POLITICAL ECONOMICS AND MACROECONOMIC POLICY

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ABSTRACT

This paper surveys the recent literature on the theory of macroeconomic policy. We study the effect of various incentive constraints on the policy making process, such as lack of credibility, political opportunism, political ideology, and divided government. The survey is organized in three parts. Part I deals with monetary policy in a simple Phillips curve model: it covers credibility issues, political business cycles, and optimal design of monetary institutions. Part II deals with fiscal policy in a dynamic general equilibrium set up: the main topics here are credibility of tax policy, and political determinants of budget deficits. Part III studies economic growth in models with endogenous fiscal policy.

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Political Economics and Macroeconomic Policy*

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1. Introduction

Traditional macroeconomic policy analysis asks the positive question of how the economy responds to alternative, but exogenous, policy actions or rules. Knowing these responses, the analyst can go on to the normative problem of policy advice. The best action or rule is selected, given a specific objective function.

But as macroeconomists, we should also be able to shed light on a more ambitious set of questions. Why is it that we observe such different inflation rates across countries and time? Why did we not observe peace-time accumulations of government debt until the seventies, and why did they arise only in some countries? Why are growth rates so different in different parts of the world? To answer such questions, we need a positive theory, explaining why different countries choose different macroeconomic policies. Early steps towards such a theory were taken about twenty years ago; the credibility problem in macroeconomic policy was introduced by Kydland and Prescott (1977) and Calvo (1978), and the

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first models of electoral and partisan motivations in policymaking were suggested by Nordhaus (1975) and Hibbs (1977). The literature did not really take off until ten years later. But since then "political economy", or "political economics" as we prefer to call it, has been one of the most active fields in macroeconomics—as well as in other branches of economics.[1] With its emphasis on institutions as important determinants of policy, this literature has taken the normative analysis one step further, replacing the question: Which policies should be followed? with the question: What policymaking institutions produce better policy outcomes?

In surveying this literature, we split the material into three parts: Part I deals with monetary policy, Part II with fiscal policy, and Part III with growth. Following the conventional approach in the literature, this division is based both on substance and on methodology. The monetary policy part relies on quadratic loss functions over macroeconomic outcomes and on models incorporating rational expectations, but assuming an ad hoc Phillips Curve. The fiscal policy and growth parts have better microfoundations: agents' preferences, technologies and endowments govern their economic and political interactions in simple, but complete, two-period general equilibrium models. Each part emphasizes the credibility and politics of policymaking, and includes a normative evaluation of different institutions.

The general approach of this line of research is to explain deviations in observed economic policies from a hypothetical social optimum by appealing to specific incentive constraints in the decision problem of optimizing policymakers. The positive analysis focuses on identifying the relevant incentive constraints, while the normative analysis focuses on institutional reforms which may relax them. Despite the separation into three parts, several common themes run throughout the chapter, reflecting similar incentive constraints. It is useful to summarize already here the nature of these incentive constraints, when they arise, and their positive and normative implications.

Desirable policies may suffer from *lack of credibility* when policy decisions are taken sequentially over time (under "discretion") and the government lacks a non-distorting policy instrument, so that the socially optimal policy (the optimal policy in the absence of the incentive constraint) yields a second best outcome. Lack of credibility has several positive implications, and arises both in monetary and in fiscal policy. When the government takes private expectations embodied in private economic decisions as given, it neglects the policy effects running through expectation formation. This way, equilibrium average inflation or wealth

[1] Many recent contributions have been collected in Persson and Tabellini (1994a).

taxes become too high. Moreover, in a Natural Rate world, monetary policy and inflation respond to all shocks, and not only to those over which the monetary authority has an information advantage, as the optimal policy should do. Losing control of private expectations also makes the government a prospective victim of confidence crises: runs on public debt, capital flight, or speculative attacks on the currency. All these events stem from the same fundamental problem: the government is forced to react to self-fulfilling private expectations. Finally, lack of credibility breaks a Modigliani-Miller theorem of government finance, in the same way as incentive constraints in the relationship between owners and managers break the Modigliani-Miller theorem of corporate finance. The composition of the outstanding public debt into nominal or real securities (i.e. indexed to the price level) affects the propensity of a government to rely on unexpected inflation as a source of government revenue. Similarly, the maturity composition of government debt affects the likelihood of debt runs or the interest rate policies that future governments want to pursue. Thus, public debt management can relax future incentive constraints and thereby affect private sector expectations.

Lack of credibility also has implications for institution design. First, it makes delegation to an independent policymaker desirable. Second, it makes it desirable to restrict the tasks of the policymaker. Rather than pursuing loosely defined social welfare, the central bank should target a specific variable, such as inflation, or the money supply, or the exchange rate. If a sufficiently rich incentive mechanism—a complete contract—can be designed and enforced, the credibility problem can be eliminated completely. If state-contingent payments are not feasible, however, or if narrowly defined tasks are inappropriate, as in fiscal policy, incentive mechanisms are necessarily incomplete. But in order to gain credibility, strategic delegation of the decision-making authority to a policymaker with "distorted" preferences may still be desirable. This insight has been exploited in monetary policy, to advocate the benefit of an independent and "conservative" central bank. It also applies to the election of a conservative policymaker facing the task of selecting a wealth tax, or to the delegation of certain policy choices to a foreign government, as in the case of multilateral exchange rate arrangements, or currency boards.[2]

A second incentive constraint is *political opportunism*, by which we mean that

[2]International competition is another institutional device for coping with credibility which is emphasized in the literature but not in this survey. Tax competition, or exchange rate competition, contribute to overcoming a domestic credibility problem because they can reduce the ex-post incentives to unilaterally increase tax rates or inflation.

the incumbent government is prepared to introduce distorted policies to increase its chances of re-election. This incentive constraint typically applies when politicians value holding office *per se* and voters, although rational, are uninformed. We study the consequences of political opportunism in monetary policy only, but the empirical implications for fiscal policy have been spelled out in the literature. The main prediction is an electoral cycle in aggregate demand policies: the incumbent government has an incentive to stimulate the economy just before elections to appear more competent in the eyes of uninformed voters, thus boosting of the probability of reelection. This always leads to an electoral cycle in inflation which, depending on the information advantage of the government, could also increase output volatility at the time of elections. The normative implications tend to reinforce those of the credibility literature: central bank independence and monetary or inflation targets reduce the scope for electoral cycles in monetary policy. Other, deeper reforms, such as who should have the right to call the elections and at what time, remain to be investigated.

Political ideology may shape policy formation if different parties pursue different "partisan" (i.e. ideological) platforms once in office, and if the election outcome is uncertain. Political polarization and political instability thus induce another incentive constraint, which also gives rise to an electoral cycle in aggregate demand, output or public spending. But here the cycle takes place after, rather than before, elections and reflects the winning party's desire to influence economic outcomes. In a dynamic context, this incentive constraint may generate "strategic myopia". The government in office realizes that it may be replaced by a policymaker with different ideological preferences. This gives an incentive to accumulate public debt or postpone investment, so as to influence the future behavior of the opponent. Political ideology also implies strategic manipulation of state variables to influence the voters; for instance, an extremist incumbent may restrain his own future behavior by appropriate institutional reforms to increase his own electability. The strategic manipulation of future opponents and voters are both stronger, the more unstable and polarized the political system. From a normative point of view, the benefits of delegation and targeting in monetary policy are further reinforced. More generally, there may be advantages of institutional checks and balances and institutions that moderate political conflict and policy extremism.

The discussion, so far, applies to a single decision-maker facing static or dynamic incentive constraints. Often, however, decision-making power is dispersed among several political actors. This creates another incentive constraint, which

we may call *divided government.* Examples include coalition governments, soft budget constraints on public enterprises or local governments, veto rights held by key individuals in government or by organized groups in society, or the lobbying activities of special interests. Divided government arises almost exclusively in fiscal policy. In a static context its central implication is over-spending, as every decision-maker fully internalizes the benefits of public spending but only a fraction of the cost: this is the so called "common pool" problem. In a dynamic context, myopic behavior emerges: each decision maker has an incentive not only to over-spend, but also to spend sooner rather than later. Leaving tax revenues for tomorrow can be counter-productive, because they are partly appropriated by other decision-makers. Hence, models of divided government also predict debt accumulation and/or under-investment. In some circumstances, the dispersion of veto rights delays stabilization in an unsustainable fiscal situation.

The most straightforward institutional remedy is to centralize power in the hands of a single decision-maker (a prime minister, or a president, or the Secretary of the Treasury). Alternatively, one might rely on two-stage budgeting, with a decision on aggregate items (total spending, or total borrowing) preceding the decision on how spending is allocated. Such budgetary solutions entail a trade-off between an allocative distortion (a lopsided spending result from centralized decision-making power) and an aggregate distortion (over-spending resulting from inadequate centralization). At a deeper political level, the incentive constraints induced by divided government and political ideology can be traded off. Political reforms that centralize power in the hands of single parties or individuals also exacerbate polarization between the majority and the opposition, and may thus imply that political instability becomes a more binding incentive constraint.

The last incentive constraint considered in this chapter arises when there is income heterogeneity, so that tax policies are motivated by *pressure for redistribution.* The positive implication is that the overall size of government is determined by the extent of inequality in pre-tax income or, in the case of social insurance policies, by inequality in risk. This, in turn, has implications for the link between inequality and measures of economic performance. But the redistributive motive is also an important force shaping the composition of spending or the structure of taxation. Public financial policies that redistribute along different dimensions become non-equivalent, because they are supported by different coalitions of voters. For instance, public debt and social security redistribute across generations in the same way; nevertheless in a political equilibrium they give rise to different allocations, because they redistribute between rich and poor in different ways.

A similar non-equivalence result holds with regard to alternative instruments of geographic redistribution. As in the case of lacking credibility, an incentive constraint on policy formation breaks the Modigliani-Miller theorem of government finance.

Some of the topics covered in this survey partly overlap with a companion survey, Persson and Tabellini (1997). There we cover the literature on public economics and public choice, dealing with static allocation issues in fiscal policy, rather than the intertemporal policy issues emphasized here. Neither do we cover the literature on monetary and fiscal policy in an international context, which is surveyed in Persson and Tabellini (1995).

Each part starts with a separate introduction, in which we highlight a number of empirical regularities, motivating the sections to follow, and provide a more detailed road map. We comment on the original literature both as we go along and in separate "Notes on the Literature" at the end of each section.

Part I

Monetary Policy

The empirical evidence for the (democratic) OECD countries in the post-war period suggests the following stylized facts:

> (i) Inflation rates vary greatly across countries and time. But there is a common time pattern: in most countries inflation was low in the 1960s, but very high in the 1970s; it came down in the 1980s and 1990s in all countries, though at different speeds and to different extents.[3]
>
> (ii) Inflation rates are correlated with real variables, such as growth or unemployment, in the short run. But there is little evidence of a systematic correlation over longer periods. Across countries, average inflation and average growth tend to be negatively correlated or not correlated at all.[4]

[3] See, for instance, Bordo and Schwarz (this volume).

[4] Time-series evidence (for the US) can be found in Stock and Watson (this volume), whereas (broad) cross-country evidence can be found in Barro (1997) and in Fischer (1991)

(iii) There is little evidence of systematic spillover effects between monetary and fiscal policy. Specifically, higher budget deficits are not systematically associated with higher inflation rates.[5]

(iv) Inflation increases shortly after elections; budget deficits tend to be larger during election years; there is also some (not very strong) evidence that monetary policy is more expansionary *before* elections. On the other hand, real variables such as growth or unemployment are not systematically correlated with election *dates*.

(v) Output displays a temporary partisan cycle just *after* elections: newly appointed left-wing governments are associated with expansions, right-wing governments with recessions. This cycle tends to occur in the first half of the inter-election period and is more pronounced in countries with two-party systems. Inflation displays a permanent partisan cycle: higher inflation is associated with left-wing governments.[6]

(vi) Average inflation rates and measures of central bank independence are negatively correlated; this holds up when controlling for other economic and institutional variables (even though the correlation is less robust). There is also some evidence that fixed exchange rates are associated with lower inflation. Real variables, on the other hand, have no systematic correlation with the monetary regime (although the variance of the real exchange rate is lower under fixed than floating exchange rates).[7]

These stylized facts will be taken as the starting point for Part I. Fact (i) clearly calls for a positive model of inflation. Fact (ii) is not well understood and the profession is still searching for a satisfactory model of the joint determination of nominal and real variables. But it suggests that a plausible model would encompass the natural rate hypothesis that the Phillips curve is vertical

[5] See for instance Grilli, Masciandaro and Tabellini (1991). This fact no longer applies if one considers the interwar period or developing countries. In particular hyperinflations are typically associated with fiscal problems.

[6] Statements (iv) and (v) are suggested by the comprehensive study by Alesina and Roubini (1997).

[7] See Grilli, Masciandaro and Tabellini (1991), Cukierman (1992), Jonson (1995a), Eijffinger and de Haan (1996), Mussa (1986), Baxter and Stockman (1989). The robustness of these findings have been questioned by Posen (1993), (1995), however.

and monetary policy is neutral in the long run, while preserving some scope for aggregate demand policies to affect output in the short run. Fact (iii) suggests that abstracting from fiscal policy may not be a bad first approximation. Facts (iv) and (v) indicate that political variables might be important ingredients in successful positive models of inflation and macroeconomic policy. Fact (vi) finally suggests that the institutional features of the monetary regime—particularly the statutes regulating the central bank—should also play a role in a successful model.

In section 2 we formulate and discuss a model of macroeconomic policy and inflation which has been the workhorse in much of the recent literature. We illustrate how credibility problems in monetary policy may arise and how these may be fully or partly resolved by reputation. Section 3 extends the simple model with political institutions and incentives. We illustrate how political business cycles and partisan cycles, consistent with the stylized facts above, may come about. Designing monetary institutions to tackle the distortions created by credibility problems and political cycles is the topic of Section 4.

2. Credibility of monetary policy

In this section, we first formulate and discuss a model of macroeconomic policy and inflation, in the spirit of Kydland and Prescott (1977), Fischer (1977) and Barro and Gordon (1983a), which has been the starting point for much of the recent literature. In Subsection 2.1 we set up the model and make general comments. Subsection 2.2 derives a normative benchmark. In Subsection 2.3 we emphasize how the credibility problems tied to the central banks' ability to temporarily boost the economy result in excessively high equilibrium inflation—the celebrated "inflation bias". Subsection 2.4 briefly illustrates how reputation may provide full or partial solutions to such credibility problems, drawing on the work by Barro and Gordon (1983b), Backus and Driffill (1985), Canzoneri (1985) and others that—in turn—borrow heavily from the literature on repeated games.

2.1. A simple positive model of monetary policy

The demand side of our model economy is represented by:

$$\pi = m + \nu + \mu, \tag{2.1}$$

where π is inflation, m is the money growth rate, ν is a demand (or velocity) shock, and μ is a "control error" in monetary policy. Letting output enter the implicit

money demand function underlying (2.1) complicates the algebra, but does not yield important additional insights. The supply side of the model assumes that nominal wage setting (unilaterally by firms, unilaterally by labor unions, or bilaterally by bargaining between these actors) aims at implementing an exogenous, but stochastic, real wage growth target ω.[8] Letting π^e denote rationally expected inflation, nominal wage growth w is then becomes:

$$w = \omega + \pi^e. \tag{2.2}$$

Employment (or output growth), x, satisfies:

$$x = \gamma - (w - \pi) - \varepsilon,$$

where γ is a (potentially stochastic) parameter, and ε is a supply shock. Combining this relation with (2.2), we obtain an expectations-augmented short-run Phillips curve

$$x = \theta + (\pi - \pi^e) - \varepsilon, \tag{2.3}$$

where $\theta \equiv \gamma - \omega$ can be interpreted as the stochastic natural rate of employment (output growth). We assume that all shocks are i.i.d., orthogonal to each other, have (unconditionally) expected values of zero, well-defined variances $\sigma_\theta^2, \sigma_\varepsilon^2$, and so on.

The timing of events is as follows: (0) rules of the monetary regime may be laid down at an institution design stage; (1) the value of θ is observed both by the private sector and the policymaker; (2) π^e is formed, given the information about θ; (3) the values of ν and ε are observed; (4) the policymaker determines m ; (5) μ is realized together with π and x.

The assumed timing captures the following concerns: Some shocks, related to the labor market, are commonly observable and can therefore be embodied in private sector wage-setting decisions, here captured by expectations formation. Other shocks can only be embodied in policy. This distinction is best interpreted as reflecting the ease with which monetary policy decisions are made, relative to the laborious wage-setting process, but could also reflect a genuine information advantage of the policymaker (which is perhaps only plausible for financial sector shocks). Of course, it is this advantage that allows monetary policy to stabilize the economy. Finally, there is some unavoidable noise in the relation between policy and macroeconomic outcomes.

[8] As is well-known, the "surprise supply" formulation we end up with below could also be derived from a model of price-setting firms, or from a Lucas-style "island model".

Clearly, (2.1) and the assumed information implies that rationally expected inflation is:

$$\pi^e = E(\pi \mid \theta) = E(m \mid \theta), \tag{2.4}$$

where E is the expectations operator. Substituting (2.1) and (2.4) into (2.3), we have:

$$x = \theta + m - E(m \mid \theta) + \nu + \mu - \varepsilon. \tag{2.5}$$

The model thus entails the usual neutrality result: only unanticipated aggregate demand policy affects real variables. But if policy responds to shocks, it can still stabilize employment.

2.2. Ex Ante Optimal Monetary Policy

We follow the rational expectations literature in thinking about policy as a rule. Suppose society has the quadratic loss function:

$$E[L(\pi, x)] = E[(\pi - \pi^*)^2 + \lambda(x - x^*)^2]/2, \tag{2.6}$$

where π^* and x^* are society's most preferred values for inflation and employment, and λ is the relative weight on fluctuations in these two variables. As the objective is quadratic in macroeconomic outcomes, which in turn are linear in the shocks, the optimal policy rule is of the form:

$$m = k + k^\theta \theta + k^\nu \nu + k^\varepsilon \varepsilon; \tag{2.7}$$

that is, policy potentially responds to all shocks observable to the policymaker. Suppose furthermore that the policymaker can make a *binding commitment* to the rule (2.7) at the institution design stage (0), i.e. before the observation of θ.

Clearly, since $E(\nu) = E(\varepsilon) = 0$, this implies private sector expectations:

$$E(m \mid \theta) = k + k^\theta \theta. \tag{2.8}$$

By (2.1), (2.5), (2.7) -(2.8) macroeconomic equilibrium under the rule is:

$$\pi = k + k^\theta \theta + (k^\nu + 1)\nu + k^\varepsilon \varepsilon + \mu \tag{2.9}$$

$$x = \theta + (k^\nu + 1)\nu + \mu + (k^\varepsilon - 1)\varepsilon. \tag{2.10}$$

What is the optimal rule? Substitute (2.9)-(2.10) into (2.6), take expectations over all shocks, and set the derivatives of the resulting expression with regard to the intercept and the slope coefficients in (2.7) equal to zero. The following results emerge:

(i) $k = \pi^*$ and $k^\theta = 0$. The optimal rule provides an "anchor for inflationary expectations". Expectations are right where society wants them to be, namely at the preferred rate of inflation: $E(\pi \mid \theta) = \pi^*$. The optimal rule is thus neither conditional on the observable shock to the natural rate, θ, nor on society' s output target, x^*. Such conditionality would be embodied in expectations; it would therefore do nothing to stabilize employment, only add costly noise to inflation.

(ii) $k^v = -1$. Demand (velocity) shocks are fully stabilized. As policy also operates via aggregate demand, a complete stabilization of demand shocks nullifies their effects on inflation as well as on employment.

(iii) $k^\varepsilon = \lambda/(1+\lambda)$. Supply shocks are stabilized according to the policymaker's trade off between inflation and employment fluctuations. The higher the weight on employment, the more these shocks are stabilized.

The optimal state-contingent policy rule can thus be written as:

$$m = \pi^* - \nu + \frac{\lambda}{(1+\lambda)}\varepsilon.$$

Macroeconomic outcomes–indexed by R—when the rule is followed are:

$$\pi^R = \pi^* + \frac{\lambda}{1+\lambda}\varepsilon + \mu \tag{2.11}$$

$$x^R = \theta - \frac{1}{1+\lambda}\varepsilon + \mu. \tag{2.12}$$

Results such as these have been—and continue to be—very influential for academic economists' thinking about policy. They suggest that delivering low inflation and stable employment is essentially a technical (not a strategic) problem: inflation can be kept low by clearly announcing a rule aiming at low average inflation. Demand shocks should be completely stabilized. The inflation and employment consequences of supply shocks should be traded off according to society's preferences. Control errors are unavoidable, but can perhaps be reduced by better forecasting or operating procedures in monetary policy. Even though this picture is too rosy for a realistic positive model of macroeconomic policy, it still provides a useful normative benchmark that we can use to evaluate the outcome in the positive models below.

In the remainder of the paper, we simplify the stochastic structure by setting $\nu = \mu = 0$. Demand shocks, as we saw, present no problem for the policymaker in this class of models, provided that they can be identified in time and that there are no other policy goals such as interest rate smoothing. Control errors do present problems, but are unavoidable. [9] With these simplifications, there is no meaningful distinction in the model between m and π. For simplicity, we therefore assume that the policymaker sets π directly. Why don't we eliminate the shocks to the natural rate θ, with a similar motivation? The answer is that such shocks do not affect the solution under commitment, whereas they do affect policy in an interesting way under alternative assumptions about the policymaking process.

2.3. Discretion and credibility

In reality, decisions on monetary policy are taken sequentially over time, rather than once and for all. Assuming *ex ante* commitment to a state-contingent policy rule rhymes badly with this practice. In our static model, reality is better captured by an alternative timing: policy is chosen under "discretion" when the policy instruments are set at stage (4) above, after wages have been set (π^e formed) and shocks have been realized. This adds an *ex post* incentive compatibility condition to our positive model: policy has to be optimal *ex post*—when it is actually enacted. This additional credibility constraint makes the solution less advantageous for the policymaker (and society).

The policymaker still sets π (that is, m), seeking to minimize the loss in (2.6). But all uncertainty has been resolved at the new decision stage, so the expectations operator is redundant. Consider how the loss is affected by a marginal expansion, for given π^e and ε. Using (2.3) and (2.6), we have

$$\frac{dL(\pi,x)}{d\pi} = L_\pi(\pi,x) + L_x(\pi,x)\frac{dx}{d\pi} = (\pi - \pi^*) + \lambda(\theta + (\pi - \pi^e) - \varepsilon - x^*), \quad (2.13)$$

where a subscript denotes a partial derivative. By (2.13), the benchmark policy rule is not incentive compatible under discretion. Suppose that wage setters believed in an announcement of that rule, implying that $\pi^e = \pi^*$. Using the

[9] Abstracting from control errors is innocuous as long as the public can monitor monetary policy perfectly and as long as policymaker competency and efforts are exogenous. Below, we comment on where control errors would matter. Moreover, in a richer (dynamic) setting with expectactions entering the aggregate demand function, demand shocks and control errors may give rise to incentive problems similar to those discussed below.

optimal-rules outcome in (2.11)-(2.12), and evaluating the derivative in (2.13) at the point prescribed by the *ex ante* optimal policy rule, we get:

$$(\frac{dL(\pi^R, x^R)}{d\pi})_{|\pi^e=\pi^*} = \lambda(\theta - x^*).$$

If preferred employment (output) exceeds the natural rate (if $x^* > \theta$), an expansion reduces the loss, rendering the *ex ante* sub-optimal policy rule *ex post* inoptimal. Once wages have been set, the marginal inflation cost—the first term on the RHS of (2.13)—is always smaller than the marginal employment benefit—the second term on the RHS.[10] Thus, the *ex post* incentive-compatibility constraint is binding and the low-inflation rule is not credible.

