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MONETARY POLICY COMMITTEES: INDIVIDUAL AND COLLECTIVE REPUTATIONS

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Abstract

This paper looks at how the reputation of a monetary policy making committee is jointly determined with the reputations of its individual members. I ask whether individuals have more or less incentive to gain a reputation for being tough on inflation when they are part of a group. I examine the effect of increased transparency – in the form of publishing the votes of individual members – on individuals' incentives to appear hard nosed. I look at how other institutional features of central banks affect the policy making body's incentive to refrain from inflation.

Keywords: Reputation, collective decision making, central banks

JEL Classification: D71, E50, E58

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„And, credibility is the name of the game.“

Hans Tietmeyer, President of the Deutsche Bundesbank, (1999).

I Introduction

Most models of monetary policy view the policy maker as a single decision maker. In some cases this is reasonable; many central banks are dominated by their chairmen. However, monetary policy is often made by a group. As Blinder (1997) comments, „This institutional „detail“ may – and probably does – have important behavioral consequences (page 16).“ The intent of this paper is to provide a framework for analysing systematic inflation and reputation building when monetary policy is made by a committee.

I suppose policy makers come in two types. The first is opportunistic and wants to expand output or improve the government's fiscal situation by producing higher than expected inflation. The second is hard-nosed or non-opportunistic and refuses to succumb to the temptations of surprise inflation. A policy maker's type is his private information, and can only be signalled through the policy maker's behaviour. Opportunistic central bankers may be temporarily deterred from supporting inflationary policies by an incentive to build a reputation for being tough on inflation.

I ask how the reputation of a group of policy makers is related to the characteristics of its individual members, and whether individuals have more or less incentive to gain a reputation for being hard nosed when they are part of a group.[1] I show that there can be more or less reputation building when monetary policy is made by a group, rather than by the chairman alone. The value of a reputation declines, but so does a committee member's payoff to voting individually for inflation when decisions

[1]There appears to be little economic research analysing collective reputations. An interesting recent exception is Tirole's (1996) model of corruption in groups with atomistic members.

are made by the group as a whole.

The paper provides a framework for asking how the institutional features of central banks influence the incentive of policymaking groups to gain credibility for inflationary toughness. For example, how does the quality of information the public has about individual members of the group affect the equilibrium behaviour of the group? Some central banks publish individual committee members' votes; others do not. I demonstrate that not publishing the votes makes reputation building less attractive. Inflation is higher and social welfare is lower.

Some central banks may face more external pressure to be inflationary. This may lead to compromise inflation being higher than it otherwise would when there is dissension in the policy making committee. I show this can increase or decrease both an opportunistic policy maker's incentive to gain a reputation and social welfare. In some countries, more of an effort may be made to populate central banks with inflation-averse members. I show this has an ambiguous effect on reputation building, but improves social welfare. The culture of some central banks may lead to more importance being attached to the opinions of policy makers who have been in office longer. I show that this effect increases policy makers' incentives to gain a reputation.

My baseline model is inhabited by policy makers serving two-period-long overlapping terms. The policy makers come in two types. This first wants to inflate. This is because with fixed nominal wage contracts and an outstanding stock of nominal government debt, an unanticipated increase in the money supply lowers real wages and improves the government's fiscal situation. If the natural rate of employment is below the socially optimal rate or lump-sum taxes are infeasible and feasible taxes are sufficiently distortionary or costly to administer and comply with, it improves welfare as well. Unfortunately, the central bank cannot systematically fool the public and this leads to an inflation bias without social gain. This is the familiar time-inconsistency problem of Kydland and Prescott (1977) and Calvo (1978). The existence of the first type of central banker may be one reason why inflation has been sub-optimally high in many countries during the post-World-War-II period.[2]

The second type of central banker might be interpreted as non-opportunistic. McCallum (1995) suggests that some central bankers may recognise the futility of opportunistic behaviour and simply refrain from it. An alternative interpretation is that some central bankers prize price stability above all else. Blinder (1997) suggests that central bankers are inherently inflation averse, saying, „... the noun 'central banker' practically cries out for the adjective 'conservative' (page 14)." The existence of central bankers such as Paul Volcker and Hans Tietmeyer, as well as the recent low inflation in many industrialised countries, suggests that not all central bankers are opportunistic.

If an opportunistic central banker does not vote for inflation in his first period in office, then this increases the private sector's belief that he is not opportunistic. This decreases future expectations of inflation, making future inflationary surprises less costly. Thus, opportunistic policy makers may masquerade as non-opportunistic policy makers during their first term in office to increase the benefit of inflation during their second term.

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[2]Fear of such central bankers has recently led some industrialised countries to adopt inflation targets. (See Bernanke, et. al. (1999) for a description.) In the United Kingdom, for example, the Monetary Policy Committee must meet a 2-1/2 percent inflation target. This does not solve the time inconsistency problem, however, as the Chancellor can change the target whenever he wants. As McCallum (1995) points out, inflation targeting or any other monetary policy contract merely shifts the

time-inconsistency problem from the central bank to the enforcing government.

Models of individual reputation building have been used before to analyse monetary policy. Barro and Gordon (1983b) analyse monetary policy as a repeated game. One outcome is that the central banker does not inflate and the private sector does not expect inflation as long as no one has deviated from this behaviour in the past. A deviation, however, results in the central bank inflating forever after and the private sector expecting this. The model here is more similar to Backus and Driffill's (1985a,b) adaptation of Kreps and Wilson's (1982a) model of reputation and to Vickers (1986). There, a single strategic policy maker signals he is tough on inflation by acting as a hard-nosed type so that he can later exploit his enhanced reputation. One troubling aspect of these three papers is that the private sector is not assumed to have rational expectations. Instead, the expectations of atomistic private-sector agents are viewed as discretionary actions that can be coordinated in mixed or „punishment" strategies. None of the above papers considers policy making by a group.

In section II, the basic model is described and it is shown how various features of the environment affect equilibrium inflation and welfare. In Section III, I compare decision making in committees with monolithic decision making; I look at the effect of not publishing committee members' votes; I consider the effect of a more hierarchical structure on the outcome. Section IV is the conclusion.

II A Model of Reputation Building in Groups

IIA The Setup

The underlying macroeconomic framework is a variant of Barro and Gordon (1983a).[3] Social welfare loss is increasing in squared deviations of inflation from its optimal rate of zero and decreasing in unanticipated inflation. Inflation is costly for several reasons. It leads to shoe-leather and menu costs;

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[3]Sibert (1999) uses the framework to analyse some of the features of the European Central Bank (ECB).

it makes the currency an inconvenient unit of account; it may cause an undesirable redistribution of income; it distorts capital taxes. Unanticipated inflation may be beneficial to society for two reasons. First, if there is nominal wage contracting and the real wage is too high to clear the labour market, it increases employment and output. Second, with an outstanding stock of nominal public debt, it improves the fiscal situation and reduces the need for distortionary or costly taxes. Within-period social welfare

$$L = g(p) + c\,p^{e},\; g(p) \equiv p^{2}/2 - cp\,,$$

loss is written as

where p is inflation, p^{e} is the private sector's subjective expectation of inflation, and $2c$ is the weight society places on output loss relative to inflation variability. The parameter c plays no role here and is set equal to one.

