Institutions, Politics, and Macroeconomic Performance

On Incomplete Information in Political Agency Games

by

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Declaration

I declare the following:

The material contained in this thesis is my own work, except for Chapters 4 and 5 which are based on joint work with my supervisor, Professor Ben Lockwood. Out of Chapter 4, we produced a paper entitled "*Do Elections Always Motivate Incumbents?*". The paper is available as a Warwick Economic Research Paper No. 580 (December 2000). Out of Chapter 5, we produced a paper entitled "*Candidate Entry, Screening and the Political Budget Cycle*".

No material in the thesis has been used before and no material has been published either.

The thesis has not been submitted for a degree at another university.

Abstract

This thesis analyses the interactions between politics, institutions, and policy outcomes using a political agency framework with incomplete information. After an introductory chapter, we develop a political agency model that is consistent with the empirical evidence on politically-induced fiscal cycles, and especially budget deficit cycles. We find that electoral concerns create, on average, a rising budget deficit prior to elections. The net welfare effect of elections is ambiguous: although they give rise to a *deficit bias*, they increase the quality of office-holders. The next chapter uses this microfounded model to study the incentive and welfare effects that the imposition of fiscal constraints has on policy makers' decision to create excessive deficits. Three types of constraints are investigated: deficit ceilings, a Golden Rule of public investment, and a balanced-budget rule. We find that constraints are effective in reducing excessive budget deficits - although at the expense of unconstrained instruments. Only one can yield higher welfare than the fully discretionary case. No appropriately designed fiscal constraint can achieve the first-best.

In Chapter 4, we show that two key results in the political agency literature are not robust. The first is that a cutoff rule followed by voters in re-electing an incumbent always motivates the latter. The second is that this cutoff rule is an optimal incentive mechanism. Under symmetric incomplete information, the first result can be reversed since elections can reduce the *experimentation* effect of office-holders (i.e. the incentive to raise effort so that performance becomes a more accurate signal of ability). This reduction may more than offset the positive effect of elections on effort. When incentives to stand for office are modelled, result two can be overturned since a *revealing equilibrium* at the candidate entry stage can always be designed. This screens out low-ability citizens from policy making and therefore eliminates the adverse selection problem. If this latter is more important than moral hazard issues, the cutoff rule at the policy stage is no longer an optimal mechanism.

In Chapter 5, we investigate in more details whether relevant (private) information about citizens' competence in political office (ability, honesty, etc.) can be revealed by their entry and campaign expenditure decisions. We find that this depends on whether voters and candidates have *common* or *conflicting* interests; only in the former case can entry be revealing in equilibrium. We apply these results to Rogoff's (1990) Political Budget Cycles model, allowing for candidate entry: as interests are common, low-ability candidates are screened out at the entry stage, and so there is no signalling via fiscal policy. In a variant of the Rogoff model where citizens differ in honesty, rather than ability, interests are conflicting, and so the political budget cycle can persist in equilibrium. The final chapter concludes the thesis.

Chapter 1

Introduction

This thesis analyses the role that incompleteness of information among agents has on economic policy outcomes. We focus on a specific type of relationship among agents, namely agency (principal-agent) relationships that arise in public policy making; In particular, policy decisions being undertaken by elected governments. Using this political agency framework, we investigate the interactions between politics, institutions, and policy outcomes. We use the term "institutions" to refer to mechanisms that limit the discretion that policy makers have in office. The policy outcomes we analyse deal with fiscal policy and public good provision.

In Section 1.1 we outline the salient features that, we argue, models aiming to analyse decision making by elected officials should include. Section 1.2 briefly presents the remaining chapters of the thesis. We highlight the motivation for those chapters, the methodology chosen, and the results obtained.

1.1 Political Agency in Representative Democracies

1.1.1 Representative Democracy

A political agency framework is a natural starting point to analyse policy outcomes. Indeed, in democratic regimes, by far the most common form of public policy making is one where citizens *delegate* their decision making power to an elected government, i.e. a regime of *representative democracy.*[1] This delegation of power gives rise to a principal-agent relationship with voters as the principal and the government (or elected representative(s)) as the agent.

Although the use of a principal-agent framework to analyse policy outcomes has been extensively used in the political economy literature (e.g. Rogoff and Sibert, 1988; Alesina, 1987 for rational expectations based models), it is only recently that representative democracy has been properly modelled, in the sense that a citizen's decision to stand for office and to become a candidate is endogenised (Osborne and Slivinski, 1996; and Besley and Coate, 1997). Prior to these "citizen-candidate" models,[2] political economy models incorporated a "political" dimension by introducing an election at the end of a period in office. The analysis of the game between an office-holding politician and voters centered on the effects of this end-of-term election. However, absent the recent citizen-candidate models, in this political economy literature it is

[1] Direct democracy in which citizens vote directly on policy issues is another alternative, although not very often used in the real world. Referenda, and petitions are other means of decision making. These do not give rise to a delegation of power and to the concomitant agency relationship that a representative democracy creates. However, these alternative schemes are, for obvious reasons (e.g. cumbersomeness, cost, time requirements, etc.), best suited to limited and specific cases of public policy issues.

[2] As these models have been labelled by Osborne and Slivinski (1996).

always assumed that the first-period office-holder is exogenously drawn (sometimes from the citizenry, sometimes from a different set), i.e. these political economy games always start with an *exogenously given office-holder* in the first period.

1.1.2 Incomplete Information in Agency Relationships

As is generally the case in any agency context, incompleteness of information is pervasive: players have differing degrees of information on variables that have an important bearing on the relationship. As is well known from the literature on information and contracts (e.g. Salanié's 1997 book), incompleteness of information among players has an important bearing on the outcome and efficiency obtained out of the relationship.[3]

1.1.3 Political Agency: Specificities and Early Contributions

The study of political agency relationships is relatively recent and not extensive - at least compared to the agency literature that focuses on the theory of the firm. Although research on agency issues within a firm has implications for the understanding and analysis of political agency problems, it is well known that agency relationships in government differ along key specific features from the traditional agency problems within a firm. The most distinctive characteristic is that monetary rewards, which form a crucial part of incentive schemes within a firm (e.g. bonuses, stock options), are usually very low-powered in government.[4] Government officials, for the most

[3]This literature historically focused on agency issues within the context of the firm. Hence, problems such as that of selecting and motivating workers, managers, inducing them not to shirk, to select efficient projects have been the focus of extensive studies. Recent surveys of these issues can be found, for instance, in Gibbons and Waldman (1999) and Prendergast (1999).

[4]An important rationale for the widespread use of low-powered incentives in the public sector is related to the difficulty in assessing (in a timely manner) the quality of the output produced. As Holmström and Milgrom (1991) have shown, when agents have to perform several tasks and that some of these tasks are unobservable and substitutes, then low-powered incentives are more

part, receive a fixed pay package. Their monetary reward is therefore not related to their performance on the job, or the performance of their department (Wilson, 1989; Dixit, 2000). An important question in political theory is therefore how citizens can induce their elected representatives to perform diligently once in office since standard incentives schemes are not present in the public sector.

This important question, was first analysed formally by Barro (1973). In this seminal paper, Barro asked how citizens could control (in the sense of limiting rent seeking activities) office-holding politicians. In Barro's model, politicians suffer from a moral hazard problem since, once in office, they can "steal" rent from tax revenues. As Barro showed, this moral hazard problem can be attenuated by retrospective voting from the part of citizens. Politicians that seek to retain office can therefore be motivated not to extract maximum rent by the (credible) threat of not being re-elected if they do so.[5] One limitation of Barro's paper was the assumption that full information exists among politicians and voters. In particular, this implies that voters can perfectly and accurately observe, prior to voting, whether and how much politicians have stolen. This is a strong assumption, and one which has important consequences for Barro's conclusion. The introduction of imperfect information into

efficient as far as the principal is concerned. For instance, providing high monetary rewards for the production of a good might induce the agent to neglect quality if this latter is not measurable (or only after some delay), or the provision of high monetary rewards to perform one task might induce the agent to neglect other tasks which are less rewarded or/and less easily measurable by the principal. Examples related to this factor abound in the public service. Indeed, a common criticism of the recent introduction of performance targets by the Labour government of Tony Blair for the public sector is that they induce civil servants to neglect tasks that are not part of the target or create perverse incentives; e.g. targets on reducing the waiting list for hospital admissions is said to have sharply increased the time patients have before seeing a specialist doctor (which can then put them on the hospital waiting list), and also is said to induce hospital doctors to often give priority to quickly treatable patients since this reduces the waiting list (The Economist, February 2001)

[5] In fact, in Barro's model, since the actions of office-holders are always observable (full information is assumed), and if office-holders are infinitely lived, office-holders can always be induced to take efficient actions provided discounting is sufficiently low (by a simple folk theorem argument).

political agency models only started more than a decade later with an article by Ferejohn (1986). Again, the focus is on a moral hazard problem, i.e. the idea is that, left to his own devices, an office-holder would rather pursue activities from which he can obtain greater utility rather than pursue those that maximize voters' welfare. However, instead of focusing on rent stealing (as Barro did), Ferejohn focuses on labour supply by office-holders. The key novelty of Ferejohn's model however is the introduction of incomplete (asymmetric) information among the two parties: politicians know perfectly if and how much labour they supplied in office - the production of public good requires labour input from the office-holding politician - but voters do not (politicians labour supply is their private information). In this (more realistic) context, Ferejohn shows that, in equilibrium, voters follow a cutoff rule by voting for the incumbent only if his observed performance does not fall below a certain level, and the office-holder chooses effort so that performance remains just at the cutoff. So, office-holder effort is higher than it would be without elections. Thus, even under asymmetric information, *electoral control* of the incumbent by voters is still present.

A different approach - and with a different focus - to introducing imperfect information into a political agency model was pioneered by Rogoff and Sibert (1988) and Rogoff (1990). Aiming to explain, in a rational expectations environment, the observed occurrence of politically-induced business cycles in taxes, government spending and money growth (Rogoff and Sibert, 1988), and in government taxes and expenditures (Rogoff, 1990), Rogoff and Sibert developed an asymmetric information political agency model based, not on a moral hazard, but on an adverse selection problem leading to a signalling game. In their model, the political cycle is driven by temporary information asymmetries regarding the ability of office-holders in managing public affairs (ability is temporarily the private information of the office-holder). More specifically, Rogoff (1990) shows that, in order to increase her re-election probability, an office-holder of high-ability will distort fiscal policy instruments ahead of elections so as to signal to the electorate that she is indeed a high-ability leader.[6] We should note that a forerunner to the Rogoff and Sibert (1988) explanation of the political business cycles can be found in Backus and Driffill (1985). Indeed, as Backus and Driffill point out, their Barro-Gordon (1983) type model shows that political business cycles can still arise when agents are fully rational (yet imperfectly informed). This improves upon the political business cycles model of Nordhaus (1975) in which citizens are assumed to be myopic. The Backus and Driffill model, similar to the Rogoff and Sibert model, is also based on asymmetric information on the type of the office-holder.[7] One limitation of the Backus and Driffill early rational-expectations based "political budget cycles" model is that it does not introduce elections explicitly.

1.2 Political Agency Models: Applications and Robustness

1.2.1 On Politics, Budget Deficits, and Fiscal Constraints

Given the state of the literature briefly described above,[8] in this thesis we focus on two issues. In a first part of the thesis (Chapters 2 and 3), we are interested in analysing

[6]Rogoff and Sibert (1988) derive similar result in a less microfounded model but with many ability types.

[7]The two types of government refer to a different loss function for each type. One type is (infinitely) inflation averse (the "hard-nosed" type), while the other type (the "wet" type) tolerates some positive inflation rate.

[8]A more detailed review of the appropriate literature follows in each of the subsequent chapters.

the effect that fiscal constraints have on policy outcomes via the constraints they impose on policy makers. Recently several such fiscal constraints on sovereign states have been introduced around the world. Examples include the European Monetary Union's Stability and Growth Pact (SGP) and its forerunner, the Maastricht Treaty. These set strict ceilings on budget deficits and public debt that a country can have. The SGP imposes some fines (which can amount to 0.5 per cent of GDP) on countries that do not abide by these ceilings. Another recent example is the United Kingdom and its Code for Fiscal Stability, introduced in 1997 by the new Labour government of Tony Blair. This Code introduces a "Golden Rule" for public investment whereby the government can issue new debt only to finance public investment, and not public consumption expenditures. Finally, a recurrent debate in the United States of America has been over whether to introduce a balanced-budget constraint on the Federal government.[9] So far, the US Congress has always rejected these proposals. One common motivation for introducing these fiscal restraints is that barring these, politically motivated office-holders suffer from a "*deficit bias*", i.e. for electoral purposes, they are keener to increase government expenditure than they are to raise taxes (Alesina and Perotti, 1995a). The net effect is a tendency for a budget deficit to emerge. Limiting the discretionary fiscal power of politicians in office is therefore advocated as a natural solution to counter politicians' incentives (Alesina and Perotti, 1996).

In Chapter 2, we develop a theoretical model that can allow us to analyse the effect of fiscal constraints in an environment where the government (office-holder) is politically motivated.[10] Given this, our aim is to develop a model that is consistent

[9] Balanced-budget rules already exist for numerous States in the US, but so far no such rules exist at the Federal level.

[10] The motivation of the office-holder is to stay in office as long as possible since holding office provides the politician added utility compared to other citizens.

with the empirical evidence on politically-induced fiscal cycles, and especially budget deficit cycles. After reviewing the existing literature, we argue that the Equilibrium Political Budget Cycles model of Rogoff (1990) is the most appropriate starting point. However, in Rogoff's model it is assumed that the budget is balanced in every period. Thus, although a politically-induced cycle is shown to arise even with rational agents, this cycle cannot lead to a budget deficit. In Chapter 2, we therefore extend Rogoff's model by allowing office-holders to finance government expenditures by issuing debt. Strategic deficit financing can therefore arise. Through a signalling effect, we find that electoral concerns create, on average, a rising budget deficit prior to elections, the so-called "deficit bias". The net welfare effect of elections is ambiguous: although they give rise to a deficit bias, they increase the quality of office-holders by enabling society to fire low-ability incumbents. This trade-off has important implications for the design of fiscal institutions aimed at curbing policy makers' bias towards deficit financing and political cycles.

In Chapter 3, building on the model of Chapter 2, we study the incentive and welfare effects that the imposition of constitutional fiscal constraints has on the endogenous decision of politically motivated policy makers to create excessive deficits. The novelty and main achievement of this chapter is to provide a (qualified) rationale for fiscal constraints based on a one country, microfounded model. This avoids one important drawback of the (small) literature: namely the use of *ad hoc* assumptions that totally drive the results regarding the desirability of fiscal constraints. It also enables us to make a case for fiscal constraints without the recourse to a public finance argument regarding fiscal externalities in a multi-country currency union. Our main motivation for avoiding this argument is that, except for European Monetary

Union countries, all the fiscal constraints recently introduced or discussed are *not* motivated by this argument (e.g. New Zealand, the United Kingdom, the US Federal government). Also, contrarily to the (few) existing formal studies, we undertake a comparative analysis of various fiscal constraints. We focus on three widely known type of constraints: deficit ceilings (qualitatively similar to those of the Stability and Growth Pact), a Golden Rule of public investment (as recently introduced in the United Kingdom's Code for Fiscal Stability), and a balanced-budget rule (following the US proposals). We find that constraints are effective in reducing excessive budget deficits. However, when the fiscal constraints do not apply to all fiscal instruments available to office-holders, then, a *substitution effect* arises, whereby politicians use unconstrained instruments to signal to the electorate enhanced managerial ability. Comparing the three types of fiscal constraints, we find that only one can yield a higher welfare than the status quo (i.e. where full discretion on fiscal policy is left to the office-holder). Finally, we investigate whether we can design a fiscal constraint that would be "optimal", in the sense that it would eliminate the electorally-induced deficit bias highlighted in Chapter 2. We find that no appropriately designed fiscal constraint can achieve the first-best but that the deficit bias can be eliminated.

1.2.2 A Robustness Check on the Political Agency Literature

In a second part of the thesis (Chapters 4 and 5), we aim to test the robustness of the existing results based on political agency models. As this field is relatively recent, important assumptions have been made and results obtained given these assumptions. However, alternative, and equally realistic, assumptions can also be made. For instance, the implications of alternative information structures have not yet been fully investigated: full information has been studied since Barro (1973), and asymmetric information since Ferejohn (1986), but another type of incomplete information has been underinvestigated, namely symmetric incomplete information. Also, as the political agency literature that followed Ferejohn's article showed, although Ferejohn's modelling is simple and very tractable, it suffers from unattractive features. For instance, as Ferejohn himself recognizes (see p10 of his paper) his analysis relies on the assumption that an official may stay in office for ever (no term limits).[11] With term limits, incumbents can never be induced to supply more than their myopic level of effort in the final period, and an "unravelling" argument then shows that incumbents can then never be induced to supply more than their myopic level of effort in *any* period of office. Extensions of Ferejohn's model by Austen-Smith and Banks (1989), Banks and Sundaram (1993, 1998), aim to offer solutions to the limits of Ferejohn's analysis. We aim to test the robustness of these models.

In particular, in Chapter 4, we analyse the incentives that politicians face while in office, and the incentives they face to stand for office, in a "career-concerns" model of the Holmström (1982/1999) type. In this model, agents are heterogeneous, and their efforts if in office are unobservable. One contribution of the chapter is to extend the career-concerns literature to the case of elected policy makers. Another is that we are able to analyse the effect of candidate entry and elections separately, on equilibrium effort, and on quality of the office-holder, and on voter utility given *various informational structures*. Specifically, we analyse the effects of full information (as a benchmark), of asymmetric information, and of symmetric incomplete information. A key finding is that the efficiency of democracy relative to dictatorship[12] depends

[11]With term limits, Ferejohn's model can only exhibit electoral control in equilibrium if voters can precommit to a cutoff rule, a rather unattractive assumption.

[12]Where "dictatorship" refers to a regime in which the incumbent is randomly selected in the first

on the information structure assumed. In particular, if (potential) office-holders are initially uninformed about their own abilities (symmetric incomplete information), effort and voter welfare may be higher with dictatorship, but this cannot happen if agents are informed about their own abilities, whether this information is private or public information. That dictatorship (or bureaucratic appointment) can Pareto dominate a democratic regime is a new result in the political agency literature. So far, democracy has always been shown to reduce agency problems (e.g. limit rent extraction, increase effort on the job) thanks to the "electoral control" that elections offer to voters. We show that this seemingly robust result is in fact due to a specific modelling assumption regarding the information structure. The intuition for our surprising result in the symmetric information case is that, if office-holder's effort and ability interact in the "production function" that determines performance in office, then an office-holder has an incentive to *experiment*, i.e. raise effort so that performance becomes a more accurate signal of her ability. Elections reduce the experimentation effect. This is because experimentation is about incurring a short-term cost (higher effort) with the view of obtaining a better information in the future and therefore higher utility in the future. However, since an office-holder facing an election has a positive probability of not being re-elected and therefore of not reaping the future benefits of costly experimentation, she will not experiment has much has in the case when she has a long-term contract (which is the case under bureaucratic appointment/dictatorship). We can show that the reduction in this experimentation effect may more than offset the positive "career concerns" effect[13] of elections on

period of the game and stays in office until the end of the game (in period two). In Chapter 4, we interchangeably call this regime a "dictatorship" or an "appointment" (of a bureaucrat) regime.

[13] Whereby office-holders increase effort so as to increase their visible performance measure so as to increase their re-election prospects.

effort. Moreover, when this occurs, appointment of officials may Pareto-dominate elections.

As described earlier in this Introduction, an important recent development in the political agency literature has been the modelling of representative democracy (Osborne and Slivinski, 1996; and Besley and Coate, 1997). Although numerous studies have extended the Osborne and Slivinski (1996) and Besley and Coate (1997) approaches to a more general environment (e.g. Besley and Coate (1998) extended their earlier static representative democracy model to a dynamic framework), no research exist on the implications of representative democracy in an environment with incomplete (asymmetric) information. Indeed both Besley and Coate (1997) and Osborne and Slivinski (1996) assume full information in their models. In Chapter 5, we analyse the role that incomplete information can have in this recent line of research. Besley and Coate (1997) state in their conclusion that this line of research is an important issue. In particular, in Chapter 5, we investigate whether relevant (private) information about citizens' competence in political office (ability, honesty, etc.) can be revealed by their entry and campaign expenditure decisions. We find that this depends on whether voters and candidates have *common* or *conflicting* interests; only in the former case can entry be revealing in equilibrium. Our finding that representative democracy can lead to a screening out of undesirable candidates as far as citizens is concerned is, we believe, an important and general result that has implications for several (seemingly) different literatures. To illustrate our findings, we apply these results to Rogoff's seminal (1990) model of the political budget cycle, allowing for candidate entry, as well as elections. As interests are common in Rogoff's original model, low-ability candidates are *screened out* at the entry stage, and so there is no signalling via fiscal policy (i.e. no "political budget cycle"). In a variant of the Rogoff model where citizens differ in honesty, rather than ability, interests are conflicting, and so the political budget cycle can persist in equilibrium. Another well known literature to which we could have directly applied our results is the macroeconomics literature with asymmetric information that arose in the 1980s (e.g. the early survey by Driffill, 1988; and Drazen, 2000a, for further developments). In this Barro-Gordon based literature, an inflation bias can arise if citizens (wage setters) are imperfectly informed about the loss function of a government (i.e. whether the government is "wet" in that it tolerates inflation, or "hard nosed" in that it always pursues a zero inflation policy - Backus and Driffill, 1985). In these (signalling) games, as in the Rogoff (1990) model, the first-period policy maker is randomly selected and his type (which is his private information) affects the utility of all citizens. We conjecture that allowing for candidate entry in, e.g. the signalling model of Vickers (1986),[14] would eliminate the (welfare reducing) inflation bias that arises because of an assumed pooling of types in the first-period of the game. Other literatures to which our results would apply are discussed in the conclusion of Chapter 5.

Finally, Chapter 6 concludes the thesis.

[14]The models of Vickers (1986) or Rogoff (1987) are technically very close to the Rogoff (1990) model that we analyse, hence our conjecture.

Part I

The Politics of Budget Deficits and Fiscal Constraints

Chapter 2

The Politics of Budget Deficits and Fiscal Cycles: Theory and Evidence Reconciled

2.1 Introduction

Since the 1970s, many countries have experienced persistent budget deficits leading to sizeable national debt. Numerous empirical studies have shown that these deficits are difficult to reconcile with neoclassical models of fiscal policy such as the one of Barro (1979). However, these same studies[1] find that political factors are important determinants of fiscal policy outcomes and especially budget deficits. Two main political channels have been emphasized in the literature: "partisan"[2] and "oppor-

[1] Recent surveys of this empirical literature can be found in Alesina and Perotti (1995a), and the books by Alesina, Roubini and Cohen (1997) and by Drazen (2000a). Drazen's book offers a more impartial critical view of the literature.

[2] This terminology follows from Hibbs (1977), and subsequently from Alesina (1987) in a rational expectations environment.

tunistic" behaviour. Partisan behaviour arises because different policy makers have different ideologies and, when elected, choose macro-economic policies according to their preferences and those of the electorate they represent. Opportunistic behaviour on the other hand occurs because political leaders care about being re-elected and manipulate policies to maximize their probability of staying in power.[3]

Despite strong supportive and recent empirical evidence (discussed in Section 2.2) that office-motivation leads to distorted fiscal policy, the theoretical political economy literature concerned with budget deficits and fiscal cycles has concentrated mostly on partisan models. In particular, no opportunistic model featuring both *endogenous re-election* and *public debt accumulation* exists. A model including both these features is however necessary to address important policy issues such as the comparative analysis of fiscal constraints (both *vis à vis* other fiscal constraints and *vis à vis* the no constraint case). Such constraints, aimed to a great extent at curbing politically-induced budget deficits, have recently been introduced in New Zealand, the United Kingdom, and European Monetary Union. The United States Congress has repeatedly discussed the pros and cons of introducing a balanced-budget rules at the Federal level. Many such fiscal constraints exist in federal states (e.g. the US, Germany, etc.). As shown in practice, fiscal constraints come in various forms (e.g. balanced-budget rules, ceilings on part or all of the budget, etc.). For a meaningful positive comparative analysis of fiscal constraints, a microfounded model is desirable. Furthermore, this model should be based on opportunistic behaviour (since empirical

[3]Politicians can be opportunistic for two reasons. Either because they value holding office *per se* (e.g. for the prestige it confers), or because they value the economic rents they can extract once in office. We shall refer to the former case as "office-seeking" politicians, and to the latter case as "rent-seeking" politicians. Throughout the chapter (and most of the thesis), we focus on office-seeking politicians. Persson and Tabellini (2000) study extensively the case of rent-seeking politicians.

evidence point to the significance of this channel in affecting budget deficits and fiscal cycles), and office-seeking politicians should endogenously adjust their fiscal policy to the institutional environment they face.

In this chapter we aim to bridge the gap in the literature mentioned above, i.e. we construct a political agency model that allows both endogenous re-election probabilities and public debt accumulation. The model closest to our aim is the Equilibrium Political Budget Cycles model of Rogoff (1990). This microfounded political agency model does feature endogenous re-election probabilities but it otherwise assumes an atemporal fiscal policy game. In this chapter, we therefore use the Rogoff model as a baseline framework and extend it by allowing debt financing of government expenditures. The model is a two-period signalling model in which the first-period office-holder is seeking re-election for another term. Office-holders can be of varying ability in producing public goods (either high- or low-ability types). Ability is an agent's (temporary) private information. In equilibrium, in order to increase their re-election probabilities, high-ability incumbents signal to the electorate their enhanced ability by distorting fiscal policy ahead of elections.[4] Because office-holders can now use debt strategically rather than run balanced-budgets as in Rogoff's original model, we find the following new results.

First, a political fiscal cycle emerges, and this political cycle gives rise to a *deficit bias*, i.e. electoral concerns induce high-ability incumbents to increase the budget deficit ahead of elections compared to periods in which they do not face elections. Hence, on average, *fiscal policy is looser prior to elections* (larger budget deficits),

[4]For simplicity our model (as does Rogoff's 1990 model) deals with only two types of policy makers. Rogoff and Sibert (1988) study the case of a large number of different types. They show that all but the lowest ability policy maker distort policy in equilibrium (because of signalling).

and tighter afterwards (reduction in the budget deficit). This electoral budget deficit cycle is consistent with empirical evidence.

Second, even though high-ability incumbents exhibit a deficit bias ahead of elections, we show that these high-type leaders create *smaller ex post (cost-adjusted) budget deficits* while providing *more* public goods than low-ability leaders. Although the result that a competent policy maker creates a smaller budget deficit than a less able office-holder is intuitive, we should note that, in the context of an opportunistic model *à la* Rogoff, our result might seem surprising and even counter-intuitive. Indeed, in Rogoff and Sibert (1988), Rogoff (1990) and in the literature that follows,[5] a high-ability office-holder is shown to *increase* government expenditures and *decrease* taxes ahead of elections. All these models assume that the government balances its budget in each period; nevertheless, they might give the impression that the fiscal policy stance of a competent policy maker is looser than that of a less able policy maker. Indeed, as already mentioned, we do find that high-type leaders increase the budget deficit ahead of elections compared to non-election periods. However, we show that even though electoral considerations induce high-ability office-holders to increase the budget deficit ahead of elections, this higher deficit does not exceed the budget deficit (in a cost-adjusted measure) that low-ability incumbents generate. The intuition for this result is that high-ability incumbents can use their ability advantage to lower the cost of public expenditures and therefore lower the budget deficit.

Third, despite the fact that elections give rise to a budget deficit bias (which is distortionary), the net welfare effect of elections is ambiguous since they enable citizens to fire low-ability office-holders in the first period of the game so that the

[5] Gonzalez (1999) and Drazen (2000b) are recent extensions of Rogoff (1990).

expected quality of the office-holder is higher than under a mechanism whereby, e.g., policy making is delegated to bureaucrats with full tenure.

Finally, a *trade-off between low budget deficits and efficiency* is highlighted: high-type leaders create lower (cost-adjusted) budget deficits than low-type incumbents but these competent leaders pursue distortionary (cf. signalling) policies. This trade-off points to interesting welfare issues regarding the *design of fiscal institutions* aimed at curbing politically-induced budget deficits. Hence, the model provides a natural framework to study recent institutional changes in the domain of fiscal policy such as the fiscal constraints adopted in New Zealand, the United Kingdom, and the European Monetary Union countries (Chapter 4 deals with these issues). We also find a new result regarding Ricardian Equivalence in asymmetric information, representative agent models.

The structure of the chapter is as follows. In Section 2.2 we briefly review the empirical literature and expose a gap in the theoretical literature. In Section 2.3, we develop a political fiscal cycle model with *deficit financing* based on a political channel consistent with the empirical evidence on fiscal policy. Finally, in Section 2.4 we conclude on this chapter.

2.2 The Literature on Budget Deficits And Fiscal Cycles

2.2.1 From The Empirical Evidence...

Empirical studies reveal that opportunistic behaviour is an important and significant determinant of fiscal policy. For instance, early and influential studies such as Frey and Schneider (1978) find that pre-electoral opportunistic behaviour is more acute the less popular the incumbent is. An electoral cycle is also found by Bizer and Durlauf (1990) in their study of US tax behaviour. Lockwood et al. (1996), and Alesina et al. (1997) find evidence of an electoral cycle on all fiscal instruments they analyse.

More recently, using recent econometric techniques and "natural experiments" or control groups, recent studies have solved the econometric issues that often limited the robustness of many prior studies, and still found opportunistic behaviour to significantly affect fiscal policy. These studies include Besley and Case (1995a,b), Levitt and Snyder (1997) and Shi and Svensson (2001). We review these important studies in turn.

First, the Besley and Case studies. In a series of papers, Besley and Case (1995a,b) empirically tested key predictions of office-motivated political economy models (e.g. Austin-Smith and Banks, 1989; Banks and Sundaram, 1993; Rogoff, 1990). In Besley and Case (1995a), the authors analyse the behaviour of US governors from 1950 to 1986 in the fiscal policy area. Political agency models predict that office-holders that can run for re-elections will, on average, strategically (e.g. for signalling purposes) distort fiscal policy ahead of elections. On the other hand, office-holders that do not face elections set fiscal policy based on purely economic conditions. In the US, some States' constitutions impose some maximum term limit to governors, others do not. This constitutional variation across States enables Besley and Case to test whether strategic fiscal manipulation occurs or not, as political agency models predict (i.e. a natural control group exists so that identification problems are avoided). The results of Besley and Case support such models: they find evidence that taxes and government spending do respond to a binding term limit (when the governor is a Democrat).

More specifically, a political fiscal cycle exists in which taxes are lowered prior to elections and raised afterwards. In Besley and Case (1995b), the authors again test a political agency model such as Banks and Sundaram (1993) or Rogoff (1990) but extended to a model with multiple fiscal/political jurisdictions. As a result, assuming jurisdictions face correlated shocks, voters can infer their office-holder's ability or performance by observing their relative performance (as in Holmström, 1982). Besley and Case again find support for the theoretical models: tax changes appear to be a significant determinant of governors' electoral success or failure. Governors whose tax increases are out of line with other States' increases are penalised at the polling booth.

Second, the Levitt and Snyder (1997) study. Levitt and Snyder demonstrate that the previously inconclusive evidence on opportunistic behaviour is due to a substantial omitted-variable bias (i.e. that incumbents' spending spree is likely to be related to their perception of their future electoral vulnerability). After controlling for this bias in their empirical analysis of US Congressional elections, Levitt and Snyder find strong and convincing evidence that rising government expenditures ahead of elections benefits incumbents (it helps incumbents win votes). An additional $100 per capita in spending increases the incumbent's share of votes by 2%. Specifically, Levitt and Snyder find that "high-variation" programs[6] are positively related to election outcomes. These evidence lend support to opportunistic models and in particular to that of Rogoff (1990). In his survey of 25 years of research on Political Business Cycles, Drazen (2000b) argues that opportunistic models and especially the Rogoff

[6] "High-variation" programs, despite being a small part of the overall programs, are programs that target specific constituencies and are more amenable to political manipulation because of their discretionary nature. They are the types of programs that opportunistic models refer to.

and Sibert (1988) and Rogoff (1990) models are best suited in explaining politically-induced business cycles.

Finally, and most recently, the Shi and Svensson (2001) study. The econometric strength of the Shi and Svensson study is the use of dynamic panel data techniques to identify opportunistic political behaviour. In a comprehensive empirical study covering 123 developed and developing countries over 21 years, Shi and Svensson (2001) find significant and robust evidence of a political budget cycle consistent with the predictions of Rogoff's (1990) model. Specifically, Shi and Svensson find that spending increases ahead of elections while taxes fall. This leads to a larger deficits in election years (a politically-induced *deficit bias*). Their result is robust to the introduction of many other variables including measures of political polarization and fragmentation (which they find not to be significant).

For completeness, we should also note that the latest empirical evidence tend to show that variables indicative of partisan behaviour are not a robust predictor of fiscal policy instruments and outcomes (political party dummies are generally found to have a statistically insignificant effect on budget deficit variables). Lack of partisan effect can be found, for instance, in multi-country panel data studies undertaken by Alesina and Perotti (1995b), Alesina et al. (1997), by Kontopoulos and Perotti (1997), and by Levitt and Snyder (1997). For example, even Alesina et. al. (1997) conclude from their empirical analysis of OECD countries that opportunistic models give better predictions on policy instruments than partisan models do. These predictions hold after controlling for standard control variables and even for the effects of institutional differences among countries (e.g. government fragmentation and budget procedures).[7]

[7] On the other hand, as noted by Alesina et al. (1997), partisan models are better in predicting outcomes (growth, unemployment, inflation). Although, in a more refined partisan model, Lockwood

Lockwood et al. (1996) find weak evidence in favour of partisan effects in UK fiscal policy. Given that these authors chose to analyse the UK precisely because of its clear partisan division over fiscal policy - a clear case of ex ante sample selection bias - the fact that only weak evidence of partisan behaviour can be found tends to confirms the results of multi-country panel data studies.

2.2.2 ...To The Theoretical Gap

Although empirical studies do find a significant relationship between office-motivated policy makers and fiscal policy outcomes and in particular the occurrence of budget deficits, no theoretical model which could account for these phenomena exists.[8]

Indeed, opportunistic models featuring both public debt accumulation and endogenous re-election probabilities do not exist.[9] For instance, in Cukierman and Meltzer's (1986a) early contribution, a generic policy instrument is used to represent government's actions. Therefore this cannot give any predictions on specific fiscal instruments and politically-induced fiscal cycles. Rogoff and Sibert (1988) and Rogoff (1990) have a model with endogenous re-election probabilities but public debt is not introduced (and their models do not include any other state variable). The budget

et al. (1996) show that such models can be reconciled with the empirical literature. This stems from the fact that they have an hybrid model (semi-partisan, semi-opportunistic). Indeed, their model produces "an electoral cycle which is very similar to the one generated by Rogoff-type electoral manipulation".

[8] Models pertaining to explain fiscal deficits that are politically-induced but arising for reasons other than because of partisan or opportunistic behaviour exist. These include models based on the idea of "fiscal illusion", models of intergenerational redistribution, of distributional conflict, of geographically dispersed interests, and of budgetary institutions. See Alesina and Perotti (1995a) for an early survey of the literature, and Drazen (2000a) for more recent developments.

[9] We only review the formal literature that assumes agents form rational expectations. Key references that do not make this assumption (i.e. that assumes adaptive expectations) but that focus on the occurrence of political business cycles include Nordhaus (1975) and Tufte (1978).

is balanced in every period in these two models.[10] Hence, budget deficits cannot be studied.[11]

In a recent related paper, Lizzeri (1999) presents a model with opportunistic/office motivated candidates in which voters are homogenous. Budget deficits are due to the fact that candidates use debt as a tool of redistributive politics. Borrowing enables candidates to better target their promises to groups of voters and increase their election prospects. Unlike the Rational Political Budget Cycles models (Rogoff and Sibert, 1988, and the subsequent literature), Lizzeri assumes that candidates can *commit* to their pre-election promises. If candidates were allowed to renege on their electoral promises, it is not clear whether there would be a reason for budget deficits to arise in Lizzeri's model. Indeed, promises to tax one (small) group of citizens in order to redistribute the proceeds to a (larger) group of citizens would not sway voters in favour of a candidate making such non credible promises. Casual observation indeed reveals that electoral promises (e.g. "read my lips"!) are often not kept once the candidate has been elected. In this chapter, for lack of an explicit modelling of the commitment technology, we will maintain the Rogoff and Sibert (1988) assumption

[10]Note that in the model of Rogoff and Sibert, a (small) *intra-period* budget deficit is possible: the government sets taxes and government expenditures at the beginning of the period; any shortfall in the budget is *balanced* at the end of the period by (distortionary) seigniorage revenue.

[11]Since writing this chapter, a recent paper by Shi and Svensson (2001) has been written. Although the main focus of Shi and Svensson is empirical (they aim to test for the presence or not of political budget cycles), they also develop a simple model that is consistent with their empirical results (described in Section 2.2.1). Their aim is related to Rogoff's (1990) model but their modelling approach differs (in simplifying ways). First, Shi and Svensson focus on a moral hazard rather than an adverse selection agency problem. Second, they assume symmetric incomplete information rather than asymmetric information (no signalling activity therefore takes place). Third, they also allow for public debt to be issued. The focus on moral hazard and symmetric incomplete information simplifies greatly the analysis. Their model gives similar predictions as ours. However, given that the underlying problem is different, our models have different implications for both positive and normative analysis. Whether moral hazard or adverse selection problems is more acute in policy making is hard to determine. Our models are therefore useful complements in that we should be more confident about the robustness a theoretical predictions if they are obtained using different modelling assumptions.

that pre-election pledges are not credible.

By contrast to the office-motivated literature, numerous models exist in which partisan policy makers can manipulate public debt/budget deficits ahead of elections, sometimes leading to increased re-election probabilities. Key papers include Persson and Svensson (1989), Alesina and Tabellini (1990), Tabellini and Alesina (1990) and Aghion and Bolton (1990).[12] Given that the theoretical underpinnings of ideology is not yet very well understood in economics, economists have introduced partisan biases in different ways, and the *arbitrary* choice along which voters' preferences are assumed to differ critically drives the predicted behaviour of public debt. This is clearly an important limitation of these theories since these often lead to contradicting predictions. For instance, Alesina and Tabellini's model predicts a deficit bias irrespective of the party in power. In contrast, Persson and Svensson's model predicts that right-wing governments run budget deficits and left-wing governments run surpluses. Aghion and Bolton's model does not predict, in general, debt accumulation before elections, rather, in some cases, debt under-accumulation. Lockwood et al. (1996) have conjectured that the same problem of debt under-accumulation before elections would arise if, in Alesina and Tabellini's model, parties also have different preferences regarding the level of public spending. Alesina et al. (1997) also reach the same conclusion, namely that the fiscal implications of partisan models are not clear cut. Overall, these models do predict that left-wing governments are keener on spending *but, at the same time,* they are also less averse to tax increases. It is thus

[12]More recent contributions include Milesi-Ferretti and Spolaore (1994) who build a model with endogenous re-election probabilities, and Lockwood et al. (1996) who construct a mixed partisan and opportunistic policy makers model but in which re-election probabilities are assumed to be exogenous. Biglaiser and Mezzetti (1997) study the effect of re-election concerns on the decision to undertake public investment projects (they assume that information is incomplete but symmetric among citizens and politicians)..

difficult to find consistent predictions on budget deficits.

This lack of theoretical robustness is also reflected in the empirical literature, perhaps indicating that there are indeed several ways of being partisan and that empirical studies should try to identify each possible ways separately.

In a recent related paper, Velasco (2000) focuses on voter (ex ante) heterogeneity and in particular on a dynamic "common pool" problem. Velasco highlights the role that fragmented fiscal policy making can play in creating a "deficit bias". This is because government resources are the common property of a large number of fiscal authorities. His model does not include elections. As argued by Lizzeri (1999), "it is not clear whether debt accumulation would obtain in Velasco's model if elections took place".

We now turn to our model. We build on the model of Rogoff (1990) for three main reasons. First, this model imposes the most realistic assumptions with regards to the type of asymmetric information assumed (Drazen, 2000a,b). Furthermore, it does not require the assumption that a commitment technology exists for candidates' pre-electoral promises. Second, it has recently received further empirical support (e.g. Besley and Case, 1995a,b; Levitt and Snyder, 1997; Shi and Svensson, 2001). Finally, its microfounded nature makes it an appropriate model given that we want to be able to tackle positive and normative welfare issues (such as the analysis of fiscal constraints).

2.3 Equilibrium Political Fiscal Cycles

2.3.1 The Model

This section extends the seminal Equilibrium Political Budget Cycles model of Rogoff (1990). The novelty is the introduction of public debt as a state variable. Adding debt as a state variable noticeably complicates the analysis. We therefore simplify Rogoff's model by having a two-period game instead of two-period game repeated over an infinite horizon. This also enables us to greatly simplify the stochastic structure of the game.[13]

Preferences of a Representative Citizen

The (small and open) economy, which evolves over two time periods, $t = 1, 2$, consists of a large number N of (ex ante) identical rational and forward looking citizens (with $\#N = n > 3$) who maximize their expected utility. The representative citizen's utility is:

$$U = [u(c_1, g_1) + \eta] + [u(c_2, g_2) + v(k_2)] \tag{2.1}$$

where c_t is a representative citizen's consumption of the private good at period t $(t = 1, 2)$, g_t is government spending on goods and services per capita (i.e. the public "consumption" good) at period t, and k_2 is public "investment" per capita. u and v are both strictly concave functions, with u_1, u_2, $v' > 0$.[14] η is a random shock that captures the personal characteristics of the incumbent leader which are *not* related to her ability to manage the public good production function; for example, her "looks".

[13]The two-period structure is not critical to our results and is common in the literature (Drazen, 2000b, also uses a two-period version of the Rogoff model).

[14]In addition to the usual Inada conditions, it is also assumed that $\lim_{k \to 0} v(k) = -\infty$. This condition is sufficient to ensure an interior solution in the asymmetric information case.

This shock is experienced by each citizen i. Each η is a continuously distributed i.i.d. random variable on $[-\bar{\eta}, \bar{\eta}]$, with η^i and η^j independent for all $i \neq j$. We assume that η is only revealed at the end of a pre-electoral period (i.e. just before citizens vote, but after the incumbent has set her fiscal policy). As a result, incumbents do not condition their fiscal policy on the "looks" shock.[15]

Technology

The budget constraint of the representative citizen for period 1 and 2 respectively is:

$$c_1 + b = y - \tau_1 \tag{2.2}$$

and

$$c_2 = y - \tau_2 + rb \tag{2.3}$$

where, y is the exogenous, per period, endowment of a non-storable good. r is equal to one plus the interest rate (assumed constant[16] and not taxed). b denotes government debt issued at the beginning of period 1.[17] τ_t are taxes in period t ($t = 1, 2$).

The government budget constraint (which is also the public good production function) for period 1 and 2 respectively is given by:

$$g_1 + k_2 = \tau_1 + \theta + b - f(\tau_1) \tag{2.4}$$

[15]Note that η does not drive any of our results. This shock is introduced by Rogoff (1990) for purely technical reasons: it enables the use of refinements of the equilibrium concept in Section 2.3.5 so that all pooling equilibria can be eliminated using the "intuitive criterion" of Cho and Kreps (1987).

[16]This follows from our assumption of a small an open economy. Shi and Svensson (2001) in a related political agency model (but focusing on moral hazard with a symmetric incomplete information framework) also assume a small and open economy and the resulting fixed interest rate on public debt.

[17]Given our small economy assumption, we should take into account the fact that domestic residents need not purchase all public debt, i.e. we could allow government debt to be held partly by domestic residents and by foreigners, so that only a fraction of b would be held by domestic citizens. This however does not change our results and would unnecessarily burden the model with more variables. We therefore simplify the notation by assuming that all public debt is held domestically.

and

$$g_2 = \tau_2 + \theta - rb - f(\tau_2) \tag{2.5}$$

where θ measures the ability of the office-holder in transforming the private good (tax revenue) into public goods. Citizens' competency to manage the public good production function can be of two types: either they have a high competency level (θ_H), or a low competency level (θ_L) (i.e. $\theta \in \{\theta_H, \theta_L\}$), where $\rho \equiv \Pr(\theta = \theta_H)$, $(1-\rho) \equiv \Pr(\theta = \theta_L)$, and $\theta_H > \theta_L > 0$. So, the *ability types* of the citizens are indexed by $a \in \{H, L\}$. To simplify the analysis, we assume that an individual's competency is constant for the two periods of the game. Competency is a leader's individual characteristic. From the public good production functions (2.4) and (2.5), we can see that the more competent the leader (i.e. the higher θ) , the less funds are necessary for a given level of public goods.

We assume that the game starts with no inherited debt or assets. In the second and last period, the government repays its total debt (principal and interest) issued in the first period and cannot issue debt.[18]

Note that equations (2.4) and (2.5) contain a $f(.)$ function. This function represents the distortionary costs of taxation (e.g. because of tax collection costs). We assume that $f'(.) > 0$, $f''(.) > 0$ and $f'(0) = 0$. Distortionary taxes are introduced so as to avoid the Ricardian Equivalence proposition (otherwise τ_1 and b are not uniquely determined, only the sum of the two is). That we need to introduce distortionary taxes into our model seems surprising at first: as will become apparent, the model has asymmetric information and the incumbent leader manipulates fiscal

[18]We assume that the government cannot default on its debt - a realistic assumption in the context of developing countries.

instruments (including taxes and debt) for signalling purposes. We shall prove later in the chapter that this is indeed the case (see Proposition 2.4). As in Rogoff (1990), another important element to notice in (2.4) is that public investment has a one-period production lag. Thus public investment decided in period 1 becomes visible and productive in period 2. In the final period, there is no public investment.[19]

Leader's Utility Function

Candidates are randomly drawn from the pool of citizens. When one citizen is elected, because of the prestige of being in charge of the country's public resources the leader receives an "ego rent" R per period in office.[20] This private utility from holding office cumulates with the (social) utility that all citizens derive from the consumption of private and public goods. Hence, the incumbent leader's expected utility is:

$$E_1^I(U) + \pi R \tag{2.6}$$

where U is given by (2.1). E_1^I denotes expectations based on the incumbent's information set at period 1,[21] and π is the incumbent's period 1 estimate of her probability of being in office in period 2; π is endogenously determined by the incumbent and is a function of her first-period fiscal policy. π is derived at a later stage.

Information Structure and Timing of Events

Elections are held at the end of the first period. The opposition candidate is drawn at random from the rest of the population. In period 1 the incumbent observes θ and

[19]Note that we maintain a time subscript on k so as to emphasize the crucial timing assumption of public investment.

[20]Throughout Chapters 2 and 3, R denotes the office-holder's ego rent, and r denotes the interest rate on public debt.

[21]Throughout Chapters 2 and 3, a "O" superscript refers to the opponent candidate; a "I" refers to the incumbent.

sets g_1, τ_1, b and k_2 (without knowing η^I and η^O). Voters observe g_1, τ_1, b, η^I, η^O and then vote (voters do not observe θ contemporaneously, only with a one period lag). There is asymmetric information between the incumbent and voters in that voters can only make inferences about the ability of the incumbent given their observed fiscal variables. The uncertainty concerning θ translates directly into uncertainty about k_2 (k_2 "hides" θ: voters only observe, via the government's budget constraint (2.4), the sum of $k_2 + \theta$, not the individual components of this sum). In period 2 the winner of the period 1 election takes office for the remaining period of the game.

The representative citizen votes for the incumbent ($\Lambda = 1$) if her expected utility under the incumbent is as great as or equal to that under the opponent. If not she votes for the opponent ($\Lambda = 0$), i.e.:

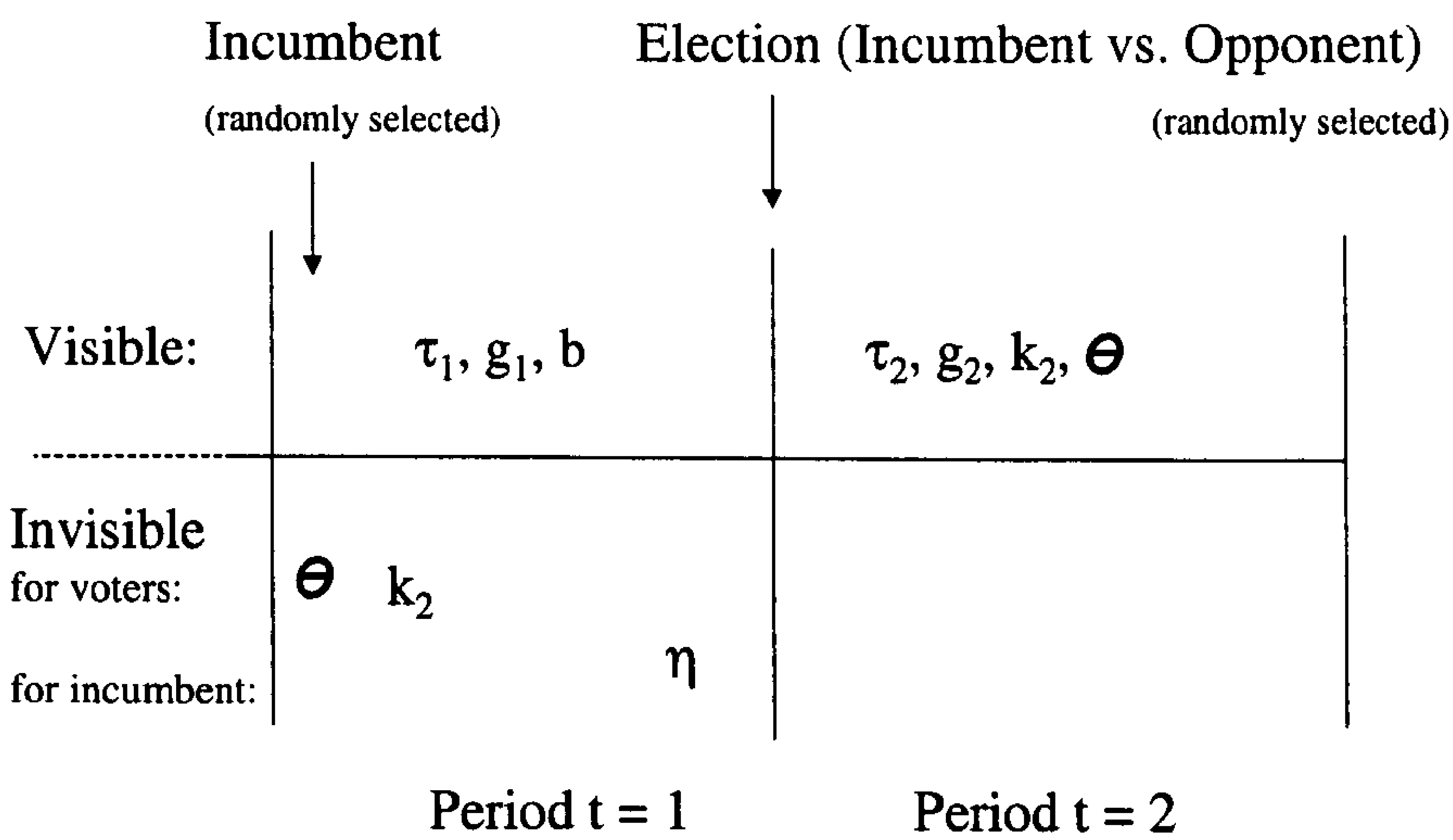
$$\Lambda = \begin{cases} 1 & \text{if } E_1^P\left(U_2^I\right) \geq E_1^P\left(U_2^O\right) \\ 0 & \text{otherwise} \end{cases} \tag{2.7}$$

E_1^P refers to expectations based on the public's information (P) set at period 1. U_2^I (U_2^O) denotes the utility of the representative citizen if the period 1 incumbent (I) policy maker is in office in period 2 (if the opponent (O) candidate is in office in period 2).

Figure 2.1 below summarises the timing of events. In particular, attention is paid to the information structure of the game with both visible (above the horizontal line) and (yet) invisible (below the horizontal line) variables being highlighted. The invisible variables (as of period one) are of two types: those that are invisible to voters (i.e. θ and k_2) and the one (i.e. η) which is unknown to the incumbent at the time when she must set fiscal policy in the first period.

Note that the asymmetries of information assumed are quite realistic (see also

Figure 2.1 Information Structure and Timing of Events



Drazen (2000a,b) on this point). The composition of government spending and especially the composition between current (visible prior to voting) public consumption and future (invisible prior to voting) public investment is an area where incumbent governments can realistically be assumed to have an informational advantage. Public investment, for instance, include such "intangible" and contingent elements as off-budget loans guarantees. Implicit guarantees aimed at maintaining the stability of the financial sector can be thought of such an "invisible as of period *t*" investment (or lack of). Only in period $t+1$ will voters, for instance, know whether the public finances will have to put up a safety plan to rescue ailing financial institutions. Such examples abound: Japan (1990s), South Korea (1997 onwards), the US Savings and Loans (mid 1980s, early 90s), Scandinavian countries (early 1990s), France with Crédit Lyonnais, are all examples where multi-billion dollar rescue packages have been needed and could, arguably, have been attenuated or prevented by adequate "invisible" investment in improved prudential regulation and supervision.

2.3.2 Equilibrium Under Full Information and Under a Social Planner

To gain intuition, we first analyse the equilibrium outcome if voters could observe k_2 prior to voting in period 1. In this case, the incumbent's decision problem is equivalent to maximizing the welfare of the representative agent as voters can observe θ with certainty prior to voting. We need to solve the game backwards.

In the second period, the problem is to $\max\limits_{\tau_2, c_2, g_2} u(c_2, g_2)$ s.t.(2.3), (2.5) and $c_2, g_2 \geq 0$, which, after direct substitution, gives the indirect utility function:

$$\max_{\tau_2} \; J(b, \theta) \equiv u(y - \tau_2 + rb, \tau_2 + \theta - rb - f(\tau_2)) \tag{2.8}$$

The first-order conditions for an interior solution (which stems from the Inada conditions on u) imply:

$$u_c(c_2, g_2) = \left[1 - f'(\tau_2)\right] u_g(c_2, g_2) \tag{2.9}$$

where u_c (u_g) refers to the derivative of $u(.,.)$ with respect to the first (second) argument. Equation (2.9) defines τ_2 as a function of b and θ, i.e. $\tau_2^* = G(b, \theta)$, and with normal goods $G_b(.) > 0$, $G_\theta(.) < 0$. Using the envelope theorem on (2.8), we have:

$$\frac{dJ(b, \theta)}{db} = u_c r - u_g r = -rf'(\tau_2) u_g(c_2, g_2) < 0$$

and, with distortionary taxes:

$$\frac{dJ(b, \theta)}{d\theta} > 0$$

The intuition is that an increase in debt in the first period requires higher taxes in the second period. These taxes however are distortionary.

In the first period, the office-holder's problem is to $\max_{\tau_1, c_1, g_1, b, k_2} u(c_1, g_1) + v(k_2) + J(b, \theta)$ s.t. (2.2), (2.4) and $k_2, c_1, g_1 \geq 0$. After substitution, this is equivalent to the following problem:

$$\max_{\tau_1, g_1, b} W(g_1, \tau_1, b, \theta) \equiv u(y - \tau_1 - b,\ g_1) + v\left[\tau_1 + \theta - g_1 + b - f(\tau_1)\right] + J(b, \theta) \quad (2.10)$$

subject to $g_1,\ \tau_1,\ b,\ y - \tau_1 - b,\ \tau_1 + \theta - g_1 + b - f(\tau_1) \geq 0$.

We know from the Inada conditions on u and v that this problem has an interior solution in g_1, τ_1 and b, i.e. the non-negativity constraints do not bind on these variables. Thus:

$$u_c = (1 - f'(\tau_1))\, v' \qquad (\tau_1 > 0) \qquad (2.11)$$

$$u_g = v' \qquad (g_1 > 0) \qquad (2.12)$$

$$u_c = v' - r f'(\tau_2)\, u_g(c_2, g_2) \qquad (b > 0) \qquad (2.13)$$

or:

$$\frac{1}{1 - f'(\tau_1)} u_c = u_c + r f'(\tau_2)\, u_g(c_2, g_2) = u_g(c_1, g_1) = v' \qquad (2.14)$$

There exists a unique $[g_1^*(\theta), \tau_1^*(\theta), b^*(\theta)]$ which satisfies (2.11)-(2.13) and that is a global maximum.[22] (u and v are strictly concave and the constraint set is convex ; distortionary taxes allow us to determine separately τ_1 and b rather than the sum of the two). With normal goods $c_1^*(\theta)$, $g_1^*(\theta)$, and $k_2^*(\theta)$ are increasing in θ, and $c_2^*(\theta)$, and $g_2^*(\theta)$ are increasing in θ, $\tau_2^*(\theta)$ is decreasing in θ.

[22] Throughout Chapters 2 and 3, a star superscript refers to the equilibrium obtained under full information.

We can note that a policy maker will choose an interior solution for taxes in both periods. The intuition is the following. Suppose that we had $\tau_1 = 0$. Then, given the assumed distortionary loss function (convex and tangent at the origin), a marginal increase in τ_1 imposes a zero deadweight loss, but if b is reduced, τ_2 is also reduced and so is the associated positive second-period deadweight loss. First-period taxes therefore cannot be equal to zero. The policy maker will choose τ_1 and b so as to equate their marginal costs ($[1 - f'(\tau_1)]^{-1}$ and $rf'(\tau_2)\, u_g(c_2, g_2)$ respectively). The same argument applies to second-period taxes.

The equilibrium under full information is represented in Figure 2.2. A high-ability incumbent's equilibrium is represented by point H. A low-ability incumbent is represented by point L. We have $g_H > g_L$, $\tau_H < \tau_L$, $b_H < b_L$ (where, to simplify the notation when *both* a time index and an ability index occur, we drop the time index on g_1 and τ_1; i.e. $g_{1,H} \equiv g_H > g_{1,L} \equiv g_L$, $\tau_{1,H} \equiv \tau_H < \tau_{1,L} \equiv \tau_L$. We continue with this simplification for $t = 1$ variables for the rest of Chapters 2 and 3; for $t = 2$ variables we keep to time index so that no confusion should be possible).

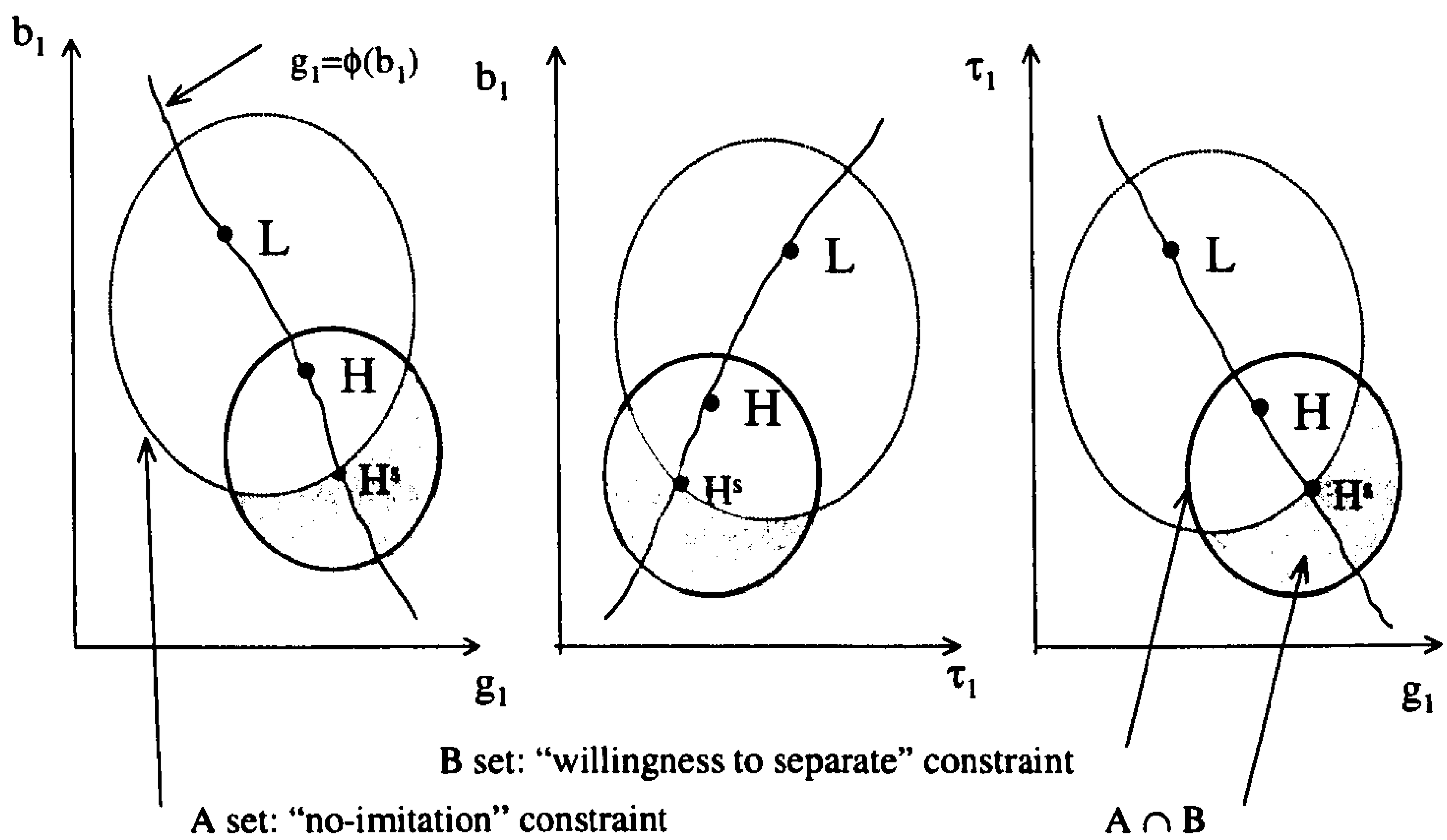
From (2.7), we know that, at the end of period one, the incumbent leader is re-elected ($\Lambda = 1$) if:

$$E_1^P\left[W^*\left(\theta^I\right)\right] - E_1^P\left[W^*(\theta^O)\right] + \eta^I - \eta^O \geq 0 \tag{2.15}$$

where W^* denotes the utility of the representative citizen under full information (and W_a^* denotes the utility of the representative citizen under full information when the office-holder is of ability $a \in \{H, L\}$). Under full information, with voters observing θ and given that θ is constant in both periods, it is easy to find the public's expectations for the incumbent:

$$E_1^P\left[W^*(\theta^I)\right] \equiv W^I = W_a^* \tag{2.16}$$

Figure 2.2 Equilibria for the Low- and High-Type Incumbents



with $a \in \{H, L\}$. Voters however do not have information on the opponent's competency: since the opponent has not produced public goods, voters cannot observe or infer θ from (2.4); thus:

$$E_1^P \left[W^*(\theta^O) \right] \equiv W^O = \rho W_H^* + (1 - \rho) W_L^* \tag{2.17}$$

Clearly, $W^I > W^O$ if the incumbent I is a type-H, and $W^O > W^I$ if I is a type-L (for $\rho < 1$), i.e. a competent incumbent is preferred over an unknown opponent who herself is preferred over an incompetent incumbent.