A credible policy must simultaneously fulfill two conditions: (i) the policy is *ex post* optimal, $\frac{dL}{d\pi} = 0$, given π^e and ε; (ii) expectations are rational, i.e. $\pi^e = E(\pi \mid \theta)$. In game-theoretic terms, those are the conditions for a Nash Equilibrium in a game with many atomistic private wage setters (desiring to minimize the deviation of the realized real wage $w - \pi^e$, from the targeted real wage ω) moving before the policymaker.[11] Condition (i) requires that the expression in (2.13) equals zero. Taking expectations of that expression, condition (ii) can be expressed as $E(\pi \mid \theta) = \pi^* + \lambda(x^* - \theta)$. Combining the two conditions, we get:

$$\pi^D = \pi^* + \lambda(x^* - \theta) + \frac{\lambda}{1+\lambda}\varepsilon, \tag{2.14}$$

where the D superscript stands for discretion. The employment outcome remains as in (2.12) except that $\mu = 0$ by assumption. If we assume $x^* - \theta > 0$, the discretionary policy outcome in (2.14) and the commitment outcome in (2.11)-(2.12) illustrate the celebrated "inflation bias" result: equilibrium inflation is higher under discretion than under commitment to a rule, whereas employment is the same, independently of the policy regime. The bias is more pronounced the higher is λ (the more valuable is employment on the margin) and the higher is x^* relative to θ (the higher is preferred employment relative to the natural rate); both factors contribute to a greater "temptation" for the policymaker to exploit

[10] To make this more clear, consider the case when $\varepsilon = 0$, such that the optimal rule prescribes the policy $\pi^R = \pi^*$, implying $x^R = \theta$. Then, by (2.13) the marginal inflation cost is actually zero (to the first order), whereas the marginal employment benefit is positive (if $x^* > \theta$).

[11] The equilibrium would also apply identically to a simultaneous game between the government and a single trade union. If the union moved before the government, the equilibrium might differ slightly, but the fundamental incentive problem would not be affected

his short-run ability to boost employment by expansionary policy once wages are fixed. Since the natural rate θ is random, whereas the employment target x^* presumably is constant (or at least more stable than θ), inflation is also more variable under discretion than under the rule.

The inflation bias is due to two key assumptions. The first is the sequential timing of monetary policy decisions. The second is the assumption that the employment target is higher than the natural rate, that is: $x^* - \theta > 0$. This assumption must reflect a lack of policy instruments: some distortion in the labor or product market keeps employment too low. The government does not remove this distortion; either because it does not have enough policy instruments or because the distortion is kept in place by some other incentive problem in the policy-making process. These assumptions capture important features of monetary policymaking in the real world.

In this static model, the policy response to the supply shock ε is not distorted: shocks are stabilized in the same way under discretion and commitment. This equivalence does not, however, carry over to a dynamic model where employment (but not the employment target) is serially correlated. In such a dynamic model, the future inflation bias depends on current employment (since the future equilibrium employment depends on current employment). To reduce the future inflation bias, the policymaker thus responds more aggressively to supply shocks under discretion than under commitment. Moreover, the systematic inflation bias increases, as an *ex post* expansion today expands both current and future employment.[12]

The "distortion" in the policymaking process can be described as follows: under discretion, the policymaker (correctly) fails to internalize the mapping from actual policy to expected policy. He is not being foolish: he really cannot influence private sector expectations. This is what we mean when saying that a (low inflation) policy "lacks credibility". Yet, actual policy maps into expected policy in equilibrium when private agents have rational expectations. Under commitment, on the contrary, the policymaker internalizes this equilibrium mapping; indeed announcing the optimal policy rule brings rationally expected inflation down precisely to the preferred rate of inflation. The conclusions are pretty stark. First, a desirable policy rule does not become credible just by announcing it; is thus point-

[12]Svensson (1997a) proves this result formally, drawing on earlier work by Lockwood, Miller and Zhang (1995) and Jonsson (1995b). See also Obstfeld (1997) for a related result in a dynamic model of seignorage. Beetsma and Bovenberg (1997), show that stabilization bias arises also when monetary and fiscal policy are pursued by different authorities with diverging objectives.

less to recommend a non-credible policy rule. Second, the inability to commit to a policy rule has obvious costs. Institutional reforms that give policymakers greater commitment ability can thus be desirable.

This simple model of monetary policy credibility is often criticized with reference to the plausible objection that "real world policymakers are not trying to surprise the private sector with unexpected inflation". But this criticism misses the point of the analysis. The model does not predict that the policymaker tries to generate policy surprises *in equilibrium*. On the contrary, in equilibrium the policymaker would like to bring inflation down but refrains from doing so as his lack of credibility would turn any anti-inflationary policy into a recession. In other words, the model predicts an inertia of expectations to a suboptimally high inflation rate, and a difficulty in curbing these expectations down to the socially efficient rate. What the model does rely on, however, is an assumption that the policymaker would want to generate policy surprises *outside of equilibrium* to a more favorable outcome. Is this a plausible positive model of inflation ? Some observers, like McCallum (1996), apparently do not think so. A convincing rebuttal should address the question already posed by Taylor (1983), who—in his discussion of Barro and Gordon (1983b)—asked why society has not found ways around the credibility problem in monetary policy, when it has found ways around the credibility problem of granting property rights to patent holders. This question is best addressed in connection with a closer discussion of the institutions of monetary policymaking, so we come back to it in Section 4.

What are the observable implications of the analysis so far? One implication is that a binding credibility problem would show up by the central bank reacting to variables that entered the private sector's information set (before policy is set), whereas the reaction function would not include such variables under commitment. Hence, the unconditional variance of inflation is higher under discretion. If the credibility problem is caused by a high λ, the model indeed predicts a positive correlation between average inflation and the variance of inflation, in conformity with international evidence.

The discretionary model also suggests a plausible explanation of the secular trend in inflation experienced by the industrialized countries and mentioned in the introduction. The fifties and sixties were a period without serious supply shocks and with a low natural rate of unemployment (low variance of ε, high realizations of θ), which made it easy to keep inflation low. Enter the seventies with severe supply shocks (high realizations of ε) pushing up the natural rate (to capture this in the model would require serial correlation in employment) and inflation; we

may then interpret the rise in inflation as the result of policymakers maintaining their earlier high employment objectives (x^* staying constant or falling by less than θ). The gradual decline in inflation from the mid eighties and onward, despite continued high natural rates (in Europe), can be understood to derive from policymakers gradually adapting their employment ambitions to the structural problems in the labor market (x^* drifting downwards over time) and from the institutional reforms in central banking arrangements in a number of countries in the recent decade. Naturally, learning from past policy mistakes is also likely to have played an important role. To date, time-series implications of this type have received too little attention in the credibility literature.[13] Instead, the literature has focused on normative issues of institutional reform, and to some extent on explaining cross-sectional differences in macroeconomic outcomes by different institutions.

2.4. Reputation

One can criticize the simple model discussed so far for being static and failing to capture the repeated nature of policymaking. Specifically, the model rejects repeated interaction with the public and hence ignores reputational forces. A branch of the literature has studied reputational forces in detail. The main result is that a link from current observed policy to future expected policy can indeed discipline the policymaker and restore credibility. With repeated interaction, a policymaker operating under discretion faces an intertemporal trade-off: the future costs of higher expected inflation, caused by expansion today, may more than outweigh the current benefits of higher employment.

To illustrate the idea, consider the model of Subsection 2.3, repeated over an infinite horizon. The policymaker's intertemporal loss function, from the viewpoint of some arbitrary period s, can be written:

$$E_s[\sum_{t=s}^{\infty} \delta^{t-s} L(\pi_t, x_t)], \tag{2.15}$$

where δ is a discount factor. To simplify the algebra, we assume the static loss function to be linear, not quadratic, in employment:

$$L(\pi, x) = \pi^2/2 - \lambda x. \tag{2.16}$$

[13] See, however, the recent papers by Parkin (1993), Barro and Broadbent (1995) and Broadbent (1996).

With the simpler loss function, the *ex ante* optimal policy rule is simply to have zero inflation all the time and to accept employment $x = \theta - \varepsilon$ (since $\pi^* = 0$ and employment volatility is not costly), while the static equilibrium under discretion has inflation equal to λ and employment still at $x = \theta - \varepsilon$.

We now show that, even under discretion, reputation can indeed create strong enough incentives to enforce zero inflation. As an example, assume that wage setters set wages on the basis of the following expectations:

$$\pi_t^e = \begin{cases} 0 & iff \quad \pi_v = \pi_v^e \quad v = t-1, ..., t-T \\ \lambda & otherwise \end{cases} \tag{2.17}$$

Equation (2.17) says that wage setters trust a policymaker who sticks to zero inflation in period t to continue with this same policy in the next period. But if they observe any other policy in period t, they lose this trust and instead expect the discretionary policy to be pursued for the next T periods. A policymaker confronted with such expectation formation, in effect, faces a non-linear incentive scheme: he is "rewarded" for sticking to the rule, but he is "punished" if deviating from it. Consider a policymaker that enjoys the trust of the public (i.e. $\pi_s^e = 0$). When is the punishment strong enough to outweigh the immediate benefit of cheating on the rule?

To answer formally, note that the optimal deviation (found by minimizing the static loss function, given ε and $\pi_s^e = 0$) is simply $\pi_s = \lambda$, thus implying employment $x_s = \lambda + \theta_s - \varepsilon_s$. After some algebra, the current benefit from cheating can then be expressed as:

$$B = L(0, \theta_s - \varepsilon_s) - L(\lambda, \lambda + \theta_s - \varepsilon_s) = \lambda^2/2. \tag{2.18}$$

Due to the simpler loss function, the benefit is independent of the realizations of θ and ε. The punishment comes from having to live with higher expected and actual inflation in the next T periods. Why *higher* actual inflation? As the expectations in (2.17) are consistent with the static Nash Equilibrium outcome in Section 2.3, it is indeed optimal for the policymaker to bear the punishment if it is ever imposed. In other words, the private sector's expectations will be fulfilled,

both in and out of equilibrium.[14] Thus, the cost of a deviation is:

$$\begin{aligned} C &= E_s[\sum_{t=s+1}^{T} \delta^{t-s}(L(\lambda, \theta_t - \varepsilon_t) - L(0, \theta_t - \varepsilon_t))] \\ &= \delta\frac{(1-\delta^T)}{(1-\delta)}\lambda^2, \end{aligned} \tag{2.19}$$

which is clearly stationary if we assume that θ is i.i.d over time. Obviously, the policymaker finds it optimal to stick to the zero inflation rule as long as $B \leq C$. Inspection of (2.19) and (2.18) reveals that this is more likely the higher the discount factor δ and the longer the horizon T for which inflationary expectations go up after a deviation.

Many extensions of this basic framework are feasible; and some have been pursued in the literature. For instance, if we retained the quadratic loss function of the previous subsection, the benefit of cheating would be an increasing function of the actual realization of θ, while the cost would depend on the variance and the expected value of θ. As a result, even with reputation, equilibrium inflation would continue to depend on the actual realization of θ: a high value of θ makes the incentive-compatibility condition more binding, as it increases the benefit B but not the cost C. The lowest sustainable inflation rate (defined by the condition that $B = C$) would be an increasing function of θ. Thus, reputation would reduce average inflation but would not change the main positive implications of the model of the previous section.

Canzoneri (1985) studied a framework with shocks to inflation that are unobservable to private agents both *ex ante* and *ex post*; an example could be the μ shocks in (2.1) above. If observed inflation exceeds some threshold, such monitoring problems give rise to temporary outbreaks of actual and expected inflation, because the public cannot clearly infer whether high inflation is due to large shocks or to deliberate cheating. Backus and Driffill (1985), Barro (1985), Tabellini (1985) and (1987) and Vickers (1986) studied reputational models where the private agents are uncertain about the policymakers "type" (as his λ in the model above). They use the information embodied in current observations of policy to learn about this type, and the policymaker sets policy optimally with a

[14] By this argument the analysis identifies a sequentially rational (subgame perfect) equlibrium. For other expectation formation schemes, in which expectations changed more drastically after a deviation, we would have to impose a separate incentive-compatibility constraint, namely that it is indeed optimal to carry out and bear the punishment after a deviation (see Persson and Tabellini (1990, ch 3) on this point).

view to this private learning process. Such models illustrate how a "dovish" policymaker (someone with a high λ or without access to a commitment technology) can temporarily borrow the reputation of a "hawkish" policymaker (someone with a low λ or with access to a commitment technology). They also illustrate how a hawkish policymaker may have to impose severe output costs on the economy to credibly *establish* a reputation. This is differs from the equilibrium considered above, where the policymaker merely *maintains* a reputation he is lucky enough to have.

Cukierman and Meltzer (1986) also studied credibility and private learning but in a richer dynamic setting, where parameters in the central bank's objective function vary stochastically over time.

The central insight of the reputation literature is that ongoing interaction between a policymaker and private agents can mitigate the inflation bias and restores some credibility to monetary policy. Whether the problem is entirely removed is more controversial, however, and depends on details of the model and the expectations formation mechanism. Even though the insight is important, the reputation literature suffers from three weaknesses. As in the theory of repeated games, there is a multiple-equilibrium problem, which strikes with particular force against a *positive* model of monetary policy. Moreover, the problem of how the players somehow magically coordinate on one of the many possible equilibria is worse when the game involves a large number of private agents rather than a few oligopolists. Finally, the normative implications are unclear. The existence of reputational equilibria with good outcomes is not helpful to a country where inflation is particularly high at a given moment in time. The lack of suggestions for policy improvements is another reason why researchers largely turned away from reputational models, towards an analysis of the policy incentives entailed in different monetary policy institutions.[15]

2.5. Notes on the Literature

Textbook treatments of the general material in this section can be found in Persson and Tabellini (1990, Chs. 1-4), and in Cukierman (1992, Chs. 9-11, 16), both covering the literature up to around 1990. The literature on credibility in

[15]Some interesting recent work, however, suggests an institutional interpretation of some of these reputational equilibria arguing that some institutional arguments are more conducive to reputation building than others; see Jensen (1996), al Nowaihi and Levine (1996) and Herrendorf (1996). The ideas are related to Schotter (1981) and to the view that international institutions may facilitate cooperation in trade policy (see Staiger (1995) for a survey).

monetary policy starts with Kydland and Prescott (1977), who included a brief section with the basic insight of the static model in Section 2.3. Barro and Gordon (1983a) formulated a linear-quadratic version and pushed its use as a positive model of monetary policy. Calvo (1978) studied the credibility problem of monetary policy in a dynamic model, where the short-run temptation to inflate arises for public-finance reasons. Obstfeld (1997) provides an insightful analysis of the credible policies in a dynamic seignorage model. Dynamic models of the employment motive to inflate were developed by Lockwood and Philippopoulus (1994), Lockwood, Miller and Zhang (1995), and Jonsson (1995b). Parkin (1993) argues that the great inflation of the seventies can be explained by an increase in the natural rate in the kind of model dealt with here.

Barro and Gordon (1983b) started the theoretical literature on reputation in monetary policy, drawing on the work on trigger strategies in repeated games with complete information. Backus and Driffill (1985), Tabellini (1985) and (1987), and Barro (1986) developed incomplete information models of reputation, emphasizing how a dovish policymaker can borrow a reputation from a super-hawkish policymaker who only cares about inflation and not at all about employment. Vickers (1986) instead emphasized how a policymaker who seriously wants to fight inflation may have to engage in costly recessionary policies in order to signal his true identity to an incompletely informed public. Reputation with imperfect monitoring of monetary policy was first studied by Canzoneri (1985). Grossman and van Huyck (1986) and Horn and Persson (1988) studied reputational models dealing with the inflation tax and exchange rate policy, respectively. Rogoff (1987) includes an insightful discussion about the pros and cons of the reputational models of monetary policy.

3. Political Cycles

The empirical evidence for the democratic OECD countries during the post-war period suggests systematic pre-electoral expansionary policies—fact (iv) in the introduction—as well a post-election partisan cycle in real variables and inflation—fact (v). These "facts" vary somewhat depending on the country and the time period considered and their robustness has not been checked with the same standards as, say, in the modern macroeoconometric literature attempting to identify innovations in monetary policy.[16] But they are interesting enough to

[16]Faust and Irons (1996) criticize the literature on partisan cycles in the US for failing to control for simultaneity- and omitted-variable bias and argue that the support for a partisan

motivate this line of research.

The empirical evidence also indicates that there is so-called "retrospective voting": the likelihood of election victory for the incumbent government or legislature depends largely on the state of the economy; as expected, a higher growth rate boosts the re-election probability of the incumbent.[17] It is then tempting to "explain" fact (iv)—the political business cycle—by opportunistic governments seeking re-election by taking advantage of the voters' irrationality. But how can we claim that the same individuals act in a rational and forward-looking way as economic agents, but become fools when casting their vote? One of the puzzles any rational theory of political business cycles must address is thus how to reconcile retrospective voting with the evidence of systematic policy expansions before elections. This puzzle is addressed in subsection 3.1, under the assumption that voters are rational but imperfectly informed, and that the government is opportunistic and mainly motivated by seeking re-election. This section builds on work by Lohman (1996), Rogoff and Sibert (1988) and Persson and Tabellini (1990).

The correlations between macroeconomic outcomes and the party in office are easier to explain, provided that we are willing to assume policymakers to be motivated by ideology (have preferences over outcomes) and, once in office, prepared to carry out their own agenda. These assumptions lead to a theory of "partisan" political business cycles, which is summarized in subsection 3.2, following the pioneering work by Alesina (1987).

3.1. Opportunistic Governments

Throughout this section, we discuss political business cycles in the simple monetary policy model of Section 2, as does most of the literature. But the ideas generally apply to aggregate demand management, including fiscal policy. We deal in turn with "moral hazard" and "adverse selection", where the labels refer to the informational asymmetry between voters and the elected policymaker.

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cycle in output is much weaker than what a cursory inspection of the data would suggest. Mishra (1997) uses modern panel data estimation techniques trying to control for similar biases in a panel of 10 OECD countries. He finds strong support for a post-electoral partisan cycle and weaker support for a pre-electoral cycle.

[17] See, for instance, Fair (1978).

3.1.1. Moral Hazard in Monetary Policy

The model in this first subsection is adapted from Lohman (1996), whose work builds on that by Persson and Tabellini (1990) and Holmstrom (1982). Its main insight is that elections aggravate the credibility problem of monetary policy, because they raise the benefit of surprise inflation for the incumbent.

Consider a version of the model in Subsection 2.4. Voters are rational, have an infinite horizon and are all identical. Their preferences are summarized by a loss function defined over inflation and employment, identical to (2.15) and (2.16) above—and are thus linear in employment. Political candidates have the same objectives, defined over output and inflation, as the voters. In addition, they enjoy being in office: their loss is reduced by K units each period they hold office.

Candidates differ in their ability to solve policy problems. One candidate may be particularly able to deal with trade unions, another to deal with an oil price shock, a third is better able to organize his administration. This *competence* is reflected in output growth (employment): a more competent candidate brings about higher growth, ceteris paribus. To capture this, we write the Phillips curve exactly as in (2.3), except that we set θ to zero; we thus consider only ε shocks, but change their interpretation. Throughout this section, ε captures the competence of the incumbent policymaker, not exogenous supply shocks. We assume that the competence of a specific policymaker follows a simple MA-process: $\varepsilon_t = -\eta_t - \eta_{t-1}$, where η is a mean zero, i.i.d. random variable, with distribution $F(\cdot)$ and density $f(\cdot)$ (in this formulation a positive realization of η leads to high output). Competence is assumed to be random, as it depends on the salient policy problems, but partially lasting, as the salient policy problems change slowly and as competence may also depend on talent. Serially correlated competence is the basis of retrospective voting: as competence lasts over time, rational voters are more likely to re-elect an incumbent who brought about a high growth rate. In the very first period of this repeated game, we assume $\eta_0 = 0$.

The timing in a given period t is as follows. The previous period's policy instrument and inflation π_{t-1} are observed. Wages (and expected inflation) are determined. The policymaker sets the policy instrument for t. Competence is realized and output growth x_t is observed by everybody. Finally, if t is an election year—which happens every other year—elections are held.

Two remarks should be made about these assumptions. First, unlike in Section 2, the policymaker does not have any information advantage over private agents: when policy is set, the current competence shock η_t is unknown to everyone, including the incumbent. The voters do not face an adverse selection problem in

that the policymaker cannot deliberately "signal" his competence. This assumption distinguishes the model in Lohman (1996) from the earlier work by Rogoff and Sibert (1988), Rogoff (1990) and Persson and Tabellini (1990). The voters still face a moral hazard problem: through his monetary policy action, the incumbent can appear better than he really is. The voters understand these incentives, but can do nothing about them, as policy is unobservable. A model of this kind was first studied by Holmstrom (1982) in a standard principal-agent set-up, where the agent has career concerns. Subsection 3.1.2 discusses the alternative, and more complicated, setting when the policymaker is better informed about his own competence than the voters.

Second, at the time of the elections, voters only observe output growth and wages (expected inflation), but not inflation or policy. This assumption is not as bad as it may first appear. Inflation typically lags economic activity. And even though monetary policy instruments are immediately and costlessly observed, this information is meaningless unless the voters also observe other relevant information that the policymaker has about the state of the economy. To properly understand an expansion of the money supply six months before the elections, voters would have to know the policymaker's forecasts of money demand and other relevant macroeconomic variables. Assuming that policy itself is unobservable is just a convenient shortcut to keep the voters signal-extraction problem as simple as possible.[18]

Finally, we make two other simplifying assumptions. Once voted out of office, an incumbent can never be reappointed. The opponent in any election is drawn at random from the population and his pre-election competence is not known. Thus the expected competence of any opponent is zero.