Monetary policy is made by a committee of members with overlapping terms. Time is discrete and stretches infinitely far into the future. Choosing the simplest scenario, I suppose the committee has two members and each member serves for two periods. Thus, in any period there is a new policy maker who has just taken office and an old policy maker serving his last period.

There are two types of policy makers. The first is non-opportunistic and always votes for zero inflation. The second type wants to minimise social welfare loss. One might imagine various names for the two types; following Margaret Thatcher, Backus and Driffill (1985a) call them „hard nosed“ and „wet“. I adopt the more recent avian terminology of the British press and refer to them as „hawks“ and „doves“, respectively. A fraction $r \in\,]0,1[$ of policy makers are hawks and a policy maker's type is his private information. Hawks are denoted by h and doves by d.[4] I initially suppose that votes are published.

Denote the policy maker who takes office at time t by q_t. At the beginning of period t, the private sector forms its expectation of inflation, p_t^e, and then q_{t-1} and q_t choose inflation. The private sector's subjective expectation of inflation is the conditional statistical expectation. The central bank takes expectations as given. Opportunistic policy makers optimise solely over their term in office.

[4]I assume that r and the rest of the structure of the model are common knowledge.

Suppose there were a single opportunistic policy maker. If he held office for only one period, he would minimise social welfare loss. Minimising equation (1), taking p^e as given, he would choose inflation to be one. This is not necessarily true when his tenure lasts two periods. In his second period in office, he would choose inflation to be one.[5] But, in period one he might choose zero inflation to increase the private sector's belief that he might be a hawk. By strengthening this belief, he would increase the benefit of inflating in period two.

With two policy makers, each will vote for inflation of either one or zero.[6] If both prefer the same policy, that policy is implemented. If one policy maker prefers zero and one policy maker prefers one, then some compromise inflation rate, a, is implemented, where $a \in]0,1[$. One possibility is that this rate might be ½ -- half the inflation the dissenting dove wants. Or, because the payoff is nonlinear, it might be the rate that gives the opposing dove half the benefit from inflation he wants. Then, $a = a^*$, where $g(a^*) = g(1)/2 = 1/4$. In Section IIB, I consider the effect of the choice of a on expected

[5]Assuming *L* (in equation (1)) is linear in unanticipated inflation simplifies matters by ensuring policy makers have a dominant strategy in their second period in office.

[6]No one can credibly claim they want anything else. Thus, votes must be for inflation of zero or one.

inflation and welfare and in Section IIIC, I allow the senior policy maker's vote to carry greater weight.

Consider the scenario beginning in period t. The retiring policy maker votes for zero inflation if he is a hawk and for inflation of one if he is a dove. The new policy maker votes for zero inflation if he is a hawk and solves a two-period problem by backwards recursion if he is a dove. The solution is the probability he does not vote for inflation in period t. I refer to this probability as his strategy and I allow mixed strategies, where the probability is between zero and one.[7]

If the policy maker taking office at t is a dove, he knows he will vote for inflation in period t+1. Expected social welfare loss in t+1 depends on the likelihood q_{t+1} is a dove and the conjectured probability that q_{t+1} votes for inflation in period t+1 if he is a dove. Thus, I must specify how q_t and the private sector believe the actions of q_t affect the strategy of q_{t+1}, if he is a dove.

Following Prescott and Townsend (1980), I restrict attention to equilibria in minimal state or memoryless Markov strategies. That is, I suppose that the strategy of a dove who has just taken office is a time-invariant function of the senior policy maker's type. This variable summarises the current economic environment for the dove. While it is not known to the private sector, it is revealed to the dove when the two policy makers choose inflation; there is no incentive for the senior policy maker to misrepresent his type to his junior colleague. Thus, I suppose that the private sector and q_t conjecture that if the time-t+1 policy maker is a dove, then the probability he does *not* vote for inflation in period t+1 is given by f^{j*}, where j is q_t's type.[8]

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[7]Kreps (1990) admits that the use of mixed strategies is „troubling to much of the laity"; he suggests we might think of them as an artifice of a coarse model of reality. In the real world, a policy maker's vote depends on many details known to himself, but unknown to other players, and not built into the model.

[8]The Markov restriction rules out repeated-game equilibria where past strategies influence current play – not because they influence the state of the economy – but solely because players believe

Let p denote the private sector's beginning of period t+1 probability assessment that the policy maker who took office at time t is a hawk. Then, the private sector's and q_t's expectation of inflation in period t+1 is

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that past strategies matter. See Maskin and Tirole (1988) for a discussion of the relative merits of Markov and repeated-game equilibria.

$$p^{e}(p, f^{h*}, f^{d*}) =$$

$$\text{(probability } q_t \text{ is a dove and } q_{t+1} \text{ is either a hawk or a dove}$$
$$\text{who does not vote for inflation at } t) \text{ x } a$$

$$+ \text{(probability } q_t \text{ is a hawk and } q_{t+1} \text{ is a dove who votes for inflation at } t) \text{ x } a$$

$$+ \text{(probability } q_t \text{ is a dove and } q_{t+1} \text{ is dove who votes for inflation at } t) \text{ x } 1 =$$

$$(1-p)[r + (1-r) f^{d*}]a + p(1-r)(1-f^{h*})a + (1-p)(1-r)(1-f^{d*}) =$$

$$C(f^{d*}) - A(f^{h*}, f^{d*})p,$$

$$A(f^{h}, f^{d}) := C(f^{d}) - (1-r)(1-f^{h})a > 0$$

$$C(f^{d}) := [r + (1-r)f^{d}]a + (1-r)(1-f^{d}).$$

where the functions A and C are defined by

The function A measures the decrease in time-t+1 expected inflation resulting from an increase in the private sector's belief that q_t is a hawk. If it is believed more likely that q_{t+1} will vote for zero inflation if q_t is a hawk or for inflation of one if q_t is a dove, then the size of this decrease rises. Thus, A is an increasing function of f^{h^*} and a decreasing function of f^{d^*}.

The private sector updates its beliefs with Bayes' rule. Thus,

$$p = \begin{cases} 0 \textit{ if } q_t \textit{ votes for inflation at } t \\ \\ P(f) \equiv \dfrac{r}{r + f(1-r)} \textit{ otherwise,} \end{cases}$$

where f denotes the probability q_t votes for zero inflation at time *t* if he is a dove.