2.3.3 Benchmark: The Appointment Case

Before analysing the asymmetric information case and the resulting fiscal policy, we need to have a benchmark that can enable us to identify politically-induced fiscal cycles and excessive deficits. A natural benchmark in our model is when fiscal policy is delegated to an *appointed bureaucrat*: i.e. the bureaucrat has a long-term contract (for the two periods of the game) and cannot be fired so that *electoral considerations are not present.* In this case, the appointee sets fiscal policy purely based on economic criteria.

As any other citizen, potential bureaucrats have varying degree of ability in managing the public good production function. Given that there is no shock to the economy the bureaucrat sets fiscal policy in period 1 for the two periods of the model. The objective of a bureaucrat is to maximize her expected utility which is analogous to (2.6) except that there is no election uncertainty (i.e. $\pi = 1$). The solution to this problem is the same as the solution to an opportunistic incumbent under full information. It is given by (2.11)-(2.14). Note however that the equilibrium fiscal policy in the appointment case is unchanged whether there is an asymmetry of information between incumbents and voters or not. Thus, in terms of Figure 2.2, the equilibrium outcome of a high-ability (low-ability) appointed bureaucrat is given by point H (L), so that $g_H > g_L$, $\tau_H < \tau_L$, $b_H < b_L$.

We now return to the analysis of the effects of elections.

2.3.4 Asymmetric Information and Elections

We analyse the more realistic case where the public cannot observe k_2 and therefore θ until period 2 but can form "beliefs" about θ given observations on g_1, τ_1, and b. These are parameterized as $\widehat{\rho}(g_1, \tau_1, b)$ where $\widehat{\rho}$ is the probability weight that the public attaches to $\theta = \theta_H$.

As in the full information case, we need to solve the game backwards. In the final period, the incumbent has no incentive to engineer a fiscal cycle. Hence $E_1^P[J(\theta)] = E_1^P[J^*(\theta)]$ regardless of the citizen who wins the election.

In period one, we know from (2.15)-(2.17) that the incumbent is re-elected ($\Lambda = 1$) if

$$W^I - W^O + \eta^I - \eta^O \geq 0 \tag{2.18}$$

where $W^I = \widehat{\rho} W_H + (1 - \widehat{\rho}) W_L$ and $W^O = \rho W_H + (1 - \rho) W_L$.

Although the office-holder does not know $\eta^I - \eta^O$ prior to setting her election-year fiscal policy, for any choice of (g_1, τ_1, b), she can infer $\widehat{\rho}(g_1, \tau_1, b)$ and thus calculate the probability that $\eta^I - \eta^O$ is high enough for her to win, i.e.

$$\begin{aligned} \pi\left[\widehat{\rho}(g_1, \tau_1, b)\right] &\equiv E^I(\Lambda \mid g_1, \tau_1, b) \\ &= 1 - F\left[W^O - W^I\right] \\ &= 1 - F\left[(\rho W_H + (1-\rho) W_L) - (\widehat{\rho} W_H + (1 - \widehat{\rho}) W_L)\right] \end{aligned} \tag{2.19}$$

where F is the probability distribution of $\eta^I - \eta^O$. A competent incumbent is able to signal her competency. This stems from the fact that an incompetent leader, who cares about the mix of consumption and investment, is more limited in the extent to which she can distort fiscal policy.

Using equations (2.1), (2.2)-(2.6), (2.10), and (2.19), the incumbent's maximization problem is:

$$\max_{g_1, \tau_1, b} Z\left[g_1, \tau_1, b, \widehat{\rho}(g_1, \tau_1, b), \theta^I\right] \text{ subject to:} \tag{2.20}$$

$g_1,\ \tau_1,\ b,\ \ y - \tau_1 - b,\ \ \tau_1 + \theta^I - g_1 + b - f(\tau_1),\ \ y - \tau_2^*(b, \theta^I) + rb,$ and $\tau_2^*(b, \theta^I) +$

$\theta^I - rb - f(\tau_2^*(b, \theta^I)) \geq 0.$

$$\text{where} \quad Z\left[g_1, \tau_1, b, \widehat{\rho}(g_1, \tau_1, b), \theta^I\right] \equiv \Delta^I \pi\left[\widehat{\rho}(g_1, \tau_1, b)\right] + W\left(g_1, \tau_1, b, \theta^I\right) \qquad (2.21)$$

$$\Delta^I \equiv R + W^I - W^O \qquad (2.22)$$

Δ^I is the incumbent's surplus from winning. It consists of the ego rent for the post-election period R, and the amount by which the representative citizen's expected utility is higher when the incumbent wins over her opponent. It is assumed that $\Delta^L > 0$ (which requires ego rents to be sufficiently high).

The objective function of a competent incumbent differs from that of an incompetent leader in two respects. First, expected social welfare (and the value of being re-elected) is higher if a competent incumbent wins over an unknown candidate. Second, for any (g_1, τ_1, b), a high-type leader invests $\theta_H - \theta_L$ more units into k_2 than a low-type incumbent. A high-type can therefore cut back on government investment at lower marginal cost than a low-type; the *signalling cost is lower for a competent incumbent.*

To solve the model under asymmetric information, our equilibrium concept is Sequential Equilibrium.

Sequential Equilibria

We have a multidimensional signalling problem in which g_1, τ_1, b act as signals of the incumbent's (contemporaneously) unobserved competency. Usually, using sequential equilibrium as a notion of equilibrium leads to a great multiplicity of equilibria. These are of two kinds: *separating* equilibria, in which a competent incumbent successfully signals her competency (i.e. $(g_L, \tau_L, b_L) \neq (g_H, \tau_H, b_H)$); and *pooling* equilibria, in which both types behave similarly so that voters are unable to differentiate them prior to elections (i.e. $(g_L, \tau_L, b_L) = (g_H, \tau_H, b_H)$). In order to obtain a unique equilibrium (which is a separating equilibrium), two standard refinements of the equilibrium concept will be used. We restrict our attention to equilibria under pure strategies as existence of equilibrium is not a problem in this model.

Definition 2.1. (Sequential Equilibrium). *Let (g_1^I, τ_1^I, b^I) describe a strategy for the incumbent, and let $\Lambda = \left[\widehat{\rho}(g_1, \tau_1, b), \eta^I - \eta^O\right]$ describe a belief for voters. The pair $\left((g_1^I, \tau_1^I, b^I),\ \Lambda\right)$ describes a sequential equilibrium if:*

(a) voters set Λ according to (2.18);

(b) the incumbent chooses (g_1^I, τ_1^I, b^I) according to (2.20);

(c) voters beliefs are Bayes consistent.[23]

Separating Equilibria

In any separating equilibrium, a low-ability leader must choose her full information fiscal policy:[24] $(g_L, \tau_L, b_L) = [g_L^*, \tau_L^*, b_L^*]$

Assumption 2.1. *We first assume that "off the equilibrium path" beliefs of voters are given by $\widehat{\rho}(g_1, \tau_1, b) = 0 \quad \forall (g_1, \tau_1, b) \neq (g_H, \tau_H, b_H)$.*

In this case, a low-type will not benefit by mimicking a high-type as long as $(g_H, \tau_H, b_H) \in$

[23]That is, if $(g_L, \tau_L, b_L) \neq (g_H, \tau_H, b_H)$, then $\widehat{\rho}(g_L, \tau_L, b_L) = 0$ and $\widehat{\rho}(g_H, \tau_H, b_H) = 1$. If $(g_L, \tau_L, b_L) = (g_H, \tau_H, b_H)$, then $\widehat{\rho}(g_L, \tau_L, b_L) = \widehat{\rho}(g_H, \tau_H, b_H) = \rho$.

[24]Since otherwise $Z\left\{g_L^*, \tau_L^*, b_L^*, \widehat{\rho}\left(g_L^*, \tau_L^*, b_L^*\right), \theta_L\right\} - Z\left(g_L, \tau_L, b_L\right) > 0$ which is inconsistent with (g_L, τ_L, b_L) maximizing (2.20).

$\mathcal{A}$ ("no-imitation" constraint), where:

$$\mathcal{A} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_L) - Z\left[g_L^*, \tau_L^*, b_L^*, 0, \theta_L\right] \leq 0\} \tag{2.23}$$

For a separating equilibrium, it is also necessary that $(g_H, \tau_H, b_H) \in \mathcal{B}$ (i.e. "willingness-to-separate" condition), where:

$$\mathcal{B} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_H) - Z\left[g_H^*, \tau_H^*, b_H^*, 0, \theta_H\right] \geq 0\} \tag{2.24}$$

In Figure 2.2, point L corresponds to (g_L^*, τ_L^*, b_L^*). Set $\mathcal{A}$ consists of the points outside the dashed circle. Note that any point within the disc would be preferred to point L, if by choosing such a point a low-type could fool the public about her true type. Point H corresponds to (g_H^*, τ_H^*, b_H^*). Because all goods are normal, H must lie south-east of L in the (b, g_1) planes, south in the (b, τ_1) plane, and east in the (τ_1, g_1) plane. H could either lie within or outside the dashed disc. It is more likely to be within the disc the larger the ego rent R, the smaller $\theta_H - \theta_L$, and the lower the variance of $\eta^I - \eta^O$. The large solid ellipses in the planes (τ_1, g_1), (b, g_1), and (b, τ_1) represent the $\mathcal{B}$ set. The shaded region represents $\mathcal{B} \cap \mathcal{A}$. As is usual with sequential equilibria, we have a great multiplicity of separating equilibrium strategies for a high competency leader.

Proposition 2.1. (beliefs). *The set of all separating equilibria is nonempty and is characterized by* $(g_L, \tau_L, b_L) = (g_L^*, \tau_L^*, b_L^*)$*, and* $(g_H, \tau_H, b_H) \in \mathcal{B} \cap \mathcal{A}$.

The proofs of all propositions (unless they are straightforward) are relegated to Appendix A.

Undominated Separating Equilibria

Following Cho and Kreps (1987), we can reduce the multiplicity of equilibria by requiring that rational voters will not play dominated strategies. This enables us to eliminate all but one of the separating equilibria. Formally, a point $(\tilde{g}_1, \tilde{\tau}_1, \tilde{b})$ is dominated for an incumbent I, if:

$$Z\left[g_1^*(\theta^I), \tau_1^*(\theta^I), b^*(\theta^I), 0, \theta^I\right] - Z(\tilde{g}_1, \tilde{\tau}_1, \tilde{b}, 1, \theta^I) > 0 \qquad (2.25)$$

Equation (2.25) says that choosing the full information triplet $(g_1^*(\theta^I), \tau_1^*(\theta^I), b^*(\theta^I))$, even in the case where voters assign a zero probability to the incumbent being of type H, yields the incumbent a strictly higher utility than in the case where the incumbent chooses any triplet $(\tilde{g}_1, \tilde{\tau}_1, \tilde{b})$ and has voters attaching a probability of one to the incumbent's type being high.

In Figure 2.2, all points outside the dashed circle are dominated for a low-type, and all points outside the solid circle are dominated for a high-type. Hence, the set of points which are dominated for the low but not for the high-type is where $\mathcal{B} \cap \mathcal{A}$. To rule out dominated equilibria, we introduce the refinement that:

Assumption 2.2. *"Off the equilibrium path" are given by* $\widehat{\rho} = 1\ \forall (g_1, \tau_1, b) \in \mathcal{B} \cap \mathcal{A}$ *and not just at* (g_H, τ_H, b_H).

This refinement on voters' beliefs is plausible given that a low-type will not benefit from choosing g_1, τ_1, b such that $(g_1, \tau_1, b) \in \mathcal{B} \cap \mathcal{A}$. With this minimal degree of sophistication, a high-ability office-holder is free to choose the separating strategy which entails the least distortions. We shall say that voters have ***sophisticated beliefs*** when these are set according to Assumptions 2.1 and 2.2. Thus, in an undominated separating equilibrium, (2.20) holds if (g_H, τ_H, b_H) solves:

$$\max_{g_1, \tau_1, b} W(g_1, \tau_1, b, \theta_H) \tag{2.26}$$

subject to g_1, τ_1, b, $y - \tau_1 - b$, $\tau_1 + \theta_H - g_1 + b - f(\tau_1)$, $y - \tau_2^*(b, \theta_H) + rb$, $\tau_2^*(b, \theta_H) + \theta_H - rb - f(\tau_2^*(b, \theta_H)) \geq 0$, and $(g_1, \tau_1, b) \in \mathcal{A}$.

As shown in the proof of Proposition 2.2, the first-order condition to problem (2.26) is given by

$$[1 - f'(\tau_1)]^{-1} u_c(c_1, g_1) = u_c(c_1, g_1) + rf'(\tau_2) u_g(c_2, g_2) = u_g(c_1, g_1) < v'(k_2) \tag{2.27}$$

From the above relationship, we can implicitly define the government's income expansion path $b = \phi(g_1)$, which passes through points L and H in Figure 2.2. $\phi'(.) < 0$ since we have normal goods. The unique undominated equilibrium is given by point H^s in Figure 2.2.[25] At this point, given that we have normal goods, $g_{H^s} > g_H$, $\tau_{H^s} < \tau_H$, $b_{H^s} < b_H$ and $k_{2,H^s} < k_{2,H}$.

The following Proposition summarises our solution to problem (2.26).

Proposition 2.2. (Undominated Separating Equilibrium) *Assume sophisticated beliefs (Assumptions 2.1 and 2.2). Then there exists a unique (undominated) separating equilibrium, and in this equilibrium the high-ability office-holder distorts fiscal policy ahead of election so as to signal his enhanced ability to the electorate; thus* $g_{H^s} > g_H$, $\tau_{H^s} < \tau_H$, $b_{H^s} < b_H$ *and* $k_{2,H^s} < k_{2,H}$ *(cf. (2.27)). The low-type incumbent pursues his full information strategy* g_L, τ_L, b_L *(cf. (2.14)).*

where the subscript H^s (H) refers to the high-type's strategy in the undominated

[25] The superscript "s" denotes the signalling equilibrium for the high-type leader.

separating equilibrium (full information or appointment equilibria), and L refers to the low-type's strategy in all cases (these points are represented in Figure 2.2).

Pooling Equilibria

The above refinement is not necessarily sufficient to rule out all pooling equilibria.[26] In order to do so, we further refine the equilibrium concept by using Cho and Kreps' (1987) "Intuitive Criterion" which states that an equilibrium $\{(g_L, \tau_L, b_L), (g_H, \tau_H, b_H)\}$ is *unintuitive* if there exists a point $(\bar{g}_1, \bar{\tau}_1, \bar{b})$ such that:

$$Z\left(\bar{g}_1, \bar{\tau}_1, \bar{b}, 1, \theta_H\right) - Z\left[g_H, \tau_H, b_H, \hat{\rho}\left(g_H, \tau_H, b_H\right), \theta_H\right] > 0 \tag{2.28}$$

$$\text{and } Z\left(\bar{g}_1, \bar{\tau}_1, \bar{b}, 1, \theta_L\right) - Z\left[g_L, \tau_L, b_L, \hat{\rho}\left(g_L, \tau_L, b_L\right), \theta_L\right] < 0 \tag{2.29}$$

Proposition 2.3. *All pooling equilibria are unintuitive.*

One can easily confirm that the unique undominated separating equilibrium is an intuitive equilibrium (i.e. not unintuitive). Therefore the only sequential equilibrium that survives our refinements is the undominated separating equilibrium of Proposition 2.2.

Ricardian Equivalence

An interesting result of our model concerns the Ricardian Equivalence proposition (Barro, 1974). It can be seen from (2.27) in the case where distortionary taxes are

[26] For example, if ρ is large enough, then $(g_L, \tau_L, b_L) = (g_H, \tau_H, b_H) = (g_H^*, \tau_H^*, b_H^*)$; $\hat{\rho}\left(g_H^*, \tau_H^*, b_H^*\right) = \rho$ can be an undominated pooling equilibrium.

set to zero. It is summarized in the following proposition:

Proposition 2.4. (Ricardian Equivalence). *For a given type of incumbent, if* $f(\tau_1) = f(\tau_2) = 0$, $\tau_1 + b = \delta$ *(where* δ *is a constant) is uniquely determined, but there exists a continuum of equilibria regarding the composition of the financing mix:* $\tau_1 + b$.

Proposition 2.4 states that without distortionary taxes, even though we have a signalling model in which public debt and taxes are used strategically by the incumbent policy maker for electoral purposes, the financing decision of the government is irrelevant, that is, the Ricardian Equivalence proposition (Barro, 1974) holds.

2.3.5 Political Fiscal Cycles and Welfare

We are now able to analyse the welfare and fiscal effects that arise because of the electoral motivations of office-motivated incumbents. Let us call the undominated separating equilibria obtained in Proposition 2.2 (points L and H^s in Figure 2.2) the "*electoral equilibrium*" of the game, as opposed to the "*appointment equilibrium*" obtained in Section 2.3.3 (Benchmark case) represented by points L and H in Figure 2.2. Also let us define an electoral fiscal cycle as:

Definition 2.2. (Electoral fiscal cycle) *A (type contingent) electoral fiscal cycle is the difference between the value of a variable in the "electoral equilibrium" and the value of the same variable in the "appointment equilibrium". These values are computed for a given type of incumbent.*

Also, note that given the technology available for the production of public goods, two notions of the budget deficit exist. First, the "*visible*"/*ex ante* deficit ($g_1 - \tau_1 +$

$f(\tau_1)$) which is observed contemporaneously. Second, the "*true*"/*ex post* budget deficit $(g_1 - \tau_1 + f(\tau_1) - \theta)$ which is only observed in the second period and which takes into account the true cost of providing public goods.

We can now summarize, in the next two Propositions, our results regarding the effects of electoral considerations in setting fiscal policy ("electoral equilibrium") as opposed to purely economic-based fiscal policy ("appointment equilibrium").

Proposition 2.5. (Level effects). *(i) Individual equilibrium fiscal variables across types and equilibria are such that:* $g_{H^s} > g_H > g_L$, $\tau_{H^s} < \tau_H < \tau_L$, $b_{H^s} < b_H < b_L$ *and* $k_{2,L} < k_{2,H^s} < k_{2,H^s}$; *(ii) The equilibrium budget deficit (both ex ante and ex post) created by a high-ability appointed bureaucrat is lower than the one created by either a low-ability bureaucrat or a high-ability politician (e.g.* $g_H - \tau_H + f(\tau_H) < g_{H^s} - \tau_{H^s} + f(\tau_{H^s})$, *and* $g_H - \tau_H + f(\tau_H) < g_L - \tau_L + f(\tau_L)$*).*

Let us now compare the appointment and the electoral cases in terms of quality of the office-holder. First, note that generally, the probability that an institution (election or long-term appointment) will select a high-type office-holder will depend on $n_H = \#\{i \in N \,|\theta_i = \theta_H\}$, the number of citizens who are high-ability types. Of course, ex ante, n_H is a random variable, as it is determined by the realizations of the θ_i. So, when comparing institutions, it is more appropriate to use the expected value of this variable, as, following Buchanan, choice between constitutions should be thought of as taking place behind a Rawlsian "veil of ignorance" (Dixit, 1996). As n_H is binomially distributed, ($n_H \sim B(n, \rho)$), it is straightforward to calculate[27]

[27]The expected value of n_H is $n\rho$, and that of n_H^2 is $n\rho(1-\rho) + n^2\rho^2$. Also, the probability that a citizen selected at random is high-type is n_H/n, and $E(n_H/n) = \rho$. Next, conditional on n_H, the probability that a high-type is selected for office in the second period in the electoral case

that (i) the expected probability that a high-type is in office in either period with appointment is $E(n_H/n) = \rho$; (ii) the expected probability that a high-type is selected for office in the first (respectively second) period in the electoral case is ρ (respectively $\rho + \rho(1-\rho)$). So, we can summarise:

Proposition 2.6. (Deficit bias versus quality of office-holders). *With an electorally-concerned office-holder, the expected budget deficit (both ex ante and ex post) is higher than under an appointed bureaucrat (i.e.* $g_1^e - \tau_1^e + f(\tau_1^e) > g_1^a - \tau_1^a + f(\tau_1^a)$ *and* $g_1^e - \tau_1^e + \theta + f(\tau_1^e) > g_1^a - \tau_1^a + \theta + f(\tau_1^a)$*). However, in the appointment case, a high-ability type is selected in both periods with expected probability* $\rho < 1$*, while in the electoral case, a high-ability type is selected in the first period with probability* ρ *and in the second with probability* $\rho + \rho(1-\rho)$*.*

where a "e" ("a") superscript refers to the expected value (prior to the beginning of the game) of a variable in the "election equilibrium", e.g. $b^e \equiv \rho b_{H^s} + (1-\rho)b_L$ ("appointment equilibrium", e.g. $b^a \equiv \rho b_H + (1-\rho)b_L$), and $\theta \equiv \rho\theta_H + (1-\rho)\theta_L$.

The proof of Proposition 2.5 follows directly from the comparison of the fiscal outcomes in Proposition 2.2 and in (2.11)-(2.14) ; that of Proposition 2.6 follows directly from Proposition 2.5 and the paragraph preceding Proposition 2.6.

The above two Propositions show that an electorally-motivated policy maker, compared to an appointed office-holder, distorts fiscal policy ahead of elections. An *electoral fiscal cycle arises.* Income receipts (τ_1, b) and public investment (k_2) are suboptimally low while government consumption expenditures (g_1) are suboptimally high. As a result, on average, an electoral cycle emerges in *budget deficits*: even

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is, $\frac{n_H}{n} + (1 - \frac{n_H}{n})\frac{n_H}{n-1}$ the expected value of which, after some calculation, turns out to be $\rho + \rho(1-\rho)$.

though a low-ability incumbent does not create an electoral cycle, a high-ability office-motivated incumbent creates a higher budget deficit than a non-politically motivated leader of similar ability. Note that although the fiscal policy of a high-ability office-motivated leader is distorted towards a *deficit bias* because of his re-election concerns, signalling is "efficient" in the sense that no reallocation of expenditures between private and government consumption can yield voters higher welfare.

An important *trade-off* as far as designing an optimal fiscal constitution is concerned therefore emerges. On the one hand, in expected values, elections lead to a deficit bias whereby the budget deficit is higher than in the appointment case (*ceteris paribus*, this signalling activity is welfare reducing). On the other hand, elections enable society to fire low-ability office-holders in the first period of the game so that the expected quality of the office-holder is higher under the electoral case than under the appointment case. The net welfare effect of elections is therefore ambiguous. Elections are more likely to increase welfare the larger the competency difference between the two possible types $(\theta_H - \theta_L)$,[28] and the smaller the ego rent (R).

Finally, note that from part (ii) of Proposition 2.5, we know that the budget deficit created by a high-ability bureaucrat is lower than the one created by either a low-ability bureaucrat or a high-ability politician.[29] However, a much more interesting comparison as far as budget deficits is concerned is between the high- and low-ability office-holders in the electoral case. We know that elections induce the high-type to increase his budget deficit; is this election-induced deficit high enough so that society would be better-off (in terms of welfare or in terms of absolute deficit levels) with a

[28]Indeed, the larger $\theta_H - \theta_L$, the more acute the adverse selection problem becomes. In this case, election gives citizens the option to dismiss badly performing (and therefore low ability) office-holders. This option becomes more valuable the larger the ability spread.

[29]Throughout the thesis we label as a politician an office-holder that faces elections.

low-ability leader? The next Proposition addresses this issue.

Proposition 2.7. *For sufficiently high levels of "ego rent" (R), in the electoral (undominated separating) equilibria, a high-ability incumbent creates a smaller ex post (true) budget deficit than a low-ability incumbent (i.e. $g_{H^s} - \tau_{H^s} - \theta_H + f(\tau_{H^s}) < g_L - \tau_L - \theta_L + f(\tau_L)$).*

Although Proposition 2.7 is intuitive, we should note that, in the context of an opportunistic model *à la* Rogoff, our result might seem surprising and even counter-intuitive. Indeed, in Rogoff and Sibert (1988), Rogoff (1990) and in the literature that follows,[30] a high-ability office-holder is shown to *increase* government expenditures and *decrease* taxes ahead of elections. All these models assume that the government balances its budget in each period. However, they might give the impression that the fiscal policy stance of a competent policy maker is looser than that of a less able policy maker. Indeed, from Proposition 2.5, we know that both budget deficit measures of a high-type leader increase in the electoral equilibrium (leading to a *deficit bias*) compared to the appointment equilibrium. What Proposition 2.7 reveals is that, even though electoral considerations induce high-ability office-holders to increase the budget deficit ahead of elections, this higher deficit nevertheless does not exceed the (true) deficit that low-ability incumbents generate. The intuition for this result is that high-ability incumbents can use their ability advantage to lower the cost of public expenditures and therefore lower the budget deficit.

[30]Gonzalez (1999) and Drazen (2000b) are recent extensions of Rogoff (1990).

2.4 Conclusion

In this chapter, we have first briefly reviewed the empirical literature on the political determinants of budget deficits and fiscal cycles. The literature reveals that electoral effects are important and significant determinants of such outcomes. These empirical results have recently been corroborated by advanced econometric studies, thereby vindicating the opportunistic channel in fiscal policy.[31] Despite these strong supporting empirical evidence, no theoretical model featuring office-motivated incumbents exists in which the government's set of fiscal instrument (which is used to *endogenously* increase the incumbent's re-election probability) include *public debt.* Important topical policy issues related to the interaction between politics and the occurrence of fiscal deficits cannot therefore be analysed based on a microfounded model whose political channel is supported by empirical evidence. The political bias towards deficit financing is however worrisome enough that numerous countries are introducing constitutional rules to curb these excesses (e.g. The Stability and Growth Pact for European Monetary Union countries, the Code for Fiscal Stability for the United Kingdom, etc.). Without a theoretical model that is consistent with the empirical channel that has been found to be a significant determinant of budget deficits and fiscal cycles, economic analyses of the recent constitutional changes would remain unsatisfactory.

The main achievement of this chapter is the construction of an opportunistic model with public debt as a state variable. This exercise, not only fills an important gap in the theoretical literature, but given the empirical evidence it also provides an

[31] It also transpired that the other main political motive (namely partisan behaviour), does not seem to be a robust predictor of fiscal outcomes.

appropriate framework with which to address issues related to politically-generated excessive deficits.

Our model gives the following new predictions. First, on average, an *electoral fiscal cycle arises.* This cycle exists in all fiscal instruments, and in particular in the budget deficit: on average, elections give rise to a deterioration of the budget deficit (specifically, the pre-election period exhibits a deterioration of the deficit, while the post-election period is characterized by an improvement in the deficit). Second, we find that *more competent policy makers run lower (ex post) budget deficits* than less able office-holders. This result is intuitive, yet, in the context of opportunistic models, it might seem surprising. Indeed in these (balanced budget) models high-ability leaders *increase* government expenditures and *reduce* taxes ahead of elections, potentially giving the impression that if one were to allow for debt financing of government expenditures, high-type leaders would be the one creating high deficit levels. In this chapter we have indeed shown that high-ability leaders, because of their signalling strategy, do create politically-induced *"excessive" deficits* (or *deficit bias*) ("excessive" in the sense that this high-ability incumbent would run a lower budget deficit should she face no election). However, even though this "excessive" deficit arises, because high-ability leaders have an advantage in producing public goods at a lower cost, their budget deficit levels still remain below that of lower ability incumbents. Third, we highlight a *fundamental trade-off between the efficiency gain arising from the possibility of firing low-type office-holders during the election, and the efficiency cost that elections create via signalling in the pre-electoral period and the associated rising budget deficit.* Therefore, the net welfare effect of elections is ambiguous. We have also established that asymmetric information and signalling are not sufficient to break the Ricardian Equivalence proposition.

Given the trade-off highlighted in this chapter, the model can be used to investigate the welfare and (endogenous) incentive effects of alternative institutional designs aimed at curbing the welfare reducing electoral cycles. The next chapter tackles these issues.

Chapter 3

The Effects of Fiscal Constraints on Sovereign States: Applications to EMU, the UK, and the US.

3.1 Introduction

"In practical terms, the [Stability and Growth] Pact can be seen as a device aimed at securing respect of the Treaty, i.e., that excessive government deficits are indeed avoided."

Antonio José Cabral (1997)[1]
(European Commission, DGII)

"Just as we cannot be sure that announcing a low-calorie diet for a person suffering from obesity will lead that person to eat less, there is no guarantee that governments will be able to control their deficit excesses by simply being told to borrow less"

Robert P. Inman (1996)

[1]In von Hagen (1997) "A Stability Pact for Europe", Zentrum für Europäische Integrationsforschung, Bonn, *ZEI Policy Paper* B97-01.

Will the Stability and Growth Pact signed in Amsterdam on 18 June 1997 really avoid excessive government deficits within the European Monetary Union, as the first quote claim it will, or is further analysis warranted as the second quote hints at? More generally, are fiscal constraints effective in reaching their designed goal (which is to prevent or reduce "excessive" deficits once we recognise that policy makers differ from benevolent social planners), and are such constraints an efficient way of reaching such a goal? These are the issues we investigate in this chapter.

The imposition of fiscal constraints at the sovereign level is a new and growing phenomenon. Countries that have recently introduced fiscal restraints include New Zealand ("Fiscal Responsibility Act", 1994), the European Monetary Union (EMU) countries ("Stability and Growth Pact", 1997), and the United Kingdom ("Code for Fiscal Stability", 1997). Throughout the 1980s and 1990s, the United States Congress has discussed the pros and cons of introducing a balanced-budget rule at the federal level, so far rejecting this idea. A common argument in favour of fiscal constraints is that they prevent politically motivated policy makers from creating "excessive" deficits such as those that have arisen since the 1970s in most OECD economies. Ample empirical evidence indeed show that such deficits are well explained by political variables (Alesina et al. 1997 ; Persson and Tabellini, 1998). Despite the recent trend towards the adoption of fiscal constraints in practice, the evidence from the economics literature regarding their desirability is still open. Key questions still need to be addressed, such as (i) whether constitutional fiscal restraints on sovereign governments fulfil their aim, (ii) whether fiscal constraints are welfare increasing, and (iii) whether fiscal constraints are efficient. In this chapter we shed some light on these questions by analysing three specific fiscal constraints, namely those introduced and considered by the European Monetary Union (EMU), the United States of America and United Kingdom (EMU member countries face specific fiscal ceilings on budget deficits and guidelines on public debt accumulation; The UK has a "Golden Rule" of public investment; The US proposed to introduce a balanced-budget rule at the federal level).[2] Following this positive analysis of these three widely publicised fiscal constraints, we ask a normative question using the same theoretical framework, namely whether an "optimal" fiscal constraints can be designed.[3]

The rest of this chapter is organised as follows. In Section 3.2, we review the literature on the pros and cons of fiscal constraints both from an empirical and theoretical point of view. Some shortcomings are highlighted. In the light of these latter, we argue that the model we developed in Chapter 2 is ideally suited to analyse the issues we are interested in: it allows us to study, from a *microfounded* model, the endogenous response of policy makers to a new fiscal regime. Hence, the backbone model we use in this chapter is the one developed in Chapter 2. Before turning to the formal analysis of the effects of fiscal constraints, we describe in details (in Section 3.4) the three specific rules that we shall be investigating. As will transpire, the model of Chapter 2 is ideally suited to analyse and contrast the effects of these different constraints as the model is flexible enough to differentiate between public consumption and investment. These differences between different components of public expenditures are at the very heart of various types of fiscal constraints actually implemented around the world. In Section 3.5, we formally analyse the effectiveness and welfare

[2]Throughout the chapter we therefore often refer to the different types of constraints by their country of adoption even though slight differences exist between our theoretical exercise and the constraints adopted.

[3]As will later be detailed, we shall say that a fiscal constraint is optimal if it eliminates politically-induced budget deficits (which we classify as "excessive" deficits) *and* if it also leads to a first-best allocation. Our definition is therefore fairly restrictive.

effects of various constitutional fiscal constraints on sovereign states. We find that all the existing fiscal constraints studied do fulfil their goal of reducing "excessive" budget deficits, though some constraints induce policy makers to substitute restricted for unrestricted fiscal instrument (Section 3.5.2). In Section 3.5.3, we Pareto rank the three fiscal constraints vis-à-vis one another and vis-à-vis the status quo (i.e. no fiscal constraint, and full fiscal discretion to office-holders). Only one of the constraint (the Golden Rule) can yield higher welfare than the status quo. An important achievement of this chapter is therefore to provide a rationale for the introduction of fiscal constraints at a national level in a one country, microfounded model. As detailed in the next section, the (limited) existing formal literature on fiscal constraints finds such constraints to be desirable either because of fiscal externalities in multi-country models with a single monetary authority/currency (Beetsma and Bovenberg, 1997; Chari and Kehoe, 1998), or because *ad hoc* assumptions such as government myopia are imposed (Beetsma and Bovenberg, 1999; Beetsma and Uhlig, 1999). In Section 3.5.4 we show that it is not possible to design an "optimal" fiscal constraint (i.e. one that eliminates all inefficiencies in the economy) in the set of standard fiscal constraints. We conclude this chapter in Section 3.6.

3.2 The Literature on Fiscal Constraints

The desirability or not of fiscal constraints is a perennial issue in the economics literature. For instance, as early as 1939, Musgrave argued against the introduction of a Capital Budget at the federal level for the US.[4] The debate as been a recurrent

[4] A capital budget which contains only public capital expenditures, requires the existence of dual budgets: a capital budget and a current budget (which contains only non-capital expenditures). In practice, the distinction between capital and current items is often blurred so much so that

issue in the United States, where states have various degree of fiscal constraints (e.g. Poterba, 1994), and where fiscal restraints on the federal budget are frequently discussed. Most recently, the debate on the pros and cons of fiscal constraints has received new attention because of the imposition of fiscal constraints for countries aiming to join the European Monetary Union (those constraints were set out in the Maastricht Treaty, 1992), and for countries that have joined the Euro zone.[5] Thus, most of the latest literature on sovereign-based fiscal constraints focuses on fiscal constraints with a view to EMU. A significant part of this literature takes a "transatlantic perspective" and draws from the US states' experience with varying degree of fiscal constraints to offer some lights on the effects of introducing fiscal constraints on EMU countries.

3.2.1 The Arguments Against Fiscal Constraints

Mainstream textbook economic theories all agree that fiscal constraints are detrimental. This conclusion can be reached either from neoclassical models of fiscal policy (e.g. Barro, 1979) which advocate the use of tax smoothing over the business cycle, or from Keynesian models which advocate the use of counter-cyclical fiscal policy. For instance, Musgrave (1963) argues that fiscal constraints and in particular dual budgets (current and capital budgets) are undesirable at the national level since fiscal policy is required for stabilization purposes. Arguments from the optimum currency area literature also reach the same conclusion given that fiscal constraints limit fiscal

accounting measures differ among US states for the treatment of certain items (see Poterba, 1995, footnote 2 for further details and references).

[5]The constraints for EMU members are detailed in the Stability and Growth Pact signed in Amsterdam in 1997; these constraints are very similar to those of its predecessor, the Maastricht Treaty.

policy precisely when such a policy has a more prominent role to play as an adjustment mechanism (Masson and Mélitz, 1991). Fiscal constraints, and especially balanced-budget rules, have also been criticized for amplifying the business cycle since they stimulate aggregate demand during expansionary periods through tax cuts and higher public expenditures, and they reduce demand in recessionary periods via a corresponding fiscal contraction. These features of balanced-budget rules would occur not only is a traditional Keynesian IS-LM model, but also in a neoclassical growth model (for instance, King, Plosser and Rebelo (1988) find that, in a real business cycle model, a government that follows a balanced-budget rule and that finances government expenditures with income taxes would increase the amplitude of the business cycle). Schmitt-Grohe and Uribe (1997) find that balanced-budget rules can lead to another source of instability. Using a standard neoclassical growth model they show that such rules can "make expectations of higher tax rates self-fulfilling if the fiscal authority relies heavily on changes in labour income taxes to eliminate short-run fiscal imbalances." Calibrations of their model on parameters and income tax rates consistent with the US economy and other G7 countries show that indeterminacy indeed arises.

In terms of actual implementation, the choice of a specific ceiling level (e.g. as is the case for the Maastricht fiscal criteria and EMU's Stability and Growth Pact (SGP thereafter)) has been criticized for its arbitrariness (Buiter et al., 1993). Although in the context of a monetary union, fears of a debt bail-out and/or of pressure from fiscal authorities onto the central bank, have been advanced as arguments in favour of fiscal constraints (Eichengreen and Wyplosz, 1998, and the literature therein), Von Hagen and Eichengreen (1996) argue that, in EMU, such fiscal constraints are redundant because each European Union (EU) country still control the majority of its own taxes. Taxes can be increased should financial difficulties arise in one country. The possibility of a bail-out[6] is non-existent, and as a result, so is the rational for fiscal constraints. Von Hagen and Eichengreen (1996) add that the procedure is in fact more than redundant for if countries cannot use the tax-smoothing and automatic fiscal stabilizers because of the binding restraint, they will pressure for the EU to perform such a role. The end result being a rise in EU's indebtedness and a real possibility of pressures being put on the European Central Bank.

One of the (implicit) assumption that is retained throughout the above models is that policy makers are benevolent social planners. Indeed, in these models, should budget deficits arise they are optimal (e.g. Barro, 1979). However, the fiscal history of most OECD countries since the 1970s cannot easily be reconciled with optimal tax setting by a social planner (Alesina, Roubini, and Cohen, 1997). Hence, although the above models argue that fiscal constraints should not imposed on governments, given that these models do not take into account the reasons that led to the need for restraints on policy makers' discretionary fiscal policies to be adopted (the observed deficit bias in policy making), the robustness of their conclusion is open to question.

3.2.2 The Rationale For Adopting Fiscal Constraints

As pointed out by Musgrave (1997) there is a "sensible case for balanced budgets as a matter of fiscal discipline. The beneficiaries of public services should pay and not burden future generations". In earlier work, Musgrave (1963) also argued that dual budgets, i.e. separating current and capital expenditures, are desirable at the

[6]This possibility has often been advanced as a rationale for adopting fiscal restraints in order to prevent the fiscal authorities from putting pressure on the common central bank.

state and local level since at this level of authority fiscal policy is not responsible for stabilisation policy.[7] A same argument, namely that fiscal constraints are desirable at the state but not at the federal level is also expressed by Alesina and Perotti (1996).

Aside from fiscal stabilisation issues (or lack of), various distortions or externalities have been shown to provide a rationale for adopting fiscal constraints. Politics and policy making are one of the major motivation. As pointed out in Chapter 2, robust empirical evidence highlight the importance of political variables in explaining budget deficits (see also the evidenced gathered by Alesina et al, 1997). In parallel to these empirical evidence, numerous theoretical models can explain why political considerations create a bias towards deficit financing in fiscal policy. Persson and Svensson (1989), Aghion and Bolton (1990), Alesina and Tabellini (1990), Tabellini and Alesina (1990) are among the early influential models featuring agents with rational expectations; Velasco (2000) is a recent interesting paper pertaining to explain the rising public debt levels that occurred since the 1970s. Despite a plethora of theoretical and empirical evidence pointing to a robust link between politics and budget deficits, and the widely proclaimed aim that constitutional fiscal constraints are introduced in countries as a mean to reduce "excessive" budget deficits, there is only a limited economics literature that analyses the effects of fiscal constraints taking into account the political environment (that creates the need for these constraints to be imposed).

Of the few formal models that have analysed the interaction between politically motivated office-holders and fiscal constraints, the consensus result is that fiscal constraints can eliminate the politically-induced deficit bias. These models also show

[7]Musgrave however opposes the idea of a dual budget at the federal level on fiscal stabilisation grounds.

that this reduction of the political bias is welfare increasing.

For instance, Beetsma and Bovenberg (1999), extending the Alesina and Tabellini (1987) framework (itself based upon Barro and Gordon, 1983) to public debt accumulation and politically motivated governments, show that a monetary union leads to higher public debt than what would obtain in a national environment. The intuition of their result is that within a monetary union the credibility of the common central bank is like a public good. A free rider problem occurs: each individual fiscal authority has less incentive (in terms of inflation) to reduce debt.[8] If policy makers have a higher discount rate than society, this higher level of debt leads to excessive debt accumulation and reduces welfare. The authors show that debt ceilings reduce excessive debt and enable the common central bank to focus on price stability. In a companion model, Beetsma and Bovenberg (1997) show that in the presence of political distortions (meaning in their paper that policy makers have a higher discount rate than society), an optimally designed "Rogoff-conservative" (Rogoff, 1985) and independent central bank needs to be supplemented with a public debt ceiling in order to achieve the first best. Agell et. al. (1996), building on the time-inconsistency literature, develop a small open economy model in which the government can use both exchange rate and fiscal policy to affect output and employment. They find that the equilibrium under discretion is characterized by both an inflationary and a public debt bias. Delegating monetary policy to a supra-national authority solves the inflation bias but might exacerbates the debt accumulation bias. Binding fiscal constraints might help solve this bias. Canzoneri and Diba (1996), using the recent theory of fiscal determination of the price level, find that the deficit criterion (not the

[8]The effect of a single player's fiscal stance is $1/n$ that of the union; with n being the number of equal sized union members.

debt criterion) of the SGP is necessary to guarantee the "functional" independence of the European Central Bank. Without it the ECB would not be capable of controlling the price level, even if it were politically independent and had a mandate for price stability. For McKinnon (1997), the ceilings of the SGP are useful in that they will foster collective fiscal retrenchment. Without the Pact, no European government can curtail the welfare state without being voted out of office. Another argument in favour of fiscal restraints is that, by imposing fiscal retrenchment, they will enable automatic fiscal stabilizers to regain effectiveness.[9]

Fiscal constraints have also been motivated in relation to price stability and the maintenance of a truly independent central bank. For instance, they can eliminate free rider problems (leading to an inflationary bias) in a monetary union with independent fiscal authorities when the central bank is unable to pre-commit (Chari and Kehoe, 1998); they can enable an independent central bank to retain complete control over the determination of the price level (Canzoneri and Diba, 1996); they can reduce the risks and consequences of public debt crises, and they can reduce the potential inflationary consequences of high public debt levels (see Gerlach's comments of Eichengreen and Wyplosz, 1998). More generally, fiscal constraints can safeguard the credibility of the central bank in a monetary union by acting as an incentive device for fiscal discipline (Artis and Winkler, 1998). Imposing fiscal constraints can also be seen as a partial substitute for policy coordination among EMU countries.

Finally, in a paper closest to our motivation, Beetsma and Uhlig (1999) analyse

[9]See Cotis et al. (1997) for empirical evidence of reduced effectiveness of fiscal policy, and automatic stabilizers in particular, in France during the 1990s; See Sutherland (1997) for a theoretical explanation of the underlying mechanism; and Masson (1996) for a general point. Hairault et al. (1997) collect several papers on the role of built-in stabilizers over the business cycle.

the SGP using a "partisan" model. They find that short-sighted governments[10] fail to fully internalise the inflationary consequences of their debt policies in a monetary union. This leads to excessive debt accumulation. The public debt constraint of the SGP and the associated fine provide the right mechanism to correct the debt bias. An unpleasant characteristic of their constraint is that it requires "a huge penalty for debt in the first period and a huge subsidy in the second period" (p. 23).[11] Clearly, this is unsatisfactory for the SGP does not (a) allow for subsidies, and, more importantly, (b) an important time-lag (compared to elections span) exists between the occurrence of an "excessive" deficit and the subsequent fine which renders their necessary first-period fine impossible. The *real features of the SGP*, in their model, cannot prevent excessive debt accumulation, on the contrary they *worsen debt accumulation.*

To conclude, we have shown that the few formal models providing a rationale for fiscal constraints rely either on (i) *ad hoc* assumptions to drive their key results (these models are not microfounded but based on a Barro and Gordon (1983) framework), or (ii) rely on multi-country models with fiscal externalities and a common currency. The former type of models include Beetsma and Bovenberg (1997) and Beetsma and Uhlig (1999): Their result is driven by their assumption that citizens and government have a different discount factor (the government being assumed to be more myopic). However, it is not clear from their model what could motivate this assumption. Indeed, since governments are motivated by partisan behaviour, whether in or out of office, it would seem that they should have the same time preference for public goods as the citizens that support them/they represent. Without an endogenous derivation

[10]Meaning, in their model, that governments have (by assumption) a higher discount factor than society.

[11]They have a two-period, two-party model in which one party is in office in the first period and is reelected with an exogenous probability $0 < p < 1$.

of this key political distortion, the robustness of these models is questionable. The latter type of models include Beetsma and Bovenberg (1997) and Chari and Kehoe (1998). Another limitation of some of these studies is that the political channel that is assumed to give rise to budget deficits (i.e. partisan behaviour) does not find much support in the empirical literature (c.f. Section 2.2). Furthermore, as argued in Chapter 2, there are many ways a government can be partisan (a point also made by Persson and Tabellini, 2000),[12] and the different ways this behaviour is modelled leads to opposite predictions.

3.2.3 Empirical Evidence

Until recently, constitutional fiscal constraints were virtually nonexistent for sovereign states. Direct empirical studies were therefore impossible. However, as already mentioned, statutory or constitutional fiscal restraints do however exist on subnational entities in federal states. In part motivated by the prospects of the introduction of fiscal constraints in Europe, a growing empirical literature has focused on the US states so as to assess the effects of fiscal constraints. States in the US are especially suited to empirical investigation since all but one State (Vermont) have fiscal restraints, and, more interestingly, States have varying degree of fiscal stringency being imposed on them (see ACIR, 1987, for a classification of the degree of stringency of fiscal constraints for each US state). This provides sufficient variability in the data for meaningful econometric studies of the effect of fiscal restraints to be undertaken. The consensus from these studies based on *state-based* fiscal constraints (and not

[12] So far it is not well understood in economics why individuals have different ideology. As a result, no microfounded model explaining partisan behaviour endogenously exists. The political economy literature has therefore analysed the effects of introducing partisan behaviour by assuming, in an arbitrary way, differing preferences among agents.

national fiscal constraints) is that fiscal restraints, provided they are carefully designed, are effective. For instance, Alt and Lowry (1994), Poterba (1994), Bayoumi and Eichengreen (1995), and Bohn and Inman (1996) all find strong evidence that the more stringent the fiscal constraints, the lower the average fiscal deficits, and the quicker incumbents react to adverse shocks (by cutting spending and not by raising taxes[13]). A more detailed investigation by Bohn and Inman (1996) reveals that these results hold when the restraints apply to end-of-year budgets (not to prospective ones), when they are constitutionally grounded (not statutory), and enforced by an independent body (not a politically appointed one).[14] Alesina and Bayoumi (1996) have an even stronger result: besides from being effective in enforcing fiscal discipline in US states, balanced-budget rules have no costs in terms in increased state output variability. This runs counter to the standard argument that a trade-off exists between the benefits of rules and those of discretion. This finding is controversial. Bohn and Inman (1996) find mixed support for it (depending on the cyclical indicator used), while Eichengreen and Bayoumi (1994) find that fiscal restraints limit the use of fiscal stabilizers. A partial explanation of Alesina and Bayoumi's result is that, as Bayoumi and Masson (1995) point out, US states do rely to a large extent on the federal government budget in smoothing out negative shocks (specifically, stabilisation flows amount to 31 cents in the dollar).[15] In his analysis of the effects of Capital Budgets and of a Pay As You Go (PAYG) capital finance rule for public investment

[13]The study by Bayoumi and Eichengreen (1995) finds, in contrast to these other studies, that the adjustment comes from increased revenues not from reduced spendings.

[14]See Bohn and Inman (1996) and Inman (1996) for an extensive and critical review of the empirical literature.

[15]The Alesina and Bayoumi result could therefore potentially suffers from an omitted variable bias. An important issue for their analysis is whether transfers from the federal budget are larger the more stringent the index fiscal of fiscal controls. If this were the case, this would imply that citizens in states with the most stringent fiscal restraints are de facto being subsidised by the federal budget and therefore being subsidised by citizens from states with less restrictive fiscal constraints.

in US states, Poterba (1995) finds the following results. First, states with capital budgets exhibit higher levels of capital spending (by approximately one third compared to states that do not have capital budgets). Second, the PAYG rule (whereby the state cannot borrow to finance public investment) is correlated with lower levels of public capital (by about 20 percent). Poterba (1995) also finds no evidence that capital budgets affect the level of non-capital spending, while he finds that a PAYG finance rule does have a negative effect on non-capital spending (states with such a rule spend 11 percent less on non-capital projects than states without such a rule). This latter effect is consistent with a model of intertemporal government finance. Poterba's results are robust to the introduction of political ideology variables.

A different type of test of the effectiveness of fiscal restraints can be found in Kontopoulos and Perotti (1999). The authors study the impact that spending limits set by finance ministers on spending ministers have on fiscal outcomes in a group of industrialized countries. They find that spending limits do seem to affect fiscal outcomes but they also highlight that this result is not robust.

Finally, another approach has been undertaken by Kopits and Symansky (1998). The authors analyse the effects of several types of fiscal rules (including the proposed US balanced-budget rules and EMU's SGP constraints) in MULTIMOD, the International Monetary Fund's multi-country econometric model. They do so using stochastic simulations of the model, which gives a more robust conclusion regarding the effect of fiscal constraints when the economy is subject to a multitude of (historical) shocks. Overall, they find that the constraints studied (slightly) increase output and price variability (their welfare metrics). The authors also review the major fiscal policy rules in existence.

Although the above studies tend to a common result, care must be exercised in drawing inferences from these for several reasons. First, as shown in an important empirical study of US states by von Hagen (1991), incumbent office-holders consistently bypass balanced-budget rules or public debt ceilings by using off-balance sheet debt and by using "creative accounting". Such practices have been common place among EU countries in their attempt to meet the Maastricht fiscal criteria.[16] These practices have also been observed in the US following the Gramm-Rudman-Hollings (federal) Deficit Control Act of 1985. The deficit targets were first met both via the sale of governments assets and by moving expenditures "off-balance sheet". Such a strategy eventually reached its limits. The targets then had to be adjusted upwards each time they became binding. The von Hagen finding has important implication for empirical studies of the effectiveness of fiscal constraints. For instance, this reveals a potential weakness of Kopits of Symansky's (1998) study. Indeed, it reveals that the reaction function of policy makers is affected by the new fiscal regime. The Lucas critique could be a problem. A second warning is that caution has to be exercised by drawing inferences from constraints on *subnational* authorities. Corsetti and Roubini (1996) argue that the supply and demand side macroeconomic effects of imposing fiscal rules at the *federal* level in the US would, during a recession, be much larger than those that currently exist at the states level (because the states' budget only account for a small share of the state income compared to the federal government's

[16]They range from one off lump sum "transfers" from publicly-owned companies towards state budget (e.g. the FRF30bn, representing 10 per cent of the annual budget deficit, that France Telecom's pension fund had to transfer to the national budget in 1997), to Italy's one-off repayable Euro-tax, or to the temptation by the German government to revalue the Bundesbank's gold stock (and thereafter to transfer part of the book-keeping profits to the government's budget). Indeed, both the Bundesbank and the German government's own council of economic advisers (the "five wise men") have critisised the government for undertaking "creative accounting" (The Economist, 14-20 February 1998). Use of off-budget expenditures, of privatisation receipts, and takeover of pension funds, are among the other accounting "tricks" used to satisfy the Maastricht criteria.

with respect to the US GNP). Hence, we cannot be certain that the fiscal policies of state governments that are subject to fiscal constraints would be a good predictor of fiscal policies at the federal level should one introduce similar fiscal constraints.

To conclude our literature review, empirical studies - based on sub-national data - reveal two main points. First, fiscal constraints are effective in reducing budget deficits. Second, policy makers, despite abiding to the letter of the constitutional constraints, do not abide to its spirit: attempts to bypass the constraints are consistently found. Because the inference are drawn on sub-national data, they can only be indicative.

In the light of our analysis of the literature and the caveats highlighted, we investigate the effects of fiscal constraints using a theoretical framework. More specifically we do so using a political economy model in which excessive deficits arise endogenously because of "opportunistic" behaviour. Within this class of model, the Equilibrium Political Budget Cycle model of Rogoff (1990) extended in Chapter 2 to allow for deficit financing is the most appropriate for our purpose. A key advantage of this model is its microfounded nature. As we showed in Chapter 2, this model gives rise to endogenous budget deficit and fiscal cycles which is related to a microfounded political distortion. These features enable us to avoid the limitations of *ad hoc* models. Furthermore, we study fiscal constraints in a one country model so that we do not rely on multi-jurisdictions fiscal externalities are a rational for fiscal constraints. Most countries that have introduced or considered introducing fiscal constraints at a national level are not part of a common monetary union (e.g. New Zealand, the United Kingdom, the US Federal budget). Hence, whether a case can be made for fiscal constraints without recourse to the fiscal externality argument is clearly an important issue.

3.3 Equilibrium Political Fiscal Cycles

In this chapter we shall be using as a backbone the model of the previous chapter. However, once we study fiscal constraints, the tractability of the model is seriously impaired. Thus, to improve tractability, we simplify the model of Chapter 2 by assuming that second period taxes are non-distortionary. This simplification leads to a corner solution in τ_1 in Section 3.3 but it does not modify the qualitative results of the analysis of the various fiscal constraints. As we saw in Chapter 2, allowing for distortionary taxes in both periods leads to an interior solution for τ_1. Concretely, our simplification is that we set $f(\tau_2) = 0$ in equation (2.5). As a result, the second-period government's budget constraint becomes

$$g_2 = \tau_2 + \theta - rb \tag{3.1}$$

Apart from the above equation, the structure of the model is exactly the same as in Section 2.3.1.

In the next sub-sections we briefly highlight the changes implied by setting second period distortionary taxes to zero. This proves helpful for our analysis of the effect of fiscal constraints in Section 3.5.

3.3.1 Equilibrium Under Full Information and a Social Planner

As indicated, Section 2.3.1 of Chapter 2 carries over to this chapter except for equation (2.5). From Section 2.3.2, it is easy to see that with $f(\tau_2) = 0$, the equilibrium solution to the incumbent's problem becomes:

$$u_c = u_g = v_I' \quad \text{, where } I \text{ has ability } a \in \{H, L\} \quad \text{, and } \tau_1 = 0 \tag{3.2}$$

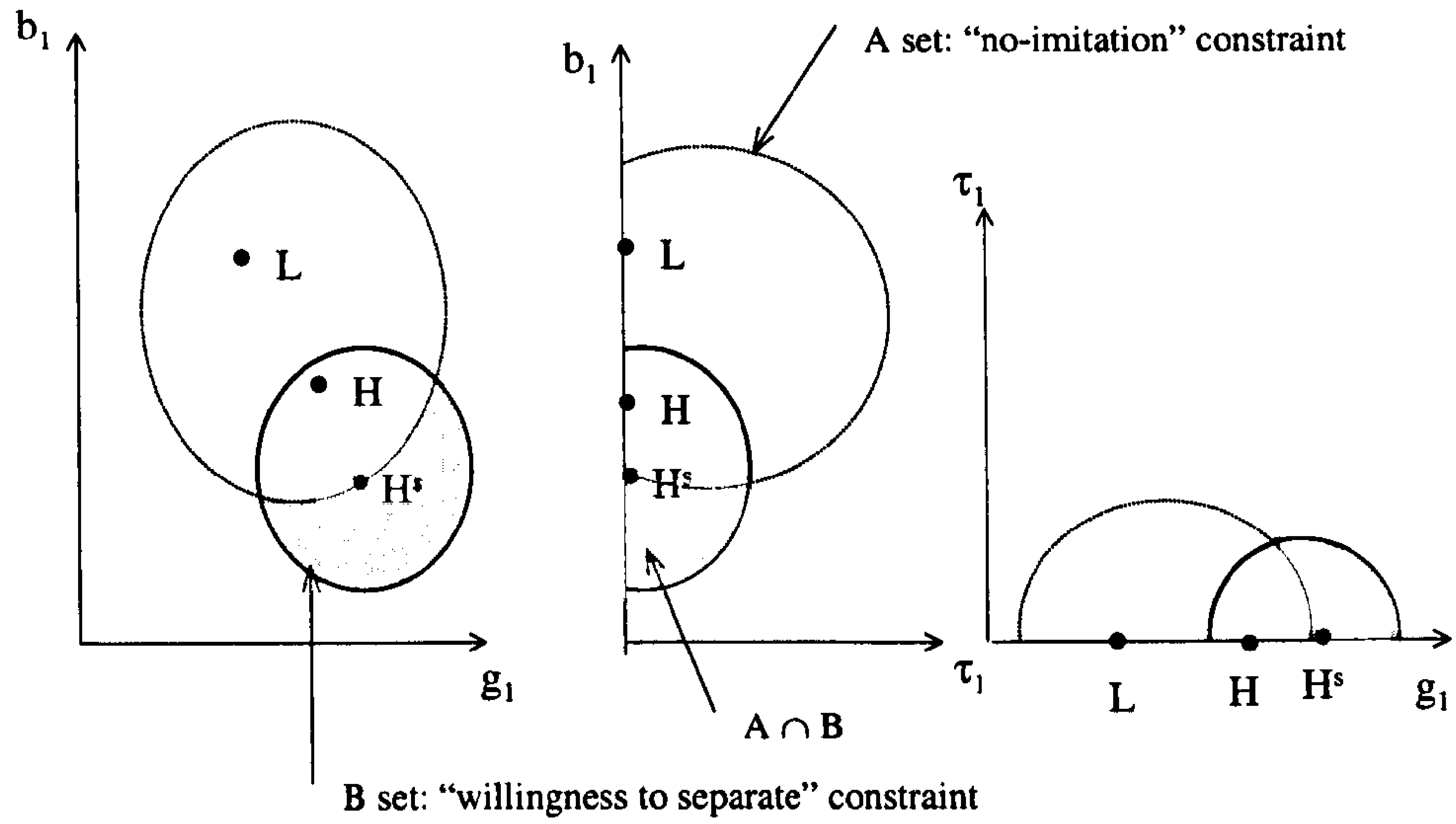
Hence, the type-contingent equilibria obtained with opportunistic leaders in the no-election case are such that: $g_H = \hat{g}_H > g_L = \hat{g}_L$, $\tau_H = \hat{\tau}_H = \tau_L = \hat{\tau}_L = 0$, $b_H = \hat{b}_H < b_L = \hat{b}_L$, where a "hat" over a variable refers to the value attained under a social planner equilibrium. These equilibria are represented in Figure 3.1.[17]

3.3.2 Equilibrium Under Asymmetric Information

Given the technology available for the production of public goods, two notions of the budget deficit exist. First, the "*visible*"/*ex ante* deficit $(g_1 - \tau_1 + f(\tau_1))$ which is observed contemporaneously. Second, the "*true*"/*ex post* budget deficit $(g_1 - \tau_1 - \theta + f(\tau_1))$ which is only observed in the second period and which takes into account the true cost of providing public goods. In Proposition 2.7 (Chapter 2) we proved that, for high levels of "ego rents" (R), and sufficiently small competency differences $(\theta_H - \theta_L)$, $g_{H^s} - \tau_{H^s} + f(\tau_{H^s}) - \theta_H < g_L - \tau_L + f(\tau_L) - \theta_L$ in the undominated separating equilibria. That is, *competent incumbents run lower "true"/ex post current budget deficits than incompetent incumbents.* Figure 3.2 shows the different levels of

[17]Recall that, with distortionary taxes in both periods, we have $0 < \tau_H = \hat{\tau}_H < \hat{\tau}_L = \tau_L$. This can be seen in Figure 2.2, Chapter 2.