The Equilibrium First, consider wage-setters. They have the same information as the policymaker and can thus compute equilibrium policy and perfectly predict inflation. Hence, in equilibrium $\pi = \pi^e$ in every period. Next, consider voters. By observing output and knowing the previous period shock to competence, η_{t-1}, they can correctly infer the current competence of the incumbent by using

[18] As Lohman (1996) observes, however, this assumption is not easily made consistent with a surprise supply formulation (like in Section 2) where employment (output growth) is determined by realized real wages in a one-sector setting. Lohman instead formulates her model as a Lucas island model where firms observe the local inflation but not economy-wide inflation (the policy instrument).

equation (2.3): $\eta_t = x_t - \eta_{t-1} =$.[19] The equilibrium voting rule is then immediate. Voters always prefer the policymaker with the highest expected competence. As the opponent has zero expected competence, the voters re-elect the incumbent with probability one if and only if $x_t > \eta_{t-1}$, as in this case $\eta_t > 0$ (if $x_t = \eta_{t-1}$, we can assume that the voters randomize, as they are indifferent). To an outside econometrician, who observes x_t but not η_{t-1}, this voting rule appears consistent with retrospective voting: the probability of re-election, $\Pr(\eta_{t-1} \leq x_t) = F(x_t)$, increases with output growth in the election period.

Next, consider the policymaker's optimization problem. In *off-election* years, he can do nothing to enhance future re-election probability, as competence shocks last only one period and are observed with the same lag. Hence, the equilibrium inflation rate minimizes the static loss in (2.16) with respect to π, subject to (2.3) and taking π^e as given. As in Subsection 2.4, this yields $\pi_t = \lambda$. *On-election* years entail different incentives: by raising output growth through unexpected inflation, the incumbent policymaker would increase his election probability. In equilibrium, wage setters correctly anticipate these incentives, and raise expected inflation accordingly, so that output continues to grow at its natural rate.

To formally derive these results, we first compute the equilibrium probability of re-election from the point of view of the incumbent. Recall that he is re-elected iff $[x_t > \eta_{t-1}]$, or—by (2.3) and our definition of ε—iff: $[\eta_t > \pi_t^e - \pi_t]$. When setting policy, the incumbent has not yet observed η_t . His perceived probability of re-election is: $1 - Prob(\eta_t \leq \pi_t^e - \pi_t) \equiv 1 - F(\pi_t^e - \pi_t)$, where $F(\cdot)$ is the cumulative distribution of η. This probability is clearly an increasing function of unexpected inflation.

Next, we need some additional notation. Let V^R and V^N be the expected equilibrium continuation values of reappointment and no reappointment, at the point when policy in an on-election year is chosen. Furthermore, let $\bar{\pi}$ be equilibrium inflation during on-election years, to be derived below. Simple algebra establishes that:

$$V^N = \frac{\lambda^2 + \delta\,\bar{\pi}^2}{2(1-\delta^2)}, \qquad V^R - V^N = -\frac{K(1+\delta)}{1-\delta^2(1-F(0))}, \tag{3.1}$$

where $1-F(0)$ is the equilibrium probability of re-election perceived by the incumbent in all *future* elections (he recognizes that future inflation surprises are not

[19] Voters known that $\pi = \pi^e$. Also, recall that in period 0 we have, by assumption, $\eta_0 = 0$. Hence in period 1: $x_1 = \eta_1$,and output fully reveals the policymaker's competence. Knowing η_1, in period 2, voters can infer η_2 from $x_2 = \eta_2 + \eta_1$, and so on.

possible in equilibrium). Intuitively, the expected value of winning the elections—the difference $V^R - V^N$ —depends on K, the benefits from holding office, but not on the equilibrium policies, λ and $\bar{\pi}$, since those are the same irrespective of who wins. Note also that these continuation values do not depend on the policymaker's competence, as competence is not known when policy is set.

We are now ready to formulate the problem of an incumbent during an on-election year. The incumbent takes expected inflation as given and chooses current inflation to minimize:

$$E[L^I] = \left[\pi^2/2 - \lambda(\pi - \pi^e) - K + \delta(1 - F(\pi_t^e - \pi_t))V^R + \delta F(\pi_t^e - \pi_t)V^N\right]. \tag{3.2}$$

The first two terms in (3.2) capture the expected loss in the current period. The last two terms capture the expected value of future losses, as determined by reappointment or not in the upcoming elections. Taking the first order condition for a given π^e and then imposing the equilibrium condition $\pi = \pi^e$ yields the equilibrium inflation rate during on-election years:

$$\bar{\pi} \;\; = \lambda + \delta f(0)(V^N - V^R) = \lambda + K\frac{\delta(1+\delta)f(0)}{1 - \delta^2(1 - F(0))}, \tag{3.3}$$

where the last equality follows from (3.1). The LHS of (3.3) is the marginal cost of inflation. The RHS is the marginal benefit: λ is the usual benefit of higher output growth, present at all times; the second term is the additional on-election-year benefit; higher output growth increases the chance of re-election. This additional benefit of surprise inflation undermines credibility and makes policy more expansionary during on-election years. Thus, equilibrium inflation right after the election is higher, the more the policymaker benefits from holding office, as measured by K, and the more surprise inflation raises the probability of reappointment, as measured by the density $f(0)$. Finally, as the incentives to inflate before elections are perfectly understood by private agents, expected inflation is also higher, and equilibrium output growth is not affected. Thus, the equilibrium is consistent with stylized fact (iv) in the introduction. Elections aggravate the credibility problem, as the incumbent cares even more than usual about output growth.

3.1.2. Adverse Selection

What happens when policy is instead chosen after the incumbent has observed the realization of current competence η_t, but the sequence of events is otherwise

exactly as before? In this setting, studied by Rogoff and Sibert (1988), Rogoff (1990) and Persson and Tabellini (1990), the policymaker enjoys an information advantage over wage setters, who do not know the realization of η_t when forming expectations. Output fluctuations can still reveal the policymaker's type, but in a less straightforward fashion: voters have to deal with an adverse selection problem, where output can be used as a deliberate signal of the incumbent's competence.

To cope with this more intricate problem, we postulate that in each period η can only take one of two values: $\overline{\eta} > 0$ and $\underline{\eta} < 0$ with probabilities P and $(1-P)$, respectively. As before, η is i.i.d. and has an expected value $E(\eta) = P\overline{\eta} + (1-P)\underline{\eta} = 0$. We refer to an incumbent with a high (low) realization of η as competent (incompetent). The opponent's competence is still unknown to everyone.

In the moral hazard model, all incumbent types chose the same action, because *ex ante* they were all identical. Here, a more competent incumbent has stronger incentives to surprise with higher inflation. There are two reasons for this. First, a more competent incumbent cares more about winning the elections, since he knows that he can do a better job than his opponent. Second, a more competent incumbent also has a lower cost of signalling his competence through high output growth. Here, we only sketch the arguments needed to characterize the equilibrium. A full derivation is provided by Persson and Tabellini (1990, Ch. 5). As a first step, compute the *expected net value of winning the elections*:

$$V^R - V^N = \lambda\eta + \frac{(1+\delta)K}{1-\delta^2(1-P)} \tag{3.4}$$

Comparing (3.1) and (3.4), the net value of winning now depends on the competence of the incumbent: a competent incumbent knows he is more likely to bring about higher future output growth than his opponent, and hence values office more. A incompetent incumbent realizes the converse – and is less eager to be re-elected.[20] The equilibrium inflation rate trades off this net value of winning against the *short run cost of signalling.* Both types want to appear competent and are prepared to artificially boost the economy through unexpected inflation

[20] We assume that K is sufficiently high that even an incompetent incumbent values being re-elected. Note also that here the equilibrium probability of winning future elections coincides with P, the probability of a high realization of μ. That is, in equilibrium a competent incumbent is always reappointed and an incompetent one is not. This is a feature of all separating equilibria, that will be discussed below; some equilibria may exist that are not separating, but we neglect them here. Persson and Tabellini (1990) contain a more general discussion of this issue.

to increase the chances of winning. But the competent type can signal at a lower cost: he needs to inflate less to produce any level of output growth. As the value of winning is also higher for the competent type, a "separating equilibrium" generally emerges: rational voters re-elect the incumbent only if output growth exceeds a minimum threshold. The threshold is so high that only a competent incumbent finds it optimal to reach it through unexpected inflation. The incompetent type instead prefers to keep inflation low, knowing he will not be re-elected.

Recall that wage setters have to form inflation expectations without knowing which incumbent type they face. *ex post*, they will always be wrong, even though their *ex ante* inflation forecast is rational. If the incumbent is incompetent, he chooses the short run optimal inflation rate ($\pi = \lambda$ in the model), which is lower than expected; hence, the economy goes through a recession. If the incumbent is competent, inflation is higher than expected and the economy booms.

How do the conclusions of this model compare with the stylized facts? Clearly, retrospective voting applies: voters reward pre-electoral booms with reappointment and punish pre-electoral recessions. Output is not systematically higher before elections; on average, inflation is higher just after the elections, but this cycle is weaker than in the moral hazard model, as only the competent type now raises equilibrium inflation. Overall, the predictions of this model are not inconsistent with the stylized facts.

Which model is more satisfactory? The moral hazard model has more clear cut predictions and makes less demanding assumptions about the rationality of the voters. Moreover, multiplicity of equilibria is an additional problem in the adverse selection model. With enough data, one could discriminate between the two models: output volatility before the elections and inflation volatility after the elections are higher only in the adverse selection model. Note that these two models also have different normative implications. With moral hazard, the political cycle is entirely wasteful, whereas it conveys valuable information to voters in the adverse selection model.[21]

3.2. Partisan Governments

The prior section relied on two crucial assumptions. All voters are alike and policymakers are opportunistic: their main purpose is re-election to enjoy the

[21] Rogoff (1990) shows in a closely related adverse selection model of fiscal policy that society may actually be worse off if one tries to curtail pre-election signalling through, say, a balanced budget amendment (the loss of losing the information may more than outweigh the gain of eliminating the distortions associated with signalling).

rents from office. Elections serve only one purpose: to select the most competent policymaker. But voters are not alike, and policymakers are also motivated by their own "ideological" view of what ought to be done and which group of voters to represent. Therefore, elections serve another goal: they resolve conflicts and aggregate preferences. The policy outcome then hinges on the partisan interests of the elected government. In monetary policy, and more generally aggregate demand policies, one crucial concern is the relative weight assigned to stabilizing output. For left-wing governments output and employment may weigh more heavily than prices; if so, they will also pursue more expansionary aggregate demand policies than right-wing governments. Elections thus create uncertainty about economic policy. This uncertainty is greater in a two-party system with very polarized parties. It may create a *post-electoral* cycle in the policy instruments, and a resulting macroeconomic cycle. We now extend our simple monetary policy model to illustrate these ideas, showing how one can account for stylized fact (v) in the introduction. The ideas originate with the work of Alesina (1987), (1988).

The Model Consider the same model as in the previous section, but suppose that individual voters differ in their relative evaluation of output and inflation. The preferences of voter i are still described by an intertemporal loss function like (2.15), but the static loss of individual i has an idiosyncratic relative weight on output:

$$L^i(\pi, x) = \pi^2/2 - \lambda^i x. \tag{3.5}$$

Two political candidates or parties, called D and R, have the same general loss function as the voters, with relative weights $\lambda^D > \lambda^R$. The D candidate thus cares more about output growth and less about inflation than the R candidate. The candidates' preferences are known by everybody, but the outcome of the election is uncertain. For simplicity, there are no competence or supply shocks: output growth is described by equation (2.3), without any ε so that $x = \theta + \pi - \pi^e$. The timing of events is as follows: Wages are set at the beginning of each period. Elections are held every other period, just after wages are set for that period. Thus, wage contracts last through half the legislature and cannot be conditioned on the election outcome. Finally, to capture the electoral uncertainty about policy, we assume that candidates can only set policy once in office. In other words, electoral promises are not binding and the policy must be *ex post* optimal, given the policymaker's preferences.

Economic Equilibrium Under these assumptions, voters are perfectly informed and the state of the economy does not reveal anything to them. Hence, policymaker I chooses the same inflation rate in office whether it is an on- or off-election period. Given the assumed timing, it is easy to verify that $\pi^I = \lambda^I$, $I = D, R$. In off-election periods, this inflation rate is perfectly anticipated by wage setters, and output grows at the natural rate: $x = 0$. But just before the elections, wage setters do not know which policymaker type will win. Suppose they assign probabilities P and $(1 - P)$ to the event that D and R wins. During on-election periods, expected inflation is thus: $\pi^e = \lambda^R + P(\lambda^D - \lambda^R)$. If party R wins, it sets $\pi = \lambda^R < \pi^e$ and causes a recession in the first period of office: output is $x = -P(\lambda^D - \lambda^R)$. If D wins, the opposite happens: actual inflation is higher than expected and a boom occurs: $x = (1 - P)(\lambda^D - \lambda^R)$. Thus, uncertain election outcomes may cause economic fluctuations. But this political output cycle occurs *after* the election and is due to different governments having different ideologies, in contrast to the previous model where the political output cycle is due to signalling and occurs *before* elections.

Interpreting these ideological differences along a left-right political dimension, we get a possible explanation for stylized fact (v). The model predicts that left-wing governments stimulate aggregate demand and cause higher inflation throughout their tenure, while the opposite happens under right-wing governments. An election victory of the left brings about a temporary boom just after the elections; victory of the right is instead followed by a recession. These partisan effects are more pronounced under a more polarized political system (i.e. with large differences between $\lambda^D$and λ^R in the model), or more generally if the elections identify a clear winner, like in two-party systems. Alesina and Roubini (1997) argue that these predictions are consistent with the evidence for industrial countries.

Political Equilibrium The partisan model focuses on the role of party preferences in elections. Voters anticipate what each party would do if elected, and choose the party closest to their ideal point. Thus, the probability that one party or the other wins is entirely determined by fluctuations in the distribution of voters' preferences for the two parties. Moreover, as electoral promises are not binding and voters are rational and forward-looking, the policy platforms of the two candidates do not converge towards the median voter.

In the model, voters face a trade-off. If R wins, inflation is lower but output is temporarily lower, while the opposite happens if D wins. How voters evaluate this trade-off depends on their relative weight parameter λ^i. Computing the losses

to a generic voter after an R and D victory, respectively, and taking differences, it is easy to verify that voter i strictly prefers R to win if:

$$\lambda^i < (1+\delta)(\lambda^R + \lambda^D)/2. \tag{3.6}$$

The probability $(1-P)$ that R wins is the probability that the relative weight of the median voter λ^m satisfies inequality (3.6). Electoral uncertainty thus ultimately relies on the identity of the median voter being unknown, because of random shocks to the voters preferences or to the participation rate.

Ceteris paribus, right-wing governments enjoy an electoral advantage: because all policymakers suffer from an inflation bias, a high value of λ is a political handicap. [22] Inequality (3.6) implies that a voter whose ideological view is right in between L and D (that is, such that $\lambda^i = (\lambda^R + \lambda^D)/2$) votes for the right-wing candidate. This suggests that an incumbent can act strategically to increase its chances of re-election. Specifically, a right-wing government can make its left-wing opponent less appealing to the voters by increasing the equilibrium inflation bias. This could be done by reducing wage indexation, by issuing nominal debt (to raise the benefits of surprise inflation), or by creating more monetary policy discretion, via a less disciplining exchange rate regime or weaker legislation regarding central bank independence, or even by current monetary policy if unemployment is serially correlated. These ideas have their roots in the literature on strategic public debt policy, further discussed in Section 6.1 below.

On the normative side, electoral uncertainty and policy volatility are inefficient, and voters would be better off ex-ante by electing a middle-of-the-road government that enacted an intermediate policy. But in the assumed two-party system, there is no way of eliminating this unnecessary volatility. The stark result that there is no convergence to the median position, is weakened under two circumstances. One, studied by Alesina and Cukierman (1988), is uncertainty about the policymaker type. Then each candidate has an incentive to appear more moderate, so as to raise the probability of winning the next election. The second, studied by Alesina (1987), is repeated interactions. Then the two candidates can sustain self-enforcing cooperative agreements: a deviation from a moderate policy would be punished by the opponent who also reverts to more extreme behavior once in office. Alternatively, cooperation could be enforced by the *voters* punishing a government that enacted extreme policies. Naturally, there is the same problem of multiple equilibria as in the reputational equilibria of Section 2.4.

[22] This observation is related to the argument, about the benefits of appointing a conservative central banker discussed in Section 4.3 below.

Institutional checks and balances can also moderate policy extremism. In a presidential system, for instance, actual policies often result from a compromise between the legislature and the executive. The model of partisan policymakers suggests that the voters would take advantage of these institutional checks and balances to moderate the behavior of the majorities. Alesina and Rosenthal (1995) argue that the voters' attempt to moderate policy extremism can explain split ticket voting in Presidential systems (i.e., the same individuals voting for different parties in Presidential and Congressional elections) and the mid-term election cycle (the party who won the last general elections loses the interim election).

3.3. Notes on the Literature

Alesina and Roubini (1997) present existing and new evidence on electoral cycles in OECD countries. They also survey the theoretical work on political cycles in aggregate demand policy. Alesina and Rosenthal (1995) focus on the United States in particular. The evidence for a partisan cycle is scrutinized by Faust and Irons (1996) (for US) and by Mishra (1997) (for a panel of OECD countries). Fair (1978), Fiorina (1981) and Lewis-Beck (1988) discuss the evidence on retrospective voting in the US and elsewhere.

The first models of political business cycles with opportunistic government are due to Nordhaus (1975) and Lindbeck (1976). The first theory of a partisan political cycle is due to Hibbs (1977). All these papers relied on the assumption that private agents are backward-looking, both in their economic and voting decisions.

The model of an opportunistic government and adverse selection with rational voters, summarized in section 3.1.2, was developed by Rogoff and Sibert (1988) in the case of fiscal policy, and adapted to monetary policy by Persson and Tabellini (1990). Rogoff (1990) generalized the fiscal policy results to two dimensional signalling by the incumbent. Ito (1990) and Terrones (1989) considered political systems in which the election date is endogenous and chosen by the incumbent himself, after having observed his own competence.

The moral hazard model studied in subsection 3.1.1 is very similar to a principal-agent problem with career concerns developed by Holmstrom (1982). It was studied in the context of monetary policy by Lohman (1996) and, in a somewhat different set up, by Milesi-Ferretti (1995b). Ferejohn (1986) and Barro (1973) study a more abstract moral hazard problem where an incumbent is disciplined by the voters through the implicit reward of reappointment.

The model of partisan politics with rational voters is due to Alesina (1987),

(1988). This model is extended by Alesina, Londregan and Rosenthal (1993) and by Alesina and Rosenthal (1995) to allow for ideological parties who also differ in their competence. Milesi-Ferretti (1994) discusses how a right-wing incumbent might increase his popularity by reducing the extent of wage indexation; similar points with regard to nominal debt and the choice of an exchange rate regime were investigated by Milesi-Ferretti (1995a,b). Jonsson (1995a) discusses strategic manipulation of monetary policy for political purposes when there is autoregression in employment. Uncertainty about the policymaker's ideological type is considered in Alesina and Cukierman (1988). The role of moderating elections, in theory and in the US data, is studied by Alesina and Rosenthal (1995).

4. Institutions and incentives

Theoretical work on institutions and incentives in monetary policy has developed over the last ten years. Below, we give a selective account of key ideas in that development. We do not follow the actual course of the literature over time, but we exploit what, in retrospect, appear to be the logical links between different ideas. The main issue is how the design of monetary institutions can remedy the incentive problems discussed in Sections 2 and 3. Even though we focus on lack of credibility, some results extend to the political distortions of Section 3.

The ideas in this section rely on a common premise: institutions "matter". A constitutional or institution-design stage lays down some fundamental aspects of the rules of the game, which cannot be easily changed. Once an independent central bank has been set up, an international agreement over the exchange rate has been signed, or an inflation target has been explicitly assigned to the central bank, it has some such staying power, in the sense that changing the institution *ex post* is costly or takes time. This premise is questioned by some critics (in particular by McCallum (1996) and Posen (1993)), who argue that some of the proposed institutional remedies discussed in this section "do not fix the dynamic inconsistency" that is at the core of this literature, they "merely relocate it". The criticism is correct, in that the institutions are assumed to enforce a policy which is *ex post* suboptimal from society's (or the incumbent government) point of view. Hence, there is always a temptation to renege on the institution. But the staying power of institutions need not be very long to be effective. In the model that dominates the literature, what is needed is a high cost for changing the institution within the time horizon of existing nominal contracts. Beyond the contracting horizon, expectations would reflect any constitutional change,

which removes the distinction between *ex post* and *ex ante* optimality. As already remarked in sub-section 2.4, the cost of suddenly changing the institution could also be a loss of reputation. By focusing political attention on specific issues and commitments, institutions alert private individuals if governments explicitly renege on their promises. To pick up the thread from section 2, one purpose of successful monetary institutions is to make monetary policy a bit more like patent legislation. In our view, real world monetary institutions do have such staying power. They can be changed, but the procedure for changing them often entails delays and negotiations between different parties or groups that were purposefully created when the institution was designed. We thus think that the premise of the literature is generally appropriate. But it would be more convincing to derive the institutional inertia as the result of a well-specified non-cooperative strategic interaction between different actors, something the literature—so far—has failed to do.[23]

4.1. Fixed exchange rates: simple rules and escape clauses

Pegging the value of the exchange rate to gold or to some reserve currency has been a common device, particularly in smaller countries, to anchor inflationary expectations, discipline domestic price and wage setting, or prevent political interference in monetary policy. Such attempts have met with mixed success. Among the industrialized countries during the post- war period, the Bretton Woods system and (part of) the ERM experiment were reasonably successful. But unilateral attempts of some European countries to peg their exchange rates in the seventies and eighties often ended up in failure: with lack of credibility generating a spiral of repeated devaluations, domestic wages and prices running ahead of foreign inflation. What can explain such differences?

To shed light on this question, let us study a slight modification of the static model in Section 2. A small open economy is specialized in the production of a single good which is also produced by the rest of the world. The central bank controls π through the exchange rate, given a foreign inflation rate denoted π^*. The rest of the model, including the expectations-augmented Phillips curve (2.3), the rational-expectations assumption, the objective function of the policy maker (2.6), and the timing of events are as in section 2.2 or 2.3; except that we assume

[23] Jensen (1996) in fact studies a simple model—related to the contracting solution to be studied in Section 4.3—where the government can renege on the initial institution at a continuous (non-lump sum) cost. In this setting institution design generally improves credibility, but cannot remove the credibility problem completely.

not only θ, but also π^* to be known when wages are set (π^e are formed). Note that π^* denotes both foreign and target inflation, as pegging the exchange rate to a low-inflation currency can be seen as an explicit or implicit attempt to target a low inflation rate.

Under discretion, the model is formally identical to that in Section 2.3 and thus generates the inflation and employment outcomes in (2.12) and (2.14). As $E(\pi) > \pi^*$, the model is consistent with the idea of a devaluation spiral, fuelled by low credibility among wage setters and a devaluing exchange rate.

Consider now the following institution. At stage (0), society commits to a simple rule of holding the exchange rate fixed, or of letting it depreciate at a fixed rate k. There is commitment, in the sense that the rate of depreciation k is chosen at the start of each period, and cannot be abandoned until one period later. The rule is simple, because it cannot incorporate any contingencies. In practice, simple commitments of this kind can be enforced by multilateral agreements such as the Bretton Woods system or the ERM, where the short-run interests of other countries are hurt if one country devalues. Policy commitments to complex contingent rules would require implausible assumptions on verifiability and foresight.