By equation (4), if the time-*t* policy maker does not vote for zero inflation, he is revealed as a dove. If q_t votes for zero inflation at time t, the likelihood the private sector attaches to his being a hawk is decreasing in the probability he votes for inflation in his first period in office, if he is a dove. If doves rarely vote for inflation their first period in office, then observing the junior policy maker vote for zero inflation does little to change the private sector's priors. If doves almost always vote for inflation in their first period in office and a junior policy maker does not, then the private sector will conclude it is likely he is a hawk. In the polar cases, if doves never vote for inflation their first period in office, then observing zero inflation has no effect on the public's priors. If doves always vote for inflation and a policy maker does not, the public will infer he is a hawk.

$$\textit{Prob}(q_{t+1} \textit{ is a hawk or a dove who does not vote for inflation}) \; x \; g(a)$$

$$+ \textit{Prob}(q_{t+1} \textit{ is a dove who votes for inflation}) \; x \; g(1) + p^{e}(p, f^{h*}, f^{d*})$$

$$= F(f^{d*}) + p^{e}(p, f^{h*}, f^{d*})$$

$$\textit{where } F(f^{d*}) := [\, r + (1-r) f^{d*}] g(a) + (1-r)(1-f^{d*}) g(1).$$

By equation (1), if the time-*t* policy maker is a dove, his expected loss in period *t*+1 is

The function *F* does not depend on the actions of q_t. A dove's sole benefit from voting for zero inflation his first period in office is lower expected inflation his second period in office.

Let i be q_{t-1}'s type and p^{e} be expected inflation at time t. Time-t inflationary expectations are in place when q_{t-1} and q_{t} vote; hence, they treat them as a constant. If the time-t policy maker is a

$$\begin{cases} Prob(he\ votes\ for\ no\ inflation)\ x\ g(0) + Prob(he\ votes\ for\ inflation) g(a) + p^{e} \\ \qquad if\ q_{t-1}\ is\ a\ hawk \\ Prob(he\ votes\ for\ no\ inflation)\ x\ g(a) + Prob(he\ votes\ for\ inflation)\ x\ g(1) + p^{e} \\ \qquad if\ q_{t-1}\ is\ a\ dove. \end{cases}$$

$$= \begin{cases} (1-f)g(a) + p^{e}\ if\ i = h \\ fg(a) + (1-f)g(1) + p^{e}\ if\ i = d. \end{cases}$$

dove, then by equation (1), his expected welfare loss in period t is

Policy makers and society have the same discount factor $d \in\ ]0,1[$. Then, by equations (1) and

$$\_ = \begin{cases} fd\,p^{e}(P(f), f^{h*}, f^{d*}) + (1-f)[g(a) + d\,p^{e}(0, f^{h*}, f^{d*})]\ if\ i = h \\ f[g(a) + d\,p^{e}(P(f), f^{h*}, f^{d*})] + (1-f)[g(1) + d\,p^{e}(0, f^{h*}, f^{d*})]\ if\ i = d, \end{cases}$$

(4) - (6), if q_{t} is a dove, his time-t expected discounted social welfare loss is

where variables that q_{t} treats as constants are ignored.

Proposition 1. *A solution to the policy maker's problem is a pair* $\{f^{h}, f^{d}\}$ *such that*

$$- g(a) - dA(f^{h*}, f^{d*})P(f^{h})^{2} \left\{ \begin{matrix} \geq \\ = \\ \leq \end{matrix} \right\} 0 \text{ and } f^{h} \left\{ \begin{matrix} = 0 \\ \in [0,1] \\ = 1 \end{matrix} \right\}$$

$$g(a) - g(1) - dA(f^{h*}, f^{d*})P(f^{d})^{2} \left\{ \begin{matrix} \geq \\ = \\ \leq \end{matrix} \right\} 0 \text{ and } f^{d} \left\{ \begin{matrix} = 0 \\ \in [0,1] \\ = 1 \end{matrix} \right\}.$$

Proof. *See the Appendix.*

The intuition behind the policy maker's problem is as follows. Current inflationary expectations are already in place and are unaffected by his actions. Thus, if he increases the likelihood that he will vote for no inflation, within-period inflation is more likely to be further below its optimal level than it otherwise would. Expected future welfare rises, however, as expected inflation falls if he actually votes for zero inflation. The latter effect is dampened, but not reversed, as the increased probability of voting for zero inflation causes actually voting for zero inflation to be a poorer signal of being a hawk. Thus, in deciding whether or not to increase his probability of voting for zero inflation, the time-t policy maker trades off a current expected cost against an expected future benefit.

As either the discount factor or the prior probability a policy maker is a hawk rises, the future expected benefit becomes relatively more important. The effect of d is obvious; that of r is less so. If a dove votes for inflation in his first period in office, he is revealed to be a dove no matter what prior beliefs are. But, if he does not vote for inflation, the likelihood the private sector attaches to his being a hawk is increasing in the private sector's prior belief that he is a hawk. Hence, the current cost to voting for inflation is unaffected by r and the expected future benefit is increasing in r.

If d is sufficiently small, then a dove who takes office at time t always votes for inflation at t. If δ and ρ are sufficiently close to one, then for some values of α and some strategies of the time-t+1 agents, he never votes for inflation at t. Both δ and ρ must be sufficiently large because having a reputation is only important if the policy maker cares about the future and caring about the future is only important if refraining from inflation has a sufficiently large effect on the policy maker's reputation.

If the above sets of conditions are not satisfied, the policy maker follows a mixed strategy. He votes for zero inflation with some probability strictly greater than zero and strictly less than one.

Equilibrium requires that the conjectures of the time-t policy maker and the private sector are consistent. Thus, $f^{i*} = f^{i}$, $i = h,d$. I have the following definition.

Definition 1. *A sequential Nash equilibrium with Bayesian updating is a pair* $\{f^{h}, f^{d}\}$

$$- g(a) - dA(f^{h}, f^{d})P(f^{h})^{2} \begin{Bmatrix} \geq \\ = \\ \leq \end{Bmatrix} 0 \text{ and } f^{h} \begin{Bmatrix} = 0 \\ \in [0,1] \\ = 1 \end{Bmatrix}$$

$$g(a) - g(1) - dA(f^{h}, f^{d})P(f^{d})^{2} \begin{Bmatrix} \geq \\ = \\ \leq \end{Bmatrix} 0 \text{ and } f^{d} \begin{Bmatrix} = 0 \\ \in [0,1] \\ = 1 \end{Bmatrix}.$$

such that[9]

IIB Properties of the Equilibrium

In this section, I show that an equilibrium exists and analyse its properties.

Proposition 2. *A unique equilibrium exists.*

[9]Sequential in the sense of Prescott and Townsend (1980).

Proof. *See the Appendix.*

The equilibrium depends on the state of the world because the current loss to a opportunistic policy maker of voting for zero inflation depends on whether the senior policy is a hawk or dove. Only when compromise inflation equals α^* and a dissenting dove gets half his desired gain from inflation ($g(\alpha^*) = g(1)/2$) is this untrue.

In principle, one may have doves voting for zero inflation their first period in office without assuming hawks exist. The equilibrium strategies are that first-period policy makers do not vote for inflation and the private sector believes they do not vote for inflation as long as no one has deviated from these strategies in the past. However, if any player deviates from this, all players play non-cooperatively from then on. Thus, policy makers in their first period in office act like hawks because they are afraid they will be punished by the new policy maker next period if they do not.[10] This type of equilibrium is described in Crémer's (1986) model of organisations with overlapping generations of workers. It is less attractive here as it requires an unrealistic amount of coordination among members of the private sector.

I now consider the effects of the exogenous variables on equilibrium inflation and welfare.

