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MONETARY POLITICS AND UNEMPLOYMENT

PERSISTENCE

by

Gunnar Jonsson

INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES
Stockholm University

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Institute for International Economic Studies
S-106 91 Stockholm
Sweden

Monetary Politics and Unemployment Persistence

Gunnar Jonsson*

Institute for International Economic Studies

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Abstract

This paper develops a simple positive model of monetary policy that allows for persistent unemployment. Monetary policy incentives are thus studied in a dynamic context, rather than in the more common repeated game setting. The main results are as follows: When unemployment is persistent, the credibility problem implies both a more severe inflation bias as well as a stabilization bias. However, a simple state contingent performance contract eliminates both biases. Moreover, if policymakers with different preferences alternate in office following general elections, monetary policy becomes subject to various strategic political considerations. Monetary policy is used to influence future policymaking by affecting future governments' incentive constraints, but it is also used to increase the incumbent's probability of re-election. The resulting political business cycle in monetary policy is fundamentally different for left-wing and right-wing oriented governments.

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1. Introduction

Despite ample theoretical and empirical evidence for unemployment persistence,¹ the typical model on credibility issues in monetary policy assumes that supply side disturbances affect employment and output within a given period, but without any lasting effects. In particular, unexpected monetary policy drives unemployment away from its natural level in the current period, but in subsequent periods the unemployment rate is back at its natural level.²

However, if unemployment is persistent - for example due to an insider-outsider mechanism in the labor market - monetary policy has real effects that last for several periods. The unemployment rate turns up as a state variable in the government's stabilization problem which consequently becomes a genuinely dynamic one. This has implications both for the credibility versus flexibility trade-off, discussed by Rogoff (1985), and for the design of an optimal contract between a government and the central bank as analyzed by Persson & Tabellini (1993) and Walsh (1995). But unemployment persistence also implies that monetary policy might be influenced by dynamic political considerations. A government that faces a positive probability of losing an upcoming election to an opponent with potentially different preferences can affect the future policymaker's incentive constraints by pursuing more or less expansionary monetary policy already today. Moreover, if the electorate has preferences over inflation and unemployment, monetary policy might affect the incumbent government's re-election probability. The purpose of this paper is to explore these aspects of monetary policy decisions more thoroughly.

In a simple Barro & Gordon (1983) type model, it is intuitively clear that unemployment persistence affects the incentive to pursue monetary policy. An unexpectedly expansionary policy reduces unemployment both today and tomorrow. Hence, the "in-

¹See for example Blanchard & Summers (1986), Alogoskoufis & Manning (1988) or Lindbeck & Snower (1989).

²The most important contributions to the theory on credibility issues in monetary policy are collected in Persson & Tabellini (1994). See also Cukierman (1992) for an overview of this literature.

flation bias” generated by the time inconsistency problem is more severe the higher the degree of persistence in unemployment.

How elections affect the incentives for the government to pursue monetary policy is a bit more sophisticated. The basic idea in this paper is that the presence of unemployment persistence and electoral uncertainty generate two different strategic aspects of monetary policy. First, a rational government has to take into account what happens if they lose the upcoming election to a party with different preferences. A monetary policy decision that affects the current unemployment rate will also imply a constraint on future monetary policy decisions through the persistence in unemployment. Consequently, if the government cares about the macroeconomic outcomes when out of power, this future incentive constraint affects the incumbent government’s monetary policy decision.³

This kind of strategic aspect of policymaking has been examined with respect to public debt management by Persson & Svensson (1989), Alesina & Tabellini (1990) and Tabellini & Alesina (1990), whereas Cukierman, Edwards & Tabellini (1992) and Svensson (1994) analyze similar strategic considerations with respect to a government’s choice of the tax system or the legal system, respectively. The current paper shows that the argument generalizes to monetary policy whenever unemployment exhibits persistence. However, in this paper it is only the policy instrument (the inflation rate) which is affected by elections, whereas the actual state variable (the unemployment rate) in equilibrium just fluctuates around its natural level.

Second, if the voters are rational, informed and forward-looking, and have preferences over inflation and unemployment outcomes (just as the government), they will take the current unemployment rate into account when choosing among the policy candidates in an election. The reason is again that if future levels of unemployment are related to the current level, the latter will also affect future policy decisions. How attractive the voters

³Alogoskoufis, Lockwood & Philippopoulos (1992) also analyze the credibility problem in monetary policy under unemployment persistence and electoral uncertainty. In particular they show that the “inflation bias” depends on the number of remaining periods to the next election. However, since they assume that the parties only care about the macroeconomic outcomes when in office, there exists no strategic considerations of the kind discussed in the current paper. Alexius (1994) studies issues similar to those in Section 2 and 3 of the current paper, but since electoral uncertainty is not an issue in her model, monetary policy is not used strategically.

find the party candidates will therefore depend on the current unemployment rate. Hence, monetary policy can influence the election outcome.

Although casual reflection might suggest that a model where politicians use policy variables strategically in order to influence election outcomes is a fair approximation of reality, there are surprisingly few models where this behavior is explained within a rational expectations framework. Aghion & Bolton (1990) show that a more conservative government can ensure its re-election by accumulating public debt. The reason is that the median voter will (rationally) fear a left-wing government to default on the outstanding debt. In a similar fashion Milesi-Feretti (1991, 1993) and Milesi-Feretti & Spolaore (1994) argue that a conservative government might want to issue non-indexed debt, choose a floating rather than fixed exchange rate regime or collect public resources inefficiently, in order to either make a more inflation-prone left-wing government look unattractive in the eyes of the voters, or to reduce the importance of government spending from the election agenda. The common feature of these models is the general idea that manipulations of state variables are important for the election outcome.

While theoretically appealing, some of these applications may be of less importance for the voters. In reality the parties differ with respect to a number of policy issues, and it may be more natural to assume that the election outcome is a function of the incumbent party's performance with respect to variables such as aggregate output and unemployment. If there exist uncertainties about the parties preferences or abilities, pre-election manipulations of these aggregate variables may have a signaling effect about the parties relative expected future performance. This "political business cycle" aspect of monetary policy has been studied by e.g. Rogoff & Sibert (1988), Rogoff (1990) and Persson & Tabellini (1990, Ch.5). Contrary to these models, it will be showed below that there exists an ex ante incentive to manipulate monetary policy and unemployment in order to enhance the re-election probability even in the absence of such uncertainties.

The rest of the paper is organized as follows. Section 2 introduces a simple two-period dynamic game between a monopolistic trade union and a government where the unemployment rate is persistent. The normative aspects of this basic model are discussed in Section 3. In Section 4 the analysis is extended by introducing an election between the

two periods. Section 5 presents some empirical evidence for the main implications of the model. Finally, in Section 6 the results are summarized and discussed.

2. A model of monetary policy with persistent unemployment

In this section a two-period model of credibility issues in monetary policy is laid out, where persistence in unemployment is incorporated in a simple way. Two different cases are considered. In the first case the government is assumed to be able to commit itself to a certain policy rule in the beginning of the period, then the private sector (a monopolistic trade union) forms inflation expectations and sets nominal wages, after which a stochastic supply side shock is realized. Finally, inflation is set according to the initially determined rule. In the second case the governments acts in a discretionary way. That is, the private sector forms inflation expectations and determines the nominal wage in the beginning of each period. Then the shock is realized, and finally the government determines inflation implying the determination of the real wage and employment. In both cases the same steps are repeated in period 2. In Section 4 it is assumed that all steps from period 1 are observed before the election takes place. The election outcome is then observed by all agents and the steps from period 1 are repeated.

2.1. The trade union's strategy

Since the focus of this paper is on the policymaker's incentives and behavior under the presence of unemployment persistence, the actual source of the persistence mechanism is modeled in the simplest possible way. Hence, assume that an encompassing monopolistic trade union chooses the nominal wage in order to reach - in expected terms - full employment among the insiders within the union in any period t . The loss function to be minimized is (superindex TU stands for Trade Union):

$$\min_{w_t} E_{t-1}[L_t^{TU}] = E \left(x_t - x_t^{IN} \right)^2, \quad (2.1)$$

where x_t is employment, x_t^{IN} is the employment target equal to the number of insiders in the trade union, (small letters always denote the natural logarithm of a variable), and

E_{t-1} is the expectations operator conditioned on the information available in period $t - 1$. One could alternatively add the real wage as an argument in the trade union's objective function and derive the same results. It is also reasonable to argue that the trade union is concerned about, for example, the inflation rate and level of unemployment benefits. However, as long as those variables are included in the objective function in an additively separable way the results are unaffected.

The important assumption is instead that the trade union's employment target (i.e. the number of insiders) is time varying, following the process:

$$x_t^{IN} = \theta x_{t-1} + (1 - \theta)\bar{x} = x_{t-1} + (1 - \theta)(\bar{x} - x_{t-1}), \quad (2.2)$$

where $0 \leq \theta \leq 1$ is the degree of (un)employment persistence and $\bar{x}$ is the natural level of employment. This "long-run" employment level is assumed to be less than the total number of workers in the economy. Or more specifically, it is assumed that $\bar{x}$ is below the government's employment target. One can either think about this assumption as an unspecified distortion in the labor market, or alternatively define $\bar{x}$ as the number of members of the trade union and assume it to be less than the total labor force. For simplicity reasons it will in the following sections also be assumed that the initial employment level, x_0 , is equal to the natural level, $\bar{x}$.