Figure 3.1 Equilibria for the Low- and High-Type Incumbents when $f(\tau_2) = 0$

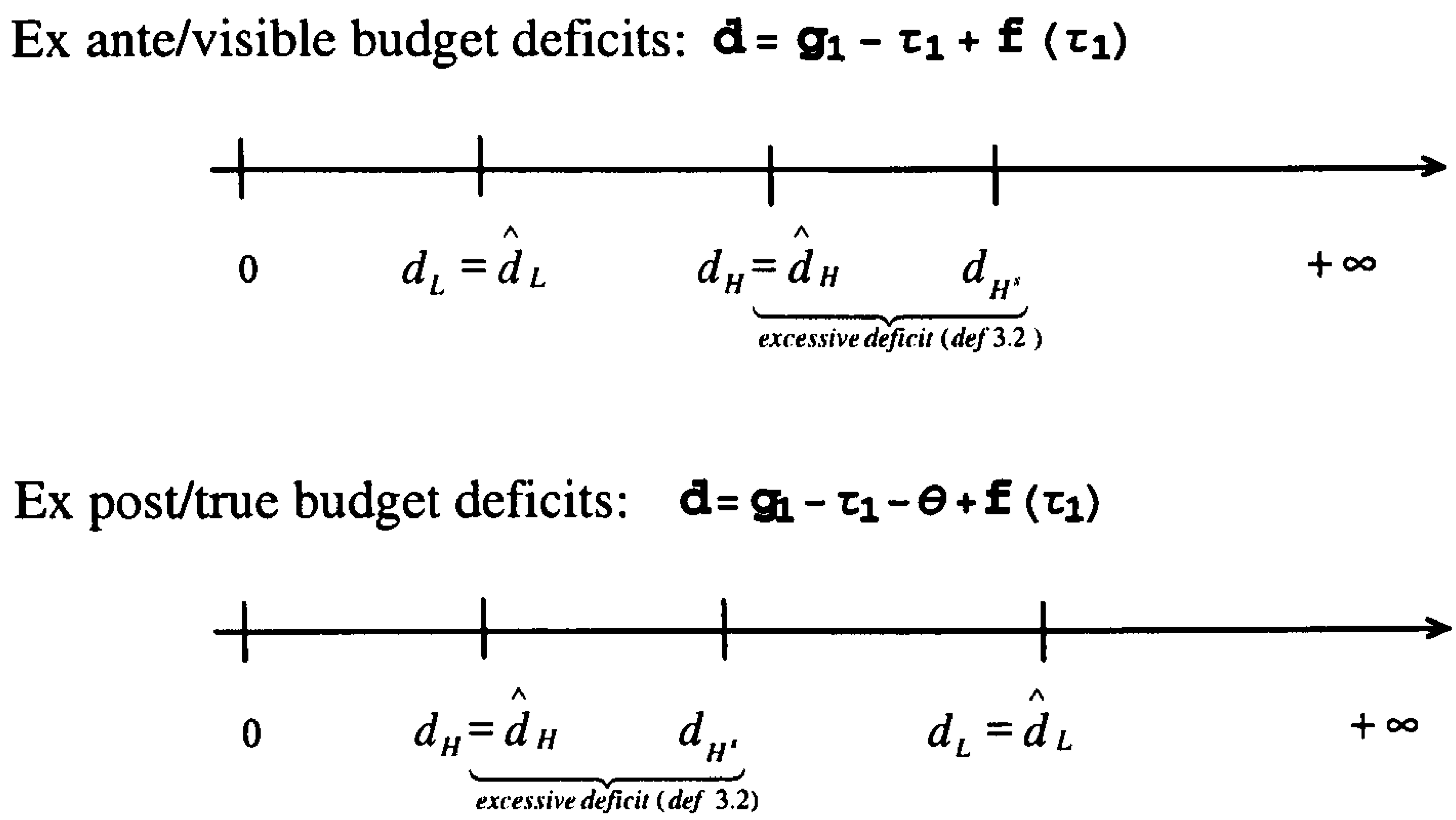


budget deficits that obtains depending on the type of the office-holder.

3.4 Constitutional Fiscal Constraints: Description

Using the (slightly simplified) model of the previous chapter, we can now turn to the analysis of the effects of various types of fiscal restraints aimed at preventing "excessive" deficits. First, we describe in details the three specific type of constraints we investigate. These are the EMU's Stability and Growth Pact, the UK's Code For Fiscal Stability and a proposed US's Balanced-Budget rule. Although specific, undertaking a comparative analysis of these three rules is interesting in that each of these constraints tackles the problem of "excessive" deficit bias differently.

Figure 3.2 Ranking of Budget Deficits by Types of Policy Makers



3.4.1 The European Monetary Union's Stability and Growth Pact

The Stability and Growth Pact (1997, Amsterdam Summit) requires that the budget deficits to GDP ratio of each EMU member country do not exceed three per cent, and also recommends that the debt-to-GDP ratio should not exceed 60 per cent. If the budget deficit-to-GDP ceiling is not respected, a fine of up to 0.5 per cent of GDP might be imposed on the profligate country. The fine is far from automatic. It is the eventual outcome of a long lasting process (See European Commission, 1997, for full text of the Pact, and Artis and Winkler, 1998, for a summary). Missing the debt-to-GDP guideline does not incur a potential pecuniary fine. However, a country missing the recommended debt-GDP target might incur a political or credibility cost for national governments (Kopits and Symansky, 1998). Mathematically, the SGP fines have the following properties:

$$\text{Budget deficit fine} = \max\left\{\Psi_B^{emu}\left(g_1 - \tau_1 - \theta + f(\tau_1) - \bar{d}\right), 0\right\}$$

$$\text{Public debt fine} = \max\left\{\Psi_D^{emu}\left(b - \bar{b}\right), 0\right\}$$

where $\bar{d}$ and $\bar{b}$ represent respectively the maximum budget deficit-to-GDP ratio and public debt-to-GDP ratio allowed. $0 < \Psi_B^{emu} < 1$ and $0 < \Psi_D^{emu}$ represent the fine resulting from "excessive" budget deficit (B subscript) and public debt (D subscript) respectively. The Ψ_B^{emu} fine starts at 0.2 per cent of GDP. Every 1 percentage point of deficit in excess of the threshold leads to a further 0.1 per cent of GDP fine, up to a maximum fine of 0.5 per cent (European Commission, 1997).

Two important features of our mathematical representation of the SGP fines are worth explaining. First, we assume that the constraint refers to the consumption component of government expenditure. The SGP indeed explicitly allows for a correction of the budget deficit in the case of public investment (see Maastricht Treaty, Article 104.c.3). Second, the budget deficit is gauged from its "true" measure. This is the natural measure to take given that, in the case of the SGP, the fine is imposed after a lapse of time sufficiently long (i.e. two years) for all uncertainty on a state's national accounts to have disappeared. Importantly, we can also note that we preserved the "kink" of the penalty structure. This is not the case in the model of Beetsma and Uhlig (1999) whose aim is also to analyse the effects of the SGP. These authors model the SGP penalties as a linear function of the entire range of debt choices, thereby producing the possibility of *subsidies* for countries running non-excessive deficits. As noted by Beetsma and Uhlig, it turns out that the optimal SGP that they propose requires a "huge subsidy in the second period" of their model!

The timing of events is the same as in Chapter 2. The only difference is that in deciding on fiscal policy the incumbent also needs to take into account the fine that will occur should deficits exceed the thresholds.[18] Thus, the effect of the SGP fines is to modify the second-period government budget constraint (equation 3.1) in the following way:

$$g_2 = \tau_2 + \theta - rb - \max\left\{\Psi_B^{emu}\left(g_1 - \tau_1 - \theta + f(\tau_1) - \bar{d}\right), 0\right\} - \max\left\{\Psi_D^{emu}\left(b - \bar{b}\right), 0\right\}$$

The fines are imposed in the second period of the game. This is in accordance with the timing structure of the SGP fines.

3.4.2 The United Kingdom's Code For Fiscal Stability

The United Kingdom recently introduced a "golden rule" of public sector borrowing - i.e. the proposition that, over the business cycle, government borrowing should not exceed government (net) capital formation ("A Code for Fiscal Stability", HM Treasury, 1997).

Buiter (1998) analyses the UK constraint and argues that the golden rule is both unnecessary and undesirable and that it "could also induce a misplaced sense of complacency about the accumulation of public investment-related public debt". Buiter's analysis focuses on accounting identities. We take a different approach: we study the UK constraint from an incentive viewpoint, recognizing that a main purpose of the

[18] Given that the model does not include stochastic macroeconomics shocks, when fiscal profligacy occurs it can not result from "exceptional" circumstances (these would give a waiver to countries - see European Commission, 1997), and according to the SGP, is subject to a fine.

constraint is to introduce some checks and balances on policy makers discretionary policies. The Code (which is part of a code of good practice is not constitutionally grounded) acts as an incentive device for incumbent governments to present an ex ante consumption balanced budget. Any ex ante imbalance in this budget can be thought of as carrying an electoral cost. The Golden Rule implies the following constraint structure:

$$\text{Constraint} = \max\left\{\Psi^{uk}\left(g_1 - \tau_1 + f(\tau_1)\right), 0\right\}$$

where Ψ^{uk} represents the cost (e.g. political, credibility, etc.) resulting from an unbalanced current budget. $\Psi^{uk} > 0$ and Ψ^{uk} is also "sufficiently" large so that the government has an incentive to separate its consumption-related budget from its investment-related budget.[19]

3.4.3 The United States' Balanced-Budget Rule Proposal

Several proposals have been discussed in the US. Congress on whether or not to adopt a balanced-budget rule at the Federal level (1982, 1995, 1997). The proposals have so far always been rejected.

A "typical" balanced-budget rule has the following characteristics. Ex ante, the government has to present to the Congress a budget which is balanced. Ex post, if the budget is unbalanced, the government must bridge any shortfall in revenues

[19]The Code also includes a guideline stipulating that the public debt-to-GDP ratio should not exceed 40 percent. We abstract from this constraint for two reasons. First, this constraint is not a much publicised part of the Code, therefore its effectiveness is doubtful given that the cost of not respecting a constraint is a political or credibility cost. Second, we want to analyse the effect of a Golden Rule of public investment on its own ; the effects of public debt ceilings can be seen from the analysis of the SGP.

during the following budget. In our model this implies the following timing of events: at time $t = 0$, the incumbent must present a "visible" balanced budget. The rest of the timing is the same as in Chapter 2, except that, when the first-period budget outcome realizes, any imbalance in the budget has to be rectified in the period-two budget.

The balanced-budget rule has the following penalty structure (for period 1 and 2 respectively):

$$\begin{aligned} \text{“Visible”/ex ante constraint} &= \max\{\Psi_1^{us}(g_1 - \tau_1 + f(\tau_1)), 0\} \\ \text{“True”/ex post constraint} &= \max\{\Psi_2^{us}(g_1 - \tau_1 - \theta + f(\tau_1)), 0\} \end{aligned}$$

Ψ_1^{us}, Ψ_2^{us} represent the first and second-period fines. $\Psi_1^{us} = 1$, and $\Psi_2^{us} \geq 1$ so that any deficit in a given period is fully compensated in the next period, possibly at a penalty rate. Note that we assume that the constraints refer to the current budget. This assumption is motivated partly by our model (if k_2 is included in the constraint, no informational asymmetry is possible), and partly by the fact that numerous balanced-budget constraints at the State level do exclude public investment.

3.5 Constitutional Fiscal Constraints: Analysis

Before turning to the analysis of fiscal constraints, we first need to define what constitutes an "excessive" deficit. In our model two definitions are possible.

3.5.1 "Excessive" Deficits: Two Definitions

Definition 3.1. (Incompetency-generated deficits). *A deficit is "excessive" when it is higher than the one that the high-competency leader would have chosen.*

Definition 3.2. (Politically-generated deficits). *A deficit is "excessive" when the deficit obtained by an opportunistic leader is higher than the one that a social planner (of the same type as the incumbent) would have chosen.*

Definition 3.1 focuses on absolute deficit levels. The rationale for this definition (not modelled in this chapter) is that high absolute deficits are undesirable. Eichengreen and Wyplosz (1998), in their analysis of the Stability and Growth Pact, provide an overview of the reasons why high deficits are to be avoided (e.g. because of financial stability issues). The importance and identification of the welfare costs of high deficits is a controversial issue in the literature (Buiter and Sibert, 1998 ; Eichengreen and Wyplosz, 1998). Definition 3.2 focuses on efficiency issues. Fiscal constraints, using this definition, aim to target and reduce inefficiencies and therefore to increase welfare.

It should be clear from our model (e.g. Figure 3.2) that, using Definition 3.1, if fiscal ceilings are effective in reducing the incompetency-generated deficits this is welfare reducing: the incompetent leader pursues an efficient policy given her ability. Nevertheless, given that the absolute deficit level is the one that is referred to when governments introduce fiscal constraints and that this is also the one that is the focus of attention in the economics literature, we shall analyse the effects of fiscal constraints using this definition in the next section (Section 3.5.2). In Section 3.5.3, using Definition 3.2, we focus on the welfare effect of the different fiscal constraints.

3.5.2 Fiscal Constraints and *Incompetency-Generated* "Excessive" Deficits

The three type of constraints are, mathematically, not so different from one another. In order to save space, and save repeating very similar analysis, we study one of them in details and give the end results for the two others. We focus on the SGP as our "benchmark".

The Stability and Growth Pact as a "Benchmark"

As already stated, Proposition 2.7 of Chapter 2 shows that a competent incumbent's fiscal policy leads to a lower debt accumulation and a lower "true"/ex post budget deficit than an incompetent incumbent. This "true" budget deficit is the basis for the enactment of fines in Pact. Depending on the level of the deficit ceilings, nine possible cases can occur in our model: one or both constraints can bind on one type of agents, on both, or on none. If fiscal constraints are aimed at reducing the absolute deficit levels (Definition 3.1), fiscal ceilings are most effective when they bind on the incompetent leader. Therefore, we study the equilibrium strategies in this case.

Proposition 3.1. *There exists a budget deficit ceiling and a public debt ceiling where, in equilibrium, only the incompetent incumbent (who generates "excessive" deficits) is constrained by both ceilings.*

We conjecture that this Proposition is true and we later check that it indeed holds.[20] The decision problem under full information is type contingent.

[20] i.e. that $g_{H^{emu}} - \tau_{H^{emu}} - \theta_H + f(\tau_{H^{emu}}) < \bar{d}$, and $b_{H^{emu}} < \bar{b}$ in the undominated separating equilibrium.

Equilibrium Strategy of the Low-Type Leader

Repeating the analysis as in Section 2.3.2 but for the inclusion of the fiscal constraints, we find that the low-type pursues her full information strategy which is given by (see Appendix B6):

$$(1-f')^{-1}u_c - \Psi_B^{emu}J_L' = u_g - \Psi_B^{emu}J_L' = u_c + \Psi_D^{emu}J_L' = v_L' \qquad (3.3)$$

Comparing the fiscal policy of a low-type leader when both fiscal constraints are binding (equation (3.3)) with the case when no fiscal constraints exist (equation (3.2)), we can notice that first-period taxes increase (we have an interior solution for τ_1), that government consumption and investment, along with public debt decrease, i.e. $\tau_{L^{emu}} > \tau_L = 0$, $g_{L^{emu}} < g_L$, $b_{L^{emu}} = \bar{b} < b_L$, and $k_{2,L^{emu}} < k_{2,L}$.

To gain intuition for the above result, we can first analyse the case where only the public debt ceiling is binding. In this case, the terms in Ψ_B^{emu} in equation (3.3) disappear. Because the low-type leader faces a fine due to "excessive" public debt accumulation, she trades-off the deadweight loss due to first-period taxes with the fine that results in the second period. This induces her to lower b and increase τ_1 (up to the point where the deadweight loss due to first-period taxes equates the marginal cost of the debt-related fine, i.e. where $f'v_L' = \Psi_D^{emu}J_L'$). Because we have normal goods the low-type office-holder reduces the supply of public goods whose relative price has increased. Therefore both g_1 and k_2 are reduced compared to the case were no fiscal restraints exist. Similarly, when only the budget deficit ceiling binds (the term in Ψ_D^{emu} disappears in (3.3)), the low-type trades-off the fine that results from high g_1 and low $\tau_1$with the distortionary cost of taxes. With normal goods, the incumbent is induced to increase first-period taxes and public debt, and to decrease government expenditures.

Equilibrium Strategy of the High-Type Leader

The fiscal constraints of the SGP changes the analysis of Section 2.3.4 in a straightforward way, we therefore turn directly to the following propositions:

Proposition 3.2. *The set of all separating equilibria is nonempty and is characterized by* $(g_L, \tau_L, b_L) = (g_L^*, \tau_L^*, b_L^*)$, *and* $(g_H, \tau_H, b_H) \in B \cap \mathcal{A}^{emu}$.

where $\mathcal{A}^{emu}$ replaces the $\mathcal{A}$ set (cf. (2.23)), and we have

$$\mathcal{A}^{emu} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_L) - Z \left[\begin{array}{c} g_1^{**}(\theta_L, \Psi_D^{emu}, \Psi_B^{emu}), \tau_1^{**}(\theta_L, \Psi_D^{emu}, \Psi_D^{emu}), \\ b^{**}(\theta_L, \Psi_D^{emu}, \Psi_D^{emu}), 0, \theta_L \end{array} \right] \leq 0\}$$

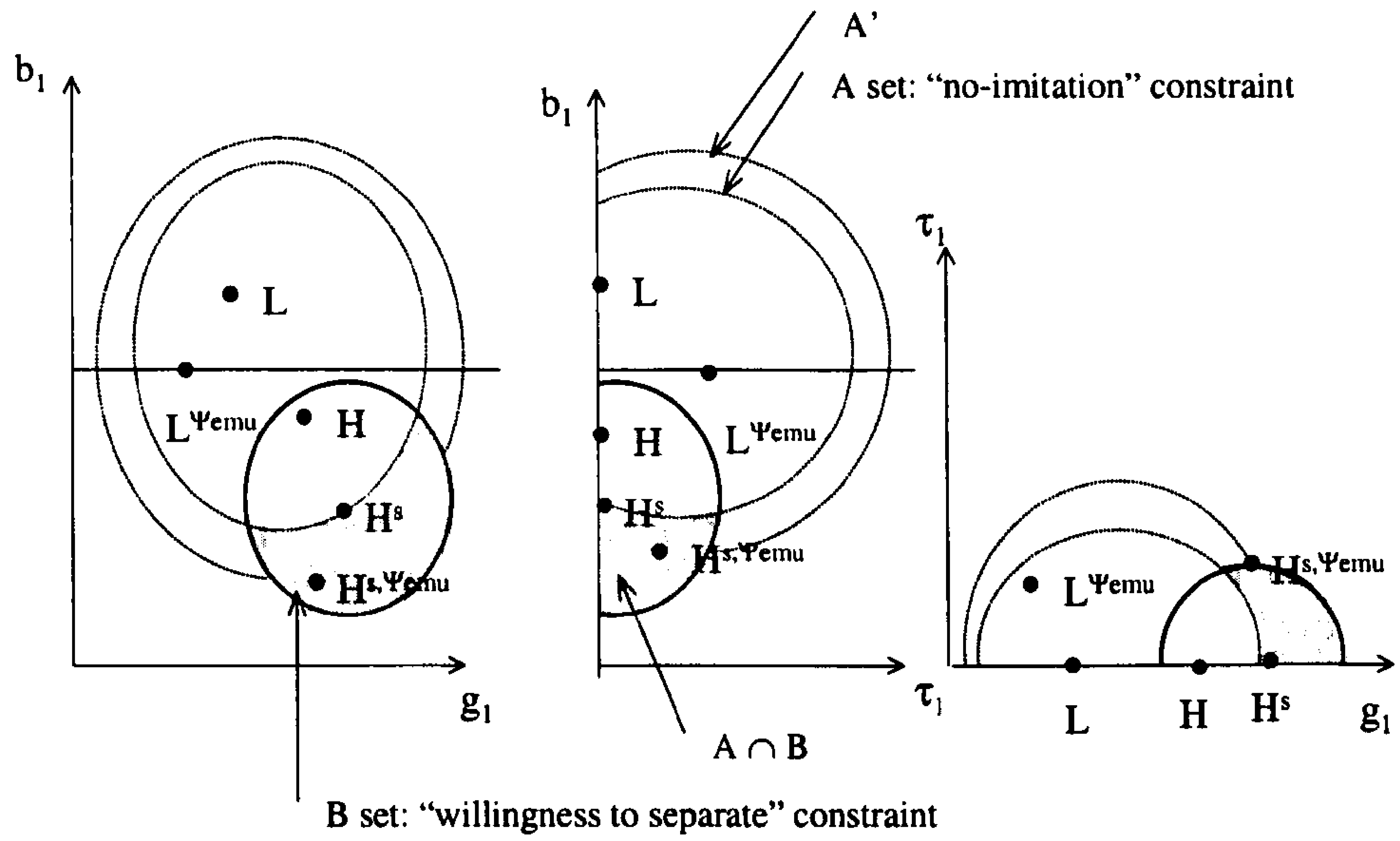
Comparison of the $\mathcal{A}^{emu}$ and $\mathcal{A}$ sets reveals that $\mathcal{A}^{emu}$ is a subset of $\mathcal{A}$ so that an incompetent incumbent is willing to further distort fiscal policy to convince voters that she is a high-type when she faces a binding public debt constraint.

Proposition 3.3. *There exists a unique undominated separating equilibrium, and in this equilibrium* $(1 - f')^{-1} u_c - \lambda (1 - \lambda)^{-1} \Psi_B^{emu} J_L' = u_g - \lambda (1 - \lambda)^{-1} \Psi_B^{emu} J_L' = u_c + \lambda (1 - \lambda)^{-1} \Psi_D^{emu} J_L' < v_I'$ *for a high-type.*

$\lambda > 0$ is the Lagrange multiplier on the $\mathcal{A}^{emu}$ set constraint.

Thus, as can be seen in Figure 3.3, with normal goods the unique undominated separating equilibria is given by point H^{emu}, where $g_{H^{emu}} < g_{H^s}$, $\tau_{H^{emu}} > \tau_{H^s}$, $b_{H^{emu}} < b_{H^s}$.

Figure 3.3 The Effects of the SGP Constraints on Equilibria



We can now prove Proposition 3.1 by using the following proposition (which parallels Proposition 2.7).

Proposition 3.4. *In the unique undominated separating equilibrium* $g_{H^{emu}} - \tau_{H^{emu}} - \theta_H + f(\tau_{H^{emu}}) < g_{H^s} - \tau_{H^s} - \theta_H + f(\tau_{H^s}) < \bar{d}$, *and* $b_{H^{emu}} < b_{H^s} < \bar{b}$.

The fiscal restraints of the SGP therefore induce the incompetent incumbent to reallocate both her financing mix and her expenditure decisions so as to reduce "excessive" public debt accumulation and "excessive" budget deficits (both ex post and ex ante). As a result the competent leader can *also* reduce both public debt issues and the budget deficit because *less signalling* needs to be undertaken to separate from a low-type leader.

Results for the UK and US Cases

We know that in equilibrium all incumbents run a budget deficit (cf. Section 3.3). By requiring budgets to be balanced, the UK and US constraints therefore bind on all incumbents. The method to solve for the equilibrium strategies for the UK and US constraints is the same as for the SGP. A key difference is that because constraints bind on both types of incumbents, the $\mathcal{B}$ set of Chapter 2 (cf. (2.24)) is changed to $\mathcal{B}^{us}$. $\mathcal{B}^{us}$ is a subset of $\mathcal{B}$: the willingness to separate from high-type incumbents is reduced because of binding constraints. By analogy to the proof of Proposition 3.2, it is easy to prove that $\mathcal{A}^{us} \cap \mathcal{B}^{us}$ is non-empty (and similarly for the UK case). We therefore directly turn to the following Proposition:

Proposition 3.5. (Balanced-Budget rule). *A unique undominated separating equilibrium exists. In this equilibrium the high-type signals; her strategy is given by* $[(1-f')(1+\Psi_1^{us})]^{-1} u_c - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_I' = (1+\Psi_1^{us})^{-1} u_g - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_I' = u_c < v_I'$; *the low-type pursues her full information strategy:* $[(1-f')(1+\Psi_1^{us})]^{-1} u_c - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = (1+\Psi_1^{us})^{-1} u_g - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = u_c = v_L'$.

As can be seen by comparing the UK and US constraints, the Golden Rule of public investment approach of the UK is similar to the ex ante balanced-budget requirement of the US. Mathematically, the UK constraint is therefore a special case of the US balanced-budget rule ($\Psi_2^{us} = 0$, $\Psi_1^{us} = \Psi^{uk}$). Hence, we have the following proposition.[21]

Proposition 3.6. (Golden Rule). *A unique undominated separating equilibrium*

[21]The proof is omitted: it is the same as that Proposition 3.5 in the special case where $\Psi_2^{us} = 0$, $\Psi_1^{us} = \Psi^{uk}$.

exists. In this equilibrium the high-type signals; her strategy is given by $[(1-f')(1+\Psi^{uk})]^{-1}u_c = \left(1+\Psi^{uk}\right)^{-1}u_g = u_c < v_I'$ *(so that* $\Psi^{uk} = f'(1-f')^{-1}$*); the low-type pursues her full information strategy which is:* $\left[(1-f')\left(1+\Psi^{uk}\right)\right]^{-1}u_c = \left(1+\Psi^{uk}\right)^{-1}u_g = u_c = v_I'$.

The intuition for the above two Propositions is best understood by comparing the constrained strategies of low-type leaders in Propositions 3.5 and 3.6 with equation (3.2) of Section 3.3 (case were no constraints are present). We can see that in both cases (i.e. the Balanced-Budget Rule and the Golden Rule) incumbents now choose an interior solution for τ_1. The reason being that policy makers are "fined" should they run an unbalanced current budget. To avoid this, they lower g_1, increase τ_1 and, because we have normal goods, also increase b and lower k_2.

In the UK case, we can note that two opposite effects are at play regarding first period tax setting: (i) the deadweight loss due to distortionary taxes $(1-f')$, and (ii) the "fine" (Ψ^{uk}). Incumbents trade-off these effects. Hence, in equilibrium incumbents still have unbalanced budgets albeit with reduced "excessive" budget deficits. The higher Ψ^{uk}, the more compliant are leaders in balancing the current budget. For the US case, we also have these two opposite effects ($1-f'$ and Ψ_1^{us}), plus the ex post constraint (Ψ_2^{us}). With normal goods, this supplementary effect induces incumbents to further reduce public expenditures (both the consumption and investment parts) and to raise all revenue sources. The same qualitative effects also occur in the undominated equilibria. Thus the public debt level is higher under the UK and US constraints compared to the unconstrained case.

Our findings for this section can be summarised in the following statement:

Result 3.1. *The three types of fiscal constraints studied do reduce incompetency-generated excessive budget deficits. However, both the UK and US constraints further increase excessive public debt accumulation. The SGP constraints induce policy makers to reduce excessive public debt.*

Our result that the Golden Rule of public investment leads to rising "excessive" public debt supports the criticism that Buiter (1998) expressed regarding the complacency that such a rule creates regarding the build up of public debt.

We now turn to the analysis of fiscal constraints using our second definition of "excessive" deficits. This definition avoids the welfare comparison problem of Definition 3.1.

3.5.3 Fiscal Constraints and *Politically-Generated* "Excessive" Deficits

Because Definition 3.2 focuses on efficiency, reducing politically-generated "excessive" deficits is directly measurable in terms of welfare. That is, the political distortion fiscal constraints aim to reduce is endogenous in our model. Hence, in this section we assess whether the three fiscal constraints can be welfare increasing compared to the status quo situation (no fiscal constraint and full discretion left to policy makers), and whether they can yield the "first-best" outcome. This first-best is attained when "*excessive*" deficits are eliminated (i.e. the budget deficit and public debt accumulated are the same as a social planner of the same competency level).

For fiscal constraints to be welfare increasing they must target the source of the inefficiency in the economy (see Figure 3.2). The following lemma are useful to our analysis.

Lemma 3.1. *Fiscal constraints reduce political inefficiencies only if they target and reduce the "excessive" ex ante/visible budget deficits of high-type incumbents.*

The proof follows directly from Propositions 2.5 and 2.7 of Chapter 2. Proposition 2.5 shows that only the fiscal policy of a competent incumbent is distorted compared to the social planner (i.e. $g_{H^s} > \hat{g}_H > \hat{g}_L = g_L$, $\tau_{H^s} = \hat{\tau}_H = \hat{\tau}_L = \tau_L = 0$, $0 < b_{H^s} < \hat{b}_H < b_L < \hat{b}_L$ and $k_{2,H^s} < \hat{k}_{2,H}$ where a "hat" refers to the social planner's policy). The high-type leader creates "excessive" budget deficits, both ex ante and ex post. The ex ante measure of the budget deficit is higher for a high- than for a low-type leader. The low-type leader's policy is optimal given her ability. Proposition 2.7 shows that the ex post measure of the budget deficit is lower for a high-type than for a low-type (see Figure 3.2). Thus, for a fiscal constraint to increase welfare compared to the status quo it has to target the competent incumbent only, and more specifically her ex ante budget deficit. □

Lemma 3.2. *Fiscal constraints targeting ex post budget deficits are welfare reducing compared to the status quo.*

Proof: from Proposition 2.7 we know that the ex post budget deficit of a high-type is lower than that of a low-type. An ex post budget deficit ceiling therefore first binds on the low-type whose policy is efficient. This changes the "no-imitation constraint" (set $\mathcal{A}$) and induces the high-type to reduce the budget deficit, which is done through the use of second-best instruments (distortionary taxes). This reduces welfare. If the deficit ceiling is sufficiently low, both types are constrained. This induces the high-type to reduce her "excessive" budget deficit. However, because the high-type needs to choose her fiscal policy within the "no-imitation constraint" and that the lower the deficit ceiling the smaller this set becomes, the high-type can only reduce her "excessive" budget deficit by choosing welfare reducing policies. □

Turning to the welfare effect of the fiscal constraints, we have the following results:

Proposition 3.7. (Stability and Growth Pact). *The fiscal constraints of the Pact cannot lead to the first-best equilibrium. They are even welfare reducing compared to the status quo when both the debt and budget deficit constraints bind on the low-type leader.*

Proof: The first part of the proof follows from Lemma 3.1 and Propositions 2.5 and 2.7: in the Pact, the ex post budget deficit is the basis for the enactment of fines (see Section 3.4.1). Incompetent leaders produce higher ex post budget deficits than competent ones. The budget deficit constraint of the Pact therefore binds on low-type leaders prior to being binding on high-type leaders; any reduction in inefficiency on the high-type creates a new distortion on the low-type policy maker: the first-best is not achievable.

Second part: we know from the previous sub-section (The Stability and Growth Pact as a "Benchmark") that when both the debt and budget deficit constraints are binding (on low-types first), this forces both types to reduce their budget deficits. As can be seen from Figure 3.3, because of the no-imitation constraint ($\mathcal{A}^{emu}$), the high-type chooses a fiscal policy which is further away from her full information equilibrium. Welfare is therefore lower than under the status quo. □

Figure 3.4 Social Welfare With Binding Constraints on Ex-Post Budget Deficits and Debt

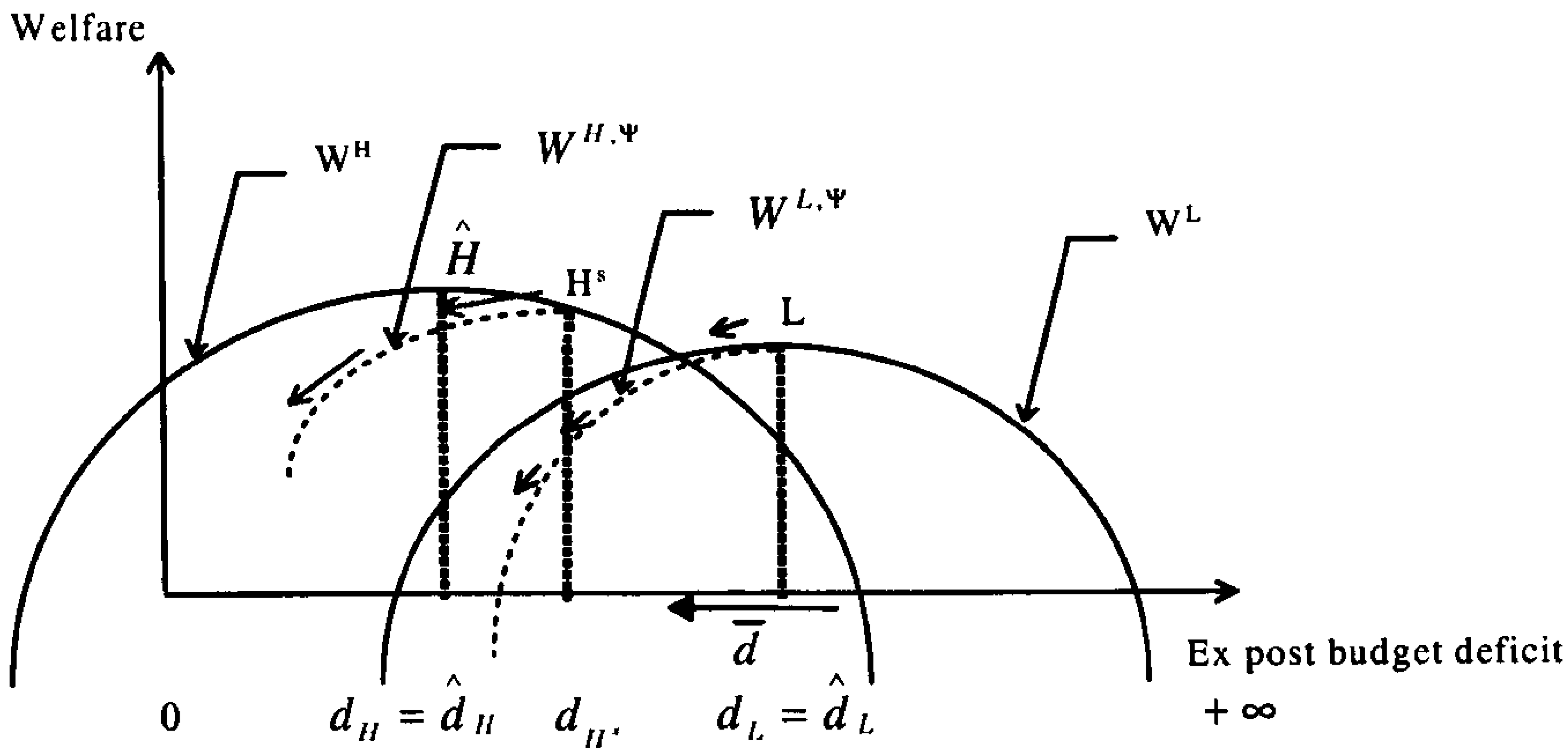


Figure 3.4 illustrates the welfare effect of varying the ex post budget deficit ceiling in the SGP case (assuming that $\bar{b}$ is binding for low-type leaders).

Proposition 3.8. (Balanced-Budget Rules). *The first-best equilibrium is not attainable under a balanced-budget rule. Welfare is reduced compared to the status quo.*

Proof: The proof of the first sentence is immediate: the ex post constraint first binds on low-type leaders and forces them to distort their previously efficient fiscal policies.

Second sentence: We know from Lemma 3.2 that an ex post budget constraint is welfare reducing vis-à-vis the status quo.[22] The ex ante constraint induces incumbents to balance their budgets. No incumbents (even social planners) do so in equilibrium

[22] Welfare is further reduced the higher the penalty for "excessive" deficits, and the lower the deficit ceiling. Thus the ex post SGP constraint yields higher welfare than the ex post US balanced-budget rule (c.f. $\Psi^{emu} < 1$, $\bar{d}^{emu} > 0$, $\Psi^{us} > 1$, $\bar{d}^{emu} > 0$, $\bar{d}^{us} = 0$).

prior to the introduction of constraints (see Figure 3.2). Thus the policy of the high (low) type policy maker is distorted away from an "excessive" (efficient) budget deficit towards an excessive budget *surplus* (vis à vis a social planner). Distortionary taxes need to be used. Given that the penalty for an unbalanced budget is high ($\Psi_1^{us} = 1$), the excessive budget *surplus* of both types will be large which is welfare reducing compared to the status quo. □

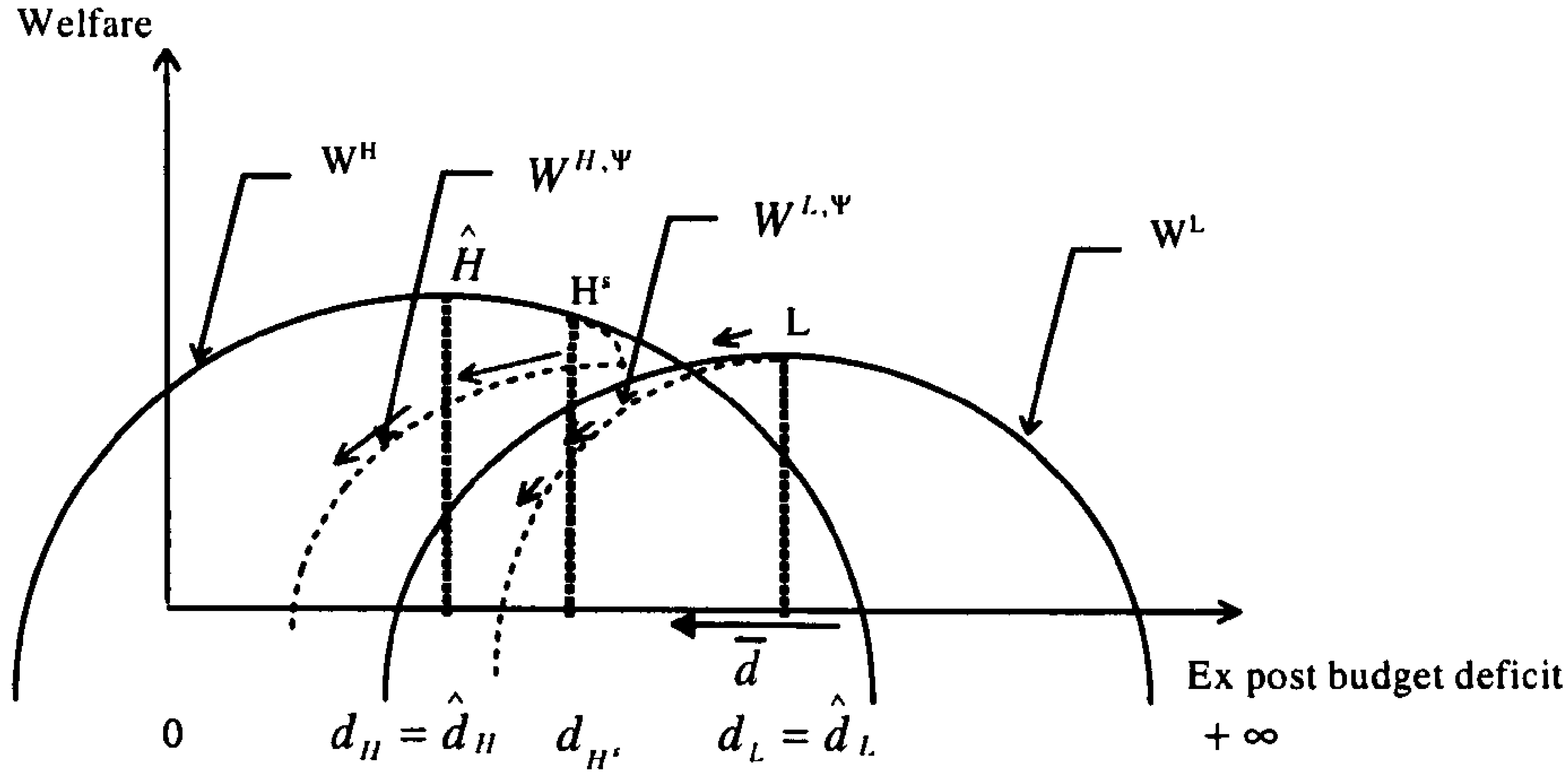
Proposition 3.9. (Golden Rule of public investment). *Under a "Golden Rule": (i) the first-best equilibrium is not attainable; (ii) an optimal penalty (Ψ^{*uk}) exists such that welfare is higher than under the status quo; (iii) welfare is higher than under balanced-budget and SGP-type constraints.*

Proof: We first prove part (ii); part (iii) then follows directly since both balanced budget and SGP-type constraints yield lower welfare than the status quo (Propositions 3.7 and 3.8); we then prove part (i).[23]

The Golden Rule is an ex ante constraint. Competent leaders run higher (and "excessive") ex ante budget deficits compared to low-ability leaders. From an envelope theorem argument, for a small enough penalty (Ψ^{uk}) the welfare gain from a reduction of the high-type leader's distortion is larger than the (approximately zero) reduction in welfare due to the small distortion of the low-type's policy. As the penalty rises, the low-type leader's policy moves further away from the optimum which significantly decreases welfare. Similarly, as the penalty rises, this first induces the high-type leader to reduce her "excessive" budget deficit - by using second best instruments (τ_1) - but passed a penalty threshold, this induces the high-type to run an "excessive" budget

[23]The strategies for the status quo and the Golden Rule are given in Sections 3.3 and 3.5.2 respectively.

Figure 3.5 Social Welfare With Binding Constraints on Ex-Ante Budget Deficits



surplus which is welfare reducing. Optimality requires to set the second-best penalty (denoted by Ψ^{*uk}) such that it trades-off the welfare gains from reducing the original distortion on the high-type, the welfare loss from the creation of distortions on the low-ability leader, and the distortion that balanced-budget requirements create. Since the optimal Golden Rule penalty trades-off several distortions it cannot achieve the first-best. □

The optimal penalty Ψ^{*uk} is such that: $\hat{g}_H < g_{H^{*uk}} < g_{H^s}$, $\hat{\tau}_H < \tau_{H^{*uk}}$, $\hat{b}_H > b_{H^{*uk}} > b_{H^s}$, $\hat{k}_{2,H} > k_{2,H^{*uk}} > k_{H^s}$, and $\hat{g}_L > g_{L^{*uk}}$, $\hat{\tau}_L < \tau_{L^{*uk}}$, $\hat{b}_L < b_{L^{*uk}}$, $\hat{k}_{2.L} < k_{2,L^{*uk}}$. Figure 3.5 illustrates the welfare effect of varying the ex ante budget deficit ceiling in the UK and US cases.

To conclude this section, we have shown that, of the three types of constraints investigated, the Golden Rule is the only one which can lead to a higher welfare level than the status quo - which is to leave full fiscal discretion to elected policy makers.

Nevertheless, although an optimally designed Golden Rule can raise social welfare compared to a full discretion case, such a constraint cannot restore the economy to its first-best. The next interesting question is therefore whether an "optimal"[24] fiscal constraint can be designed. We investigate this question in the next section.

3.5.4 Designing an Optimal Fiscal Constraint

From Lemma 3.1, to eliminate "excessive" budget deficits, an optimal constraint should have the following characteristics: (i) it should apply to *ex ante* budget deficits, and (ii) it should *not* require budgets to be balanced, that is:

$$\text{potential optimal constraint} = \max\left\{\Psi\left(g_1 - \tau_1 + f(\tau_1) - \bar{d}\right),\ 0\right\},\quad \bar{d} > 0 \quad (3.4)$$

With such a constraint, it is possible to find a deficit ceiling ($\bar{d}^* > 0$) such that only high-type leaders are constrained. Furthermore, by choosing the penalty constraint optimally (Ψ_H^* - where the H subscript indicates that only the high-type faces a binding constraint) it should be possible to induce the high-type incumbent to choose the same budget deficit as a competent social planner.

The method to solve for the equilibrium strategies is similar to that of Section 3.3 (or 2.3). The most notable modification from the analysis of Section 3.3 (or 2.3) is that the $\mathcal{B}$ set is replaced by $\mathcal{B}^* \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_H) - Z[g_1^{**}(\theta_H, \Psi_H^*), \tau_1^{**}(\theta_H, \Psi_H^*), b^{**}(\theta_H, \Psi_H^*), 0, \theta_H] \geq 0\}$.- the double star superscript refers to the full information equilibrium obtained subject to the new (potentially optimal) constraint.

[24] "Optimal" in the sense that it would enable the economy to reach the first best *and* eliminates "excessive" deficits.

It is straightforward to show, by analogy to the proof of Proposition 3.2, that the set of all separating equilibria is nonempty and is characterized by $(g_L, \tau_L, b_L) = (g_L^*,\ \tau_L^*,\ b_L^*)$, and $(g_H, \tau_H, b_H) \in \mathcal{B}^* \cap \mathcal{A}$. Note that we are now more likely to obtain a pooling equilibrium because the willingness-to-separate set for the high-type is reduced while the no-imitation set of the low-type is unchanged. Note also that regardless of the equilibrium strategy followed (pooling of separating), Proposition 3.11 below always holds. Given the small changes compared to Section 3.3, we therefore turn directly to the following propositions:

Proposition 3.10. *Conditional on the pair $(\Psi_H^*,\ \bar{d}^*)$, for a high enough competency advantage and a small enough penalty (Ψ_H^*), a unique undominated separating equilibrium exists. In this equilibrium the high-type strategy is $[1-f']^{-1}u_c - (1-f')[1-\lambda]^{-1}\Psi^* v_H' = u_g - [1-\lambda]^{-1}\Psi^* v_H' = u_c < v_I'$; the low-type pursues her full information strategy which is given by (3.2).*

$\lambda > 0$ is the Lagrange multiplier on the $\mathcal{A}$ set constraint.

Proposition 3.11. *Let us define the optimal fiscal constraint as the pair $(\Psi_H^*,\ \bar{d}^*)$ in the class of (3.4) that eliminates "excessive" budget deficits. For a high enough competency advantage, (i) the optimal fiscal constraint exists, (ii) it has the form:*

$$\text{“Excessive” deficit penalty} = \max\left\{\Psi^*\left(g_1 - \tau_1 + f(\tau_1) - \bar{d}^*\right), 0\right\}.$$

$$\text{where } \Psi^* = [f'(1-\lambda)u_c]\left[(1-f')^2 v_H'\right]^{-1} \text{ and } \bar{d}^* = \hat{d}_H = \hat{g}_H - \hat{\tau}_H + f(\hat{\tau}_H)$$

;

and (iii) it cannot achieve the first-best.

The proof is immediate. If $\mathcal{B}^* \cap \mathcal{A}$ is empty, we have a pooling equilibrium. This cannot be a first-best (both types distort their equilibrium policies compared to a social planner). It is also easy to see that if $\mathcal{B}^* \cap \mathcal{A}$ is nonempty so that a separating equilibrium exists it yields a lower welfare level (e.g. distortionary taxes need to be used). □

Comparing the equilibrium strategy of a competent leader subject to the "optimal" constraint with the fiscal policy set by a competent social planner, we can see that by choosing the penalty optimally "excessive" budget deficits can be eliminated. However, even in this case, the first-best cannot be achieved through fiscal constraints.[25] Note that $\hat{d}_H > \hat{g}_L - \hat{\tau}_L + f(\hat{\tau}_L) = g_L - \tau_L + f(\tau_L)$ so $\bar{d}^*$ is feasible (it binds only on the competent leader). The equilibrium strategies are such that: $g_{H^{\Psi^*}} < g_{H^s}$, $\hat{\tau}_H < \tau_{H^{\Psi^*}}$.

3.6 Conclusion

In this chapter we have studied, in a microfounded, one country model, the incentive and welfare effects that the imposition of fiscal constraints has on the *endogenous* decision of policy makers to reduce or eliminate previously "excessive" deficits (i.e. deficits that occur for political reasons when office-holders have full fiscal discretion).

[25]Casella (1999) argues, using a different approach than ours, that an efficient implementation of the fiscal constraints of the Stability and Growth Pact is possible through the use of tradable budget deficit permits. Such permits, analogous to tradable pollution permits, enable to set an upper limit on the overall fiscal deficit of the monetary union but leave markets to allocate efficiently these permits among countries. Our approach in this chapter differs, and in some sense complements, Casella's study in that we analyse whether the *existing* constraints, as voted and enshrined in the law, will achieve their goals and also whether these constraints are efficient. Casella investigates whether one different type of mechanism than the one already established in the SGP can efficiently implement the Stability and Growth Pact.

This comparative analysis of the endogenous response by incumbent policy makers to the imposition of fiscal restraints is, to the best of our knowledge, new in the literature. More importantly, so is our microfounded, one country analysis.

In analysing the effects of various fiscal constraints, our first important finding is that a critical distinction needs to be made between constraints aimed at reducing *absolute* deficit levels, and constraints aimed at reducing *politically-generated* deficits. Indeed, a crucial point of our model is that these two notions of the budget deficit need not coincide. We have shown that fiscal constraints aimed at one type of deficit can *worsen* the other type of deficit. A policy implication is that societies contemplating introducing fiscal constraints should first identify the source of the distortion their countries suffer from. Depending on the distortion we have shown that some types of fiscal constraints are more desirable - if at all - than others.

We also found the following results. First, when constraints are aimed at reducing the *absolute* deficit levels, we find that the three types of fiscal constraints studied *do reduce (incompetency-generated) "excessive" budget deficits.* This result should not be so surprising. It confirms similar results obtained by Beetsma and Uhlig (1999). In our model however, a crucial difference is that policy makers's fiscal policy decision endogenously reacts to the imposition of fiscal constraints. This result is also consistent with empirical evidence, mainly based from studies of US States. However, although fiscal constraints do reduce absolute deficit levels, we find that both a Golden Rule of public investment and a balanced-budget rule induce policy makers to further increase the already "excessive" public debt level. This *substitution effect* from constrained to unconstrained fiscal instruments has important implications as far as the design of fiscal constraints is concerned. Indeed, it highlights the importance of having a *comprehensive approach* to the instruments that policy makers can use for re-election purposes. Simply curtailing abuses on one front induces office-holders to substitute these instruments with other, more distortionary, instruments. Von Hagen (1991), in his empirical analysis of the effects of fiscal constraints in the US States, does find that such substitution effects do occur in practice. Buiter (1998) also argues that the UK Golden Rule could induce policy makers to be more complacent about public debt, an argument which as recently been voiced also by the European Commission and the International Monetary Fund in their year 2000 analysis of the UK's medium term public finances.

Second, when constraints are targeted towards curbing the *politically-generated deficits*, we find that *contrarily* to the results obtained when constraints target absolute deficit levels, SGP-type and balanced-budget constraints are undesirable because they reduce social welfare even below the case where full discretion is left to office-motivated leaders. This finding contrast with those obtained by Beetsma and Uhlig (1999). In their model a reduction in the budget deficit necessarily increases social welfare. Similarly, Tabellini and Alesina (1990), using a partisan model, also find that a balanced-budget rule is welfare increasing compared to the status quo (leaving full discretion to office-holders). The intuition for their result is that budget deficits arise because current policy makers are uncertain over the public good preferences of future policy makers. By running a budget deficit a government can both ensure that public expenditures are spent on its preferred goods and it can also limit the amount of funds that a future government can spend on goods that the current government does not value highly. However, as shown by Peletier, Dur and Swank (1999), the Tabellini and Alesina result is not robust to the introduction of public investment into the model. Extending the Tabellini-Alesina model to allow for public investment, Peletier et al. (1999) find that balanced-budget rules (i) reduces public investment below its optimal level, and (ii) need not be welfare increasing.[26] We find similar results using a different modelling framework (opportunistic rather than partisan). Since the understanding of ideology in economics is not very developed, and that there are many ways in which individuals can exhibit partisan behaviour, the political economy models featuring partisan preferences have, *arbitrarily*, introduced preference heterogeneity in different ways. As pointed out in Section 2.2, different assumptions regarding partisanship have produced opposite conclusions regarding the interaction between fiscal policy and political parties.[27] These modelling problems clearly render the robustness of results (on the desirability or not of fiscal constraints) based on partisan models questionable.

Of the three types of fiscal constraints investigated, we find that the UK Golden Rule yields the highest welfare level and can yield higher welfare than the full discretion case (provided the penalty for unbalanced current budgets is not too high). Nevertheless, welfare remains sub-optimal under the three types of fiscal constraints investigated. We find that a fiscal constraint that would mix elements of the UK Golden Rule (specifically the *timing of the constraint*) with the *ceilings approach* of the SGP would yield a higher welfare than the three constraints we analysed since it can eliminate the political distortion leading to "excessive" budget deficits. However, even this potentially "optimal" fiscal constraint cannot achieve the first-best outcome.

[26] These results, that balanced-budget rules negatively affect public investment, is confirmed empirically by Poterba (1995) in his analysis of capital spending in US states.

[27] e.g. the contrasting results between the models of Persson and Svensson (1989), Alesina and Tabellini (1990), and Aghion and Bolton (1990).

One of the main achievement of this chapter is to provide a (qualified) rationale for fiscal constraints to be imposed on national governments once we recognise that policy makers have their own agenda. Importantly, our rationale is not based on a typical argument regarding negative fiscal externalities, free rider problems arising in multi-country monetary unions. Nor does our argument rely on exogenously imposed distortions. In our model, fiscal constraints can be desirable by reducing the (domestic) political fiscal cycles and budget deficits that politicians engineer to increase their (endogenous) probability of re-election. Widespread empirical evidence do find significant politically-induced cycles. Our model shows that these have a welfare cost which can be reduced by carefully designed fiscal constraints.

An interesting extension of our model would be to endogenise the benefits of reducing "excessive" absolute deficits levels. The introduction of positive benefits (e.g. because of a lowering of a default probability, of a reduction of the potential political and fiscal pressure on an independent central bank, etc.) would allow us to compare the welfare effects of fiscal constraints using Definition 3.1.

We can also note that welfare can be increased by improving transparency with regard to the incumbent's competency parameter. Any action that reduces the temporary informational asymmetry between voters and the incumbent leader enables voters to better assess incumbents' abilities. Having transparent budget procedures is one of these actions. Von Hagen and Harden (1994) do find that transparent procedures lead to lower deficits. Transparency of the budget process coupled with numerous reporting procedures are among the very elements that have been pointed out by the European Parliament and the Commission as being key elements in the success of the SGP, and is a key element of the UK's Code for Fiscal Stability. This is consistent with our model's welfare properties.

Part II

On the Robustness of the Political Agency Literature

Chapter 4

The Career Concerns of Politicians: Efficiency in a Representative Democracy?

4.1 Introduction

During much of 1999, US President Bill Clinton was reported to be devoting an important share of his time to prepare for his defence in the Monica Lewinsky affair. Antonio Gutteres, Portugal's Prime Minister, is featured in a Portuguese satirical show as being too busy with his European ambitions[1] to have time for his national ministerial duties. Countless examples abound about Members of Congress/Parliament being too busy with national politics to have time to devote to their local constituents. On a more sombre note, many "democracies" are more like "kleptocracies", where

[1]Mr Gutteres is the leader of the European Socialist Movement and has been rumoured for the job of European Commissioner.

the senior members of the government use the powers of office to amass personal fortunes.[2]

At the heart of all these cases lies a simple moral hazard problem: once elected policy makers enjoy considerable autonomy in their job and, *ceteris paribus*, they dislike supplying time and effort on their job and would rather prefer to pursue other activities from which they can obtain greater utility (leisure, other political or economic activities). These pervasive problems in policy making have recently led economists and political scientists to apply principal-agent theory to study the relationship between voters and elected officials. The literature starts from the idea that there is a moral hazard problem between the elected official and the electorate: left to his own devices, the official will pursue his own interests, rather than those of the voters. This is modelled formally by supposing that the official can supply unobservable effort (Ferejohn, 1986; Austen-Smith and Banks, 1989; Banks and Sundaram, 1993, 1998) or has the opportunity to "steal" rent from tax revenue (Barro, 1973; Persson and Tabellini, 2000). In this literature, two crucial modifications of the standard principal-agent literature are introduced. First, it is assumed that, contrary to the private sector, financial incentives to induce high effort are far more limited in public service. Indeed, unlike private employees/managers, elected officials cannot typically be offered monetary rewards for their performance on the job: the salaries of political office are usually independent of short-term performance. As a result, financial incentives, which form an important component of incentive mechanisms within a firm, are very low powered in government.[3] This leads to the second key

[2]For example, "during Mobutu's 35-year rule, Zaire had ministers and a cabinet, ministries and governors, officials and diplomats. These appeared to make up the structure of a government. In fact, they were Mobutu's personal networks, though which he stole the wealth of the Congo" The Economist, May 2000.

[3]Within a firm, solutions to the moral hazard problem (between a manager (agent) and the firm's

point of the political agency literature, namely that dismissal from office (or lack of re-election) is costly.[4]

Under these two conditions, officials can only be motivated (to supply additional effort, to steal less rent, etc.) by "*career concerns*",[5] i.e. the fear of losing elections. The recent literature in this area has modelled this process formally, starting with the seminal work of Barro (1973) and Ferejohn (1986). This literature now comprises a variety of models (discussed in more detail in the Conclusion) but with three apparently very robust conclusions:

- (i) in (sequential) equilibrium, voters follow a *cutoff rule*, i.e. will only re-elect the incumbent if his observed performance is above a certain critical level;
- (ii) the cutoff rule *always* motivates the office-holder (to supply more effort, or extract less rent);
- (iii) that a cutoff rule is an *optimal mechanism* available to voters in order to provide incentives to office-holders.

owners (principal)) include various incentive mechanisms ranging from promotion and demotion, wage changes, performance contracts (e.g. stock options, bonuses), etc. (see Prendergast, 1999, Murphy, 1999, Malcomson, 1999, and Gibbons and Waldam, 1999, for recent surveys).

[4]In the context of a private firm, the principal-agent literature often assumes that a manager's wage will not be affected whether he separates from his current employer or not (e.g. Holmström, 1999; or Fairburn and Malcomson, 2001 for recent such models). This result holds when firms operate in a competitive environment and the agent's performance is observable by all firms in a symmetric (though maybe incomplete) way. In the context of a political career, given that "employment opportunities" (i.e. elections) are scattered at fixed time intervals, an incumbent politician who is not re-elected cannot instantaneously find a similar job with another employer (i.e. another constituency). This is one sense in which dismissal from political office is costly compared to private sector jobs.

[5]Career concerns refer to the fact that an agent's current actions (e.g. labour supply, effort on the job, firm-specific human capital accumulation, etc.) are in part determined by taking into account the effect that these actions have on the agent's future career prospects even though no *explicit* incentives (e.g. performance contracts) links the two.

The aim of this chapter is twofold. First, we argue that conclusions (ii) and (iii) are in fact *not* robust. We shall show that these two results are critically dependent on assumptions regarding respectively the *information structure* of the game (for conclusion (ii)), and on a *partial equilibrium voting game* (for conclusion (iii)). Second, given our first result and its causes, we compare welfare of all agents in the economy across information structures and institutions (welfare is a function of the office-holder's quality and effort level). The aim of this comparative welfare analysis is to find conditions under which welfare is maximized.