Proposition 3. *Suppose the junior policy maker is a dove. An increase in the discount factor, δ, increases the likelihood he will vote for zero inflation. If the discount factor is sufficiently small, doves always vote for inflation. If compromise inflation, α, is not too small and $\rho^2\delta$ is sufficiently close to one, doves never vote for inflation their first*

[10]The history-dependent equilibrium in this repeated game violates my assumption that equilibrium strategies are Markov.

period in office.

Proof. *See the Appendix.*

Thus if δ is sufficiently small, there is a separating equilibrium where doves always vote for inflation their first period in office and hawks never do. If $r^2 d$ is sufficiently close to one and α is not too small, there is a pooling equilibrium where no policy maker votes for inflation in his first period in office. Compromise inflation cannot be too small because this makes the current cost to not voting for inflation too large if the senior policy maker is a dove.

For other values of the parameters there are semi-separating equilibria where hawks never vote for inflation in their first period in office and doves randomise between voting for inflation and not voting for inflation. As an example, suppose $a = 1/2$. Then $d \leq 1/4$ ensures doves always vote for inflation and $r^2 d \geq 3/4$ ensures junior policy makers never vote for inflation.

Consider an increase in r . This might result from a deliberate attempt by society to appoint conservative central bankers. The higher is ρ, the greater the likelihood the private sector attaches to the junior time-t policy maker being a hawk if they observe him vote for zero inflation at time t. Thus, it might seem that the probability an opportunistic junior policy maker votes for zero inflation should be increasing in ρ. Surprisingly, this is not the case; however, an increase in ρ must improve welfare.[11]

Proposition 4. *An increase in the fraction of the population made up by hawks,* r, *has an ambiguous effect on the probability an opportunistic junior policy maker votes for*

[11]The central bank has no stabilisation role here. Rogoff (1985) points out that if the central bank has such a role, more conservative central bankers may not improve matters.

inflation and increases expected welfare.

Proof. *The first result is demonstrated in Figure 1; the proof of the second is found in the Appendix.*

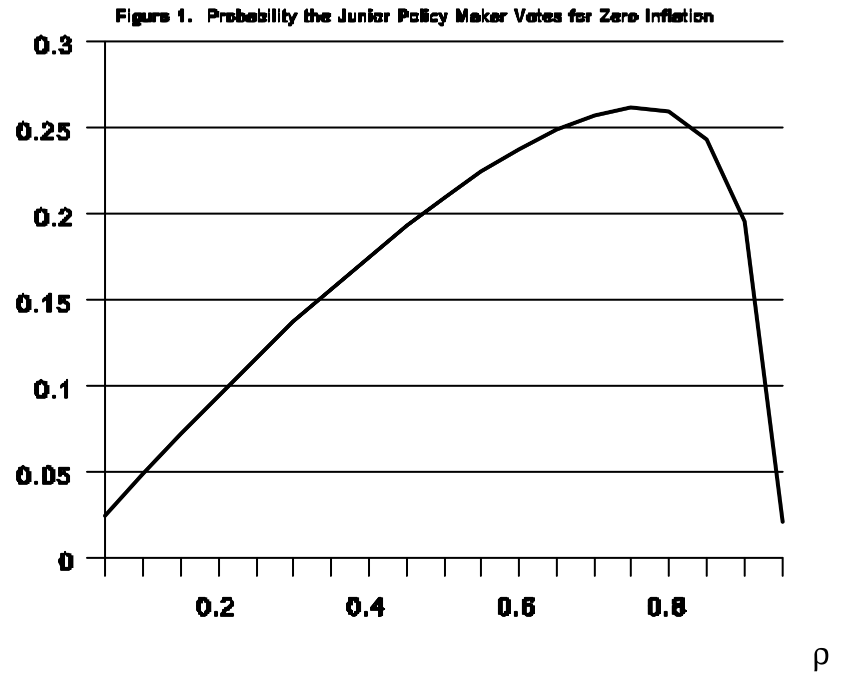


Figure 1 shows the impact of ρ when δ = .8 and α = α*. In this case, $f^h = f^d$. The intuition is as follows. An increase in ρ raises the belief that q_t is a hawk if he votes for zero inflation at t, but it has an ambiguous effect on the fall in expected inflation associated with this change in perception. To see this, suppose it were known that q_{t+1} will vote for inflation. Then, an increase in p – the likelihood that q_t is a hawk – increases the likelihood time-t+1 inflation will be α, rather than one. If it were known that q_{t+1} will not vote for inflation, an increase in p increases the probability time-t+1 inflation will be zero, rather than α. This benefit will be smaller than the previous one if α is less than one half. A rise in ρ increases the likelihood q_{t+1} will not vote for inflation, and thus it can lower the decrease in expected inflation associated with the increase in p.

If this occurs, it is possible for the rise in ρ to cause the probability an opportunistic q_t votes for inflation to rise. However, the effect on welfare is unambiguous. The direct effect on inflation of a decline the percentage of policy makers who are opportunistic causes expected social welfare loss to decline.

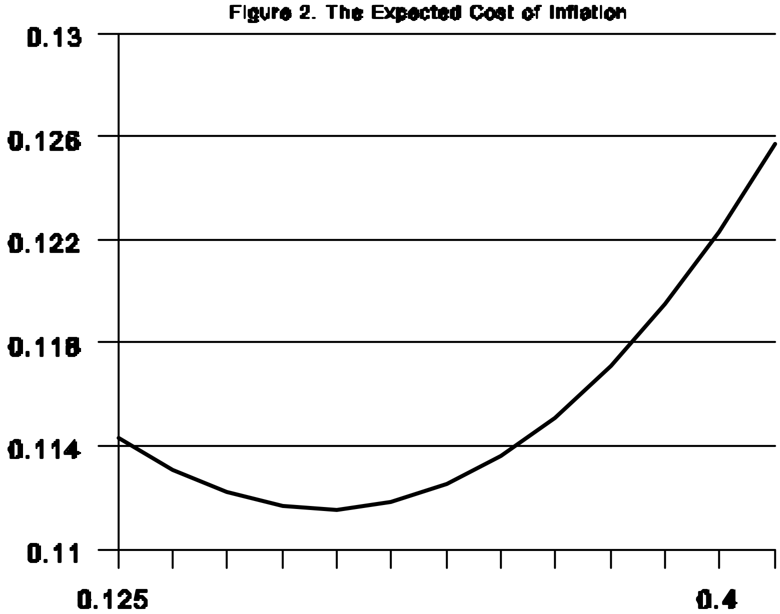
I now consider a change in the compromise level of inflation, α. This might be the result of a vociferous press or government which puts pressure on the central bank to inflate.

Proposition 5. *If the junior policy maker is a dove, then an increase in* α *causes the probability he votes for zero inflation to fall (rise) if the senior policy maker is a hawk (dove). An increase in* α *can raise or lower social welfare.*

Proof*. See the Appendix for the proof of the first part of the proposition. Figure 2 demonstrates the second part.*

An increase in compromise inflation increases the junior policy maker's benefit to voting for inflation if the senior policy maker is a hawk and decreases it if the senior policy maker is a dove. Surprisingly, Figure 2 (drawn for the case of δ = .9and ρ = .5) shows that the decline in the likelihood that a junior policy maker votes for inflation when the senior policy maker is a dove can be large enough that an increase in compromise inflation can increase welfare.