Expression (2.2) implies that the number of insiders in any period t is equal to a weighted average of employment in the previous period and the natural level of employment, or put differently, the number of insiders is equal to the number of employed in the previous period plus a fraction of the unemployed members in the previous period. The rate at which unemployed members become insiders (or the weight the trade union attaches to the unemployed members in the wage setting process) is captured by $1 - \theta$.

The trade union minimizes (2.1) with respect to the nominal wage, w_t , subject to the constraint of a downward sloping labor demand schedule:

$$x_t = \alpha(p_t - w_t) + \varepsilon_t, \quad (2.3)$$

where p_t is the nominal price level, α is the elasticity of labor demand and ε_t is an

aggregate supply side shock. Assuming that the nominal wages in period t are set before the realization of period t 's price level, we get that

$$x_t = x_t^{IN} + \alpha(\pi_t - \pi_t^e) + \varepsilon_t, \quad (2.4)$$

where π_t and π_t^e are inflation and expected inflation (defined as $p_t - p_{t-1}$ and $p_t^e - p_{t-1}$), respectively. Combining (2.4) with (2.2) implies that employment in period t equals

$$x_t = (1 - \theta)\bar{x} + \theta x_{t-1} + \alpha(\pi_t - \pi_t^e) + \varepsilon_t. \quad (2.5)$$

Hence, the aggregate unemployment rate evolves according to

$$\chi - x_t = \theta(\chi - x_{t-1}) + (1 - \theta)(\chi - \bar{x}) - \alpha(\pi_t - \pi_t^e) - \varepsilon_t, \quad (2.6)$$

where χ is equal to (the natural logarithm of) full employment. In the following I denote the unemployment rate by $u_t = \chi - x_t$, whereas the natural rate of unemployment is denoted by $\bar{u} = \chi - \bar{x}$. The parameter α is normalized to 1 in the following sections. Hence, (2.6) can be written as

$$u_t = \theta u_{t-1} + (1 - \theta)\bar{u} - (\pi_t - \pi_t^e) - \varepsilon_t = \bar{u}_t - (\pi_t - \pi_t^e) - \varepsilon_t, \quad (2.7)$$

where $\bar{u}_t = \bar{u} + \theta(u_{t-1} - \bar{u})$ denotes the "equilibrium rate" of unemployment in period t .

The only important thing for the government in this paper is equation (2.7) above. The aggregate unemployment rate is persistent (here captured by θ) and unexpected monetary policy, implying an inflation-surprise, affects unemployment. There are many different ways of deriving an equation like (2.6). The most important feature with the chosen setup is that it assumes away any dynamic links for the trade unions. The number of insiders is a function of time, but the trade union only cares about employment deviations from the current level of insiders.⁴ Thus, expression (2.7) is the relevant constraint for

⁴Roberts (1989) is an example of a model where the union takes such dynamic considerations into account in its wage setting behavior.

the government in any period t .

2.2. The government's strategy

Given the trade union's strategy I can focus on the government's incentive to pursue monetary policy. The government's loss function in any period t is assumed to be:

$$L_t^J = \pi_t^2 + \lambda^J u_t^2 - K z_t, \quad (2.8)$$

where superscript $J \in \{L, R\}$ stands for type of government (Left or Right), and the parameter $\lambda^J \geq 0$ measures the weight attached to unemployment relative to inflation. The variable z_t is a dummy variable that takes the value of 1 if a given government holds office and 0 if it is in opposition. The parameter K is a "political variable" measuring the extra "kick" the party gets from holding office.⁵ Thus, we have two parties who only differ with respect to how they value inflation versus unemployment. It is assumed that a right-wing oriented government is more conservative than a left-wing oriented government in the sense that $\lambda^R < \lambda^L$.

In a two-period framework, when no election takes place (or when the incumbent party wins the upcoming election with probability one), government J sets π in period 1 so as to solve:

$$\min_{\pi_1} E_1[\mathcal{L}^J] = E_1[L_1^J + \beta L_2^J] \quad (2.9)$$

subject to (2.7), where β is the discount factor. This is a dynamic problem whenever unemployment is persistent. The unemployment rate becomes the state variable, and it is affected by the government's choice of inflation which is the control variable. In general, the optimal monetary policy for the government depends on whether it can or cannot commit itself to a certain policy (or policy rule), i.e. it depends on what kind of commitment technology the government has access to. Although commitments to a certain policy in practice often cannot be made, this case will be used as benchmark

⁵A less cynical view is perhaps to argue that the "kick" variable represents some other policy issue over which the parties have different preferences. An example could be the level of government expenditures. Hence, instead of just getting a "kick" from holding office per se, a given party can reduce its loss when in office by implementing the desired size of government expenditures.

case and the policy outcomes under this assumption will be compared with the case of discretionary monetary policy, which in reality probably is more likely.

2.2.1. Commitment

The ex ante optimal monetary policy is defined as a situation where the government can commit itself to a time dependent inflation rule which is contingent on the supply side shocks. The focus is restricted to the class of linear policy rules since the government's problem is of a quadratic-linear form. Hence, assume that the policy rule is

$$\pi_t = a_t - b_t \varepsilon_t \quad (2.10)$$

where a_t and b_t are time dependent coefficients. These coefficients are to be determined by the government at the outset of the game.⁶ The explicit optimal monetary policy rule is found by solving:

$$\min_{\{a_t, b_t\}} E[\mathcal{L}] = E[L_1 + \beta L_2] \quad (2.11)$$

subject to (2.7), (2.10) and the constraint that expectations are formed rationally. This yields the following expressions for the coefficients:

$$a_1 = a_2 = 0, \quad b_1 = \frac{\lambda + \Phi}{1 + \lambda + \Phi} \text{ and } b_2 = \frac{\lambda}{1 + \lambda} \quad (2.12)$$

where $\Phi = \beta\theta^2\lambda > 0$. Hence, the equilibrium state and time contingent monetary policy rules in the two periods are:

$$\pi_1 = -\frac{\lambda + \Phi}{1 + \lambda + \Phi} \varepsilon_1, \quad (2.13)$$

$$\pi_2 = -\frac{\lambda}{1 + \lambda} \varepsilon_2. \quad (2.14)$$

From this it follows that the equilibrium unemployment rate in the two periods are:

$$u_1 = \bar{u}_1 - \frac{1}{1 + \lambda + \Phi} \varepsilon_1, \quad (2.15)$$

⁶Or alternatively, the coefficients are determined by the government in the beginning of each period.

$$u_2 = \bar{u}_2 - \frac{1}{1 + \lambda} \varepsilon_2. \quad (2.16)$$

The interpretations of these expressions are straightforward. The government stabilizes the shocks effect on unemployment by varying the inflation rate. A negative shock is counteracted by a positive inflation surprise in order to cushion the increase in unemployment, and vice versa.⁷ The degree of this stabilization is an increasing function of λ , the government's concern about unemployment relative to inflation. Moreover, the government stabilizes the effect of a given shock more in the first period than in the second period. The reason is that a shock to unemployment in the first period carries over to the second period implying a larger variance in the second period. Hence, it is optimal to stabilize a bit more in the first period, and the extent of this extra stabilization is an increasing function of the degree of persistence in unemployment, θ , as well as of the discount factor, β . Finally, the rational expectations assumption implies that it is optimal for the government to choose an expected value of the inflation rate equal to zero in both periods, and that unemployment just fluctuates around its natural rate in the assumed persistent way.

2.2.2. Discretion

Consider instead the more realistic case where the government cannot commit to a policy rule, but chooses policy under discretion. That is, the timing of the game is now that monetary policy is determined in each period after inflation expectations have been formed and the supply side shock has been realized. With this timing the optimal policy in period 2 becomes a constraint on the minimization problem in period 1, and the time consistent policy is found by backward induction (restricting ourselves to the subgame perfect equilibria). Solving the optimization problem for period 2, and imposing rational expectations we end up with the following equilibrium expressions for inflation and unemployment:

$$\pi_2 = B_2 - \frac{\lambda}{1 + \lambda} \varepsilon_2, \quad (2.17)$$

⁷Or more specifically, to keep inflation expectations to zero the government must sometime create a negative inflation surprise. This is done when a good shock hits the economy, i.e. when the marginal cost of contractionary policy is relatively low.

$$u_2 = \bar{u}_2 - \frac{1}{1 + \lambda} \varepsilon_2, \quad (2.18)$$

where $B_2 = \lambda \bar{u}_2$ is the "inflation bias" in the second period. Since $\bar{u}_2 = \bar{u} + \theta(u_1 - \bar{u})$ expressions (2.17) and (2.18) appear as constraints on the first period's minimization problem. Hence, the first order condition in period 1 is:

$$E_1[\mathcal{L}_{\pi_1}] = E_1 \left[\frac{\partial(L_1 + \beta L_2^*)}{\partial \pi_1} \right] = G(\pi_1) = 0, \quad (2.19)$$

where * implies that the second period's loss function is evaluated in the Nash equilibrium given by (2.17) and (2.18). Assuming that the initial rate of unemployment is equal to the natural rate, i.e. $u_0 = \bar{u}$, the explicit solutions for inflation and unemployment are (see Appendix for the intermediate steps):

$$\pi_1 = B_1 - \frac{\lambda + \Phi + \Phi \lambda}{1 + \lambda + \Phi + \Phi \lambda} \varepsilon_1, \quad (2.20)$$

$$u_1 = \bar{u} - \frac{1}{1 + \lambda + \Phi + \Phi \lambda} \varepsilon_1, \quad (2.21)$$

where B_1 in (2.20) is the first period's "inflation bias" equal to

$$B_1 = \lambda \bar{u} + \beta \theta (1 + \lambda) \lambda \bar{u}. \quad (2.22)$$