What is the optimal rule? As the depreciation rate is known in advance of wage setting and expectation formation and is not contingent on the ε shocks, it is neutral with respect to real variables. Hence, the optimal rule has $k = 0$. Under this simplicity constraint, a fixed exchange rates is thus the optimal commitment. This results in the following equilibrium outcome: $\pi^S = \pi^*$, $x^S = \theta - \varepsilon$,where the S superscript stands for simple rule.

Is the simple rule better than discretion? It depends. The rule brings about lower average inflation, but employment is more variable. A formal comparison of the two regimes can be made by substituting (2.12)-(2.14), and the previous expression for $\pi^S$and x^S, into (2.6) and taking expectations of the difference in their payoffs. Recalling that $E(\theta) = 0$, this gives:

$$E[L(\pi^D, x^D)] - E[L(\pi^S, x^S)] = \frac{\lambda^2}{2}\left\{E(x^*)^2 + \sigma_\theta^2 - \frac{1}{(1+\lambda)}\sigma_\varepsilon^2\right\}.$$

The first two terms on the RHS capture the benefit of credibility under the simple rule— the sum of the squared average inflation bias and its variance. The last term is the loss from not from being able to stabilize employment. A simple rule is better than discretion if the gain of credibility is larger than the loss of stabilization policies. This trade-off between credibility and flexibility is a recurrent theme in the literature on institution design. The benefit of the simple rule is further

enhanced if, under discretion, monetary policy is also distorted by the electoral incentives discussed in Section 3.

Another monetary regime, often advocated though harder to enforce, is a commitment to a k % money growth rule. Suppose we add a simple quantity-theory equation to our model, where money demand depends on output growth (or employment), so that : $\pi + x = m + \nu$. The policy instrument is m, like in section 2. Under a simple money growth rule, velocity shocks v destabilize employment and prices. A simple exchange rate peg, on the other hand, automatically offsets velocity shocks. On the other hand, a money supply rule might better stabilize supply shocks; as these destabilize both output and prices, the price response acts as an automatic output stabilizer. In the limit, if $\lambda = 1$, a k % money rule mimics the optimal policy response to a supply shock.[24]

The assumption that an exchange rate peg, once announced, cannot be abandoned until next period, may be too stark. Multilateral exchange rate agreements often have escape clauses: European countries have temporarily left the ERM or realigned their central parities when exceptional circumstances made it difficult to keep the exchange rate within the band. An escape clause can be thought of as follows. Define *normal times* as a range of possible realizations of the unobservable supply shock: $\varepsilon \in [\varepsilon^L(\theta), \varepsilon^U(\theta)]$. Inside this interval, the central bank remains committed to the simple rule. During *exceptional times*, defined by the complementary event, an escape clause is invoked. The central bank abandons the simple rule and pursues a discretionary (*ex post* optimal) policy, given inflationary expectations.

At normal times, the exchange rate is fixed and output is destabilized by (small) supply shocks. There is also a *peso problem*: as the escape clause will be invoked with positive probability, expected inflation is always positive. Normal times with actual inflation at zero, thus has some unexpected deflation and employment below the natural rate. At exceptional times, on the other hand, the central bank abandons the rule and sets an *ex post* optimal policy to stabilize (unusually large) supply shocks. But less inflation is now needed compared to the regime with pure discretion, because expected inflation is lower. Hence, a simple rule with an escape clause strikes a better balance between credibility and flexibility, by allowing for flexibility when it is most needed. Indeed, Flood and

[24] A literature dating back to the seventies has studied the choice of between alternative rules in richer models—for surveys, see Genberg (1989) and Flood and Mussa (1994). Recent contributions to the comparison of exchange rate versus money based stabilizations of inflation are surveyed by Calvo and Vegh (this volume)

Isard (1989) have shown that a rule with an escape clause always dominates pure discretion and, if supply shocks are sufficiently volatile, it also dominates a simple rule. As Obstfeld (1996) has stressed, however, escape-cluse regimes can give rise to multiple equilibria. Intuitively, expected inflation depends on how often the escape clause is invoked. At the same time, the *ex post* decision whether or not to invoke the escape clause depends on expected inflation. As higher inflationary expectations make it more tempting to abandon the rule, high inflationary expectations may become self-fulfilling.

How can a regime with an escape clause be implemented? In a multilateral exchange rate regime where realignments have to be approved by an international body, the bounds would depend on the bargaining power of the devaluing (revaluing) country, which, in turn, would depend on the details of the institution (the prospective sanctions, the procedure for making the decisions, etc.). In a domestic context, we could suppose that at the institution design stage (before θ is realized) society sets a pair of fixed costs $[c^L(\theta), c^U(\theta)]$ incurred whenever the escape clause is invoked. These costs would capture the public image loss for the central banker from not fulfilling his mandate, or the costs for the government of overriding a central bank committed to the simple rule. They would implicitly define bounds $\varepsilon^L(\theta)$ and $\varepsilon^U(\theta)$, that leave the central bank indifferent between sticking to the simple rule and bearing the cost of no stabilizing policies, or paying the cost and invoking the escape clause. In neither of these interpretations it is reasonable to assume that the costs could be calibrated very carefully *ex ante*. For instance, costs may have to be state-dependent or symmetric; $c^L(\theta) = c^L$, $c^U(\theta) = c^U$ or $c^U = c^L = c$. Such plausible constraints would prevent society from reaping the full value of the escape clause regime, but still generally improve on the discretionary outcome. Flood and Marion (1997) point out that an important consideration behind the *ex ante* choice of c might be to prevent multiple equilibria.

4.2. Central bank independence

The first example of strategic delegation in monetary policy is the independent and conservative central banker, suggested by Rogoff (1985). To illustrate the idea in our simple model, we continue to make a formal distinction between society and the central bank. Society's true preferences take the form of (2.6). At the institution design stage (0) of the model, society appoints a central banker. The central banker is independent: once appointed, society can no longer interfere with his decisions. (Towards the end of this subsection, we ask how reasonable

this assumption really is.) Prospective central bankers have loss functions of the form (2.6), but differ in their personal values of λ.[25] The appointment thus boils down to the choice of a parameter, say λ^B. The private sector observes λ^B and forms its inflationary expectations accordingly.

The appointed central banker sets monetary policy freely at stage (4), according to his own private preferences. As already discussed in section 2.3, this choice gives the equilibrium outcomes:

$$\pi(\lambda^B, \theta, \varepsilon) = \pi^* + \lambda^B(x^* - \theta) + \frac{\lambda^B}{1+\lambda^B}\varepsilon$$

$$x(\lambda^B, \theta, \varepsilon) = \theta - \frac{1}{1+\lambda^B}\varepsilon,$$

Note that the outcomes do not only depend on the realized shocks, but also on the bankers's preferences. These expressions illustrate a basic trade-off in the strategic delegation: a central banker more hawkish on inflation, i.e. someone with a lower λ^B, has more credibility in keeping inflation low, but is less willing to stabilize supply shocks.

To formally study delegation, consider society's expected loss function, as a function of the central banker type:

$$E[L(\lambda^B)] = E[(\pi(\lambda^B, \theta, \varepsilon) - \pi^*)^2 + \lambda(x(\lambda^B, \theta, \varepsilon) - x^*)^2]/2, \tag{4.1}$$

where the expectation is taken over θ and ε, for any λ^B. Next, insert the expressions for equilibrium inflation and employment into (4.1) and take expectations. The derivative of the resulting expression with regard to λ^B is:

$$\frac{dE[L(\lambda^B)]}{d\lambda^B} = \lambda^B(x^{*2} + \sigma_\theta) + (\lambda^B - \lambda)\frac{\sigma_\varepsilon}{(1+\lambda^B)^3}. \tag{4.2}$$

The first term is the expected credibility loss of choosing a central banker with a higher λ^B. The second term measures the expected stabilization gain. The

[25] This suggests a heterogeneity in the population with regard to the relative weight placed on inflation versus employment, which our formal model abstracts from. As discussed in section 3, however, such heterogeneity can be formally introduced in the model without any difficulties. Alesina and Grilli (1992) indeed show that strategic delegation of the type to be discussed below would take place endogenously in a model where heterogenous voters elect the central banker directly.

optimal appointment involves setting this expression equal to zero. Evaluating the derivative (4.2) at the extreme points implies that $\lambda > \lambda^B > 0$.[26]

Thus, by optimally choosing an independent central banker, society strikes a different compromise between credibility and flexibility than in the fixed exchange rate regime. But it is still a compromise: it is optimal to appoint a central banker who is more conservative on inflation than society itself (to address the inflation bias), but still not ultraconservative (to preserve some of the benefits of stabilization). Note also that fluctuations in the inflation bias arising from observable θ shocks remain. If λ^B could be chosen after the realization of θ, society would want to meet a more serious incentive problem—a smaller θ—with a more hawkish central banker—a smaller λ^B. In practice, the extent of the incentive problem is serially correlated over time, so that making appointments at discrete points is probably a good way of dealing with this problem.

Like in the escape-clause model, we could give society or government the option of over-riding the central bank decision in exceptional circumstances. The over-ride option could involve firing the central banker, introducing ad-hoc legislation or an explicit over-ride clause under a prespecified procedure (the latter arrangement is indeed observed in the central bank legislation of many countries). An implicit escape clause mitigates the *ex post* suboptimality of central bank behavior, inducing even a conservative central banker to stabilize extreme supply shocks to the same extent as society would do.[27] This option should not be overemphasized, however; escape clauses can hardly be optimally designed *ex ante*. Moreover, as already noted in the introduction, if the government has an override option, why does it not use it all the time to get the policy it wants *ex post*?

We may also note that having an independent central bank also protects society from the distortions introduced by the electoral business cycles discussed in Section 3. In this case, however, only independence is required, and no special emphasis on inflation relative to other macroeconomic goals. Waller (1989) was probably first in formulating a model of central bank independence under partisan politics.[28]

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[26] Equation (4.7) is a fourth-order equation in λ^B,which is difficult to solve. But as the derivative is negative at $\lambda^B = 0$, postive for all $\lambda^B > \lambda$, and the second-order condition is fulfilled for any λ^B in the interval $(0, \lambda)$, we know that the solution must be inside the interval $(0, \lambda)$

[27] This is indeed proved by Lohman (1992)

[28] Fratianni, von Hagen and Waller (1995) fomally analyze the role of central bank independence in the absence of a traditional credibility problem, but in the presence of explicit electoral

The literal interpretation that society picks a central banker *type* is not very satisfactory: individual priorities or attitudes towards inflation and employment are often unknown and vaguely defined. Moreover, individual attitudes are probably less important than the general character and tradition of the institution itself. A better interpretation is that, at the constitutional stage, society drafts a central bank statute spelling out the "mission" of the institution. Thus, the parameter λ^B reflects the priority assigned to price stability relative to other macroeconomic goals. As instrument independence is a necessary condition for delegation to work, we should expect such a strategic setting of goals to work better if combined with institutional and legislative features, lending independence to the central bank and shielding it from short run political pressures.

In this interpretation, the model yields observable implications: countries or time periods in which the central bank statute gives priority to price stability and protects central bank independence should have lower average inflation and higher employment (or output) volatility—since if $\lambda^B < \lambda$, stabilization policies are pursued less vigorously. Moreover, electoral business cycles in inflation or output should be less pronounced with greater central bank independence. By now, a number of studies have constructed measures of central bank independence based on central bank statutes, also taking the priority given to the goal of price stability into account.[29] Cross-country data for industrial countries show a strong negative correlation between those measures of central bank independence and inflation, but no correlation between output or employment volatility and central bank independence. Thus, central bank independence seems to be a free lunch: it reduces average inflation, at no real cost. Different interpretations of this result have been suggested. Alesina and Gatti (1996) note that an independent central bank could reduce electorally induced output volatility, as would be predicted by the models of section 3, and Lippi (1997) provides evidence that could support this proposition. Posen (1993) and (1995) argues that the cross-country correlation between central bank independence and lower inflation is not causal, and suggests that both may be induced by society's underlying preferences for low and stable inflation.

Finally, Rogoff (1985) also suggests another interpretation of the model: the conservative central banker might be interpreted as a targeting scheme supported by a set of punishments and rewards. Having a conservative central banker is

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incentives.

[29] See in partcular Bade and Parkin (1988), Grilli, Masciandaro and Tabellini (1991), Alesina and Summers (1993), Cukierman (1992), Eijffinger and Schaling (1993).

formally equivalent to having an additional term in inflation in his loss function, $(\chi^B - \chi)(\pi - \pi^*)^2$, where $\chi^B > \chi$. The central banker thus has the same objective function as everybody else, but faces additional sanctions if actual inflation exceeds the target. In this simple model, a conservative central banker is thus equivalent to an inflation target.[30] This alternative interpretation has been picked up by a more recent literature, asking which targets are more efficient, and more generally how a targeting scheme should be designed to optimally shape the central bank ex-post incentives.

4.3. Inflation targets and inflation contracts

Central banks have traditionally operated with intermediate targets, like money or the exchange rate. In the nineties, several central banks started to target inflation: whereas some central banks imposed the procedure on themselves, the transition has been mandated by some governments.[31] Such targeting schemes have recently been studied from the point of view of the theory of optimal contracts. Society, or whoever is the principal of the central bank, presents its agent—the central bank—with punishments or rewards conditional on its performance. The question is what constitutes an optimal contract, and what kind of behavior it induces on the agent. We illustrate the basic ideas of this recent literature in our simple model of credibility. The optimal contract can easily be modified so as to implement the optimal monetary policy even in the presence of political distortions, but we do not pursue this extension. Much of the discussion in this subsection is based on results in Persson and Tabellini (1993) and Walsh (1995a).

The central bank holds the same quadratic preferences as everybody in society. It operates under discretion, setting policy at stage (4). At the constitutional stage (0), the government formulates a publicly observable complete contract for the central bank which formulates state-contingent punishments (or rewards) conditional on realized inflation:

$$P(\pi; \theta, \varepsilon) = p_0(\theta, \varepsilon) + p_1(\theta, \varepsilon)\pi + p_2(\theta, \varepsilon)\pi^2. \tag{4.3}$$

[30] Rogoff (1985) compares an inflation target to other nominal targets, such as money and nominal income. He shows that strategic concerns of the type considered here, can indeed overturn the ranking of intermediate targets, based on parameter values and relative variance of shocks, in the traditional non-strategic literature on monetary targeting.

[31] A substantial literature discusses real-world inflation targeting. See in particular Leiderman and Svensson (1995), Haldane (1995), McCallum (1996), Mishkin and Posen (1997), Almeida and Goodhart (1996). In practice, an inflation target means that the central bank is using its own *inflation forecast* as an intermediate tareget; see Svensson (1997b) for instance.

Our goal is to optimally set the terms $p_i(\theta, \varepsilon)$, $i = 0, 1, 2$, that define the contract. We only include up to second-order terms in the contract, since that is sufficient for our purposes. Units are normalized so that, at stage (4), the central bank minimizes the sum of the loss function and its punishment with respect to inflation: $L(\pi, x) + P(\pi; \theta, \varepsilon)$.

Going through the same steps as in section 2.3 (deriving the central bank optimum condition for inflation, given the contract and expected inflation, solving for rationally expected inflation, and combining the resulting expressions), we get the equilibrium condition:

$$(1 + p_2(\theta, \varepsilon))\pi = \pi^* - p_1(\theta, \varepsilon) + \lambda(x^* - \theta) + \frac{\lambda}{1+\lambda}\varepsilon. \tag{4.4}$$

The benchmark optimum in (2.11) can be implemented by setting $p_2(\theta, \varepsilon) = 0$ and $p_1(\theta, \varepsilon) = p_1(\theta) = \lambda(x^* - \theta)$. Since the constant $p_0(\theta, \varepsilon)$ does not affect any of the central bank marginal incentives, it can be set freely—for instance, it can be set negative enough that the participation constraint is satisfied: the central bank leadership finds it attractive enough in expected terms to take on the job.

Thus a remarkably simple linear performance contract—imposing a linear penalty on inflation—removes the inflation bias completely. The credibility-flexibility trade-off has disappeared: average inflation is brought down to the target, at no cost of output volatility. Once the simple contract has been formulated, the central bank has the right incentives to implement *ex ante* optimal policy. Note that the optimal contract is not conditional on ε; this is because the marginal incentives to stabilize the economy are correct under discretion (in the terminology of Section 2, there is an inflation bias but no stabilization bias). But the slope of the penalty for inflation is conditional on θ; as the incentive to inflate the economy also varies linearly with θ. To see the intuition for this result, think about the punishment for inflation as a Pigovian corrective tax. As discussed in Section 2.3, the distortion we want to address is that the central bank does not internalize the effect of its policy on inflationary expectations, when acting *ex post*. Since expected inflation $E(\pi \mid \theta)$ is a linear projection of π, a linear penalty for inflation makes the central bank correctly internalize the marginal cost of its policy.[32] To see this formally, substitute (2.3) into the objective function (2.6) and calculate the equilibrium marginal cost of expected inflation in state θ as: $\frac{dE[L(\pi,x)|\theta]}{d\pi^e} = \lambda(x^* - \theta) = p_1(\theta, \varepsilon)$.

[32] Indeed, linearity of the optimal contract is preserved for any general loss functions, and not just for the quadratic one.

That there is no credibility-flexibility trade-off with an optimal contract contrasts with the previous subsection, where—under a quadratic inflation target—lower expected inflation was associated with distorted stabilization policy. A quadratic inflation target is thus not an optimal contract. The Rogoff (1985) targeting solution, discussed at the end of the last section, is equivalent to an inflation contract with $p_2 = (\chi^B - \chi)/2$, $p_1 = (\chi^B - \chi)\pi^*$, and $p_0 = (\chi^B - \chi)(\pi^*)^2/2$. This clearly gives the central banker incorrect marginal incentives.

Nevertheless, the optimal linear inflation contract can be reinterpreted as similar to an inflation target. As the intercept can be set freely, we can write the optimal contract as

$$P(\pi;\theta) = \widetilde{p}_0 + p_1(\theta)(\pi - \pi^*); \tag{4.5}$$

the central banker is punished linearly, but only for *upward* deviations from society's preferred inflation rate. Walsh (1995b) shows that the marginal penalty on inflation can be interpreted as resulting from an arrangement where the governor of the central bank faces a probability of being fired which increases linearly in inflation. Such an arrangement resembles the Price Targeting Agreement in force in New Zealand since 1990. Other looser interpretations would be to associate the penalty with altered central-bank legislation, a lower central-bank budget, or a loss of prestige of the institution and the individuals heading it, for failing to deliver on a publicly assigned or self imposed "mission". Naturally, it may be impossible to specify the penalty exactly as a linear function of inflation. But to approximate an optimal incentive scheme, the punishment for upward deviations from an inflation target should not increase too rapidly with the size of the deviation. In fact, if the central bank is risk averse, the optimal contract entails a diminishing marginal penalty on inflation (to reintroduce linearity in the incentive scheme).

Svensson (1997a) has proposed an alternative interpretation of inflation targets, related to—but somewhat different from—the optimal performance contract interpretation. In his formulation the central bank is not assumed to have any generic preferences over macroeconomic outcomes; instead society can impose a specific objective function on the central bank. Suppose that, through a targeting scheme or otherwise, society manages to assign a loss function with a lower goal for inflation, say $\pi^B(\theta)$ to the central bank. Then the optimal goal for inflation is: $\pi^B(\theta) = \pi^* - \lambda(x^* - \theta)$. Pursuing this goal would eliminate the inflation bias, without giving up on stabilization policies. That is, the lower inflation goal is equivalent to an optimal inflation contract in (4.5), with parameters $p_2 = 0$, $p_1 = \lambda(x^* - \theta)$ and $p_0 = [\lambda(x^* - \theta)^2 - 2\pi^*\lambda(x^* - \theta)]/2$, if we are willing to interpret

a lower π^B as higher CB-dependence. This representation of an inflation target suggests an alternative explanation for the empirical observation discussed in the previous subsection. A lower π^B is associated with lower inflation but not with higher output variability, as in the data.

It is not without problems to associate this scheme with real world institutions, however. Suppose that the optimal inflation rate for society, π^*, is about 2%, and that the average inflation bias, $\lambda(x^* - \theta)$, is about 5% (not an outrageous number, given the recent monetary history of many European countries). The central bank should then be given an inflation goal, $\pi^B(\theta)$,of -3%. But in equilibrium, the central bank would not take any action to bring inflation below 2%, which may present it with some problems when explaining its policy to the public. A second, more important, problem relates to enforcement. How can we ensure that the central bank accepts to evaluate the costs and benefits of the policy according to the imposed objective function, rather than according to society's preferences? A plausible answer is that the central bank is held accountable for its actions and that there is a performance based scheme of rewards or punishments that makes the central bank behave in the desired fashion. But then we are back to the performance contract interpretation of inflation targets explicitly suggested by (4.5).[33]

A natural question is whether to base the contract on inflation or on other measures of performance, such as money, the exchange rate, or nominal income. Persson and Tabellini (1993) show that if the central bank is risk neutral, if the constraints faced by the central bank (i.e. the behavioral equations of the economy) are linear, as assumed so far, and if the marginal penalties under the contract can be contingent on θ, there is an equivalence result: alternative targets yield the same equilibrium. With relevant non-linearities, however, an inflation based contract is simpler; to replicate the *ex ante* optimal policy with other measures of performance, the contract must be contingent on a larger set of variables, such as shocks to money demand, or to the money multiplier. In this sense, an inflation target dominates targeting schemes based on other nominal variables: simplicity implies enhanced accountability and thus easier enforcement. Intuitively, the whole purpose of optimal contracts is to remove an inflation bias. This is most easily done by means of a direct penalty on inflation, rather than in a more round about way, by targeting other variables that are only loosely related to inflation.

What happens if the contract cannot be made state-contingent, so that p_0, p_1,

[33]The best assignment if society could really freely impose an objective fuction on CB, would be to set $x^*(\theta) = \theta$, thereby eliminating the inflation bias completely.

and p_2, in (4.3) each have to be constant across θ? This question and its answer are related to the problem in Herrendorf and Lockwood (1997), who study delegation in a model with observable shocks, and to the problem in Beetsma and Jensen (1996), who study delegation via an optimal contract when the central banker's preferences are uncertain *ex ante*. To find the optimal incomplete contract in this case, we first plug the solution for π in (4.4) with the slope coefficients constant, as well as the associated solution for x, namely

$$x = \theta - \frac{1 + p_2(1+\lambda)}{(1+\lambda)(1+p_2)}\varepsilon$$

into the quadratic objective function. We then take expectations of the resulting expression over θ and ε and maximize with regard to p_1 and p_2. After tedious but straightforward algebra, we can write the optimality conditions as:

$$\begin{aligned} p_1 &= \lambda x^* - p_2 \pi^* \\ p_2 &= (1+\lambda)\frac{\sigma_\theta^2}{\sigma_\varepsilon^2} \end{aligned} \tag{4.6}$$

These conditions are both intuitive. It is easy to show that the first condition says $E(\pi) = \pi^*$: unconditionally expected inflation should coincide with society's preferred rate of inflation. The second condition says that the coefficient on the quadratic term in the contract should be a positive increasing function of the relative importance of observable to unobservable shocks. Thus, when fluctuations in the observable incentives to inflate can not be handled by a state-contingent linear punishment, the constrained optimum gives up a little bit on (first-best) stabilization in order to diminish the costly fluctuations in π.