Figure 2. The Expected Cost of Inflation



α

III Reputation and the Characteristics of Central Banks

In this section, I analyse how some characteristics of central banks affect the incentive to build a reputation, and hence, inflation and welfare.

IIIA Committees vs. Monolithic Decision Making

Central banks in countries such as the US, New Zealand, the Netherlands, and Italy are dominated by the chairman. Policy is effectively made by a single individual. This is not true in Japan and is unlikely to be true for the European Central Bank (ECB). In this section I compare the outcomes when policy is made by a chairman and when policy is made by a committee.

Suppose that instead of a committee, policy is made by a non-overlapping sequence of two period-lived decision makers. A opportunistic policy maker who takes office in period t solves a two-period problem by backward recursion.

In period t+1, expected inflation is one if he chooses inflation in period t and $1 - P(f)$ if he does not, where ϕ is the probability he chooses inflation in period t and P is as defined in equation (4).

$$L_{t+1} = \begin{cases} g(1) + 1 \text{ if } p_t \text{ NE } 0 \\ g(1) + 1 - P(f) \text{ otherwise.} \end{cases}$$

Thus, his expected loss in period t+1 is

$$\_ = (1 - f)g(1) - f d P(f),$$

By equations (1) and (10), his discounted expected loss in period t is

where variables the policy maker treats as constants are ignored.

Differentiating equation (11) and employing $P(f) + fP'(f) = P(f)^2$, which follows from

$$- g(1) - dP(f)^2 \left\{ \begin{matrix} \geq \\ = \\ \leq \end{matrix} \right\} 0 \text{ and } f \left\{ \begin{matrix} = 0 \\ \in [0,1] \\ = 1 \end{matrix} \right\}.$$

equation (4), yields the complementary slackness conditions.

Proposition 6. *There exists a unique* f *such that equation (12) is satisfied. If* $d \leq - g(1)$*, then* $f = 0$*; if* $d\, r^2 \geq - g(1)$*, then* $f = 1$*.*

Proof. *See the Appendix.*

The intuition is similar to that behind the result in Proposition 2.

Proposition 7. *If the discount factor is sufficiently small, policy making by committee produces no higher inflation than and is at least as good as policy making by a single decision maker. If the discount factor and the prior belief that policy makers are hawks are both sufficiently close to one and* a *is sufficiently close to* a^**, a single policy maker produces no higher inflation than and is at least as good as policy making by committee.*

Proof. *See the Appendix.*

When decision making is done by committee, a vote by the time-*t* policy maker to inflate has only a partial effect on inflation. Thus, the output gain is less than if he could unilaterally decide on inflation equal to one. Therefore, inflating produces less short-term gain and this tends to lower the incentive of the policy maker to vote for inflation. However, if he votes to inflate, it has less of an effect on next-period's expectation of inflation. Thus, gaining a reputation is less important. This long-term gain tends to increase the incentive of the policy makers to vote for inflation. The latter effect is more important when the discount rate is high and when the prior belief the policy maker is a hawk is high.

As an example, suppose $\alpha = 0.5$. Then if $\delta < 0.25$, doves always vote for inflation in both regimes. If $0.25 < \delta < 0.5$, doves always vote for inflation when they are the sole policy maker, but they do not always vote for inflation when they are part of a committee. If $\delta > 0.75/\rho^2$, then doves never vote for inflation in their first period in office in either regime. If $0.5/\rho^2 < \delta < 0.75/\rho^2$, then doves never vote for inflation if they are the sole policy maker. But, they sometimes do if they are part of a committee.

IIIB Equilibrium when votes are published with a lag

The Bank of England, the Bank of Japan and the US Federal Reserve publish the votes of individual members. The ECB, however, does not plan to publish the votes of its members until 17 years have passed.

In this section I suppose society considers the experiment of not publishing the votes of committee members until after their retirement[12]. As a simple example, I suppose that the time-t votes are not published until after the time-t+1 inflation decision is made. Thus, when the private sector is forming its expectation of time-t+1 inflation, they know time-t inflation and all votes dated time-t-1 and earlier. Thus, it knows how the policy maker who took office in period t-1 voted at time t-1. I also assume $a = a^*$[13]. Thus, the probability that dovish junior policy makers taking office other than at time t vote for inflation does not depend on the senior policy maker's type.

There are three possible states of the world at time t. First, the policy maker who took office at time $t-1$ may be a dove and may have revealed this by voting for inflation at $t-1$. Call this type of

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[12]Policy makers do not attempt to influence outcomes after their retirement.

[13]It is straight forward to show the results in this section hold for Install Equation Editor and double-click here to view equation., but the notation is messy.

time-t - 1 policy maker $d*$. Second, the policy maker who took office at time $t - 1$ may be a dove, but may not have voted for inflation at $t - 1$; this type is called d. Finally, the policy maker may be type h. If the time-$t - 1$ policy maker is type $d*$, then not publishing the time-t vote does not matter; the actions of the policy maker who takes office at time t are revealed.

Now consider the case where q_{t-1} does not vote for inflation at time $t - 1$. If time-t inflation is one, then it is revealed that the time-t policy maker is a dove. The actions of future policy makers will be unchanged by the one-time experiment and this is known by both the private sector and q_t. Thus, time-t+1 expected inflation is $p^e(0, f, f)$ (where the function p^e is defined in equation (2)). If time-t inflation is zero, then it is known that the time-t policy maker voted for zero inflation and time-t+1 expected inflation is $p^e(P(f_t^i), f, f)$, where f_t^i is the probability q_t votes for zero inflation at time t if he is a dove and q_{t-1} is type $i = d,h$.

If inflation at time t is $a*$ and q_{t-1} is type h or d, then the public does not know whether q_{t-1} or q_t voted for inflation. There are three possible scenarios: first, q_t is type h and q_{t-1} is type d; second; q_t is type d and voted for zero inflation and q_{t-1} is type d; third, q_t is type d and voted for inflation and q_{t-1} is type h. Thus, using equation (4), the public believes that q_t is type h with probability

$$Prob(q_t \text{ is } h, q_{t-1} \text{ is } d \,|\, q_{t-1} \text{ is not } d^*)/[Prob(q_t \text{ is } h,$$

$$q_{t-1} \text{ is } d \,|\, q_{t-1} \text{ is not } d^*) + Prob(q_t \text{ is } d \text{ and voted}$$

$$\text{for zero inflation}, q_{t-1} \text{ is } d \,|\, q_{t-1} \text{ is not } d^*)$$

$$+ Prob(q_t \text{ is } d \text{ and voted for inflation}, q_{t-1} \text{ is } h \,|\, q_{t-1} \text{ is not } d^*)]$$

$$= r Prob(q_{t-1} \text{ is } d \,|\, q_{t-1} \text{ is not } d^*)/[\, r Prob(q_{t-1} \text{ is } d \,|\, q_{t-1} \text{ is not } d^*)$$

$$+ (1 - r) f_t^d \, Prob(q_{t-1} \text{ is } d \,|\, q_{t-1} \text{ is not } d^*) +$$

$$(1 - r)(1 - f_t^h) Prob(q_{t-1} \text{ is } h \,|\, q_{t-1} \text{ is not } d^*)] = r/[\, r + (1 - r)x] = P(x),$$

$$x = x(f_t^h, f_t^d) \equiv f_t^d + \frac{1 - f_t^h}{f} \frac{r}{1 - r}.$$

where

The notational dependence of x on t is suppressed.