Compared to the equilibrium policy in the commitment case the government here suffers from the well-known credibility problem. In both periods the average rate of inflation is greater than zero, which implicitly is assumed to be the government's inflation target. This inflation bias is positive as long as the weight attached to unemployment relative to inflation, λ , and the natural rate of unemployment are positive.⁸ Notice also that the (unconditional) inflation bias is more severe in the first period than in the second period. This is because a given (unexpected) monetary expansion in the first period reduces unemployment in both periods as well as the inflation bias in the second period. Hence,

⁸Alternatively, if the initial unemployment rate is above the natural rate, the inflation bias in the first period equals $B_1 = \lambda \bar{u} + \beta \theta (1 + \lambda) \lambda \bar{u} + \lambda \theta (u_0 - \bar{u}) (1 + \beta \theta^2 (1 + \lambda))$. Hence, even if $\bar{u} = 0$ it suffices to assume that $u_0 > 0$ to yield a strictly positive inflation bias.

the incentive to expand the economy is stronger in the first period and the equilibrium average rate of inflation is higher. This effect is an increasing function of both the degree of unemployment persistence, θ , and the discount factor, β . However, several simulation exercises (not reported) reveals that for reasonable parameter combinations the *time* dependence of B vanishes - except for the last few periods - as the number of time periods is increased. This is intuitively plausible, since the effect of a given monetary expansion very far into the future will be negligible if $\theta < 1$ and also strongly discounted if $\beta < 1$. The inflation bias is, however, still always *state* dependent in the sense that it is a function of the previous period's unemployment rate which fluctuates from period to period.

More interesting is perhaps that the combination of a credibility problem and persistent unemployment also generates a "stabilization bias". Compared to the optimal monetary policy rule from the commitment case the government now stabilizes the shocks too much in the first period. Although it is *ex ante* indeed optimal to stabilize more in the earlier period, a discretionary government will exaggerate stabilization. This stabilization bias is again an increasing function of the three parameters β , θ and λ , the discount factor, the degree of unemployment persistence and the relative weight attached to unemployment. The intuition is that a shock to unemployment in the first period affects not only unemployment in the next period - as in the commitment case - but also the next period's inflation rate. Since the inflation bias is a function of the previous period's unemployment rate a bad shock is counteracted by a positive inflation surprise both in order to reduce the fall in employment in the two periods and in order to reduce the second period's inflation bias. A good shock will in itself reduce unemployment in both periods as well as the future inflation bias, and the government capitalizes on that by reducing inflation already today implying a negative inflation surprise.

An alternative way of comparing discretion with commitment is to evaluate the difference in the unconditional present discounted value of the loss. Inserting the equilibrium expressions for inflation and unemployment in the two periods into the loss function yields

$$E_0 [\mathcal{L}^d - \mathcal{L}^c] = B_1^2 + \beta(\lambda\bar{u})^2 + \frac{\lambda(1+\lambda)\Phi(\Phi^2 + \Phi(2+\lambda) + 1 + \lambda)}{(1+\lambda+\Phi+\Phi\lambda)^2(1+\lambda+\Phi)^2}\sigma_\varepsilon, \quad (2.23)$$

where superindex d and c denotes discretion and commitment, respectively. The first two terms are due to the inflation bias in period 1 and 2, whereas the last term is the extra loss under discretion due to the stabilization bias. In the special case of $\theta = 0$ the difference reduces to $(1 + \beta)(\lambda \bar{u})^2$ which, of course, is the present discounted value of the loss incurred by the inflation bias when there is no unemployment persistence.

3. Normative implications of the basic model

The modern literature on delegation, optimal contracts and principal-agent relations analyzes how institutions should be designed to alleviate incentive problems. This literature suggests that under certain circumstances it is welfare improving for society at large to let an independent central banker be in charge of monetary policy instead of the government. In this section I briefly analyze these questions within the context of the two-period model where unemployment is persistent. The society at large is supposed to have the same preferences as the government given by (2.8) where $K = 0$. Hence, the concepts of "society at large" and "the government" are used interchangeably.

3.1. The optimal degree of central bank independence

Rogoff (1985) uses an atemporal model to show that the government can make itself better off by delegating monetary policy decisions to an independent central banker with a lower λ . However, this solution involves a credibility versus flexibility trade-off. The gain of lower inflation comes at the expense of larger fluctuations in employment and output. Is this conclusion also true in the above two-period model with unemployment persistence? The answer is yes and the intuition straightforward. Since both the average rate of inflation and the variability in inflation are too high, it is indeed optimal to delegate the monetary policy decision to an agent with a lower λ . This will reduce both the inflation bias and the stabilization bias. However, just as in an atemporal model, the relative weight attached to unemployment should be strictly positive. The head of the central bank should be more "conservative" than the government, but still not "ultra-conservative". Hence, the credibility versus flexibility trade-off is still present.

The proof is found by inserting the equilibrium values for inflation and unemployment for the two periods (expressions (2.17), (2.18), (2.20) and (2.21)) into the governments loss function (expressions (2.8) and (2.9)), defining the society's true weight on unemployment relative to inflation to $\tilde{\lambda}$, and differentiating the present discounted value of the government's loss, $E_0[\mathcal{L}(\lambda)]$, with respect to λ . This yields (the details are given in Appendix):

$$E_0[\mathcal{L}_\lambda(\lambda)] = \lambda \bar{u}^2 A_1 + (\lambda - \tilde{\lambda}) A_2 + \lambda \beta \theta^2 A_3, \quad (3.1)$$

where A_1 , A_2 and A_3 always are positive (see Appendix). From (3.1) we directly see that neither $\lambda = 0$ nor $\lambda \geq \tilde{\lambda}$ are optimal.⁹ Hence, the optimal value of λ is positive but smaller than $\tilde{\lambda}$.

An interesting aspect, compared to the Rogoff (1985) model, is that the presence of unemployment persistence makes it optimal to delegate monetary policy decisions to a more conservative agent even when $u_0 = \bar{u} = 0$, i.e. even when there is no distortion in the labor market. The reason is obvious. Even in the absence of a labor market distortion, shocks to unemployment affects the future credibility problem implying that the "stabilization bias" remains. This bias is reduced the more conservative is the policymaker.

3.2. The optimal contract solution

Although the appointment of an independent conservative central banker in general improves upon the policy outcomes under discretion, Persson & Tabellini (1993) and Walsh (1995) have shown that the government can do even better. By designing a simple linear performance contract that imposes a penalty for inflation rates above the government's target, the central banker can be induced to behave in the ex ante optimal way. In fact, the optimal contract resolves the credibility problem completely without imposing a cost of insufficient flexibility.

The analysis in these two papers is again carried out in a static framework where the inflation bias is the only imperfection generated by the credibility problem. However, in the dynamic framework above with persistent unemployment the credibility problem

⁹The SOC is always fulfilled which in turn implies that the solution $0 < \lambda^* < \tilde{\lambda}$ is unique.

leads both to an inflation bias and a stabilization bias. This may suggest that the optimal contract should be conditioned on factors related both to the inflation bias (as in Persson & Tabellini (1993) and Walsh (1995)) and to the variance in unemployment. This intuition is however partly wrong. A remarkably simple contract will still do the job.

Assume that the government writes a state and time contingent contract with an independent central bank at the outset of the two-period game, and is not allowed to renegotiate the contract later on. The central bank then acts under discretion, i.e. the inflation rate is determined after expectations have been formed and the supply side shock has been realized in each period. The objective function that the central bank maximizes is assumed to be

$$\mathcal{W} = \sum_{t=1}^2 \beta^{t-1} (T_t - L_t) \quad (3.2)$$

where L_t is given by (2.8) with $K = 0$, and T_t is a conditional transfer (positive or negative) that the central bank receives from the government as specified by the contract.¹⁰ Maximizing the expected value of (3.2), imposing rational expectations, and assuming that the transfer is a linear function of the inflation rate in each period, i.e. $T_t = -\kappa_t \pi_t$, yields the following expressions for the inflation rate in the two periods:

$$\pi_1 = -\frac{\kappa_1}{2} + \lambda \bar{u}(1 + \beta\theta) - \frac{\lambda + \Phi}{1 + \lambda + \Phi} \varepsilon_1, \quad (3.3)$$

$$\pi_2 = -\frac{\kappa_2}{2} + \lambda \bar{u} + \lambda \theta(u_1 - \bar{u}) - \frac{\lambda}{1 + \lambda} \varepsilon_2. \quad (3.4)$$

Comparing these expressions with the equilibrium policy rules in the commitment case we find that letting $\kappa_1 = 2\lambda\bar{u}(1 + \beta\theta)$ and $\kappa_2 = 2\lambda\bar{u} + 2\lambda\theta(u_1 - \bar{u}) = 2\lambda\bar{u}_2$ generates the ex ante optimal policy.¹¹ Hence, a contract of the simple form

$$T_t(u_{t-1}, \pi_t; \bar{u}, \beta, \theta, \lambda) = -2 \left(\bar{k}_t + k_t u_{t-1} \right) \pi_t \quad (3.5)$$

¹⁰Following Persson & Tabellini (1993) it is assumed that the transfer, T , can be expressed in the same utility metric as the loss given by L , and that the central bank is risk neutral with respect to these two arguments. Moreover, it is assumed that the government is unaffected by the transfer per se and that the central bank faces no binding participation constraint.

