, complete dependence in monetary policy is extremely unfavourable although the magnitude of the loss varies considerably from country to country. The losses in column three appear to be relatively small. However, when these figures are converted into "growth rate equivalents", we find that these losses to be significant. A growth rate

equivalent is the loss in output growth that would produce the same welfare loss if all other variables remain fixed at their optimized values.[30]

The figures in column four show that the losses associated with simultaneous decision-making are equivalent to having permanent reductions of up to 8 percent in the level of national income. That is, Germany, France, Italy and the Netherlands could have expected to have grown about 2%-7% more (double their 2003 growth rates) had they adopted this regime of fiscal leadership with debt targets; and Sweden, the UK and New Zealand around 1% less had they not done so. Similarly the gain from fiscal leadership in the US, Canada and Switzerland would be worth 2%-4% extra GDP. These are significant gains: a little larger than would be expected from international coordination (Currie et al, 1989) or from the single currency itself (EC, 1990).

7. Conclusions

a) Fiscal leadership leads to improved outcomes because it implies a degree of coordination, and reduced conflicts between institutions, without the central bank having to lose its ability to act independently. This places the outcomes somewhere between the superior (but discretionary) policies of complete cooperation; and the noncooperative (but rule based) policies of complete independence.
b) The coordination gains come from the self-limiting action of fiscal policy when fiscal policy is given a long run focus in the form of a (soft) debt rule. Leadership is the crucial element here; those gains do not appear in a competitive regime with the same debt rule.
c) Debt ratios increase in an optimal game without coordination, but do not do so under fiscal leadership. However the former approaches the latter under a hard debt rule.

---

[30] Currie et al (1989). To obtain these figures we compute the marginal rates of transformation around each government's indifference curve to find the change in output growth, dy_t, that would yield the welfare losses in column three. Formally,

$dy_t = \dfrac{dEL_t^g}{[\lambda_2^g\{(b-\theta)y_t - \tau_t\}(b-\theta) - \lambda_1^g]}$ using (9). The minimum value of dy_t is reached when tax revenues τ_t grow at the same rate as the repayment target $(b-\theta)y_t$. These are the losses reported in column four.

d) These results also show that the important property for monetary policy is instrument independence. Given that, target independence brings few additional gains and could have the effect of undoing the complementarity between fiscal and monetary policies.

e) Although it is hard to get definitive results from direct observation, the incentive to adopt fiscal leadership is clear from the theoretical results. Confirmation comes from the numerical evaluations in table 3. The leadership with separation model predicts improvements in inflation and the fiscal targets worth 2%-4% of GDP (in most cases), without any loss in growth. In addition, leadership requires less precision in setting the strategic and institutional parameters than other strategies. It is more robust.

References

Barro, R.J. (1981), "Output Effects of Government Purchases", *Journal of Political Economy* **89**, 1086-1121.

Barro, R.J. and D.B. Gordon (1983), "Rules, Discretion, and Reputation in a Model of Monetary Policy", *Journal of Monetary Economics* **12**, 101-21.

Basar T (1989) "Time Consistency and Robustness of Equilibria in Non-Cooperative Dynamic Games" in F van der Ploeg and A de Zeeuw (eds) *"Dynamic Policy Games in Economics*", North Holland, Amsterdam.

Basar T and G Olsder (1999) "Dynamic Noncooperative Game Theory", SIAM series *"Classics in Applied Mathematics",* SIAM Publications, Philadelphia.

Brandsma A and A Hughes Hallett (1984)"Economic Conflict and the Solution of Dynamic Games" *European Economic Review*, **26**, 13-32.

Buti M, S Eijffinger and D Franco (2003) "Revisiting the Stability and Growth Pact: Grand Design or Internal Adjustment?" Discussion Paper **3692**, Centre for Economic Policy Research, London.

Calmfors L and G Corsetti (2003) "How to Reform Europe's Fiscal Policy Framework", mimeo, University of Stockholm.

CESifo (2003) "EEAG Report on the European Economy:2003" edited by G Corsetti and others, Ifo Institute, Munich.