We present a simple two-period model of the agency problem between the electorate and the office-holder. The economy is populated by a number of citizens, who may vary in competence if in political office. Their performance in office is described by a production function that maps competence, effort, and a random shock into a scalar variable, the "public good". The two novel aspects that we introduce into this framework are the following:

First, drawing on the work of Holmström (1982, 1999) and Dewatripont, Jewitt, and Tirole (1999), we modify the information structure from one of *asymmetric incomplete information* (where individual competence is initially the private information of the citizen) to one of *symmetric incomplete information* (where, at the beginning of the game, no citizen knows his competence in producing the public good. Competence can only be inferred from an individual's performance in office). Since Holmström's celebrated (1982/1999) paper,[6] this latter informational environment has been the focus of a large body of theoretical work in the context of the theory of

[6]In an earlier contribution, Fama (1980) also highlights the importance of career concerns in motivating managers. Fama, however, only sketches an analytical model, while Holmström provides a complete formalization of this effect.

the firm and organizations.[7] Recently, Dewatripont, Jewitt and Tirole (1999) have extended Holmström's model to study the incentives of government agencies' officials (i.e. *appointed* civil servants).[8] By contrast, the role that career concerns have on *elected* official has been under-researched.[9] These concerns however are bound to be especially important in politics (and in policy making in particular) compared to other types of labour markets that can be encountered in private or public organisations for two reasons. First, in politics more than in any other market for labour, the competency of potential policy makers is especially difficult to assess. Indeed, unless candidates already have some experience for the post they are contesting, voters have very few benchmarks against which to evaluate the competency, adequacy of a candidate for a very skill-specific job. Candidates themselves can be unsure of their yet-to-be-tried ability in managing a large and multi-dimensional public sector. Second, career concerns are also bound to be important in politics given the "winner takes all" nature of this job market. That is, should an election be lost, the political career of the defeated incumbent takes an abrupt dive, possibly a terminal

[7]Prendergast (1999), and Gibbons and Waldman (1999) review the labour economics and industrial organisation literature that analyses the effects of career concerns within organisations. "Career concerns" (also called "influence") behaviour arises because of *implicit* incentive considerations: an agent tries to influence beliefs regarding her imperfectly known abilities (e.g. Holmström, 1999) or abilities of potential competitors (e.g. Carmichael, 1988). If successful, this leads to promotion to higher paid jobs either inside or outside the organisation. (See also the previous footnote for a "definition" of career concerns.)

[8]The study of incentives within the public sector is expanding rapidly. See Tirole (1994) for an introduction to "the internal organization of Government" (meaning non elected bureaucrats). Dixit (2000) is an excellent recent survey of this new field.

[9]The closest model to ours is the recent career concerns model of Chapter 4.5 of Persson and Tabellini (2000), which also builds on Holmström's work, and that we saw after the first draft of this chapter was completed. We show in Section 4.9 that (subject to some inessential qualifications) their model can be considered as a special case of ours where there is no randomness in the production function. As a consequence, in their model, the incumbent can perfectly observe his competence at the end of the first period of office, and so there is no *experimentation* effect, which is one of the main topic of this chapter (and a key novelty in the literature). Our reading of their model is that it is intentionally kept very simple to permit an easy analysis of the way career concerns are affected by *electoral rules*.

one. Evidence on the prior experience of government ministers, discussed in Section 4.2 below, indicates that both these assumptions may be (approximately) valid for different OECD countries.

The second modification that we introduce to the "standard" political agency model aims to remedy a weakness of the existing literature on the principal-agent relationship between voters and office-holders, namely that the office-holders (the incumbent and challenger) are assumed to be *randomly* drawn from some population. To tackle this issue, we study *democracy with endogenous (candidate) entry*, where at the beginning of each of the two periods, any citizen can stand for election, and candidates are voted on by plurality rule, with the winner taking office for one period (becoming the office-holder). This approach combines the citizen-candidate modelling (or representative democracy) of selection of office-holders (Besley and Coate, 1997; Osborne and Slivinski, 1996) with the principal-agent relationship between office-holder and voters. In order to highlight the sometimes complex mechanisms that give rise to our results, we contrast the case of democracy with endogenous candidate entry with two simpler political institutions. The first is *appointment* or *delegation to an appointed bureaucrat* (alternatively this environment could also be described as a *dictatorship*), where the office-holder (we shall call him/her a bureaucrat) is randomly selected from the population, and is in office for two periods (i.e. the bureaucrat is characterised by a long-term employment contract, or a tenured job). The second is *democracy with exogenous (candidate) entry*, which differs from the appointment/dictatorship case in that at the beginning of the second period, there is an election, contested by the first-period incumbent and an opponent, the latter randomly selected from the population, with the winner holding office for the second period. In both democratic regimes, we shall denote the office-holder as a politician. Our main focus of attention is the representative democracy case, but the first two cases serve as benchmarks which allow us to study the effects of elections and candidate entry separately on the behaviour of the office-holder. Last but not least, the second case is of independent interest as it is essentially the political institution assumed by Ferejohn in his seminal 1986 paper and in the extensive literature that follows, and also by Rogoff and Sibert (1988) and the subsequent rational political business cycle literature (RPBC).[10]

A subsidiary, yet related, objective of this chapter is to address another, related, weaknesses of the existing literature on the principal-agent relationship between voters and office-holders, namely that the office-holders (the incumbent and challenger) have *different preferences* than the voters.[11] We address this problem by having the incumbent and challenger randomly selected from the *same* population as the electorate.

Using this simple yet rich political agency setting,[12] we can show why conclusions (ii) and (iii) of the literature described at the beginning of the introduction are not robust. The intuition for our new results is easier to understand once we analyse the effect of the various political institutions and information structures on:

[10]The relationship between this chapter and the RPBC literature is discussed later in the Introduction.

[11]In Banks and Sundaram (1993, 1998), the principal (voters) care about the output of the agent, but the agent's payoff is independent of this output. The same is true of Persson and Tabellini (2000), where voters care about the output of the public good, but the office-holder cares only about an exogenous ego-rent and the rents that he can extract from tax revenue.

[12]Our model enables us to analyse three political institutions and three informational regimes (in order to contrast our results under our two incomplete information structures, we shall also analyse the model under full information as a benchmark case).

- (a) the effort chosen by the office-holder, conditional on his ability;
- (b) the average ability of the office-holder;
- (c) the welfare of citizens.

We first discuss our results on point (a). First, we find that the moral hazard problem due to (uncontractible) supply of effort coupled with heterogeneity of policy makers' abilities give rise to several strategic considerations in the choice of effort. The first kind of strategic behaviour, occurring only in the democratic case, is a "*career concerns*" effect. In an important contribution, Holmström (1999) showed that even in the absence of current monetary incentives, a manager's concerns for her future career influence her current effort on the job. The reason is that effort influences, via the observation of the manager's output, the principal's (and the manager's) updating of their initial beliefs about the competence of the manager, leading to enhanced future wage prospects. However, in our model, the "career concerns" of the office-holder *lead to a different kind of* implicit performance contract:[13] the higher the visible performance while in office, the higher the probability of being re-elected and therefore the higher the expected payoff in the future.

A second effect is *experimentation,* which can arise only in the symmetric incomplete information case (but regardless of whether the labour market is one with bureaucrats or politicians). The experimentation literature initially studied the problem of a monopolist facing an unknown demand curve. In this case, the monopolist

[13]In our model, the career concerns considerations are closely related to a "*tournament*" effect (Lazear and Rosen, 1981; Green and Stokey, 1983). Elections can be seen as a tournament game in which citizen-candidates, once in power, compete against opponent citizens. The performance of the incumbent is evaluated *relative* to that of potential candidates. The preferred candidate wins and takes office, the losers receiving nothing but the utility of a representative citizen.

faces a trade-off between the long-term benefits that will accrue should it discover the true demand curve and the short-term costs that need to be incurred in order to experiment with different price-quantity combinations. Prescott (1972) and Grossman, Kihlstrom, and Mirman (1977) are early contributions.[14] In our political agency model, experimentation occurs when the incumbent deviates from the myopically optimal action that just maximizes the current payoff in order to improve the information content of his signal about his own ability, namely the output of the public good. We show that experimentation will occur in the first period of our two-period setting when the technology for producing the public good is non-additive (in the sense of Dewatripont, Jewitt, and Tirole, 1999), and that when it occurs, it unambiguously induces the office-holder to put in more effort than the myopic level. However, the incentive to experiment is unambiguously higher in the appointment case, because the appointed bureaucrat is always the office-holder in the second period of the game, and so always reaps the full benefit of experimentation in the first period, whereas in a democratic regime, in equilibrium, the incumbent office-holder in the first period will lose the election in the second period with some probability. Hence, point (ii) of the literature (i.e. that the cutoff rule *always* motivates the office-holder to supply more effort, or extract less rent) is *not robust* to an informational environment that is symmetric and incomplete. In this case, we show that in sequential equilibrium, elections may *demotivate:* that is, the incumbent will supply *less* effort than without the "discipline" of an election. The intuition is simple. When the ability and the effort of the office-holder interact positively, the office-holder can learn more about his ability by supplying more effort (the *experimentation* motive). However, if he is

[14]Mirman, Samuelson, and Urbano (1993) develop a tractable two-period monopolist game and establish conditions under which experimentation occurs. We will make use of their results. Keller and Rady (1999) contains recent references and a brief overview of the literature.

exposed to the possible future loss of office, his motive to experiment will be reduced. This diminution in the experimentation motive may more than offset the increase in effort induced by the desire to signal competence to the electorate (the *career concerns* effect). One way of interpreting the diminution is as *short-termism;* the incumbent underinvests, anticipating he will lose power (see also Besley and Coate, 1998, for examples of this type).

The existence of, and implications of, experimentation in a career-concerns setting is (as far as we know) a new finding. This is because the existing literature assumes either (1) that potential office-holders are already fully (privately) informed about their ability, as in Banks and Sundaram (1993, 1998); (2) an additive technology, where information has no value (e.g. Fama, 1980; Holmström, 1999; Gibbons and Murphy, 1992; and Fairburn and Malcomson, 2001); (3) one period only, in which case information acquired currently cannot be used in the future (Dewatripont et al., 1999); (4) there is no noise in the production function so that incumbents can perfectly observe their ability from performance at the end of the first period of office (Persson and Tabellini, 2000; Shi and Svensson, 2001).

An important insight from our chapter is that career concerns and experimentation, while both inducing the incumbent to increase effort, are *substitutes* under symmetric incomplete information: that is, democracy introduces career concerns, but also necessarily reduces the incentive to experiment.

We now turn to discuss point (b), that is how the average ability of the office-holder differs, in equilibrium, by political institution. Whatever the information structure, democracy (of either type) performs "better" than the appointment case, because the electorate can "fire" low-ability office-holders at the beginning of the second period. More interestingly, democracy with endogenous entry outperforms democracy with exogenous entry when ability is private information; in this case, there may be "*revealing*" equilibria where only high-ability candidates run for office in both periods. However, this perfect screening at the candidate entry stage comes at a cost; the incumbent office-holder is never "fired" by the electorate and so has no "career concerns" incentive to increase effort above the myopic level; in the terminology of Barro (1973) and Ferejohn (1986), the electorate loses control of the office-holder. Hence, conclusion (iii) of the literature (i.e. that a cutoff rule is an optimal mechanism available to voters in order to provide incentives to office-holders[15]) is not robust once the model is extended from a partial equilibrium electoral game (i.e. opponents are exogenously selected, and so is the first-period office-holder) to a *general equilibrium* electoral game (a representative democracy *à la* Besley and Coate, 1997). Indeed, in a representative democracy, if the adverse selection problem is more acute than the moral hazard problem, then *a cutoff rule* (at the policy stage) *is not an optimal mechanism for society.* Instead, a screening of candidates at the candidacy stage is more efficient. We can elaborate on this point by analysing how citizens' welfare is affected by our various institutions (i.e. point (c) above).

Turning to point (c), an important focus of our analysis is on the relative efficiency of the different institutional regimes discussed in this chapter. Our microfounded set-up allows us to calculate voters and office-holder utility in equilibrium. With asymmetric information, democracy (with or without endogenous entry) is unambiguously Pareto-improving compared to dictatorship. This is because democracy is always more efficient at selecting high-ability office-holders and is at least as efficient

[15]See Banks and Sundaram's (1998) paper on "Optimal Retention Strategy" for such a claim.

in inducing the office-holder to supply effort. On the other hand, when information is symmetric but incomplete, we show that there is also an important relationship between the "efficiency" of equilibrium with democracy and the presence of an experimentation motive. Consider a *constrained* social planner who only knows the distribution of the competency variable initially (so he is only as well-informed as citizens), and has the same powers as citizens, i.e. can "fire" the incumbent if performance falls below some cutoff value. We say that democracy (with or without endogenous entry of candidates) is *constrained efficient*[16] if a constrained social planner cannot make every citizen better-off. It turns out that (subject to a uniqueness condition holding) when technology is additive (so there is no experimentation motive), the equilibrium with democracy is constrained efficient, but that this need not be the case with an experimentation motive. These findings relate to the old (and still hotly debated) issue of whether democracy is an efficient regime. For instance, Stigler (1972), and Wittman (1989) argue that democracy, because it ensures that office-holders are elected through a perfectly competitive competition for citizens' votes, is an efficient mechanism, as effective as economic competition. This ideal view of electoral competition has been challenged by models which incorporate imperfections. These include a lack of ability to commit to a pre-announced political platform (Besley and Coate, 1998), imperfect information (Coate and Morris, 1995), or because pork barrel projects lead to higher political benefits (Lizzeri and Persico, 2000).

We should also mention that our chapter is also related to the literature on dynamic moral hazard games. In this literature, it has been shown that these games

[16]Of course, due to the underlying agency problem, the equilibrium outcome with democracy will never be first-best efficient, so that the latter is not a very interesting benchmark.

very quickly become analytically intractable once realistic features are accounted for (e.g. access to a credit market). The reason being that the initial moral hazard problem endogenously creates an adverse selection problem (see Salanié, 1997, for an overview of the literature). Interestingly, this is not the case in our model. The reasons are, however, specific to dynamic electoral games. First, we assume (as in all opportunistic models) that the benefice from holding office is constant). This is a realistic assumption within government but obviously less so within a firm. Second, the issue of whether the agent (i.e. the policy maker) has access to a credit market is irrelevant given that the agent is not motivated by monetary incentives but by what is called since Rogoff and Sibert (1988) an "ego rent". Hence, our model is a simple, tractable dynamic moral hazard game.

One final point is that this chapter can be interpreted as generalizing the literature[17] on the microfoundations of the rational political business cycle (RPBC) by endogenising entry of candidates to election, following Besley and Coate's (1997) approach. The RPBC literature shows that, even with rational and forward looking voters, political business cycles could occur because incumbent office-holders have a temporary informational advantage (regarding their ability) compared to voters. In order to reveal superior ability, an incumbent is able to use policy instruments to credibly signal to the electorate and therefore create a political business cycle.[18] This

[17]The seminal contributions are Rogoff and Sibert (1988), and Rogoff (1990). See Alesina et al. (1997) and Drazen (2000a) for a textbook treatment of this vast rational expectations-based literature, and for a review of the empirical evidence pointing to such politically-induced business cycles. Chapters 2 and 3 belong to such class of models.

[18]As in these papers, a political business cycle arises in our model. However, contrarily to these models, our cycle is robust to the removal of the *ad hoc* assumption that incumbent leaders are exogenously chosen in the first period of the game. Indeed, as shown in Chapter 5, by endogenising citizens' decision to stand for election or not, an optimally designed cost of electoral campaign always exists such that a revealing equilibrium obtains at the candidate entry stage so that no signalling arises while in a policy maker is in office. Hence no political business cycle.

extension enables us to have a *general equilibrium* electoral model with "opportunistic" or "office motivated" leaders, in contrast to the partial equilibrium models that so far exist, where the existence of an "incumbent" and "opponent" at the date of election is simply assumed, and their objectives exogenously specified. Apart from endogenising entry, we also extend this literature by allowing for unobservable effort by politicians, thus allowing for moral hazard.

The rest of the chapter is structured as follows. In Section 4.2, we present some evidence on the prior experience of politicians. In Section 4.3, we describe the model. In Section 4.4 we solve the model under full information. In Sections 4.5 and 4.6 we solve the model respectively under symmetric incomplete information, and under asymmetric information. Section 4.7 is devoted to a normative analysis of the model, while Section 4.8 investigates some extensions of the model. Finally, Section 4.9 concludes and discusses related literature.

4.2 Some Evidence on Prior Experience of Politicians

Turning to empirical evidence from electoral and governments' composition data (see Tables in Appendix $C.4$), several interesting points regarding policy makers' career in relation to their on-the-job experience can be observed. These confirm that closer attention should be devoted to the study of career concerns in politics. Tables $C.1$ and $C.2$ (in Appendix $C.4$) show the percentage of Cabinet Secretaries that have had prior Cabinet experience. The data are shown for the United States from 1789 to 2001, and the United Kingdom from 1859 to 2001. This previous experience offers a yardstick against which the electorate can better evaluate the candidates' ability in managing public accounts, but also it offers politicians more insights as to their potential ability in office.

As can be seen from these Tables, this percentage ranges from 0.0 to 100.0 percent. Tables $C.1 - C.2$ show that, beyond the much emphasized difference in political platforms (left- versus right-wing governments), governments are constituted of persons and these persons have different abilities. As these abilities become known while in office, we can see that these latter have a profound impact on a policy maker's career: even though a Secretary's party might be re-elected, this by no means assures him/her a seat in the new Cabinet. For instance, in the United Kingdom's Conservative government of Harold Macmillan (1957-63) only half the Secretaries had prior Cabinet experience despite being preceded by two Conservative governments. More striking examples can be found in the United States. For his second mandate President Bill Clinton kept only over half of his previous team. President George W. Bush (senior) contained 37.5% of experienced Secretaries despite following Ronald Reagan's two terms in office. Herbert Hoover's Republican government included 30.8% of seasoned Secretaries despite coming immediately after seven years of Republican government under President Coolidge. The sharpest illustration of the role of policy makers' ability can be found in the period 1869-1881 where three consecutive Republican governments hold office. President Rutherford B. Hayes' Cabinet contained only 11.1% of experienced Secretaries despite following eight years of Republican government. Hayes was himself replaced by another Republican President: James A. Garfield. Yet Garfield's Cabinet consisted, including Garfield himself, of strictly *in*experienced Secretaries even though this government followed twelve years of Republican governments.

Tables $C.1 - C.2$ also reveal cases where incumbent governments have been replaced by a totally inexperienced team. Recent examples include the UK government of Tony Blair (1997-), and the first Clinton government in 1993. This is interesting as it reveals that voters preferred to elect a policy maker (or team of policy makers) with no prior governmental experience[19] rather than to re-elect the currently experienced policy maker (whose ability is revealed to the public). We can also note that these sweeping changes in favour of "new" policy makers in the 1990s come in the background of one to two decades of sharp deterioration in the fiscal stance in these countries (e.g. mounting public debt to GDP ratio), of "boom and bust" economic cycles, a forced devaluation of the British Pound and exit from the Exchange Rate Mechanism in the United Kingdom. A similar pattern can be noted for other "new" governments such as the one of Frankin Roosevelt which was elected in the midst of the Great Depression. In terms of our model, these observations support the following interpretation: following a period of poor economic performance, above and beyond voters' desire to change political parties, voters insist in electing citizens with no senior governmental experience given that those that have this experience have revealed that they do not possess outstanding abilities. The election of a "new" team can also indicate to voters that the political party the new team belongs to offers a new political platform and a new management style. Possible examples of this include Ronald Reagan's 86.7% new team which departs from the Nixon and Ford governments, and J.F. Kennedy's government.

Tables $C.3$ and $C.4$, contain the same data as the previous two Tables but gath-

[19]This is strictly the case in British politics as the opposition party forms a Shadow Cabinet. The members of the Shadow Cabinet are therefore fully known before the election which enables voters to compare the incumbent versus the opponent's teams.

ered by frequency and deciles respectively. They reveal another interesting point, namely that the shape of the frequency distribution of the percentage of prior cabinet experience strongly differs across countries. From Table $C.3$, we can see that the British governments' distributions are skewed towards a high percentage of experienced Secretaries, while the United States exhibits a bimodal, U-shaped distribution, with peaks towards both extremes of the scale, the highest peak being towards the low end of the scale. For instance, the percentage of governments with a percentage share of experienced members between 0.0 and 10.0% equals 30.2% in the US and less than 5% in the UK.

Table $C.4$ reveals that the lowest quartile of US governments contains virtually no experienced Secretaries, and that the lowest half of US Cabinets contains only 18.2% of experienced Secretaries. This compares with 52.8% and 81.0% for the United Kingdom. US politics differs noticeably from UK politics as far as the selection of Cabinet Secretaries is concerned. A tentative explanation is that the United States has a federal structure with each state having a prominent say on its internal affairs (e.g. on fiscal policy). Prominent state policy makers can therefore obtain valuable experience in running large scale public accounts and therefore can learn (or receive a good signal) about their potential abilities on this type of job. The public can also learn from this experience.

Schlesinger (1966), in his seminal study of political careers in the US from 1900 to 1958, also finds strong supporting evidence regarding the role that career concerns play in politicians' career.[20] His study complements our finding at the federal level

[20]Strangely enough, although there is a large literature in Political Science on the career of politicians, most of these studies have focused on legislative office holder (and especially US Congressional careers - e.g. Hibbing, 1991), not on executive positions. Schlesinger is a major exception. A recent extension of Schlesinger's work is by Black (1993).

in the US: Schlesinger studies political careers at the state level.[21] It is found that in all the offices examined, personnel change is always greater than the one due to party change. For instance, out of 13,735 elections, 1,938 party changes occurred, but more than 4,291 personnel changes took place (states which do not permit re-election to the office are excluded). A main conclusion of Schlesinger's study is that there is "evidence of extrapartisan dimensions in elections. The great variations in the degree of party competition among the states suggest that in those states where the range of competition from office to office is greatest, party labels are least important in affecting votes." (Schlesinger, 1966, p. 59-60).

Finally, a recent econometric investigation of the role that individual office-holders play in shaping policy (as opposed to political parties) can be found in Besley and Case (1995a). They test the predictions of an electoral principal-agent model under asymmetric information (which is similar to our Section 4.5). They draw on Banks and Sundaram's (1998) model (which features exogenous candidate entry). Besley and Case's analysis of US gubernatorial elections from 1950 to 1986 reveals that policy instruments do respond to a binding term limit if a Democrat governor is in office. As stated by Besley and Case, this is consistent with a principal-agent model in which incomplete information regarding the agent's (office-holder's) ability induces the latter to supply more effort in order to influence the principal's (voters') decision of whether or not to retain the agent for another period.

To conclude this section, empirical evidence show that career concerns can significantly distort decision making in private and public organisations.[22] Furthermore,

[21] Eight offices are studied: Governor, Senator, Lieutenant Governor, State Treasurer, State Attorney General, State Auditor, Secretary of State, US. Representative.

[22] The empirical literature on career concerns is unfortunately far less developed that its theoretical counterpart. The seminal study is by Gibbons and Murphy (1992) who study CEOs compensation.

we argue that specific factors point towards important career concerns motivations in policy making. These, coupled with supportive data on policy makers' career warrant a comprehensive analysis of the effect of career concerns on the conduct of public policy. As argued in the Introduction, by doing so, we can show that two important conclusions of the political agency literature are in fact not robust. We now turn to our model to substantiate these claims.

4.3 The Model

4.3.1 Overview of the Model

Our model combines a "career concerns" model (Holmström, 1999 ; Dewatripont, Jewitt and Tirole, 1999) with a political economy model[23] of fiscal policy (Rogoff and Sibert, 1988; Rogoff, 1990), but where candidate entry is endogenous, as in Besley and Coate (1997). The economy is populated by a set N of citizens with $\#N = n > 3$ and evolves over two time periods, $t = 1, 2$. The performance of the office-holder while in office is measured by a scalar variable $g \in \Re$ which we call the "public good". This good can only be produced by a single agent (equivalently, only one agent is needed to produce the good). We call this agent the "office-holder" (and, depending on the institution in which the office-holder operates we shall further call her either a "bureaucrat" or a "politician" - see Section 4.3.4 below). Neither the office-holder's effort nor her ability can be directly observed. So, the office-holder is in a principal-

Brandt and Hosios (1996) analyse labour supply in rural China. Both papers find strong support for Holmström's theory. Gibbons and Waldman (1999) and Prendergast (1999) survey the limited empirical evidence.

[23]These political economy models focus solely on "hidden information" problems while we consider the joint issue of "hidden actions" and information. Our model can therefore be seen as a generalization of this literature.

agent relationship with the citizens. The precise nature of this relationship depends on how the office-holder is selected from the set of citizens (See Section 4.3.4 below).

4.3.2 Technology

The ability of an office-holder $i \in N$ is measured by $a_i \in \{\theta_H, \theta_L\}$, and his effort level in period t is measured by $e_{i,t} \in [0, \infty)$. Following Dewatripont, Jewitt, and Tirole (1999), this office-holder produces g_t units of the public good, where:

$$g_t = \mu(\theta_i + e_{i,t}) + (1-\mu)\theta_i e_{i,t} + \varepsilon_t, \qquad t = 1, 2 \tag{4.1}$$

where $\mu \in [0, 1]$. The more able (i.e. the higher θ) and/or the more effort supplied by the incumbent, the more public good is supplied. We assume that each a_i is a random draw from a distribution that can take two values $\{\theta_H, \theta_L\}$, with $\theta_H > \theta_L > 0$ and with probabilities ρ, and $1 - \rho$ respectively. This draw takes place at the beginning of period one. So, the θ_i are uncorrelated across citizens. We refer to H, L as the *types* of the citizens.

Also, $\varepsilon_1, \varepsilon_2$ are independently distributed random shocks. In either period, the office-holder has to decide on a level of effort before observing ε_t. We assume that ε has a continuous distribution with probability density function f, cumulative distribution function F, and has full support on $[\underline{\varepsilon}, \bar{\varepsilon}]$, where $\underline{\varepsilon}$ may be $-\infty$, and $\bar{\varepsilon}$ may be $+\infty$. We assume that f satisfies the Monotone Likelihood Ratio Condition (MLRC) that $f'(a)/f(a)$ is a continuous and decreasing function.[24] We also assume that $f(\underline{\varepsilon}) = f(\bar{\varepsilon}) = 0$, i.e. zero density at the endpoints, and that.

[24]The MLRC says that, for a given competency type, a high effort increases the probability of obtaining a high visible performance at least as much as it increases the probability of obtaining a low visible performance variable.

Assumption 4.0. *For any $e > 0$, there exists $\varepsilon', \varepsilon''$, $\varepsilon'' > \varepsilon'$, such that* $\frac{f(\varepsilon'-e)}{f(\varepsilon')} < 1 < \frac{f(\varepsilon''-e)}{f(\varepsilon'')}$.

It is well-known that a large number of distributions satisfy MLRC (See Milgrom, 1981), including the Normal, and it is easy to check that if θ is Normally distributed, Assumption 4.0 is also satisfied.

Note that the general production function (4.1) encompasses two important special cases. The first is where $\mu = 1$, in which case the technology is purely additive (as in Holmström's paper). The second is where $\mu = 0$, in which case the technology is purely multiplicative (in the sense of Dewatripont, Jewitt and Tirole, 1999). More generally, the technology is a mix of additive and multiplicative.

Our production function, plus the assumption on the support of ε_t, of course implies that g can be negative, and so cannot be literally interpreted as a public good in a public finance model. The reason for allowing shocks ε_t to be negative is that if we constrained ε_t to be positive, i.e. by assuming the lower bound of the support of ε_t to be zero, then if the incumbent observed $g_t < \mu\theta_H$, he could be *sure* his type was low. This problem of "perfect inference" would complicate the analysis considerably. The simplest way to model non-negativity for g_t is to suppose that the random shock is *multiplicative,* i.e.

$$g_t = [\mu(\theta_i + e_{i,t}) + (1 - \mu)\theta_i e_{i,t}]\, \varepsilon_t \tag{4.2}$$

and has support $[0, \infty)$. The qualitative features of the analysis of this chapter would be unchanged if we worked with (4.2).

4.3.3 Preferences

If $i \in N$ is an office-holder in period t, and produces g_t, then $j \neq i$ has the following (lexicographic) preferences over pairs (g_t, i). For a given i, j has utility linear in g_t, i.e. $u_{j,t} = g_t$. If office-holders i, i' both supply amount g_t, j strictly prefers (g_t, i') to (g_t, i) iff $i' > i$. So, j cares about the level of public good provision, and the identity of the office-holder; i.e. voters have preferences over the "looks" of the office-holder.[25] The purpose of introducing "looks" preferences is to break ties in preferences over candidates that lead to multiple voting equilibria, and does not affect the main results.[26] If an agent $i \in N$ is an office-holder in period t, she has the following payoff;

$$u_{i,t} = g_t + R + \zeta g_t - c(e_{i,t}) \tag{4.3}$$

Here, $R + \zeta g_t$ is an "ego-rent" from being in office (as in Rogoff and Sibert, 1988), deriving from the prestige in managing public affairs. If $\zeta > 0$, the ego-rent interacts positively with the amount of public good provided.[27] Following Rogoff and Sibert (1988), we assume for the moment that $\zeta = 0$. (the case of $\zeta > 0$ is discussed in Section 4.8.1 below). Next, $c(e_{i,t})$ is the cost of effort, where $c(.)$ is strictly increasing and strictly convex, and $c(0) = 0$, $c'(0) < 1$.[28] For simplicity, we do not allow discounting

[25]This index could refer to any visible variable that belongs to a citizen but is unrelated to her economic performance. For instance, her "look" as in Rogoff and Sibert (1988) and Rogoff (1990). That beauty is an important determinant of a person's performance in the labour market is shown in Hamermesh and Biddle (1994) and Biddle and Hamermesh (1998).

[26]These "looks" can be dispensed with if we are only interested in analysing the appointment case and democracy with exogenous entry.

[27]Of course, $\zeta > 0$ could also model a public duty/altruistic motive for the office-holder, capturing the fact that holders of public office may feel some obligation towards the citizens they represent, quite independently from the discipline that elections impose. The existence of such a motive, often called "Public Service Motivation" (PSM) has long been recognised in the literature on public administration. Numerous survey-based evidence also indicate that such motivations exist (See Francois, 2000, for a recent economic modelling of PSM, and for a recent review of the literature).

$\zeta > 0$ could also be interpreted as an endogenous part of the ego rent: the higher public output, the higher social welfare, and therefore the higher the popularity (hence ego rent) of the office-holder.

[28]The last condition $c'(0) < 1$ ensures that myopic effort is positive.

so, the present value of pay-offs for $i \in N$ is $U_i = u_{i,1} + u_{i,2}$.

4.3.4 Institutions

The agent whose task it is to produce the public good (the office-holder) is selected in one of three ways.

1. *Representative Democracy (Democracy with Endogenous Candidate Entry)*

This institution follows Besley and Coate (1997). There is an election at the beginning of each of the two time periods. The first stage of an election process is *candidate entry.* Any citizen can stand for election in either of the two periods, at a cost of $\delta > 0$. We restrict citizens to pure-strategy entry decisions.[29] The second stage is *plurality voting* over the set of candidates. That is, every citizen has one vote which he must cast for one of the candidates, (we rule out abstentions), and the candidate with the most votes wins (given the lexicographic preferences assumed a voter is never indifferent between two or more candidates). We impose the restriction that voters vote *sincerely,* i.e. for their most favoured candidate. The justification for this, and the consequences of relaxing it, are discussed in Section 4.8.2 below.

In the event of a tie (i.e. two or more candidates with equal numbers of votes) we adopt the standard tie-breaking rule that every candidate with the most votes is chosen with equal probability. In the event that nobody stands for election, a *default option* is selected by the constitution, which is that no public good is provided.

This institutional arrangement is the main one studied in this chapter. It allows

[29]Existence of equilibrium in this model is not a problem, and so we do not need to consider the extension to mixed strategies.

for both candidate entry and voting to be modelled in a complete way without any *ad hoc* assumptions. To bring out the (sometimes complex) effect of this institutional structure on the principal-agent relationship between the "office-holder" and the electorate, we consider two benchmarks.

The first abstracts from the endogenous entry decision while allowing the electorate to "fire" bad office-holders. It also is quite close to the modelling of the electoral process in Rogoff and Sibert (1988), and Rogoff (1990).

2. *Partial Democracy (Democracy with Exogenous Candidate Entry)*

At the beginning of period $t = 1$, an office-holder (we call him the *incumbent*) is selected by random draw from the set of citizens. This office-holder is in place during period $t = 1$ but faces an election at the beginning of period 2. At this stage, an *opponent* is selected by random draw from the set of citizens. The citizens then vote on the opponent versus the incumbent, and the winner is the office-holder in period $t = 2$. We require an individual rationality condition to hold, i.e. that both the incumbent and the opponent prefer to be in office in the relevant periods.

The second is very simple, and abstracts from both entry of candidates and voting.

3. *Appointment of a Bureaucrat (or Dictatorship)*

At the beginning of period $t = 1$, the office-holder is selected by random draw from the set of citizens, and is in place for both periods. Again, we require the individual rationality condition to hold that the appointee prefers to be in office than not.

4.3.5 Information Structures

We consider three possible information structures in this model. The first (*complete information*) is where all citizens can observe the type of every citizen, i.e. every citizen knows the ability vector $a = (a_1 \in \{\theta_H, \theta_L\}, ..., a_n \in \{\theta_H, \theta_L\})$. This is an unrealistic but useful benchmark case. The second is where all citizens know nothing, i.e. citizens do not know their own types nor anybody else's, but all know the joint distribution of types (*symmetric incomplete information*). The third is where citizens do know their own types but nobody else's, but all know the joint distribution of types (*asymmetric information*). In each of these cases, it is assumed that the effort e is only observable by the incumbent. Because of this, the office-holder cannot be rewarded on the basis of e.[30] If she receives a salary, this is modelled as a component of R, the "ego-rent". It is also assumed that g is not verifiable, so the office-holder cannot be rewarded on the basis of g. This is a standard assumption in the incomplete contract literature. One can view g as the overall supply of public goods in a country. Writing contracts specifying all the characteristics of the goods (e.g. quantity, quality, time delivery, etc.) is realistically not feasible (or prohibitively costly).

4.3.6 Myopic Choice of Effort and Two Assumptions

Consider the choice of effort by an office-holder who is in power for one period only, and believes he is high-ability with probability ρ. This office-holder solves the prob-

[30]The assumption that labour contracts are incomplete for precisely the assumptions that we are making is standard in the labour economics literature. See, for instance, Macleod and Malcomson (1989) and (1998).

lem[31]

$$v_o(\rho) = \max_e \left\{ \begin{array}{c} \rho[\mu(\theta_H + e) + (1-\mu)\theta_H e] \\ +(1-\rho)\left[\mu(\theta_L + e) + (1-\mu)\theta_L e\right] - c(e) + R \end{array} \right\} \tag{4.4}$$

The first-order condition is

$$\mu + (1-\mu)(\rho\theta_H + (1-\rho)\theta_L) - c'(e) = 0 \tag{4.5}$$

This solves to give $e^*(\rho)$, which we call the *myopic optimal action* by the office-holder, given a belief that he is competent with probability ρ. Note that if If $\mu = 1$, $e^*(\rho) \equiv e^*$, for all ρ.

Finally, we can define the utility of the non-office-holding citizen when both the citizen and the office-holder believe the office-holder to be competent with probability ρ;

$$v_c(\rho) = \rho[\mu(\theta_H + e^*(\rho)) + (1-\mu)\theta_H e^*(\rho)] + (1-\rho)\left[\mu(\theta_L + e^*(\rho)) + (1-\mu)\theta_L e^*(\rho)\right] \tag{4.6}$$

Some useful properties of e^* and the associated value functions v_o, v_c are the following. First, it is clear from the first-order condition (4.5) that

$$\frac{\partial e^*}{\partial \rho} = \frac{(1-\mu)(\theta_H - \theta_L)}{c''(e^*)} \tag{4.7}$$

So, e^* is independent of ρ if the technology is purely additive and strictly increasing in ρ otherwise.

Second, by direct application of the envelope theorem to (4.4), we have

$$v_o'(\rho) = \mu(\theta_H - \theta_L) + (1-\mu)(\theta_H - \theta_L)e^*(\rho) \tag{4.8}$$

[31] Throughout this chapter, we shall use a subscript "o" to refer to the office-holder, and a subscript "c" to refer to citizens.

so v_o is strictly increasing in ρ. By inspection of (4.7), v_c is also strictly increasing in ρ. Moreover, as $R > 0$, and by the properties of c, $v_o(\rho) > 0$, and by inspection, $v_c(\rho) > 0$.

We can now state and discuss the only two assumptions that we require. The first says that the ego-rent from office is high enough that a low-type prefers to take office, even if he is sure that he is displacing a high-type:

Assumption 4.1. $R > \max\{c(e^*(0)) + v_c(1) - v_c(0),\ c(e^*(1))\}$.

The second assumption ensures that candidate entry costs are low enough so that *some* agent will stand for election, and high enough to deter *all* agents from standing for election:

Assumption 4.2. $\frac{1}{n}v_o(1) < \delta < v_o(1)$

4.4 Equilibrium with Full Information

4.4.1 Appointment of a Bureaucrat

In this case, the optimization problem of a type i policy maker over the two-period time horizon can be considered as two one period or myopic problems, as there is no state variable. So, by the analysis of Section 4.3.7, a high-type bureaucrat chooses action $e^*(1)$, and has utility $v_o(1)$, and a low-type appointed bureaucrat chooses action $e^*(0)$, and has utility $v_o(0)$. If the bureaucrat does not take office in any period, the public good is not supplied, and so the dictator's payoff is zero. So, the individual rationality condition that ensures that the bureaucrat prefers to take office is $v_o(1), v_o(0) \geq 0$, which certainly holds.

4.4.2 Partial Democracy (Democracy with Exogenous Entry)

In this case, we have a multi-stage game rather than a decision problem. We solve for the unique subgame-perfect equilibrium. At the second period, if elected, a citizen $i \in N$ with ability $a_i \in \{\theta_H, \theta_L\}$ will solve the same optimization problem as the appointed bureaucrat and a high-type office-holder chooses action $e_2 = e^*(1)$, and has utility $v_o(1)$, and a low-type office-holder chooses action $e_2 = e^*(0)$, and has utility $v_o(0)$.

The expected payoff to any citizen (except i) if citizen i wins the election is $v_c(1)$ if i is a high-type, and $v_c(0)$ if i is a low-type. So, moving back to the stage of the election, if the incumbent and the opposer have different abilities, the one with the higher θ will be elected. If the incumbent and the opposer have the same abilities, the one with the higher "looks" characteristic is elected. Finally, in the first period, it is clear that the randomly selected office-holder i will behave myopically (as his first-period action cannot affect the second-period equilibrium).

The individual rationality conditions are the following. First, consider the second period. The first case is where both incumbent and opposer are of the same ability type. In this case, if both are high-types, the gain to winning the election, rather than allowing the other to win, is $v_o(1) - v_c(1) = R - c(e^*(1))$. This is positive by Assumption 4.1. A similar argument shows that both prefer to win if both are low-types.

If the incumbent and opposer are of different ability types, then the one of lower ability will only prefer to win the election if the "net" ego-rent from winning, $R - c(e^*(0))$, exceeds the efficiency loss from him taking office, i.e. $v_c(1) - v_c(0)$. Again, this holds by Assumption 4.1. Finally, in the first period $R > c(e^*(1))$ is enough to ensure that the randomly selected incumbent wishes to take office. Again, this holds by Assumption 4.1.

4.4.3 Representative Democracy (Democracy with Endogenous Entry)

In this case, we have a multi-stage game of a more complex kind, as in this case, citizens must make entry decisions as well as effort decisions. The following result characterizes the unique subgame-perfect equilibrium. Let $N_H = \{i \,|a_i = \theta_H\}$, and $m_H = \max_{i \in N_H}$. We now have the following result. This, and all following results, are proved in Appendix C if a proof is required.

Proposition 4.1. *Assume Assumptions 4.1 and 4.2. The following is the unique subgame-perfect equilibrium of the model in the full information case of democracy with endogenous entry. In period* 1*, only* m_H *stands for election, and is elected. In period* 2*, again only* m_H *stands for election, and is elected. In each period,* m_H *chooses action* $e^*(1)$.

So, endogenous entry is a perfect institutional arrangement for deterring low-ability citizens from standing for election.

4.4.4 Comparing Institutions

First, we can compare the three institutions in terms of equilibrium effort and quality of the office-holder. First, note that generally, the probability that any institution will select a high-type office-holder will depend on $n_H = \#\{i \in N \,|a_i = \theta_H\}$, the number of citizens who are high-type. Of course, ex ante, n_H is a random variable, as it is determined by the realizations of the θ_i. So, when comparing institutions, it is more appropriate to use the expected value of this variable, as, following Buchanan, choice between constitutions should be thought of as taking place behind a Rawlsian "veil of ignorance" (Dixit, 1996).

As n_H is binomially distributed, ($n_H \sim B(n, \rho)$), it is straightforward to calculate[32] that (i) the expected probability that a high-type is in office in either period with appointment is $E(n_H/n) = \rho$; (ii) the expected probability that a high-type is selected for office in the first (respectively second) period with exogenous entry democracy is ρ (respectively $\rho + \rho(1-\rho)$). Of course, the probability that a high-type is selected for office with endogenous entry democracy is unity in both periods. So, we can summarise:

Proposition 4.2. *Assume Assumptions 4.0-4.2. With complete information, actions (conditional on types) are the same with appointment, partial democracy (exogenous candidate entry), and representative democracy (endogenous candidate entry). However, in the appointment case, a high-ability type is selected in both periods with*

[32]The expected value of n_H is $n\rho$, and that of n_H^2 is $n\rho(1-\rho) + n^2\rho^2$. Also, the probability that a citizen selected at random is high-type is n_H/n, and $E(n_H/n) = \rho$. Next, conditional on n_H, the probability that a high-type is selected for office in the second period with exogenous entry democracy is, $\frac{n_H}{n} + (1 - \frac{n_H}{n})\frac{n_H}{n-1}$ the expected value of which, after some calculation, turns out to be $\rho + \rho(1-\rho)$.

expected probability $\rho < 1$, with partial democracy, a high-ability type is selected in the first period with probability ρ and in the second with probability $\rho + \rho(1-\rho)$, and finally with representative democracy, a high-ability type is selected in both periods with probability 1.

4.5 Equilibrium with Symmetric Incomplete Information

In this section, we assume that citizens do not know their own types nor anybody else's, but all know the joint distribution of types (*symmetric incomplete information*). In a one-period version of this model, this deviation from full information would not be very interesting. However, as the model is dynamic, both citizens and the first-period office-holder may learn about the first-period office-holder's type by observing first-period output of the public good. This gives rise to new motives in choosing effort levels, *experimentation* and *career concerns*. In particular, experimentation occurs when the office-holder adjusts his first-period action away from the myopically optimal level in order to increase the informativeness of first-period output. Career concerns arise when an agent (here, the office-holder) exerts effort not just to maximize current utility but also to affect the perception that the principal (here, the voters) has regarding the agent's ability.[33] Experimentation occurs with all three institutional forms, but career concerns effects occur only with democracy.

[33]In a more standard labour market, this perception influences the agent's future labour market performance (e.g. promotions, wage increases, etc.). Here, this perception influences the agent's chance of retaining office.

4.5.1 Appointment of a Bureaucrat

We solve the appointee's decision problem with the usual dynamic programming approach. In the second period, the appointed bureaucrat faces a myopic problem, so chooses $e_2 = e^*(\hat{\rho})$ where $\hat{\rho}$ is the bureaucrat's posterior belief that he is a high-ability type. The individual rationality condition for the appointee is that $v_o(\hat{\rho}) \geq 0$ which is always satisfied.

Now, note from (4.8) above that as long as the technology has a multiplicative component, i.e. $\mu < 1$, his second-period payoff is strictly convex in $\hat{\rho}$;

$$v_o''(\hat{\rho}) = (1-\mu)(\theta_H - \theta_L)\frac{\partial e^*}{\partial \hat{\rho}} > 0 \tag{4.9}$$

This means that information about $a \in \{\theta_H, \theta_L\}$ obtained by Bayesian updating is *strictly valuable.* Now when updating, the bureaucrat can observe both his own output of the public good in the first period, g_1, and his action in the first period, e_1. So, from Bayes' rule, the bureaucrat's posterior belief that he is a high-type is

$$\hat{\rho}(e_1, g_1) = \Pr(a = \theta_H \mid e_1, g_1) = \frac{\rho}{\rho + (1-\rho)\, f_L(g_1, e_1)/f_H(g_1, e_1)} \tag{4.10}$$

where we have used the definitions

$$f_H(g_1, e_1) = f\left(g_1 - (1-\mu)\theta_H e_1 - \mu(\theta_H + e_1)\right), \tag{4.11}$$

$$f_L(g_1, e_1) = f\left(g_1 - (1-\mu)\theta_L e_1 - \mu(\theta_L + e_1)\right) \tag{4.12}$$

Note from (4.10) that *changes in actions are informative*, i.e. a change in e_1 affects the posterior probability that the office-holder is competent, given output $(\partial\hat{\rho}(g_1, e_1)/\partial e_1 \neq 0)$. So, the two well-known[34] conditions for optimal experimentation are satisfied in

[34] See, for instance, Proposition 1 of Mirman, Samuelson and Urbano (1993).

our model, i.e. the bureaucrat has an incentive to deviate from the myopic effort level in the first period.

Now we go to the first-period problem for the bureaucrat. Note that for a given value of e_1, g_1 is a random variable with distribution function

$$\begin{aligned} H(g_1, e_1) &= \rho F(g_1 - (1-\mu)\theta_H e_1 - \mu(\theta_H + e_1)) + \\ & (1-\rho)F((g_1 - (1-\mu)\theta_L e_1 - \mu(\theta_L + e_1)) \end{aligned} \tag{4.13}$$

Consequently, $\hat{\rho}(g_1, e_1)$ is also a random variable, conditional on e_1, implying an expected optimized second-period payoff of $E_{g_1}[v_o(\hat{\rho}(e_1, g_1))]$. So, the problem for the appointee in the first period is

$$\max_{e_1} \left\{ \begin{array}{c} \rho[\mu(\theta_H + e_1) + (1-\mu)\theta_H e_1] + (1-\rho)[\mu(\theta_L + e_1) + (1-\mu)\theta_L e_1] \\ +E_{g_1}[v_o(\hat{\rho}(e_1, g_1))] - c(e_1) + R \end{array} \right\} \tag{4.14}$$

The first-order condition can be written

$$[\mu + (1-\mu)(\rho\theta_H + (1-\rho)\theta_L)] + \frac{\partial E_{g_1}[v_o(\hat{\rho}(e_1, g_1))]}{\partial e_1} = c'(e_1) \tag{4.15}$$

The first term in the square brackets on the left-hand side is the first-period (myopic) gain from a small increase in effort. The second term on the left-hand side is the marginal experimentation benefit or cost from changing e_1 from its myopic level $e^*(\rho)$. Let the value of e_1 that solves (4.15) be e_1^A.

The question is now: what sign is the marginal experimentation term? Following the proof of Lemma 2 of Mirman, Samuelson and Urbano (1993) it is possible to show (derivation relegated to Appendix C.3.1) that

$$\frac{\partial E_{g_1}[v_o(\hat{\rho}(e_1, g_1))]}{\partial e_1} = \rho(1-\mu)(\theta_H - \theta_L)\int_{-\infty}^{+\infty} v_o''(1-\hat{\rho})\frac{d\hat{\rho}}{dg_1} f_H(g_1, e_1)\, dg_1 \tag{4.16}$$

Now, from (4.9), $v_o'' > 0$ as long as $\mu < 1$, and

$$\frac{d\hat{\rho}}{dg_1} = \frac{\rho(1-\rho)}{\left[\rho f_H + (1-\rho) f_L\right]^2}\left(f_L f_H' - f_L' f_H\right) > 0 \tag{4.17}$$

from the MLRC. So, we see that

$$\frac{\partial E_{g_1}[v_o(\hat{\rho}(e_1, g_1))]}{\partial e_1} > 0 \text{ if } \mu < 1$$

i.e. that the experimentation term is strictly positive iff the technology is partly multiplicative. So, the following result is immediate from the previous discussion and the strict concavity of $c(.)$:

Proposition 4.3. (Appointment) *In the second period, the appointed bureaucrat chooses the myopic level of effort $e^*(\hat{\rho})$, conditional on her posterior belief. In the first period, the bureaucrat will choose to experiment by choosing a higher effort than the myopic one, $e_1^A > e^*(\rho)$, unless the technology is purely additive ($\mu = 1$), in which case $e_1^A = e^*(\rho)$.*

4.5.2 Partial Democracy (Exogenous Candidate Entry)

This case is more complex, as we have a game of incomplete information, where there is both experimentation (unless the technology is additive) *and* a career concerns (or tournament) effect. We characterise the perfect Bayesian equilibria (PBE) of this game, which turn out to be unique[35] except that (possibly) the incumbent may choose multiple actions in period 1. Suppose first that the challenger to the incumbent, $j \in N$, is elected. His choice of action is $e_{j,2} = e^*(\rho)$, because he has no additional

[35] Sufficient conditions for uniqueness are derived below.

information about his own competence. So, the expected utility to any member $i \neq j$ of the electorate from the opponent is $v_c(\rho)$.

Now, at the time the electorate votes, every citizen has had the chance to observe g_1, first-period public good provision. Let $\hat{\rho}$ be the updated belief on the part of the electorate, having observed g_1, that the incumbent is a high-type. Now, when forming the posterior $\hat{\rho}$, citizens rationally deduce that in the first period, the incumbent has taken equilibrium action e_1^*. So, their posterior probability that the incumbent is competent is

$$\hat{\rho}^c(g_1) = \frac{\rho}{\rho + (1-\rho)\left[f_L\left(g_1, e_1^*\right)/f_H\left(g_1, e_1^*\right)\right]} \tag{4.18}$$

Note that we superscript $\hat{\rho}^c(g_1)$ to distinguish it from the incumbent's *own* posterior, which is defined in (4.10). However, note that in equilibrium, $\hat{\rho}^c(g_1) = \hat{\rho}(g_1, e_1^*)$.

Then the expected utility that citizens can expect from the incumbent is $v_c(\hat{\rho}^c(g_1))$. So, given the tie-breaking rule, all the citizens (apart possibly from the opponent), will vote for the incumbent when $v_c(\hat{\rho}^c(g_1)) \geq v_c(\rho)$. As v_c is strictly increasing in its argument, this is equivalent to $\hat{\rho}^c(g_1) \geq \rho$. From (4.17), (4.18), $\hat{\rho}^c(g_1)$ is strictly increasing in g_1. Moreover, from this fact and Assumption 4.0, there exists a unique critical value $\tilde{g}_1$ such that $\hat{\rho}^c(\tilde{g}_1) = \rho$, with $\hat{\rho} > \rho$ for $g_1 > \tilde{g}_1$, and $\hat{\rho} < \rho$ for $g_1 < \tilde{g}_1$. The conclusion is that all voters (except the incumbent) follow the following cutoff rule: *vote for the incumbent iff $g_1 \geq \tilde{g}_1$, and for the opponent if $g_1 < \tilde{g}_1$*. As there are at least three voters by assumption, this cutoff rule determines the outcome of the election, i.e. how the incumbent votes is irrelevant.

It remains to check that it is individually rational for both the incumbent and opponent to stand for election in this case. The net gain to winning the election for the incumbent is

$$\begin{aligned} \phi(\hat{\rho}^c(g_1)) &= v_o(\hat{\rho}^c(g_1)) - v_c(\rho) \\ &= [v_c(\hat{\rho}^c(g_1)) - v_c(\rho)] + [R - c(e(\hat{\rho}^c(g_1))] \end{aligned} \tag{4.19}$$

where, in the second line, the first term in (4.19) is the net efficiency gain to the incumbent given that he wins rather than the opponent, and the second is the net ego-rent from holding office. By Assumption 4.1, this is unambiguously positive. A similar argument implies that the opponent also wishes to hold office. Alternatively, looking at the first line of (4.19), the individual rationality condition requires that $\phi(\hat{\rho}^c(g_1)) \geq 0$, $\hat{\rho}^c(g_1) \geq \rho$. But from (4.19), $\phi'(\hat{\rho}^c(g_1)) = v_o'(\hat{\rho}^c(g_1)) > 0$ from Section 4.3.6. So, we only need that $\phi(\rho) \geq 0$. But by definition, $\phi(\rho) = R - c(e^*(\rho))$, and from Assumption 4.1, this is unambiguously positive.

So, in view of the preceding discussion, we can write the second-period equilibrium continuation payoff of the incumbent conditional on g_1, e_1 as:

$$w(g_1, e_1) = \begin{cases} v_o(\hat{\rho}(g_1, e_1)), & \text{if } g_1 \geq \tilde{g}_1 \\ v_c(\rho), & \text{if } g_1 < \tilde{g}_1 \end{cases} \tag{4.20}$$

So, the expected second-period continuation payoff of the incumbent, conditional on first-period effort only, is

$$\begin{aligned} E_{g_1}\left[w\left(\hat{\rho}\left(g_1, e_1\right)\right)\right] &= v_c(\rho) H\left(\tilde{g}_1, e_1\right) \\ &+ \int_{\tilde{g}_1}^{+\infty} v_o(\hat{\rho}(g_1, e_1)) h\left(g_1, e_1\right) dg_1 \end{aligned} \tag{4.21}$$

where $h\left(g_1, e_1\right) = \rho f_H + (1-\rho) f_L$ is the density of H from (4.13).

Now consider the choice of first-period action for the incumbent, given his continuation payoff (4.21). This must solve:

$$u_1 = \max_{e_1} E_{g_1} \left\{ \begin{array}{c} \rho[\mu(\theta_H + e_1) + (1-\mu)\theta_H e_1] + (1-\rho)\left[\mu(\theta_L + e_1) + (1-\mu)\theta_L e_1\right] \\ -c\left(e_1\right) + R + E_{g_1}[w(\hat{\rho}(e_1, g_1))] \end{array} \right\} \tag{4.22}$$

The first-order condition can be written as

$$\mu + (1-\mu)(\rho\theta_H + (1-\rho)\,\theta_L) + \frac{\partial E_{g_1}[w(\hat{\rho}(e_1, g_1))]}{\partial e_1} = c'\left(e_1\right) \tag{4.23}$$

After some manipulation, the third term on the left-hand side, evaluated at e_1^*, is given by (derivation available in Appendix C.3.2)

$$\begin{aligned} \frac{\partial E_{g_1}[w(\hat{\rho}(e_1, g_1))]}{\partial e_1}\Big|_{e_1^*} &= \rho\left(1-\mu\right)\left(\theta_H - \theta_L\right)\int_{\tilde{g}_1}^{+\infty} v_o'' \frac{d\hat{\rho}}{dg_1}\left(1-\hat{\rho}\right) f_H\left(g_1, e_1^*\right) dg_1 \\ &\quad + \rho\left(1-\rho\right)\left(1-\mu\right) v_o'\left(\rho\right) f_H\left(\tilde{g}_1, e_1^*\right) \\ &\quad + \left[R - c\left(e^*\left(\rho\right)\right)\right]\left(-\frac{\partial H(\tilde{g}_1, e_1)}{\partial e_1}\right) \end{aligned} \tag{4.24}$$

where

$$-\frac{\partial H(\tilde{g}_1, e_1)}{\partial e_1} = \rho\left[\mu + (1-\mu)\,\theta_H\right] f_H\left(\tilde{g}_1, e_1^*\right) + (1-\rho)\left[\mu + (1-\mu)\,\theta_L\right] f_L\left(\tilde{g}_1, e_1^*\right) > 0 \tag{4.25}$$

The first term on the right-hand side represents the "*experimentation*" effect that we encountered in the appointment case. However, in this case it is clear by inspection that the incentive to experiment is unambiguously smaller than in the appointment case. The intuition is that the democratically elected office-holder only reaps the benefits of experimentation in the event that she is re-elected, which occurs with probability less than one. The second term $\rho\left(1-\rho\right)\left(1-\mu\right) v_o'\left(\rho\right) f_H\left(\tilde{g}_1\right)$, which is positive, is an additional incentive to experiment.

More importantly, the last term in (4.24) is a new effect which we call the "*career concerns*" (or "tournament") effect, and is the product of two terms. The first,

$R - c(e^*(\rho))$ is the net gain, or "prize" to winning the election when $\hat{\rho} = \rho$. This term can be related to the tournament literature (Lazear and Rosen, 1981). There, the motivation for effort is to gain the first prize instead of the second prize. Here, the first prize for the incumbent is taking office (with payoff $v_o(\rho)$) and second prize is losing the election in which case the opponent wins, giving the incumbent $v_c(\rho)$. Of course, $v_o(\rho) - v_c(\rho) = R - c(e^*(\rho))$. Therefore, as in the tournament literature, a policy maker's effort depends on the *spread* between winning and losing prizes. The second term, $-\frac{\partial H}{\partial e_1}$, is the increased probability of winning the "prize" due to a small increment in effort. So, this last term in (4.24) represents the marginal extra effort that the incumbent office-holder is willing to supply in order to win the election. Note that the last term is always strictly positive by Assumption 4.1.

Let the level of action that solves (4.23) be denoted e_1^{PD} for partial democracy (we shall denote equilibrium effort levels in the representative democracy case by RD). As the career concerns effect is always positive, then $e_1^{PD} > e^*(\rho)$. Then we can summarise:

Proposition 4.4.(Partial Democracy) *In the second period, the elected official chooses the myopic level of effort $e^*(\hat{\rho})$, conditional on her posterior belief. In the first period, the official will choose a higher effort than the myopic one, $e_1^{PD} > e^*(\rho)$, even if the technology is purely additive ($\mu = 1$).*

Because this is an equilibrium action in a game, we cannot be sure that it is unique. Indeed in their analysis of career concerns in the labour market for bureaucrats, Dewatripont, Jewitt and Tirole showed that in the Normal-quadratic version of the model (ε Normally distributed, $c(.)$ quadratic) if the technology is sufficiently multiplicative, there are multiple (two) equilibrium action levels, but if the technology is additive, the equilibrium action is unique. We are also able to show that in the Normal-quadratic case, if the technology is additive, the equilibrium action is unique.

In our model, in the additive case, from (4.24), we get

$$1 + \left[\rho f_H\left(\tilde{g}_1, e_1^{PD}\right) + (1-\rho) f_L\left(\tilde{g}_1, e_1^{PD}\right)\right](R - c(e^*)) = c'(e_1^{PD}) \tag{4.26}$$

where e^* is the myopic optimal action in period 2 (independent of $\hat{\rho}$). So, as $c'' > 0$, and $c'(0) < 1$, a sufficient condition for uniqueness is that left-hand side of (4.26), viewed as a function of e_1, is decreasing for all $e_1 \leq e_1^{PD}$. But for this, it is sufficient that $f'_H\left(\tilde{g}_1, e_1^{PD}\right), f'_L\left(\tilde{g}_1, e_1^{PD}\right) \geq 0,\ \ e_1 \leq e_1^{PD}$, or, more explicitly

$$f'(x) \geq 0, \quad x \leq \tilde{g}_1 - \theta_L - e_1^{PD} \tag{4.27}$$

This condition will be useful in what follows. We are also able to show that in the Normal-quadratic case, if the technology is additive, the equilibrium action is unique (see Appendix C.2).

Moreover, simulations reported in Appendix C.2, show that for a range of parameter values, the equilibrium action is unique even when technology is almost completely multiplicative ($\mu \simeq 0$). So, when comparing institutions in Section 4.5.4, we will assume that e_1^{PD} is unique.

4.5.3 Representative Democracy (Endogenous Candidate Entry)

Again, here we are interested in locating the perfect Bayesian equilibrium of the model. Here, as entry is endogenous, voters' off-the-equilibrium path beliefs about the types of citizens who do not enter in equilibrium are important. We will assume that at all information sets where k has entered, all $j \neq k$ believe that k is high-ability with probability ρ, *except* where k is the incumbent (i.e. was elected in the previous period). Given that every citizen who is not the incumbent believes himself to be high-ability with probability ρ, these seem the only reasonable off-the-equilibrium path beliefs.

Next, let e_1^{RD} (RD stands for Representative Democracy) be the solution to (4.23) above, but where the ego rent R is replaced by $R - \delta$, the "net ego rent", i.e. net of the cost of standing for election. Again, we will assume e_1^{RD} unique, which as argued above, is a weak restriction in the Normal-quadratic case. The interpretation of e_1^{RD} is that it is the first-period effort chosen by an incumbent with endogenous entry. Then it is clear that $e_1^{RD} < e_1^{PD}$, as in the endogenous entry case, the "prize" for winning the election is reduced by the amount of the entry cost.

We then have the following result:

Proposition 4.5. (Representative Democracy) *Assume Assumptions 4.0-4.2. Then, with symmetric incomplete information, there is a unique PBE with the following structure. In period* 1, *only* $i = n$ *stands for election and is elected. He chooses effort level* e_1^{PD}. *In period* 2, *if* $g_1 \geq \tilde{g}_1$, *only* $i = n$ *stands for election and is elected. He chooses effort level* $e^*(\hat{\rho}(g_1, e_1^*))$. *If* $g_1 < \tilde{g}_1$, *only* $i = n - 1$ *stands for election and is elected. He chooses effort* $e^*(\rho)$.

The intuition is that given that citizens do not know their own types, no citizen runs for election on the basis of her superior ability in the first period. Only the citizen with the best "look" stands for election and is elected: non-economic variables decide which citizen becomes candidate and office-holder in the first period. In the second period, the incumbent is re-elected if his track record is sufficiently good, and anticipating this, he stands. On the other hand, if his track record is weak, he does not bother to stand (rationally anticipating defeat if he does), thus allowing the remaining citizen with the best "look" to stand and win.