Proceeding as in Section II and using the definitions of g and a^*, q_t's expected loss in period t is

$$\_ = \begin{cases} f_t^h d\,p^e(P(f_t^h), f, f) + (1 - f_t^h)[d\,p^e(P(x(f_t^h, f_t^d)), f, f) - 1/4] \text{ if } i = h \\ \\ f_t^d [d\,p^e(P(x(f_t^h, f_t^d)), f, f) - 1/4] + (1 - f_t^d)[d\,p^e(0, f, f) - 1/2] \text{ if } i = d, \end{cases}$$

where the time-$t-1$ policy maker is type i and variables the policy maker treats as constants are ignored.

Proposition 8. *In a sequential equilibrium where votes are not published at time t, time-t*

$$\frac{1}{4} - dA^* \left\{ P(f_t^h)^2 - \frac{P(x)}{x}[f_t^d + (x - f_t^d)P(x)] \right\} \begin{Bmatrix} \geq \\ = \\ \leq \end{Bmatrix} 0 \text{ and } f_t^h \begin{Bmatrix} = 0 \\ \in [0,1] \\ = 1 \end{Bmatrix}$$

strategies are $f_t = f$ *if* $i = d^*$ *and* $f_t = f_t^i$ *if* $i = h,d$, *where*

$$\frac{1}{4} - \frac{dA^* P(x)}{x}[f_t^d P(x) + x - f_t^d] \begin{Bmatrix} \geq \\ = \\ \leq \end{Bmatrix} 0 \text{ and } f_t^d \begin{Bmatrix} = 0 \\ \in [0,1] \\ = 1 \end{Bmatrix},$$

where $A^* = A^*(f, f)$ and A^* is A evaluated at $\mathbf{a} = \mathbf{a}^*$.

Proof. *See the Appendix.*

It is now shown that not publishing the votes is inflationary.

Proposition 9. *Suppose the time-t policy maker is a dove. Not publishing the votes at time t increases the likelihood he votes for inflation.*

Proof. *See the Appendix.*

To see the intuition, first suppose q_{t-1} is a hawk. If the time-t policy maker does not vote for inflation, he is revealed to have acted as a hawk would, whether or not votes or published. If he votes for inflation, he is revealed to be a dove if votes are published. If votes are not published, the public remains uncertain about his type. This tends to make the cost of voting for inflation lower when votes are not published. Now suppose q_{t-1} is a dove, but this is not known with certainty. If the time-t policy maker votes for inflation, he is revealed to be a dove, whether or not votes are published. If he does not vote for inflation, he is revealed to have acted as a hawk would if votes are published. If votes are not published, the public remains uncertain about his action. This tends to make the benefit to not voting for inflation lower when votes are not published.

Proposition 10. *Not publishing the votes lowers expected welfare.*

Proof. *See the Appendix.*

Not publishing the votes does not affect time-t+1 expected welfare. On average, the private sector continues to guess inflation correctly and the actions of the time-t+1 policy makers are unchanged. However, average inflation in period t rises.

IIIC. Inflation when the bank is hierarchical

It may be unreasonable to suppose that all policy makers have equal weight in voting. New policy makers may be less sure of themselves or the central bank's culture may give more weight to senior policy makers. In this section, I look at the effect of giving the senior policy maker's vote more importance. Formally, if both policy makers vote for the same policy, that policy is enacted. If the senior policy maker votes for inflation and the junior policy maker does not, inflation of $\alpha + \varepsilon$ is enacted. If the junior policy maker votes for inflation and the senior policy maker does not, a policy of $\alpha - \varepsilon$ is enacted.

Proceeding as in Section II, a sequential Nash equilibrium with Bayesian updating is a pair $\{f^h, f^d\}$ such that

$$G_e^h(f^h, f^d) \equiv -g(a - e) - d\, A_e(f^h, f^d)P(f^h)^2 \begin{Bmatrix} \geq \\ = \\ \leq \end{Bmatrix} 0 \text{ and } f^h \begin{Bmatrix} = 0 \\ \in [0,1] \\ = 1 \end{Bmatrix}$$

$$G_e^d(f^h, f^d) \equiv g(a + e) - g(1) - d\, A_e(f^h, f^d)P(f^d)^2 \begin{Bmatrix} \geq \\ = \\ \leq \end{Bmatrix} 0 \text{ and } f^d \begin{Bmatrix} = 0 \\ \in [0,1] \\ = 1 \end{Bmatrix},$$

$$\text{where } A_e(f^h, f^d) :=$$

$$[r + (1 - r)f^d](a + e) + (1 - r)(1 - f^d) - (1 - r)(1 - f^h)(a - e).$$

Suppose that initially $\alpha = a^*$. Then consider an experiment where the senior policy maker is given slightly more weight. If doves vote for inflation their first period in office with probability zero or one, there is no effect. But, if they have a mixed strategy, the probability of voting for inflation declines.

Proposition 11. *A small increase in the importance of the senior policy maker causes the probability that a dove votes for no inflation in his first period in office to rise and the expected cost of inflation to fall.*

Proof*. See the* Appendix.

The intuition is straightforward. The cost of building a reputation declines because less weight is put on a junior policy maker's vote for zero inflation. The benefit of building a reputation rises because more weight is put on a vote for inflation when the policy maker is senior. Thus, dovish junior policy makers are less apt to vote for inflation their first period in office.

Inflation is higher when the senior policy maker is a dove and the junior policy maker does not vote for inflation and lower when the senior policy maker is a hawk and the junior policy maker votes for inflation. However, the welfare cost of the higher inflation in the former case is outweighed by the lower inflation in the latter case and the greater propensity of dovish junior policy makers to oppose inflation.

IV Conclusion

Macroeconomic analyses of central bank decision making typically treat the monetary authority as a single entity. In reality, monetary policy is typically made by a committee. Thus, the reputation of the central bank is jointly determined with the reputations of the individual commi-ttee members. Institutional rules affecting the way members interact and the observability of indi-vidual actions affect members' incentives to build reputations, and hence, inflation and welfare.

This paper attempts to build a simple model of reputation building when monetary policy is made by a group. I use the model to analyse how some of the institutional features of central banks can be expected to influence incentives to maintain a reputation, inflation, and welfare.