Currie, D.A., G. Holtham and A. Hughes Hallett (1989), "The Theory and Practice of International Economic Policy Coordination: Does Coordination Pay?" in R Bryant,D Currie,J Frenkel, P Masson, and R Portes (eds) *Macroeconomic Policies in an Interdependent World,* International Monetary Fund, Washington DC.

Currie D and P Levine (1991) "The international Coordination of Monetary Policy: A Survey" in C Green and D Llewellyn (eds), *Surveys in Monetary Economics,* Vol I, Blackwell and Co, Oxford.

Dieppe A, K Kuster and P McAdam (2004) "Optimal Monetary Policy Rules for the Euro Area: an analysis using the Area Wide Model" Working Paper 360, European Central Bank, Frankfurt.

Dixit A (2001)"Games of Monetary and Fiscal Interactions in the EMU", *European Economic Review*, **45**, 589-613.

Dixit, A.K. and L. Lambertini (2003), "Interactions of Commitment and Discretion in Monetary and Fiscal Issues" *American Economic Review*, **93**,1522-42.

EC (1990), "One Market, One Money", *European Economy* No 44, EU Official Publications, Luxembourg.

European Commission (2002)"Public Finances in EMU:2"*European Economy: Studies and Reports,* **4**, European Commission, Brussels.

Fatas, A., J. von Hagen, A. Hughes Hallett, R. Strauch and A. Sibert (2003), "Stability and Growth in Europe", *Centre for Economic Policy Research* (**MEI-13**), London.

Gali J and R Perotti (2003)"Fiscal Policy and Monetary Integration in Europe" *Economic Policy*, **37**, 533-71.

HM Treasury (HMT, 2003), "*Fiscal Stabilisation and EMU",*HM Stationary Office, Cmnd 799373, Norwich; also available from www.hm-treasury.gov.uk.

Hughes Hallett A (1984) "Noncooperative Strategies for Dynamic Policy Games and the Problem of Time Inconsistency", *Oxford Economic Papers*, **36**, 381-99.

Hughes Hallett A (1992) "Target Zones and International Policy Coordination" *European Economic Review*, **36**,893-914.

Hughes Hallett A (1998) "When Do Target Zones Work?" *Open Economies Review*, **9**, 115-38.

Hughes Hallett, A. and D. Weymark (2002), "Government Leadership and Central Bank Design", *Discussion Paper **3395***, Centre for Economic Research, London.

Hughes Hallett A and N Viegi (2002) "Inflation Targeting as a Coordination Device" *Open Economies Review*, **13**, 341-62.

Hughes Hallett, A. and D. Weymark (2004a), "Policy Games and the Optimal Design of Central Banks" in P. Minford (ed), *Money Matters,* Edward Elgar, London.

Hughes Hallett, A. and D. Weymark (2004b), "Independent Monetary Policies and Social Equity", *Economics Letters,* **85**, 103-10.

Hughes Hallett, A. and D. Weymark (2005), "Independence before Conservatism: Transparency, Politics and Central Bank Design", *German Economic Review,* **6**, 1-21.

Issing O (1999), "The Monetary Policy of the Eurosystem" *Finance and Development,* March 1999, 18-21.

Lucas, R.E. (1972), "Expectations and the Neutrality of Money", *Journal of Economic Theory* **4**, 103-24.

Lucas, R.E. (1973), "Some International Evidence on Output-Inflation Trade-Offs", *American Economic Review* **63**, 326-34.

McCallum, B.T. (1989) *Monetary Economics: Theory and Policy,* Macmillan, New York.

Pisani-Ferry J (2002) "Fiscal Discipline and Policy Coordination in the Eurozone: Assessment and Proposals", mimeo, Universite Paris-Dauphine, Paris.

Saraceno F and P Monperrus-Veroni (2004) "A Simple Proposal for a Debt Sensitive Stability Pact", Quarterly Bulletin of Economic Research:DIW Berlin, 73, 471-80.