Note, however, that once in office in the first period, the incumbent's choice of effort is *exactly the same* (modulo the fact that δ reduces the ego-rent) as in the simpler case of democracy with exogenous candidate entry. So, our results are robust to the introduction of endogenous candidate entry.[36]

4.5.4 Comparing Institutions

We can now turn to one of the main results of this chapter, namely that the conclusion that the cutoff rule *always* motivates the office-holder to supply more effort, or extract less rent is not robust (c.f. point (ii) of the Introduction). In this section, we first show why there is a possibility that this conclusion will not hold.[37] We show this by comparing effort levels under appointment and democracy (whether partial or representative). In the final period, conditional on posterior belief about type, the same (inefficiently low) effort level occurs under all three institutions. The interesting comparison is therefore in the first period. Here, it is instructive to compare the incentive to raise the effort level above the myopic optimum in the representative

[36]As shown later in this chapter (and further examined in Chapter 5) the result that partial democracy and representative democracy lead the same qualitative results need not be the case under an asymmetric information structure. This difference between the two regime has not been investigate in the political agency literature.

[37]The proof that democracy can be less efficient than appointment in inducing effort from the office-holder is left for Section 4.7 (Normative Analysis section).

democracy case and the appointment case. The difference between this incentive is

$$\begin{aligned}\Delta &= [R-\delta-c\left(e^{*}\left(\rho\right)\right)]\left(-\frac{\partial H(\tilde{g}_1,e_1)}{\partial e_1}\right) \\ &+\left[\begin{array}{c}\rho\left(1-\rho\right)\left(1-\mu\right)v_o'\left(\rho\right)f_H\left(\tilde{g}_1,e_1^{*}\right) \\ -\rho\left(1-\mu\right)\left(\theta_H-\theta_L\right)\int_{-\infty}^{\tilde{g}_1}v_o''\frac{d\hat{\rho}}{dg_1}\left(1-\hat{\rho}\right)f_H\left(g_1,e_1^{*}\right)dg_1\end{array}\right]\end{aligned} \tag{4.28}$$

Again assuming uniqueness of e_1^{RD}, by the convexity of $c(.)$, $e_1^{RD} > e_1^A$ if and only if $\Delta > 0$.

Now, the first term in Δ is the "career concerns" term, and is positive. The second term in square brackets is the additional incentive for experimentation in the democratic case. Although it is not analytically possible to sign Δ in general, it is clear that when the technology is (approximately) linear i.e. $\mu \simeq 1$, the second term is zero (experimentation has no value), and so $\Delta > 0$ overall, implying $e_1^{RD} > e_1^A$ the conventional result that elections motivate office-holders (this effect means that the electorate can maintain *control* of politicians once in office; Barro (1973) and Ferejohn (1986)). Illustrative calculations in row 1 of Table 4.1 show that when the variance of ε is high, the career concerns effect on effort may be large.

Our main focus of interest is to establish conditions under which elections may *demotivate.* Inspection of (4.28) indicates that this is likely to occur when the net ego-rent from office, $R - \delta - c(e^*(\rho))$ is close to zero. In this case, using in the Normal-quadratic case, simulation results reported in Appendix $C.2$ show that it is possible that $\Delta < 0$ when $\theta_H - \theta_L$ is sufficiently large. In this case, there is (approximately) no "career concerns" effect under democracy, so that as long as there is more incentive to experiment with appointment, we will have $\Delta < 0$ and hence $e_1^{RD} < e_1^A$. For the Normal-quadratic case, simulation results reported in column 1 of Table 4.1 below show that this can easily happen, and the demotivating effect of elections is larger, the more multiplicative the technology is. A natural way to measure this is in terms of the increase relative to the myopic level of effort induced by either arrangement. When $\mu = 0.75$, $(e_1^{RD} - e^*(\rho))/(e_1^A - e^*(\rho)) \simeq 1$, but when $\mu = 0$, $(e_1^{RD} - e^*(\rho))/(e_1^A - e^*(\rho)) \simeq 5/8$. Table 4.1 also shows that it is possible that $\Delta < 0$ when $\theta_H - \theta_L$ is sufficiently large. In this case, information about θ is valuable, so the bureaucrat's incentive to experiment is strong, and is much diminished by an electoral constraint.

Table 4.1 Equilibrium Effort Levels e_1^A, e_1^{RD} in the Normal-Quadratic Case

$\backslash \quad R - \delta - c(e^*(\rho))$:	$\simeq 0$	50	100	$e^*(\rho)$
μ :				
1.00	1.00, 1.00	1.00, 1.20	1.00, 1.40	1.00
0.75	4.05, 4.03	4.05, 4.81	4.05, 5.58	4.00
0.50	7.69, 7.41	7.69, 8.61	7.69, 9.71	7.00
0.25	12.08, 11.22	12.08, 12.19	12.08, 13.00	10.00
0.00	15.00, 14.25	15.00, 14.69	15.00, 15.07	13.00
$\theta_H - \theta_L$:				
0.5	1.1250, 1.1253	1.1250, 1.35	1.1250, 1.57	1.1250
10	3.51, 3.52	3.51, 4.21	3.51, 4.91	3.50
20	6.34, 6.21	6.34, 7.33	6.34, 8.39	6.00
50	15.05, 14.43	15.05, 14.75	15.05, 15.03	13.5

Notes: When μ is variable, other parameters are: $\rho = 0.5$, $\theta_H = 25$, $\theta_L = 1$, $\sigma = 100$. When $\theta_H - \theta_L$ is variable, other parameters are: $\rho = 0.5$, $\mu = 0.5$, $\sigma = 100$.

Next, consider the expected probability (taken with respect to $a_1 \in \{\theta_H, \theta_L\}, ..., a_n \in \{\theta_H, \theta_L\}$) that the office-holder is a high-type, under any institutional arrangement. As in the full information case, the expected probability that the office-holder in either period is high-type under appointment is ρ, as is the probability that the office-holder is high-type in the first period, with democracy. In the second period, the expected probability that the office-holder is high-type is

$$\Pr(a_i = \theta_H \,|g_1 \geq \widetilde{g}_1)(1 - H(\widetilde{g}_1, e_1^*)) + \rho H(\widetilde{g}_1, e_1^*) = \widetilde{\rho} > \rho$$

So, we can summarise the discussion as follows:

Proposition 4.6. *With symmetric incomplete information, the same (myopic) level of effort is chosen in all cases in the second period. In the first period, assuming a unique solution to (4.23), the effort level is lower with representative democracy than with partial democracy ($e_1^{RD} < e_1^{PD}$). This level, e_1^{RD}, will be higher than in the appointment case, e_1^A, if the technology is linear (in which case there is no motive for experimentation), but it can be lower than in the appointment case if the "prize" $R - \delta - c(e^*(\rho))$ is approximately zero and $\theta_H - \theta_L$ is sufficiently large.*

With appointment, a high-ability type is selected in both periods with expected probability $\rho < 1$. In both democratic cases, a high-ability type is selected in the first period with probability ρ and in the second with probability $\widetilde{\rho} > \rho$.

This raises the possibility that democracy need not be more "efficient" than appointment, as the former, while undoubtedly raising the average quality of the second-period office-holder, may lower effort (relative to appointment). This is investigated further in Section 4.7 below.

4.6 Equilibrium with Asymmetric Information

We now turn to the case where the competency variable θ_i is private information to citizen i. This is related to the set-up of Rogoff and Sibert (1988) and especially

Rogoff (1990) - a major difference with these models is that they do not incorporate a moral hazard problem since no effort has to be supplied by the office-holder. In these papers, office-holders have full control over g (*i.e.* in our notation, $\varepsilon = 0$), and effort is analogous to unobservable seigniorage (Rogoff and Sibert, 1988)) or public investment (Rogoff, 1990). In this case, in equilibrium, the high-ability type will "separate" from the low-ability type, i.e. produce a different level of the public good, thus perfectly signalling his type to the electorate. Signalling requires him to produce more than the myopic level of the public good, while the low-ability type just produces the myopically optimal level.

By contrast, we will find that - in the case with exogenous entry - both high and low-types will choose higher effort than the myopic optimum, due to career concerns considerations. Interestingly, when we allow endogenous candidate entry both "revealing" and "non revealing" equilibria at the candidate entry stage are possible, so that career concerns does not necessarily occur. Entry is not present in the RPBC literature so that only non revealing (distortionary) equilibria are possible.

A more directly related strand of literature is the one following from Ferejohn's (1986) article. In particular, our model is closely related to Banks and Sundaram (1998). This latter model features asymmetric information between a principal (e.g. voters) and his agent (e.g. incumbent politician). As in our model, agents differ in ability and, once in office, need to supply effort to increase the utility of the principal (Banks and Sundaram consider the case of a multiplicative technology between ability and effort - as we do). The major difference between Banks and Sundaram (1998) and our model of this Section 4.6 is that Banks and Sundaram limit their investigation to the regime where the agent is exogenously given at the beginning of the game and his opponent is randomly drawn (partial democracy case). Under this regime, they show that a *cutoff strategy*[38] *for the principal is an optimal retention strategy* (conclusion (iii) of the literature mentioned in the Introduction). We shall prove in this section that this strategy need not be an optimal mechanism any more once we abandon the unrealistic assumption that office-holders are exogenously selected, and instead consider a representative democracy regime.

4.6.1 Appointment

In this case, the analysis is identical to that in the complete information case, as the office-holder has no reason to signal his ability.

4.6.2 Partial Democracy

In this case, we have a multi-stage game rather than a decision problem. We solve for the unique subgame-perfect equilibrium. At the second period, if elected, a citizen $i \in N$ will choose $e_2 = e^*(a_i)$, $a_i \in \{\theta_H, \theta_L\}$. So, the expected payoff to any citizen[39] (except i) if citizen i wins the election is $v_c(a_i)$.

Now consider the election stage. Let the incumbent and the opposer be i, j respectively. If the opposer wins, citizens $k \neq j$ have play-offs

$$\tilde{v}_c(\rho) = \rho v_c(\theta_H) + (1-\rho)\, v_c(\theta_L) \tag{4.29}$$

Now, if a citizen observes output g_1 by the incumbent and rationally anticipates equilibrium actions $e_1^*(\theta_L)$, $e_1^*(\theta_H)$ in the first period, his posterior belief that the

[38] i.e. the incumbent keeps is job provided observable performance is above a cutoff value.

[39] For this to be an equilibrium, it must also be the case that the citizen i who is elected prefers to be a producer rather than have no public good provided, but this follows directly from $v_o(x_i) \geq 0$.

incumbent is competent is

$$\hat{\rho}^c(g_1) = \frac{\rho}{\rho + (1-\rho)\left[f_L(g_1, e_1^*(\theta_L)) / f_H(g_1, e_1^*(\theta_H))\right]} \tag{4.30}$$

Note here that (4.30) differs from (4.10) in that in this case, the incumbent can condition her first-period effort level on her type ($e_1^*(a_i)$ is the equilibrium effort level of type i given his known ability $a \in \{\theta_H, \theta_L\}$).

If the incumbent wins, citizens $k \neq i$ have play-offs $\tilde{v}_c(\hat{\rho}^c(g_1))$. Assume, without loss of generality, that $i > j$. So, all citizens $k \neq i, j$ will vote for i if and only if $\tilde{v}_c(\hat{\rho}^c(g_1)) \geq \tilde{v}_c(\rho)$, which in turns holds if and only if $\hat{\rho}^c(g_1) \geq \rho$. So, by the arguments of the previous section, there exists a unique $\tilde{g}_1$ such that i is re-elected if and only if $g_1 \geq \tilde{g}_1$.

We now confirm that the incumbent i prefers to be re-elected rather than lose to the opponent. His payoff if re-elected is $v_o(a_i)$, and his payoff if not re-elected is $\tilde{v}_c(\rho)$. As $v_o(\theta_H) > v_o(\theta_L)$, we require

$$v_o(\theta_L) = v_c(\theta_L) + R - c(e^*(\theta_L)) > \rho v_c(\theta_H) + (1-\rho)\, v_c(\theta_L) \tag{4.31}$$

which clearly holds by Assumption 4.1. We also confirm that the opponent j prefers to be elected rather than lose to the incumbent when $g_1 < \tilde{g}_1$. If he wins, he gets $v_o(a_j)$, and if he loses he gets $\tilde{v}_c(\hat{\rho}^c(g_1))$. When $g_1 < \tilde{g}_1$, $\hat{\rho} < \rho$, so it is certainly sufficient that (4.31) also holds for the opponent.

Now, the payoff of incumbent i at the beginning of period 2 can be written as

$$w(a_i) = \begin{cases} v_o(a_i), & \text{if } g_1 \geq \tilde{g}_1 \\ \tilde{v}_c(\rho), & \text{if } g_1 < \tilde{g}_1 \end{cases} \tag{4.32}$$

So,

$$E_{g_1}[w(a_i)] = \begin{cases} F_H(\tilde{g}_1, e_1)\,\tilde{v}_c(\rho) + [1 - F_H(\tilde{g}_1, e_1)]\, v_o(\theta_H) & \text{if } a_i = \theta_H \\ F_L(\tilde{g}_1, e_1)\,\tilde{v}_c(\rho) + [1 - F_L(\tilde{g}_1, e_1)]\, v_o(\theta_L) & \text{if } a_i = \theta_L \end{cases} \tag{4.33}$$

where

$$F_k(g_1, e_1) = F\left(g_1 - (1-\mu)\theta_k e_1 - \mu(\theta_k + e_1)\right), \qquad k = H, L \tag{4.34}$$

is the distribution of g_1 conditional on i's action and his type. So, in the first period, incumbent i's problem is to solve

$$\max_{e_1} \left\{ \mu\left(\theta_i + e_1\right) + \left(1-\mu\right)\theta_i e_1 + E_{g_1}\left[w\left(a_i\right)\right] + R - c\left(e_1\right) \right\} \tag{4.35}$$

The first-order condition for effort is

$$\mu + \left(1-\mu\right)\theta_i + \frac{\partial E_{g_1}\left[w\left(a_i\right)\right]}{\partial e_1} = c'\left(e_1\right) \tag{4.36}$$

Now, from (4.33), it is clear that

$$\frac{\partial E_{g_1}\left[w\left(a_i\right)\right]}{\partial e_1} = \begin{cases} f_H\left(\tilde{g}_1, e_1\right)\left(\mu + \left(1-\mu\right)\theta_H\right)\left(v_o(1) - \tilde{v}_c(\rho)\right) & \text{if } a_i = \theta_H \\ f_L\left(\tilde{g}_1, e_1\right)\left(\mu + \left(1-\mu\right)\theta_L\right)\left(v_o(0) - \tilde{v}_c(\rho)\right)) & \text{if } a_i = \theta_L \end{cases} \tag{4.37}$$

which has the following intuitive interpretation: it is the marginal effect of an increase in first-period action on the probability of winning the election (first two terms), times the "prize" for winning (the third term $v_o(a_i) - \tilde{v}_c(\rho)$).[40] In line with our analysis of the case with symmetric information, we call this incentive the *career concerns effect.* By inspection, the career concerns effect is positive. That is, both types have a positive incentive to increase their effort above the myopic level in order to increase the probability of re-election.

Note, however, it is possible to show that at the equilibrium values of e_1 the career concerns effect for the high-ability type is stronger than for the low-ability type. The

[40]Note that this differs from other tournament models (e.g. Lazear and Rosen, 1981) in which the prizes are exogenous.

argument is as follows. First, from the definition of $\widetilde{g}_1$ as solving $\hat{\rho}^c(\widetilde{g}_1) = \rho$, and (4.30), we see that $f_H(\widetilde{g}_1, e_1^*(\theta_H)) = f_L(\widetilde{g}_1, e_1^*(\theta_L))$. So, from (4.37),

$$\begin{aligned} & \frac{\partial E_{g_1}\left[w\left(\theta_H\right)\right]}{\partial e_1}\Big|_{e_1=e_1^*(\theta_H)} - \frac{\partial E_{g_1}\left[w\left(\theta_L\right)\right]}{\partial e_1}\Big|_{e_1=e_1^*(\theta_L)} \qquad (4.38) \\ = \; & f_H(\widetilde{g}_1, e_1^*(\theta_H))\left[(\mu + (1-\mu)\,\theta_H)(v_o(\theta_H) - \tilde{v}_c(\rho)) - (\mu + (1-\mu)\,\theta_L)(v_o(\theta_L) - \tilde{v}_c(\rho))\right] \\ > \; & 0 \end{aligned}$$

where the term in the square brackets is surely positive as $v_o(\theta_H) > v_o(\theta_L)$. It follows directly from this that $e_1^*(\theta_H) > e_1^*(\theta_L)$.

Proposition 4.7. *Assume Assumptions 4.0-4.2. The unique sub-game perfect has the following structure. At time $t = 1$, the randomly drawn office-holder j chooses a higher effort level than the myopic level (because of the career concerns effect), i.e. $e_1^*(a_i) > e^*(a_i)$, $a_i \in \{\theta_H, \theta_L\}$. Also, high-ability office-holders choose a higher effort level than less able incumbents, i.e. $e_1^*(\theta_H) > e_1^*(\theta_L)$. At time $t = 2$, (i) if $g_1 \geq \tilde{g}_1$, the incumbent j is re-elected; (ii) if $g_1 < \tilde{g}_1$, the randomly drawn opponent k is elected. The office-holder $l = j, k$ in $t = 2$ chooses myopic effort $e^*(a_l)$, with $e^*(\theta_H) > e^*(\theta_L)$. These results hold even if the technology is purely additive ($\mu = 1$).*

We can note that our result that both the high and low-ability agents act strategically in equilibrium differs from other asymmetric information political economy models. In Rogoff and Sibert (1988), the lowest type does not signal, and the highest types do not signal much; the highest signalling incentive lies with medium ability agents. In Rogoff (1990), the low-type does not signal, only the high-type does. The results of this section are also related to Banks and Sundaram's (1998) analysis of a principal's optimal retention strategy. As our next section shows, because Banks and Sundaram have a partial equilibrium model (in terms of selection of the agent), we cannot be certain that their "optimal retention strategy" is indeed optimal once we extend the analysis to a representative democracy regime. In fact, depending on parameter values, the next section of our model shows that this will not be the case in numerous cases (In Chapter 5 we will pursue this argument more rigorously).

Finally, in contrast to our findings under symmetric incomplete information, we can note that, under asymmetric information, whether the technology is multiplicative or additive between effort and ability does not affect our qualitative results.

4.6.3 Representative Democracy

In this case, we can show that there are two perfect Bayesian equilibria: one where a citizen of either type may stand for election, and one where only high-ability citizens stand.

Proposition 4.8. (Multiple Equilibria) *Assume Assumptions 4.0-4.2. If $v_o(0) \geq \delta$, then there is a "non revealing" PBE with the following structure. At time $t = 1$, only n stands for election, and at $t = 2$, (i) if $g_1 \geq \tilde{g}_1$, only n stands for election; (ii) if $g_1 < \tilde{g}_1$, only $n-1$ stands for election. The only candidate is elected with probability 1 in each case. The office-holder $l = n$, $n-1$ in $t = 2$ chooses action $e^*(x_l)$, and the office-holder n in $t = 1$ chooses action $e_1^*(x_l)$.*

If $v_o(0) < \delta < v_o(1)$, then there is a "revealing" PBE with the following structure. At $t = 1, 2$, only some $m_t \in N_H = \{i \mid a_i = \theta_H\}$ stands for election. The only candidate is elected with probability 1 in each case. In a revealing equilibrium, the *office-holder m_t chooses action $e^*(1)$ in both periods.*

Note that the "*non-revealing*" equilibrium is consistent with the existing RPBC literature and with models such as Banks and Sundaram (1998) in that, as far as ability is concerned, the candidate is a random draw from the population. In our model, of course, this is *derived as an equilibrium*, rather than assumed.

More interestingly, there is another equilibrium, the "*revealing*" one, where candidate entry is a perfect device for screening out low-ability candidates. This implies that there will be no distortionary signalling activity by the incumbent, in contrast the existing RPBC literature. However, comparing the two equilibria, we see that screening of candidates at the entry stage has two conflicting effects on efficiency. On the one hand, the average quality of the office-holder is higher in the revealing equilibrium. On the other, the first-period effort of the office-holder, conditional on type, is higher in the non-revealing equilibrium.

4.6.4 Comparing Institutions

Given previous results, we can now state:

Proposition 4.9. *Assume Assumptions 4.0-4.2. If a revealing equilibrium occurs with representative democracy, then, conditional on the type of the office-holder, the same level of effort is exercised in the representative democracy and the appointment cases (modulo δ). This level is lower, because of the lack of career concerns, than in the partial democracy case. When a non revealing equilibrium occurs, conditional on* *the type of the office-holder, the same level of effort is exercised in both democratic cases (modulo δ). This level of effort is higher than in the appointment case.*

With appointment, a high-ability type is selected in both periods with probability $\rho < 1$. If a non-revealing equilibrium occurs with representative democracy, a high-ability type is selected in the first period with probability ρ and in the second with probability $\widetilde{\rho} > \rho$ in both democratic cases. When a revealing equilibrium occurs, a high-type is selected with probability 1 in both periods in a representative democracy.

4.7 Normative Analysis

We address two questions here, to what extent are equilibrium outcomes (effort levels and quality of office-holders) with democracy inefficient relative to some benchmark? Second, can a social planner facing the same informational constraints as citizens design institutions that Pareto-dominate democracy? This latter question tackles point (iii) raised in the introduction (i.e. the argument found in the literature[41] that a cutoff rule is an *optimal mechanism* available to voters in order to provide incentives to office-holders).

Following Wittman (1989), Besley and Coate (1998), we study efficiency of democracy in the Pareto sense, rather than relative to some arbitrary social welfare function (e.g. Benthamite) for a social planner.[42]

[41] This claim has recently been made by Banks and Sundaram (1998).

[42] One motivation for this is due to the well known problem of preference aggregation. indeed, in our model, all citizens have identical preferences over outcomes in any period (a choice of office-holder and an effort level for this office-holder). However, as the "good" of office is indivisible, any outcome must be horizontally inequitable, and so the social planner faces the problem of preference aggregation.

An *outcome* here is defined as: (1) a choice of office-holder in each period; and (2) a level of effort by the office-holder in each period, conditional on his information about his type. With symmetric incomplete information, outcomes (1) and (2) are described by Proposition 4.4, and 4.5 for the partial and representative democracy cases respectively.[43] With asymmetric information, outcomes (1) and (2) are described by Propositions 4.7 and 4.8 for the partial and representative democracy cases respectively.[44]

One widely used benchmark is what could be achieved by a social planner with *complete information* (i.e. knowing the ability vector of all citizens $(a_1 \in \{\theta_H, \theta_L\}, ...,$ $\theta_n \in \{\theta_H, \theta_L\})$, and the effort level of the office-holder) who can choose the identity and effort of the office-holder, and a *full set of economic instruments* (i.e. can make unrestricted transfers of some numéraire good between citizens).

Say that democracy with endogenous entry is *unconstrained efficient* if the social planner of this type (the *unconstrained* social planner) cannot choose a feasible outcome that makes every citizen better-off. Assume for convenience that citizen utilities are linear in the numéraire good. As the social planner can make unrestricted transfers between agents, democracy (with or without endogenous entry) is unconstrained efficient if and only if it selects the same conditional actions in each period, and the same choice of office-holder, as does the social planner.

It is then clear that democracy cannot be unconstrained efficient. First, clearly, the social planner will always select a high-type office-holder; if the office-holder i is

[43]Proposition 4.3 describe the outcome for the appointment case under symmetric incomplete information.

[44]Under asymmetric information, for the appointment case, the randomly drawn office-holder has an expected ability of ρ, and for $t = 1, 2$ chooses a myopic effort level, contingent on her ability $(e^* (a), a \in \{\theta_H, \theta_L\})$.

a low-type, all voters, except i are better-off if a high-type is made office-holder, and the gainers can clearly compensate i. Also, as there are n citizens, each of whom gets utility g from a level of the public good g, the social planner will choose e to maximize the expected value of ng minus $c(e)$, conditional on a high-type being in office, i.e. it solves

$$n(\mu + (1-\mu)\theta_H) = c'(e) \tag{4.39}$$

Let the solution to (4.39) be $e^{**}(1)$, consistently with previous notation. Comparing these outcomes to the equilibrium ones that occur either under symmetric incomplete information (Propositions 4.4, and 4.5), or asymmetric information (Propositions 4.7, and 4.8), it is clear that equilibrium outcomes with democracy are *never* unconstrained efficient.

So, not surprisingly, all democratic institutions[45] studied in this chapter are inefficient relative to this benchmark. The weakness of the unconstrained efficiency benchmark is of course that the social planner is given superior information and more economic instruments than the office-holder. Consider now a *constrained* social planner who has the same information as the citizens (i.e. only knows the distribution of $a \in \{\theta_H, \theta_L\}$ initially), and has the same powers as citizens, i.e. can "fire" the incumbent if performance falls below some cutoff value (i.e. no ability to redistribute the numéraire good). Say that democracy (with or without endogenous entry) is *constrained efficient* if this social planner cannot choose a feasible outcome that makes every citizen better off. Constrained efficiency is a much weaker test for any institution. So, another, more appropriate, question to ask is whether a constrained social planner can achieve a better (Pareto-superior) outcome than democracy. We

[45] It is also easy to see that the appointment regime is also never unconstrained efficient.

turn to this issue by first looking at the symmetric incomplete information case, and then by examining the asymmetric information structure.

(i) Symmetric Incomplete Information Case

This is certainly the case with symmetric incomplete information, as it can be shown (Proposition 4.10 below) that the appointment case, i.e. a random selection of office-holder, may Pareto-dominate democracy, and the former is certainly implementable by such a social planner.

We can now turn to the proof that one of the conclusion of the literature (c.f. point (ii) of the Introduction) is not robust. Indeed, it is easy to see that the only feasible actions for the constrained social planner are; (i) random selection of an office-holder in the first period; (ii) replacement of the initial office-holder by another citizen selected at random if the only publicly observable indicator of the incumbent's performance, g_1, falls into some "unacceptable" set U. From the assumption of the MLRC, the social planner can do no better than to set $U = \{g_1 \,|g_1 < g_1^*\}$, i.e. follow a cutoff rule. Obviously, if $g^* = -\infty$, this is simply appointment, and if $g_1^* = \widetilde{g}_1$, democracy. Nevertheless, in the presence of an experimentation motive ($\mu < 1$), *democracy may not even be constrained efficient.* Indeed, we can state:

Proposition 4.10. *Assume Assumptions 4.0-4.2. With symmetric incomplete information, democracy (with or without endogenous candidate entry) is constrained efficient if the technology is additive ($\mu = 1$) and in addition (i) the sufficient condition (4.27) for uniqueness of e_1^{PD} holds; (ii) $R > c(e^*) + \rho(\theta_H - \theta_L)$. However, with (partly) multiplicative technology ($\mu < 1$), there are parameter values for which* *"appointment ", i.e.* $g_1^* = -\infty$*, may Pareto-dominate democracy, in which case democracy is not even constrained efficient.*

The key idea is that with a linear technology, there is *never* unanimity about changing g_1^* from $\tilde{g}_1$; the initial office-holder will always prefer $g_1^* = -\infty$, effectively making him an appointee, but all citizens who never hold office always prefer (ex ante) a g_1^* higher than $\tilde{g}_1$, in order to motivate the initial office-holder to supply more effort. This argument breaks down when the technology becomes multiplicative, as then (due to the experimentation effect) the initial office-holder may be motivated[46] by *lowering* the cutoff g_1^*, as then he captures more of the gains from experimenting. So then, everybody may gain from a lowering of g_1^*.

To conclude, under symmetric incomplete information, and under the realistic assumption that a social planner possesses the same information and instruments as citizens (i.e. a constrained social planner), a constrained social planer can certainly implement a Pareto improving regime whereby office-holders are appointed on a long-term basis (appointment of a bureaucrat case) . In this case, a (constrained) social planner chooses at random a citizen, makes a payment $R - \delta - c(e^*(\rho))$ for being in office - this payment being approximately zero. Note that this Pareto improvement (compared to democracy) arises in our model even though effort is unobservable, and g is uncontractible.

(ii) Asymmetric Information Case

We now analyse whether a constrained social planner can achieve a Pareto-

[46]This also requires that the career concerns effect will be small, i.e. that the "prize" for winning the election $(R - c(e^*(\rho)))$ is approximately zero.

superior outcome than democracy in the asymmetric information case. It is easy to see that this is not the case as welfare is unambiguously lower in the appointment case compared to either kind of democracy. Indeed, we can state

Proposition 4.11. *Assume Assumptions 4.0-4.2. With asymmetric information, democracy is constrained efficient whichever equilibrium prevails.*

The proof is immediate. Under a representative democracy we know the following points. First, suppose that the revealing equilibrium prevails under a representative democracy. Here, voter utility is unambiguously lower in the appointment case. This is because; (1) effort conditional on type is the same as it is with appointment ; (2) the average quality of the office-holder is higher in both periods. Second, suppose that the non-revealing equilibrium prevails. Again, voter utility is unambiguously lower in the appointment case. This is because; (1) effort conditional on type is higher (in the first period) than with appointment ; (2) the average quality of the office-holder is higher in the second period. The same qualitative result also applies to partial democracy. So, appointment never Pareto-dominates democracy. □

So, in our setting, the "Chicago view" that democracy is efficient is (partially) confirmed when politicians have private information. This results differs from the one obtained, in an asymmetric information agency model, by Coate and Morris (1995). In Coate and Morris's model, the two possible types of office-holders are *equally* efficient in producing public goods, only one type accepts bribes while the other does not. Coate and Morris do not consider endogenous candidate entry.

We can also compare welfare across the two democratic institutions in the Normal-quadratic case. We find the following results (see Appendix $C.2$). *Ceteris paribus*, welfare in the partial democratic case (exogenous entry) or under a representative democracy with a non revealing equilibrium is higher than in a representative democracy with a revealing equilibrium: (i) the larger the ego rent R, and the smaller the cost of entry δ (ii) the larger σ, the standard deviation of ε, (iii) the more additive the technology is (i.e. the closer is μ to 1) (iv) and the higher the prior belief (ρ), and (v) the higher is the competency difference $(\theta_H - \theta_L)$. These results are intuitive: the larger the career concerns effects (which occur solely under exogenous entry or a non revealing equilibrium), the higher equilibrium effort, and, *ceteris paribus*, the higher the welfare level. As our numerical results (stated in Appendix $C.2.4$) show that for any pair of equilibria E_1, E_2, it is possible to find parameter values such that either E_1 Pareto-dominates E_2 or vice versa.[47]

To conclude, under asymmetric information, although a social planner cannot implement a Pareto-improving appointment regime, given our maintained assumption that citizens have full information on the model's parameters, a social planner can certainly implement a Pareto-improving (representative) democracy by, for instance, varying the cost of entry δ so that either a revealing or a non revealing equilibrium obtains. Given this result, the observed wide variation across countries regarding the treatment of candidates campaign contributions (e.g. publicly funded or not, refunded if a certain threshold of votes is attained, upper limits, etc.) highlights the role these entry cost could have in shaping policy outcomes and welfare. This

[47]Strictly speaking, revealing and non-revealing equilibria with asymmetric information cannot coexist at the same parameter values (c.f. Proposition 4.8). However, we ask the following question. Suppose that $\delta = v_o(0) - \varepsilon$, so that initially only a revealing equilibrium exists. Then change δ to $\delta = v_o(0) + \varepsilon$, so that now only a non-revealing equilibrium exists. Can we find an ε and other fixed parameter values such that everyone is better-off (or worse off) in the first equilibrium rather than the second? The meaning of this exercise is that by changing δ slightly, a social planner could bring about a Pareto-improvement.

interesting legal treatment of cost of candidate entry and the potential this could have in shaping the fiscal policy of incumbent politician is left for future empirical research.

We now turn to the question of whether the equilibria (democracy with endogenous entry) under different information structures can be Pareto-ranked. There are three equilibria of interest (equilibrium with symmetric information,[48] the non-revealing and revealing equilibria under asymmetric information). Our numerical results (stated in Appendix $C.2.4$) show that for any pair of equilibria E_1, E_2, it is possible to find parameter values such that either E_1 Pareto-dominates E_2 or vice versa.

It is perhaps not so surprising that the asymmetric equilibria may dominate the symmetric equilibrium; as in the former, the office-holder is better-informed. It is more surprising that the reverse is the case. The reason is when the technology is multiplicative, with symmetry, the level of effort is raised due to experimentation, and this more than offsets the loss in efficiency of not being able to condition actions on types. Under asymmetric information, the result that either the revealing equilibrium can Pareto-dominate the non revealing equilibrium is less surprising. Indeed, in this case, we know (Proposition 4.8) that these cases trade-off increased efficiency on office-holders' ability (revealing equilibrium) against increased efficiency on effort (non revealing equilibrium).

[48]In all our numerical simulations, this was unique, as discussed above.

4.8 Extensions

4.8.1 Office-Holder Altruism ($\zeta > 0$)

The assumptions of the model generate a very strong form of underprovision of effort; as effort is non-contractible, the office-holder only has $1/n$ of the correct incentive to provide effort. Consequently, (at least for large n), the higher equilibrium effort, the more efficient the effort is. This strong result can be refined by the (admittedly, *ad hoc*) device of supposing that the position of office has some psychological impact on the office-holder, making him or her more altruistic.[49] If $\zeta > 0$, the positive analysis of the chapter is qualitatively unchanged, except that the total ego-rent from office is now $R + \zeta(n-1)g$, i.e. the ego-rent depends on performance while in office. Of course the efficiency analysis will be different: in particular, for ζ close to 1, equilibrium effort levels much above the myopic may be inefficiently *high*. In theory, one should be able to find an optimal value of ζ such that the first-best is achieved.

4.8.2 Strategic Voting

Our analysis has assumed that voters vote sincerely (i.e. for their most preferred candidate) at each election, no matter what the candidate set is. However, it is well-known that when there are three or more candidates, voting sincerely might not be

[49] Holmström and Milgrom (1991) have such a type of assumption in their multitask agency model: they assume that not all work is unpleasant for an agent so that even without explicit incentives, the agent will supply effort on some tasks. Hess and Orphanides (2001b) also introduce a similar assumption; they introduce a parameter similar to ζ and refer to it as the degree of selfishness of the office-holder. See Gill (1999) for a multi-disciplinary survey of the theory and evidence on the meaning of work beyond the economists' definition. The social psychology literature, for instance, emphasizes individuals' psychological need for work. These "needs are embedded in our social, ethical, and cultural structures".

the only Nash equilibrium strategy[50] (see Besley and Coate, 1997; or Dhillon and Lockwood, 1999). For example, in our model, it is a Nash equilibrium for all voters to vote for the candidate with the *lowest* index (i.e. looks characteristic). This is because no single voter can change the outcome by deviating, and so it is a weak best response to vote this way. However, as looks are uncorrelated with competence, this would not change the equilibrium outcome described in Propositions 4.5 and 4.8 in any economically relevant way.

4.9 Related Literature and Conclusion

4.9.1 Related Literature

The papers[51] most closely related to this chapter are Ferejohn (1986), Austen-Smith and Banks (1989), Banks and Sundaram (1993, 1998), and Persson and Tabellini (2000). In all these models, there is a moral hazard problem between office-holder and voters, and periodic elections unambiguously induce incumbent office-holders to supply more effort (or in the case of Persson and Tabellini (2000) extract less rent).

In a classic article, Ferejohn (1986) proposed a simple and elegant moral hazard model of electoral control of office-holders. In equilibrium, voters follow a cutoff rule by voting for the incumbent only if his observed performance does not fall below a certain level, and the candidate chooses effort so that performance remains just at the cutoff. So, office-holder effort is higher than it would be without elections (there

[50] There is also much empirical evidence that it occurs in single-seat elections by plurality rule (Cox, 1997).

[51] Barro (1973) was the first to explicitly model electoral control of politicians. However, in his model, the actions of office-holders were always observable, and so if office-holders are infinitely lived, they can always be induced to take efficient actions, if discounting is sufficiently low (by a simple folk theorem argument).

is *electoral control* of the incumbent).

As Ferejohn himself recognized (see p10 of his paper) his analysis relies[52] on the assumption that official may stay in office for ever (no term limits). With term limits, incumbents can never be induced to supply more than their myopic level of effort in the final period, and an "unravelling" argument then shows that incumbents can then never be induced to supply more than their myopic level of effort in *any* period of office.[53]

More recently, Banks and Sundaram (1998) have shown that with finite term limits, there can be electoral control of the incumbent if there is also an adverse selection ingredient to the model, namely, some ability parameter of the potential office-holder that is initially unobservable to the electorate. In this case, it is no longer ex post optimal to "fire" the incumbent in his last term of office if he has revealed himself to be of high enough quality. Indeed, under some very weak regularity conditions, the threat of (electoral)[54] dismissal induces agents of *all* types to supply more effort than they would otherwise in their first term of office[55] (Proposition 3.3).

Persson and Tabellini (2000, Chapter 4.5), have a two-period model with both adverse selection and moral hazard, where, as in this chapter, initially the incumbent does not know his type.[56] Given an incumbent with competence θ, the technology

[52]With term limits, Ferejohn's model can only exhibit electoral control in equilibrium if voters can precommit to a cutoff rule, a rather unattractive assumption.

[53]For a formal statement of this result, see Banks and Sundaram (1998), Proposition 3.5.

[54]Banks and Sundaram have a general model where the principal can only control the agent by dismissing him. This has an electoral interpretation, amongst others.

[55]See Besley and Case (1995a) for an empirical test of the effects of term limits on the behaviour of US State governors.

[56]Biglaiser and Mezzetti (1997) have a paper where in the first period, the incumbent chooses an observable discrete project, but where the value of the project depends on the incumbent's ability (initially unknown to everybody) and a random shock. The paper focuses on the issue of whether undertaking the project is a good or bad signal to the electorate about the incumbent's ability.

for supplying the public good is

$$g_t = \theta(\tau - r_t) \tag{4.40}$$

where g_t is output of the public good, τ is exogenous tax revenue, and r_t are rents misappropriated from tax revenues. So, incumbents transform tax revenues net of rents into public goods. Voters care only about the level of public good provision, and the office-holder in period t has payoff $R + r_t$, where R is an ego-rent, as in our model.

Although Persson and Tabellini model rents in monetary terms, one (formally very similar) way of interpreting rent is to assume that it is the degree to which the official "slacks" from the first-best level of effort defined in (4.39), i.e. $r = e^{**} - e$. In that case, we can write our production function, assuming $\mu = 1$, as

$$g_t = \theta(e^{**} - r_t) + \varepsilon_t \tag{4.41}$$

which is of course formally identical to (4.40) except that we now have a random productivity shock.

Also, note that the payoffs to the office-holder in our model can be written $R + g_t - c(e^{**} - r_t)$. So, the payoffs in Persson and Tabellini correspond to the special case where $c(.)$ is linear and the incumbent does not care about the public good.[57] To conclude, the Persson and Tabellini career concerns model can be thought of as a "special case" of ours,[58] and moreover, one in which the experimentation effect

[57] This last fact creates the modelling problem that, in the final period, the incumbent will supply no effort, i.e. extract maximum rent, *whatever* his type, implying that voters do not care about the types of the elected officials. Persson and Tabellini deal with this in a relatively ad hoc way by imposing an upper bound on the amount of rent that can be extracted. Given our representative democracy setting, this issue does not arise in our model since the agent attaches some weight on the principal's utility.

[58] Mathematically, it is not literally a special case, as in their model, θ is continuously distributed.

is ruled out by construction. Of course, the merit of their model is that it is very simple and easily analysed, and so it very well-suited to an analysis of the way career concerns are affected by electoral rules (Persson and Tabellini (2000), Chapter 9.1). This would be much more difficult with a model such as ours.

4.9.2 Conclusion

This chapter provides a first step, using a *general equilibrium electoral model*, towards a formal analysis of the effect that career concerns can have in shaping incentives of elected policy makers while in office. We analyse the effect of these concerns under various institutional and informational regimes and, for each of these regimes, we study the ensuing equilibrium level of effort and quality of the office-holder's ability. Office-holders' performance is affected by both moral hazard and adverse selection issues. We find that these two issues can give rise to interesting strategic behaviour ahead of elections: career concerns and experimentation. This latter effect is new in the whole principal-agent literature (we should stress that this result is, as far as we know, not present in the very extensive literature focusing on the theory of the firm, nor is it in the political agency literature which is the specific focus of this chapter). *Experimentation* occurs when the incumbent deviates from the myopically optimal action that just maximizes the current payoff in order to improve the information content of his signal about his own ability, namely the output of the public good.

Under symmetric incomplete information, we find that, even with appointment, effort may vary over time, due to experimentation, We find that experimentation occurs in the first period of our two-period setting if and only if effort and ability *interact* in the production of the public good, and that when it occurs, it unambiguously induces the office-holder to put in more effort than the myopic level. One of our key result is that when we move from appointment to democracy, the incentive to experiment unambiguously *falls*, for the reason described above. Of course, in our model, as in others in the literature, elections also have a positive effect on equilibrium effort via *career concerns* effect; the better the observable performance while in office, the higher the probability of being re-elected and therefore the higher the expected payoff in the future. More generally, we can say that career concerns and experimentation, while both inducing the incumbent to increase effort, are *substitutes* under symmetric incomplete information: that is, democracy introduces career concerns, but also necessarily reduces the incentive to experiment. This substitutability is not present in other career concerns models because of *simplifying assumptions which prevent experimentation from occurring* (e.g. static models or additive technology).

Contrarily to previous claims in the literature, we have shown in this chapter that it is possible that electoral control may demotivate the office-holder, or alternatively, too much electoral control induces the office-holder to have a *short-term approach* to "policy" issues. More specifically, the loss of the incentive to experiment may more than offset the career concerns effect, so that (conditional on ability) first-period *equilibrium effort may be lower in democracy than with appointment.* We argue that this effect (i.e. too much electoral control), or "too much democratic accountability" is not only a theoretical possibility but also a reality and a source of concern in US politics, and especially for House Representatives. House Representatives face elections every two years - the shortest term of office that any member of congress faces in any developed democracy. As argued by King (1997) in his recent treatise on the US political system, this very short-term of office makes Congressmen "run scared" and results in acute short-termism. Because the speed with which the electorate comes to judge House Representatives, King argues that this prevents Congressmen from investing in actions whose payoffs are medium term (i.e. beyond the two-year term!) but whose costs are short-term (i.e. borne within two years). This short-termism effect, argues King, can explain, *inter alia*, the massive surge of the Federal debt during the Reagan presidencies of the 1980s. We can note that the US House of Representatives is not the only important office with this especially short mandate. In some US states, governors are also elected for two years. Interestingly, although in 1960, 16 States had two-year terms of Gubernatorial office,[59] in 1998, only 2 States still have such short-terms;[60] all other states have four year terms.

We believe that this short-termism result arising from reduced experimentation is however much more general and applies to other labour markets: as long as the agent has some positive probability of being "fired" by the principal, that the model is dynamic and the technology the agent uses is at least partly multiplicative in talent and effort then both career concerns and experimentation will be present. Short-termism should also arise in standard principal-agent models of the firm. Whether the negative effect of reduced experimentation due to short labour contracts can be muted or offset by proper incentives (e.g. financial) needs to be investigated. We believe this would be an especially worthwhile issue given the noted trend for CEOs' spell at the top of their corporation to be declining rapidly in the US. A phenomenon described as "CEO churning" by Bennis and O'Toole (2000). The general message is that the *selection and retention process* of an agent are important elements of job

[59]These States are Arkansas, Arizona, Iowa, Kansas, Massachusetts, Michigan, Minnesota, North Dakota, Nebraska, New Hampshire, New Mexico, Rhode Island, South Dakota, Texas, Wisconsin.

[60]These States are New Hampshire and Vermont.

design in agency relationships; in this chapter, we have highlighted a new strategic element; this element needs to be recognised by the principal to design an efficient incentive scheme.

Under asymmetric information, career concerns are the only strategic effect that arises. This occurs solely under a democratic regime. Welfare is always unambiguously higher in a democratic regime than under appointment. This is because democracy is more efficient at selecting high-ability agents and also induces agents to supply at least as much effort on the job. An important, and novel, issue still arises under democracy as two types of equilibria are possible in a representative democracy: *revealing* and *non revealing*. Depending on parameter values, each of these types of equilibrium can Pareto dominate the other. A principal might therefore be interested in inducing one equilibria or the other depending on other structural parameters. This is the focus of our next chapter. Again, the general message of this section is that the selection (e.g. high cost of applying for the job) and retention process (e.g. job security such as tenure versus less job security) are key aspects that a principal has to consider in its mechanism design.

We believe that extending our model to the case where the elected office-holder has to perform several tasks while in office should be worthwhile. Indeed, the multiplicity of tasks has been shown to have profound implications for job design (e.g. the choice of high versus low powered incentives). The joint analysis of the effects of the selection and retention process of an agent and the effects of a multiplicity of tasks that the agent has to perform should enable us to better understand agents' incentives within a more realistic agency environment.

Chapter 5

Candidate Entry, Screening and the Political Budget Cycle

5.1 Introduction

One of the main themes of the literature on political economy is that policy makers may be better informed than voters are about factors that affect their performance in office: ability, effort, honesty, the cost of producing public goods, etc. This asymmetry of information gives rise to problems of both adverse selection and moral hazard. For example, low-ability candidates may elected to office, and once there, may slack, or use the powers of office of personal enrichment (extreme cases might include, for instance, Marcos of the Philippines and Mobutu of Zaire).

However, elections provide a mechanism for controlling these adverse selection and moral hazard problems arising from incomplete information. In particular, elections allow: (i) voters to replace "bad" office-holders with good ones (*selection effect*); (ii) office-holders to signal or conceal information via choice of policy (*incentive effect*). Elections are suboptimal for two reasons: first, the reward of re-election is a crude way of rewarding performance relative to, for instance, performance-related pay, and second, voters cannot credibly commit ex ante (i.e. before incumbents choose policy), and this limits their ability to punish poor performance by incumbents.

In the last two decades, a formal literature has grown showing how selection and incentive effects work in particular settings. First, there are a class of pure adverse selection models where potential office-holders differ only in ability. The seminal contributions here are Rogoff and Sibert (1988), Rogoff (1990), and more recent work includes Harrington (1993), Hess and Orphanides (1995), Bartolini and Drazen (1997), and Drazen (2000b). Rogoff's work showed how selection and incentive effects interact: in his models, that ability is signalled though policy in equilibrium (the "political budget cycle"), and thus voters condition their strategies on the performance of politicians while in office.[1] A related class of models have potential office-holders that differ in honesty (Besley and Case, 1995a,b; Coate and Morris, 1995; Persson and Tabellini, 2000; Besley and Smart, 2001).

A second class of models, initiated Barro (1973), and Ferejohn (1986) is *pure moral hazard models,* where office-holders have a cost of effort, and voters prefer higher (unobservable) effort. The moral hazard problem between the elected official and the electorate is therefore that, left to his own devices, the official will pursue his own interests, rather than those of the voters. Here, if voters could precommit to a voting rule conditional on performance, they would fire low-performing office-holders. However, this voting policy is not time-consistent, as *ex post,* it does not

[1] There is also a large literature studying the implications of the fact that the preferences (rather than abilities) of policy makers may not be known by voters (e.g. Alesina and Cukierman, 1990).

pay to replace one incumbent with an identical replacement. This problem does not arise for the *mixed moral hazard, adverse selection* models studied by Austen-Smith and Banks (1989), Banks and Sundaram (1993,1998), and Besley and Case (1995a). In these models, office-holders choose an unobservable effort, and may be of different ability. Now voters will fire low-performing office-holders even without precommitment, as such office-holders (partially) reveal themselves to be low-ability. So, in this setting, pre-electoral changes in performance on the job are a sign of efficient "electoral control" of the incumbent.

However, in our view, all this literature suffers from the serious problem that the incumbent office-holder and the agent who challenges the incumbent are assumed to be *randomly drawn* from some population; there is no candidate entry stage. To put it another way, although these models claim to model the interaction between the economy and the political process, they do so incompletely: elections are modelled, but the decisions by citizens to contest these elections (candidate entry) are *not* modelled. This chapter attempts to "complete the model" of the political process by modelling candidate entry explicitly, and analyses the implications of doing so for the "political business cycle". Our results also have a bearing on the more general debate between the Chicago and Virginia schools on the "efficiency" of democracy (see Coate and Morris, 1995, for a recent account of this debate).

The approach that we take builds on the representative democracy or "citizen-candidate" approach of Besley and Coate (1997), and Osborne and Slivinski (1996). Specifically, we suppose that at the beginning of every period, there is a candidate entry stage, where any citizen can stand for election. At the entry stage, candidates can also decide how much to spend contesting the election; so we endogenise the cost of entry, assumed fixed in Besley and Coate (1997). Elections then take place via plurality rule, and the winner becomes policy maker for that period. Candidates are privately informed about their ability (or other relevant characteristics) prior to entry.[2]

The first question we address, in a one period version of this model, is whether candidate entry decisions can reveal relevant (private) information about candidates to the electorate in equilibrium. To put some structure on this problem, we assume that potential candidates may be of two types, high-ability and low-ability when in office. All citizens - including the office-holders - get a higher payoff from policy if the office-holder is high-ability. However, the office-holders may also get *rents* from holding office, which are ego-rents, plus financial benefits of various kinds (Persson and Tabellini, 2000). These rents may differ by ability type.

It turns out that the answer to our question depends on whether the preferences of voters and candidates are *congruent*,[3] in the sense that high-ability citizens have a greater incentive to seek office than low-ability citizens. Congruent preferences arise, for example, in Rogoff's (1990) model, where candidates for office only differ in ability; both types have the same ego-rent from office. Non-congruence will typically arise where there is an agency problem[4] between office-holder and citizens (e.g. Coate and Morris 1995; Persson and Tabellini, 2000; Besley and Smart, 2001), in which case dishonest candidates may have a greater incentive to gain office. As an illustrating

[2]We argue in Section 5.2 that this simple set-up captures the "stylized facts" of the US electoral system quite well; specifically, candidates for federal offices or for gubernatorial offices are not rigorously screened by political parties, and are responsible for financing their own campaign.

[3]More precisely, congruency occurs where the policy payoff, plus the rent from office, is higher for the high ability type than for the low ability type.

[4]That is, office-holders have the opportunity to take bribes, divert tax revenues to personal use, etc.

example, in this chapter we present a variant of Rogoff's model where candidates for office only differ in honesty (dishonest office-holders "steal" tax revenues) which has this property.

Our key insight is the following; free candidate entry acts as a device to *screen out* candidates who have low-ability in office *if and only if preferences are congruent.* Specifically, with congruent preferences, the only perfect Bayesian equilibrium of our one-period model that is stable (in the sense that it satisfies the Cho and Kreps, 1987, Intuitive Criterion) is a separating one, where only high-ability candidates enter. With non-congruent preferences, the only stable perfect Bayesian equilibrium is a pooling one, where both types of candidates enter.

We then apply these results to Rogoff's well-known model of the political budget cycle. Specifically, we analyse a two-period version of his model, with elections in both periods, preceded by candidate entry in both periods. We find that the only stable perfect Bayesian equilibrium has separating at the entry stage of the first election; only high-ability candidates stand for office. In this case, of course the incumbent in the first period does not have to signal his ability, and so there will be no distortion in policy in the first period, i.e. no "political budget cycle". The outcome is in fact first-best efficient. The reason is that as remarked above, the Rogoff model has congruent preferences between office-holder and voters. We then study a different version of the Rogoff model, where candidates have an opportunity to divert tax revenues to their own personal benefit, and differ not in ability, but honesty. In this case, any equilibrium has pooling at the entry stage in period 1, so there is always an incentive for the honest type to try to signal his type though policy once in office.

Overall, our conclusion is that;

- (i) with *congruent preferences*, compared to the benchmark of exogenous candidate selection, free entry of candidates mitigates the political budget cycle; while
- (ii) with *non-congruent preferences*, representative democracy leads to the same pattern of policy choice as with exogenous candidate selection.

An important part of the chapter is then devoted to checking for the robustness of our (sharp) theoretical predictions. All the extensions that we analyse do confirm our above-mentioned conclusion. In particular, our results are unaffected so long as at least one able individual that can afford the high entry fee exists in the population. Whether the agency problem between citizens and office-holders also suffers from a moral hazard problem on top of the original adverse selection or not does not affect our screening mechanism. The introduction of a moral hazard problem however implies that screening at the candidate entry stage might not be welfare enhancing. The key issue is this case is whether the moral hazard or the adverse selection is more acute. Nevertheless, assuming some citizens have varying degree of Public Service Motivation (see the discussion of Section 5.7.3), it is theoretically possible to design an entry cost such that a revealing equilibrium is always desirable to a pooling (entry) equilibrium. Our conclusion is also robust to the introduction of heterogeneous preferences whereby some citizens prefer one type of public good (e.g. Education) and others prefer another type of public good (e.g. Defence). Similar results also obtain if we model political parties, and also if campaign costs are unobservable.

Finally, these conclusions are, in principle, testable. Our claim is that the political business cycle is smaller, *ceteris paribus*, when the degree of congruence between office-holders and the electorate is high. Moreover, (non)-congruence could be proxied empirically by measures of the rents from holding office. Interestingly, recent empirical studies do support this prediction. For instance, Shi and Svensson (2001) in an empirical investigation (of 123 countries over 21 years) that fits our theoretical modelling, find that political budget cycles are positively related to a proxy for the rents from holding office.[5]

Our results are also related to two other literatures. First, the one-period model we investigate in this chapter can be seen as extension of both the Besley and Coate (1997, 1998) and the Osborne and Slivinski (1996) representative democracy models to a more general information structure. Indeed, both of these models assume that there is *full information* on preferences and ability of citizens. As Besley and Coate note in both of their papers' conclusion, extension of their modelling framework to cases of imperfect information is an important research issue.

Second, this chapter is a contribution to the broader debate about the efficiency of democracy (Wittman, 1989; Coate and Morris, 1995; Persson and Tabellini 2000). For example, Wittman (1989) adopts the sanguine view that electoral competition will mitigate both problems of asymmetric information between voters and politicians, and agency problems (shirking, corruption, etc.). By contrast, in a well-known formal model, Coate and Morris (1995) show that, with asymmetric information about candidates' honesty, in order to maintain a good reputation, dishonest politicians

[5]Specifically, they proxy rents from office using the indicators from the International Country Risk Guide. This guide provides a measure of rent-seeking and protection of property rights and includes factors such as the "rule of law", "corruption in government", "quality of the bureaucracy", and "risk of expropriation of private investment".

may make inefficient transfers to special interests. This chapter enables to reconcile these apparently conflicting conclusions. Indeed, this chapter shows that free entry will reduce problems of asymmetric information between voters and politicians, but only when agency problems are relatively minor, in that politicians and voters have similar interests.

Note that our one-period model is also related to a small literature on campaign expenditures as signalling devices (Austen-Smith, 1987; Prat, 1997 and 2000). In particular, our "money burning" role of campaign expenditures is similar to Prat's, although our model is much less sophisticated (no lobbies, candidates are independently wealthy).

The layout of the rest of the chapter is as follows. Section 5.2 gives a brief overview of the US electoral system in relation to candidate entry. In Section 5.3, we construct a simple model to analyse screening effect of endogenous costly candidate entry. In Section 5.4, we briefly present a simplified version of Rogoff's model, and in Section 5.5 we introduce endogenous candidate entry. Section 5.6 studies a version of Rogoff's model with agency costs. Some extensions and robustness checks are investigated in Section 5.7. These modifications of our baseline model are (i) the introduction of wealth constraints on some citizens (Section 5.7.1); (ii) the introduction of "looks" shock as in Rogoff's original model (Section 5.7.2); (iii) the introduction of moral hazard on top of the original adverse selection problem following Banks and Sundaram (1998) (Section 5.7.3); (iv) the introduction of heterogeneous preferences *à la* Alesina and Tabellini (1990) (Section 5.7.4); (v) the introduction of political parties, following Besley and Coate (2000), given that parties in most democracies pay for a large party of candidates campaign costs (Section 5.7.5); (vi) allowing, in Section 5.7.6, for wealth heterogeneity leading to different fund-raising ability (or "burning" cost); (vii) allowing for unobservable cost of candidate entry (Section 5.7.6); and finally (viii), introducing several ability types (Section 5.7.8). Finally, Section 5.8 concludes.

5.2 Some "Stylized Facts" About the US Electoral System

The novelty of this chapter is to introduce a candidate entry stage into political agency models. In this section, we argue that our modelling of the entry stage fits particularly well the US electoral system. This makes us more sanguine about the sharp theoretical results that we obtain. Key elements of the citizen-candidate model, as we model it, are the following. First, citizens can stand for office directly, i.e. without having to be selected by a political party (although, as shown in Section 5.7, parties can be introduced without affecting our results). Second, becoming a candidate is costly. To the very least, a minimum legal requirement has to be paid by the candidate (such as a filing fee), but more importantly, political campaigns are a costly enterprise. The amount that candidates can spend on campaigns has no upper bound. As this section explains, all these features are crucial elements of the US election system. Before turning to these points in details, the following quote from Maidment and McGrew (1991) is helpful in giving an overview of the US electoral system and in particular the paramount role that candidates, as opposed to parties, have.

> "To a considerable extent, candidates have replaced parties as the central influence in political campaigns. Candidates have become the principal

actors in the electoral process. Their abilities and personalities are now critically important factors in any American election. When they enter a Primary election, they must, if they wish to succeed, create their own campaign organization, they must raise the campaign finance through their own efforts and recruit volunteers on the back of their own enthusiasm. [...] Candidates construct personal campaign organizations designed for their own electoral success. [...] Of course, after the victory in the primary election, the candidate becomes the official party nominee, though in a very real sense the nomination is merely a label. The nominees still have to rely on their own resources and organization." (p. 128).

Let us now review these points into more details.

5.2.1 Weak Party Control Over Candidate Entry

The major reason for the relative weakness of political parties in the United States is due to the widespread use of primary elections as a means to select candidate nominees. This characteristic is specific to the US. Primary elections have gradually gained momentum since the 1950s and 1960s and nowadays account for close to 100% of Republican and Democrat candidate nominations for Presidential, Federal or Gubernatorial offices. For instance, out of the 1996 to 1998 round of gubernatorial elections, of the 48 continental States, 46 candidates belonging to either the Democratic or Republican party have been elected. These 46 winning candidates all won their party nomination through a primary election (the two other winning candidates were independent candidates).

Also, in most states, any citizen can run in the primary if he/she makes a statement of affiliation to the party they want to run for. Political parties cannot veto, screen would be primary candidates even if a candidate's ideology differs markedly from the party's political platform. A striking example of this phenomenon occurred in 1980 when a member of the Ku-Klux-Klan won the Democratic Party nomination for a seat in the House of Representative. Also, in some States (e.g. California) parties are even prohibited by law from endorsing a candidate in the primaries. A party's elite is therefore prevented to even express preferences about candidates that they think would better represent the party.

In order to run for party nomination, candidates must raise campaign funds by themselves to run for the primary, only then can they market themselves to primary voters. As the next section reveals, these campaign cost have recently reached very high levels.

5.2.2 Campaign expenditures

Four main points need to be emphasized about campaign finances in the US.