Appendix

$$\frac{\partial\_}{\partial f} = \begin{cases} -g(a) - d\,p^{e}(0, f^{h*}, f^{d*}) + d\,p^{e}(P(f), f^{h*}, f^{d*}) \\ \quad + df\,p_{1}^{e}(P(f), f^{h*}, f^{d*})P'(f) \text{ if } i = h \\ g(a) - g(1) - d\,p^{e}(0, f^{h*}, f^{d*}) + d\,p^{e}(P(f), f^{h*}, f^{d*}) \\ \quad + df\,p_{1}^{e}(P(f), f^{h*}, f^{h*})P'(f) \text{ if } i = d. \end{cases}$$

Proof of Proposition 1. Differentiating equation (7) yields

$$\frac{\partial\_}{\partial f} = \begin{cases} -g(a) - dA(f^{h*}, f^{d*})P(f)^{2} \text{ if } i = h \\ g(a) - g(1) - dA(f^{h*}, f^{d*})P(f)^{2} \text{ if } i = d. \end{cases}$$

By equation (2) and $P(\phi) + \phi P'(\phi) = P(\phi)^2$ (from equation (4)),

By equations (4) and (20), $\partial^2\_/\partial f^2 > 0$; hence the second-order conditions for minima are satisfied and the right-hand-side of equation (20) is monotonic. A solution is then a pair $\{f^h, f^d\}$ such that the complementary slackness conditions (8) are satisfied.

Proof of Proposition 2. By equations (3), (4), and (9), a pair $\{f^h, f^d\}$ is an equilibrium iff

$$F^i(y^h,y^d) := G^i - d\ r^2 B(y^h,y^d)/\ y^{i^2} \left\{ \begin{matrix} \geq \\ = \\ \geq \end{matrix} \right\} 0 \ and\ y^i \left\{ \begin{matrix} = r \\ \in [\ r, 1] \\ = 1 \end{matrix} \right\},$$

$$where\ B(y^h,y^d) := (1-a)(1-y^d) + a\ y^h,\ y^i := r + (1-r) f^i,\ i = h,d$$

$$G^h := -g(a) > 0,\ G^d := g(a) - g(1) > 0.$$

A solution to (21) is a fixed point of the mapping $\Omega : [\ r, 1] \rightarrow [\ r, 1]$ defined by $\Omega(y^h, y^d)$

$$\Omega^i(y^h,y^d) := \begin{cases} 0\ if\ \sqrt{d\ r^2 B(y^h,y^d)/\ G^i} \leq r \\ 1\ if\ \sqrt{d\ r^2 B(y^h,y^d)/\ G^i} \geq 1 \\ \sqrt{d\ r^2 B(y^h,y^d)/\ G^i}\ otherwise \end{cases}.$$

= $(\Omega^h(y^h,y^d), \Omega^d(y^h,y^d))$, where

W is a continuous mapping from a compact, convex set into itself; hence Brouwer's Theorem ensures a fixed point (y^h, y^d) which solves (21) exists. This implies an equilibrium exists.

$$F^h_h = d\ r^2(2B - a\ y^h)/\ y^{h^3} > 0,\ F^h_d = d\ r^2 (1-a)/\ y^{h^2} > 0$$

$$F^d_h = -d\ r^2 a/\ y^{d^2} < 0,\ F^d_d = d\ r^2 [2B + (1-a)\ y^d\ ]/\ y^{d^3} > 0,$$

The mappings F^i, $i = h,d$ have the following properties:

where the subscript $i = h,d$ denotes a partial derivative with respect to y^i. This ensures $\Delta :=$ $F^h_h F^d_d - F^h_d F^d_h > 0.$ Therefore, the equilibrium is unique.

Proof of Proposition 3. To show f^i is increasing in δ it is sufficient to show y^i is increasing in δ. With a corner solution, it is clearly (weakly) increasing. Otherwise, by (21) (with equality),

$$\Delta\,\partial\, y^i /\partial d = F^i_j\, \partial\, F^j /\partial d - F^j_j\, \partial\, F^i /\partial d\ , iNEj, i = h, d$$

$$\partial\, F^i /\partial d = - d^2 B/\ y^{i^2}, i = h, d.$$

$\Delta > 0$ and $B > 0$; hence by (24), the result holds if $F^i_j\, y^{i^2} < F^i_i\, y^{j^2}$. This is true by (23) and the definition of B (in (21)).

Let $\Gamma := \{- g(a\ ), g(a\ ) - g(1)\}$. By (9), $f^h = f^d = 0$ if $dA(0,0)P(0\ )^2 \leq\ min\ \Gamma$ and $f^h = f^d = 1$ if $dA(0,0)P(0\ )^2 \geq max\ \Gamma$. By (3), $A(0,0) = r a + (1 - r\ )(1 - a\ )$ and A(1,1) = α. By (4), P(0) = 1 and P(1) = ρ. This yields the rest of the result.

$$\{\ r\,(1 - r\ )(1 - f^h\ ) + (1 - r\ )[\ r + (1 - r\ ) f^d\ ]\}\, a^2 /2 + (1 - r\ )^2 (1 - f^d\ )/2$$

$$= [\ r\,(1 - y^h\ ) + (1 - r\ )\, y^d\ ]\, a^2 /2 + (1 - r\ )(1 - y^d\ )/2.$$

Proof of Proposition 4. The expected cost of inflation is

This is decreasing in ρ if $\partial\, y^i /\partial r\ > 0$, $i = h,d$. By (21) and Δ > 0, this is true iff $F^i_j \partial\, F^j /\partial r$ $- F^j_j \partial\, F^i /\partial r > 0, iNEj, i = h, d$. By (21), this is true iff $y^{i^2}\, F^i_j < y^{j^2}\, F^j_j, iNEj, i = h, d$. By (21) and (23), this is true.

Proof of Proposition 5. To establish the first part of the proposition, it is sufficient to show that y^h

$$\Delta\partial\, y^i /\partial a = F^i_j \partial\, F^j /\partial a - F^j_j \partial\, F^i /\partial a\ , jNEi, i = h.$$

is decreasing in α and y^d is decreasing in α. By (21),

Substituting (23) and (27) into (26) yields

$$\partial\, F^h /\partial a = - g'(a\ ) + (1 - y^h - y^d\ ) d\ \ r^2 /\ y^{h^2}$$

$$\partial\, F^d /\partial a = g'(a\ ) + (1 - y^h - y^d\ ) d\ \ r^2 /\ y^{h^2}.$$

$$\Delta y^{j^3}/(d\ r^2)\ \partial y^i/\partial a = g'(a)V^i - 2d\ r^2 B(1 - y^h - y^d)/\ y^{i^2},\ jNEi, i = h, d,$$

$$V^h = (1 - a)\ y^{d^3}/\ y^{h^2} + (1 - a)\ y^d + 2B, V^d = a\ y^{h^3}/\ y^{d^2} + a\ y^h - 2B.$$

$$\Delta y^{d^3}/(d\ r^2)\ \partial y^h/\partial a = a^2 y^h + (1 - a)^2 y^d - 2 < 0$$

$$\Delta y^{h^3}/(d\ r^2)\ \partial y^d/\partial a = (1 - a)[(1 - a)(1 - y^d) + (1 + a - a^2)y^h/(2 - a)] > 0.$$

Substituting the definitions of B, and g into (28) yields

Proof of Proposition 6. By (4) and (12), $\phi = 0$ if $\delta \leq - g(1)$ and $\phi = 1$ if $\delta\rho^2 \geq - g(1)$. Otherwise, the left-hand side of (12) is a strictly increasing function of ϕ, which takes a strictly negative value at zero and a strictly positive value at one. This yields the result.