Taylor, J.B. (1993), *Macroeconomic Policy in a World Economy: From Econometric Design to Practical Operation,* W.W. Norton and Company, New York.

Taylor, J.B. (2000) "Discretionary Fiscal Policies", *Journal of Economic Perspectives* **14,** 1-23.

Turner D and E Seghezza (1999)"Testing for a Common OECD Phillips Curve" WP 219, Economics Department, OECD, Paris
Turrini A and J in 't Veld (2004)"The Impact of the EU Fiscal Framework on Economic Activity" European Commission, DGII, Brussels.
Woodford, M. (2003), *Interest and Prices: Foundations of the Theory of Monetary Policy*, Princeton University Press, Princeton.

Appendix A: Central Bank Leadership and Target Independence

We examine this case by first allowing the Central Bank to adopt its own inflation target, $\hat{\pi}^{cb}$ in a world of simultaneous moves by governments and the Central Bank. This gives the central bank target independence, but not first mover advantage or leadership as such.

(a). Target Independence. To identify the impact of target independence itself, we start by assuming that the institutional parameters, δ and λ^{cb}, are chosen by the government. We also assume that the central bank's inflation target will be lower than that of the government: $\hat{\pi}^{cb} < \hat{\pi}$. Repeating steps (11) to (21), with $\hat{\pi}^{cb} < \hat{\pi}$ in L^{cb} and a simultaneous choice of m_t and g_t at the second stage, we now get

$$\pi_t = \frac{(1-\delta)\beta\phi(\alpha\hat{\pi}^{cb} + \lambda^{cb}) + \delta(\beta\phi + \gamma\Lambda)(\alpha\hat{\pi} + \lambda_1^g)}{\alpha[\beta\phi + \delta\gamma\Lambda]}; \tag{A1}$$

$$y_t = -\frac{u_t}{\alpha}; \quad \text{and} \quad \tau_t = \frac{\beta\gamma s(1-\delta)[\alpha(\hat{\pi}^{cb} - \hat{\pi}) + (\lambda^{cb} - \lambda g_1^g)]}{[\beta\phi + \delta\gamma\Lambda]\lambda_2^g} - \frac{(b-\theta)u_t}{\alpha} \tag{A2}$$

As a result, the first order conditions at stage 1 become:

$$\lambda_2^g \beta\phi(1-\delta)\{(1-\delta)\beta\phi\lambda^{cb} + \delta(\beta\phi + \gamma\Lambda)\lambda_1^g - \alpha\beta\phi(1-\delta)(\hat{\pi} - \hat{\pi}^{cb})\}$$
$$-(\alpha\beta\gamma s)^2(1-\delta)\{\lambda_1^g - \lambda^{cb} + \alpha(\hat{\pi} - \hat{\pi}^{cb})\} = 0 \tag{A3}$$

$$\lambda_2^g \beta\phi(\beta\phi + \gamma\Lambda)[(1-\delta)\beta\phi\lambda^{cb} + \delta(\beta\phi + \gamma\Lambda)\lambda_1^g - \alpha\beta\phi(1-\delta)(\hat{\pi} - \hat{\pi}^{cb})].\{\lambda_1^g - \lambda^{cb} + \alpha(\hat{\pi} - \hat{\pi}^{cb})\}$$
$$-(1-\delta)(\alpha\beta\gamma s)^2(\beta\phi + \gamma\Lambda)[\lambda_1^g - \lambda^{cb} + \alpha(\hat{\pi} - \hat{\pi}^{cb}]^2 = 0. \tag{A4}$$