¹¹If the initial unemployment rate is not equal to the natural rate we get that $\kappa_1 = 2\lambda\bar{u}(1 + \beta\theta) + 2\lambda\theta(1 + \beta\theta^2)(u_0 - \bar{u})$ induces the optimal policy.

where $\bar{k}_t$ and k_t are time dependent functions of β , θ , λ and $\bar{u}$, is optimal in the sense that it induces the central bank to pursue monetary policy in a way that is equivalent with the ex ante optimal policy rule.

Three remarks are in order. First, the optimal contract is *state* dependent. The penalty (or reward) should be a function of the previous period's unemployment rate. This is a stochastic but observable (and thus verifiable) variable in any period t , and can be written into the contract. Second, there is no need to worry about the stabilization bias. A contract that removes the incentive to pursue expansionary policy in the future period(s), i.e. a contract that removes the future inflation bias, automatically also removes the incentive to stabilize too much in the current period. These two remarks can be summarized into the observation that the contract is independent of both ε_t and σ_ε . Although supply side shocks - which perhaps by themselves temporarily are private information of the central bank and thus hard to verify - affect the future inflation bias, it is not necessary to condition the contract upon these shocks. The reason is immediate; at the time the shock becomes important for the inflation bias it has turned into something observable, namely unemployment. Third, the optimal contract is not only state dependent but also *time* dependent. However, the time dependence is an artifact of the finite horizon assumption. By induction it is easy to show that in a multi-period setting $\bar{k}_t = \lambda \bar{u} \left(\sum_{i=t}^N (\beta\theta)^{N-i} - \theta \sum_{i=t}^N (\beta\theta^2)^{N-i} \right)$ and $k_t = \lambda \theta \sum_{i=t}^N (\beta\theta^2)^{N-i}$ where N is the number of periods. For any t sufficiently far away from the last period these two expressions can be approximated by $\bar{k} = \lambda \bar{u} (1 - \theta) / (1 - \beta\theta)(1 - \beta\theta^2)$ and $k = \lambda \theta / (1 - \beta\theta^2)$ if $\beta < 1$ and/or $\theta < 1$. Hence, a state dependent contract suffices if the number of periods for which the contract is written is large enough.

Persson & Tabellini (1993) and Walsh (1995) discuss several extensions and variations of the simplest contract solution to the credibility problem. In particular they investigate contracts based on intermediate monetary targets, the role of central bank announcements, and the features of incomplete contracts. Since it is necessary to make only a small modification of the simplest contract when unemployment is persistent, the conjecture is that the most of the results in Persson & Tabellini (1993) and Walsh (1995) also generalize to the dynamic setting studied in the current paper. Still, this could possibly

be an interesting issue for further research.

4. Introducing elections

4.1. Exogenous re-election probabilities

Consider now the case where an election takes place between the two periods. To start with it is assumed that the incumbent government loses the upcoming election to the opponent with the exogenous probability p . In the next section the re-election probability is endogenized.

In the second period the problem is identical to the problem without elections, and the inflation and unemployment outcomes are hence given by (2.17) and (2.18), respectively. Thus, assuming that the government cares about the macroeconomic outcomes also when out of power, expressions (2.17) and (2.18) are still the relevant incentive constraints on the first period's minimization problem. The problem facing the incumbent government in period 1 is then:

$$\min_{\pi_1} E_1[\mathcal{L}^I] = E_1 \left[L_1^I + \beta L_2^{I*} + \beta p (L_2^{O*} - L_2^{I*}) \right] \quad (4.1)$$

subject to the same constraints as previously. Superindex I and O stand for Incumbent and Opponent respectively. Notice that L_2^O denotes the incumbent's loss when the opponent is in power, i.e. the incumbent evaluates his loss (given his preferences) given the preferred policy by the opponent. The first order condition is now:

$$E_1[\mathcal{L}_{\pi_1}^I] = G(\pi_1) + \beta p E_1 \left[\frac{\partial (L_2^{O*} - L_2^{I*})}{\partial \pi_1} \right] = G(\pi_1) + H(\pi_1) = 0. \quad (4.2)$$

The solution to this first order condition yields (following the same steps as without elections, see Appendix) the following equilibrium expressions for inflation and unemployment in the first period:

$$\pi_1 = B_1 + \bar{u}\psi - \frac{\lambda^I + \Phi(1 + \lambda^I) + \theta\psi}{1 + \lambda^I + \Phi(1 + \lambda^I) + \theta\psi} \varepsilon_1, \quad (4.3)$$

$$u_1 = \bar{u} - \frac{1}{1 + \lambda^I + \Phi(1 + \lambda^I) + \theta\psi} \varepsilon_1 \quad (4.4)$$

where $\psi = \beta\theta p \left((\lambda^O)^2 - (\lambda^I)^2 \right)$.

In this equilibrium the government acts strategically. In addition to considering the effects of monetary policy on unemployment and output today, the government takes into account how changes in unemployment - that persist to the next period - affect the incentive constraints for a potentially different government in the next period. Both the average rate of inflation and the extent of stabilization are subject to these considerations. However, as indicated by ψ , this strategic effect works in opposite ways for a right-wing incumbent and a left-wing incumbent.

In expected terms we find that a positive probability of losing an upcoming election induces a right-wing government to pursue more expansionary policy before the election, whereas the opposite is true for a left-wing incumbent. In other words, each government tries to smooth the inflation rate across the two periods. A right-wing government increases inflation already today in order to relax the potential future left-wing government's incentive constraints, so as to achieve a less severe future credibility problem. Similarly, a left-wing government can capitalize on the potential future right-wing government's lower credibility problem by decreasing the inflation rate already today.

The degree of stabilization is also affected by the election. A right-wing government stabilizes more (compared to a situation with no election) in the first period, whereas the opposite again is true for a left-wing government. The reason is that the marginal effect of a change in inflation is stronger the more severe is the credibility problem. At a higher level of expected inflation the marginal cost of a bad shock is even worse and the marginal gain of a good shock is even better. Put differently, since the shock is transmitted into the second period's inflation bias, it is more important to stabilize these shocks the more severe is the credibility problem. Hence, the credibility problem in period 2 and the extent of stabilization in period 1 are positively related.

Finally, it can also be noticed that

$$\partial\psi/\partial p = \beta\theta(\lambda^O + \lambda^I)(\lambda^O - \lambda^I)$$

and

$$\partial\psi/\partial\lambda^O = 2\beta\theta p\lambda^O > 0.$$

Thus, the strategic effects generated by elections are more pronounced the higher the perceived probability of election loss for the incumbent ($\partial\psi/\partial p > 0$ when $\lambda^I > \lambda^O$ but $\partial\psi/\partial p < 0$ when $\lambda^I < \lambda^O$), and the higher the degree of political polarization, defined as how "distant" the opponent is relative to a given incumbent (remember that for a left-wing government "more distant" implies that λ^O is even lower).

4.2. Endogenous re-election probabilities

If the individuals (or the voters) in the economy have preferences over inflation and unemployment outcomes, it is possible that monetary policy affects the election outcome. When unemployment is persistent the current unemployment rate affects future policy decisions. Hence, a rational forward-looking voter takes the current unemployment rate into account when choosing between a left-wing and right-wing party. Therefore, a government's re-election probability is affected by its current monetary policy decision.

Assume that individual (or voter) i has a loss function similar to the government's:

$$L_t^i = \pi_t^2 + \lambda^i u_t^2, \quad (4.5)$$

where λ^i is distributed in some way across the population. Given the policymaker's decision rules we can express the individual's loss function in terms of the previous period's unemployment rate, u_{t-1} , and the parameters λ^i and λ^J :

$$L_t^i(u_{t-1}; \lambda^i, \lambda^J). \quad (4.6)$$

The voter decides whether to cast his vote for the left-wing party or right-wing party by comparing the expected losses for period 2 under the two party regimes. Voter i votes for

the right-wing party if ¹²

$$E_1 \left[L_2^i(u_1; \lambda^i, \lambda^L) - L_2^i(u_1; \lambda^i, \lambda^R) \right] \geq 0. \quad (4.7)$$

By inserting the equilibrium expressions for unemployment and inflation in period 2 into (4.7) we end up with the following condition for having individual i voting for an incumbent right-wing party:

$$\lambda^i \leq \frac{(\bar{u} + \theta(u_1 - \bar{u}))^2 C_0}{C_1 \sigma_\varepsilon} + C_2 \equiv Q(\pi_1) \quad (4.8)$$

where $C_0 = (\lambda^O + \lambda^I)(1 + \lambda^O)^2(1 + \lambda^I)^2$, $C_1 = (2 + \lambda^O + \lambda^I)$, $C_2 = (2\lambda^O \lambda^I + \lambda^O + \lambda^I)/C_1$ and σ_ε is the variance of the supply side shock. Since unemployment, u_1 , is a function of the incumbent's choice of inflation, the government can affect the number of voters who support him by pursuing a more or less expansionary monetary policy. The RHS of (4.8), defined as $Q(\pi_1)$, is thus a quadratic function of the incumbent's policy instrument where $Q_{\pi_1} < 0$ (as long as $E_1[u_2] > 0$)¹³ and $Q_{\pi_1 \pi_1} > 0$.