As p_1 contains a term in π^*, we can rewrite the optimal non-state contingent contract as

$$P(\pi) = p_0 + \overline{p}_1 \pi + p_2(\pi - \pi^*)^2,$$

with p_2 given by (4.6) and $\overline{p}_1 = (\lambda x^* + p_2 \pi^*)$. According to this expression, the central bank should be targeting society's preferred rate of inflation and face an extra reward for low inflation. It is perhaps not too far fetched to interpret the inflation targeting schemes enacted in the 1990s in many countries as an instance of this arrangement.[34]

[34] In the model of Beetsma and Jensen (1996) with uncertain CB preferences, the optimal inflation target may instead be above society's target.

The simple contracting model discussed here has been extended in several directions. If some shocks are observable, but not verifiable and hence not contractible, the central bank can be required to report the value of these shocks. Persson and Tabellini (1993) show that the optimal contract is related both to the inflation outcome and to the central bank announcement; it is structured in such a way as to induce optimal behavior as well as truth telling. Policy announcements matter not because they convey information to the private sector (that already observes everything), but because they change central bank incentives, by providing a benchmark against which performance can be assessed *ex post*.[35] Walsh (1995a) shows that the optimal contract can also handle costly effort by the central bank. Dolado, Griffiths and Padilla (1994), as well as Persson and Tabellini (1996) extend the contract approach to the international policy coordination problems that arise when central banks fail to internalize the international externalities of their monetary policies.

McCallum (1996) and others have argued that the contracting solution makes little sense, because it just replaces one commitment problem with another: who enforces the optimal contract? This question reintroduces the general question about institutional reforms raised at the beginning of this section, although it might apply more forcefully to a more ambitious incentive scheme such as the optimal contract. As in the case of the fixed-exchange rate regimes of section 4.1, enforcement is more likely if agents have heterogenous *ex post* benefits of inflation and agents hurt by inflation are given a prominent role in the enforcement. Interestingly, Faust (1996) argues that a desire to balance redistributive interests for and against surprise inflation was a clear objective in the mind of the framers of the Federal Reserve. As stated before, we also do believe that changing institutions takes time. The public image of a policymaker who emphatically announces an inflation target, would be severely tarnished, if he explicitly abandoned it shortly afterwards. This is one of the main reasons why in the real world inflation targets can alter the *ex post* incentives of policymakers. The emphasis of the contracting solution on accountability and transparency is helpful for thinking more clearly about these issues, and about the trade-offs that emerge if the reward scheme cannot be perfectly tailored to mimic the optimal contract. We cannot demand much more than that from simple theoretical models. But where the literature should go next is probably not to other variations of the objective function in the simple linear-quadratic problem. Instead it would be desirable to model the

[35] In the reputational model of Cukierman and Liviatan (1991), by contrast, announcements matter because they convey information about the policymaker's type.

different steps and the incentives in the enforcement procedure as a well-defined extensive-form, non-cooperative game.

4.4. Notes on the literature

The literature on institutions in monetary policy has been surveyed in textbook form by Persson and Tabellini (1990), Cukierman (1992) and Schaling (1995).

The formal theoretical literature on central bank independence starts with Rogoff (1985), whose analysis of the conservative central banker is the basis of the model in Section 4.3 although the treatment of society's problem as a principal-agent problem is suggested by Barro and Gordon (1983b) in an anticipatory footnote. Giavazzi and Pagano (1988) discuss the commitment ability in multilateral fixed exchange rate regimes, although their analysis is carried out in a richer dynamic framework than the simple model of Section 4.1. Flood and Isard (1989) introduced the formal analysis of the rules with escape clauses. Lohman (1992) discussed the implementation of an escape clause, by costly government override, in a monetary policy model that also included delegation to a Rogoff-type central banker. Obstfeld (1996) applied an escape-clause model in his analysis of realignments within the ERM, emphasizing the possibility of multiple equilibria. Bordo and Kydland (1995) argue that the classical gold standard worked like a rule with escape clauses. Flood and Marion (1997) includes an insightful discussion of escape clause models and speculative attacks. The optimal contracting solution to the credibility problem, in Section 4.4, was developed by Walsh (1995a) and by Persson and Tabellini (1993), and was further extended by Beetsma and Jensen (1996) and by Herrendorf and Lockwood (1997).

Insightful recent general discussions about the appropriate institutional framework for monetary policy can be found in Fischer (1995), McCallum (1996), Goodhart and Vinals (1994). Cukierman and Lippi (1997) study theoretically and empirically how the optimal central banking arrangement varies with the structure of labor markets. The early real-world experience with inflation targeting is surveyed in Leiderman and Svensson (1995). More recent surveys include Haldane (1995), and Mishkin and Posen (1996).

A number of studies—including Bade and Parkin (1988), Alesina (1988), Grilli, Masciandaro and Tabellini (1991), Cukierman (1992), and Eijffinger and Schaling (1993)—have developed empirical measures of central bank independence and studied their relation to inflation and other macroeconomic outcomes in a cross-section of countries during the last few decades. Capie, Mills and Wood (1994)

study historical evidence on inflation before and after major central bank reforms in twelve countries since the end of the 19th century. Jonsson (1995b) uses pooled time-series and cross-section data from the OECD countries since the early sixties and finds that the negative relation between central bank independence and inflation is robust to the control of a number of other institutional and economic variables. Posen (1993) criticizes this kind of finding and argues that it is caused by an omitted variable problem, the causal variable for both independence and inflation being the resistance against inflation in the financial community. A survey of empirical studies is found in Eijffinger and de Haan (1996).

Each subsection above refers to additional relevant studies on specific topics.

Part II
Fiscal Policy

This part of the chapter focuses mainly on intertemporal aspects of fiscal policy, such as government debt issue and taxation of wealth. A companion piece (Persson and Tabellini (1997)) surveys the research on static "public finance" problems. The main stylized facts regarding the intertemporal aspects of post-war fiscal policy in the industrialized countries include:

> (i) Tax rates on capital vary considerably across countries and fluctuate over time, with an upward trend. In many countries, estimates of effective tax rates on capital are quite high and often higher than tax rates on consumption or labor. [36]
>
> (ii) Many countries have accumulated large debts, even in peace time. For most countries, debt accumulation in the post-war period started in the early 1970s. The cross-sectional pattern of deficits is far from homogenous; some countries have been endemically in deficit and built up massive debts, whereas others have not.[37]

[36] Mendoza, Milesi Ferretti and Asea (1996), building on earlier work by Mendoza, Razin and Tesar (1994), compute effective tax rates for a sample of 14 industrial countries, during the period 1965-91. For the most recent six-year period, the average capital tax rate for these countries was close to 40%, higher than both the average labor tax rate and the average consumption tax rate. Furthermore, the average tax rate on capital was higher than that on labor and consumption during every five-year period since 1965, and kept rising over time.

[37] See for instance Elemendorf and Mankiw (this volume) and Alesina and Perotti (1995b).

(iii) Large deficits and debts have been more common in countries with proportional rather than majoritarian and presidential electoral systems, in countries with coalition governments and frequent government turnovers, and in countries with lenient rather than stringent government budget processes.[38]

It is difficult to account for these regularities by the theory of optimal taxation or, more generally, any theory that assumes policy to be set by a benevolent social planner. According to Chamley (1986), the optimal capital tax should decline over time, asymptotically approaching zero, as the long-run elasticity of investment is very high compared to that of other tax bases. Similarly, Barro's (1979) tax-smoothing model of deficits can successfully explain war-time deficits, but not the persistent accumulation of debt that has occurred in many industrial countries since the 1970s. Moreover, the correlations between policies and political institutions suggest that political and institutional factors play an important role in shaping fiscal policy.

In this second part of the chapter, we survey some recent literature that speaks to these stylized facts on the basis of positive models of fiscal policy. As in monetary policy, these recent contributions try to explain departures from socially optimal outcomes by various incentive constraints in the policy formation process. In section 5 we discuss credibility again, abstracting from politics and individual heterogeneity. Section 6 we add politics to our basic model of fiscal policy and discuss alternative explanations for large government borrowing.

5. Credibility of Fiscal Policy

We first discuss the *ex post* incentive compatibility constraints that imply a lack of credibility for desirable tax policies. Many insights parallel those in monetary policy. But by adding microeconomic foundations, we can now make more meaningful welfare statements. And by adding an explicitly dynamic setting, we can investigate how state variables link policy decisions over time. As in monetary policy, sequential (or discretionary) decision-making and a lack of policy instruments may imply that the government lacks credibility and loses control of private sector expectations. The economy gets trapped in a third-best equilibrium, where the government relies excessively on a highly distorting policy instrument. The

[38] See von Hagen and Harden (1994), Alesina and Perotti (1995b), Grilli, Masciandaro and Tabellini (1991), Roubini and Sachs (1989).

most obvious example is the "capital levy problem". But credibility problems are not confined to capital taxation: they are the norm rather than the exception in a dynamic economy. These issue are discussed in Subsecton 5.1. Subsection 5.2 treats another consequence of lack of credibility: the possibility of multiple equilibria and confidence crises, features often observed in countries with high public debts. In a dynamic economy current policy credibility depends on previous policy decisions; for instance, it depends on the size and denomination of the outstanding public debt; this new dimension is discussed in subsection 5.3. Finally, as in monetary policy, reputation can mitigate the adverse effects of the *ex post* incentive constraint and institutions can be designed to relax it. These remedies are briefly discussed in Subsection 5.4.

5.1. The Capital Levy Problem

According to the standard theory of optimal taxation, capital should be taxed at a much lower rate than labor or consumption. Moreover, the tax rate on capital income should generally decrease over time and approach zero asymptotically. The reason is that the elasticity of investment tends to be higher than those of labor supply and consumption, and it is even higher over longer horizons, as there are more opportunities for intertemporal substitution. This prescription sharply contrasts with stylized fact (i) above. Lack of credibility offers a reason why even a benevolent government can end up with such a suboptimal tax structure.[39]

The Model Consider a two period closed economy, t =1,2, with one storable commodity. A representative consumer has preferences defined over consumption in both periods, c_t, and leisure in the second period, x, represented by:

$$u = U(c_1) + c_2 + V(x). \tag{5.1}$$

In the first period, the consumer either consumes his exogenous and untaxed endowment, e, or invests a non-negative amount in a linear storage technology with unitary gross returns. In the second period, he devotes his unitary time endowment to labor l, or leisure time x, and consumes all his income and wealth after having paid taxes. His budget constraints are:

$$c_1 + k = e \tag{5.2}$$

[39]The next two subsections draw on Persson and Tabellini (1990, ch. 6).

$$c_2 = (1-\theta)k + (1-\tau)l, \tag{5.3}$$

where k is the investment in the storage technology, θ and τ are the capital and labor income tax rates, and the real wage is unity.

Finally, the government must finance a given amount of second period per-capita public consumption, g. Thus, the government budget constraint is:

$$g = \tau l + \theta k. \tag{5.4}$$

Taxes are only paid in the second period and lump-sum (i.e. non-distorting) taxes are not available. We follow the public-finance tradition of treating the set of available Ramsey taxes as exogenous; but ultimately, the non-availability of (personalized) lump-sum taxes must be due to some heterogeneity that can only be imperfectly observed by the government. What is the optimal tax structure in this economy? And what is the equilibrium tax structure if the government lacks credibility? We address both questions in turn.

The Ex Ante Optimal Policy To derive a normative benchmark, we assume that at the start of period 1—before any private decision is made—the government commits to a tax structure (θ, τ) for the period 2. The decision is observed by the private sector, and cannot be changed. There is no uncertainty, and period 2 public consumption, g, is known already in period 1.

We first describe how the private sector responds to the tax rates. The private sector first-order conditions are:

$$U_c(e-k) \geq 1-\theta; \qquad V_x(1-l) = 1-\tau, \tag{5.5}$$

where the equality in the first condition applies at an interior optimum with positive investment. Each tax rate thus drives a wedge between the relevant marginal rates of transformation and substitution. Optimal policy seeks to minimize the resulting distortions. Inverting these two expressions, we obtain the private sector savings function $k = Max[0, K(1-\theta)]$, where $K(1-\theta) \equiv e - U_c^{-1}(1-\theta)$, and labor supply function $l = L(1-\tau) \equiv 1 - V_x^{-1}(1-\tau)$. The partial derivatives K_θ and L_τ are both negative. By the separability and quasi-linearity of the utility function, each tax base depends on its own tax rate only. For future reference, it is useful to define the elasticities of these two tax bases with respect to their own net of tax returns, as $\varepsilon_k(\theta), \varepsilon_l(\tau)$, respectively [40].

[40] These elasticities are, respectively:

The optimal tax structure maximizes consumer welfare, subject to the private sector and government budget constraint, (5.2)- (5.4), and the private sector first-order conditions, (5.5). Solving this optimization problem yields the following version of the Ramsey Rule[41]:

$$\frac{\theta}{1-\theta}\varepsilon_k(\theta) = \frac{\tau}{1-\tau}\varepsilon_l(\tau). \tag{5.6}$$

Equation (5.6) implicitly defines the *ex ante* optimal tax structure. What are its general properties? First, optimal tax rates are higher on the more inelastic tax base. Second, it is always optimal to tax both bases, as long as both elasticities are finite and strictly positive. Finally, both tax rates move in the same direction if the revenue requirements change; higher public consumption drives up both tax rates, in proportion to their elasticities. If, as empirically plausible, labor supply is much more inelastic than investment, the optimal tax rate on labor is much higher than that on capital. As taxes are distorting, the economy reaches a second best—not a first best.

Equilibrium under Discretion Suppose instead that the policy decision is taken at the start of period 2, after period 1 investment decisions have been made. This timing is much more plausible, as a sovereign country can change its tax structure at any time, under a normal legislative procedure. Under this timing, however, every tax structure promised in period 1 is not credible. A credible tax structure must be optimal *ex post*; from the vantage point of period 2. More precisely, a credible equilibrium tax structure satisfies three requirements. (i) Individual economic decisions are optimal, given the expected policies and the decisions of all other individuals in the economy. (ii) The tax structure is *ex post* optimal, given outstanding aggregate capital and individual equilibrium responses to the tax structure. (iii) Individual expectations are fulfilled and markets clear in every period. Let us consider each of these requirements.

$$\varepsilon_k(\theta) \equiv \frac{(1-\theta)}{K}\frac{dK}{d(1-\theta)} = -\frac{U_c}{KU_{cc}} > 0$$

$$\varepsilon_l(\tau) \equiv \frac{(1-\tau)}{L}\frac{dL}{d(1-\tau)} = -\frac{V_x}{LV_{xx}} > 0$$

[41] See Persson and Tabellini (1990, ch.6), for a derivation.

(i) Optimal individual behavior is still summarized by the functions K and L and by the corresponding elasticities. But the investment function and the corresponding elasticity are now defined over the *expected,* not the actual, capital tax rate, as the tax structure is decided in period 2, after the investment decision. Thus, $k = K(1-\theta^e)$ and $\varepsilon_k(\theta^e)$. We call this elasticity the *ex ante* elasticity of investment, since it is defined over θ^e rather than θ.

(ii) The *ex post* optimal tax structure also continues to be described by the Ramsey Rule, (5.6), but with one important proviso. The investment elasticity that enters equation (5.6) is the *ex post* elasticity, that is the elasticity with respect to the actual tax rate θ, since that is what the government is choosing. By the argument at point (i), this *ex post* elasticity is zero: k depends on θ^e, not on θ. Equation (5.6) then implies that for any given capital stock k the *ex post* optimal capital tax rate, θ^*, must satisfy:

$$\theta^* = Min[1, g/k]. \tag{5.7}$$

The optimal labor tax rate τ follows from the government budget constraint. In particular, $\tau = 0$ if $\theta^* = g/k < 1$. This result is very intuitive. When tax policy is chosen, the supply of capital is completely inelastic at k , whereas the supply of labor continues to have a positive elasticity, as it is chosen by the private sector after observing tax policy. Hence, the government finds it *ex post* optimal to set either a fully expropriating capital tax rate of 1, or a tax rate sufficiently high to finance all of public consumption with capital taxes, driving labor taxes to 0.

(iii) Rational individuals correctly anticipate government policy. Hence, $\theta^e = \theta^*$ and $k = K(1-\theta^*)$. Combining this last result with (5.7), the equilibrium tax rate is defined by: $\theta^* = Min[1, g/K(1-\theta^*)]$.

We illustrate the possible equilibria in Figure 1. The solid curve is the *ex ante* revenue function for different values of θ. Tax revenues first grow with the tax rate, but at a decreasing rate, since the tax base shrinks as θ rises. Once we reach the "top of the Laffer Curve", tax revenue begins to shrink, as the reduction in the tax base more than offsets the higher tax rate.

If g is sufficiently high (higher than point G) only one equilibrium exists, in which $\theta^* = 1$ and $k = 0$ (point C in the diagram). Irrespective of private expectations, the government fully expropriates any outstanding capital stock. Anticipating this, nobody invests. It is easy to verify that all three requirements for an equilibrium are fulfilled. Private individuals optimize and have correct expectations about policy. And the government also optimizes, for even with no capital outstanding, $\theta = 1$ is (weakly) optimal, as confirmed by (5.7). This

equilibrium is disastrous: there is a prohibitive tax on capital, but still a large tax on labor which is the only available tax base. Yet, the government can do nothing to change the outcome. No promise to tax capital at a rate lower than 1 would be believed, because it would not be *ex post* optimal for the government to fulfill it.

If g is below point G in Figure 1, this disastrous outcome continues to exist together with two other equilibria. Suppose that government spending corresponds to the horizontal line in Figure 1. Then points A and B are also equilibrium outcomes. At point A, every consumer expects $\theta^e = \theta^A$ and invests $K(1-\theta^A)$. Hence, the government can just finance g by setting θ exactly at θ^A, while keeping the labor tax equal to 0. Thus, the government is at an *ex post* optimum. The same argument establishes that point B is also an equilibrium.

These equilibria are clearly Pareto ranked: A is better than B which is better than C. They are all worse than the *ex ante* optimal tax structure, since they tax capital too heavily and labor too lightly (except at point C where both bases are taxed too heavily). If the government is unable to commit, the economy is trapped in a third best, or worse, allocation.

Extensions Results similar to those above, apply to the taxation of other forms of wealth, in particular to public debt and real money balances; in the case of money, naturally, the tax takes the form of inflation. The logic is always the same. Once an investment decision has been made, the tax base is fixed and it becomes *ex post* optimal to tax it as much as needed, or as much as possible.

Moreover, credibility problems are not confined to wealth taxes, but are generic in a dynamic economy with sequential policy decisions. The reason is that the *ex post* and *ex ante* elasticity of tax bases generally differ from each other. In general this difference is not as stark as with wealth taxes, where the *ex post* elasticity is zero. In the case of other tax bases than wealth, we can no longer conclude that the optimal tax rate is always higher *ex post* than *ex ante*. To gain some intuition for why, consider an increase in a labor tax rate in a given period t. If the tax increase is *unanticipated*, the household substitutes from labor into leisure in the current period. But if the tax increase was *anticipated* in period $t-1$, some intertemporal substitution has already taken place: the household works less in period t, but has already worked more in period $t-1$. We cannot generally tell whether an anticipated or an unanticipated tax hike is more distorting, however. Intertemporal substitution increases the distortion at time t, the period of higher taxes, as the tax base is more elastic. But this greater distortion is offset by a

larger tax base in period $t-1$, when the household is working more in anticipation of higher future taxes. In general, therefore, we can say that optimal tax rates are different, but not whether they are higher *ex ante* or *ex post*.[42]

We close this discussion with two remarks. First, characterizing the equilibrium with sequential government decisions is relatively easy in a two-period economy, and doable in a finite-horizon economy. But it becomes very difficult in an infinite horizon economy.[43] Second, so far we have considered a representative consumer economy in which the government lacks a non distorting tax and has incentives to raise revenues in less distorting ways. Lump-sum taxation may, however, not be enough to avoid lack of credibility. If the government also has distributive goals, but not enough lump-sum taxes and transfers to reach its desired income distribution, the optimal tax policy may still lack credibility despite the availability of (non-personalized) lump-sum taxation. What matters ultimately is thus a scarcity of policy instruments relative to objectives.

5.2. Multiple Equilibria and Confidence Crises

When discussing reputational equilibria in monetary policy, we argued that multiple equilibria indicated an incomplete theory. Here, multiplicity of equilibria instead reflects an indeterminacy in the economy, and helps explain the occurrence of sudden speculative attacks or capital flights that have plagued many economies. Absent a commitment technology, policy is driven by private expectations rather than the other way around. Equilibria under discretion thus become intrinsically fragile, as investors face a difficult coordination problem. The *ex post* optimal policy depends on aggregate investment. But aggregate investment depends on the simultaneous decisions of many atomistic individuals, which in turn depend on expectations about policy. Thus, there is a strategic complementarity. A single investor expecting nobody else to invest also finds it optimal not to invest: he realizes that aggregate capital will be small, and hence full expropriation is inevitable. Thus, individual expectations are self-fulfilling and, as they are not nailed down by any economic fundamentals, can fluctuate widely. The resulting policy uncertainty is yet another drawback of a discretionary policy environment.

These problems arise in many policy decisions. Consider public-debt repayment in a two-period economy, and suppose that in the second period debt can be partially defaulted or taxed away, at a cost proportional to the size of the default.

[42] For a further discussion, see Persson and Tabellini (1990, ch.8).

[43] See also the survey by Krusell, Quadrini and Rios Rull (1994).

Calvo (1988) shows that we then get multiple equilibria. In a good equilibrium, every investor expects the debt to be fully repaid and demands a low interest rate. To avoid the cost of default, the government indeed services the outstanding debt. In a bad equilibrium, every investor expects partial default and demands a higher interest rate. The cost of servicing this debt is now higher, and with distorting taxes the government prefers a partial default; hence, default expectations are self-fulfilling. The equilibrium with default is Pareto inferior, as the net amount serviced is the same, but default costs are borne.