There are clearly two solutions in this case:

either $\delta = 1$ and $\lambda^{cb} = \lambda_1^g + \alpha(\hat{\pi} - \hat{\pi}^{cb})$ (A5)

or $$\delta = \frac{\beta^2\phi^2\lambda^{cb}\lambda_2^g - \Omega}{\beta^2\phi^2\lambda^{cb}\lambda_2^g - \Omega - \beta\phi(\beta\phi + \gamma\Lambda)\lambda_1^g\lambda_2^g} \quad \text{(A6)}$$

with $\lambda^{cb} = \alpha(\hat{\pi} - \hat{\pi}^{cb}) + \frac{(\alpha\gamma s)^2\lambda_1^g}{[(\alpha\gamma s)^2 + \phi^2\lambda_2^g]} - \frac{\delta\phi[\beta\phi + \gamma\Lambda]\lambda_1^g\lambda_2^g}{\beta(1-\delta)[(\alpha\gamma s)^2 + \phi^2\lambda_2^g]}$, where we have put $\Omega = \alpha\beta^2\phi^2(\hat{\pi} - \hat{\pi}^{cb})\lambda_2^g + (\alpha\beta\gamma s)^2[\lambda_1^g - \lambda^{cb} + \alpha(\hat{\pi} - \hat{\pi}^{cb})]$. It is easy to check that inserting (A5), with (A1) and (A2), into (9) gives $EL^g = ½[\lambda_1^g / \alpha]^2$ again; and that (A6) with (A1) and (A2) gives (26) again. In other words, the government/society's welfare losses are unchanged. Consequently, there is no advantage (or disadvantage) in target independence from society's point of view since, if the central bank were to choose a lower target for inflation, the government would simply impose a lower degree of independence (or less conservatism in those appointed to manage monetary policy) to compensate. We can see that δ increases with $\hat{\pi} - \hat{\pi}^{cb}$ under optimal policies, as does λ^{cb} even when $\delta = 0$. Hence target independence is not, in itself, welfare improving. However it is not a matter of indifference since target independence alters the *mix* of outcomes: a lower $\hat{\pi}^{cb}$ value will produce less inflation, but fewer debt repayments, given δ and λ^{cb}. That might suit the central bank and other groups in society, but not the economy as a whole.

(b). Full Operating Independence ("short term leadership"). Given that result, we need to remove the assumption that the government can choose the value of λ^{cb}. Indeed, if the central bank is potentially independent and is able to set its own inflation target, it is artificial to suppose the government could impose its preferred degree of conservatism. However we do not, as yet, allow monetary policy Stackelberg leadership. The reasons are the following. Our empirical results show that the ECB does not have a longer planning horizon than fiscal policy, or a long run view of policy formation. Its focus has been short run. Second, being dependent on national statistical sources, it has no information advantage over national policy makers. Third, being independent and unable to discuss its policies with national policy makers, it has no political leverage. At best it is

independent and free to choose $\hat{\pi}^{cb}$ and λ^{cb} as it sees fit (δ is fixed by treaty). So simultaneous moves, but self-selected $\hat{\pi}^{cb}$ and λ^{cb} values, would seem appropriate for the ECB. Starting from (9), and (10) with $\hat{\pi}^{cb}$ for $\hat{\pi}$, the stage 2 outcomes are as before: (A1) and (A2). But moving back to stage 1, we now get first order conditions which yield

$$\bar{\lambda}^{cb} = \frac{\delta\{(1-\delta)\beta(\alpha\gamma s)^2 - [\beta\phi + \gamma\Lambda]\phi\lambda_2^g\}[\alpha(\hat{\pi} - \hat{\pi}^{cb}) + \lambda_1^g]}{(1-\delta)\beta[\delta(\alpha\gamma s)^2 + \phi^2\lambda_2^g]} \tag{A7}$$

for the Central Bank if $\delta \neq 1$. This must be solved jointly with the government's first order condition for δ. But the government, had it been able to choose both parameters, would have preferred λ^{cb*} as given below (A6). Hence two simple solutions emerge in this case. If the government chooses $\delta = 0$, then $\bar{\lambda}^{cb} = 0$ follows. If on the other hand, the government chooses $\delta = 1$, the central bank will be indifferent to the choice of λ^{cb} since λ^{cb} no longer appears in L^{cb}. In that case the government's preferred value from the previous case, $\lambda^{cb*} = \lambda_1^g + \alpha(\hat{\pi} - \hat{\pi}^{cb})$, will prevail. In all other cases we equate $\bar{\lambda}^{cb}$ to λ^{cb*} from below (A6) to obtain δ. This yields four solutions: $\delta = 1, \delta = 0, \delta > 1,$ and $\delta < 0$. The last two have no economic meaning. An optimising government has just two choices:

$$\delta = 1 \quad \text{and thus} \quad \bar{\lambda}^{cb} = \lambda_1^g + \alpha(\hat{\pi} - \hat{\pi}^{cb}); \text{ or}$$

$$\delta = 0 \quad \text{and thus} \quad \bar{\lambda}^{cb} = 0. \tag{A8}$$

Inserting these solutions, together with (A1) and (A2), into (9) yields

$$EL^g = ½[\lambda_1^g / \alpha]^2 \text{ when } \delta = 1, \tag{A9}$$

and

$$EL^g = ½[(\hat{\pi} - \hat{\pi}^{cb})^2 + \gamma^2 s^2(\alpha(\hat{\pi} - \hat{\pi}^{cb}) + \lambda_1^g)^2 / (\phi^2\lambda_2^g)] \text{ if } \delta = 0. \tag{A10}$$

Meanwhile, given (10), the central Bank would achieve

$$EL^{cb} = [\alpha(\hat{\pi} - \hat{\pi}^{cb}) + \lambda_1^g]^2 / (2\alpha) > 0 \quad \text{if } \delta = 1,$$

but

$$EL^{cb} = 0 \quad \text{when} \quad \delta = 0. \tag{A11}$$

Hence it is easy to see that the government would never choose $\delta = 1$ unless

$$(\hat{\pi} - \hat{\pi}^{cb}) > \left[\frac{\phi^2\lambda_2^g - (\alpha\gamma s)^2}{\alpha^2[(\alpha\gamma s)^2 + \phi^2\lambda_2^g]}\right]^{1/2} .\lambda_1^g \tag{A12}$$

holds (a sufficient condition from (A10)). In other words, governments would never actually choose $\delta = 1$ unless the central bank threatened to set too conservative an

inflation target; or unless $\lambda_2^g \to 0$, in which case they have no fiscal constraints. In all other cases, governments would choose $\delta = 0$. The result of course is that the central bank has an incentive not to set its inflation target too far below that of the government, since to do so would precipitate a response even more unfavourable (for the central bank) than not getting $\pi = \hat{\pi}^{cb}$ from (A1). Instead the bank would compensate by adopting a more conservative policy stance $(\bar{\lambda}^{cb} = 0)$, given that governments retain the responsibility for determining how much delegation should take place. Nonetheless, because (A9)-(A10) are always positive, this particular institutional set up would never be chosen if fiscal leadership were acceptable. If it is not acceptable, then it is best to allow the central bank to choose its own degree of conservatism as in this regime, rather than have fixed values imposed by the lexographic ordering of the ECB's two pillar approach.

(c). Stackelberg ("long term") Leadership. Using the graphical analysis in figure 1, it is straightforward to show that full monetary leadership would not be preferred to fiscal leadership – even if it is better than the simultaneous moves case. Hughes Hallett and Viegi (2002) show algebraically that the optimal reaction functions form an acute angle in our case: i.e, when inflation and output both depend positively on fiscal and monetary policy, and when policy makers have targets in common but may differ in priorities and target values. This is shown in figure 1. The greater the divergence in priorities between players, the more elliptical the preferences in the output gap $(\lambda^{cb} < \lambda_1^g)$; and the greater the difference in target values $(\hat{\pi}^{cb} < \hat{\pi})$, the wider the angle between reaction functions. It now follows from figure 1 that, if pre-commitment and conservatism are needed to prevent opportunistic policy making, a policy of granting leadership to the party that is already more committed and conservative will bring smaller gains (from Nash) than those that could be attained by granting leadership to the other party. Moreover, the greater the divergence between priorities or target values, the smaller the gains achieved by granting leadership to the more committed and conservative player. Figure 1 demonstrates the point. The more elliptical (conservative) the central bank's preferences, and the wider the angle between the two reaction functions, the closer is point S to N compared to point T.