Expression (4.8) tells us that a right-wing government is going to be preferred by more voters at higher rates of unemployment and at lower variance of the supply side shocks, whereas the opposite is true for a left-wing government. The intuition is the following: a right-wing government has - in the eyes of the voters - a relative advantage with respect to credibility for low-inflation monetary policy. This is more important at higher levels of unemployment since the credibility problem is then more severe. The left-wing government has a relative advantage with respect to output stabilization. This is of course more important the higher the variance of the supply side shocks.

In this setting, the election outcome will be determined by the choice of the median voter. However, the government may be uncertain about the position of the median voter. This can be thought of as some uncertainty about the size of the electorate or the participation rate in the election. But since the government can affect the number

¹²For convenience it is assumed that the right-wing party is preferred if the difference in expected utilities is zero.

¹³ $Q_{\pi_1}(\pi_1) = -2\theta E_1[u_2]C_0/C_1\sigma_\varepsilon$

of supporting voters by setting an inflation rate different from what the private sector expects, the government can also affect the choice of the median voter. Thus, monetary policy has repercussions on the probability of re-election.

In general we have that the probabilities for the parties to win the election are given by

$$prob(\text{Right-wing wins}) = F(Q(\pi_1)) \quad (4.9)$$

$$prob(\text{Left-wing wins}) = 1 - F(Q(\pi_1)) \quad (4.10)$$

where $F(\cdot)$ is the (government's subjective) cumulative distribution function for the position of the median voter.¹⁴ This condition should be regarded as another incentive constraint on the policymaker's decision in the first period. Hence, in period 1 the incumbent government solves

$$\min_{\pi_1} E_1[\mathcal{L}^I] = E_1 \left[L_1^I + \beta L_2^{I*} + \beta p^J (L_2^{O*} - L_2^{I*}) \right] \quad (4.11)$$

where p^J now is given by $F(Q(\pi_1))$ for a left-wing incumbent and $1 - F(Q(\pi_1))$ for a right-wing incumbent. The first-order condition for a left-wing incumbent becomes

$$E_1[\mathcal{L}_{\pi_1}^I] = G(\pi_1) + H(\pi_1) + \beta f(\cdot) Q_{\pi_1} E_1 [L_2^{O*} - L_2^{I*}] = 0 \quad (4.12)$$

whereas for a right-wing incumbent it is

$$E_1[\mathcal{L}_{\pi_1}^I] = G(\pi_1) + H(\pi_1) - \beta f(\cdot) Q_{\pi_1} E_1 [L_2^{O*} - L_2^{I*}] = 0 \quad (4.13)$$

where $f(\cdot)$ is the probability density function associated with $F(\cdot)$. The new term in this first-order condition (compared to the situation where the re-election probability is assumed to be exogenous) is $\beta f(\cdot) Q_{\pi_1} E_1 [L_2^{O*} - L_2^{I*}]$. Hence, the government considers the discounted effect of their monetary policy decision on the probability of losing the

¹⁴Assume for example that λ^i is uniformly distributed over $\underline{\lambda}, \bar{\lambda}$, where the upper support is stochastic and also uniformly distributed, or alternatively, assume that λ^i is normally distributed with a constant variance but where the mean is stochastic and uniformly distributed. The median voter's position is in both cases a stochastic variable with a uniform distribution and, hence, a probability density function that is constant.

election times the expected disutility from being in opposition instead of in office. Since the first order condition is highly non-linear in inflation, the explicit expressions for the inflation and unemployment outcomes given the first period shock are not analytically tractable. However, the interior solution to the first order condition implies that the (unconditionally) expected value for the inflation rate in the first period, i.e. the inflation bias in the first period, for a right-wing incumbent is¹⁵

$$E_0[\pi_1] = B_1 + \bar{u}\psi - \beta\theta f(\cdot) \frac{C_0}{C_1\sigma_\varepsilon} \Psi, \quad (4.14)$$

whereas the condition for a left-wing incumbent is

$$E_0[\pi_1] = B_1 + \bar{u}\psi + \beta\theta f(\cdot) \frac{C_0}{C_1\sigma_\varepsilon} \Psi, \quad (4.15)$$

where

$$\Psi = \left((\lambda^O)^2 - (\lambda^I)^2 \right) E_0 \left[(E_1[u_2])^3 \right] + \frac{(\lambda^O - \lambda^I)^2 \sigma_\varepsilon \bar{u}}{(1 + \lambda^O)^2 (1 + \lambda^I)} + K\bar{u}. \quad (4.16)$$

Still assuming that $E_1[u_2^*] \geq 0$, we find the following: For a right-wing incumbent the expected value of the optimal inflation rate is lower compared to the situation where the re-election probability is treated as an exogenous parameter.¹⁶ But for a left-wing incumbent the sign of Ψ is ambiguous. However, if $E_1[L_2^{O*} - L_2^{I*}]$ is positive (that is, if holding office yields a smaller total loss than being in opposition), then Ψ is positive for a left-wing government as well, and the expected value of the optimal inflation rate is higher than when the re-election probability is exogenous.

Summarizing, monetary policy is subject to two different strategic considerations that work in opposite directions. Further, these strategic considerations work in opposite directions for right-wing and left-wing governments. On the one hand the incumbent wants to affect future policymaking. This aspect is captured by $\bar{u}\psi$ in (4.14) and (4.15), and implies that a right-wing government has an incentive to expand the economy before

¹⁵Solutions might also exist where the government pursues an "extreme policy" and drives the probability of being re-elected towards 1 or 0. However, these corner solutions are ruled out by assuming that the uncertainty about the median voter's position is sufficiently large.

¹⁶Obviously, the condition $E_1[u_2] \geq 0$ is sufficient but not necessary. To get expression (4.16) it is also used that $E_0[E_1[u_2]] = E_0[u_2] = \bar{u}$.

the election ($\psi > 0$), whereas the opposite is true for a left-wing government ($\psi < 0$). On the other hand, the incumbent party can enhance its re-election probability by pursuing a more or less expansionary policy. This effect is captured by the third term in (4.14) and (4.15). A right-wing government wants to pursue contractionary policy before the election in order to increase the unemployment rate and generate a more severe future credibility problem. This would make a left-wing oriented government less attractive in the eyes of the voters. The opposite reasoning applies for a left-wing oriented incumbent. By reducing the unemployment rate a left-wing incumbent reduces the importance of the credibility problem. Instead it is the degree of stabilization which becomes the more important issue of the election agenda. Thus, a left-wing incumbent increases its probability of re-election by pursuing a more expansionary policy before the election.

However, the magnitude of this second effect is always larger for a right-wing incumbent than for a left-wing incumbent. This is because the term $E_1 [L_2^{O*} - L_2^{I*}]$ is larger for a right-wing incumbent than for a left-wing incumbent. As already mentioned, for a left-wing incumbent it is even possible that it is negative, which explains the ambiguous sign of Ψ . More explicitly

$$\Psi = E_0 [E_1 [u_2] \ E_1 [L_2^{O*} - L_2^{I*}]] \quad (4.17)$$

where

$$E_1 [L_2^{O*} - L_2^{I*}] = \left((\lambda^O)^2 - (\lambda^I)^2 \right) (E_1 [u_2])^2 + \frac{(\lambda^O - \lambda^I)^2 \sigma_\epsilon}{(1 + \lambda^O)^2 (1 + \lambda^I)} + K. \quad (4.18)$$

The second and third terms in (4.18) are always positive. The first term is positive if the right-wing government is the incumbent ($\lambda^O - \lambda^I > 0$), but negative for a left-wing incumbent. Thus, for a left-wing incumbent the sign of the whole expression depends on the relative magnitudes of the expected unemployment rate in period 2, the size of the variance of the output shocks and the size of the "kick" variable. If the output shocks or the extra gain from holding office per se are sufficiently large, the loss is greater as an opponent than as an incumbent also for a left-wing oriented party. The explanation for why the opposite might occur is again the story of delegation, discussed in Section 3. Each

party can make itself better off as incumbent by delegating monetary policy to an agent with more conservative preferences. This is what happens when a left-wing government loses the election to a right-wing party. However, a right-wing government who loses the election to a left-wing government is driven even further away from its optimal delegation solution. Although the possibility that a left-wing government is better off in opposition than in office seems rather pathological (and raises the question why the left-wing party exists at all), the general conclusion from this analysis is that the strategic considerations that arise from the opportunity to manipulate the re-election probability should have less pronounced effects for a left-wing oriented government.

Which of the two strategic effects dominates? In general we cannot tell. However, it can be noticed that when the political motivations for holding office is stronger (a large "kick" variable), it becomes more important to win the election, i.e. the second effect is more important. On the other hand, the larger the uncertainty about the position of the median voter, i.e. the larger the variance of the median voter's position,¹⁷ the less effective is monetary policy for influencing the re-election probability. This would make the first strategic effect relatively more important.