Another example, studied by Velasco (1994) and Giavazzi and Pagano (1990), concerns exchange-rate crises in a high public debt economy. By assumption, the cost of outright default is prohibitive, but the outstanding debt could be monetized away. In a good equilibrium, investors expect the exchange rate peg to be viable and the domestic interest rate equals the foreign interest rate; at this low interest rate, it is optimal to service the outstanding public debt by tax revenue alone. In a bad equilibrium, investors expect the peg to collapse. They demand a higher interest rate, which raises the cost of servicing the debt through tax revenue; at the higher interest rate, it becomes optimal to fulfill the expectations, the peg is abandoned and the debt is partially monetized through higher inflation.[44]

Related coordination problems arise in *sequential* (as opposed to simultaneous) investment decisions. Alesina, Prati and Tabellini (1990) and Cole and Kehoe (1996a,b) study an infinite horizon economy with a large public debt. Like in Calvo (1988), default is costly, but the cost is assumed to be a lump sum cost. In the good equilibrium, the debt is rolled over forever at low interest rates, and distorting taxes are raised to pay interest on the debt. In the bad equilibrium, there is a debt run, as nobody wants to buy the outstanding debt for fear that—next period—investors will refuse to roll it over. Faced with such a situation, it is indeed *ex post* optimal for the government to default on the debt, rather than repaying it all at once. Thus the investors fears are indeed rational and self-fulfilling. Here, the coordination problem thus concerns investment decisions at different points in time.

[44] A high cost of servicing the debt is not the only reason why an exchange rate peg may not be credible. In a related argument, Bensaid and Jeanne (1997) show that multiple equilibria can arise if raising the interest rate to defend an exchange-rate peg is too costly for the government.

5.3. Public Debt Management

The papers discussed in the previous subsection have implications for debt management policies, as the occurrence of a confidence crisis depends on the maturity structure or currency denomination of outstanding debt. For instance, the debt-run equilibrium discussed by Alesina, Prati and Tabellini (1990) disappears if the outstanding debt has a long enough maturity, whereas it is more likely with a short-maturity debt that must be rolled over every period. Similarly, the results in Giavazzi and Pagano (1990) suggest that issuing foreign currency debt can reduce the risk of capital flight, as investors are already protected against depreciation.

More generally, public debt management policies alter the future incentives of the monetary and fiscal authorities in many subtle ways, even if the *ex ante* and *ex post* elasticities of all tax bases are the same. This point was first noted in the seminal paper by Lucas and Stokey (1983) with regard to the maturity structure of public debt. They start from the observation that fiscal policy typically alters real interest rates. The resulting wealth effect can benefit or harm the government, depending on the composition of its balance sheet. With a lot of long-term debt, a higher long-term real interest rate depreciates the outstanding debt and acts like a non-distorting capital levy. Alternatively, if it has long-term assets and short-term liabilities, the government benefits from a policy that reduces the short-term real interest rate. Under sequential decision making, the government's *ex ante* optimal policy may not credible: the government may have an incentive to deviate from it *ex post*, in order to change the value of its outstanding assets and liabilities. Conversely, these incentives give an additional role for public debt management policies: if the maturity and contingency structure of the debt is rich enough, it can be revised over time so as to maintain credibility of the *ex ante* optimal tax policy under sequential decision making, even if *ex ante* and *ex post* elasticities of relevant tax bases differ from each other. [45] Naturally, these results only hold if the economy is closed or large enough to affect intertemporal world prices.

Not only the maturity structure of the public debt shapes policy incentives. Its composition into nominal and indexed debt plays a similar role, as the real value of the former, but not the latter, depends on the price level.[46] Based on this observation, Persson, Persson and Svensson (1987) show that the capital-levy incentive for the government to dilute the real value of its outstanding nominal liabilities—

[45] "Rich enough" generally means that there are as many goverement debt instruments as there are policy instruments.

[46] Public debt denominated in foreign currency is similar to indexed debt in this regard, but will not be considered here.

such as the money stock—can be relaxed if the government holds claims on the private sector, denominated in nominal terms. If the nominal claims and liabilities are balanced, the *ex ante* Ramsey solution may be sequentially sustained. But nominally denominated liabilities can also offer valuable insurance against unanticipated fluctuations in government spending, if the government does not have access to contingent debt. Calvo and Guidotti (1990) study the choice between nominal and indexed debt as a tradeoff between credibility and flexibility.

The upshot is thus that the structure of the public debt becomes a strategic variable that can be manipulated by a government to relax incentive constraints which it will meet in the future. As a result, the "government capital structure" again becomes non-neutral, even if a Modigliani-Miller theorem about the irrelevance of the government financial structure would apply in the absence of these incentive constraints. In this section, we have only considered governments that continue to make decisions in the future with full certainty. But the idea of using public financial policies strategically to influence future fiscal policy decisions, obviously extends to the case which is more relevant for real-world democracies (dictatorships), where elections (coups and revolutions) shift the identity and policy preferences of governments over time. Strategic public financial policies have indeed received attention in the literature on the politics of public debt that we survey in Section 6.

5.4. Reputation and enforcement

As in monetary policy, repeated interaction creates incentives to maintain a reputation, which may mitigate the capital-levy problem. Suppose that future expected capital tax rates depend on the current tax structure. Even though existing capital is taken as given by the government, it still perceives future investment to respond to current tax rates, through expected future tax rates, and this discourages overtaxation. Chari and Kehoe (1990) have studied this reputation mechanism in an infinitely repeated version of the simple two-period model of Section 5.1. The equilibrium with reputation comes arbitrarily close to the *ex ante* optimal Ramsey rule, under appropriate assumptions about the government discount factor and the length of the punishment period. Kotlikoff, Persson and Svensson (1988) show that a related enforcement mechanism may be available in an overlapping-generation economy. A misbehaving government is not deterred by investors expectations, but by the threat that future generations of tax payers will withdraw their intergenerational transfers to a generation that breaks "the

social contract" by overtaxing capital. Naturally, multiplicity of equilibria remain in both models.

When we consider default on public debt, however, reputational equilibria encounter additional difficulties. Suppose that a defaulting government is "punished" by savers, who refuse to buy public debt in the future. The punishment thus consists of not being able to smooth tax distortions overtime, in the face of fluctuating public spending or tax bases. Is this sufficiently strong to deter default? Bulow and Rogoff (1989) argue that it is not. Suppose that a defaulting government can never borrow again, but can nevertheless still invest budget surpluses in assets earning the market rate of return (for instance, by accumulating reserves of a foreign asset). Then, a simple arbitrage argument implies that the government is always better off defaulting rather than repaying its debt. [47] Thus, simple reputation models cannot explain public debt repayment. There must be other reasons why governments honor their debts: either reputational spillovers across policy instruments, or other costs in a default, such as distress in the banking system, arbitrary redistributions, or sanctions credibly enforced by the international community.

In Part I, we discussed various institutional reforms that might raise the credibility of desirable policies. In the case of fiscal policy, such reforms are less effective, however, as the tasks of a sovereign legislature cannot be narrowly defined. Nevertheless, some institutional devices could mitigate the capital-levy problem. Political delegation to a conservative policymaker is one way. International tax competition is another. As discussed in a companion survey (Persson and Tabellini (1995)), capital controls or international tax agreements that limit tax competition exacerbate the domestic credibility problems, and could thus be counterproductive.

5.5. Notes on the Literature

Much of this section is based on Persson and Tabellini (1990, chs. 6-8). There is a large game theoretic literature on dynamic games with sequential decision-making. What started this line of research are again the papers by Kydland and Prescott (1977) and Calvo (1978). The book by Basar and Olsder (1982) provides a game-theoretic analysis of these problems in an abstract setting.

[47] Bulow and Rogoff (1989) develop their argument in the case of sovereign loans that finance consumption or investment, with no tax distortions, for arbitrary concave utility and production function. But their result generalizes to a model with tax distortions.

The "capital levy problem" has a long history in economics. Eichengreen (1990) provides a historical account. It has been formally analyzed (although with numerical solutions) in a two-period economy by Fischer (1980). An early treatment of surprise inflation to tax real money balances is Auernheimer (1974), but Calvo (1978) is the classic here.

A large literature deals with speculative attacks and multiple equilibria. In this section we have only focused on multiple equilibria that arise when policy is endogenous and there is a credibility problem. Confidence crises on public debt have been studied by many authors; in particular by Calvo (1988), Alesina, Prati and Tabellini (1990), Cole and Kehoe (1996a,b), Giavazzi and Pagano (1990). Multiple equilibria with discretionary monetary policy have also been extensively treated in the literature, in particular by Obstfeld (1991), Bensaid and Jeanne (1997), Chari, Christiano and Eichenbaum (1996), Velasco (1994)

Reputation and capital taxation is discussed by Kotlikoff, Persson, and Svensson (1988), Chari and Kehoe (1990) and, more recently, by Benhabib and Rustichini (1996), while Grossman and van Huyck (1988) and Chari and Kehoe (1993) applied reputation to a model of public debt repayment. The idea that reputation can fail in the case of sovereign debt repayment is due to Bulow and Rogoff (1989), whereas Chari and Kehoe (1993) show that enforcement problems on both sides of the market can restore a role for reputation. Reputational spillovers across contracts are discussed by Cole and Kehoe (1994). Political delegation and capital levies are modeled in Persson and Tabellini (1994b) and discussed by North and Weingast (1989) in a fascinating historical context. The literature on international tax competition and credibility is surveyed by Persson and Tabellini (1995).

The credibility of optimal tax structures in a general intertemporal context and without capital has been studied by Lucas and Stokey (1983). Their seminal paper discusses both debt management and the credibility of tax policy. Subsequently, Persson and Svensson (1984) and Rogers (1987) reinterpret and clarify some of the general issues concerning the credibility of optimal intertemporal taxation. The debt management implications of the Lucas and Stokey paper are also generalized and interpreted, by Chari, Christiano, and Kehoe (1992) and by Persson and Svensson (1986). Persson, Persson and Svensson (1987) extend the Lucas and Stokey result to a monetary economy, whereas Persson, Persson and Svensson (1996) show that the temptation to generate surprise inflation may be much stronger than the theoretical literature suggests, once the full set of nominal rigidities in public expenditure and tax programs are taken into account. Rogers (1987) discusses strategic debt management and credible tax policy in an econ-

omy with endogenous government consumption, while Rogers (1986) considers distributive goals. Missale and Blanchard (1994) study how the maturity structure required to make a low-inflation policy incentive compatible varies with the level of debt. Calvo and Guidotti (1990) study the credibility-flexibility tradeoff in the optimal decomposition of public debt into indexed and non-indexed securities. Finally, Missale, Giavazzi and Benigno (1997) as well as Prati and Drudi (1996) have studied public debt management as a signal of the government resolution to enact stabilization policies.

6. Politics of Public Debt

As noted in the introduction to Part II, many industrial countries have accumulated large debts in peace time. Moreover, debt and deficits appear to be correlated with specific political and institutional features. The goal of this section is to survey the literature that addresses these issues.

We begin with the idea that deficits may be a by-product of political instability. Section 5 emphasized that governments can manipulate their debt structure to resolve their own future credibility problems. Subsection 6.1 takes up this thread, showing how the debt level itself can be used strategically to bind the hands of succeeding governments with different political preferences, in a way first suggested by Alesina and Tabellini (1990) and Persson and Svensson (1989). This idea typically applies to political systems with two parties and a government that clearly represents the view of a cohesive political majority. The debt level can also be used to enhance the incumbent government's re-election probability, in a way first suggested by Aghion and Bolton (1990) and also discussed in Section 3. We construct a simple two-period example that incorporates both of these mechanisms.

The remainder of the section then looks at political systems with more dispersed political powers, as in the case of coalition governments or powerful political interest groups. In Subsection 6.2, we discuss why such a situation may be particularly prone to generate deficits. The argument is a dynamic version of the *common-pool* problem formulated by Levhari and Mirman (1980)—in the context of natural resources—and applied to government debt by Velasco (1996). In Subsection 6.3 we follow the approach of Alesina and Drazen (1991), showing how the struggle between powerful groups, about who will bear the cost of necessary cuts in spending, may lead to a war of attrition delaying the elimination of existing deficits. In both these subsections, we reduce the full-blown dynamic

models found in the literature to simple two-period examples.

In Subsection 6.4, finally, we discuss briefly how the politics of intergenerational redistribution may trigger government deficits, as suggested by Cukierman and Meltzer (1989), Tabellini (1991) and others.

6.1. Political Instability in a Two Party System

Economic Equilibrium Consider a two-period economy without capital, but otherwise similar to that of subsection 5.1. A continuum of individuals have identical preferences over consumption and leisure. First we describe their preferences over private economic outcomes and their private economic behavior, for a given economic policy. Individual preferences over public policy and different parties are described later.

Preferences over private economic outcome are given by the utility function:

$$u = c_1 + c_2 + V(x_1) + V(x_2). \tag{6.1}$$

Every consumer faces the same constraints. Leisure and labor in period t, x_t and l_t, must sum to unity. Budget constraints are:

$$c_1 + b = (1 - \tau_1)l_1 \quad ; \quad c_2 = (1 - \tau_2)l_2 + Rb,$$

where τ_t is a labor tax rate, R the gross interest rate, and b the holding of public debt—the only available form of saving. By the absence of discounting and the linearities in the utility function, an interior equilibrium for b requires $R = 1$. Recognizing this, we can write the equilibrium consolidated budget constraint as

$$c_1 + c_2 = (1 - \tau_1)l_1 + (1 - \tau_2)l_2.$$

Solving the consumer problem, leads to labor supply functions $L(1 - \tau_t)$ identical to those of section 5.1.

Public spending only takes place in period 2. Let g denote total per capita public consumption. Using $R = 1$, the government budget constraints are:

$$-b = \tau_1 l_1 \quad ; \quad b + g = \tau_2 l_2$$

It is useful to re-express private utility as an indirect utility function defined over the policy variables b and g. Private equilibrium utility is only a function of the two tax rates τ_1 and τ_2. From the government budget constraints, these

tax rates can be expressed as functions of b and g. Thus we can rewrite (6.1) as: $J(b,g) \equiv Max[c_1+c_2+V(x_1)+V(x_2)]$. This indirect utility function has intuitive properties. First, $J_g < 0$, is the private marginal cost of government spending which is increasing in g : $J_{gg} < 0$. Second, J_b is the private marginal cost of government debt. The symmetry of labor supply implies:

$$J_b \gtreqless 0 \qquad as \qquad b \lesseqgtr -g/2. \tag{6.2}$$

That is, when tax rates are equal over time, tax distortions are optimally smoothed out ($J_b = 0$). But if more (less) than half the revenue necessary to finance g is raised in period 1, so that $b < -g/2$ ($> -g/2$), private utility could be enhanced by higher (lower) debt issue. Finally, as taxes are distortionary and as higher b adds to the government's tax bill in period 2, the cross-derivative J_{bg} is negative. [48]

The Political System Individuals belong to two different groups, which we label d and r, of given size s and $(1-s)$. The two groups are identified with the supporters of two political parties: D and R. Individuals and parties differ in their preferred allocation of public spending over two types of public consumption: g^d and g^r . The two types of public consumption each requires one unit of output, but they provide different utilities to the two parties and their individual supporters. For simplicity we assume that individuals belonging to group d (r) only care about g^d (g^r) and that each party only cares about the utility of its own supporters. If elected, party I thus maximizes the utility function:

$$u^I = J(b,g) + H(g^i). \tag{6.3}$$

Thus, party I correctly internalizes the welfare effects of economic policy on private economic outcomes, according to the indirect utility function J defined over debt and total spending and evaluates the benefits of public consumption for its constituency according to the (concave) H function, defined over g^i. Political parties are "outcome motivated" rather than "office motivated". It is easy, however, to amend the model with a separate benefit of holding office, as in Section 3.

[48] Note that our formulation of the model rules out credibility problems of the type discussed in Section 5. The assumed preferences imply that labor supply functions depend on the current after tax wage only, so that there is no difference between ex ante and ex post elasticities. Also, incentives for debt repudiation do not arise, because the government is a creditor and has no opportunity to manipulate the equilibrium interest rate.

Finally, we assume that relative group size s is a random variable, the realization of which determines the election outcome. We define $P = \Pr(s \leq 0.5)$ as the probability, from the viewpoint of period 1, that party R wins. This electoral uncertainty can be due to a random participation rate, or to uncertainty about the relative popularity of parties on other policy dimensions. Below we suggest an explicit model for P, but for now we take it as exogenous.

Equilibrium Policy Events in the model unfold as follows: (1) One of the parties holds office in period 1; this party sets debt (tax) policy b. (2) Economic decisions in period 1 are made. (3) The elected party takes office and sets public spending. (4) Economic decisions in period 2 are made. As before, we consider a sequentially rational equilibrium, and we characterize it by backward induction.

Optimal private decisions at stages (2) and (4) are already subsumed in the indirect utility function. Suppose party I holds office in period 2. It chooses g so as to maximize its objective in (6.3), given the outstanding debt level b. The first-order condition for good i is

$$J_g(b, g) + H_g(g^i) = 0. \tag{6.4}$$

Thus party I spends on good i only (good $j \neq i$ has only costs and no benefits) and equates the marginal cost of supplying good i to its marginal benefit (to group i). Clearly, this condition defines a reaction function $g^i = G(b)$ which is the same for both parties. Since higher debt implies higher period-2 tax distortions, any government type is less willing to spend on public goods if it inherits a higher public debt; hence: $G_b < 0$.

We can look at the period-1 incentives to issue debt at stage (1). The identity of that government does not matter for the results, but to fix ideas we suppose that party D is the incumbent. Its expected payoff, given the expected election outcome, depends on debt policy according to the incentive constraint imposed by equilibrium policy choices in period 2:

$$E(u^D(b)) = J(b, G(b)) + (1 - P)H(G(b)].$$

Optimal debt policy thus has to satisfy:

$$J_b + [J_g + (1 - P)H_g]G_b = J_b - PH_gG_b = 0, \tag{6.5}$$

where the second equality follows once we impose condition (6.4). Condition (6.5) has an intuitive interpretation. To strengthen the intuition, first consider

the special case in which party R stands no chance at winning—that is, $P = 0$ for any b. Then (6.5) reduces to $J_b = 0$. In words, a government that is certain of re-election chooses the efficient debt policy, smoothing completely over time the tax distortions from the financing of its preferred public good.

When re-election is not certain, however, other incentives come into play. The larger is the probability that the opponent will win, the more party D deviates from the efficient debt policy, as is evident from the second term. As this term is positive, party D sets $J_b < 0$ whenever $P > 0$. A positive probability of losing the election leads to excessive debt issue—or more precisely to an insufficient surplus today (recall (6.2)). Whereas the incumbent government fully internalizes the benefits of borrowing associated with tax smoothing, it does not fully internalize the cost of lower public spending in the future, because these costs are born only if the government is re-elected. Thus, the over-issue of debt is larger the slimmer is the re-election probability. To express the intuition in an alternative way: it is optimal for the party D government to tie the hands of a prospective party R government, as that party will spend on a good not valued by the natural constituency. This strategic motive, creating facts for a successor with different preferences, was first stressed by Persson and Svensson (1989) and Alesina and Tabellini (1990).

Endogenous Election Outcomes As mentioned already in Section 3, governments also manipulate state variables to increase their chances of re-election. We now modify our model to show how this incentive applies to public debt, illustrating an idea first stressed by Aghion and Bolton (1990). Consider the same model, but suppose that parties and individuals also differ along a second—not explicitly modeled—dimension capturing aspects of public policy that do not directly affect the economy. Specifically, we assume that individual utility depends on the identity of the party holding office, in addition to the public good it provides. But we allow individuals belonging to the same group to have different preferences over policymakers in this second dimension. Thus, we postulate the following overall preferences for individual j in group i , for $i = D, R$:

$$u^{ij} = J(b, g) + H(g^i) + (\alpha^j + \beta)K^D, \tag{6.6}$$

where $H(\cdot)$ is the same concave function as in (6.3), and the dummy variable K^D equals 1 if party D holds office in period 2, and 0 if party R holds office. The parameter α^j is distributed around a mean value of 0 in the population of each group, according to the symmetric and unimodal distribution function $F(\alpha^j)$. In

period 1 the precise value of β is not known, but only its expected value $E(\beta)$. The α^j parameter thus measures an idiosyncratic "ideological" (and exogenous) bias for party D, and to the extent that β is positive, party D enjoys a popularity advantage.

That is, individuals evaluate public consumption according to their group affiliation, and each party cares about its natural constituency. But voters also trade off the economic benefits obtained from their party against other (exogenous or non-economic) aspects of public policy, according to the parameters α and β. These "non-economic" determinants of political preferences are not related to group affiliations in any precise way. This specification of political preferences implies that group affiliation does not completely determine how individuals vote, so that the vote share of each party is endogenous.

Finally, we assume that the relative size of the two groups, given by s, is now a fixed parameter, not a random variable. The timing of events is as before, except that just before the date of elections the realization of aggregate popularity, β, becomes known.

What determines the election outcome ? At the time of elections, debt policy b is given by previous decisions. Consider voter j in group d. She votes for party R if and only if $J(b,g)+H(G(b))+\alpha^j+\beta > J(b,g)$, or if $\alpha^j > -(H(G(b))+\beta)$. Thus, unless the $D-$party is generically unpopular ($\beta < 0$), only group d individuals with a strong idiosyncratic ideological bias against party D vote for party R. Next, consider voter j in group r. She votes for party R if and only if $J(b,g)+\alpha^j+\beta > J(b,g)+H(G(b))$,or $\alpha^j > H(G(b))-\beta$. Not surprisingly, a group r voter is more likely to support party R, since she draws economic benefits from its election.

Combining these conditions and using the law of large numbers, we get the total vote share for party R :

$$S_R(b,\beta) = sF(-H(G(b))-\beta)+(1-s)F(H(G(b))-\beta),$$

where β is a random variable; everything else is known or chosen by the incumbent government. Thus, before knowing the realization of β, the *probability that R wins* is :

$$P(b) \equiv \Pr_{\beta}[S_R(b,\beta) \geq 0.5].$$

We want to know how this probability depends on public debt. As a preliminary step, note that :

$$\frac{dS_R}{db} = H_g G_b[(1-s)f(H(G(b))-\beta) - sf(-H(G(b))-\beta)].$$

where f is the derivative (density) of F. As $H_g G_b$ is negative, the sign hinges on the expression in square brackets. Consider first the case $\beta = 0$. By symmetry of F, we see that the vote share of party R goes up for any β if $s > (1 - s)$. Intuitively, higher b leads to lower future spending, which increases the R party's advantage among voters in group d, but it reduces it among voters in group r. If group d is larger, the former effect prevails. Consider next the case in which $s = (1 - s) = 1/2$. Then, by symmetry and unimodality of F, the vote share for R goes up as b increases if and only if $\beta < 0$. Again the voters in group d are more important, not because the whole group is larger, but because at the margin the voters in group d are more mobile when the D party is generally unpopular. It follows from this discussion that $P_b > 0$ is more likely the larger is s and the smaller is $E(\beta)$. That is, from the point of view of a D incumbent, issuing more debt reduces the probability of re-election ($P_b > 0$) if its economic policies benefit a large group of voters (s is large) or if it is unpopular among all the voters ($\beta < 0$).