Appendix B: Data Sources for Table 3

The data values used in table 3 are set out in the table below. They come from different sources and represent "stylised facts" for the corresponding parameters. The Phillips curve parameter, α, is the inverse of the annualised sacrifice ratios on quarterly data from 1971-1998 by Turner and Seghezza (1999) the OECD. The values for β and γ, the impact multipliers for fiscal and monetary policy respectively, are the one year simulated multipliers for those policies in Taylor's multi-country model (Taylor, 1993). I have calibrated the remaining parameters using stylised facts from 1998: the year that EMU started, and the year that new fiscal and monetary regimes took effect in the UK and Sweden. Thus s is the automatic stabliser effect on output according to European Commission (2002) and HMT(2003) estimates, allowing for larger social security sectors in the Netherlands and Sweden. Similarly, θ is set to give a debt target somewhat below each country's 1998 debt ratio and the SGP's 60% limit. Likewise λ_2^g was set to imply a low, high or medium commitment to debt/deficit limits, as reflected in actual behaviour to 2004. Finally, I have set $\lambda_1^g = 1$ in each country to suggest that governments, if left to themselves, are equally concerned about inflation and output stabilisation.

	α	β	γ	s	θ	ϕ	λ_2^g
France	0.294	0.500	0.570	0.5	0.5	1.072	0.25
Germany	0.176	0.533	0.430	0.5	0.5	1.040	0.25
Italy	0.625	0.433	0.600	0.5	0.5	1.187	0.25
Netherlands	0.625	0.489	0.533	0.65	0.5	1.132	0.25
Sweden	0.333	0.489	0.533	0.65	0.5	1.107	1.0
NZ	0.244	0.400	0.850	0.3	0.4	1.035	1.0
UK	0.385	0.133	0.580	0.3	0.4	0.980	1.0
USA	0.278	0.467	1.150	0.3	0.4	0.992	0.5
Canada	0.200	0.400	0.850	0.5	0.4	0.910	0.5
Switzerland	0.323	0.489	0.533	0.5	0.3	1.078	0.5