First, *large amounts are spent.* For example, the cost of the 2000 Federal and Presidential elections is estimated to be above 3 billion dollars; the average winning House[6] campaign cost $636,000 ($4.90 per vote); and the average winning Senate campaigns cost $5.6 million ($6.07 per vote). George W. Bush is the first candidate to have crossed the 100 million dollar threshold for a primary election. George Bush was also the first major party nominee to have chosen to forgo Federal matching funds in order to be free to raise and spend unlimited amounts during his primary

[6] Note that House Representatives are only elected for two years, so that every two years these amounts need to be raised.

campaign. Except for Presidential elections, there is no public financing of campaigns. Furthermore, the responsibility of raising these large amounts of funds rests with the candidate, not the party. This remains true even after a candidate has successfully won his party's nomination (which requires large amounts of funds in the first place). Officially, political parties are limited in amount of financial support they can give to a candidate. For instance, parties' direct contributions to candidates' campaign for election to the House and Senate are limited, by law, to $5,000 per candidate in each election cycle for the House, and $17,500 per candidate in each cycle for the Senate. These firmly limited contribution are called "hard money" to differentiate them with "soft money". To bypass the "hard money" limits, parties have recently (especially since 1996) had recourse to the use of "soft money". Federal Election law allows political parties to spend as much as they want as long as the money goes to

These are funds that parties use, in principle, to "party building activities," such as "get-out-the-vote" efforts and generic advertising, such as "issue" ads. In particular, these funds cannot be used for "express advocacy", i.e. words like "vote for" or "vote against" cannot be used. Recently however it is widely acknowledged that the spirit of the Federal election law governing the use of soft money has been largely abused. Parties can spend as much as they want on congressional races as long as they act "independently" of the candidates. Soft money is also used by unions and advocacy groups. Soft money is largely unregulated. There is, in fact, no limit whatsoever on the amount donors can give to a party as long as it goes into soft money accounts. Recent examples of the growing importance of these source of funds are the following. For the 2000 Federal Elections, the biggest donor of "soft money" in the campaign, the American Federation of State, County and Municipal Employees gave a total of 6.3 million dollars for the election cycle. The Republican Party spent $36 million on television advertising supporting Bush from June 1 to Oct. 24, compared with $28 million by the Bush campaign itself.[7]

This brings us to the second salient feature of the US system, namely that *no limit exist on funds raised and spent in Federal elections,*[8] and also *no limit exists on the amount of own funds* that a candidate can spend for his or her campaign. The fact that candidates can spend unlimited amounts of funds is due to the First Amendment (which is about the freedom of speech). As a key US Supreme Court case revealed (*Buckley* vs *Valeo*, 1976), no legislation can put some upper bound on the amount of funds that a candidate can spend since it would limit the candidate's constitutional right of freedom of speech. A recent illustration of this constitutional right to use unlimited amount of personal funds to campaign is by Jon Corzine. Mr Corzine, a former Managing Director of Goldman Sachs, raised an impressive 57 million dollars for his 2000 New Jersey Senate campaign (which he eventually won). However, almost 55 of the 57 millions were from his own fortune.[9]

The third point to notice is that *campaign funds are observable* to the electorate. Indeed, the whole point of campaign expenditures is to get noticed by voters. A rising part of a campaign budget is now spent on media advertising. Besides this sheer visibility, legal requirement concur to improve transparency of candidates' finances.

[7]See Bowles (1998) for more details on the US electoral system, the Federal Election Commission and the Center for Responsive Politics for US campaign finance data.

[8]An exception to this concerns Presidential elections. For Presidential elections, public funding is available to candidates. Should they accept public (matching) funds, candidates have an upper limit on their campaign budget (e.g. 62 million dollars for the 2000 primary election). The availability of these public funds and limits is due to the Federal Election Campaign Finance (FECA) laws of the 1970s which were in large part motivated by Nixon's Watergate scandal.

[9]Interesting, as is often the case for very wealthy candidates, Mr Corzine did not raise a single dollar from the controversial Political Action Committees (PACs). PACs are in effect lobby groups.

For instance, for Federal elections candidates must file pre-election financial reports with the Federal Election Commission (FEC). These reports are available prior to elections on the FEC's web site and are often disseminated to the public through the media. Hence, voters know *ahead of elections* how much candidates have raised and spent on their campaign.

We should also note that next to the large amounts being spent by candidates for their campaigns, in order to officially become a registered candidate for an election, some fixed compliance costs are imposed by the law (some qualifications are also required). These cost are of two types: (i) Filing fees; (ii) Petitions. These legal requirement vary from State to State; Some States impose only a filing fee, others only a petition, while others require both filing fee and petition to be submitted by a citizen willing to stand for office. Appendix $D.1$. gives an overview of these costs for various US States. Filing fees can amount to a few thousand dollars.

Finally, the following points are worth mentioning regarding the *determinants of campaign spending*. First, as is well established, the major determinant of campaign raising and spending is incumbency (e.g. Salmore and Salmore, 1985, Chapter 4). For instance, for the 2000 House elections, the average challenger raised $361,314, while the average incumbent raised $891,956.[10] Given the important sums of money involved in US politics, and especially for winning candidates,[11] is candidates' wealth a significant factor in winning elections? Indeed, wealth is often described in the media (and in the political science literature) as giving an unfair advantage (in the US at least) to citizens well endowed with it. However, a serious econometric analysis

[10]Source: The Center for Responsive Politics based on Federal Election Commission data.

[11]For the same 2000 House elections as reported above, the average loser raised $308,837, while the average winner raised $917,867.

by Milyo and Groseclose (1999) reveals that wealthy incumbents do not raise or spend more campaign funds[12] and do not win greater vote shares in their re-election bids, i.e. the so called "wealth effect" is not significant in helping rich candidates win a greater share of votes. Also important, is Milyo and Groseclose's finding that a wealthy incumbent candidate does not deter high-quality challengers either.

5.3 Signalling via Candidate Entry

Here, we develop our main arguments in the form of a simple one-period model. The model captures some of the stylized facts of the US system described in Section 5.2: namely, that party control over candidates is weak (so parties cannot screen out bad candidates[13]), campaign expenditures are observable, and that there is some exogenously determined minimum level of expenditure.

The economy is populated by a set of citizens $i \in N$, $\#N = n \geq 3$. Only one citizen can be office-holder. Citizens in a subset $K \subset N$ are of two types: high-ability in office (H) and low-ability in office (L).[14] Citizens not in K are unsuitable for office (e.g. they do not meet required qualifications such as those described in Appendix D.1). We assume that preferences are identical in the sense that the choice of policy by a type a office-holder results in a payoff W_a for *all* citizens other than the office-holder, with $W_H > W_L > 0$. An office-holder of type a also gets an additional payoff of R_a from holding office. This may be interpreted as an ego-rent (as in Rogoff, 1990).

[12] One explanation for this is that although wealthy candidates can easily raise funding via their own funds, non (or less) wealthy candidates are more likely to receive important funding from Political Action Committees (PACs funding now account for a large - and growing- share of total campaign funding). Indeed, these latter are less inclined to fund wealthy candidates since these latter are less dependent on PACs money and are therefore less pressurable.

[13] Section 5.7 extends our analysis to the case where candidates are selected by political parties.

[14] In Section 5.7.8, we extend the model to many ability types.

Alternatively, it may reflect the ability of the office-holder to divert resources to his own pocket (see Section 5.6 below).

We will say the preferences of citizens and the office-holder are *congruent* if $R_H + W_H > R_L + W_L$, and *non-congruent* if $R_H + W_H < R_L + W_L$. So, congruence simply means that a candidate that is preferred by voters also has a greater incentive to stand for office. It turns out that this distinction is key to whether candidate entry can screen candidates.

We will assume that a citizen in K of either type always prefers to hold office in place of someone else:

Assumption 5.1. $\min\{R_H + W_H, R_L + W_L\} > \max\{W_H, W_L\}$.

The order of events is as follows.

1. Each citizen i privately observes her own ability a, which is a random draw from $\{H, L\}$ with $\Pr(a = H) \equiv \rho$.

2. All citizens in K can simultaneously decide whether to enter (stand for election) or not, and if they enter, how much to spend on campaigning.

3. All citizens in N then vote simultaneously for a single candidate, and the winner is selected by plurality rule. Ties are broken fairly.[15]

4. The winner is then office-holder and chooses policy.

In the event that nobody stands for election, a *default policy* is selected by the

[15] That is, if k candidates get equal most numbers of votes, each is selected for office with probability $1/k$.

constitution, and we assume that in this event, all citizens have a zero payoff.

This describes a simple game played between the set N of citizens. As it is a game with sequential moves and incomplete information, the equilibrium concept is perfect Bayesian. Although simple to describe, the game has a complex structure, and it is helpful to formalize it somewhat. At stage 2, all $i \in K$ take an action $s_i \in S_i$, where $S_i = \{0\} \cup \{(1,\delta) \,|\underline{\delta} \leq \delta < \infty\}$, where 0 denotes no entry, 1 denotes entry, and δ denotes campaign spending[16] given entry. The minimum level $\underline{\delta}$ of spending will be determined by minimal fixed costs of campaign organization, plus legislative restrictions (see Appendix $D.1$). Campaign expenditures are substracted from candidates pay-offs.[17] To rule out trivial equilibria where no-one enters, we assume $\underline{\delta} < \max\{R_H + W_H,\ R_L + W_L\}$.

So, an *entry strategy* at stage 2 for $i \in K$ is a map: $e_i : \{H, L\} \rightarrow S_i$. Then define $C = \{i \in K \,| s_i \neq 0\}$ to be the set of candidates who stand for election. So, at stage 3, a pure action for a voter $i \in N$ is a choice of an element of C. In some equilibria, voters will be indifferent between candidates in (subsets of) C. To break these ties in a neutral manner, we will allow voters to randomize over C; let the set of probability distributions on C be $\Delta(C)$. Then, a *voting strategy* for $i \notin K$ is a map from every possible $\mathbf{s} = (s_1, ..., s_n)$, to $\Delta(C)$, i.e. $v_i : \mathbf{S} \rightarrow \Delta(C)$, where $\mathbf{S} = \times_{i \in K} S_i$. Similarly, a *voting strategy* for $i \in K$ is a map $v_i : \{H, L\} \times \mathbf{S} \rightarrow \Delta(C)$. We now solve the game backwards in the usual way.

[16]Note that here, campaign spending plays no *direct* informational role (e.g. funding advertising, etc.): it is purely a signalling device.

[17]This assumes that all candidates have the same marginal utility of money (which may not be the case, for instance, if some candidates are wealthy). This assumption is relaxed in Section 5.7.6 below.

5.3.1 Voting

The first step in the analysis is to formalize beliefs of voters about the ability of candidates, given stage 2 actions. Beliefs can be described by the maps $\pi_i : K \times \mathbf{S} \rightarrow [0,1]$, $i \in N$, where $\pi_i(j, \mathbf{s})$ is the probability assessment on the part of i that candidate $j \in K$, $j \neq i$ is high-ability, given actions $\mathbf{s} = (s_1, ..., s_n)$. Obviously, on the equilibrium path, these beliefs are given by Bayes' rule. Also, by the fact that agents observe their own type, $\pi_i(i, \mathbf{s}) = 1$ if i is of type H and zero otherwise.

We impose the following very weak assumption on beliefs at the voting stage;

Assumption 5.2. $\pi_j(i, s) = \pi_k(i, s)$ *all* $i \in K$, $j, k \in N$, $s \in S$, $k \neq j \neq i$.

That is, any two citizens have the same posterior belief about the ability of a third, given the same information. This is certainly true on the equilibrium path, as any two agents have the same prior beliefs about a third, and so it seems natural to impose it also off-the-equilibrium path. Given Assumption 5.2, we can simplify our notation to $\pi_j(i, \mathbf{s}) = \pi(i, \mathbf{s})$, $j \neq i$. Also, let $\boldsymbol{\pi}(.) = (\pi(i, .))_{i \in K}$ be a *belief profile.*[18]

Now we can turn to the analysis of the voting subgame. A voter is said to vote *sincerely* if he votes for (one of) his most preferred alternatives. By Assumption 5.1, for any $i \in C$, i's most preferred alternative is that he gains office, i.e. i's most preferred alternative in C is i. Now let

$$B(C) = \{j \in C \,|\, \pi(j, \mathbf{s}) \geq \pi(k, \mathbf{s}),\ k \in C\} \tag{5.1}$$

So, $B(C)$ is the subset of candidates who are most preferred by all voters who are not

[18] Formally, a belief profile is a mapping $\boldsymbol{\pi} : K \times \mathbf{S} \rightarrow [0, 1]$.

themselves candidates. The following result tells us that the following sincere voting strategies constitute an undominated Nash equilibrium of the voting continuation game (i.e. a voting equilibrium in the terminology of Besley and Coate, 1997):

Lemma 5.0. *Assume $k < n-1$. Conditional some fixed belief profile $\boldsymbol{\pi}(.)$, and first-period actions* $\mathbf{s}$, *the following sincere voting strategies constitute an undominated Nash equilibrium of the voting subgame:*

1. *All $j \notin C$ vote for each candidate in $B(C)$ with probability $1/\#B(C)$*

2. *All $j \in C$ vote for themselves.*

The equilibrium outcome is that every $i \in B(C)$ wins with probability $1/\#B(C)$.

Note that every citizen is voting sincerely except those who are in C but not in $B(C)$, as by construction, these candidates cannot win, and so are happy to randomize over $B(C)$. The following example illustrates this important point, and also why Lemma 5.0 does not hold when $k = n$.

Example 5.1. $n = 5$. Suppose that $K = C = \{1,2,3\}$ and candidates $1,2$ are believed to be high-ability but 3 is believed to be low-ability ($\pi(1,\mathbf{s}) = \pi(2,\mathbf{s}) = 1$, $\pi(3,\mathbf{s}) = 0$). So, $B(C) = \{1,2\}$. Then the hypothesized equilibrium is where $1,2$ vote for themselves, and $3,4,5$ randomize over $1,2$.

Now suppose that $C = \{1,2,3,4,5\}$, and beliefs are as above, plus $4,5$ are believed to be low-ability. Then by Assumption 5.1, there is clearly an equilibrium where every candidate votes for herself, and wins with probability $1/5$. ||

In general, plurality voting games have many equilibria,[19] (Dhillon and Lockwood, 1999), and this game is no exception. However, sincere voting equilibria (if they exist) have a natural appeal, and for this reason, we will assume throughout that this is the equilibrium of the voting subgame. We are also following Osborne and Slivinski (1996) in making this equilibrium selection.

Finally, Lemma 5.0 gives us the next very useful intermediate result. Suppose that $i \in C/B(C)$. If i withdraws, it is clear from Lemma 5.0 that the outcome of the election is unchanged. So, the net gain to i from withdrawing is δ. This cannot be an equilibrium strategy, so $C = B(C)$. Formally:

Lemma 5.1. *Given the voting equilibrium described in Lemma* 5.0, *every* $i \in C$ *wins the election with probability* $1/c$.

5.3.2 Entry

Following Besley and Coate (1997), define a *political equilibrium* to be an equilibrium $\mathbf{e}^* = (e_1^*, ..., e_k^*)$ at the entry stage, given sincere equilibria (as described by Lemma 5.0) in all the voting subgames induced by $\mathbf{e}^*$. Say that entry strategies are *anonymous* if $e_i = e$, all $i \in K$. We will only consider political equilibria in anonymous entry strategies (the basic insights generalize to the case where strategies are non-anonymous in equilibrium). Note that are two types of anonymous entry strategy: *pooling*, where $i \in K$ stands for election (or does not stand) whatever his ability type, and *separating*, where $i \in K$ only stands if he is high-type (or low-type). Note

[19] For example, the voting strategy profile where everybody votes for the entrant with the lowest value of the index i is an equilibrium.

also that the voting strategies described in Lemma 5.0 are anonymous,[20] given that citizens in K follow anonymous entry strategies. At this stage, we need to separate out the analysis of congruent and non-congruent preferences.

Congruent Preferences

Let x be distributed Binomially with parameters $\rho, k-1$; this random variable is the number of entrants other than some $i \in K$, if all citizens in K follow the separating strategy of only entering if they are high-type. Let $\mu = E[\frac{1}{x+1}]$, and $\lambda = 1-(1-\rho)^{k-1}$. It is then easy to show:

Proposition 5.1. *Assume $k < n-1$. Then, if $\underline{\delta} \leq \delta_p$, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $\underline{\delta} \leq \hat{\delta} \leq \delta_p$, where $\delta_p = \frac{1}{k}[R_L - \rho(W_H - W_L)]$. Also, if $\underline{\delta} \leq \overline{\delta}_s$, there exist belief profiles for which an anonymous separating equilibrium exists where every $i \in K$ enters only if he is a high-type, and spends $\max\{\underline{\delta}, \underline{\delta}_s\} \leq \hat{\delta} \leq \overline{\delta}_s$, where $\overline{\delta}_s = \lambda W_H + \mu R_H$, $\underline{\delta}_s = \mu(W_L + R_L) + (\lambda - \mu)W_H$. There are no other anonymous equilibria.*

Note three points. First, there cannot be separating equilibria where only low-ability types enter; this is because - from Lemma 5.1 - all entrants win with probability $1/c$, and also high-ability types get a bigger payoff from winning.

Second, as the proof of Proposition 5.1 shows, there are a range of campaign spending levels in both pooling and separating equilibria: the belief profiles that

[20]To see this, note that as all entrants are following the same strategy, $\pi(i,s) = \pi(j,s)$, all $i, j \in C$, so then $B(C) = C$. But then, all voters not in C randomise over C, and all voters in C vote for themselves.

support these equilibria "punish" non-equilibrium behaviour; if some citizen decides to deviate by spending $\delta' \neq \hat{\delta}$, all other citizens assign probability 0 to the event that he is high-ability, and so will not vote for him.

Third, ex ante, all citizens prefer the separating equilibrium to the pooling equilibrium if k is large enough.[21] Is there any way that $\underline{\delta}$ could be set ex ante at some constitutional stage to ensure that only the separating equilibrium could occur? The answer is yes. In fact, by definition, $\mu = E[1/(x+1)] > 1/k$, as $x + 1 \leq k$, so by inspection, $\overline{\delta}_s > \delta_p$. But then if $\hat{\delta}$ is set so that $\overline{\delta}_s \geq \hat{\delta} > \delta_p$, only the separating equilibrium will occur.

Non-Congruent Preferences

Let x be distributed Binomially with parameters $1-\rho, k-1$; this random variable is the number of entrants other than some $i \in K$, if all citizens in K follow the separating strategy of only entering if they are of type L. Let $\mu = E[\frac{1}{x+1}]$, and $\lambda = 1 - \rho^{k-1}$.

Proposition 5.2. *Assume $k < n - 1$. Then, if $\underline{\delta} \leq \delta_p$, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $\underline{\delta} \leq \hat{\delta} \leq \delta_p$, where $\delta_p = \frac{1}{k}[R_H + (1-\rho)(W_H - W_L)]$. There exist belief profiles for which a separating equilibrium exists where every $i \in K$ enters only if he is a low type iff $\overline{\delta}_s \geq \underline{\delta} \geq \underline{\delta}_s$, where $\underline{\delta}_s = \mu(W_H + R_H) + (\lambda - \mu)W_L$, $\overline{\delta}_s = \lambda W_L + \mu R_L$, in which case every entrant spends $\hat{\delta} = \underline{\delta}$. There are no other anonymous equilibria.*

[21] If k is small, λ may be large, so the loss from having the default policy may outweigh the gain from screening out low-ability candidates.

Again, the key result from our point of view is that there is no separating equilibrium where only high-ability candidates enter, i.e. with non-congruent preferences, the electoral process cannot screen out low-ability candidates. The intuition is simple: if there were such an equilibrium, low-ability candidates would find it profitable to imitate high-ability ones. The two types of candidates can only be sorted by high-ability candidates *not* entering.

Note also the fact that the pooling equilibria have the same structure in the two cases, whereas the structure of the separating equilibria is rather different. In particular, there can be at most one separating equilibrium in the non-congruent case, whereas in the congruent case, there are a continuum of them. The reason for this asymmetry is that in the congruent case, deviators can be "punished" by a loss of reputation (i.e. the assignment to them of zero probability that they are able). In the non-congruent case, by contrast, in the separating equilibrium, entrants *already* have no reputation in this sense, and hence cannot be punished in this way if they choose lower campaign expenditures. This drives down equilibrium expenditures to the minimum, $\underline{\delta}$; if this level is insufficient to deter entry by high-types, there is no separating equilibrium.

Note also that of the two possible kinds of equilibria, it is now the *separating* equilibrium that is undesirable from the voters' point of view. Suppose that there is a prior constitutional design stage where a level of $\underline{\delta}$ could be set, say by majority voting. Now, to be able to set $\underline{\delta}$ to eliminate the separating equilibrium, but not the pooling equilibrium, they need to set $\underline{\delta} < \min\{\underline{\delta}_s, \delta_p\}$. In what follows, we will assume that $\underline{\delta}$ is set in this way.

5.3.3 Equilibrium Selection via Stability

Propositions 5.1 and 5.2 indicate that in both cases, there are multiple equilibria, and moreover, in the congruent case, there may be both pooling and separating equilibria. We show here that requiring equilibrium to satisfy a stability condition related to the Cho-Kreps Intuitive Criterion (IC) in fact rules out all equilibria except one in each case, giving us a unique equilibrium selection.

First, we adapt the formal definition of the IC to our game, which has many "senders" and "receivers", and where we are assuming particular play (conditional on beliefs) at the voting stage. Let $u_a(s, 1, \hat{\pi})$ be the expected payoff to $i \in K$ from an action $s \in S_i$ given that i is of type $a = H, L$, given that voting takes place as described in Lemma 5.0, and given a belief profile $(1, \hat{\pi})$ that assigns 1 to the probability that i is a high-type, and $\hat{\pi}$ are beliefs about the type of any $j \in K$, $j \neq i$ generated by equilibrium play[22] by all $j \in K$, $j \neq i$. Also, let $\hat{u}_a$ be the equilibrium payoff for an $i \in K$ of type a. Then say that action s is *equilibrium dominated*[23] at that equilibrium for i if $\hat{u}_a > u_a(s, 1, \hat{\pi})$. That is, an action is dominated for i if he prefers his equilibrium payoff to taking it, even though voters would respond to the action as if he were high-ability with probability 1.

Now define the set of types for which action s is dominated at equilibrium;

$$J(s) = \{a \in \{H, L\} \,|\hat{u}_a > u_a(s, 1, \hat{\pi})\}$$

[22]Formally, in the congruent case, $\hat{\pi} = \pi(j, (1, \hat{\delta})) = \rho$ if the equilibrium is pooling, and if the equilibrium is separating, $\hat{\pi} = \pi(j, (1, \hat{\delta})) = 1$, $\hat{\pi} = \pi(j, 0) = 0$, and similarly in the non-congruent case.

[23]This concept of equilibrium dominance is weaker than in the original IC, where the receiver (the voters) are assumed to respond with their undominated action that is best for the sender. However, in the pooling equilibrium, this makes no difference to the "bite" of the criterion, as in either case, all voters would vote for i.

Then, define the out-of-equilibrium beliefs $\phi(J(s))$ as:

$$\phi(\emptyset) = \phi(H, L) = \rho, \quad \phi(H) = 0, \quad \phi(L) = 1.$$

This says (for example) that voters will attach probability zero to the event that i is of type H if the observed action s is dominated at equilibrium for H but not type L, and vice-versa, but if it is dominated for both (or neither), voters will not update their priors. This function fully specifies out-of-equilibrium beliefs.

The equilibrium denoted by "hats" *fails the intuitive criterion (IC)* if for some $s \in S_i$ there exists a type $a = H, L$ such that

$$\hat{u}_a < u_a(s, \phi(J(s)), \hat{\pi})$$

That is, there exists a "sender" i of type a who would prefer to deviate from his equilibrium action by choosing s, given that by doing so, it could credibly signal to the voters that he was of type a. We can now show:

Proposition 5.3. *Assume that preferences are congruent. Then, all pooling equilibria fail the IC, as does any separating equilibrium with campaign expenditure* $\hat{\delta} > \max\{\underline{\delta}_s, \underline{\delta}\}$.

The intuition is clear. Starting at the pooling equilibrium, a high-type will always be willing to "pay more" via greater campaign spending to signal that he is a high-type than the low-type is willing to do, and this allows him to signal credibly and break the pooling equilibrium. Starting at a separating equilibrium with $\hat{\delta} > \underline{\delta}_s$, any high type can cut his expenditure by ε to $\hat{\delta} - \varepsilon > \underline{\delta}_s$, and still credibly signal that he is a high-type.

We can apply this refinement to the pooling equilibria in the non-congruent case.

Proposition 5.4. *Assume that preferences are non-congruent. Any pooling equilibrium with $\hat{\delta} > \underline{\delta}$ fails the IC.*

So, in either case, there is an unique equilibrium that passes the (modified) intuitive criterion:

- In the congruent case, a separating equilibrium where only H-types enter and spend $\max\{\underline{\delta}_s, \underline{\delta}\}$.
- In the non-congruent case, a pooling equilibrium where both types enter and spend $\underline{\delta}$.

5.4 The Rogoff Model

We now turn to apply Section 5.3 to a simplified version of Rogoff's (1990) Equilibrium Political Budget Cycle model. The two simplifications are: (i) we assume two periods, rather than the T-period setting of Rogoff; (ii) we assume away the "looks" shocks, which in Rogoff (1990), serve only as a technical device to eliminate pooling equilibrium.[24] These simplifications do not change the structure of the undominated separating equilibrium studied by Rogoff, but allow us to focus on our main argument with the minimum of complexity.

[24]We discuss how the introduction of looks shocks would affect the equilibrium with endogenous candidate entry in Section 5.7.2 below.

5.4.1 Elements of the Model

The economy is populated by a set N of citizens with $\#N = n > 3$ and evolves over two time periods, $t = 1, 2$. In each time period, there is one *office-holder,* whose responsibility is to raise taxes and produce public goods. The possible institutions by which the office-holder is selected from the citizens are described in Section 5.4.2.

There are two types of publicly provided goods,[25] a consumption good and an investment good whose levels of consumption in periods $t = 1, 2$ are denoted by g_t and k_t respectively. The investment good is produced in the period before it is consumed, so $k_1 \equiv 0$. All citizens also derive utility from the consumption of a private numéraire good, c_t. Preferences of citizens over $(c_1, g_1, k_2, c_2, g_2)$ are given by

$$u(c_1, g_1) + v(k_2) + u(c_2, g_2) \tag{5.2}$$

where u, v are strictly increasing in their arguments and strictly concave. The office-holder also benefits from an ego-rent of R when in office.

The budget constraint of the representative citizen for period t is:

$$c_t = y - \tau_t \tag{5.3}$$

where, y is the exogenous, per period, endowment of a non-storable good, and τ_t is a tax in period t.

The public good production function for period 1 and 2 respectively is given by:

[25] Rogoff (1990) implicitly assumes that these goods are technically private, i.e. rivalrous in consumption. This seems a reasonable assumption for most public goods and services (education, health) and so we adopt this assumption here also.

$$g_1 + k_2 = \tau_1 + \theta, \qquad g_2 = \tau_2 + \theta \tag{5.4}$$

where θ measures the ability of the office-holder in transforming the private good (tax revenue) into public goods. We suppose that[26] the *ability types* of the citizens are indexed by $a \in \{\theta_H, \theta_L\}$, with $\theta_H > \theta_L > 0$, and the type of any citizen is determined by a random draw from $\{\theta_H, \theta_L\}$ with probabilities $\rho \equiv \Pr(\theta = \theta_H)$ and $(1-\rho) \equiv \Pr(\theta = \theta_L)$ at the beginning of period 0.

5.4.2 Information Structure and Order of Events

We consider two institutions by which candidates are selected and elections are arranged. The first is that studied by Rogoff.

1. *Partial Democracy (i.e. with Exogenous Candidate Selection)*

Then, at the beginning of period 1, a citizen is selected at random from the population to be office-holder. Conditional[27] on her own ability, she then sets g_1, τ_1 and k_2. Next, at the beginning of period 2, a *challenger* j is randomly selected from the remaining citizens to contest the election against i. All citizens then vote for i or j having observed g_1, τ_1 but not k_2 (or θ given that ability is private information). The candidate with most votes wins, and then chooses g_2, τ_2. We will also assume throughout that voters have a lexicographic second preference for the incumbent, i.e. if a voter believes that both challenger and incumbent are high-ability with the same probability, then the voter strictly prefers the incumbent.

[26]Note that because of the assumption of two periods, we can simply assume that θ is constant for the two periods of the game, rather than following a moving-average process as in Rogoff (1990).

[27]Note that we are not allowing the choice of policy to depend on the name (index) of the office-holder, i.e. strategies are *anonymous*, as in the above one-period game.

2. *Representative Democracy (i.e. with Endogenous Candidate Entry)*

At the beginning of period 1, each citizen i privately observes her own θ. Then there is an election, which is characterized by two steps, as in Section 5.3 above. That is, first, all citizens in $K \subset N$ can simultaneously decide whether to enter (stand for election) or not, and if they enter, how much to spend on campaigning (δ is the cost of campaigning). Second, all voters then vote simultaneously for a single candidate, and the winner is selected by plurality rule. Ties are broken fairly.[28] Let the resulting set of candidates be C_1. All voters then vote[29] for a single candidate in C_1, and the winner is selected by plurality rule. The winner is then office-holder and sets g_1, τ_1 and k_2.

A the beginning of period 2, an election identical to that in period 1 occurs. Let the resulting set of candidates be C_2. All voters then vote for a single candidate in C_2, and the winner is selected by plurality rule. The winner is then office-holder and sets g_2, τ_2. In both elections, voters vote sincerely, i.e. as described in Lemma 5.0.

5.4.3 The Efficient Benchmark

Suppose that there were no elections. Then an incumbent of type a would choose policy to maximize (5.2) subject to (5.3) and (5.4). The first-order conditions to this problem can be written

$$u_c(y - \tau_1, g_1) = u_g(y - \tau_1, g_1) \tag{5.5}$$

$$u_c(y - \tau_2, \tau_2 + \theta_a) = u_g(y - \tau_2, \tau_2 + \theta_a) \tag{5.6}$$

[28] Here, the *default option* is zero supply of both public goods. We assume without loss of generality that $v(0) = u(y, 0) = 0$, so the default option gives all citizens a zero payoff.

[29] As in the one-period model, we allow voters to randomise.

$$u_g(y-\tau_1, g_1) \;=\; v'(\tau_1+\theta-g_1) \tag{5.7}$$

in obvious notation. That is, (5.5) and (5.6) say that the marginal utility from private and public consumption goods must be the same in both periods, and (5.7) says that the marginal utility from the first-period public consumption good and public investment good must be equal. Let the solution to this problem be $(\tau_1^*(\theta_a), g_1^*(\theta_a), \tau_2^*(\theta_a))$. As all citizens have the same preferences, this solution is efficient *conditional* on the ability of the incumbent, θ_a. So, we refer to $(\tau_1^*(\theta_a), g_1^*(\theta_a), \tau_2^*(\theta_a))$ as the *conditionally efficient policy.* This solution is only efficient overall, of course, if $a = \theta_H$, i.e. an efficient incumbent is selected. So, we refer to $(\tau_1^*(\theta_H), g_1^*(\theta_H), \tau_2^*(\theta_H))$ as the *first-best efficient policy.*

5.4.4 Equilibrium with Partial Democracy

Rogoff (1990) shows that there is a unique "separating" perfect Bayesian equilibrium[30] (PBE) of the above model under a reasonable assumption (minimal sophistication) on voters' beliefs, described below. We briefly describe this equilibrium below and also, for intuitive purposes, use the diagrams in Rogoff (1990).

In period 2, once elected, an office-holder of type $a \in \{\theta_H, \theta_L\}$ chooses g_2 to maximize $u(c_2, g_2)$ subject to the second-period private budget constraint, $c_2 = y - \tau_2$, and the government budget constraint, $g_2 = \tau_2 + \theta_a$. In period 2, once elected, an office-holder of type $a \in \{\theta_H, \theta_L\}$ chooses τ_2 to maximize $u(c_2, g_2)$ subject to $c_2 = y - \tau_2,\;\; g_2 = \tau_2 + \theta_a$; i.e.

$$\tau_2^*(\theta_a) = \arg\max\; u(y-\tau_2,\; \tau_2+\theta_a) \tag{5.8}$$

[30] He also shows that there may be a pooling equilibrium, but that this pooling equilibrium fails the Cho-Kreps Intuitive Criterion. So, we will focus - as Rogoff does - on the separating equilibrium in what follows.

Note that second-period policy is *always* conditionally efficient. Let $V_a \equiv u(y-\tau_2^*(\theta_a), \tau_2^*(\theta_a)+\theta_a)$ be the payoff to any voter from a second-period office-holder of type a.

Now consider voter behaviour at the beginning of period 2. Let $\hat{\pi} = \pi(g_1, \tau_1)$ be the probability belief that the incumbent is high-ability, given first-period actions g_1, τ_1. Then, assuming that the incumbent is i, and the challenger j, the pay-offs to all $k \neq i, j$ from voting for i or j are

$$\hat{\pi} V_H + (1-\hat{\pi})V_L, \ \rho V_H + (1-\rho)V_L \tag{5.9}$$

respectively. So, $k \neq i, j$ will vote for the incumbent if $\hat{\pi} \geq \rho$, and for the challenger otherwise. As $n > 3$, voters $k \neq i, j$ are decisive, so i will win the election iff $\hat{\pi} \geq \rho$. So, a first-period incumbent of type a has a second-period continuation payoff of

$$V_a^2(\hat{\pi}) = \begin{cases} V_a + R & if \ \ \hat{\pi} \geq \rho \\ \rho V_H + (1-\rho)V_L & if \ \ \hat{\pi} < \rho \end{cases} \tag{5.10}$$

Now consider the first period. The present-value payoff of the incumbent, conditional on first-period policy and $\hat{\pi}$, is:

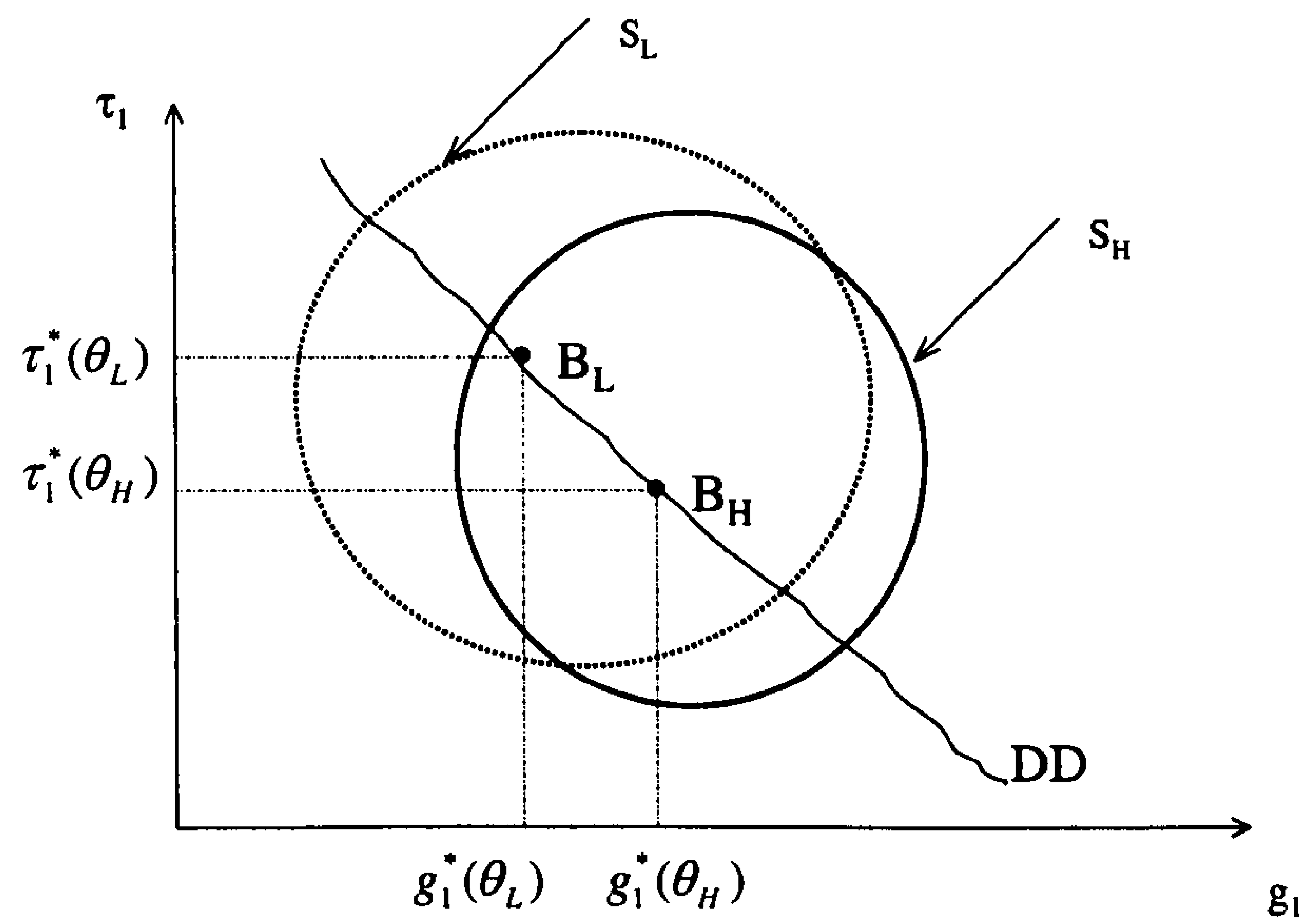
$$V_a^1(g_1, \tau_1, \hat{\pi}) \equiv u(y-\tau_1, g_1) + v(\tau_1 + \theta_a - g_1) + V_a^2(\hat{\pi}), \qquad a \in \{\theta_H, \theta_L\} \tag{5.11}$$

So, in perfect Bayesian equilibrium, $(\hat{\tau}_1(\theta_a),\ \hat{g}_1(\theta_a))$ must maximize (5.11) given $\hat{\pi} = \pi(\tau_1, g_1)$, and $\pi(\tau_1, g_1)$ must satisfies Bayes' rule.

In general, the form of this equilibrium will depend on off-the-equilibrium path beliefs. We follow Rogoff in constraining these beliefs. Now define the *credible signalling sets* $S_H, S_L \subset \Re_+^2$ as follows:

$$S_a = \{(g_1, \tau_1) \,|V_a^1(\tau_1, g_1, 1) \geq V_a^1(\tau_1^*(\theta_a), g_1^*(\theta_a), 0)\}, \qquad a \in \{\theta_H, \theta_L\} \tag{5.12}$$

Figure 5.1 First-Best Equilibria and Credible Signalling Sets



For example, S_H is the set of first-period policies (g_1, τ_1) that a high-type incumbent prefers to his conditionally efficient first-period policy, given that in the first case, voters believe he is a high-type with probability 1, whereas in the second, voters believe he is a high-type with probability 0. $S_H, S_L \subset \Re_+^2$ measure the (maximum) extent to which incumbents are willing to distort first-period policy away from the conditionally efficient level in order to signal to the electorate that they are a high-type (and therefore increase their probability of re-election). Note that S_a is a convex set containing the type-a's bliss point $B_a = (\tau_1^*(\theta_a), g_1^*(\theta_a))$, as shown in Figure 5.1.

Also, note that for S_a to be non-empty, a type-a incumbent must suffer a utility loss from losing power. This is always the case for high-types, but for low-types, this requires the following assumption:

Assumption 5.3. $R > \rho(V_H - V_L)$.

Assumption 5.3 says that the ego-rent exceeds the expected gain (from more efficient supply of the public good) to a low-type from standing down and conceding office to a randomly selected challenger. In fact, Assumption 5.3 is the analogue of Assumption 5.1 above.

Our constraint on out-of-equilibrium beliefs is now as follows. Say that voters' beliefs are *sophisticated* if:

$$\widehat{\pi}(g_1, \tau_1) = 1 \text{ if } (g_1, \tau_1) \in S_H \cap \Re^2_+ / S_L = Q \tag{5.13}$$

That is, voters believe that (g_1, τ_1) signals a high-type if (g_1, τ_1) is in S_H but not in S_L. This is a reasonable restriction, because if $(g_1, \tau_1) \notin S_L$, a low-type would never want to choose (g_1, τ_1), *even if* by doing so he could convince the voters that he was a high-type. Finally, say that a PBE is *separating* if first-period policy (g_1, τ_1) depends non-trivially on θ, and *pooling* otherwise. Then, summarizing various results of Section IV of Rogoff (1990), we have:

Proposition 5.5 (Rogoff, 1990). *Assume Assumption* 5.3. *If voters' beliefs are sophisticated, then there exists a unique separating equilibrium. In this equilibrium, first-period policy of the low-type is conditionally efficient* $(\widehat{\tau}_1(\theta_L), \widehat{g}_1(\theta_L) = \tau_1^*(\theta_L), g_1^*(\theta_L))$. *On the other hand,* $\widehat{\tau}_1(\theta_H), \widehat{g}_1(\theta_H)$ *maximizes* $u(y - \tau_1, g_1) + v(\tau_1 + \theta_H - g_1)$ *subject to* $(g_1, \tau_1) \in Q$. *If the constraint in this problem is binding, the first-period policy of the high-type is distorted by a signalling motive, i.e.* $(\widehat{\tau}_1(\theta_H) < \tau_1^*(\theta_H)$, *and* $\widehat{g}_1(\theta_H) > g_1^*(\theta_H))$.

For completeness, this result is proved in Appendix D.2. This result says that there will be policy distortion by the high-type if he cannot signal his type just by choosing his most desired first-period policy, i.e. the constraint that $(g_1, \tau_1) \in Q$ is binding. The latter can occur under plausible conditions.[31] In this event, the first-period policy choice of the competent type is distorted in the direction of higher consumption good than is optimal, and a lower tax than is optimal. This of course implies, via the production function (5.4), that the provision of the investment good k_2 is suboptimally low.

This equilibrium can be illustrated via the following figure (Figure 5.2), which is adapted from Figure 2 of Rogoff (1990). The shaded area is the set Q. As drawn, the constraint $(g_1, \tau_1) \in Q$ is binding, i.e. the most preferred policy of the high-type, $B_H = (\tau_1^*(\theta_H),\ g_1^*(\theta_H))$, is in the credible signalling set of the low-type, S_L. Also, the line DD is the locus of points for which efficiency condition (5.5) holds. As Rogoff shows, $\hat{\tau}_1(\theta_H),\ \widehat{g}_1(\theta_H)$ satisfies this efficiency condition, and so the equilibrium E must be that point on DD on the boundary of Q closest to B_H, i.e. as shown.

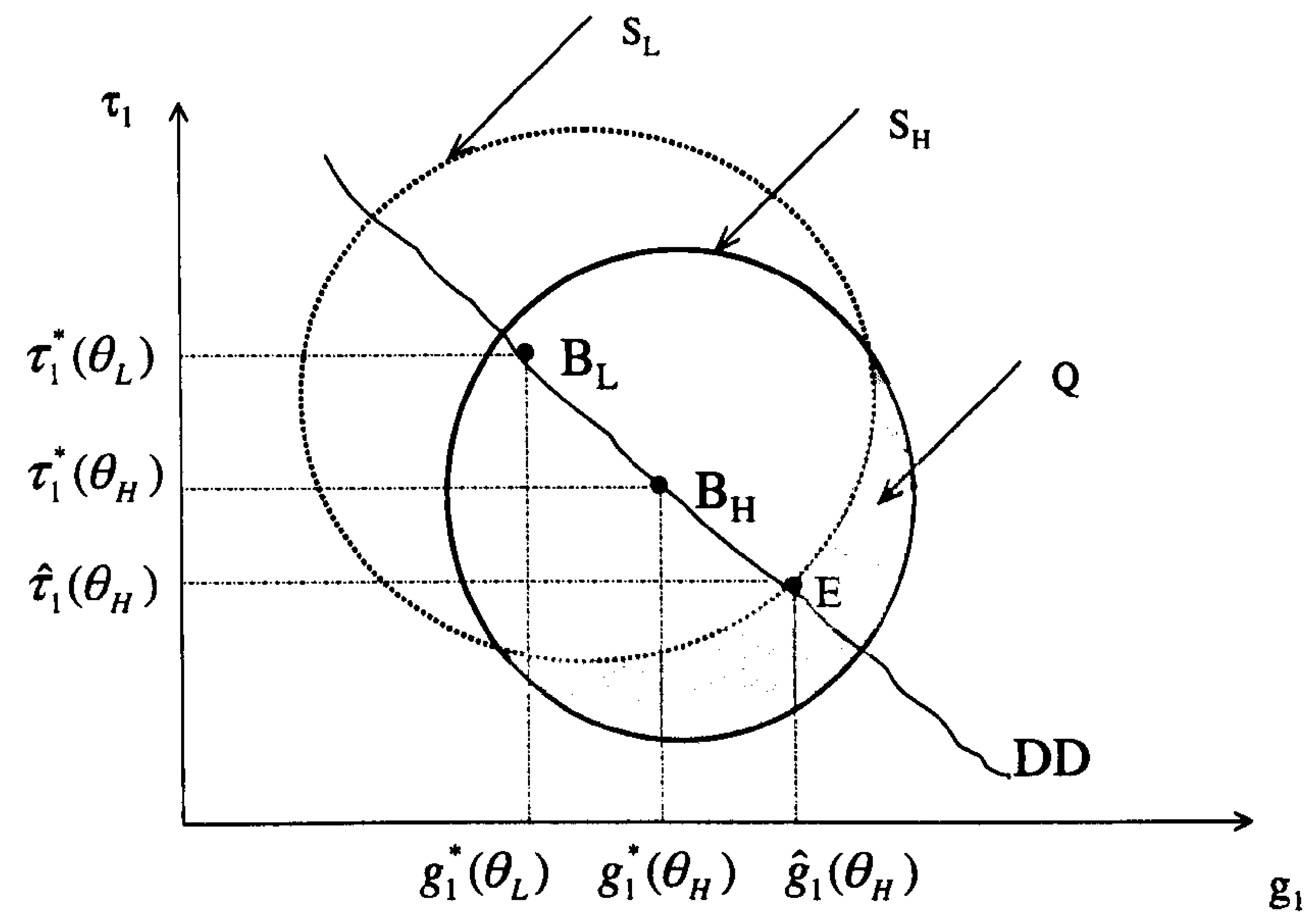
5.5 Representative Democracy in the Rogoff Model

In this section we analyse the Rogoff model[32] under the alternative, and more realistic, institution of a representative democracy (i.e. where candidate entry is endogenised). The resulting model essentially is a twice-repeated version of the model of Section 5.3, with the additional complication that the winner of the first-period election (the

[31] When R is large, or when $\theta_H - \theta_L$ is small. See Rogoff (1990), p28.

[32] In this section, we will assume that utility is quasi-linear in the private good, i.e. $u(c, g) = c + u(g)$. Otherwise, as Rogoff observed, "*A fee tends to distort a (selfish) leader's choice of tax policy, because it gives him a different trade-off between private and public goods expenditure than the representative voter.*" (p.33). Of course, if this effect is small, then our results carry over approximately to the more general case.

Figure 5.2 Undominated Separating Equilibrium



incumbent) can signal his ability via first-period policy choice. Nevertheless, we will find that the analysis of Section 5.3 will give us a powerful guide for our analysis. In particular, note that in the Rogoff model, using the notation of Section 5.3, $R_H = R_L = R$, so preferences are always *congruent*. We solve the model backwards.

Second Period: $t = 2$

First, we need a formalization of off-the-equilibrium path beliefs as in Section 5.3. Let $\pi(j,h)$, $j \neq i$ be the probability assessment on the part of all $i \neq j$ that candidate $j \in K$ is high-ability, given a *public history*[33] of play h. Generally, h is a list of all past candidate entry and campaign expenditure decisions by $i \in K$, and voting decisions by $i \in N$, plus choice of first-period policy g_1, τ_1 by the first-period

[33]Voters can condition their actions on the public history, plus observation of their own θ.

incumbent, denoted l. This formulation embodies Assumption 5.2 of Section 5.3, i.e. that given the same information, citizens for the same beliefs. For example, at the beginning of period 2, $h = (\mathbf{s}_1, \mathbf{v}_1, l, g_1, \tau_1)$, where $\mathbf{s}_1 \in \mathbf{S}$ are first-period entry decisions, $v_{i,1} \in C_1$ is a voting decision by $i \in N$, and $\mathbf{v}_1 = (v_{i,1})_{i \in N}$, and finally g_1, τ_1 is a policy choice by the (first-period) incumbent l.

Optimal policy choice by the office-holder of ability a at period 2 gives payoff V_a to all citizens, with $V_H > V_L$, and the office-holder gets an ego-rent of R. Now consider the voting equilibrium, given a candidate set C_2. The equilibrium strategies are exactly as in Lemma 5.0. However, note now[34] that the lexicographic preference for the incumbent means that the set $B(C_2)$ needs to be slightly redefined. If $l \notin C_2$, it is as above in (5.1). If $l \in C_2$, and $\pi(l,h) \geq \pi(j,h)$, all $j \in C_2$, then $B(C_2) = \{l\}$. Then, the following result is immediate.

Lemma 5.2. *Assume that $\pi(l,h) = 1$ at history $h = (s_1, v_1, l, g_1, \tau_1)$, and that voting at $t = 2$ is as described by Lemma 5.0. Then, the only possible perfect Bayesian equilibrium of the game in period $t = 2$ is where only l enters and chooses minimum campaign spending ($s_{l,2} = (1, \underline{\delta})$, $s_{m,2} = 0$, $m \in K$, $m \neq l$) and where l is elected.*

Proof. Suppose to the contrary that some $m \in K, m \neq l$ enters in equilibrium. Clearly, if $\pi(l,h) = 1$, then all $i \notin N/K$ will vote for l. So, m cannot win and so entry cannot be optimal, a contradiction. □

[34]The other complicating factor is that possibly $\pi(l,h) = 0$. In this case, if l chooses an s that only H-types choose in equilibrium, we have an impossible event, and Bayesian updating does not apply. We assume that in this case, $\pi(l,h) = 0$ remains unchanged.

First period: $t = 1$

Interpret W_H, W_L as the continuation pay-offs of type H, L office-holders, conditional on being elected at period 1. Then, we can define the *first period candidate entry game conditional on* W_H, W_L to be the game where at period 1, all $i \in K$ make their entry and campaign expenditure decisions, and all $i \in N$ then vote. From Proposition 5.3, it is immediate that:

Lemma 5.3. *Given any fixed continuation pay-offs $W_H > W_L$, the only symmetric perfect Bayesian equilibrium of the first period candidate entry game which satisfies the IC is where every $i \in K$ enters iff $\theta^i = \theta_H$.*

Say that the perfect Bayesian equilibrium (PBE) of the Rogoff model with endogenous entry is *intuitive* if the perfect Bayesian equilibrium of the first period candidate entry game satisfies IC, conditional on any fixed continuation pay-offs W_H, W_L. We now have one of our key results of this chapter.

Proposition 5.6. *Assume Assumption* 5.3. *There is a unique intuitive PBE of the Rogoff model with endogenous entry. This equilibrium has the following structure. At $t = 1$, every $i \in K$ enters if and only if $\theta^i = \theta_H$, and all entrants are elected with probability $1/c$. The office-holder l chooses the efficient fiscal policy in period* 1, *i.e.* $g_1, \tau_1 = g_1^*(\theta_H), \tau_1^*(\theta_H)$. *Then, at $t = 2$, only l enters, and is elected again. Once in office, he chooses the efficient fiscal policy in period* 2, *i.e.* $\tau_1 = \tau_2^*(\theta_H)$.

Proof. (a) *Existence.* This follows directly from Lemmas 5.1 and 5.2, as long as $W_H > W_L$, given the equilibrium policy choices of high and low-types. But, in *any*

PBE, a high-type who wins office in period 1 must have a higher continuation payoff than a low-type. First, the payoff from period 1 policy choice is strictly higher, as the high-type is more able. Second, second-period continuation pay-offs must be at least as high, as the high-type can always follow the pooling strategy of imitating the low-type.

(b) *Uniqueness.* Suppose that there were another intuitive equilibrium. In this other equilibrium, $W_H > W_L$ by the argument in (a). But then, by Proposition 5.3, this other equilibrium must have the same first-period equilibrium entry strategies as the one described in Proposition 5.6. But then, $\pi(h,l) = 1$ at the beginning of the second period, so the equilibrium in the second period must also be the same as described in Proposition 5.6. So, there cannot be another equilibrium. □

In this equilibrium, candidates fully signal their ability at the candidate entry stage, so the ability of the office-holder is fully known, and so there is no need to signal to the electorate via policy. That is, the entry decision is a *substitute*, and a more efficient one at that, for signalling via policy. So, in equilibrium, there is no distortionary signalling (fiscal policy) activity by the incumbent, in contrast to the case with exogenous candidate selection. In fact, the equilibrium of Proposition 5.6 is *first-best efficient*; a competent type is selected for office in each period, and he does not signal.

5.6 The Rogoff Model with an Agency Problem

We now consider a different version of the Rogoff model, where politicians differ not in ability, but in the extent to which they wish to appropriate tax revenues for their own personal or party benefit (alternatively we can assume, as in Coate and Morris, 1995, that all candidates are equally able and only differ in their honesty). Formally, we model this as follows. We start with our two-period version of the Rogoff model outlined in Section 5.4, and normalize the ability parameter of all office-holders to zero, i.e. $\theta = 0$. So, the public good production function for period 1 and 2 respectively is given by:

$$g_1 + k_2 = \tau_1 - r_1, \qquad g_2 = \tau_2 - r_2 \tag{5.14}$$

Here, r_1, r_2 are the amounts of tax revenues taken in the form of rents by politicians. This modelling of the agency problem follows Persson and Tabellini (2000), Chapter 4.

So, citizen's preferences over policy outcomes (including r_1, r_2) in the two time periods are

$$u_c(\tau_1, g_1, r_1, r_2, \tau_2) = u\,(y - \tau_1, g_1) + v\,(\tau_1 - g_1 - r_1) + u\,(y - \tau_2, \tau_2 - r_2)$$

Citizens eligible for office have preferences over policy outcomes identical to citizens, except that they value rents:

$$u_o = u_c(\tau_1, g_1, r_1, r_2, \tau_2) + \nu[\phi(r_1) + \phi(r_2)], \qquad \nu \in \{\nu_H, \nu_L\}, \qquad \nu_L > \nu_H = 0$$

where ϕ is a strictly increasing, strictly concave function with $\lim_{r \to 0} \phi'(r) = \infty$. So, here ν measures the honesty of the politician, rather than ability. So, in the agency case, H, L stand for high and low honesty respectively. As above, we suppose that the honesty type of a citizen is determined by random draw at the beginning of period 1, and $\rho \equiv \Pr(\nu = \nu_H)$. The order of events is exactly as in Section 5.4.2 except that once policy has been chosen in any period $t = 1,2$, the politician may choose r_t. Also, voters do not observe r_1, r_2 directly, as they do not observe θ in the base Rogoff model.[35]

5.6.1 Partial Democracy

We begin by the analysis of the partial democracy case. The exposition follows that of Section 5.4 as closely as possible. Once elected at $t = 2$, the office-holder of type $a = H, L$ (where a now denotes honesty rather than ability) solves the problem of choosing τ_2, r_2 to maximize $u\left(y - \tau_2,\right) + \nu_a \phi(r_2)$. The first-order conditions for this are

$$\begin{aligned} u_c(y - \tau_2, \tau_2 - r_2) &= u_g(y - \tau_2, \tau_2 - r_2) \\ u_g(y - \tau_2, \tau_2 - r_2) &= \nu_a \phi'(r_2) \end{aligned}$$

Let the solution to this problem be $\tau_2^*(\nu_a), r_2^*(\nu_a)$. It is easily checked that at the end of the second period, a type-L office-holder will take a positive amount of rent $(r_2^*(\nu_L) > 0)$, whereas the honest type will take zero rent $(r_2^*(\nu_H) = 0)$. So, following the notation of the previous section, the second-period continuation pay-offs of non-office holders are

$$V_a = (y - \tau_2^*(\nu_a),\ \tau_2^*(\nu_a) - r_2^*(\nu_a))$$

in the event that a type $a = H, L$ citizen is office-holder, with $V_H > V_L$. Also, note that the continuation pay-offs of the office-holder of type a may be written as $R_a + V_a$, where $R_a = R + \nu_a \phi(r_2(\nu_a))$, so that the ego-rent now includes the pay-offs

[35] Of course, the voter can infer r_1 in period 2 from the levels of τ_1, g_1, k but by then it is too late.

from rents. By the envelope theorem, it is easy to see[36] that $R_L + V_L > R_H + V_H$, so the continuation pay-offs of the office-holders are *non-congruent* with those of citizens. Now consider the election at $t = 2$. Clearly, the incumbent will be elected iff $\pi(g_1, \tau_1) \geq \rho$, where $\pi(g_1, \tau_1)$ has the same interpretation as above, i.e. it is the posterior belief by voters that $a = H$, given observable period 1 policy.

We can now define the signalling sets much as in the base model. Consider the first-order conditions to the problem of maximizing the first-period policy of the office-holder, ignoring the effect this choice may have on the probability that he wins the election. The first-order conditions are, in the case where there is an interior solution:

$$u_c(y - \tau_1, g_1) = u_g(y - \tau_1, g_1) \tag{5.15}$$

$$u_g(y - \tau_1, g_1) = v'(\tau_1 - g_1 - r_1) \tag{5.16}$$

$$v'(\tau_1 - g_1 - r_1) = \nu_a \phi'(r_1) \tag{5.17}$$

In the case that the politician is honest, there is a corner solution for r_1 with $r_1 = 0$. Denote these solutions by $(\tau_1^*(\nu_a), g_1^*(\nu_a), r_2^*(\nu_a))$ and call them *first-period myopically optimal* policies. Note by comparison of (5.15)-(5.17) to (5.5)-(5.7) that this policy is first-best efficient when $a = H$, but inefficient when $a = L$. Moreover, the direction of the inefficiency is the same as in the base Rogoff model: $\tau_1^*(\nu_H) < \tau_1^*(\nu_L)$, $g_1^*(\theta_H) > g_1^*(\theta_L)$. So, then we can define the signalling sets S_H, S_L as in Section 5.4.4, and it is easily checked that they have the same properties as in the base case, i.e. S_a is a convex set containing the type-a's bliss point $B_a = (\tau_1^*(\theta_a), g_1^*(\theta_a))$, as shown in Figure 5.1 above. We can also define sophisticated beliefs as above. Then, by an

[36]To see this, note that $R + V \equiv \max_{\tau_2, r_2} u(y - \tau_2, \tau_2 - r_2) + \nu\phi(r_2)$, and so by the envelope theorem, $R + V$ is increasing in ν.

argument identical to that of Section 5.4 above, we have:

Proposition 5.7. *If voters' beliefs are sophisticated, then there exists a unique separating equilibrium. In this equilibrium, first-period (observable) policy of the dishonest type is first-period myopically optimal, i.e.* $(\widehat{\tau}_1(\nu_L), \widehat{g}_1(\nu_L), = \tau_1^*(\nu_L), g_1^*(\nu_L))$. *On the other hand,* $\widehat{\tau}_1(\nu_H), \widehat{g}_1(\nu_H)$ *maximizes* $u(y-\tau_1, g_1)+v(\tau_1-g_1)$ *subject to* $(g_1, \tau_1) \in Q$, *and* $\widehat{r}_1(\nu_H) = 0$. *If the constraint in this problem is binding, the first-period policy of the high-type is distorted by a signalling motive, i.e.* $(\widehat{\tau}_1(\nu_H) < \tau_1^*(\nu_H)$, *and* $\widehat{g}_1(\nu_H) > g_1^*(\nu_H))$.

So, we see that in the version of this model with partial democracy, we have a political budget cycle in fiscal policy with the same structure as in the base Rogoff model. Moreover, as in that model, signalling is welfare reducing, in that it distorts the policy of the good type (here, the honest type) away from the first-best.

5.6.2 Representative Democracy

In this section, we analyse the Rogoff model with an agency problem under the alternative, and more realistic, institution of a representative democracy. As in the base Rogoff case, the resulting model essentially is a twice-repeated version of the model of Section 5.3, with the additional complication that the winner of the first-period election (the incumbent) can signal his ability via first-period policy choice. We solve the model backwards.

Second Period: $t = 2$

First, as above in the case of partial democracy, optimal policy choice by the office-holder of ability a at period 2 gives payoff V_a to all citizens, with $V_H > V_L$, and the office-holder gets an ego-rent of R_a. Next, we will formalize off-the-equilibrium path beliefs as in Section 5.5, i.e. $\pi(j,h)$, $j \neq i$ is the probability assessment on the part of all $i \neq j$ that candidate $j \in K$ is high-ability, given a public history of play h. Note that Lemma 5.2 above obviously applies to this case also.

First period: $t = 1$

Define W_H, W_L as the pay-offs of type H, L office-holders (excluding ego-rents), conditional on being elected at period 1. Then, we can define the *first period candidate entry game conditional on* R_H, R_L, W_H, W_L to be the game where at period 1, all $i \in K$ make their entry and campaign expenditure decisions, and all $i \in N$ then vote. From Proposition 5.4, it is immediate that:

Lemma 5.4. *Given any fixed continuation pay-offs* $R_H + W_H < R_L + W_L$, *in any symmetric perfect Bayesian equilibrium of the first period candidate entry game, every* $i \in K$ *enters, whatever their type.*

Now say that voter beliefs are sophisticated[37] at the stage of choice of policy in period 1, if voters believe that the incumbent is of type H with probability 1 if $(g_1, \tau_1) \in Q$, given that he has not previously revealed himself to be of type L. We now have another of our key results.