It is now easy to characterize the equilibrium debt issued by a D government. Going through the same steps as in the previous subsection, the optimality condition for public debt—the analog of (6.5)—is:

$$J_b - P(b) H_g G_b - P_b H(G(b)) = 0. \tag{6.7}$$

The first two terms on the left-hand side of (6.7) are identical to those in (6.5) and have the same meaning. The government trades off the efficiency considerations of public debt (captured by J_b) and the strategic effects on the future spending decisions of its opponent (captured by $P H_g G_b$). The last term captures the effect of debt on the re-election probability. If issuing debt enhances the re-election chances for party D , so that $P_b < 0$, this effect adds to the incentives to issue debt, but when $P_b > 0$ it pulls in the opposite direction. From the previous discussion we know that $P_b < 0$ is more likely when s is small and when $E(\beta) > 0$. Intuitively, a D government whose spending policies benefit only a small "minority" —one for which s is small—enhances it re-election chances by constraining its own future spending , that is by issuing more debt, since this makes him more attractive to swing voters in the larger group r. Similarly, a D government whose non-economic policies are generically popular finds it more beneficial to go after swing voters in the opposition party's natural constituency, group r.

Discussion What happens if the disagreement between the two parties is not as extreme as we assumed, so that both parties always spend on both goods, g^d and

g^r, although the preferred composition of public spending differs across parties? The answer depends on the shape of the utility function: more debt forces future spending cuts, but which public good is cut the most depends on preferences. If lower total spending is associated with a more similar mix of the public goods by the two parties, Tabellini and Alesina (1990) show that more instability (a lower probability of re-election) still leads to larger equilibrium debt.[49]

The model thus yields the empirical prediction that political polarization (i.e. sharp disagreement between the majority and the opposition) and political instability (i.e., frequent government turnovers) lead to larger debt accumulation. The simple idea that political instability causes government to behave myopically can be applied in more general models. Adding government spending in period 1 does not change the argument in any respect. Similarly, the results go through if policies are chosen directly by the voters, rather than by the government, as long as there is a probability that the current majority will be replaced by a future majority with different preferences. In fact, the prediction is more general and really applies to any intertemporal aspect of public policy, such as the choice of public investment (Glazer (1989) and Part III below), or the implementation of tax reforms (Cukierman, Edwards and Tabellini (1992)).

If political disagreement concerns the overall size of public spending, rather than its composition, the result that public debt policy is economically inefficient continues to apply. But now the direction of the inefficiency depends on which government is in office. Persson and Svensson (1989) show that a conservative government facing a more liberal opposition has an incentive to borrow, to force future spending cuts if the liberal is elected; but a liberal government has the opposite incentives and under-issues debt (runs an excessively large surplus). Hence the empirical prediction that on average left-wing governments are more disciplined than their opponents, because they are more willing to raise tax revenue.

As we saw in the introduction to this part, the general idea that government turnover is positively associated with debt issue in consistent with the stylized facts. Some of the models' specific predictions regarding public debt issue have been taken to the data by Ozler and Tabellini (1991) for developing countries and by Lambertini (1996) for industrial countries, with supportive results in the first paper but not in the second one.[50]

[49] Tabellini and Alesina (1990) formulate this condition in a precise way, referring to the concavity index of the function H.

[50] Petterson (1997) test the Persson-Svensson and Alesina-Tabellini models of strategic debt issue on panel data from Swedish municipalities. He finds support for the former model but not

Stretching the model somewhat, it also predicts that minority governments would be more prone to issue debt, as the two strategic effects pull in this direction for a government with a small natural constituency (a small s tends to raise P and to make P_b negative).[51] For a government with popular candidates, the two effects pull in opposite directions, though. The specific positive implications concerning the effect of debt on re-election probabilities are not necessarily robust, but depend on the assumptions about voters' preferences in (6.6). But the general idea, that public financial policies can also be used to manipulate the relative popularity of the two parties, is sound and has many other applications besides public debt. Clearly, these determinants of economic policy would be even more important if parties were also opportunistic, i.e., also cared about staying in office *per se*.

Finally, note that all of these predictions are confined to a two-party system, and in particular to a political system in which a government, once elected, behaves as a single decision maker. We now turn to coalition governments.

6.2. Coalition Governments

To see why coalition governments may issue debt, consider a two-period, two-group, two-party model, similar to that in the previous section. As tax distortions are not central to the argument here, we assume taxes to be exogenous and lump-sum. Furthermore, we abstract from elections and popularity and instead assume that the two parties share office, both in period 1 and period 2. Public spending occurs in each period. As before, the two groups have sharply different preferences over the composition of public consumption. We can write the utility of a typical group i individual as:

$$\begin{aligned} u^i &= c_1 + c_2 + H(g_1^i) + H(g_2^i) = \\ &\quad 2(y - \tau) + H(g_1^i) + H(g_2^i), \end{aligned}$$

here y and τ are exogenous per capita incomes and per capita taxes assumed to be equal over time.

To simplify further, let us assume that $s = 1/2$, so groups (or parties) d and r are of equal size. The government budget constraints are

$$g_1 = (g_1^d + g_1^r) = \tau + b$$

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for the latter.

[51] Questioning the stylized fact cited in the Introduction to Part II, Edin and Ohlsson (1991) argue that minority governments, rather than coalition governments, are associated with larger debt issue.

$$g_2 = (g_2^d + g_2^r) = \tau - b.$$

It is easy to see that in this setting the optimal cooperative policy (giving equal weight to the two groups) would set $b = 0$, and $g_t^i = \tau/2$ for $i = d, r$ and $t = 1, 2$, since that would smooth the benefits of government spending optimally across groups and time. This is not the equilibrium outcome, though, if groups do not cooperate.

In each period, the coalition partners simultaneously and non-cooperatively propose a spending level for their constituency. Period 2 debt is always honored. If jointly feasible, these proposals are implemented; if infeasible, each group gets a share of the feasible spending level in proportion to its proposal. More precisely, using $p(g_t^i)$ to denote the proposal of group i in period t we assume that:[52]

$$\begin{aligned} g_1^i &= \begin{cases} p(g_1^i) \quad if \quad (p(g_1^i) + p(g_1^j)) \leq 2\tau \\ \frac{p(g_1^i)}{p(g_1^i)+p(g_1^j)} 2\tau \quad otherwise \end{cases} \\ g_2^i &= \begin{cases} p(g_2^i) \quad if \quad (p(g_2^i) + p(g_2^j)) \leq \tau - b \\ \frac{p(g_2^i)}{p(g_2^i)+p(g_2^j)} (\tau - b) \quad otherwise \end{cases} \end{aligned} \tag{6.8}$$

Clearly, this model implicitly assumes a weak budget process, where each of the coalition partners is given responsibility for one separate part of the government budget, and none of them has responsibility for the overall budget constraint. We can also interpret the model as referring to a very weak government where spending ministers are in the hands of powerful interest groups.

Given the relation between proposals and outcomes in (6.8), there is a unique Nash equilibrium in period 2: each party proposes that the whole remaining pool of government resources, $\tau - b$, be allocated to its own group. Bidding for the whole pie in period 2, by setting $p(g_2^i) = (\tau - b)$, is costless. Such a proposal is a dominant strategy, as any lower proposal reduces the share of group i . Equilibrium spending thus satisfies:

$$g_2^r = g_2^d = (\tau - b)/2. \tag{6.9}$$

Equilibrium debt issue In period 1 the situation is different, because insisting on high spending eats up future resources. This cost is not high enough, though,

[52] We also assume that no group can bid for more than the total available resources. Thus, $p(g_1^i) \leq 2\tau$ and $p(g_2^i) \leq \tau - b$ for $i = r, d$.

to prevent equilibrium over-issue of debt. To see this, consider how debt links spending in periods 1 and 2. Given future equilibrium spending in (6.9) and the budget constraints (6.7), we can write the objective of party I in period 1, as:

$$u^I = 2(y - \tau) + H(g_1^i) + H[\tau - (g_1^i + g_1^j)/2].$$

When contemplating its spending proposal and taking party J s proposal as given, party I thus does not internalize more than half the cost of current spending. The optimal proposal satisfies:

$$H_g(p(g_1^i)) - \frac{1}{2} H_g \left(\tau - \frac{(p(g_1^i) + p(g_1^j))}{2} \right) = 0.$$

As the proposals of both parties are identical, they are clearly feasible: the expression in the second brackets is positive, satisfying the feasibility constraint in (6.9) They are thus implemented and the equilibrium spending profile for group i satisfies

$$H_g(g_1^i) - \frac{1}{2} H_g(g_2^i) = 0.$$

As $g_1^i > g_2^i$ for $i = d, r$, it follows from (6.8) that $b > 0$.

This result is an instance of the familiar common pool argument: as the property rights to future income are not well defined, each of the parties only internalizes a fraction of the cost of current spending and debt issue. The result is a collective irrationality, which departs radically from the cooperative solution. Naturally, with $N > 2$ groups the problem becomes even worse, because now each party only internalizes $1/N$ of the future costs of debt issue.

This model can be generalized in several directions. Velasco (1996) studies a genuine multi-period model. This gives richer debt dynamics, including the possibility of delayed endogenous stabilizations. Chari and Cole (1993) study a two-period model which combines ideas from this and the previous subsection. Legislators facing a free-rider problem that drives spending too high try to constrain future spending and avoid collective irrationality by issuing more debt. Lizzeri (1996) applies a related idea to a very different model of redistribution, originally formulated by Myerson (1993). He considers a two-period economy where elections are held every period. Candidates can make binding promises before elections, over how to redistribute the available resources across voters and over time. Rational voters reward myopic behavior, however, favoring a candidate who promises to distribute all resources today. The reason is that resources left

for the future can be taken away by the opponent if the first-period incumbent is not re-elected. [53]

A stronger budget process The over-issue of debt is obviously caused by a flawed government budget process, where each party of the coalition (each group) is given decision-making authority over part of the budget, but nobody is given decision-making authority over the aggregate outcome. Which institutional reforms could address this problem?

A natural idea is to *centralize* decision-making authority completely to one of the parties (or perhaps to reform the electoral system, to make majority governments, rather than coalition governments, more likely). If the same party fully controlled all spending decisions, it would indeed appropriately internalize the cost of overspending and of debt issue. Such centralization of decision-making power could be abused, however. In the model of Subsection 6.1, party I would spend all the revenue evenly over time on its own group, if it had the power to do so. The allocation of spending across time would thus be fine, but the allocation across groups would be terrible. Moreover, in such a world, electoral uncertainty would re-introduce the incentives for debt issue considered in that section. This problem could be mitigated by institutional "checks and balances", for instance by splitting agenda-setting power between the two groups, giving, say, party D agenda setting power over the budget size and party R agenda setting power over its allocation. [54]

It turns out that a simple institution can implement the socially optimal allocation in the model. The solution is to split the decision in stages. First public debt is chosen. Then the allocation of g_t across different types of public goods is sequentially determined, first in period 1and then in period 2, with a separate budget constraint for each period. Suppose that the allocation of spending is made according to (6.8), except that $(\tau + b)$ replaces 2τ in the expression for first-period spending on the RHS of (6.8). It is easy to see that both groups now agree to a balanced budget ($b = 0$), as any other choice would be inefficient for both of them. Since there is unanimity, any mechanism for choosing b would give the same result.

Interestingly, the empirical evidence in von Hagen (1992), von Hagen and

[53] The common pool problem has also been extensively studied in a static context. Persson and Tabellini (1997) surveys that literature.

[54] The effects of some of these checks and balances are investigated in a different set up by Persson, Roland and Tabellini (1997).

Harden (1994) and Alesina et al (1996), suggests that certain features of the budget process makes it less likely that countries run into public debt problems. One of the indicators that make up the index of budget stringency in their work is precisely whether the budget process entails a decision on the overall budget, before the decision on its allocation.[55]

6.3. Delayed stabilizations

In this section we do not focus on why budget deficits arise, but on why it may take time to get rid of them once they have arisen. Following Alesina and Drazen (1991), we illustrate the possibility of delayed stabilizations when two parties in a coalition government, or two powerful interest groups, each has an incentive to let the other party bear the brunt of the necessary adjustment. Alesina and Drazen's continuous-time model built on the biological war-of-attrition model of Riley (1980) and on the public-goods model of Bliss and Nalebuff (1984). We adapt their analysis to our simple two-period setting.

In the model of the previous section, assume that aggregate government spending has got stuck at a level higher than aggregate tax revenue. In particular, assume that $g^d + g^r = g = \tau + \beta$, with $\beta > 0$. As before, tax revenue is exogenously fixed at the same level in each period. We study two possible outcomes: (i) Stabilization is delayed, in which case $g_1^d + g_1^r = g_1 = \tau + \beta$, $b = \beta$, and $g_2^d + g_2^r = g_2 = \tau - \beta$. (ii) Stabilization occurs in period 1, in which case aggregate overspending is cut by β so that $g_1 = \tau = g_2$ and hence $b = 0$. The allocation of spending cuts across the two groups in case (ii) depends on how stabilization came about. We return to this question below. We are interested in the probability that stabilization is delayed, and what factors make delay more likely.

To simplify the algebra, we assume that the utility of group i is linear in g^i. We assume that the costs of debt policy enter additively in the utility function. They can be thought of as either a suboptimal spending allocation over time, or other costs associated with debt issue—perhaps part of the deficit is financed by a distortionary inflation tax. We thus write utility of group i as

$$u^i = 2(y - \tau) + g_1^i + g_2^i - \kappa^i b. \tag{6.10}$$

[55]Hallerberg and von Hagen (1997) argue that countries with majoritarian electoral systems (and thus are more likely to have one-party governments) have chosen to centralize power to the finance minister in the budget process, whereas countries with proportional electoral systems (more likely to have coalitions and minority governments) instead have tried to limit their deficits by adopting formal budget targets.

The parameter κ^i measures the cost to group i of postponing the stabilization. A crucial assumption is that this cost is private information to group i. Group j only knows that κ^i is distributed on the interval $[0, \overline{\kappa}]$ according to the distribution function $F(\kappa^i)$. The corresponding parameter κ^j has the same distribution, but the realizations of κ^i and κ^j are independent.

All political action takes place at the beginning of period 1, when each party, simultaneously and non-cooperatively, makes a proposal p^I of whether to stabilize ($p^I = s$), or not ($p^I = n$). If both parties propose n, the stabilization is delayed. But if *at least one* party proposes s, stabilization takes place. If only one party "gives in" and proposes s, that party bears the main burden of the necessary cutbacks. Specifically, we assume:

$$\begin{aligned} g_1^i(n,n) &= (\tau+\beta)/2 \quad g_2^i(n,n) = (\tau-\beta)/2, \quad i = d,r, \\ g_t^d(s,n) &= g_t^r(n,s) = \tau/2 - \alpha, \quad t = 1,2, \\ g_t^d(n,s) &= g_t^r(s,n) = \tau/2 + \alpha, \quad t = 1,2, \\ g_t^i(s,s) &= \tau/2, \quad i = d,r \quad t = 1,2, \end{aligned} \tag{6.11}$$

where $g^i(p^D, p^R)$ denotes how spending on group i depends on the two proposals, and where $\alpha > 0$, measures the advantage of not giving in. Implicit in (6.11) is the idea that the political process gives veto rights to some party or interest group. Thus, this model applies to countries ruled by coalition governments, or more generally to a situation where the executive is weak and faces effective opposition by organized interests in the legislature or outside of Parliament.

Consider one of the parties, say party D. It compares expected utility when proposing n, denoted by $E[u^d \mid p^d = n]$,and s, denoted by $E[u^d \mid p^d = s]$. Let $q = \Pr[p^r = s]$ be the probability that party R proposes s (q is determined in equilibrium). Then, (6.10)-(6.11) and some algebra imply

$$E[u^d \mid p^d = n] - E[u^d \mid p^d = s] = \alpha - (1-q)\kappa^d b. \tag{6.12}$$

Thus, it is more advantageous to propose n if the gains from not giving in are large (α is large), if the costs of deficit finance for group d is low (k^d is low), and if the probability that party R proposes s is high (q is high). Clearly, party D says no whenever κ^d is below some critical number K. But, since party R faces an identical decision problem, it also proposes n whenever $\kappa^r < K$. Thus it must be the case that $(1-q) = F(K)$. Using that and setting the expression in (6.12) equal to zero, we can implicitly define the equilibrium value of K by:

$$KF(K) = \alpha/\beta.$$

The LHS of this expression is increasing in K. Therefore, $K = K(\alpha, \beta)$, with $K_\alpha > 0$ and $K_\beta < 0$.

We can now answer the main questions, namely how often we would observe a delayed stabilization and what factors make equilibrium delay more likely. Delayed stabilization requires that both groups propose n. As κ^d and κ^r are independently distributed, the unconditional probability of observing delay is:

$$(1-q)(1-q) = F(K(\alpha,\beta))F(K(\alpha,\beta)).$$

The likelihood of delay is thus increasing in α, the gain from winning the war of attrition when the other party gives in first. If we interpret α as a measure of cohesion in the political system, this result thus says that delayed stabilizations and prolonged deficits are more likely in polarized political systems. Note that if $\alpha = 0$, there is never any delay; postponing adjustment only implies losses for each party. The likelihood of delay is also decreasing in β, the initial fiscal problem. The model is consistent with the general idea that a worse fiscal crisis makes adjustment more likely; here we get that result because the expected cost of waiting becomes individually larger with a higher β. Thus, the model supports the general idea that financial crises and times of economic distress resulting from budgetary instability are catalysts of reform, and should not be feared too much (Drazen and Grilli (1992)). The mechanism causing delay in the model, namely a conflict over how to distribute the losses from cutbacks in government programs, also rhymes well with casual observation. Finally, the model can be used to study the consequences of financial aid to developing countries and conditionality (Casella and Eichengreen (1995)). To be effective, external financial aid should not ease the pain of an unsustainable situation (in terms of our model, it should not reduce β), for this would simply delay the stabilization. Effective financial aid should instead be conditional on a stabilization taking place and shrink over time if the stabilization is postponed, to increase the incentives to give in early for the rivaling parties.

6.4. Debt and intergenerational politics

The models in this section all focus on how debt redistributes tax distortions, or benefits of government spending, over time. But they ignore another role of debt: redistribution across generations. They also all assume any outstanding debt to be honored by the government that inherits it. But as we have seen in Section 5, this requires a strong form of commitment. Reputational or institutional forces

facilitate commitments, but then they should really be part of the argument; such forces may also not go all the way.

In conventional representative-agent macroeconomics, debt issue and pay-as-you-go social security are identical policies. Several authors have addressed the political determinants of such policies in a median-voter setting without altruism—see Browning (1975) for an early contribution, Boadway and Wildasin (1989), and Cooley and Soares (1995). In these papers, future social-security policies are honored by assumption (at least in the next period); i.e. commitment is assumed. Working agents not too far from retirement favor introducing pay-as-you-go social security, as this allows them to free ride on younger agents. Old-age agents are, of course, also in favor. Therefore a majority of voters typically favors social security and equilibrium policy depends, in a predictable way, on age-earning profiles and the population growth rate.

Cukierman and Meltzer (1989) analyze budget deficits in a similar way, but introduce inter-generational altruism. The degree of altruism varies across households: some households leave positive bequests, but others are bequest-constrained. Non-constrained voters, who can undo any intergenerational redistribution, are only concerned with the general equilibrium effects of the policy, and not on how it redistributes across generations. But a budget deficit is favored by the bequest-constrained voters, because it allows them something they cannot do privately—redistribute resources towards themselves. In a median voter equilibrium, the size of the budget deficit depends of the efficiency effects and the number of bequest-constrained voters.

Even though these contributions introduce important aspects of politics, they still hinge on the commitment assumption. At any moment social security strictly benefits only a minority (the retired) but imposes a cost on a majority (the workers). A similar problem exists for debt. Why then does the majority not repeal the policy? Reputational concerns may help, if honoring the current program enhances the probability that it will be honored in the future. But as we have already discussed in section 5, this argument is not without problems.

Tabellini (1990) and (1991) suggests one should allow *intra*-generational heterogeneity in income, when thinking about these questions. Pure intergenerational policies rarely exist, at least when generations are altruistically linked. Social security programs thus redistribute not only from kids to parents, but also from rich to poor. Similarly, public debt default would have both intergenerational and intragenerational effects (as the rich are likely to hold more debt). A policy redistributing across generations may therefore be upheld in equilibrium, without

ex ante commitments, by a coalition of voters that contains members of different generations who belong to similar income groups. But the coalitions that form *ex post* to support existing social security and outstanding debt are different. Social security is supported by the old and the kids of poor parents, whereas debt is supported by the old and the kids of rich parents. These two intergenerational policies are thus not equal under heterogeneity and lack of commitment. As in Section 5, incentive constraints in policymaking violate the Modigliani-Miller theorem of government finance.

Majority voting is not the only way of thinking about how the policy preferences of different generations get aggregated in the political process. In many societies, different age-groups—the old, in particular—have well-organized interest groups that lobby and take other political action to support policies benefitting their members. Rotemberg (1990) discusses the repayment of government debt as the outcome of bargaining between living generations. Grossman and Helpman (1996) formulate a dynamic model of intergenerational redistribution where policy commitments are again not feasible. In the model, pressure groups of living generations make contributions to the government conditional on the support given to their members. The model has multiple expectational equilibria, which remind of the equilibria in capital taxation studied in Section 5. But it is the expectations of the current government—rather than the expectations of private agents—about the policy of the next government that introduce the self-fulfilling property. One can easily end up in a very bad equilibrium, where the pressure groups get engaged in a very stiff and costly competition for policy favors and where capital formation suffers.

6.5. Notes on the literature

A huge literature deals with the politics on government deficits. Here we only refer to the more recent contributions, that typically study general equilibrium models with rational voters and politicians. A broader survey of the public choice literature is Mueller (1989). Much of the modern macroeconomic literature on public debt is surveyed in Alesina and Perotti (1995a).

The idea that political instability induces a government to use public debt strategically, to influence the future policies of his opponent, was first independently studied by Alesina and Tabellini (1990) and Persson and Svensson (1989). The model of Section 6.1 is related to Alesina and Tabellini (1990), while Persson and Svensson (1989) studied a model where parties disagree on the overall size

(as opposed to the composition) of public spending. Since then, many other papers have applied this idea to intertemporal fiscal policy. In particular, Tabellini and Alesina (1990) provide a generalization of these results, Alesina and Tabellini (1989) study capital flight and external borrowing, Tabellini (1990) looks at these models in the context of international policy coordination, Glazer (1989) applies the same idea to the choice of duration in public investment, Cukierman, Edwards and Tabellini (1992) analyze tax reforms from this point of view and provide empirical evidence that political instability is associated with more inefficient tax systems, Roubini and Sachs (1989), Grilli, Masciandaro and Tabellini (1991), Ozler and Tabellini (1991) and Lambertini (1996) analyze the empirical evidence. Finally, the result that public debt policies also affect the re-election probability was first studied in this context by Aghion and Bolton (1990). Modeling the voters preferences as entailing a trade-off between economic and non-economic dimensions, as we do in Section 6.1, is a common strategy in some of this literature—see in particular Lindbeck and Weibull (1987).