5. Preliminary empirical evidence

The empirical importance of the credibility problem for inflation outcomes have been studied by, among others, Grilli, Masciandaro & Tabellini (1991), Cukierman (1992) and Jonsson (1995). These studies typically report results from cross-country regressions of inflation on various institutional variables such as the degree of central bank independence, the exchange rate regime and the government regime. However, the analysis in Section 2 predicts the degree of unemployment persistence to be important for the average rate of inflation. In countries (or during time periods) when the labor market is characterized by a high degree of flexibility, in the sense that unemployment rates are not very persistent, the average rate of inflation should be lower. This variable has been neglected in previous

¹⁷If the position of the median voter is uniformly distributed, a large variance implies that $f(\cdot)$ in expressions (4.12) and (4.13) is a small constant number.

empirical studies.

Table 1 reports the results from regressions where inflation is regressed on the natural rate of unemployment, UNN, or the open unemployment rate in the previous year, $UN(-1)$,¹⁸ the degree of central bank independence, CBI, a dummy variable for right- or left-wing oriented governments, RIGHT, a dummy variable for fixed exchange rate regimes, DEXCH, and the degree of unemployment persistence, UN-PERS. The sample consists of yearly data between 1961-89 for 18 OECD countries.¹⁹ Both simple cross-country regressions on average values for the three decades (column 1) and pooled regressions are performed. The data is pooled either over the three decades (column 2)²⁰ or over the 29 years (columns 3-4).

Unemployment persistence is of course an unobservable variable. As a proxy for this variable I use the estimated coefficient for lagged unemployment in a country by country regression of unemployment on a constant and lagged unemployment using yearly data, 1961-89. In the pooled regressions I allow for decade variations in unemployment persistence by running the regressions of unemployment on lagged unemployment for the first, the middle and the last 15 years of the sample, respectively.²¹

The results support the prediction that unemployment persistence is positively related to the inflation rate. In all regressions the estimated coefficient for UN-PERS is positive, and in the regressions where data is pooled over years the coefficient is significant. However, when data is pooled over decades and in the cross-country regression the estimated coefficient is insignificant (the t-statistics are 1.51 and 1.60, respectively).

¹⁸UNN is defined as the trend component from a HP-filtered series over open unemployment (see Jonsson, 1995, for details). This variable should be regarded as a direct proxy for $\bar{u}_t$. In the model $\bar{u}_t$ is a function of u_{t-1} which explains the alternative regression specification.

¹⁹The data sources in this section are Cukierman (1992) for CBI, Alesina & Roubini (1992) for RIGHT and election dates, OECD Economic Outlook, 54, 1993, for unemployment, and IFS (IMF), 6, 1993, for inflation and money growth. See Jonsson (1995) for a more detailed description of the dataset.

²⁰More precisely, following the classification in Cukierman (1992), data is pooled over the subperiods 1961-71, 1972-79 and 1980-89.

²¹I have also experimented with other definitions of unemployment persistence with qualitatively similar results. If the unemployment series are detrended before the persistence parameter is estimated the results are less supportive of the hypothesis that inflation is positively related to inflation. If the whole sample is used to measure persistence for any period (i.e. when there is no time-variation in the degree of persistence), the results are more in favor of the hypothesis. In all cases one should be aware of the "generated regressor" problem associated with these regressions (see Pagan, 1984).

The other independent variables also come in with the expected signs and most often in a strongly significant way. In particular it can be noticed that in the pooled regressions the estimated coefficients for CBI, RIGHT and DEXCH all come in significantly with the expected negative sign. These variables are all supposed to capture different aspects of λ . The only variable that does not work very well is unemployment. The natural rate of unemployment comes in with the expected positive sign, but it is significant only in the regression where data is pooled over decades, and the estimated coefficient for UN(-1) is insignificant with the wrong sign.

An important objection against the above (empirical) definition of unemployment persistence is that the model predicts that unemployment stabilization covaries with λ . Hence, the empirical series over open unemployment may tend to exhibit more persistence in countries characterized by a higher λ . The used proxy for unemployment persistence would therefore just capture another aspect of λ . The regressions could consequently be plagued by a multicollinearity problem. However, three aspects deserve to be mentioned. First, a simple comparison of the t-statistics for the individual coefficients and R^2 indicates that multicollinearity is not a serious problem. Second, the different aspects of λ all come in with a negative sign whereas the estimated coefficient for UN-PERS is positive. Moreover, a regression of UN-PERS on the other independent variables reveals no correlation between these variables (not reported). Third, it is a well known fact that the theoretical prediction about a negative relation between various aspects of λ and unemployment (or output) variability does not seem to hold empirically (see e.g. Alesina & Summers, 1993, or Jonsson, 1995). Hence, the assumed information advantage for the policymaker that can be used for stabilization purposes might be exaggerated.

When it comes to how elections affect monetary policy, the implications in the current paper are less crisp. Two counteracting effects were identified. A right-wing incumbent has an incentive to pursue more expansionary policy before the election in order to reduce a potential left-wing government's future credibility problem. On the other hand, there also exists an incentive to pursue contractionary monetary policy before the election in order to enhance the re-election probability. For a left-wing incumbent the exactly opposite reasoning applies. In general it was found that the second effect is weaker when

the uncertainty about the median voter's preferences is larger.

Anyway, whether the first effect dominates the second or vice versa, a clear prediction of the analysis is that the incentives to pursue monetary policy before an election is the opposite for a left-wing and a right-wing oriented government. This contrasts with the more common prediction (in the political business cycle literature) that any government tends to pump up the economy before elections.

Alesina, Cohen & Roubini (1992) find some evidence for a pre-electoral increase in money growth rates for the OECD-countries.²² They also tentatively argue that these effects could be different for right-wing and left-wing governments, and also present some weak evidence for this argument. In Tables 2-5, I report the results from some similar regressions. The dependent variable in these regressions is the annual money (M1) growth rate. The independent variables are average money growth for the industrial countries, M1-World, the dummy variable for government regime, RIGHT, and a dummy variable for detecting pre-electoral monetary expansions. This dummy variable takes the value of 1 in the election quarter and the previous quarter, PBC2, the previous three quarters, PBC4, the previous five quarters, PBC6, or the previous seven quarters, PBC8.

The results reported in Table 2 indicate that governments in general not tend to increase money growth in the few quarters preceding an election. The estimated coefficients for the PBC-variables are always close to zero and non-significant. However, right-wing oriented governments are in general associated with a slower rate of money growth, which is consistent with the theoretical model. To control for other country specific variables a fixed effect model is also used. The results from these regressions are very similar and reported in Table 3.

To study if there exists any differences between a left-wing and a right-wing government's behavior before the election I continue by running regressions where the PBC variable is interacted with RIGHT. The results (see Table 4) are in line with the model's prediction. The estimated coefficient for PBC2 is negative and marginally significant (the t-statistic is -1.6), whereas PBC2·RIGHT is positive, in absolute value larger than the

²²More extensive empirical studies over the implications from the political business cycle literature are Alesina (1988) and Alesina & Roubini (1992).

coefficient on PBC2, and significant on the 5-percent level. Hence, left-wing oriented governments tend to pursue contractionary policy in a couple of quarters before the election, whereas the opposite is true (in a significant sense) for right-wing oriented governments. As more quarters are included in the PBC-variable, these effects tend to die out. Finally, as indicated by the negative significant coefficient on RIGHT, it is still true that right-wing oriented governments in general are associated with lower average rates of money growth, as predicted by the model. These results are again quite similar when the fixed effects model is used, see Table 5.

Although the results in this section are not overwhelmingly strong, they tend to go in the predicted direction. Or put in a more modest way, the model's main implications are at least not strongly rejected when confronted with data.

6. Discussion

The main conclusion of this paper is that the policymaker's incentives to pursue monetary policy are affected by the degree of persistence in unemployment. Assuming that the unemployment rate follows an autoregressive process, it is shown that the well known credibility problem generates inflation rates that both fluctuate too much and on average are too high. Moreover, if unemployment is persistent and the government faces a positive probability of losing an upcoming election, monetary policy becomes subject to two different strategic considerations. The government can affect future policymaking, as well as its re-election probability, by pursuing a more or less expansionary monetary policy. The effects of these considerations for the monetary policy decisions are, however, fundamentally different for left-wing and right-wing oriented governments.

The credibility problem in this paper can be solved by writing a state dependent performance contract between the government and an independent central bank. This makes the government unambiguously better off. In the analysis it was assumed that the government's preferences reflected those of society at large. Consequently, the delegation of monetary policy decisions to an independent central bank is also welfare improving.

However, when different parties alternate in office it becomes important *who* writes the

contract with the central bank. To start with, one may wonder if any government prefers to delegate monetary policy to an independent central bank. In the current analysis the answer is affirmative as long as the re-election probability is exogenous. But if monetary policy can be used to affect the probability for re-election, the analysis would probably become more complicated. As discussed by Milesi-Feretti (1991, 1993), any institutional change that reduces the inflation bias in the economy will in general increase (decrease) the probability of a left-(right-) wing party being elected. This argument would tend to reinforce a left-wing incumbent's willingness to delegate monetary policy decisions, whereas a right-wing incumbent's decision would depend on the relative importance of the ideological versus political motivations for holding office.