Proposition 5.8. *Assume Assumption* 5.3 *and that voter beliefs are sophisticated at the stage of choice of policy in period* 1. *There is always a PBE of the (modi-*

[37] In the notation of this section, this requires that for all $h = (\mathbf{s}_1, \mathbf{v}_1, l)$ such that $\pi(h,l) > 0$, if $h = (\mathbf{s}_1, \mathbf{v}_1, l, g_1, \tau_1)$, $\pi(h,l) = 1$ when $(g_1, \tau_1) \in Q$.

fied) Rogoff model with endogenous entry with the following structure. At $t = 1$, every $i \in K$ enters, and all entrants are elected with probability $1/k$. The office-holder l chooses fiscal policy in period 1 as in the game with partial democracy, i.e. $(g_1, \tau_1) = (\hat{g}_1(\theta_H), \hat{\tau}_1(\theta_H))$, if his type is H, and $(g_1, \tau_1) = (g_1^*(\theta_L),\ \tau_1^*(\theta_L))$ if his type is L. Then, at $t = 2$, if l is type H, only l enters, and is elected again. Once in office, he chooses the efficient fiscal policy in period 2, i.e. $\tau_1 = \tau_2^*(\theta_H)$. Otherwise, only $i \in K/\{l\}$ enter. Each is elected with probability $1/(k-1)$, and once in office, chooses second-period optimal policy. Moreover, this is the only equilibrium where there is signalling via policy in period 1.

Proof. (a) *Existence.* From Lemma 5.2, if l can signal that he is a type-H, he will win the election with probability 1. So, given the associated continuation payoffs, and the sophisticated off-the-equilibrium path beliefs, an argument as in the proof of Proposition 5.6 implies that the policy choices $\hat{g}_1(\theta_H)$, $\hat{\tau}_1(\theta_H)$, $g_1^*(\theta_L)$, $\tau_1^*(\theta_L)$ constitute an equilibrium, given that l has not revealed his type at the candidate entry stage at $t = 1$. But by Lemma 5.4, there must be a pooling equilibrium at the candidate entry stage at $t = 1$, as long as $R_H + W_H < R_L + W_L$. But, in *any* PBE, a L-type who wins office in period 1 must have a higher continuation payoff than a H-type, as he gets a payoff from rent that the other type cannot.

(b) *Uniqueness.* By the argument of (a), there must always be a pooling equilibrium at the candidate entry stage at $t = 1$. But then, with sophisticated off-the-equilibrium path beliefs, the *only* separating equilibrium at the policy stage at $t = 1$ is as in the Proposition (any other g_1, τ_1 in Q is suboptimal for the H type: c.f. Rogoff, 1990). □

In this equilibrium, candidates cannot signal their ability at the candidate entry stage, so there is still a need to signal to the electorate via policy. That is, the entry decision does not substitute for signalling via policy. This is obviously in contrast to the representative democracy Rogoff model with congruent preferences, and is being driven by the fact that here, citizen and office-holder preferences are non-congruent. We would expect to find similar conclusions if candidate entry were introduced into other models where office-holders differ in honesty, e.g. Coate and Morris (1995).

5.7 Extensions and Robustness Checks

5.7.1 Wealth Constraints

As remarked in the introduction, Rogoff considered a number of institutional mechanisms for eliminating the signalling distortion in his model, and found them all wanting. The one closest to our analysis is one he called "self-denial", i.e. signalling via the destruction of part of the endowment of the private consumption good. In one version of this mechanism, he proposes that society could enforce self-denial by requiring any incumbent who runs for re-election to pay a fee. Rogoff remarks "*It is easily shown that such a scheme can be welfare-improving, but not by enough to attain the full-information equilibrium [...] the most conspicuous drawback to this approach is that it would be very difficult in practice to find a rule for setting the fee, since incumbents differ greatly in wealth and future earning power*". (p.33)

To illustrate, suppose this fee were δ, and suppose that utility is quasi-linear in the private good, i.e. $u(c, g) = c + u(g)$. Then if the fee were set at

$$R + (1 - \rho)(W_H - W_L) \geq \delta > R - \rho(W_H - W_L)$$

then only a high-ability incumbent would prefer to run against the challenger (even if a low-ability type were to win, he would prefer not to take office, but allow the challenger to be elected unopposed). So, this mechanism would implement the first-best. Now suppose that a fraction λ_a of ability type a do not have sufficient wealth to pay the fee. Then, the mechanism becomes inefficient, as with probability λ_H, an efficient incumbent is not re-elected.

However, by contrast, given the very weak assumption that at least one high-ability type can afford the entry fee, our analysis of the Rogoff model with representative democracy is unaffected by wealth constraints. So, endogenous entry as a screening mechanism is *not* subject to the problem that the "fee mechanism" analysed by Rogoff (1990) and discussed above suffers from: namely, it inefficiently excludes high-ability low-wealth incumbents from re-election. The source of difference, is of course, that under a representative democracy in which candidate entry is endogenous, candidates can self-select on the basis of wealth, as well as ability.

To see this, note first that when $\delta > W_L + R$, no low-competence citizen will stand for election in equilibrium, even if she can afford the entry fee δ. Conversely, provided there is at least one high-ability type that can afford the entry fee, then an equilibrium similar to Proposition 5.6, without a Political Budget Cycle, will exist. Specifically, Proposition 5.6 continues to hold with the difference that $a = \max\{i \in N'_H\}$, where N'_H is the intersection of N_H with the subset of citizens that can afford the entry fee δ.

5.7.2 "Looks" Shocks

In Rogoff's model, voters preferences over candidates were also determined by "looks" shocks, random variables η_i, η_j realized after candidate selection but before elections (so they should more accurately be called campaign shocks). The variables η_i, η_j are i.i.d., mean zero and are publicly observed. The interpretation of η_i is that it is the additional utility that any voter $k \neq i, j$ gets from i's performance during the "campaign" prior to the election. All citizens then vote for i or j having observed $g_1, \tau_1, \eta_i, \eta_j$ but not k_2.

The purpose of those "looks" shocks is technical: they ensure that the pooling equilibrium of Rogoff's model could be eliminated by appeal to the Cho and Kreps (1987) Intuitive Criterion. However, it does not really matter for our analysis that they are dropped, in the sense that even if the pooling (in policy) equilibrium prevails in the Rogoff model, there is still a fiscal distortion before the election. Our arguments still apply to show that there is a separating (at the entry stage) equilibrium, where such distortion is eliminated. This separating (at the entry stage) equilibrium is first-best efficient and is therefore preferable to either a pooling or separating equilibrium at the policy stage.

5.7.3 Moral Hazard

As mentioned in the Introduction, there is an important literature, starting with Barro (1973), on electoral control which, unlike the Rogoff model, allows for moral hazard and conflicting interests. We briefly sketch how our arguments apply to this case. We shall use the model analysed in Chapter 4. The model is (for the case of partial democracy) in the class of models studied by Banks and Sundaram (1998). There is only one type of public good, whose levels of consumption in periods $t = 1, 2$ are denoted by g_t. Citizen's pay-offs in period t are $u(c_t) + g_t$. The office-holder also benefits from an ego-rent of R when in office, and incurs a cost of effort $c(e)$, where $e \in \Re_+$ is the level of effort, $c(.)$ is strictly increasing and strictly convex, and $c(0) = 0,\ c'(0) < 1$.[38]

The budget constraint of the representative citizen for period t is as before, i.e. (5.3). The public good production function for period t is given by:

$$g_t = (\tau_t + \mu e_t + \theta)\varepsilon_t, \qquad t = 1, 2 \tag{5.18}$$

where θ is fixed ability, as before, but where now $e_t \in [0, \infty)$ is effort, and ε_t is a random shock. As before, $\theta \in \{\theta_H, \theta_L\}$, $\theta_H > \theta_L > 0$, $\rho \equiv \Pr(\theta = \theta_H)$ and $(1 - \rho) \equiv \Pr(\theta = \theta_L)$. Also, τ_t is an input of the numéraire private good, obtained by a (lump-sum) tax on citizens. Following Chapter 4.5 of Persson and Tabellini (2000), we assume that $\tau_t,\ t = 1, 2$ is fixed at $\overline{\tau}$. Also, $\varepsilon_1, \varepsilon_2$ are identically and independently distributed random shocks whose distribution satisfies some regularity conditions. In either period, the office-holder has to decide on an effort level e before observing ε_t.

The efficient benchmark level of effort in both periods, e^*, maximizes $ng_t - c(e_t)$ subject to (5.18), which implies $c'(e^*) = n\mu$, for $t = 1, 2$, i.e. that the marginal cost of effort must be equated to marginal *social* benefit, $n\mu$. That is, effort is a *public good*; a small increment will increase the quantity of publicly provided goods available for all.

[38]The last condition $c'(0) < 1$ ensures that the myopic equilibrium effort level is positive.

In the case of partial democracy (exogenous candidate selection), the order of events is the same as in the Rogoff model, except that the office-holder chooses effort e_t in each period t, and then ε_t and therefore g_t is realized. So, at the time of voting, voters have observed g_t but not e_t. Similar remarks apply to the representative democracy case.

Whether candidate selection is by exogenous or by endogenous entry, in the second period, office-holders of both types cannot be motivated via elections, and so choose the same (myopic) level of effort $\hat{e}_2 < e^*$. With exogenous selection, there is an equilibrium where in the first period, there are positive "electoral effects" (denoted as "career concerns" effects in Chapter 4) on the incumbent's equilibrium effort level, i.e. $\hat{e}_1(\theta_a) > \hat{e}_2$, $a \in \{\theta_H, \theta_L\}$.[39] In this case, each type of incumbent is raising his effort in order to increase the posterior belief of the voters that he is a high-ability type, and thus win the election. Note that in contrast to the Rogoff model, the "distortion" of effort may be *welfare-improving,* because absent elections, effort is too low ($\hat{e}_2 < e^*$); the latter is of course, the moral hazard problem. In particular, if n is large, the moral hazard problem will be severe and we will have $e^* > \hat{e}_1(\theta_H)$, and $\hat{e}_1(\theta_L) > \hat{e}_2$. We assume that this is the case in what follows (consistently with the existing literature).

With endogenous entry, our positive results are very similar to Proposition 5.6, i.e. there is a unique equilibrium with separating at the entry stage. The key difference with the Rogoff model is normative. In the Rogoff model, where adverse selection is the only problem, equilibrium with separation at the entry stage is fully Pareto-

[39]Note that in contrast to Proposition 5.5, *both* the high *and* low-ability agents act strategically in the first period to try to manipulate the electoral outcome. In Rogoff (1990), the low-type does not signal; only the high-type does.

efficient. In the case with both adverse selection and moral hazard, things are not so straightforward. From the above discussion, it is clear that screening of candidates at the entry stage has *two conflicting effects on efficiency.* On the one hand, the average quality of the office-holder is higher in the revealing equilibrium. On the other, the first-period effort of the office-holder, conditional on type, is higher in the non-revealing equilibrium. So, whether endogenous candidate entry leads to a welfare improvement will naturally depend on whether the moral hazard or the adverse selection problem dominates. If the former is a more acute problem, then a non-revealing equilibrium is optimal (thus δ should be set to zero); however, if the latter problem is more acute, then a revealing equilibrium can completely eliminate this adverse selection problem (δ needs to be sufficiently high for this to happen).

5.7.4 Heterogeneous Preferences

So far, we have limited our analysis to the case where citizens have homogenous preferences with regard to public goods. In this section, we check the robustness of our result to the case were citizens have *heterogeneous preferences* (and preferences are congruent with regard to ability). Following Alesina and Tabellini (1990), we introduce preference heterogeneity in a simple and symmetric way to the Rogoff model by assuming that there are two preference types (Democrats and Republicans), and two public goods,[40] e.g. education and defence. Democrats (Republicans) only get utility from education (defence). So, each preference type prefers a low-ability candidate with the same preference to a high-ability type with a different preference.

In this context, we show that a key result of this chapter stills holds, i.e. with

[40]Not counting the investment good that allows the incumbent to conceal his type in the Rogoff model.

congruent preferences, an optimal cost of entry always exists such that only high-ability citizens will ever want to stand for office. A revealing equilibrium therefore occurs at the entry stage so that no policy distortion arises.

We focus on the Rogoff model, but the moral hazard model of the previous section can also be extended in this way. Our modelling of heterogeneity follows Alesina and Tabellini (1990). Assume two *preference types* in the population, democrats (D-types) and republicans (R-types). We denote an unspecified preference type by p, q, to distinguish it from an unspecified competency type a. So, the (unconditional) type of a citizen is a pair $(a, p) \in \{L, H\} \times \{D, R\}$. There are n_D, n_R of D-types and R-types respectively. To make the model completely symmetric with respect to preference types, i.e. so that the behaviour of the incumbent does not depend on his type, we assume that $n_D = n_R = n/2$.

There are also two types of publicly supplied consumption goods, D- and R-goods (e.g. education and defence). Let g_t^p be the supply of a type-p good at time t. The payoff of a type-p citizen is

$$u\left(c_1, g_1^p\right) + v\left(k_2\right) + u\left(c_2, g_2^p\right) \tag{5.19}$$

where u, v are strictly increasing in their arguments and strictly concave. So, a type-p citizen only gets utility from his "own" type of publicly supplied consumption good. As before, the office-holder also benefits from an ego-rent of R when in office.

The budget constraint of the representative citizen for period t is as before, and the public good production function is now

$$g_1^D + g_1^R + k_2 = \tau_1 + \theta, \qquad g_2^D + g_2^R = \tau_2 + \theta \tag{5.20}$$

where as before $\theta \in \{\theta_H, \theta_L\}$ measures the ability of the office-holder in transforming the private good (tax revenue) into public goods. In all other respects,[41] the model is assumed to be the same as above.

Of course, one can look for a perfect Bayesian equilibrium in this extended model under either of the two assumptions: random selection of candidates, or endogenous candidate entry. In either case, the outcome depends critically on whether the identity of types is public knowledge or not. To focus on the new issues raised by preference heterogeneity *per se*, and not by asymmetric information about heterogeneous preferences, we assume this information is public.[42]

Equilibrium with Partial Democracy

Consider random selection of candidates first. In the second period, it is clear that if a type (a, p) candidate is elected, he will choose $g_2^q = 0$, $q \neq p$. Consequently, he chooses τ_2 to solve the following problem;

$$W^{pp}(\theta_a) = \max_{\tau_2} \; u\left(y - \tau_2, \; \tau_2 + \theta_a\right) \tag{5.21}$$

Note that $W^{pp}(\theta_a) \equiv W_a$, where the latter is defined in (5.8) (c.f. Section 5.4.4). Let the solution to this problem be $\hat{\tau}_2(\theta_a)$. So, the payoff to a p-type citizen from a p-type office-holder of ability type a is just W_a^{pp}. Also, the payoff to a q-type citizen from a

[41]The exception is that (as we shall see) D-types prefer the default option of no public good to a type-R candidate. For this reason, we might want to allow them to abstain. Allowing abstention as a voting option makes no difference to the analysis.

[42]Alesina and Cukierman (1990) have a partial democracy model in which parties' political platform is the private information of parties.

p-type office-holder is

$$W^{pq}(\theta_a) = u\,(y - \hat{\tau}_2(\theta_a),\ 0) \tag{5.22}$$

Clearly, $W^{pp}(\theta)$ is increasing in θ. Note also that as long as the private good is normal, $\hat{\tau}_2(\theta_H) < \hat{\tau}_2(\theta_L)$, i.e. not all of the additional resources available to the high-ability incumbent are spent on the public good. So, a q-type always prefers a more able p-type office-holder, i.e. $W^{pq}(\theta_H) > W^{pq}(\theta_L)$, hence *preferences are congruent* in the sense of Section 5.3. Finally, note from (5.21), and (5.22) that

$$W^{pq}(\theta_H) = u\,(y - \tau_2,\ 0) < \max_{\tau_2}\ u\,(y - \tau_2,\ \tau_2 + \theta_L) = W^{pp}(\theta_L) \tag{5.23}$$

i.e. a type-p voter prefers a low-ability office-holder of his own type over a high-ability office-holder of the other preference type.

Now consider voter behaviour at the beginning of period 2. There are two cases. The first is where both candidates, the incumbent i and the challenger j are alike (i.e. of type p), an event which happens with probability

$$\xi = \left(\frac{n_D}{n}\right)\left(\frac{n_D - 1}{n-1}\right) + \left(\frac{n_H}{n}\right)\left(\frac{n_H - 1}{n-1}\right) = \frac{n/2 - 1}{n-1}$$

In this case, by assumption, all citizens prefer a competent office-holder to an incompetent one. So, i will win the election iff $\widehat{\pi}(g_1, \tau_1) \geq \rho$.

The second case is where both candidates, the incumbent i and the challenger j are different, in which case assume, without loss of generality, that i is type-D and j is type-R. In this case, by (5.23), type-D voters will certainly vote for D, and type-R voters will certainly vote for R, *whatever the perceived competence of the incumbent,* $\hat{\rho}$. In this event, the incumbent wins with probability 0.5, whatever his policy while in office.

So, a first-period incumbent of type (a, p) has a second-period continuation payoff of

$$\tilde{V}_a^2(\widehat{\pi}) = \begin{cases} \xi\left[R + W^{pp}(\theta_a)\right] + (1-\xi)Z & if \;\; \widehat{\pi} \geq \rho \\ \xi\left[\rho W^{pp}(\theta_H) + (1-\rho)W^{pp}(\theta_L)\right] + (1-\xi)Z & if \;\; \widehat{\pi} < \rho \end{cases} \tag{5.24}$$

where $q \neq p$,

$$Z = 0.5W^{pp}(\theta_a) + 0.5[\rho W^{qp}(\theta_H) + (1-\rho)W^{qp}(\theta_L)]$$

Note that the continuation payoff is independent of the preference type; this is a consequence of the symmetry of the model in the preference dimension.

As before, in equilibrium, the first-period incumbent of type (a, p) chooses (g_1, τ_1) to maximize the sum of his payoff from first-period policy, plus his continuation payoff, $\tilde{V}_a^2$, i.e.

$$\tilde{V}_a^1(g_1, \tau_1, \rho) \equiv u(y - \tau_1, g_1) + v(\tau_1 + \theta_a - g_1) + \tilde{V}_a^2(\rho) \tag{5.25}$$

subject to the condition that $\rho = \widehat{\pi}(\tau_1, g_1)$. Also, define the analogues of (5.12) in Section 5.4.4, i.e.

$$\tilde{S}_a = \{(g_1, \tau_1) \left| \tilde{V}_a^1(\tau_1, g_1, 1, \theta) \geq \tilde{V}_a^1(\tau_1^*(\theta), g_1^*(\theta), 0, \theta) \right.\} \tag{5.26}$$

Now note the useful Lemma:

Lemma 5.5. $\tilde{S}_a \subset S_a$, $a \in \{\theta_H, \theta_L\}$.

This says that, relative to the base case of homogenous preferences, an incumbent of a given type is less willing to distort his policy in exchange for convincing voters that he is a high-, rather than low-type. This is because with probability $1-\xi$ (the probability that his challenger is a different preference type), manipulating the beliefs of the voters has no effect on the outcome.

Otherwise, the analysis of the separating equilibrium is exactly the same as in Section 5.4. That is, voters' beliefs are defined to be *minimally sophisticated* if:

$$\widehat{\pi}(g_1, \tau_1) = 1 \text{ if } (g_1, \tau_1) \in \widetilde{S}_H \cap \Re^2_+ / \tilde{S}_L = \tilde{Q} \tag{5.27}$$

and Proposition 5.5 continues to hold if Q is replaced by $\tilde{Q}$. Moreover, we can easily compare the distortion in this case to the case with homogeneous preferences. Assume voters' beliefs are minimally sophisticated. Also, assume for the moment that there is a distortion in the homogenous preference case, i.e. $B_H \in S_L$. Then, there are two possibilities. First, from Lemma 5.5, it is possible that $B_H \notin \tilde{S}_L$ so there is no distortion in the heterogeneous case. The second possibility is where there is some distortion in both cases, i.e. $B_H \in \tilde{S}_L$. There, we have seen in Figure 5.2 that, with homogenous preferences, the first-period equilibrium policy for the high-type is at point E. But as $\tilde{S}_L \subset S_L$ from Lemma 5.5, it follows that, with heterogeneous preferences, the first-period equilibrium policy for the high-type would be at point E', between B_H and E on the line DD in Figure 5.2 (not represented but obvious).

The following result summarizes this discussion.

Proposition 5.9. *If voters' beliefs are minimally sophisticated, then there exists a unique separating (policy) equilibrium, when preferences are heterogeneous. In this equilibrium, first-period policy of the low-type is always conditionally efficient. Moreover, the first-period policy of the high-type is less distorted in the case of heterogeneous preferences, i.e.*

$$\hat{\tau}_1(\theta_H) \leq \tilde{\tau}_1(\theta_H) \leq \tau_1^*(\theta_H), \quad \widehat{g}_1(\theta_H) \geq \tilde{g}_1(\theta_H) \geq g_1^*(\theta_H)$$

where every inequality above can hold strictly.

Equilibrium Under a Representative Democracy

First, we study equilibria where there is no screening at the entry stage. We can construct such a "non revealing" equilibrium where the distortion in first-period policy for the high-type is *larger* than in the exogenous entry case. The intuition is simple. Let

$$\begin{aligned}\underline{\delta}_1 &= \Delta_1 + 0.5\left[W^{pp}(\theta_H) + R - \rho(2-\rho)W^{qp}(\theta_H) - (1-\rho)^2 W^{qp}(\theta_L)\right] \\ \underline{\delta}_2 &= 0.5\left[W^{pp}(\theta_H) + R - \rho W^{qp}(\theta_H) - (1-\rho)W^{qp}(\theta_L)\right]\end{aligned}$$

where Δ_1 is defined in the proof of Proposition 5.10. It is clear that $\underline{\delta}_2$ is the critical entry cost that will make a R-type just indifferent between running against a D-type who is believed to be competent with probability ρ and not entering (or vice versa). So, if $\delta > \underline{\delta}_2$, no citizen of a different preference type will challenge the incumbent in period 2. $\underline{\delta}_1$ has a similar interpretation.

Also, let n_D, n_R be the maximal elements in N_D, N_R respectively, and let n_D^-, n_R^- be the maximal elements in $N_D/\{n_D\}, N_R/\{n_R\}$ respectively.[43] Then, under some conditions, there is a perfect Bayesian equilibrium where only one citizen stands for election, and (if he is competent), signals his competence exactly as in the basic Rogoff model.

Proposition 5.10. (Pooling at the candidate entry stage). *Assume* $W^{pp}(\theta_L) + R \geq \delta > \max\{\underline{\delta}_1, \underline{\delta}_2\}$. *Then there is a perfect Bayesian equilibrium with the following*

[43] By the assumption that $n \geq 3$, and the fact that n must be even, $n \geq 4$, so n_L, n_R, n_L^-, n_R^- exist without making further assumptions.

structure. At time $t = 1$, *only* n_p, $p \in \{D, R\}$ *stands for election and wins. If* n_p *is of ability type* $a \in \{\theta_H, \theta_L\}$, *he chooses first-period policy as in Rogoff's separating equilibrium, i.e.* $\hat{\tau}_1(\theta_a)$, $\widehat{g}_1(\theta_a)$. *At* $t = 2$, *(i) if* $\widehat{\pi}(\tau_1, g_1) \geq \rho$, *only* n_p *stands for election; (ii) if* $\widehat{\pi}(\tau_1, g_1) < \rho$, *only* n_p^- *stands for election. The only candidate is elected with probability* 1.

A basic corollary of Propositions 5.9 and 5.10 is that under some conditions, *the political budget cycle is now bigger with endogenous (yet non revealing) entry.* The intuition for this result is simple. With exogenous selection of candidates, with some positive probability, the incumbent is paired with a challenger of a different preference type in equilibrium, in which case there is no point in signalling his ability, if high. With endogenous entry, under some conditions, no citizen of a different preference type can ever credibly threaten to challenge the incumbent; only citizens with the same preference type can credibly challenge. So, in this case, the incumbent still has the "full" incentive (i.e. as in the original Rogoff model) to signal. So, we see that our result of previous sections, that endogenous entry either has no effect on the political budget cycle (PBC), or reduces it, does *not* generalize to the case of heterogeneous preferences.

However, for δ large enough, the basic insight of the previous sections - and a key result of this chapter - remains true, namely that the PBC may be eliminated in the equilibrium that survives. Let $N_{H,D}$, $N_{H,R}$ be the sets of high-ability citizens with left- and right- preferences for the public good respectively. Then, we see that Proposition 5.6 generalizes in the following sense.

Proposition 5.11. (Separating at the candidate entry stage). *If* $0.5[R + W^{pp}(\theta_H) -$

$W^{pq}(\theta_H)] < \delta \leq R + W^{pp}(\theta_H)$, *then there is a perfect Bayesian equilibrium with the following structure. At* $t = 1, 2$, *some* $c_t \in N_H$ *stands for election, and is elected with probability* 1. *The office-holder chooses the conditionally efficient fiscal policy in period* $t = 1, 2$.

If $0.5R < \delta \leq 0.5[R + W^{pp}(\theta_H) - W^{pq}(\theta_H)]$, *then there is a perfect Bayesian equilibrium with the following structure. At* $t = 1, 2$, *some* $d_t \in N_{H,D}$ *and* $r_t \in N_{H,R}$ *stands for election, i.e.* $C_t = \{d_t, r_t\}$. *Each is elected with probability* 0.5. *The office-holder chooses the conditionally efficient fiscal policy in period* $t = 1, 2$.

So, the main conclusion is the same; for a range of entry costs, an equilibrium with separation (by ability levels) at the entry stage exists. However, note a new feature; if δ is not too large, *Duverger's Law holds*, i.e. there are two entrants to the election. This is because the loss from withdrawing and allowing a suboptimal policy to be implemented (i.e. the other type's optimal policy) exceeds the cost saving of δ. Of course, if δ is large enough, then one candidate prefers to withdraw and allow the other to win (but the other then does not wish to withdraw). The proof of Proposition 5.11 is similar to that of Proposition 5.6 and is omitted.

5.7.5 Political Parties

The most obvious objection to the above analysis is that in many countries outside the United States, entry decisions are often tightly controlled by political parties, who also fund campaigns. For example, in the United Kingdom, all the three major political parties have rigorous candidate selection processes whereby constituency parties short-list and interview (in some cases, several times) potential candidates.[44]

Here, we model these two activities of political parties in the simplest way possible, and show that the main results of the previous section are robust. The basic idea is that there is still asymmetric information about candidates' abilities, this time *between political parties and the voters outside these parties*, but nevertheless, entry costs still serve to screen out low-quality candidates.

Following Besley and Coate (2000), we think of political parties simply as coalitions of citizens of the same preference for public spending, who control access to entry to elections. So, we work with the extended model of the last section with heterogeneous preferences.

There are two parties, D (for democrats), and R (for republicans), comprising m of the citizens each. Let the sets of party members be P_D, P_R. Prior to any election, the order of events is as follows.

1. Any citizen who is a member of the p-party can apply to be a candidate for that party.

2. All party members who apply can be tested at zero cost. A test is the receipt of a signal $s \in \{0,1\}$ of the candidates' ability, with $\Pr(s = 1 \,|\, \theta = \theta_H) = \Pr(s = 0 \,|\, \theta = \theta_L) = \vartheta$. The higher ϑ, the more accurate the signal is.

3. The p-party can select a candidate from those who have been tested, who is entered for the election, or can choose not to field a candidate.

[44] See King (1997) for a comparative analysis of selection processes and the importance of campaign finances in the United States, the United Kingdom, and Germany.

The costs and benefits of this process are allocated as follows. All party members pay equal shares δ/m of the cost of entry. If a candidate wins the election, he receives some ego-rent R, and other party members get surrogate ego-rents $R' < R$ if their candidate wins. Also, we assume that initially, individual citizens do *not* observe their abilities.[45] We make this assumption to show that the basic screening mechanism studied in this chapter can work at the level of the party, not the individual.

We wish to show that with this new, more complex structure, it is still possible to find a range of values of δ for which only a separating equilibrium (at the entry stage) exists. For convenience, we assume $\rho = 0.5$. This implies that the probability of observing either signal is 0.5 also.

Proposition 5.12. *There is a non-empty range of values of δ for which the following is an equilibrium at $t = 1, 2$. First every member of both political parties applies to be a candidate. Second, each political party selects some p_t from the set of applicants who have received a positive signal at time t, A_t^p, i.e. $C_t = \{d_t, r_t\}$. Each is elected with probability 0.5. The office-holder chooses the conditionally efficient fiscal policy in period $t = 1, 2$.*

5.7.6 Heterogeneous Wealth and Fund-Raising Ability/Burning Cost

So far, we have assumed that spending an amount δ during the campaign is equally costly for all candidates. However, the "ability to spend" during a campaign will

[45]In fact, we will assume that office-holders do not observe their abilities until the second public good is delivered at $t = 2$. This means that in equilibrium, the incumbent at $t = 1$ has the same information about his ability as the electorate, and so there is no scope for signalling. Also, we will assume (for convenience only) that delivery of the public good k_2 takes place *before* the office-holder chooses g_2, τ_2, so that he can condition his choice g_2, τ_2 on his true ability.

depend both on the candidates' personal wealth and his fund-raising ability. In some cases, personal wealth clearly leads to greater spending and electoral success.[46] An extreme example is Jon Corzine, a former managing director of Goldman Sachs, with no experience of office, who spent \$55 million of his own money contesting a seat in Senate representing New Jersey in 2000, and won. Fund-raising ability, on the other hand, may be related to the candidates own personal characteristics, as well as his political track record, and in particular, whether he is the incumbent.[47] Therefore, it seems desirable to test the robustness of our results to heterogeneity in the ability of candidates to spend.

We model this as follows. Every candidate in K is now described by two characteristics: his ability, as before, and also his cost of "burning" money, $b = H, L$. So, a candidate who enters and spends δ incurs a cost $\varphi_b \delta$, where $b \in \{H, L\}$ is his cost type, with $\varphi_H > \varphi_L > 0$. Citizens can now be of four possible types: two ability types a, and two cost types b, i.e. $(a, b) \in \{(H, H), (H, L), (L, H), (L, L)\}$. Let $\Pr(b = H) \equiv \omega$, and $\Pr(b = L) \equiv 1 - \omega$. We will show that as long as the cost difference $\varphi_H - \varphi_L$ is not "too large", then the results of Section 5.3 go though effectively unchanged. Also, the upper bound on $\varphi_H - \varphi_L$ goes to infinity with the number of potential candidates, $\#K$, so when there are a large number of potential candidates, our arguments of Section 5.3 are robust to even considerable cost differences among candidates.

[46] Although wealth is often described in the media (and in the political science literature) as giving an unfair advantage in the US, a recent study (Milyo and Groseclose (1999)), exploiting a unique dataset on the wealth of House incumbents running in the 1992 race, reveals that on average, personal wealth does not matter: i.e. rich candidates did not spend more on average on their campaigns than poor ones, and were no more likely to win greater shares of the vote.

[47] The major determinant of campaign raising and spending is incumbency (e.g. Salmore and Salmore, 1985, chapter 4). For instance, for the 2000 House elections, the average challenger raised \$361,314, while the average incumbent raised \$891,956.

Congruent Preferences

In this new setting, we say that congruence occurs when types $(H, H), (H, L)$ place a higher value on office than $(L, H), (L, L)$. A necessary condition for congruence is clearly $W_H + R_H > W_L + R_L$. But even if this inequality holds, congruence in our extended model will not occur when δ is very large, as then a low-ability, low-cost type (L, L) may prefer to enter, whereas a high-ability, high-cost type (H, H) may not.[48] However, there is of course an upper bound on δ in any anonymous equilibrium: this is[49] the value of δ which makes any $i \in K$ of type (H, L) indifferent between entering and not, given that all $j \in K$ only enter if they are of type (H, L). This value can be easily calculated to be[50]

$$\bar{\delta}_{st} = \frac{1}{\varphi_L}[\lambda_0 W_H + \mu_0 R_H] \tag{5.28}$$

where x_0 is the number[51] of candidates (other than some $i \in K$) in this equilibrium, $\lambda_0 = Pr(x_0 = 0)$, and $\mu_0 = E[1/(x_0 + 1)]$.

So, we can define candidate and voter preferences to be *congruent* if, given that $\delta \leq \bar{\delta}_{st}$, (H, H) places a higher value on office than (L, L), i.e.

$$W_H + R_H - \varphi_H \bar{\delta}_{st} > W_L + R_L - \varphi_L \bar{\delta}_{st}$$

which using (5.28), reduces to the condition that the difference in burning costs be not too large, i.e.

$$\varphi_H - \varphi_L < \frac{W_H + R_H - (W_L + R_L)}{\lambda_0 W_H + \mu_0 R_H} \tag{5.29}$$

[48]Note that type (H, L) places a higher value on office than does (H, H), and type (L, L) places a higher value on office than does (L, H).

[49]Type (H, L) is the one who has the most to gain from entering, and so will be willing to pay the most to signal.

[50]The use of subscript on the δ's is the following is this section: "st" ("ws") refers to strongly (weakly) separating equilibria, and "se" refers to semi-separating equilibria.

[51]x_0 is distributed Binomially with parameters $k - 1$, ρ_0, where $\rho_0 = Pr((a, b) = (H, L)) = \rho\omega$.

Note that if the candidate set K is large, i.e. $k \to \infty$, $\lambda_0, \mu_0 \to 0$, so the upper bound on the difference in costs becomes very large, and so congruence requires little more than it does in the base case. The intuition for this is simple: when there are many candidates, the probability of any one candidate winning is small, and so any potential candidate is only willing to spend a small amount in the campaign. But then it does not matter greatly if costs of "burning" money are heterogeneous.

If preferences are congruent in the sense of (5.29), it is clear that there can be four types of anonymous equilibrium: (i) a pooling equilibrium where all types enter; (ii) separating (with respect to ability) equilibria where either only (H, L) types or (H, L) and (H, H) types enter; (iii) a mixed equilibrium where (H, L), (H, H) and (L, L) enter. The following Proposition gives precise existence conditions for each of these equilibria.

Proposition 5.13. *Assume congruent preferences in the sense of (5.29) and $k < n-1$. Then, if $\underline{\delta} \leq \delta'_p$, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $\underline{\delta} \leq \hat{\delta} \leq \delta'_p$, where $\delta'_p = \frac{1}{k\varphi_H}[R_L - \rho(W_H - W_L)]$. Also, if $\underline{\delta} \leq \overline{\delta}_{se}$,*[52] *there exist belief profiles for which the following anonymous separating equilibria exist: (i) strong separating equilibrium: every $i \in K$ enters only if he is a high-ability, low-burning cost type, and spends $\max\{\underline{\delta}, \underline{\delta}_{st}\} \leq \hat{\delta} \leq \overline{\delta}_{st}$, where $\overline{\delta}_{st}$ is defined in (5.28), and $\underline{\delta}_{st} = \min\{[\mu_0(W_H + R_H) + (\lambda_0 - \mu_0)W_H]/\varphi_H, [\mu_0(W_L + R_L) + (\lambda_0 - \mu_0)W_H]/\varphi_L\}$; (ii) weak separating equilibrium: every $i \in K$ enters only if he is a high-ability type (regardless of his burning cost), and spends $\max\{\underline{\delta}, \underline{\delta}_{ws}\} \leq \hat{\delta} \leq \overline{\delta}_{ws}$, where $\overline{\delta}_{ws} =$*

[52]Where $\overline{\delta}_{se}$ is defined below in the Proposition.

$[\lambda_1 W_H + \mu_1 R_H]/\varphi_H$, $\underline{\delta}_{ws} = [\mu_1(W_L + R_L) + (\lambda_1 - \mu_1)W_H]/\varphi_L$, *and* x_1 *is the number*[53] *of candidates (other than some* $i \in K$*) in this equilibrium,* $\mu_1 = E[1/(x_1+1)]$, *and* $\lambda_1 = 1-(1-\rho_1)^{k-1}$; *(iii) semi-separating equilibrium: every* $i \in K$ *enters except if he is a low-ability, high-cost type, and spends* $\max\{\underline{\delta}, \underline{\delta}_{se}\} \leq \hat{\delta} \leq \overline{\delta}_{se}$, *where* $\overline{\delta}_{se} = \min\{[\mu_2(R_H + W_H) + (\lambda_2 - \mu_2)\Psi]/\varphi_H, [\mu_2(R_L + W_L) + (\lambda_2 - \mu_2)\Psi]/\varphi_L\}$, $\underline{\delta}_{se} = [\mu_2(W_L + R_L) + (\lambda_2 - \mu_2)\Psi]/\varphi_H$, $\Psi = [(\rho\omega + \rho(1-\omega))W_H + (1-\rho)(1-\omega)W_L]/[1-(1-\rho)\omega]$, *and* x_2 *is the number*[54] *of candidates (other than some* $i \in K$*) in this equilibrium,* $\mu_2 = E[1/(x_2+1)]$, *and* $\lambda_2 = 1-(1-\rho_2)^{k-1}$. *There are no other anonymous equilibria.*

However, we are mostly interested in which of these equilibria pass the Intuitive Criterion (IC). Then we have:

Proposition 5.14. *Assume congruent preferences. Then the only anonymous equilibria to pass the Intuitive Criterion are the strongly separating equilibrium with campaign expenditure* $\hat{\delta} = min\{\underline{\delta}_{st}, \underline{\delta}\}$ *and the weakly separating equilibrium with campaign expenditure* $\hat{\delta} = min\{\underline{\delta}_{ws}, \underline{\delta}\}$, *where* $\underline{\delta}_{st}$, $\underline{\delta}_{ws} > 0$ *are defined in Proposition 5.13.*

So, we see that when preferences are congruent, the result is essentially the same as in the base case: candidate entry screens out low-ability candidates.

Non Congruent Preferences

We now turn to the non-congruent case. Generally, non-congruence occurs when

[53] x_1 is distributed Binomially with parameters $\rho_1, k-1$, where $\rho_1 = \rho(1-\rho\omega(1-\omega))$.

[54] x_2 is distributed Binomially with parameters $\rho_2, k-1$, where $\rho_2 = 1-\omega-\rho(1-2\omega) + \rho^2(1+\omega)(\omega-1)^2 - \omega\rho^3(\omega-1)^2$.

types $(H,H),(H,L)$ place a *lower* value on office than $(L,H),(L,L)$. A necessary condition for non-congruence is $W_H + R_H < W_L + R_L$. Similar arguments to above show that the necessary and sufficient condition for non-congruence is

$$\varphi_H - \varphi_L < \frac{W_L + R_L - (W_H + R_H)}{\lambda_0 W_L + \mu_0 R_L} \tag{5.30}$$

where x_0 is the number[55] of candidates (other than some $i \in K$) in the anonymous equilibrium where only (L,L) types enter, and $\lambda_0 = Pr(x_0 = 0)$, and $\mu_0 = E[1/(x_0 + 1)]$. As before, note that if the candidate set K is large, i.e. $k \to \infty$, $\lambda_0, \mu_0 \to 0$, so the upper bound on the difference in costs becomes very large, and so non-congruence requires little more than it does in the base case.[56]

In this case, there are only two possible types of equilibrium; a pooling equilibrium, and a "mixed" equilibrium (which we call *semi-separating*) where all types except (H,H) enter. Precise conditions under which these equilibria exist are available in the following Proposition:

Proposition 5.15. *Assume non congruent preferences in the sense of (5.30) and $k < n-1$. Then, if $\underline{\delta} \le \delta'_p$, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $\underline{\delta} \le \hat{\delta} \le \delta'_p$, where $\delta'_p = [R_H + (1-\rho)(W_H - W_L)]/(k\varphi_H)$. Also, if $\underline{\delta} \le \overline{\delta}_{se}$, there exist belief profiles for which the following anonymous semi separating equilibrium exist: every $i \in K$ enters except if he is a high-ability, high-cost type, and spends $\max\{\underline{\delta}, \underline{\delta}_{se}\} \le \hat{\delta} \le \overline{\delta}_{se}$, where $\overline{\delta}_{se} = \min\{[\mu_2(R_L + W_L) + (\lambda_2 - \mu_2)\Psi]/\varphi_H$, $[\mu_2(R_H + W_H) + (\lambda_2 - \mu_2)\Psi]/\varphi_L\}$, $\underline{\delta}_{se} = [\mu_2(W_H + R_H) + (\lambda_2 - \mu_2)\Psi]/\varphi_H$, $\Psi =$*

[55] where, to parallel the notation of the congruent case, x_0 is now redefined in the following way. x_0 is distributed Binomially with parameters $k-1$, ρ_0, where $\rho_0 = Pr((a,b) = (L,L))$.

[56] So, when $\#K$ is large, almost all parameter configurations will exhibit either congruence or non-congruence.

$[(\rho\omega + \rho(1-\omega))W_L + (1-\rho)(1-\omega)W_H] / [1-(1-\rho)\omega]$, *and* x_2 *is the number*[57] *of candidates (other than some* $i \in K$*) in this equilibrium,* $\mu_2 = E[1/(x_2+1)]$, *and* $\lambda_2 = 1 - \rho_2^{k-1}$. *There are no other anonymous equilibria.*

Note that, contrarily to the strongly and weakly separating equilibria, in a semi separating equilibrium, equilibrium entrants are believed to be of high-ability with a strictly positive probability. As a result, non-equilibrium strategies can be punished by voters by assigning a probability zero to the deviant - which prevents such plays. Punishment is not possible when only low-ability types enter (strong and weak separating equilibria) since voters already assign a zero probability to entrants being high-types. In these cases, as Proposition 5.2 showed, only equilibria where campaign expenditures are set to their minimum is possible. However, given that these equilibria are undesirable for voters, we assume that $\underline{\delta}$ is sufficiently low that it pays for at least a type (H, L) to enter so that strongly and weakly separating equilibria cannot occur (see proof of Proposition 5.15).

The only equilibria of Proposition 5.15, that pass the IC are the following:

Proposition 5.16. *Assume that preferences are non-congruent. The only equilibria that pass the IC are the pooling equilibrium with* $\hat{\delta} = \underline{\delta}$, *and the semi-separating equilibrium with* $\hat{\delta} > \max\{\underline{\delta}, \underline{\delta}_{se}\}$.

So, we see that in this case, *some* screening is possible with non-congruence; high-ability, high-cost types are screened out. However, if these types are small in number, i.e. $Pr(H, H) \simeq 0$, then there is effectively no screening via entry. When preferences

[57] x_2 is distributed Binomially with parameters $1-\rho_2$, $k-1$, where $1-\rho_2 = 1-\omega-(1-\rho)(1-2\omega) + (1-\rho)^2(1+\omega)(\omega-1)^2 - \omega(1-\rho)^3(\omega-1)^2$.

are congruent, as in Section 5.3, we have shown that candidate entry continues to act as a screening mechanism even when citizens have differing cost of burning (e.g. because of differing degrees of wealth).

5.7.7 Unobservable Cost of Entry

In this section, we check whether our result regarding screening via candidate entry would still hold in the case where campaign spending is not observable to voters prior to the election (this arises under congruent preferences). Although, as argued in Section 5.2, this is not the case for the US electoral system, the case of unobservable entry might apply to countries with less transparency on campaign finances. In this section we revisit the simple one period model of Section 5.3 (we limit our analysis to the case where preferences are congruent) with the modification that δ is now only observed by the candidate itself, not by voters. The rest of the model of Section 5.3 is unchanged. It is easy to see that this modification is not going to alter the analysis very much. In particular, as shown below, our key result still holds, namely that with representative democracy there exists a critical cost of candidate entry such that only high-ability citizens will ever want to stand for office. As the analysis is almost identical to that of Section 5.3, we turn directly to the key results of this section.

We have the following proposition:

Proposition 5.17. *Assume congruent preferences, that campaign spending is not observable and $k < n - 1$. Then, if $\underline{\delta} \leq \delta_1^p$, there exist belief profiles for which a pooling equilibrium with $c < k$ candidates exists, where $\delta_1^p = R + W_L$, $\delta_c^p =$*

$\frac{1}{c}\left[R-\rho(W_H-W_L)\right], \quad c>1$. *Also, if* $\underline{\delta}\leq\delta_1^s$, *there exist belief profiles for which a separating equilibrium with* $c<k$ *candidates exists, where* $\delta_1^s=R+W_H, \quad \delta_c^s=R/c, \quad c>1$. *Finally, if* $c=k$, *then whatever the belief profile, there exists a pooling equilibrium if* $\underline{\delta}\leq\frac{1}{k}\left[R-\rho(W_H-W_L)\right]$, *and a separating equilibrium if* $\underline{\delta}\leq R/k$.

Again, the belief profiles that support these equilibria "punish" non-equilibrium entrants; if some citizen decides to deviate by entering, all other citizens assign probability 0 to the event that he is high-ability, and so will not vote for him. Consequently, he loses $\underline{\delta}$ by entering, and so will not deviate by entering. The upper bounds on $\underline{\delta}$ in the Proposition simply ensure that no candidate who is standing in equilibrium wishes to withdraw. Note also that in the case with k entrants, these equilibria exist *whatever* the beliefs.

Using our adaptation of the formal definition of the Intuitive Criterion to our game, which has many "senders" and "receivers", and where we are assuming particular play (conditional on beliefs) at the voting stage (see Section 5.3.3) we can show that by appropriate choice of $\underline{\delta}$, the equilibria with unobservable campaign spending may fail the intuitive criterion. For example, consider a pooling equilibrium with $c<k$ candidates. Suppose $i\notin C$ deviates by entering, and $R+(1-\rho)(W_L-W_H)>\underline{\delta}>R-\rho(W_L-W_H)$. First, we check whether this action is equilibrium dominated. Initially, i was getting $\rho W_H+(1-\rho)W_L$ in equilibrium. But now, $u_a((1,\delta),1,\hat{\pi}^{-i})=R+W_a-\underline{\delta}$ as by construction, voters assign probability 1 to the deviant being able, so all will vote for him. Then, for $\underline{\delta}$ in the specified range, it is easy to check that entering is equilibrium dominated only for the low-type, i.e. $u_H((1,\delta),1,\hat{\pi}^{-i})>\rho W_H+(1-\rho)W_L>u_L((1,\delta),1,\hat{\pi}^{-i})$. So, $i\notin C$ can enter and credibly signal his type simply by entering. By construction, his net gain to entry is positive. A similar argument implies that if $R/(c+1) > \underline{\delta} > (R - W_H + W_L)/(c+1)$, the separating equilibrium with c candidates fails the Intuitive Criterion. Finally, note that for $\underline{\delta} > R - \rho(W_L - W_H)$, from Proposition 5.17, a pooling equilibrium with k candidates is also impossible. So, we have proved:

Proposition 5.18. *Assume that candidate spending is unobservable. Then if* $R + (1-\rho)(W_L - W_H) > \underline{\delta} > R - \rho(W_L - W_H)$, *no pooling equilibrium exists that passes the Intuitive Criterion. Also, if* $R/(c+1) > \underline{\delta} > (R - W_H + W_L)/(c+1)$, *the separating equilibrium with* c *candidates fails the Intuitive Criterion.*

Now suppose that minimum entry cost $\underline{\delta}$ can be chosen at some constitutional stage. Again, we assume (realistically) that campaign costs are real resource costs, not transfers from entrants to non-entrants. In this case, a social planner would wish to maximize the sum of expected pay-offs (prior to the ability draw by nature), net of entry costs. In the pooling equilibrium, this sum is $R + n(\rho W_H + (1-\rho)W_L) - \sum_{i \in C} \delta_i$, whereas in the separating equilibrium, this sum is $R + nW_H - \sum_{i \in C} \delta_i$. So, given a fixed set of entrants, it is clearly desirable to induce a separating equilibrium. With unobservable campaign costs, this can be achieved at least cost as follows. If $R - \rho(W_H - W_L) > R/2$, then by setting $\underline{\delta}$ as close to $R - \rho(W_H - W_L)$ as possible, all pooling equilibria are eliminated, and we are left with the one-candidate separating equilibrium. If $R/3 < R - \rho(W_H - W_L)$ on the other hand, setting $\underline{\delta} \simeq R - \rho(W_H - W_L)$ will eliminate the one-candidate separating equilibrium, and we are left with the two-candidate separating equilibrium, implying that costs will be $2(R - \rho(W_H - W_L))$, so it is always cheaper to set $\underline{\delta} = R/2$. So, we see that the optimal choice is $\underline{\delta} = \max\{R/2, R - \rho(W_H - W_L)\}$.[58]

This therefore confirms that screening through an appropriate choice of $\underline{\delta}$ is feasible even when δ is unobservable to voters. Although we have only analysed this in a variant of the one period model of Section 5.3, it is easy to check that this result would hold in a dynamic setting such as the Rogoff model of Sections 5.4 and 5.5. Hence, with congruent preferences, representative democracy can always be designed (via an appropriate cost of candidate entry) such that only high-ability citizens ever hold elected offices.

5.7.8 Several Ability Types

In this section, we check whether the strong result obtained in this chapter still holds in the case where several ability types exist rather than the two assumed so far, i.e. we check whether, with congruent preferences, candidate entry can always screen all but the highest ability types out of office. In this section we prove that this is indeed the case.

We revisit the simple one period model of Section 5.3 (congruent preference case) and extend it to the case where there is now m potential ability types, i.e. $a = \{1, ..., m\}$, where we have the following ordering: $a_1 < ... < a_m$. The most able citizen is of type-m, the second most able is of type-$(m-1)$, and so on. In this section, $\rho_i \equiv \Pr(a = i)$, where $i = 1, ..., m$. Given that we aim to check whether candidate entry can still screen all but the highest ability types, we limit our analysis to the case of congruent preferences, where we now define congruence as the case

[58] Recall from Section 5.3 (congruent case), that with observable campaign costs, assuming that the equilibria that fail the Intuitive Criterion do not occur, a separating equilibrium with k candidates, and aggregate campaign costs $\sum_{i \in C} \delta_i$ between R and zero is the unique outcome.

where $W_m + R_m > W_{m-1} + R_{m-1} > ... > W_1 + R_1$. It is useful to regroup all types except type-m citizens into the category of L-types, for lower ability types.

Since our analysis of Section 5.3 readily extends to this case, we directly turn to the analogous of Propositions 5.1 and 5.3, pertaining to equilibria in the congruent case, i.e.

Proposition 5.19. *Assume congruent preferences and $k < n - 1$. Then, if $\underline{\delta} \leq \delta_p''$, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $\underline{\delta} \leq \hat{\delta} \leq \delta_p''$, where $\delta_p'' = \frac{1}{k}[R_1 + W_1 - \sum_{i=1}^{m} \rho_i W_i]$. Also, if $\underline{\delta} \leq \overline{\delta}_{se}$, there exist belief profiles for which the following anonymous separating equilibria exist: (i) separating equilibrium: every $i \in K$ enters only if he is of highest ability and spends $\max\{\underline{\delta}, \underline{\delta}_{se}\} \leq \hat{\delta} \leq \overline{\delta}_{se}$, where $\overline{\delta}_{se} = \lambda_m W_m + \mu_m R_m$, and $\underline{\delta}_{se} = \mu_m(W_{m-1} + R_{m-1}) + (\lambda_m - \mu_m) W_m$; (ii) (many) semi-separating equilibrium: every $i \in K$ enters except if he is below a given ability type-z, and spends $\max\{\underline{\delta}, \underline{\delta}_{ss}\} \leq \hat{\delta} \leq \overline{\delta}_{ss}$, where $\overline{\delta}_{ss} = \mu_z(W_{m-z} + R_{m-z})$ $+(\lambda_z - \mu_z)\sum_{i=z}^{m} \rho_i W_i$, $\underline{\delta}_{ss} = \mu_z(W_{m-z-1} + R_{m-z-1})$ $+(\lambda_z - \mu_z)\sum_{i=z}^{m} \rho_i W_i$. There are no other anonymous equilibria.*

Proposition 5.20. *Assume that preferences are congruent. All pooling and all semi-separating equilibria fail the IC. Also, any separating equilibrium with campaign expenditure $\hat{\delta} > \max\{\underline{\delta}_{ss}, \underline{\delta}\}$ fail the IC.*

Hence, as claimed, our screening result is robust to the case where several ability types are introduced.

5.8 Conclusions

This chapter shows that candidate entry may reveal valuable information (e.g. ability), even in an environment where information is *asymmetric* between citizens and office-holders. For a revealing equilibrium to occur at the candidate entry stage, it is necessary that voters and candidates have *common interests.* If this is not the case so that office-holders' preferences differ from those of voters (e.g. if office-holders are corrupt), then representative democracy cannot screen out candidates less preferred by voters. Extensive extensions of our base model reveal that these strong results are robust to the introduction of more complex/realistic features.

A first important conclusion of this chapter is therefore that, with congruent preferences between voters and office-holders, (representative) democracy is a more efficient institution than what the current political agency literature finds. We have illustrated this using Rogoff's seminal Equilibrium Political Budget Cycles model and showed that, with endogenous candidate entry, only high-ability citizens ever stand for election and are elected. As a result, once in office, a policy maker does not need to signal enhanced ability through distortionary fiscal policy, hence the political business cycle disappears.

We should however note that this result is much more general than the current context which we have used to illustrate it. It applies to a general class of asymmetric information games in which an agent has an informational advantage (e.g. cost, ability, etc.) and preferences are congruent between office-holders and the electorate. For instance, our result also applies to many asymmetric information games in monetary policy (e.g. Vickers, 1986; Barro, 1986; Rogoff, 1987, 1989; Cukierman and

Meltzer, 1986b; Cukierman and Liviathan, 1991) and to recent models that have extended these work (e.g. Bartolini and Drazen, 1997, 1998; Cukierman and Tommasi, 1998).[59]

A second finding is that, whether (representative) democracy is an efficient mechanism or not (a key debate between the Virginia and the Chicago schools[60]), crucially depends on whether voters and candidates have *common* or *conflicting* interests, and not on whether information is complete or not. We illustrated this point using a variant of the Rogoff model where citizens differ in honesty so that interests are conflicting between the principal and the agent. In this case, the political business cycle can persist in equilibrium.

An interesting issue which we have not addressed in this chapter is whether representative democracy is efficient in the Pareto sense of Besley and Coate (1998). Rather, in this chapter we have taken a more narrow view of efficiency, namely whether democracy can select high-ability candidates to hold office. On this efficiency criteria, Besley and Case (1997) show that, in a static model, representative democracy can fail to select high-ability policy makers when the electorate has heterogeneous preferences. This chapter shows that this type of inefficiency can also arise in a model with homogenous preferences but in which information about candidates' ability is imperfect.

Finally, our results have interesting policy implications. For instance, our model could help rationalize the very high cost of campaign contributions that is currently

[59] See Drazen (2000a) for a graduate textbook exposition of many of these asymmetric information games in macroeconomics, and Drazen (2000b) for a recent review of the latest research on Political Business Cycles.

[60] See Coate and Morris (1995) for a recent account of this debate.

observed in many democracies. This is especially true in the United States where, for instance, the 2000 campaign finance of George W. Bush is estimated to be over $180 millions; Jon Corzine, a successful Senate candidate raised $55m, almost $53m of which were from his own private fortune. One view of these campaign funds is that they are grounds for lobby group to "buy/capture" the attention of the running candidate for the lobby's interest. Contrarily to this view, this chapter shows that these costs of standing for election could be an efficient way for democracy to screen high-ability versus low-ability candidates as only the most able candidate can expect to recoup his campaign costs. Our model therefore gives a radically different policy conclusion on the current (and recurrent) debate in the US about campaign finance reform. Interestingly, on close inspection, the latest campaign finance reform bill (led by Senators McCain and Feingold) can be seen as vindicating both approaches to campaign finance. The aim of this proposed bill is to eliminate "soft money" (i.e. money which cannot be used for "express advocacy" purposes). The main source of these funds comes from Political Action Committees (PACs) which are effectively lobby groups. However, the McCain-Feingold legislation does not intend to limit the amount of funds that a candidate can use for his/her campaign.[61] In fact, according to the US Constitution's First Amendment (freedom of speech), it is unconstitutional to limit the amount of private funds that a candidate wants to spend towards her campaign. Besides from guaranteeing free speech, in our model, the First Amendment guarantees that the institutional mechanism highlighted in this chapter can always be applied. Nevertheless, our second key result of this chapter indicates that in

[61] As highlighted in Section 5.2, the source of a candidate's campaign funds can be classified into four categories. Funds received from PACs, funds received from individuals (each individual is limited in the amount he/she can give to a specific candidate), funds committed by the candidate himself/herself, and other miscellaneous funds.

countries in which corruption is endemic, these barriers to political participation and competition for office are clearly not desirable since, in this case, only dishonest citizens would ever stand for office. Although this prediction of our model needs to be tested directly, existing empirical evidence from democracies with varying degree of corruption support both of our key results: that the political business cycle is smaller, *ceteris paribus*, when the degree of congruence between office-holders and the electorate is high (e.g. Shi and Svensson, 2001).

Chapter 6

Conclusion

During the 1990s, important institutional changes have taken place in the domain of monetary and fiscal policy. On the monetary front, there has been a growing trend towards increasing central bank independence. This heightened independence occurred not only in OECD countries, and especially in the current European Monetary Union member countries, but also in countries such as the former communist countries of Eastern Europe (Cukierman, 1992, 1998). In the fiscal domain, these institutional changes have taken the form of fiscal constraints. These limit the discretionary power of elected governments. Possibly the most notorious early fiscal constraints are those contained in the Maastricht Treaty of 1992, which imposes conditions for European countries aiming to join the European Monetary Union. Among the Maastricht criteria, two were concerned with fiscal variables. One required that countries do not run budget deficits of more than 3 per cent of GDP, and the other required that the debt-to-GDP ratio of a country be lower than 60 per cent.[1] A common argument in favour of the introduction of fiscal constraints is that, left to their own device, office-holding politicians exhibit a tendency towards budget deficits. Fiscal constraints, by limiting "excessive" fiscal outcomes, can curb politically-induced excesses of governments.

In the first part of the thesis, we analysed the effects (in terms of incentives and welfare) of various institutional designs aimed at curbing politically-induced budget deficits. Numerous empirical evidence indeed find political variables to be a significant and important determinant of fiscal outcomes, and especially budget deficits (e.g. Alesina, Roubini, and Cohen, 1997; Shi and Svensson, 2001). Given that fiscal constraints have only recently been introduced at the national or federal level, an empirical investigation of these issues is not possible. In this thesis, we therefore analysed these issues from a theoretical viewpoint. The empirical findings on the specific political factors that give rise to political budget cycles and budget deficits informed our choice of a political agency model.

As detailed in Chapter 2, the most appropriate model for the purpose of studying the *endogenous* incentive effects that alternative fiscal constraints have on policy makers is the model of Rogoff (1990). For our purpose, one limitation of the Rogoff model is that it assumes that the government's budget is balanced in every period; no debt can be issued by policy makers. Budget deficits being prohibited by assumption, there is therefore no possibility of analysing the effect of fiscal constraints on budget deficits.

[1]The fiscal criteria of the Maastricht Treaty are not as strict as this. They contain some room for interpretation. For instance, a country can still qualify for entry into EMU even if its debt-to-GDP ratio is over the 60 per cent threshold provided its debt has been declining sufficiently (see De Grauwe (1997) for details).

Focusing on the study of politically-motivated budget deficits, in Chapter 2 we extend Rogoff's (1990) Equilibrium Political Budget Cycles model to one where deficit financing is possible, i.e. we introduce debt as a state variable. Using this extended fiscal policy model, we found the following key results. First, as in Rogoff's original model, on average an electoral fiscal cycle arises. A new finding is that, on average, electoral concerns induce policy makers to increase the budget deficit in the period prior to the election, and reduce the deficit in the post-election period. Second, we are able to show that high-ability office-holders run lower (ex post) budget deficits than low-ability ones. This might warrant the use of fiscal constraints on high budget deficits since only low-ability policy makers would create such deficits. We show however that a trade-off arises in the model. On the one hand, citizens' welfare is increased, *ceteris paribus*, when high-ability agents are in office; also, when in office, a high-type agent reveals himself by producing a lower budget deficit than a low-ability counterpart. On the other hand, in order to signal to the electorate that he is of high-ability, a high-type agent distorts fiscal policy away from its first-best equilibrium. Hence, from a welfare point of view, it is not clear *a priori* whether and, if so, what type of fiscal constraint should be imposed on office-motivated policy makers. A careful analysis is therefore warranted. We address these issues in Chapter 3.

Before turning to Chapter 3, we should note that the model constructed in Chapter 2 is especially suited to a comparative analysis of various fiscal constraints for two reasons others than the ones highlighted above. First, the model explicitly separates public consumption expenditures from public investment outlays. These two key fiscal components have different consequences for the future of the fiscal position.

Hence, several countries have tended to discriminate between the two components when introducing fiscal constraints.[2] Second, the microfounded nature of the model enables us to study both the endogenous reaction of office-holders to the introduction of fiscal constraints, and the welfare consequences of the introduction of these fiscal constraints. Indeed, of the few research papers that investigated the effect of fiscal constraints on politically-motivated governments, all have based their formal analysis on *ad hoc* models, i.e. models that are not microfounded. For instance, the key result of Beetsma and Uhlig (1999), namely that fiscal constraints such as those of the Stability and Growth Pact, are desirable is fully driven by the arbitrary assumption that governments and citizens have a different discount factor. Given the assumption that governments are myopic, it is not very surprising that their chosen policy is sub-optimal and that a constraint can improve upon this. A key positive result of our chapter is to show that fiscal constraints can indeed be desirable (although this is not necessarily the case) in a fully microfounded model in which the initial political distortion is derived rather than assumed.