The dynamic "common pool" problem has a long history. It has been studied in industrial organization, where it refers to dynamic games among oligopolists facing an exhaustible resource, such as an oil field or a fishery (Levhari and Mirman (1980), Benhabib and Radner (1992)). In fiscal policy, it was studied by Tabellini (1987) in a dynamic game of monetary and fiscal policy coordination, and by Velasco (1996) in a setting more similar to that of this model. This idea is also at the core of the more empirically oriented literature on budgetary procedures, such as Alesina and Perotti (1995a), von Hagen and Harden (1994), and Hallerberg and von Hagen (1997). There is also an interesting (mainly empirical) line of research, that has investigated the effects of various restrictions on government borrowing. Most of this literature has studied the variety of institutional arrangements in US states. See for instance Bohn and Inman (1996), Poterba (1994), Eichengreen and von Hagen (1996).

The model of delayed stabilizations is due to Alesina and Drazen (1991), who in turn have elaborated on earlier ideas by Riley (1980) and Bliss and Nalebuff (1984). Since then, the model has been extended in several directions, among others, by Drazen and Grilli (1992), Casella and Eichengreen (1995) and Alesina and Perotti (1995b).

Finally, a large literature deals with intergenerational redistribution. Besides the papers quoted in the previous subsection, a separate line of research has investigated the sustainability of social-security systems in reputational models (Kotlikoff, Persson and Svensson (1988), Boldrin and Rustichini (1996).

Part III
Politics and Growth

Distorted fiscal policies, such as those emerging from the political equilibria in Part II, are likely to affect economic performance. It is therefore natural to ask whether political factors and political institutions are correlated with long-run economic growth. Here, too, there are some stylized facts. Most notably, after controlling for the conventional determinants of growth:

(i) Inequality in the distribution of income or wealth is significantly and negatively correlated with subsequent growth in cross-country data. On the other hand, the evidence on the effect of growth on the distribution of income (the Kuznets curve) is quite mixed, both in cross section and time series data. [56]

(ii) Political instability, as measured by more frequent regime changes, or political unrest and violence, is significantly and negatively correlated with growth in cross-country data.[57]

(iii) Better protection of property rights is positively and significantly correlated with the growth. Whereas political rights and the incidence of democracy is strongly correlated with the level of income, there are no robust findings regarding the effect of democracy on economic growth. [58]

A recent literature has tried to explain these regularities in a setting where both economic growth and fiscal policies are endogenous. Section 7 surveys this literature.

7. Fiscal policy and growth

Subsection 7.1 illustrates how income inequality can produce a negative effect on investment and growth, because it provides stronger incentives for redistributive policies that hurt growth-promoting investment. This idea was suggested by Alesina and Rodrik (1994) and Persson and Tabellini (1994c). As in these

[56] This finding was first obtained by Alesina and Rodrik (1994) and Persson and Tabellini (1994b). For a recent and comprehensive survey of the empirical evidence on inequality and growth, see Perotti (1996).

[57] On this point see Alesina, Ozler, Roubini and Swagel (1996) and Barro (1991).

[58] On the relation between property rights and growth see Knack and Keefer (1995). A survey of the voluminous literature on the links from democracy to growth can be found in Przeworski and Limongi (1993).

papers—and a great deal of subsequent work—we rely on a simple median-voter model inspired by Roberts (1977) and Meltzer and Richards (1981). Subsection 7.2 then illustrates how political instability can hurt growth, by inducing the incumbent government to follow more myopic policies, as in the work by Svensson (1993) and Devereux and Wen (1996). The argument here is closely related to that on strategic debt policy in Section 6.1. Finally, Subsection 7.3 briefly discusses how bad protection of property rights may hurt investment and growth, as in Tornell and Velasco (1992) and Benhabib and Rustichini (1996). The underlying ideas are closely related to the dynamic common-pool problem discussed in Section 6.2.

7.1. Inequality and Growth

Consider again a two-period economy inhabited by a continuum of heterogenous agents. Everyone has the same quasi-linear preferences over private consumption in periods 1 and 2 and over government (per capita) consumption in period 2. The utility of consumer i is:

$$u^i = U(c_1^i) + c_2^i + H(g). \tag{7.1}$$

The budget constraints are:

$$\begin{aligned} c_1^i &= e^i - \tau - k^i \\ c_2^i &= (1-\theta)A(I)k^i, \end{aligned} \tag{7.2}$$

where k^i is private investment, τ and θ lump-sum and capital taxes, and $A(I)$ the gross return to private capital, which is increasing in public investment I. We abstract from credibility problems; the government can commit to these policy instruments before private capital accumulation. Finally, e^i is the endowment of agent i. These endowments are distributed in the population with mean e and a distribution function for the idiosyncratic part $F(e^i - e)$. To proxy empirical income distributions, we assume that F is skewed to the right: the median value of $e^i - e$, labeled $e^m - e$ and defined by $F(e^m - e) = 1/2$, is negative.

Assuming a balanced budget in every period, the government budget constraint in per capita terms is:

$$I = \tau \tag{7.3}$$

$$g = \theta A(I)k, \tag{7.4}$$

where k denotes per capita (average) capital. Following the approach of Section 5.1, we can derive equilibrium private investment from (7.1)-(7.3) as:

$$k^i = e - I - U_c^{-1}(A(I)(1-\theta)) + (e^i - e) \equiv K(\theta, I) + (e^i - e),$$

where the common investment function satisfies $K_\theta < 0$ and $K_I > 0$. It is again convenient to express the utility from private consumption as an indirect utility function defined over the policy variables:

$$\begin{aligned} J^i(\theta, I, e^i) &\equiv Max \quad [U(c_1^i) + c_2^i] \\ &= U(e - I - K(\theta, I)) + (1-\theta)A(I)K(\theta, I) + A(I)(1-\theta)(e^i - e) = \\ &= J(\theta, I) + A(I)(1-\theta)(e^i - e). \end{aligned} \tag{7.5}$$

By the envelope theorem, the direct welfare cost of the capital tax $J_\theta = -A(I)K$ is negative. Moreover, the welfare effect of public investment, $J_I = -U_c + (1-\theta)A_I K$, is monotonically decreasing in I (by $U_{cc} < 0$ and $A_{II} < 0$). Substituting (7.4) into (7.1) and using (7.3), we obtain individual i policy preferences over the two policy instruments θ and I :

$$u^i = J^i(\theta, I, e^i) + H(\theta A(I)K(\theta, I)).$$

These policy preferences are linear in the idiosyncratic variable e^i. They therefore fulfill a monotonicity (single-crossing) condition, such that the preferred policy of the agent with endowment e^m will be a Condorcet winner, even though the policy space is two-dimensional. If we imagine that policy decisions are taken at the beginning of period 1 by direct democracy, the winning proposal is thus the policy preferred by this decisive voter. If the second-order conditions are fulfilled,[59] the equilibrium values for I and θ thus satisfy:

$$\begin{aligned} J_I + H_g\theta(KA_I + AK_I) + (e^m - e)(1-\theta)A_I &= 0 \\ J_\theta + H_g A(K + \theta K_\theta) - (e^m - e)A &= 0. \end{aligned} \tag{7.6}$$

To understand these conditions, first assume that the distribution is symmetric, so that $e^m = e$. Then the third terms in both conditions are zero, and (7.5) characterizes the optimal policy for the average agent, which—by quasi-linear preferences—would be chosen by a utilitarian planner. The first condition says

[59] As in all optimal taxation problems, this assumption is not necessarily innocuous, but can involve restrictive assumptions on underlying functional forms.

that it is optimal to provide more public investment than would maximize private indirect utility (i.e. $J_I < 0$) due to the beneficial effects on the future tax base and hence on public spending (if public debt were allowed this result would be different). The second condition equates the average private marginal cost of raising revenue ($J_\theta < 0$) with the marginal benefit it generates via public consumption.

But if $e^m < e$, redistributive effects come into play. The decisive voter's capital falls short of average capital by exactly $(e^m - e)$. This implies that I is smaller and θ is higher than in the hypothetical planning solution. The reason is that the decisive voter does not benefit from public investment as much as the average capital holder, and he also does not suffer as much from capital taxes. To see this formally, notice that the third term in the first equation of (7.5) is negative and the third term in the second equation is positive. By the second-order conditions, I has to be lower and θ has to be higher than in the social planner's solution.

We thus see that inequality hampers growth via two different channels. The growth rate from period 1 to period 2, given by $[A(I)K(\theta, I)/e] - 1$, is increasing in I (both directly and indirectly) and decreasing in θ. Furthermore, the higher is inequality, as measured by the distance between median and average income, the lower is growth as equilibrium public investment is smaller and capital taxation—as well as government consumption—is higher.

Alesina and Rodrik (1994) and Persson and Tabellini (1994b) developed this kind of reduced-form prediction in related but explicitly dynamic models. Whereas Persson and Tabellini (as we have done) focused on the *size* distribution of income, Alesina and Rodrik focused on the *functional* distribution of income between labor and capital. Both papers also took the reduced form prediction to the data—here Alesina and Rodrik too look at the size distribution of income. And they indeed found a strong negative effect of inequality on growth in a cross section of post-war data from a broad sample of countries.[60]

These papers stimulated a body of subsequent work scrutinizing both the empirical and the theoretical argument. Whereas the reduced-form relation from inequality to growth indeed seems empirically robust, the structural links implied by the theory have not generally found support in later empirical work.[61] Thus, it has been hard to identify both the implied link from inequality to redistribution

[60] Persson and Tabellini (1994b) also found a similar relation in a small historical panel of industrialized countries with data going back to the late 19th century.

[61] Later empirical work based on better data has also questioned an empirical finding by Persson and Tabellini (1994b) that was interpreted as giving indirect support for the theory, namely that the relation between inequality and growth was only present in democracies and not in dictatorships.

and the link from redistribution to growth, as emphasized in the recent surveys by Perotti (1996) and Benabou (1996). The model in this section suggests that these links could be pretty subtle, however (with opposite effects of inequality on government consumption and investment, for example, and ambiguous effects on total government spending). Moreover, the failure to find a robust link from tax rates and redistribution on economic growth is a problem for conventional growth theory, not just for political theories of growth. The literature has also has searched for other reasons why inequality and growth may be inversely related. Perotti (1996) stresses that one link may run via political instability or via other, non-political, channels such as education. Benabou covers a whole range of recent theoretical work showing that the links between income distribution, policy and growth may run in different directions. For instance, redistribution may promote growth when agents are credit constrained, or when it promotes education.

7.2. Political Instability and Growth

We now modify the previous model as follows. First, every private agent has the same first-period endowment: that is, $e^i = e$ and the average investment function $K(\theta, I)$ applies for everyone. Instead, as in Section 6.1, agents belong to two different groups, d and r, and public spending is of either of two types: g^d (benefitting only the d group) or g^r (benefitting only the r group).

Second, and again following Section 6.1, policy is not set by majority rule but by an incumbent government D that acts so as to maximize the utility of group d agents. The incumbent may be replaced by an alternative government R in the future. For simplicity, we take the re-election probability $(1 - P)$ as exogenous. It is natural to interpret P as a measure of political instability.

Third, to introduce a meaningful policy choice in period 2, policies are chosen sequentially. Thus, public investment I is chosen in period 1, before private capital, and the capital tax rate θ is chosen in period 2. To avoid the capital-levy problem discussed in Section 5, we assume that in period 2 the private sector can still avoid some of the tax, though at a cost, by reallocating some of its accumulated capital to a non-taxed asset with a lower return. We could think of this as tax avoidance, or capital flight. A convenient formulation, following Persson and Tabellini (1992), is to rewrite the period-2 budget constraint as:

$$c_2 = (1 - \theta)A(I)(k - f) + f - M(f),$$

where $M(f)$ is a concave and increasing function of the amount f shielded from taxation and where we have recognized that everybody makes the same savings

decision. It is easy to show that average savings are still given by the function $K(\theta, I)$ and that tax avoidance is given by the function $F(\theta, I)$ with $F_\theta > 0$ and $F_I < 0$.[62] The government's tax base can thus be written as a function $\overline{K}(\theta, I) \equiv A(I)K(\theta, I) - F(\theta, I)$. The *ex ante* properties of this function (that is from the viewpoint of period 1) are the same as before: decreasing in θ and increasing in I. In period 2, when K and I are given from previous decisions, the *ex post* tax base $\overline{K}^2(\theta, I)$ is still decreasing in θ but with a smaller slope (intertemporal substitution possibilities are eliminated).

The bottom line after these modifications is similar to the previous section: we can write the *ex ante* indirect utility of an agent in group i as

$$u^i = J(\theta, I) + H(g^i) = J(\theta, I) + H(\theta\overline{K}(\theta, I)). \tag{7.7}$$

We can also define *ex post* indirect utility (for given K and I) as $J^2(\theta, I) + H(\theta\overline{K}^2(\theta, I))$. Both $J(\theta, I)$ and $J^2(\theta, I)$ have the same qualitative properties as the corresponding function in Section 7.1.

Any government holding power in period 2 spends all revenue on the public good favored by its own constituency. The *ex post* optimal tax rate is given by the condition:

$$J^2_\theta + H_g(\overline{K}^2 + \theta\overline{K}^2_\theta) = 0, \tag{7.8}$$

which has the same interpretation as the second condition in (7.5). Thus, both prospective governments will set the same tax rate. Condition (7.7) implicitly defines the optimal tax rate as a function of past public investment $\theta(I)$, with slope

$$\theta_I = -\frac{J^2_{\theta I} + H_{gg}\overline{K}^2_{\theta I}}{J^2_{\theta\theta} + H_{gg}\overline{K}^2_{\theta\theta}}.$$

Unless H is very concave, $\theta_I > 0$, as the numerator is positive and the denominator is negative (by the second-order condition). Public investment enlarges the tax base and this drives up the optimal tax rate.

The incumbent D government in period 1 chooses I so as to maximize:

$$\begin{aligned} E(u^d) &= PJ(\theta(I), I) + (1-P)[J(\theta(I), I) + H(\theta(I)\overline{K}(\theta(I), I))] = \\ &\quad J(\theta(I), I) + (1-P)[H(\theta(I)\overline{K}(\theta(I), I))]. \end{aligned}$$

[62] The first-order condition for optimal tax aviodance is for the consumer to set $A(I)(1-\theta) - 1 + M_f(f) = 0$. When this condition is inverted, we get the desired tax avoidance function.

We can rewrite the first-order condition to this problem with (7.7), recognizing that $J_\theta^2 = J_\theta$, and $\overline{K}^2 = \overline{K}$ at the equilibrium tax rate. Some additional algebra gives:

$$J_I + H_g[\theta\overline{K}_I + \theta(\overline{K}_\theta - \overline{K}_\theta^2)\theta_I] - PH_g[\theta\overline{K}_I + \theta_I(\overline{K} + \theta\overline{K}_\theta)] = 0. \qquad (7.9)$$

Suppose first that D is certain to be re-elected: $P = 0$. Then the optimal choice of I boils down to the familiar weighting of private welfare (the first term) against government revenue (the second term), where the latter are fully internalized as the government is certain to remain in office. The resulting condition is the same as the second condition in (7.5) of the previous subsection, adjusted for the different timing of tax policy and for the lack of heterogeneity. But when re-election is uncertain, $P > 0$, future government revenue is less valuable and policy myopia sets in. As the third term in (7.8) is negative, a higher probability P of losing office makes public investment less attractive and reduces it in equilibrium.

Higher instability not only draws down public investment, but reduces growth in this model. Second period income, $c_2 + g = A(I)K(\theta, I) - M(F(\theta, I))$, unambiguously goes down as I falls. The direct negative effects of lower public investment and the indirect negative effects of higher waste due to more tax avoidance always outweigh the positive effects of the smaller equilibrium capital tax.

Much of the informal discussion of why political instability is harmful for growth seems to suggest a direct effect of uncertainty or unpredictability on private investment. We know, however, that uncertainty in returns has ambiguous effects on private investment. Here a different mechanism is at work: political instability induces more myopic fiscal policies, which in turn cause lower public investment and growth. This is related to Svensson (1993), who shows that political instability may make a forward-looking government abstain from improvements in the legal system that enforces private property rights. He also finds empirical support for this idea. Political instability (as measured by Alesina et al (1996)) indeed reduces the protection of private property rights (as measured by the same index as in Knack and Keefer (1995)) in a wide cross-country sample. And controlling for property rights protection, political instability drops out of a cross-country investment regression. The theoretical paper by Devereux and Wen (1996) emphasizes a somewhat different mechanism: political instability induces incumbent governments to leave smaller assets to their successors, thereby forcing them to tax capital at a higher rate; the expectation of higher taxes drives down private investment, which leaves a smaller tax base for the successor government.

7.3. Property Rights and Growth

As mentioned in the introduction, the data support the idea that poor enforcement of property rights is harmful for investment and growth. This idea is also derived from some recent theoretical work. Benhabib and Rustichini (1996) study a growth model where two groups try to redistribute consumption towards themselves at the expenses of the economy's capital stock. They show how such incentives may arise both at low and high levels of income, and how they may be exacerbated by greater inequality in the two groups' incomes. Their model abstracts from the political mechanism and the channels of redistribution, however.

Tornell and Velasco (1992) focus on redistribution through the fiscal policy process in a linear (Ak) growth model. Their argument, as Benhabib and Rustichini's, is another instance of the common pool problem discussed in section 6.3. The common pool is now a part of the economy capital stock rather than the government tax base, but the incentive to over-exploit this common pool is the same. Because the redistribution is supposed to take place via the government policy process, the poorly enforced property rights are closely related to weak government.

Tornell (1995) studies a related model, but allows for endogenous property rights. In particular, property rights can be created and destroyed at a cost. He shows that the economy can go through a cycle with low property-rights protection at low and high levels of income. If so, this pattern is perfectly foreseen and leads to gradually falling growth rates at intermediate levels of income.

Lane and Tornell (1996) show that an exogenous positive shock due to productivity or the terms of trade may actually reduce the growth rate in an economy with powerful interest groups and poorly defined property rights. The mechanism is again a coordination failure between the interest groups, whereby the initial increase in the incentives to invest are more than outweighed by an increase in redistributive transfers. Svensson (1996) produces a related result, where the incentives of the interest groups to hold back on their demand for transfers vary negatively with government income.

7.4. Notes on the Literature

Beyond the papers cited in the text, early contributions to the theory of income distribution, investment and growth were made by Perotti (1993), who studied human capital accumulation, and tax-financed subsidies in the presence of borrowing constraints, by Bertola (1993) who studied tax policy and the functional

distribution of income, by Glomm and Ravikumar (1992) who studied private versus public provision of education, and by Saint-Paul and Verdier (1993) who also studied redistributive policies that finance public education in a setting with wealth constrained individuals. Perotti (1996) and Benabou (1996) provide additional references to recent empirical work. Finally, Caballero and Hammamour (1996) focus on the rents created by factor specificity and how the distribution of those rents affects the incentives to invest. As stated in the text, few theoretical models spell out the mechanisms whereby political instability is harmful for growth. As emphasized by Benabou (1996), there is thus scope for new work to provide better theoretical underpinnings for the empirical findings. Sharper theory is also needed to sort out the empirical channels whereby politics interacts with growth. This is not going to be easy, however, given the strong empirical correlations between inequality, instability and lacking enforcement of property rights.

We want to end with a methodological note. In this section, as in the previous one, we have relied exclusively on simple two-period examples. This avoids a major difficulty: a full-fledged treatment of the dynamic interactions between collectively chosen policy decisions and income distribution rapidly becomes analytically complex. As a result, the dynamic models studied in the literature have often relied on simplifying assumptions: dynamic links are assumed away in the model's economic structure, voting only takes place at an initial point in time rather than sequentially over time, or agents are assumed to be myopic and ignore some of the dynamic implications of their actions. The clearest formulation of a general solution concept for dynamic political models with heterogenous agents is made in Krusell and Rios-Rull (1996). This paper also makes a contribution by showing how the endogenous build up of vested interests, as agents acquire monopoly skills in operating new technologies, can lead to a growth cycle: the political majority at different points in time will shift between less and more growth-promoting policies. Krusell, Quadrini and Rios-Rull (1994) survey parts of the literature on politics and growth from a methodological angle. They also show how to go from their proposed solution concept to quantitative (numerical) applications.

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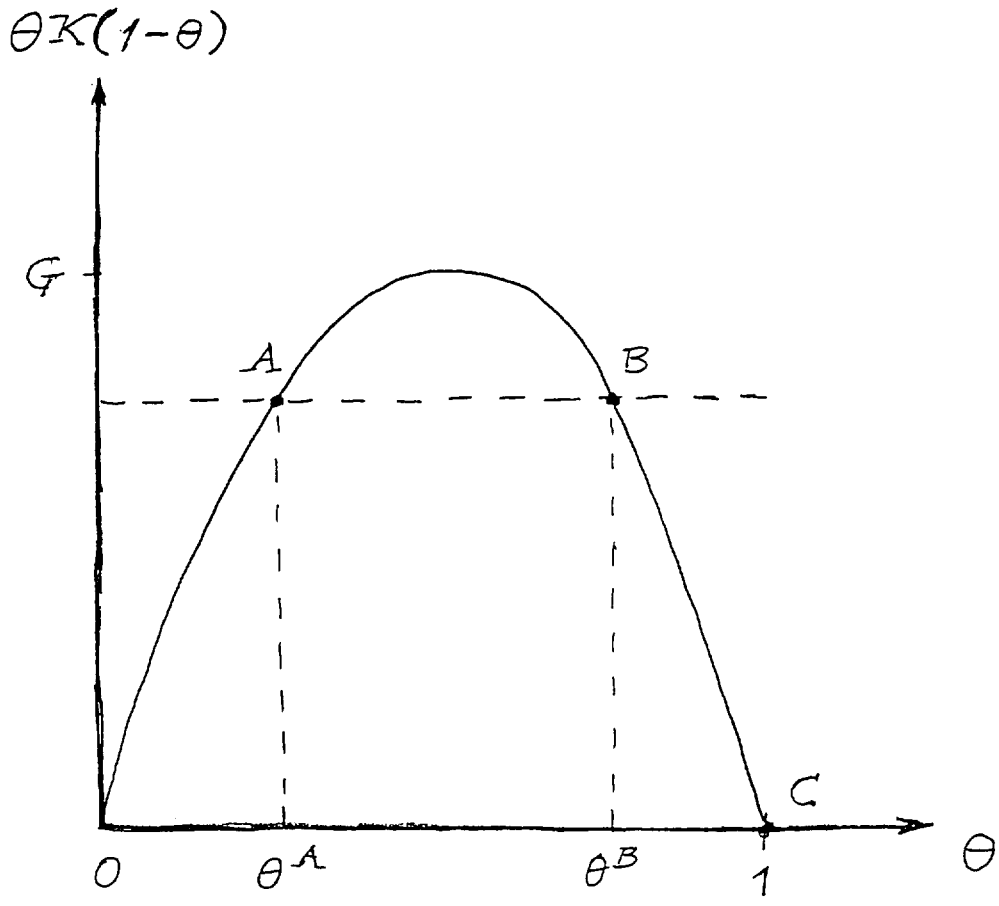

Figure 1