Appendix C: Derivation of the Change in Fiscal stance between Regimes

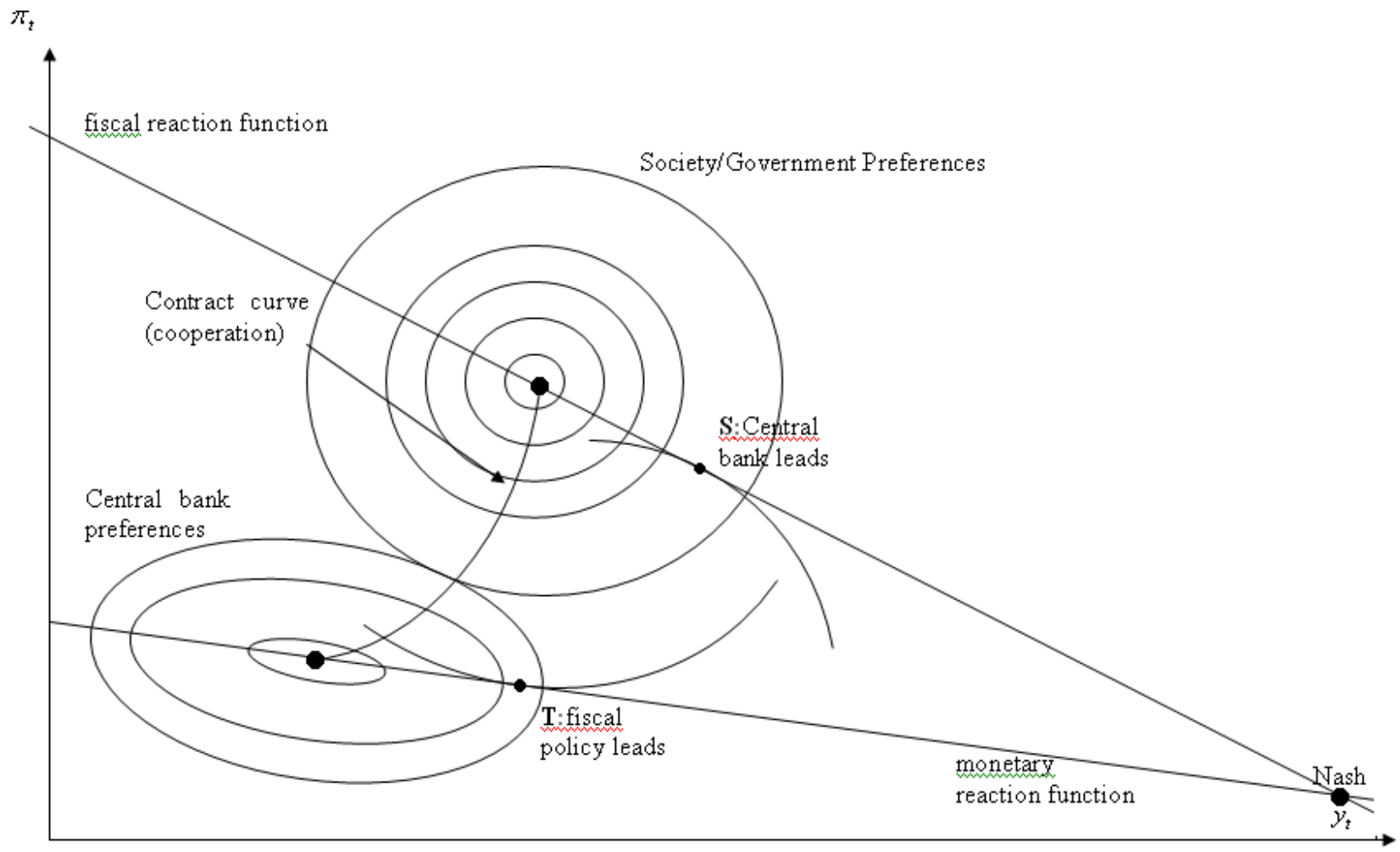
The expected value of $s(by_t - \tau_t)$ under fiscal leadership and simultaneous moves can be obtained by substituting in first (29), and then (31) and (32), respectively. Taking expected values, that yields zero and $\phi\lambda^{cb*}/(\alpha^2\gamma)$ >0 in each case. Applying that result to (4), shows that the *expected* change in output between regimes, which we know to be zero, is $(\beta-\gamma)\Delta m - \beta\lambda^{cb*}/(\alpha\lambda_1^g) + \gamma\Delta[s(by-\tau)] = 0$. Hence

$$\Delta m = \{\gamma\Delta[s(by-\tau)] + \beta\lambda^{cb*}/(\alpha\lambda_1^g)\}/(\beta-\gamma)$$

which, given the change in $s(by_t - \tau_t)$, is positive if β>γ. In that case the simultaneous move regime is unambiguously more expansionary, and runs larger deficits on average, than fiscal leadership. But since γ/(β-γ)>1, that is not necessarily true if β<γ. In the latter case, the expansion of the budget deficit will be

$$\begin{aligned}\Delta Deficit &= \Delta m + \Delta[s(by-\tau)] - \Delta\tau \\ &= \left[\frac{\beta}{\alpha(\beta-\gamma)}\left(\frac{\phi}{\alpha\gamma} + \frac{1}{\lambda_1^g}\right) - \frac{\gamma s}{\phi\lambda_2^g}\right]\lambda^{cb*} + \frac{\gamma s}{\varphi\lambda_2^g}\lambda_1^g\end{aligned}$$

which is clearly positive if λ^{cb*} is small (the central bank is conservative), or if λ_1^g is somewhat larger (the government is relatively liberal).


π_t
fiscal reaction function
Society/Government Preferences
Contract curve
(cooperation)
S: Central
bank leads
Central bank
preferences
T: fiscal
policy leads
monetary
reaction function
Nash
y_t