Moreover, the welfare analysis become somewhat blurred when different parties alternate in office. If the government's preferences coincide with society's in each period, a conjecture is that the optimal contract should be conditioned on the election outcome. However, the incumbent government would have no incentive to include such a clause. A related aspect is discussed in Persson & Tabellini (1993) who emphasize that a trade-off between incentives and information may emerge if the objective functions of the government and society are different. Waller (1992) also addresses the issue of partisan influences on the delegation of monetary policy to the central bank. He shows that although everybody have the same preferences, in a multisector economy there will exist disagreements over the choice of a conservative central banker. In the context of the model in the current paper one could argue that insiders and outsiders, or employed and unemployed, should have fundamentally different preferences regarding the relative importance of inflation and unemployment. However, although the model probably could be amended to include such features, the important assumption is that all voters have preferences over *both* inflation and unemployment stabilization. Exactly how these preferences are defined is less important. Still, questions regarding how different sorts of heterogeneity are related to the design and features of various institutions are important aspects of any normative analysis of the credibility problem in monetary policy. Even though this issue is beyond the scope of the current paper, it would be an interesting topic for further research.

Another important assumption in the analysis is that the electorate's expectations

about future monetary policy (about future inflation and unemployment outcomes) are important enough to determine the election outcome. In reality, parties differ with respect to a number of policy issues which are important for the voters. The "kick" variable can - as previously mentioned - be thought of as representing some other policy issue, such as government expenditures. An interesting extension of the model, then, would be to assume that a fraction of these government expenditures consist of benefits to the unemployed, and let the electorate have preferences over the unemployment benefits which vary with the level of unemployment. This could possibly yield a new channel for how monetary policy can affect the election outcome.

A. Appendix

A.1. The model in Section 2.2.2

The government observes the first period's shock and solves

$$\min_{\pi_1} E_1[\mathcal{L}] = E_1[L_1 + \beta L_2] = E_1[\pi_1^2 + \lambda u_1^2 + \beta \pi_2^2 + \beta \lambda u_2^2] \quad (\text{A.1})$$

subject to (2.17), (2.18) and (2.7) where it is assumed that $u_0 = \bar{u}$. The FOC is given by:

$$E_1\left[\frac{d\mathcal{L}}{d\pi_1}\right] = 2E_1[\pi_1 - \lambda u_1 - \beta \lambda \theta \pi_2 - \beta \lambda \theta u_2] = 0. \quad (\text{A.2})$$

The private sector forms inflation expectations before ε_1 is realized. These expectations are formed rationally by using (A.2). Thus, inserting expressions (2.17), (2.18) and (2.7) into (A.2) yields

$$\pi_1^e = E_0[\pi_1] = E_0[\lambda u_1 + \beta \lambda \theta \pi_2 + \beta \lambda \theta u_2] = \lambda \bar{u} + \beta \theta \lambda^2 \bar{u} + \beta \theta \lambda \bar{u} = B_1. \quad (\text{A.3})$$

The government takes π_1^e as given. This implies that (A.2) can be simplified to (again using (2.17), (2.18) and (2.7)):

$$\pi_1 = \lambda u_1 + \beta \theta \lambda (\lambda \bar{u} + \lambda \theta (u_1 - \bar{u})) + \beta \theta \lambda (\bar{u} + \theta (u_1 - \bar{u})). \quad (\text{A.4})$$

Substituting in (2.7) and rearranging yields

$$\begin{aligned} \pi_1(1 + \lambda + \Phi(1 + \lambda)) &= \lambda(\bar{u} + \pi_1^e - \varepsilon_1) + \\ &\quad \beta \theta \lambda \bar{u}(1 + \lambda) + \Phi(1 + \lambda)(\pi_1^e - \varepsilon_1) \end{aligned} \quad (\text{A.5})$$

where $\Phi = \beta \theta^2 \lambda$. Finally, using expression (A.3) for π_1^e we get that

$$\begin{aligned} \pi_1(1 + \lambda + \Phi(1 + \lambda)) &= \\ (1 + \lambda + \Phi(1 + \lambda))(\lambda \bar{u} + \beta \theta \lambda \bar{u}(1 + \lambda)) - (\lambda + \Phi(1 + \lambda))\varepsilon_1 \end{aligned} \quad (\text{A.6})$$

which generates expression (2.20). Substituting (A.3) and (2.20) into (2.7) yields (2.21).

A.2. The optimal degree of central bank independence

Expression (3.1) in Section 3.1 is found as follows: Inserting (2.17), (2.18), (2.20) and (2.21) into (2.8) and (2.9), and defining the society's true weight on unemployment relative to inflation to $\tilde{\lambda}$ implies that the problem is

$$\min_{\lambda} E_0[\mathcal{L}] = \min_{\lambda} \left[\begin{aligned} & (\lambda \bar{u} + \beta \theta \lambda \bar{u} + \beta \theta \lambda^2 \bar{u})^2 + \left(\frac{\lambda + \lambda \Phi + \Phi}{(1+\lambda)(1+\Phi)} \right)^2 \sigma_{\varepsilon} + \\ & \tilde{\lambda} \left(\bar{u}^2 + \left(\frac{1}{(1+\lambda)(1+\Phi)} \right)^2 \sigma_{\varepsilon} \right) + \\ & \beta \left((\lambda \bar{u})^2 + \left(\frac{\lambda \theta}{(1+\lambda)(1+\Phi)} \right)^2 \sigma_{\varepsilon} + \left(\frac{\lambda}{1+\lambda} \right)^2 \sigma_{\varepsilon} \right) + \\ & \beta \tilde{\lambda} \left(\bar{u}^2 + \left(\frac{\theta}{(1+\lambda)(1+\Phi)} \right)^2 \sigma_{\varepsilon} + \left(\frac{1}{1+\lambda} \right)^2 \sigma_{\varepsilon} \right) \end{aligned} \right] \quad (\text{A.7})$$

where $\Phi = \beta \theta^2 \lambda$. Differentiating with respect to λ yields

$$\frac{dE_0[\mathcal{L}]}{d\lambda} = \left[\begin{aligned} & 2\lambda \bar{u}^2 (1 + \beta \theta (1 + \lambda)) (1 + \beta \theta (1 + 2\lambda)) \\ & + 2(1 + \beta \theta^2 + 2\Phi) \left(\Phi(1 + \lambda) + \lambda - \tilde{\lambda} \right) \sigma_{\varepsilon} / ((1 + \lambda)(1 + \Phi))^3 \\ & + 2\beta \lambda \bar{u}^2 + 2\beta (\lambda \theta^2 (1 - \lambda \Phi)) \sigma_{\varepsilon} / ((1 + \lambda)(1 + \Phi))^3 + 2\beta \lambda \sigma_{\varepsilon} / (1 + \lambda)^3 \\ & - 2\beta \tilde{\lambda} \theta^2 (1 + \beta \theta^2 + 2\Phi) \sigma_{\varepsilon} / ((1 + \lambda)(1 + \Phi))^3 - 2\beta \tilde{\lambda} \sigma_{\varepsilon} / (1 + \lambda)^3 \end{aligned} \right] \quad (\text{A.8})$$

which can be simplified to

$$\frac{dE_0[\mathcal{L}]}{d\lambda} = \lambda \bar{u}^2 A_1 + (\lambda - \tilde{\lambda}) A_2 + \lambda \beta \theta^2 A_3 \quad (\text{A.9})$$

where

$$\begin{aligned} A_1 &= 2(1 + \beta \theta (1 + \lambda)) (1 + \beta \theta (1 + 2\lambda)) + 2\beta \\ A_2 &= 2\sigma_{\varepsilon} [(1 + \beta \theta^2 + 2\Phi) (1 + \beta \theta^2) + \beta (1 + \Phi)^3] / ((1 + \lambda)(1 + \Phi))^3 \\ A_3 &= 2\sigma_{\varepsilon} / ((1 + \lambda)(1 + \Phi))^3. \end{aligned} \quad (\text{A.10})$$

References

- [1] Aghion, P. and P. Bolton (1990), "Government Debt and the Risk of Default: A Political-Economic Model of the Strategic Role of Debt", in *Public Debt Management: Theory and History* (eds. Dornbusch, R and M. Draghi), Cambridge University Press.
- [2] Alesina, A. (1988), "Macroeconomics and Politics", in *NBER Macroeconomics Annual* (ed. Fischer, S.), MIT Press, Cambridge, Massachusetts.
- [3] Alesina, A. and N. Roubini (1992), "Political Cycles in OECD Economies", *Review of Economic Studies*, **59**, 663-688.
- [4] Alesina, A., G. Cohen and N. Roubini (1992), "Macroeconomic Policy and Elections in OECD Democracies", *Economics and Politics*, **4**, 1-30.
- [5] Alesina, A. and L. Summers (1993), "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence", *Journal of Money, Credit and Banking*, **25**, 151-162.
- [6] Alesina, A. and G. Tabellini (1990), "A Positive Theory of Fiscal Deficits and Government Debt", *Review of Economic Studies*, **57**, 403-414.
- [7] Alexius, A. (1994), "Optimal Monetary Policy with Unemployment Persistence", mimeo, Stockholm School of Economics.
- [8] Alogoskoufis, G., B. Lockwood and A. Philippopoulos (1992), "Wage Inflation, Electoral Uncertainty and the Exchange Rate Regime: Theory and UK Evidence", Centre for Economic Policy Research, Discussion Paper No. 657.
- [9] Alogoskoufis, G. and A. Manning (1988), "On the Persistence of Unemployment", *Economic Policy*, **7**, 427-469.
- [10] Barro, R. and D. Gordon (1983), "A Positive Theory of Monetary Policy in a Natural Rate Model", *Journal of Political Economy*, **91**, 589-610.