Proof of Proposition 7. The function A (as defined in (3)) is linear in α, $A < 1$ at $a = 0$, and $a = 1$; hence, $A < 1, \_a \in [0,1]$. Let $f^d \in [0,1]$. Then, $g(a) > g(1)$ and continuity ensure $- g(a) - dA(f, f^d)P(f)^2 < - g(1) - dP(f)^2$ for d sufficiently small. Thus, by (9) and (12), $f^h > f$. Similarly, $f^d > f$. At $a = a*$, $f^h = f^d$. Equation (4) and $g(1) = - 1/2$ ensure $- g(1)/2 - dA(f, f)P(f)^2 > - g(1) - dP(f)^2$ for $d = r = 1$. This and continuity ensure $f^i < f, i = h, d$ for d, r sufficiently close to one and a sufficiently close to $a*$.

Proof of Proposition 8. Differentiating (15), using (4) and (14) yields (16) and (17). It is easily verified that $\partial^2 \_/\partial f^{i^2} > 0, i = h, d.$

Proof of Proposition 9. The result is trivially true if the solution to (9) is one. Hence, suppose it is not. When $a = a*$, an interior solution to (9) satisfies

$$1/4 - dA^* P(f\ )^2 = 0.$$

The left-hand sides (LHS's) of (16) and (30) are strictly increasing in f and f^h_t, respectively. Thus, $f^h_t \leq f$ if the LHS of (16), evaluated at $f^h_t = f^*$, where f^* is the solution to (9) when $a = a^*$, is greater than the LHS of (30), $\_ f^d_t \in (0,1)$. By (14), this is true. The LHS of (17) is strictly increasing in f^d_t; hence I show the LHS of (17), evaluated at $f^d_t = f^*$ is greater than the LHS of (30), $\_ f^h_t \in (0,1)$. This is true if $[P(x)/x]\,[f^* P(x) + x - f^*] \leq P(f^*)^2$, where x is evaluated at $f = f^*$. By (4), this is true if $f^{*2} \leq [\,r/(1 - r\,)\,]^2 + (x - f^*)/(1 - r\,)$. This is true if $f^* \leq r/(1 - r\,)$. This is true if $f^* = 0$. If it is not, then by (3), (4), and (9), $F(f^*) = y^{*2} + 4d\ r^2(1 - 2a^*)y^* - 4d\ r^2(1 - a^*) = 0,$ where $y^* := r + (1 - r\,)f^*$. The function F reaches a minimum and is negative at zero; hence $f^* \leq r/(1 - r\,)$ if $F(\,r/(1 - r\,)) \geq 0$. This is true if $1 + 2dr(1 - 2a^*) - d(1 - a^*) \geq 0.$ By the definitions of g and $a^*, a^* \leq 1/2$; hence, this is true.

Proof of Proposition 10. $E[g(p_{t+1}) + p^e_{t+1}] = (1 - r\,)\,[\,r + (1 - r\,)f + r(1 - f\,)]$ and, hence, depends solely on the strategies of the time-t+1 agents. $E[g(p_t) + p^e_t]$ is increasing in the likelihood the time-t agent votes for inflation. Thus, expected welfare declines.

$$\Delta_e \frac{\partial y^h}{\partial e} = \frac{\partial F^h_e}{\partial y^d}\frac{\partial F^d_e}{\partial e} - \frac{\partial F^h_e}{\partial e}\frac{\partial F^d_e}{\partial y^d}, \Delta \frac{\partial y^d}{\partial e} = \frac{\partial F^h_e}{\partial e}\frac{\partial F^d_e}{\partial y^h} - \frac{\partial F^h_e}{\partial y^h}\frac{\partial F^d_e}{\partial e},$$

$$where\ \Delta_e := (\partial F^h_e/\partial y^h)(\partial F^d_e/\partial y^d) - (\partial F^h_e/\partial y^d)(\partial F^d_e/\partial y^h)$$

Proof of Proposition 11. By (18), when it holds with equality

and y^i is defined in (21).

At ε = 0 and α = a^*, (18) implies $f^h = f^d =: f$, $y^h = y^d =: y$, $P^h = P^d =: P$, $\Delta_e = \Delta$, and

$$\partial F^h/\partial e = \partial F^d/\partial e = g'(a^*) - d\,P^2 = -(1 - a^* + d\,P^2).$$

$\partial F^i_e/\partial y^j = F^i_j$. Differentiating (18) and evaluating at e = 0 and $a = a^*$ yields

$$\frac{\partial y^i}{\partial e} = \frac{y^3[1 - a^* + d\,P^2]}{d\,r^2[(1-a^*)(2-y) + a^*y]} > 0.$$

Substituting (23) and (32) into (31) yields

Thus, f^i is increasing in e.

$$\frac{\partial y^i}{\partial e} = \frac{4(1-a^*)[a^*y + (1-a^*)(1-y)] + 1}{(1-a^*)(2-y) + a^*y}\;y.$$

Substituting (9) evaluated at α = α* into (33) and (3) into the result yields

$$\{r(1-r)(1-f^h)(a-e)^2 + (1-r)\{[r + (1-r)f^d](a+e)^2$$

$$+ (1-r)(1-f^d)\}\}/2$$

$$[r(1-y^h)(a-e)^2 + (1-r)y^d(a+e)^2 + (1-r)(1-y^d)]/2.$$

As in (25), the expected cost of inflation is

Differentiating (35), evaluating at $e = 0$ and substituting in (34) yields that this cost is decreasing

iff

$$2(y - r\ )a\ *[(1 - a^*)(2 - y) + a\ *\ y]$$

$$- [\ r\, a\ *^2 + (1 - r\ )(1 - a\ *^2\ )]\{4(1 - a^*)[\ a\ *\ y^* + (1 - a^*)(1 - y^*)] + 1\}y < 0.$$

$$2a\ *[(1 - a^*)(2 - y^*) + a\ *\ y]$$

$$- (1 - a\ *^2\ )\{4(1 - a^*)[\ a\ *\ y^* + (1 - a^*)(1 - y^*)] + 1\} < 0$$

$$2(y^* - 1)[(1 - a^*)(2 - y) + a\ *\ y]$$

$$- a\ *\{4(1 - a^*)[\ a\ *\ y^* + (1 - a^*)(1 - y^*)] + 1\}y^* < 0.$$

The LHS of (36) is linear in ρ; hence this is true if

Using the definition of α*, it is easy to verify both of the LHSs in (37) are strictly increasing in y^*. Thus, (37) holds if it holds at $y^* = 1$. This is true.

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Monetary Policy Committees:

Individual and Collective Reputations

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Abstract

This paper looks at how the reputation of a monetary policy making committee is jointly determined with the reputations of its individual members. I ask whether individuals have more or less incentive to gain a reputation for being tough on inflation when they are part of a group. I examine the effect of increased transparency – in the form of publishing the votes of individual members – on individuals' incentives to appear hard nosed. I look at how other institutional features of central banks affect the policy making body's incentive to refrain from inflation.

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