- [11] Blanchard, O. and L. Summers (1986), "Hysteresis and the European Unemployment Problem", in *NBER Macroeconomics Annual* (ed. Fischer, S.), MIT Press, Cambridge, Massachusetts.
- [12] Cukierman, A. (1992), *Central Bank Strategy, Credibility and Independence*, MIT Press, Cambridge, Massachusetts.
- [13] Cukierman A., S. Edwards and G. Tabellini (1992), "Seigniorage and Political Instability", *American Economic Review*, **82**, 537-555.
- [14] Grilli, V., D. Masciandaro and G. Tabellini (1991), "Institutions and Policies", *Economic Policy*, **13**, 342-391.
- [15] Jonsson, G. (1995), "Institutions and Macroeconomic Outcomes - The Empirical Evidence", *Swedish Economic Policy Review*, forthcoming.
- [16] Lindbeck, A. and D. Snower (1989), *The Insider-Outsider Theory of Employment and Unemployment*, MIT Press, Cambridge, Massachusetts, USA.
- [17] Milesi-Feretti, G.M. (1991), "Do Good or Do Well? Public Debt Management in a Two-Party Economy", Centre for Economic Performance Discussion Paper No. 53.
- [18] Milesi-Feretti, G.M. (1993), "The Disadvantage of Tying their Hands: On the Political Economy of Policy Commitments", Centre for Economic Performance Discussion Paper No. 105.
- [19] Milesi-Feretti, G.M. and E. Spolaore (1994), "How Cynical can an Incumbent be? Strategic Policy in a Model of Government Spending", *Journal of Public Economics*, **55**, 121-140.
- [20] Pagan, A. (1984), "Econometric Issues in the Analysis of Regressions with Generated Regressors", *International Economic Review*, **25**, 221-247.
- [21] Persson, T. and L.E.O. Svensson (1989), "Why a Stubborn Conservative would run a Deficit: Policy with Time-Inconsistent Preferences", *Quarterly Journal of Economics*, **104**, 325-345.

- [22] Persson, T. and G. Tabellini (1990), *Macroeconomic Policy, Credibility and Politics*, Harwood Academic Publishers, Chur, Switzerland.
- [23] Persson, T. and G. Tabellini (1993), "Designing Institutions for Monetary Stability", *Carnegie-Rochester Conference Series on Public Policy*, **39**, 53-84.
- [24] Persson, T. and G. Tabellini (1994), *Monetary and Fiscal Policy, Volume I, Credibility*, MIT Press, Cambridge, Massachusetts, USA.
- [25] Roberts, K. (1989), "The Theory of Union Behavior: Labor Hoarding and Endogenous Hysteresis", manuscript, London School of Economics.
- [26] Rogoff, K. (1985), "The Optimal Degree of Commitment to an Intermediate Monetary Target", *Quarterly Journal of Economics*, **100**, 1169-1190.
- [27] Rogoff, K. (1990), "Equilibrium Political Budget Cycles", *American Economic Review*, **80**, 21-36.
- [28] Rogoff, K. and A. Sibert (1988), "Elections and Macroeconomic Policy Cycles", *Review of Economic Studies*, **55**, 1-16.
- [29] Svensson, J. (1994), "Investment, Property Rights and Political Instability, Theory and Evidence", Working paper, Institute for International Economic Studies, Stockholm University.
- [30] Tabellini, G. and A. Alesina (1990), "Voting on the Budget Deficit", *American Economic Review*, **80**, 37-49.
- [31] Waller C.J. (1992), "The Choice of a Conservative Central Banker in a Multisector Economy", *American Economic Review*, **82**, 1006-1012.
- [32] Walsh, C.E. (1995), "Optimal Contracts for Central Bankers", *American Economic Review*, **85**, 150-167.
- [33] White, H. (1980), "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, **48**, 817-838.

Table 1. Cross-country, pooled-decades, and pooled-years regressions.

18 OECD countries, 1961-89.

Dependent variable: Inflation

Independent variables	(1) Cross-c	(2) Pooled-d	(3) Pooled-y	(4) Pooled-y
CONST	3.18 [0.94]	9.43 [9.50]	8.68 [9.76]	9.46 [9.87]
UNN	0.17 [1.13]	0.20 [2.37]	0.17 [1.08]	
UN(-1)				-0.00 [-0.03]
CBI	-4.93 [-2.43]	-6.33 [-3.30]	-6.36 [-5.43]	-6.75 [-5.53]
RIGHT	-1.56 [-1.52]	-1.94 [-2.23]	-1.03 [-2.67]	-1.22 [-3.15]
DEXCH		-3.24 [-6.03]	-3.04 [-2.94]	-2.93 [-2.78]
UN-PERS	5.58 [1.51]	1.74 [1.60]	1.91 [3.08]	2.20 [3.20]
obs	18	54	522	504
R ²	0.50	0.57	0.28	0.26

Notes: Estimation method is OLS. In regressions 1 and 2 the t-statistics (in brackets) are based on White's (1980) heteroskedasticity consistent covariance matrix. In regressions 3 and 4 the t-statistics are based on a consistent covariance matrix where heteroskedasticity, contemporaneous cross correlations across countries and MA(1) autocorrelations within and across countries are allowed.

Table 2. Pooled regressions, 1960:1-1990:4, 18 OECD countries.
Dependent variable: Money growth

Independent variables	(1)	(2)	(3)	(4)
CONST	0.74 [2.49]	0.71 [2.42]	0.70 [2.35]	0.67 [2.23]
M1-World	0.17 [5.25]	0.17 [5.17]	0.17 [5.15]	0.17 [5.15]
RIGHT	-0.29 [-1.82]	-0.29 [-1.85]	-0.29 [-1.85]	-0.29 [-1.85]
PBC2	-0.02 [-0.09]			
PBC4		0.16 [0.90]		
PBC6			0.15 [0.96]	
PBC8				0.17 [1.09]
obs	2160	2160	2160	2160
R ²	0.79	0.79	0.79	0.79

Notes: Estimation method is OLS. The regressions also include 4 lags of the dependent variable (not reported). t-statistics in brackets.

Table 3. Fixed Effect Model, 1960:1-1990:4, 18 OECD countries.

Dependent variable: Money growth

Independent variables	(1)	(2)	(3)	(4)
M1-World	0.19 [5.84]	0.19 [5.76]	0.19 [5.74]	0.19 [5.73]
RIGHT	-0.19 [-1.09]	-0.20 [-1.12]	-0.20 [-1.12]	-0.20 [-1.12]
PBC2	-0.02 [-0.10]			
PBC4		0.16 [0.92]		
PBC6			0.16 [1.01]	
PBC8				0.18 [1.14]
obs	2160	2160	2160	2160
R ²	0.79	0.79	0.79	0.79

Notes: Estimation method is OLS. The regressions include 18 additionally country dummy variables and 4 lags of the dependent variable (not reported). t-statistics in brackets.

Table 4. Interaction effects, PBC and Government Regime.

Pooled regressions, 1960:1-1990:4, 18 OECD countries.

Dependent variable: Money growth

Independent variables	(1)	(2)	(3)	(4)
CONST	0.80 [2.71]	0.79 [2.63]	0.72 [2.37]	0.69 [2.21]
M1-World	0.17 [5.25]	0.17 [5.17]	0.17 [5.16]	0.17 [5.15]
RIGHT	-0.41 [-2.44]	-0.43 [-2.35]	-0.33 [-1.64]	-0.34 [-1.45]
PBC2	-0.58 [-1.63]			
PBC2-RIGHT	0.94 [2.03]			
PBC4		-0.15 [-0.56]		
PBC4-RIGHT		0.53 [1.48]		
PBC6			0.09 [0.37]	
PBC6-RIGHT			0.10 [0.33]	
PBC8				0.12 [0.51]
PBC8-RIGHT				0.08 [0.26]
obs	2160	2160	2160	2160
R ²	0.79	0.79	0.79	0.79

Notes: See Table 2.

Table 5. Interaction effects, PBC and Government Regime.
Fixed Effect Model, 1960:1-1990:4, 18 OECD countries.
Dependent variable: Money growth

Independent variables	(1)	(2)	(3)	(4)
M1-World	0.19 [5.83]	0.19 [5.75]	0.19 [5.74]	0.19 [5.74]
RIGHT	-0.31 [-1.66]	-0.31 [-1.56]	-0.19 [-0.85]	-0.14 [-0.59]
PBC2	-0.55 [-1.55]			
PBC2·RIGHT	0.88 [1.94]			
PBC4		-0.10 [-0.35]		
PBC4·RIGHT		0.43 [1.22]		
PBC6			0.18 [0.73]	
PBC6·RIGHT			-0.03 [-0.10]	
PBC8				0.24 [0.98]
PBC8·RIGHT				-0.10 [-0.32]
obs	2160	2160	2160	2160
R ²	0.79	0.79	0.79	0.79

Notes: See Table 3.