More specifically, building on the model of Chapter 2, in Chapter 3 we analyse the effects of imposing various types of constitutional fiscal constraints on sovereign states. The following fiscal constraints are investigated: (i) the ceilings approach of the Stability and Growth Pact (SGP) for European Monetary Union countries; (ii) the "Golden Rule" of public investment of the Code for Fiscal Stability for the United Kingdom (which states that the issuance of public debt should be strictly limited to the financing of public investment, and not public consumption expenditures); and (iii) a Balanced-Budget-Rule such as the one recently considered by the US Congress.

[2] For instance, the United Kingdom's Code for Fiscal Stability places limits on public consumption expenditures but not on public investment.

The main results of Chapter 3 are the following. We first showed that an important distinction has to be made between two types of budget deficits: (i) *incompetency-generated "excessive" budget deficits* which arise when the office-holder has low-ability; and (ii) *politically-generated "excessive" budget deficits* which arise when the high-ability office-holder distorts fiscal policy away from the first-best in order to signal her enhanced ability. The former type of deficit is conditionally efficient in the sense that, given the ability type of the office-holder, fiscal policy is set optimally. However, it is inefficient since citizens would be better-off with a high-ability office-holder pursuing his first-best policy. The latter type of deficits is inefficient due to the signalling distortion arising in election periods (however, in off-election periods an efficient policy is pursued).

We find that fiscal constraints aiming to reduce incompetency-generated budget deficits (i.e. the absolute deficit level) do provide effective incentives for politicians in office to limit budget deficits. However, we showed that all instruments available to policy makers should be taken into account when designing fiscal constraints. Indeed, if only a subset of (fiscal) instruments is restrained, then politician will *substitute* restricted with unrestricted instruments and still create a political fiscal cycle. When constraints aim to limit politically-generated deficits and cycles, we find that only a Golden Rule of public investment can be welfare improving compared to a fully discretionary policy set by office-motivated politicians. We show that an "optimal" constraint that mixes elements of the UK Golden Rule (i.e. the *timing* of the constraint) with the *ceilings* approach of the SGP performs best in our model, despite still not achieving the first-best. Hence, one key positive achievement of Chapter 3 is that we have provided a rational for *some type* of fiscal constraints to be introduced in a one-country framework without having recourse to *ad hoc* assumptions (e.g. Beetsma and Uhlig, 1999) or to fiscal externalities in multi-jurisdictions (e.g. Chari and Kehoe, 1998). This, to the best of our knowledge, does not exist in the literature.

In the second part of the thesis (Chapters 4 and 5), we investigate the robustness of the political agency literature. In particular, in Chapter 4, we revisit a "standard" political agency model that can feature both adverse selection and moral hazard problems (e.g. based on the recent work of Banks and Sundaram, 1998) and assess the robustness of key results to changes in (i) the information structure assumed, and (ii) the modelling of the electoral process. We find that two apparently robust results of the literature are in fact critically dependent on modelling assumptions.

The first result of the literature is that, by following a cutoff rule (i.e. to re-elect the incumbent policy maker if his observed performance in office is above a certain critical level), voters can *always* motivate the office-holder (to supply more effort, extract less rent, etc.). We show that in a dynamic model with symmetric incomplete information (rather than asymmetric information as is often assumed in the literature) and a multiplicative technology (in ability and effort), elections can in fact *demotivate* the office-holder.[3] This new result in the political agency literature is due to an *experimentation* effect.[4] (As far as we know this experimentation result does not appear in the much more extensive agency literature focusing on the theory of the firm either). Hence, too much electoral control can lead to increased *short-termism* from office-holders. The short-termism of politicians, especially in the US

[3]That is, conditional on ability, first-period equilibrium effort may be lower in democracy than with appointment/dictatorship.

[4]i.e. the fact that the incumbent deviates from the myopically optimal action that just maximizes the current payoff in order to improve the information content of his signal about his own ability.

for the House of Representatives with its two-year mandates, is well recognised in the Political Science literature (e.g. King's 1997 treatise on the subject).

The second important result in the literature that we challenge is that voters following a cutoff rule (on observable performance in office) for re-appointing an officeholder is an *optimal mechanism* in providing incentives to politicians. We showed that this result arises in the literature since the electoral process is modelled in an incomplete, *partial equilibrium* way. Indeed, extending the Representative Democracy/Citizen Candidate models of Osborne and Slivinski (1996) and Besley and Coate (1997) to an environment of asymmetric information, we can show that a better incentive mechanism than the cutoff rule on observable policy variables can be designed depending on whether adverse selection or moral hazard dominates as the agency issue. This is because, with a representative democracy, we can show that two types of equilibria are possible: *revealing,* where candidate entry screens out all but high-ability citizens from office, and *non revealing,* where screening does not occur and both high and low-ability politicians can be in office. In this latter case, which is akin to the partial democracy modelling present in the literature, a cutoff rule is then desirable. However, in the former case, if moral hazard is not an important problem, then a properly designed electoral system, whereby the cost of standing for election is set at a constitutional stage sufficiently high, can be Pareto improving compared to the policy cutoff rule.[5] The general message of this chapter is that the selection and retention process of an agent are important elements of job design in agency relationships.

In Chapter 5, we investigate further the robustness of the political agency lit-

[5]Indeed, as we show later in Chapter 5, if moral hazard problems are not present (as in Rogoff's 1990 model) then a revealing equilibrium at the entry stage leads to a first-best outcome.

erature in an environment of *asymmetric information.* In particular we investigate whether introducing a general equilibrium citizen-candidate model *à la* Besley and Coate (1997) and Osborne and Slivinski (1996) can affect the results found in partial equilibrium electoral games. We are able to show that candidate entry may reveal valuable *private* information (such as ability). This revealing equilibrium can only arise if citizens and candidates have *common preferences.* If this is not the case, for instance because office-holding politicians are corrupt, then representative democracy cannot screen out candidates less preferred by voters. An application of this result to Rogoff's (1990) Equilibrium Political Budget Cycles model shows that this leads to sharp, and novel, results. With endogenous candidate entry, only high-ability citizens ever stand for election and are elected. This eliminates the need for distortionary signalling through policy by office-holders (no Political Budget Cycles). A first-best is achieved. In a modified version of Rogoff's model where politicians and voters have *non congruent preferences*, we are however able to show that a political budget cycle still arises.

We conjecture that these sharp results would arise in a general class of asymmetric information games in which an agent has an informational advantage (e.g. cost, ability, etc.) and is randomly selected in the first-period of office. An important literature in monetary economics used such asymmetric information games (e.g. Backus and Driffill, 1985; Vickers, 1986; Barro, 1986; Rogoff, 1987 and 1989; Cukierman and Meltzer, 1986b; Cukierman and Liviathan, 1991).

Chapter 5 also sheds some light on the (long) debate between the Virginia and the Chicago schools about whether democracy is an efficient mechanism or not. Indeed, we can show that the efficiency result crucially depends on whether voters and candidates have *common* or *conflicting* interests, and not on whether information is complete or not as has often been claimed in the literature.[6]

Our results obtained in Chapter 5 also have important bearing on our theoretical analysis of Part I of the thesis. Indeed, given that Chapters 2 and 3 build on the model of Rogoff (1990), our screening result would apply directly to them. Hence, as in Chapter 5, a Pareto-improvement leading to the first-best can be designed at a constitutional stage by optimally setting the cost of standing for election. Applied to our analysis of fiscal constraints in Chapter 3, an important policy conclusion would therefore be that *improving the electoral process* and *strengthening the democratic regime* of a country could be preferable to the introduction of fiscal constraints in reducing political distortions such as politically-induced business or fiscal cycles. However, as another key result of Chapter 5 showed, elections can only perform as a screening mechanism if politicians and citizens have congruent preferences. If this is not the case, then clearly, our analysis of and results on fiscal constraints in Chapter 3 (and also our model of Chapter 2) would still hold (this can be seen by re-interpreting the model along the lines of our "Rogoff Model with an Agency Problem" in Section 5.6 (where office-holders aim to extract economic rent)).

Finally, we believe that, in the light of our results in this thesis, several avenues for future research would be worth investigating. The most important one, we believe, would be to test the theoretical predictions of Chapter 5, since these predictions obtained are precise enough to be directly tested and also given the strong theoretical results obtained. Indeed, as we argued in the conclusion of Chapter 5, our results potentially have important policy implications. Empirically testing the validity of

[6] See Coate and Morris (1995) for a recent account of this debate.

our theory is therefore highly desirable. An empirical approach that follows Besley and Case's (1995a) econometric analysis of the interaction between US Gubernatorial elections and economic outcomes could be appropriate to, for instance, test whether high cost of candidate entry (e.g. high campaign costs) reduce politically-induced cycles. As detailed in Chapter 5, the empirical results of Shi and Svensson (2001) already corroborate our theory. More precise tests are desirable.

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Appendix A

Appendix to Chapter 2

A.1 Proof of Proposition 2.1

Using the definition of Z, we have

$$\mathcal{B} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_H) - Z[g_H^*, \tau_H^*, b_H^*, 0, \theta_H] \geq 0\}$$

$$\Leftrightarrow \quad \mathcal{B} \equiv \left\{ \begin{array}{l} (g_1, \tau_1, b) \mid 0 \leq u^*(c_1, g_1) - u(c_1, g_1) \\ +[v^*(\theta_H) - v(\theta_H) + u^*(c_2, g_2, \theta_H) - u(c_2, g_2, \theta_H)] \leq \Delta_H \{\pi[0] - \pi[1]\} \end{array} \right\}$$

and

$$\mathcal{A} \equiv \{(g_1, \tau_1, b) \mid \Delta_L \pi[1] + W(\theta_L) - \Delta_L \pi[0] - W_L^* \leq 0\}$$

$$\Leftrightarrow \quad \mathcal{A} \equiv \left\{ \begin{array}{l} (g_1, \tau_1, b) \mid u^*(c_1, g_1) - u(c_1, g_1) \\ +[v^*(\theta_L) - v(\theta_L) + u^*(c_2, g_2, \theta_L) - u(c_2, g_2, \theta_L)] \geq \Delta_L \{\pi[1] - \pi[0]\} \geq 0 \end{array} \right\}$$

Thus given that $\Delta_H > \Delta_L$ and $v'' < 0$, the intersection of the two sets is nonempty.

□

A.2 Proof of Proposition 2.2

After rearranging equation (2.23)

$$\mathcal{A} \equiv \left\{ \begin{array}{c} (g_1, \tau_1, b) \mid \Delta_L \pi(0) + W_L^* - \Delta_L \pi(1) - u(y - \tau_1 - b,\ g_1) \\ -v[\tau_1 + \theta_L - g_1 + b - f(\tau_1)] - J(b, \theta_L) \geq 0 \end{array} \right\} \qquad \text{(A.1)}$$

Given the Inada conditions on u and v, any solution to equation (2.26) must have $g_1, \tau_1, b \geq 0$.

The Lagrangian is given by

$$\begin{aligned} L &= u(y-\tau_1-b, g_1) + v\left[\tau_1+\theta_H-g_1+b-f\left(\tau_1\right)\right] + J\left(b,\theta_H\right) \qquad \text{(A.2)} \\ &\quad +\lambda\left\{\kappa_0 - u(y-\tau_1-b,\ g_1) - v\left[\tau_1+\theta_L-g_1+b-f\left(\tau_1\right)\right] - J\left(b,\theta_L\right)\right\} \end{aligned}$$

where $\kappa_0 \equiv \Delta_L\left[\pi\left(0\right)-\pi\left(1\right)\right] + W_L^*$.

The Kuhn-Tucker conditions reduce to:

$$\begin{aligned} u_c-(1-f'(\tau_1))\,v'_H-\lambda\left[u_c-(1-f'(\tau_1))\,v'_L\right] &\leq 0, \ (=0 \text{ if } y-\tau_1 > \text{(A.3)} \\ u_g-v'_H-\lambda\left[u_g-v'_L\right] &\leq 0, \ (=0 \ \text{ if } g_1>0)\text{(A.4)} \\ u_c-v'_H+rf'(\tau_2)u_g(c_2,g_2)-\lambda\begin{bmatrix} u_c-v'_L \\ +rf'(\tau_2)u_g(c_2,g_2)\end{bmatrix} &\leq 0, \ (=0 \text{ if } c_1>0) \ \text{(A.5)} \\ \kappa_0-u\left(.\right)-v\left(.\right)-J\left(b,\theta_L\right) &\geq 0, \ (=0 \text{ if } \lambda>0) \ \text{(A.6)} \end{aligned}$$

Given the Inada conditions, $(A.3)$ to $(A.5)$ imply that $\frac{1}{1-f'(\tau_1)}\,u_c(c_1,g_1) = u_c(c_1,g_1)+ rf'\left(\tau_2\right)u_g(c_2,g_2) = u_g(c_1,g_1)$. This equation governs the downward sloping income extension path $g_1 = \phi\left(b\right)$ in Figure 2.2. We are able to determinate uniquely g_1, τ_1,and b thanks to the introduction of distortionary taxes in the first period. $(A.6)$ is the constraint $(g_1,\tau_1,b) \in \mathcal{A}$, the set of points on or outside the dashed sphere. Assume that $\lambda > 0$ so that $(A.6)$ is binding. Equations $(A.3)$-$(A.5)$ are then satisfied at exactly two distinct points. At point $H^s(\lambda < 1; \frac{1}{1-f'(\tau_1)}u_c(c_1,g_1) = u_c(c_1,g_1)+ rf'\left(\tau_2\right)u_g(c_2,g_2) = u_g(c_1,g_1) < v'_I)$ and at point $F(\lambda > 1; \frac{1}{1-f'(\tau_1)}u_c(c_1,g_1) = u_c(c_1,g_1)+ rf'\left(\tau_2\right)u_g(c_2,g_2) = u_g(c_1,g_1) > v'_I)$. To check the second order conditions at points H^s and F, we form the bordered Hessian

$$B \equiv \begin{vmatrix} 0 & G_\tau & G_g & G_b \\ G_\tau & L_{\tau\tau} & L_{\tau g} & L_{\tau b} \\ G_g & L_{g\tau} & L_{gg} & L_{gb} \\ G_b & L_{b\tau} & L_{bg} & L_{bb} \end{vmatrix}$$

where

$$\begin{aligned} G &\equiv \kappa_0 - u(y - \tau_1 - b, g_1) - v\left[\tau_1 + \theta_L - g_1 + b - f(\tau_1)\right] - J(b, \theta_L) \\ |B_1| &= -G_{\tau_1}^2 < 0 \\ |B_2| &= -G_{\tau_1}^2 L_{g_1 g_1} + 2G_{\tau_1} G_{g_1} L_{\tau_1 g_1} - G_{\tau_1}^2 L_{\tau_1 \tau_1} = (1-\lambda)\left[2u_{\tau_1 g_1} - u_{g_1 g_1} - u_{\tau_1 \tau_1}\right](u_{g_1} - v_L')^2 \end{aligned}$$

Since all goods are normal, this means that $2u_{\tau_1 g_1} - u_{g_1 g_1} - u_{\tau_1 \tau_1} > 0$. For the second order condition to hold, $|B_2|$ must be strictly positive. This can only occur for $\lambda < 1$. Therefore point F cannot be a maximum. For point H^s to be a maximum, we need $|B_3| < 0$, which we assume is satisfied. □

A.3 Proof of Proposition 2.3

Suppose (g_1^z, τ_1^z, b^z) is any point selected with positive probability by both types in a pooling equilibria. Let

$X^I(g_1, \tau_1, b) \equiv Z(g_1, \tau_1, b, 1, \theta^I) - Z[g_1^z, \tau_1^z, b^z, \hat{\rho}(g_1^z, \tau_1^z, b^z), \theta^I]$, where the incumbent I can be of ability $a \in \{H, L\}$.

Select $[\tilde{g}_1, \phi(\tilde{g}_1, \tilde{\bar{b}}), \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1)]$ such that

(a) $\phi(\tilde{g}_1, \tilde{\bar{b}}) + \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1) - \tilde{g}_1 < \tau_H^* + b_H^* - g_H^*$, and

(b) $X^H[\tilde{g}_1, \phi(\tilde{g}_1, \tilde{\bar{b}}), \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1)] = 0$.

Given that $v(0) = -\infty$ and $\pi(1) > \pi(\hat{\rho})$, such a combination exists and is feasible.

Note that $\phi(\tilde{g}_1, \tilde{\bar{b}}) + \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1) - \tilde{g}_1 < \tau_1^z + b^z - g_1^z$ since $u[y - \phi(g_1, \bar{b}) - \phi(\bar{\tau}_1, g_1), g_1]$

$\geq u[y-\tau_1^z-b^z, g_1^z]$ if $\phi(g_1, \bar{b})+\phi(\bar{\tau}_1, g_1)-g_1 = \tau_1^z+b^z-g_1^z$. Then since $v'' < 0$, it follows that $X^L[\tilde{g}_1, \phi(\tilde{g}_1, \tilde{\bar{b}}) + \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1)] < 0$. Thus by the continuity of X^I, $\exists\zeta > 0$ such that $X^H[\tilde{g}_1 - \zeta, \phi(\tilde{g}_1, \tilde{\bar{b}}) - \zeta, \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1) - \zeta] > 0$ and $X^L[\tilde{g}_1 - \zeta, \phi(\tilde{g}_1, \tilde{\bar{b}}) - \zeta, \phi(\tilde{\bar{\tau}}_1, \tilde{g}_1) - \zeta] < 0$.

The geometric intuition is that there must always exist some point on $\phi(\tau_1, b)$ sufficiently far southeast of H in the (g_1, τ_1) and (g_1, b) planes, and southwest in the (b, τ_1) plane in Figure 2.2 such that both (2.28) and (2.29) hold. □

A.4 Proof of Proposition 2.4

This derives directly from observation of equations (2.11)-(2.13).

Consider the case where distortionary taxes are excluded. In this case the system (2.11)-(2.13) becomes:

$$\begin{aligned}
\tau_1 \frac{dW}{d\tau_1} &= 0 : u_c \leq v' && (\tau_1 \geq 0) \\
g_1 \frac{dW}{dg_1} &= 0 : u_g = v' && (g_1 > 0) \\
b \frac{dW}{db} &= 0 : u_c \leq v' && (b \geq 0)
\end{aligned}$$

That is, we obtain a system of two equations out of which only two variables can be unknown. In this system we can only determine g_1 and $(\tau_1 + b)$. Only the sum of first-period taxes and debt is defined, the composition between the two is irrelevant. Introducing distortionary taxes enables us to have a system of three equation in three unknown (τ_1, g_1, b) thereby breaking the Ricardian Equivalence proposition. □

A.5 Proof of Proposition 2.7

We want to prove that $g_{H^s} - \tau_{H^s} + f(\tau_{H^s}) - \theta_H < g_L - \tau_L + f(\tau_L) - \theta_L$ for a sufficiently high level of "ego rent", i.e. that $(g_{H^s} - \tau_{H^s} + f(\tau_{H^s})) - (g_L - \tau_L + f(\tau_L)) < \theta_H - \theta_L$ in the undominated separating equilibria of Section 2.3.

We will prove this by using a revealed preference argument. Let us construct a hypothetical allocation in which half of the competency advantage of the high-type (i.e. $\frac{1}{2}(\theta_H - \theta_L)$) is spent on increasing first-period government consumption goods (g_1), and the other half is spent on reducing first period taxes. Denote by a "hat" this hypothetical allocation, so we have $\hat{g}_H = g_L + \frac{1}{2}(\theta_H - \theta_L)$, $\hat{\tau}_H = \tau_L + \frac{1}{2}(\theta_H - \theta_L)$, $\hat{c}_H = c_L$, $\hat{k}_{2,H} = k_{2,L}$, $\hat{b}_H = b_L$. If this allocation is feasible (i.e. if $(\hat{g}_H, \hat{\tau}_H, \hat{b}_H) \in \mathcal{A}$) then given that c_1, g_1, k_2 are normal goods, using a revealed preference argument, we know that $(g_{H^s} - \tau_{H^s} + f(\tau_{H^s})) - (g_L - \tau_L + f(\tau_L)) < \theta_H - \theta_L$ is satisfied, i.e. a competent incumbent would strictly prefer to allocate her competency advantage across the various goods.

For $(\hat{g}_H, \hat{\tau}_H, \hat{b}_H) \in \mathcal{A}$, we need

$$\kappa_0 - u(y - \hat{\tau}_1 - \hat{b}, \hat{g}_1) - v\left[\hat{\tau}_1 + \theta_L - \hat{g}_1 + \hat{b} - f(\hat{\tau}_1)\right] - J\left(\hat{b}, \theta_L\right) \geq 0$$

where $\kappa_0 \equiv \Delta_L[\pi(0) - \pi(1)] + W_L^*$, and $\Delta_L \equiv R + W_L - W^O$, with $W^O \equiv \rho W_H + (1-\rho) W_L$.

This is equivalent to

$$\left\{ \begin{array}{c} \kappa_0 - u(y - b_L^*, g_L^* + \theta_H - \theta_L) \\ -v\left[\theta_H - g_L^* + b_L^*\right] - J\left(b_L^*, \theta_L\right) \end{array} \right\} \geq 0$$

$$\text{i.e. to} \left\{ \begin{array}{c} \Delta_L\left[\pi(0) - \pi(1)\right] + u(y - b_L^*, g_L^*) \\ +v\left[\theta_L - g_L^* + b_L^*\right] + J\left(b_L^*, \theta_L\right) - u(y - b_L^*, g_L^* + \theta_H - \theta_L) \\ -v\left[\theta_H - g_L^* + b_L^*\right] - J\left(b_L^*, \theta_L\right) \end{array} \right\} \geq 0$$

This inequality will hold the higher the "ego rent" (R) of incumbent policy makers. We assume that the ego rent is sufficiently high so that the inequality is satisfied. □

Appendix B

Appendix to Chapter 3

B.1 Proof of Proposition 3.2

Using the definition of Z, we have

$$\mathcal{B} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_H) - Z[g_H^*, \tau_H^*, b_H^*, 0, \theta_H] \geq 0\}$$

$$\Leftrightarrow \ \mathcal{B} \equiv \left\{ \begin{array}{l} (g_1, \tau_1, b) \mid 0 \leq u^*(c_1, g_1) - u(c_1, g_1) \\ + [v^*(\theta_H) - v(\theta_H) + u^*(c_2, g_2, \theta_H) - u(c_2, g_2, \theta_H)] \leq \Delta_H \{\pi[0] - \pi[1]\} \end{array} \right\}$$

and

$$\mathcal{A}^{emu} \equiv \{(g_1, \tau_1, b) \mid \Delta_{L^{emu}} (\pi[1] - \pi[0]) + W(\theta_L, \Psi_D^{emu}, \Psi_B^{emu}) - W^{**}(\theta_L, \Psi_D^{emu}, \Psi_B^{emu}) \leq 0\}$$

$$\Leftrightarrow \ \mathcal{A}^{emu} \equiv \left\{ \begin{array}{c} (g_1, \tau_1, b) \mid u^{**}(c_1, g_1) - u(c_1, g_1) \\ + [v^{**}(\theta_L) - v(\theta_L) + u^{**}(c_2, g_2, \theta_L) - u(c_2, g_2, \theta_L)] \geq \Delta_{L^{emu}} \{\pi[1] - \pi[0]\} \geq 0 \end{array} \right\}$$

where a star superscript refer to the full information equilibrium (no constraints), and two superscripted stars refer to the full information equilibrium obtained when fiscal constraints are binding. We know that $\Delta_H > \Delta_L$. From the definition of the surplus from winning, it is clear that $\Delta_L > \Delta_{L^{emu}}$. Thus given that $\Delta_H > \Delta_{L^{emu}}$ and u'', $v'' < 0$, the intersection of the sets $\mathcal{B}$ and $\mathcal{A}^{emu}$ is nonempty. □

B.2 Proof of Proposition 3.3

For a low-type, we problem is to (recall that for a high-type the constraints are not binding)

$$\max_{\tau_2} J(b, \theta_L, \Psi_D^{emu}, \Psi_B^{emu}) \equiv u \left[\begin{array}{c} y - \tau_2 + rb, \tau_2{+}\theta_L - rb - \max\left\{\Psi_D^{emu}(b - \bar{b}), 0\right\} \\ - \max\left\{\Psi_B^{emu}(g_1 - \tau_1 - \theta_L + f(\tau_1) - \bar{d}), 0\right\} \end{array} \right]$$

The Lagrangian is

$$\begin{aligned} L &= u(y - \tau_1 - b, g_1) + v\left[\tau_1 + \theta_H - g_1 + b - f(\tau_1)\right] + J(b, \theta_H) \\ &\quad + \lambda\{\kappa_0 - u(y - \tau_1 - b, g_1) - v\left[\tau_1 + \theta_L - g_1 + b - f(\tau_1)\right] \\ &\quad - J[y - \tau_2 + rb, \tau_2{+}\theta_L - rb - \Psi_D^{emu}(b - \bar{b}) - \Psi_B^{emu}(g_1 - \tau_1 - \theta_L + f(\tau_1) - \bar{d})]\} \end{aligned}$$

where $\kappa_0 \equiv \Delta_L[\pi(0) - \pi(1)] + W_\Psi^{**}(\theta_L)$.

The Kuhn-Tucker conditions are:

$$-u_c + (1 - f')\, v_H' + \lambda\left[u_c - (1 - f')\, v_L' - (1 - f')\Psi_B^{emu} J_L'\right] = 0 \qquad \text{(B.1)}$$

$$u_g - v_H' + \lambda\left[-u_g + v_L' + \Psi_B^{emu} J_L'\right] = 0 \qquad \text{(B.2)}$$

$$-u_c + v_H' + \lambda\left[u_c - v_L' + \Psi_D^{emu} J_L'\right] = 0 \qquad \text{(B.3)}$$

$$\kappa_0 - u - v - J(b, \theta_L, \Psi_B^{emu}, \Psi_D^{emu}) \geq 0 \qquad \text{(B.4)}$$

$$(= 0 \text{ if } \lambda > 0)$$

The Inada conditions insure an interior solution. Hence $(B.1)$ to $(B.3)$ imply: $(1 - f')^{-1}u_c - \lambda(1-\lambda)^{-1}\Psi_B^{emu} J_L' = u_g - \lambda(1-\lambda)^{-1}\Psi_B^{emu} J_L' = u_c + \lambda(1-\lambda)^{-1}\Psi_D^{emu} J_L'$. $(B.4)$ is the constraint $(g_1, \tau_1, b) \in \mathcal{A}^{emu}$, the set of points on or outside the dashed circles in Figure 3.3. Assume that $\lambda > 0$ so that $(B.4)$ is binding. The first-order conditions are then satisfied at exactly two distinct points. At point $H^{emu}(\lambda < 1;\ (1 - f')^{-1}u_c -$

$\lambda(1-\lambda)^{-1}\Psi_B^{emu}J_L' = u_g - \lambda(1-\lambda)^{-1}\Psi_B^{emu}J_L' = u_c + \lambda(1-\lambda)^{-1}\Psi_D^{emu}J_L' < v_I')$ and at point $F^{emu}(\lambda > 1;\ (1-f')^{-1}u_c - \lambda(1-\lambda)^{-1}\Psi_B^{emu}J_L' = u_g - \lambda(1-\lambda)^{-1}\Psi_B^{emu}J_L' = u_c + \lambda(1-\lambda)^{-1}\Psi_D^{emu}J_L' > v_I')$. To check the second order conditions at points H^{emu} and F^{emu}, we form the bordered Hessian:

$$B \equiv \begin{vmatrix} 0 & G_\tau & G_g & G_b \\ G_\tau & L_{\tau\tau} & L_{\tau g} & L_{\tau b} \\ G_g & L_{g\tau} & L_{gg} & L_{gb} \\ G_b & L_{b\tau} & L_{bg} & L_{bb} \end{vmatrix}$$

where

$$\begin{aligned} G &\equiv \kappa_0 - u(y-\tau_1-b, g_1) - v\left[\tau_1 + \theta_L - g_1 + b - f(\tau_1)\right] \\ &\quad -J\left(y-\tau_2+rb, \tau_2+\theta_L - rb - \Psi_D^{emu}\left(b-\bar{b}\right) - \Psi_B^{emu}\left(g_1 - \tau_1 - \theta_L + f(\tau_1) - \bar{d}\right)\right) \end{aligned}$$

and

$$\begin{aligned} |B_1| &= -G_{\tau_1}^2 < 0 \\ |B_2| &= -G_{\tau_1}^2 L_{g_1g_1} + 2G_{\tau_1}G_{g_1}L_{\tau_1g_1} - G_{\tau_1}^2 L_{\tau_1\tau_1} \\ &= -\left[u_{\tau_1} - (1-f')v_L' - (1-f')\Psi_B^{emu}J_L'\right]^2 (1-\lambda)\left[u_{g_1g_1} + v_I'' - \lambda(1-\lambda)^{-1}(\Psi_B^{emu})^2 J_L''\right] \\ &\quad +2\left[u_{\tau_1} - (1-f')v_L' - (1-f')\Psi_B^{emu}J_L'\right]\left[-u_{g_1} + v_L' + \Psi_B^{emu}J_L'\right] \\ &\quad * \left\{-(1-\lambda)\left[u_{\tau_1g_1} + (1-f')v_I'' - \lambda(1-\lambda)^{-1}(1-f')(\Psi_B^{emu})^2 J_L''\right]\right\} \\ &\quad -\left[u_{\tau_1} - (1-f')v_L' - (1-f')\Psi_B^{emu}J_L'\right]^2 (1-\lambda)\left[\begin{array}{c} u_{\tau_1\tau_1} + (1-f')^2 v_I'' \\ -\lambda(1-\lambda)^{-1}(1-f')^2(\Psi_B^{emu})^2 J_L'' \end{array}\right] \end{aligned}$$

For the second order condition to hold, $|B_2|$ must be strictly positive. Given our assumptions regarding the utility functions (cf. Section 2.3.1) and the fact that we have normal goods, the first and third terms of $|B_2|$ are strictly positive if and only if $\lambda < \frac{1}{2}$.[1] The second term of $|B_2|$ is also strictly positive. The reason being that

[1]Note that: $\lim_{\lambda\to 1^-}\left(\frac{\lambda}{1-\lambda}\right) = \infty$, $\lim_{\lambda\to 0^+}\left(\frac{\lambda}{1-\lambda}\right) = 0$, $\frac{\lambda}{1-\lambda} = 1$ for $\lambda = \frac{1}{2}$, $\lim_{\lambda\to 1^+}\left(\frac{\lambda}{1-\lambda}\right) = -\infty$, $\lim_{\lambda\to\infty}\left(\frac{\lambda}{1-\lambda}\right) = -1$.

the two square brackets are equal and therefore have the same sign (from (3.3)). The curly bracket is strictly positive provided that $\lambda < \frac{1}{2}$. Thus, point F^{emu} which occurs when occur for $\lambda > 1$ cannot be a maximum. For point H^{emu} to be a maximum, we need $|B_3| < 0$, which we assume is satisfied. □

B.3 Proof of Proposition 3.4

We first prove that $g_{H^{emu}} - \tau_{H^{emu}} - \theta_H + f(\tau_{H^{emu}}) < \bar{d}$.

We know from Proposition 2.7 that it is possible to design a budget deficit ceiling such that: $g_{H^s} - \tau_{H^s} - \theta_H + f(\tau_{H^s}) < \bar{d} < g_L - \tau_L - \theta_L + f(\tau_L)$. Given that $g_{H^{emu}} < g_{H^s}$, and that $\tau_{H^{emu}} > \tau_{H^s}$ it is clear that introducing a constraint that originally binds only on the low-type also reduces the budget deficit of the high-type leader (because the latter needs to undertake less signalling because the constraint further disadvantages the former).

Proving that $b_{H^{emu}} < \bar{b}$ is satisfied is immediate given that we have found that $b_{H^{emu}} < b_{H^s}$ and that originally the debt ceiling was such that $b_{H^s} < \bar{b}$. □

B.4 Proof of Proposition 3.5

Note that we have

$$\mathcal{B}^{us} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_H) - Z \begin{bmatrix} g_1^{**}(\theta_H, \Psi_1^{us}, \Psi_2^{us}), \tau_1^{**}(\theta_H, \Psi_1^{us}, \Psi_2^{us}), \\ b^{**}(\theta_H, \Psi_1^{us}, \Psi_2^{us}), 0, \theta_H \end{bmatrix} \geq 0\}$$

and

$$\mathcal{A}^{us} \equiv \{(g_1, \tau_1, b) \mid Z(g_1, \tau_1, b, 1, \theta_L) - Z \begin{bmatrix} g_1^{**}(\theta_L, \Psi_1^{us}, \Psi_2^{us}), \tau_1^{**}(\theta_L, \Psi_1^{us}, \Psi_2^{us}), \\ b^{**}(\theta_L, \Psi_1^{us}, \Psi_2^{us}), 0, \theta_L \end{bmatrix} \leq 0\}$$

A - Under full information, the Lagrangian is

$$\begin{aligned} L &= u(y-\tau_1-b,g_1)+v[\tau_1+\theta^I-g_1+b-f(\tau_1)-\Psi_1^{us}(g_1-\tau_1+f(\tau_1))] \\ &\quad +J[y-\tau_2+rb,\tau_2+\theta^I-rb-\Psi_2^{us}(g_1-\tau_1-\theta^I+f(\tau_1))] \end{aligned}$$

The first-order conditions are

$$\begin{aligned} \frac{dL}{d\tau_1} &= 0: u_c=(1+\Psi_1^{us})(1-f')v_I'+\Psi_2^{us}J_I' \\ \frac{dL}{dg_1} &= 0: u_g=(1+\Psi_1^{us})v_I'+\Psi_2^{us}J_I' \\ \frac{dL}{db} &= 0: u_c=v_I' \end{aligned}$$

Hence we obtain

$$\frac{1}{(1-f')(1+\Psi_1^{us})}u_c-\frac{\Psi_2^{us}}{1+\Psi_1^{us}}J_I'=\frac{1}{1+\Psi_1^{us}}u_g-\frac{\Psi_2^{us}}{1+\Psi_1^{us}}J_I'=u_c=v_I'$$

B - Under asymmetric information (high-type only), the Lagrangian is the following

$$\begin{aligned} L &= u(y-\tau_1-b,g_1)+v[\tau_1+\theta_H-g_1+b-f(\tau_1)-\Psi_1^{us}(g_1-\tau_1+f(\tau_1))] \\ &\quad +J_H[y-\tau_2+rb,\tau_2+\theta_H-rb-\Psi_2^{us}(g_1-\tau_1-\theta_H+f(\tau_1))] \\ &\quad +\lambda\{\kappa_0-u(y-\tau_1-b,g_1)-J_L[y-\tau_2+rb,\tau_2+\theta_L-rb-\Psi_2^{us}(g_1-\tau_1-\theta_L+f(\tau_1))] \\ &\quad -v[\tau_1+\theta_L-g_1+b-f(\tau_1)-\Psi_1^{us}(g_1-\tau_1+f(\tau_1))]\} \end{aligned}$$

The Kuhn-Tucker conditions are

$$\tau_1\frac{dL}{d\tau_1} = 0:\left\{\begin{array}{c} -u_c+(1-f')(1+\Psi_1^{us})v_H'+(1-f')\Psi_2^{us}J_H' \\ +\lambda\left[u_c-(1-f')(1+\Psi_1^{us})v_L'-(1-f')\Psi_2^{us}J_L'\right]\end{array}\right\}=0 \quad \text{(B.5)}$$

$$g_1\frac{dL}{dg_1} = 0:\left\{\begin{array}{c} u_g-(1+\Psi_1^{us})v_H'-\Psi_2^{us}J_H' \\ +\lambda\left[-u_g+(1+\Psi_1^{us})v_L'+\Psi_2^{us}J_L'\right]\end{array}\right\}=0 \quad \text{(B.6)}$$

$$b_1\frac{dL}{db_1} = 0:-u_c+v_H'+\lambda\left[u_c-v_L'\right]=0 \quad \text{(B.7)}$$

$$\frac{dL}{d\lambda} = 0:\kappa_0-u-v\left(\Psi_1^{us}\right)-J_L\left(b,\theta_L,\Psi_2^{us}\right)\geq 0 \quad \text{(B.8)}$$

where $\kappa_0 \equiv \Delta_L [\pi(0) - \pi(1)] + W^{**}(\theta_L, \Psi_1^{us}, \Psi_2^{us})$.

The Inada conditions ensure an interior solution. Hence equations $(B.5)$ to $(B.7)$ imply: $[(1-f')(1+\Psi_1^{us})]^{-1} u_c - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = (1+\Psi_1^{us})^{-1} u_g - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = u_c = v_L'$. $(B.8)$ is the constraint $(g_1, \tau_1, b) \in \mathcal{A}^{us}$, the set of points on or outside the dashed circles in Figure 3.3. Assume that $\lambda > 0$ so that $(B.8)$ is binding. The first-order conditions are then satisfied at exactly two distinct points. At point $H^{us}(\lambda < 1$; $[(1-f')(1+\Psi_1^{us})]^{-1} u_c - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = (1+\Psi_1^{us})^{-1} u_g - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = u_c < v_I')$ and at point $F^{us}(\lambda > 1$; $[(1-f')(1+\Psi_1^{us})]^{-1} u_c - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = (1+\Psi_1^{us})^{-1} u_g - \Psi_2^{us}(1+\Psi_1^{us})^{-1} J_L' = u_c > v_I')$. To check the second order conditions at points H^{us} and F^{us}, we form a bordered Hessian $|B|$ (see proof of Proposition 3.3). In this bordered Hessian,

$$\begin{aligned}
G &\equiv \kappa_0 - u(y - \tau_1 - b, g_1) - v[\tau_1 + \theta_L - g_1 + b - f(\tau_1) - \Psi_1^{us}(g_1 - \tau_1 + f(\tau_1))] \\
&\quad - J_L[y - \tau_2 + rb, \tau_2 + \theta_L - rb - \Psi_2^{us}(g_1 - \tau_1 - \theta_L + f(\tau_1))] \\
|B_1| &= -G_{\tau_1}^2 < 0 \\
|B_2| &= -G_{\tau_1}^2 L_{g_1 g_1} + 2 G_{\tau_1} G_{g_1} L_{\tau_1 g_1} - G_{\tau_1}^2 L_{\tau_1 \tau_1} \\
&= -\left[u_{\tau_1} - (1-f')(1+\Psi_2^{us}) v_L' - (1-f')\Psi_2^{us} J_L'\right]^2 (1-\lambda) \\
&\quad * \left[u_{g_1 g_1} + (1+\Psi_1^{us})^2 v_I'' - (\Psi_2^{us})^2 J_L''\right] \\
&\quad + 2\left[u_{\tau_1} - (1-f')(1+\Psi_2^{us}) v_L' - (1-f')\Psi_2^{us} J_L'\right]\left[-u_{g_1} + (1+\Psi_1^{us}) v_L' + \Psi_2^{us} J_L'\right] \\
&\quad * \left\{-(1-\lambda)\left[u_{\tau_1 g_1} + (1-f')(1+\Psi_1^{us})^2 v_I'' + (1-f')(\Psi_2^{us})^2 J_I''\right]\right\} \\
&\quad - \left[u_{\tau_1} - (1-f')(1+\Psi_2^{us}) v_L' - (1-f')\Psi_2^{us} J_L'\right]^2 \\
&\quad * (1-\lambda)\left[\begin{array}{c} u_{\tau_1 \tau_1} + (1-f')^2(1+\Psi_1^{us})^2 v_I'' \\ +(1-f')^2(\Psi_2^{us})^2 J_I'' \end{array}\right]
\end{aligned}$$

For the second order condition to hold, $|B_2|$ must be strictly positive. Given our assumptions regarding the utility functions (cf. Section 2.3.1) and the fact that we have normal goods, the first and third terms of $|B_2|$ are strictly positive if and only if $\lambda < 1$. The second term of $|B_2|$ is also strictly positive. The reason being that the two square brackets are equal and therefore have the same sign. The curly bracket is strictly positive provided that $\lambda < 1$. Thus, point F^{us} which occurs when occur for $\lambda > 1$ cannot be a maximum. For point H^{us} to be a maximum, we need $|B_3| < 0$, which we assume is satisfied. □

Note that the derivations for the UK's Golden Rule are the same as for the US balanced-budget rule but for the replacement of Ψ_1^{us} by Ψ^{uk} and setting Ψ_2^{us} to zero. They are therefore omitted.

B.5 Proof of Proposition 3.10

Under asymmetric information (high-type only)

$$\begin{aligned} L &= u(y-\tau_1-b,g_1)+v[\tau_1+\theta_H-g_1+b-f(\tau_1)-\Psi^*(g_1-\tau_1+f(\tau_1)-\bar{d}^*)] \\ &\quad +J_H[y-\tau_2+rb,\tau_2+\theta_H-rb]+\lambda\{\kappa_0-u(y-\tau_1-b,g_1) \\ &\quad -J_L[y-\tau_2+rb,\tau_2+\theta_L-rb]-v[\tau_1+\theta_L-g_1+b-f(\tau_1)]\} \end{aligned}$$

The Kuhn–Tucker conditions are

$$\begin{aligned} \tau_1\frac{dL}{d\tau_1} &= 0: -u_c+(1-f')(1+\Psi^*)v'(\theta_H)+\lambda\left[u_c-(1-f')v'(\theta_L)\right]=0 \\ g_1\frac{dL}{dg_1} &= 0: u_g-(1+\Psi^*)v'(\theta_H)+\lambda\left[-u_g+v'(\theta_L)\right]=0 \\ b\frac{dL}{db} &= 0: -u_c+v'(\theta_H)+\lambda\left[u_c-v'(\theta_L)\right]=0 \\ \frac{dL}{d\lambda} &= 0: \kappa_0-u-J(\theta_L)-v(\theta_L)\geq 0 \end{aligned}$$

By analogy with the proofs of Propositions 3.3 and 3.5, it is easy (but cumbersome) to show that in the undominated separating equilibria we obtain $[1-f']^{-1}u_c-(1-$

$f')\left[1-\lambda\right]^{-1}\Psi^{*}v'_{H}=u_{g}-\left[1-\lambda\right]^{-1}\Psi^{*}v'_{H}=u_{c}<v'_{I}$. □

B.6 Low-Type's Full Information Equilibrium Under the SGP Constraints

The Lagrangian for the low-type incumbent is

$$L=u(y-\tau_{1}-b,g_{1})+v\left[\tau_{1}+\theta-g_{1}+b-f\left(\tau_{1}\right)\right]+J\left(b,\theta,\Psi_{B},\Psi_{D}\right)$$

The first-order conditions are

$$\begin{aligned}\frac{dL}{d\tau_{1}} &= 0:-u_{c}+v'(1-f')+(1-f')\Psi_{B}J=0\\ \frac{dL}{dg_{1}} &= 0:u_{g}-v'-\Psi_{B}J=0\\ \frac{dL}{db} &= 0:-u_{c}+v'-\Psi_{D}J=0\end{aligned}$$

Hence, the low-type's strategy is given by equation (3.3). □

Appendix C

Appendix to Chapter 4

C.1 Proofs of Propositions

C.1.1 Proof of Proposition 4.1

We show that the equilibrium described exists and is unique by backwards induction. First, it is clear that any $i \in N$ who is elected at period 2 chooses $e^*(x_i)$. Next, consider the behaviour of the voters, given any candidate set C_2. Let C_2^H, C_2^L be the partition of C_2 into high and low-ability types. All $j \in N/C_2$ will vote for their most-preferred candidate $m(C_2) = \max_{i \in C_2^H}$. Now, by Assumption 4.1, $v_o(0) > v_c(1)$, i.e. every candidate's most preferred candidate is herself, so $i \in C_2$ will vote for herself.

Now consider the candidate entry decision in period 2.

Case 1. $C_2 \neq N$. In this case, if m_H enters the election, she will surely win, no matter who else stands. As $v_o(1) > \delta$ from Assumption 4.1, m_H will surely enter. But in this case any $j \neq m_H$ who enters will surely lose δ, and so will not enter. So, $C_2 = \{m_H\}$.

Case 2. $C_1 = N$. In this case, at the voting stage, every candidate votes for himself so and is elected to be office-holder with probability $1/n$. The payoff to i from entry is thus is $\frac{1}{n}v_o(x_i) - \delta$ which is negative for all agents by Assumption 4.2. On the other hand, any $i \in N$ can guarantee herself a positive payoff by not entering. So, this case is impossible in equilibrium.

So we have demonstrated that in the second period, whatever happened in the first period, there is a unique equilibrium where only m_H stands for election and is elected (by default, as abstentions are ruled out).

Now consider the first period. The structure of the first period is exactly the same as the second, and there is no "state" variable that links the two periods (as information is complete). So, we have a twice-repeated game. It follows that the first-period equilibrium is unique and has the same structure as the second-period one. □

C.1.2 Proof of Proposition 4.5

We show that the perfect Bayesian equilibrium described exists and is unique by backwards induction. First, it is clear that any $i \in N$ who is elected at period 2 chooses $e^*(\rho)$ if he was not a first-period office-holder, and chooses $e^*(\hat{\rho}^c(g_1))$ if he was a first-period office-holder.

Next, consider the behaviour of the voters, given any candidate set C_2. The first case is where the incumbent (say i) is not in C_2. Then, the voters in N/C_2 will vote for their most preferred candidate in C_2. By our assumption about beliefs, voters believe that any member of C_2 is a high-type with probability ρ. So, they prefer the one with the highest index, $m(C_2) = \max_{i \in C_2}$. Finally, by Assumption 4.1, every candidate will vote for herself.

The second case is where the incumbent (say i) is in C_2. Then, all voters know that i is high-ability with probability $\hat{\rho}^c(g_1)$, and believe that any $j \in C_2/\{i\}$ is high-ability with probability ρ. So, if $g_1 > \widetilde{g}_1$, all voters in N/C_2 will vote for i. Also, i will vote for herself by Assumption 4.1. The remaining voters, i.e. $C_2/\{i\}$ will either vote for themselves or for i, as $v_o(\rho)$ is greater or less than $v_c(\hat{\rho}^c(g_1))$. If $g_1 < \widetilde{g}_1$, all voters in N/C_2 will vote for $m'(C_2) = \max_{j \in C_2/\{i\}}$. Also, i will vote for herself or $m'(C_2)$ as $v_o(\hat{\rho}^c(g_1))$ is greater or less than $v_c(\rho)$. The remaining voters, i.e. $C_2/\{i\}$ will either vote for themselves by Assumption 4.1. If $g_1 = \widetilde{g}_1$, all voters in N/C_2 will vote for $m(C_2) = \max_{j \in C_2}$. The remaining voters, i.e. C_2 will vote for themselves by Assumption 4.1.

Now consider the candidate entry decision in period 2.

Case 1. $C_1 \neq N$. If $g_0 > \widetilde{g}_0$, and the incumbent i enters the election, she will surely win, no matter who else stands. So, the incumbent will be the only entrant. Now let

$$l = \begin{cases} n & \text{if } i < n \\ n-1 & \text{if } i = n \end{cases} \tag{C1.1}$$

If $g_1 < \widetilde{g}_1$, if l enters the election, $l = m'(C_2)$, so she will surely win, no matter who else stands (including the incumbent). So, l will be the only entrant. Finally, if $g_1 = \widetilde{g}_1$, if n enters the election, $n = m(C_2)$, so she will surely win, no matter who else stands (including the incumbent). So, n will be the only entrant.

Case 2. $C_2 = N$. In this case, at the voting stage, every candidate votes for himself and is elected to be office-holder with probability $1/n$. The payoff to any agent who is not the incumbent from entry is thus is $\frac{1}{n}v_o(\rho) - \delta$, which is negative by Assumption 4.2. On the other hand, any $i \in N$ can guarantee herself a positive payoff by not entering. So, this case is impossible in equilibrium.

So we have demonstrated that given a first-period incumbent i, with output g_1, in the second period, the unique equilibrium candidate set is

$$C_2(i, g_1) = \begin{cases} \{i\}, & g_1 > \tilde{g}_1 \\ \{l\}, & g_1 < \tilde{g}_1 \\ \{n\}, & g_1 = \tilde{g}_1 \end{cases} \tag{C1.2}$$

Now consider the first period. Clearly, if $i \in N$ is elected, she rationally anticipates that she will stand for election next period (and win) iff either (i) $i = n,\ g_1 \geq \tilde{g}_1$, or (ii) $i < n,\ g_1 > \tilde{g}_1$. In either case, given that ε is absolutely continuous, she chooses e_1 to solve problem (4.22) where R is replaced by $R - \delta$. Moving to the voting stage, by previous arguments, all voters in N/C_1 will vote for $m(C_1) = \max_{i \in C_1}$, and all voters in C_1 will vote for themselves. So, again by previous arguments, $C_1 = \{n\}$. □

C.1.3 Proof of Proposition 4.8

(a) Existence of Non Revealing Equilibrium. We show that this is a perfect Bayesian equilibrium (PBE). Consider period $t = 2$. First, it is clear that any $i \in N$ who is elected at period 2 chooses $e^*(x_i)$. Next, consider the behaviour of the voters, a given candidate set C_2 that is either the equilibrium one or arises from unilateral deviations from equilibrium entry behaviour. Let

$$l = \begin{cases} n & \text{if } g_1 \geq \tilde{g}_1 \\ n-1 & \text{if } g_1 < \tilde{g}_1 \end{cases} \tag{C1.3}$$

First, in equilibrium, $C_2 = \{l\}$. In this case, it is trivial the candidate l is elected. Now suppose that an additional candidate j enters, i.e. $C_2 = \{l,\ j\}$. By Bayesian updating, voters $k \neq l$ know that l is high-ability with probability $\hat{\rho}^c(g_1)$ if $g_1 \geq \widetilde{g}_1$, and if $l = n - 1$, we suppose that voters $k \neq l$ conjecture that this candidate is high-ability with probability ρ. Also, we suppose that voters $k \neq j$ conjecture that j is high-ability with probability ρ. Then, it is easy to check that all voters $k \neq l, j$ strictly prefer l to j and so will vote for l. As $n \geq 3$, l will surely win the election.

We now check that the entry decisions of potential candidates are mutual best responses. As $v_o(x_l) - \delta > 0$, by Assumption 4.2, the candidate l does not wish to withdraw. By the above argument, any $j \neq l$ loses δ if she enters. So, it is optimal for no other candidate to enter.

Now go to period $t = 1$. Assume that n wins the election. Rationally anticipating that he will only stand (and win) in the next period if $g_1 \geq \widetilde{g}_1$, his effort level solves problem (4.35). Next, consider the behaviour of the voters, given a candidate set C_1 that is either the equilibrium one or arises from unilateral deviations from equilibrium entry behaviour. First, in equilibrium, $C_1 = \{n\}$, so n will be elected. Now, suppose that an additional candidate j enters (i.e. $C_1 = \{n, j\}$). Assume that voters $k \notin C_1$ conjecture that any member of C_1 is high-ability with probability ρ. Then, all voters $k \neq n, j$ strictly prefer n to j, and so all $k \neq n, j$ will vote for n. As $n \geq 3$, n will surely win the election. Consequently, j will not enter.

(b) Existence of Revealing Equilibrium. We show that this is an equilibrium supported by the following conjectures in each period : "any entrant with an index higher (lower) than the equilibrium candidate is low-ability with probability one (zero)". Consider

period $t = 2$. First, it is clear that any $i \in N$ who is elected at period 2 chooses $e^*(x_i)$. Next, consider the behaviour of the voters, given a candidate set C_2 that is either the equilibrium one or arises from unilateral deviations from equilibrium entry behaviour. If $C_2 = \{m\}$, it is trivial the candidate m is elected. As $v_o(1) - \delta > 0 > v_o(0) - \delta$ it is clear that m prefers to enter iff $m \in N_H$. Now, suppose that an additional candidate j enters (i.e. $C_1 = \{m, j\}$). By the assumed conjectures, all voters $k \neq n, j$ strictly prefer m to j, and so all $k \neq n, j$ will vote for m. As $n \geq 3$, m will surely win the election. Consequently, j will not enter.

At the beginning of period 1, exactly the same argument applies, except that agents add to their pay-offs the equilibrium continuation pay-offs in period 2. But is it easily checked that this does not affect the arguments above. □

C.1.4 Proof of Proposition 4.10

(a) We prove first that with an additive technology, equilibrium with democracy is weakly efficient. To do this, it is sufficient to show that there does not exist a cutoff $g_1^* \neq \widetilde{g}_1$ where all citizens are better-off than at the equilibrium cutoff.

Let γ be an arbitrary cutoff. Without loss of generality, we can assume that the social planner chooses citizen n to be the first-period office holder, and $n - 1$ to replace him in the second period if his performance falls below γ. Let $e_1(\gamma)$ be the office-holder's first-period action given the cutoff. So, $e_1(\gamma)$ solves (4.26) with γ replacing $\widetilde{g}_1$. Totally differentiating (4.26), we get

$$\begin{aligned} e_1'(\gamma) &= \frac{A}{c''(e_1(\gamma)) + A}, && \text{(C.1)} \\ \text{where } A &= [\rho f_H' (\gamma, e_1(\gamma)) + (1-\rho) f_L' (\gamma, e_1(\gamma))] (R - c(e^*)) \end{aligned}$$

Also, $c'' > 0$, and as (4.27) holds we have $A \geq 0,\ \gamma \leq \widetilde{g}_1$. So, from (C.1) we have

$$0 \leq e_1'(\gamma) < 1, \quad \gamma \leq \widetilde{g}_1 \tag{C.2}$$

We can first write down expected present value payoff of $i = n$ conditional on this cutoff, given that the office-holder optimises his actions in both periods;

$$\begin{aligned} v_n(\gamma) &= \overline{\theta} + e_1(\gamma) + R - c(e_1(\gamma)) + \int_\gamma^\infty v_c(\hat{\rho}(e_1(\gamma), g_1))h(g_1, e_1(\gamma))dg_1 \\ &\quad + H(\gamma, e_1(\gamma))v_c(\rho) \end{aligned} \tag{C.3}$$

where $\overline{\theta} = \rho\theta_H + (1-\rho)\theta_L$. Note first that from (C.3) and the fact that $e_1(\gamma)$ maximizes (4.26):

$$\begin{aligned} v_n'(\gamma) &= h(\gamma, e_1(\gamma))[v_c(\rho) - v_o(\hat{\rho}(e_1(\gamma), \gamma))] \\ &< h(\gamma, e_1(\gamma))[v_c(\rho) - v_o(\theta_L)] \\ &< 0 \end{aligned} \tag{C.4}$$

where the second line follows from the properties of v_o, v_c given in Section 4.3.6, and the third from the assumption that $R > c(e^*) + \rho(\theta_H - \theta_L)$, which is equivalent to $v_o(\theta_L) > v_c(\rho)$ when $\mu = 1$. So, from (C.4), n prefers the lowest possible $\gamma = -\infty$ (i.e. no election).

So, the social planner cannot make *everybody* better-off by raising γ from $\widetilde{g}_1$. Thus, to prove that the equilibrium is weakly efficient, it suffices to prove that some $j \neq n$ most prefers a cutoff *at or above* $\widetilde{g}_1$. For then, the social planner cannot make everybody better-off by lowering γ from $\widetilde{g}_1$, either. Note that for $j < n - 1$:

$$v_j(\gamma) = \overline{\theta} + e_1(\gamma) + \int_\gamma^\infty v_c(\hat{\rho}(e_1(\gamma), g_1))h(g_1, e_1(\gamma))dg_1 + H(\gamma, e_1(\gamma))v_c(\rho) \tag{C.5}$$

Now differentiating (C.5), we have;

$$v_j'(\gamma) = \frac{\partial v_j}{\partial e_1} e_1'(\gamma) + h(\gamma, e_1(\gamma))[v_c(\rho) - v_o(\hat{\rho}(e_1(\gamma), \gamma))], \qquad j < n-1 \tag{C.6}$$

Now, note from (4.10) that with a linear technology, $\hat{\rho}(e_1(\gamma), \gamma) \equiv \hat{\rho}(\gamma - e_1(\gamma))$, with $\hat{\rho}'(.) > 0$ by the MLRC. So, from this fact and the fact from (C.2) that $\gamma - e_1(\gamma)$ is increasing in γ, from (C.6), we have

$$v_o(\hat{\rho}(e_1(\gamma), \gamma)) \leq v_o(\hat{\rho}(e_1(\widetilde{g}_1), \widetilde{g}_1)), \qquad \gamma \leq \widetilde{g}_1 \tag{C.7}$$

Also, by previous definitions and results:

$$\begin{aligned} v_c(\rho) &= v_o(\hat{\rho}(e_1(\widetilde{g}_1), \widetilde{g}_1)) - (R - c(e^*)) \\ &< v_o(\hat{\rho}(e_1(\widetilde{g}_1), \widetilde{g}_1)) \\ &\leq v_o(\hat{\rho}(e_1(\widetilde{g}_1), \widetilde{g}_1)), \qquad \gamma \leq \widetilde{g}_1 \end{aligned} \tag{C.8}$$

In the first line, we have used the definition of $\widetilde{g}_1$ that $\rho = \hat{\rho}(e_1(\widetilde{g}_1), \widetilde{g}_1)$, and the definitions of v_c, v_o. In the second, we have used $R > c(e^*)$ from Assumption 4.1 (note with linearity, the myopic action e^* does not depend on $\hat{\rho}$). In the third, we have used (C.7). Therefore, from (C.6), (C.8), we see that

$$v_j'(\gamma) \geq \frac{\partial v_j}{\partial e_1} e_1'(\gamma), \qquad \gamma \leq \widetilde{g}_1, \quad j < n-1 \tag{C.9}$$

Finally, it is obvious that $\partial v_j / \partial e_1 > 0$, as e_1 is chosen optimally by the office-holder, n, but $j \neq n$ does not bear the cost of the action. So, from this fact, (C.2) and (C.9), we conclude that $v_j'(\gamma) \geq 0$, $\gamma \leq \widetilde{g}_1$ so $j < n-1$ most prefers a cutoff at least $\widetilde{g}_1$, as required.

(b) An example with non-additive technology where appointment Pareto-dominates democracy can be constructed as follows. Without loss of generality, assume that the incumbent is n and the challenger is $n-1$. Equilibrium pay-offs under (representative[1]) democracy, allowing $\mu \neq 1$, are:

$$\begin{aligned}
v_n^{RD} &= \mu(\overline{\theta} + e_1^{RD}) + (1-\mu)\overline{\theta}e_1^{RD} + R - \delta - c(e_1^{RD}) + \int_{\widetilde{g}_1}^{\infty} [v_o(\hat{\rho}(e_1^{RD}, g_1))h(e_1^{RD}, g_1)dg_1 + \\
&\quad H(\widetilde{g}_1, e_1^{RD}(\widetilde{g}_1))v_c(\rho) \\
v_{n-1}^{RD} &= \overline{\theta} + e_1^{RD}(\widetilde{g}_1) + \int_{\widetilde{g}_1}^{\infty} v_c(\hat{\rho}(e_1^{RD}(\widetilde{g}_1), g_1))h(g_1, e_1^{RD}(\widetilde{g}_1))dg_1 + H(\widetilde{g}_1, e_1^{RD}(\widetilde{g}_1))v_o(\rho) \\
v_j^{RD} &= \overline{\theta} + e_1^{RD}(\widetilde{g}_1) + \int_{\widetilde{g}_1}^{\infty} v_c(\hat{\rho}(e_1^{RD}(\widetilde{g}_1), g_1))h(g_1, e_1^{RD}(\widetilde{g}_1))dg_1 + H(\widetilde{g}_1, e_1^{RD}(\widetilde{g}_1))v_o(\rho), \; j < n-1
\end{aligned}$$

Also, under appointment of citizen i, the expected utilities are

$$\begin{aligned}
v_i^A &= \mu(\overline{\theta} + e_1^A) + (1-\mu)\overline{\theta}e_1^A + R - c(e_1^A) + \int_{-\infty}^{\infty} v_o(\hat{\rho}(e_1^A, g_1))h(e_1^A, g_1)dg_1 \\
v_j^A &= \mu(\overline{\theta} + e_1^A) + (1-\mu)\overline{\theta}e_1^A + \int_{-\infty}^{\infty} v_o(\hat{\rho}(e_1^A, g_1))h(e_1^A, g_1)dg_1, \qquad j \neq i
\end{aligned}$$

The example is the following. First, ε is Normal, with mean zero and $\sigma = 50$, and $c(e) = e^2/2$, and other parameters are: $\mu = 0.5$, $\rho = 0.55$, $R = 39.9$, $\theta_H = 25$, $\theta_L = 1$, $\delta = 1$. In this case, equilibrium pay-offs can be calculated using the above formulae as:

$$\begin{aligned}
v_i^A &= 156.3, \;\; v_j^A = 152.1, \qquad j \neq i \\
v_n^{RD} &= 148.4, \;\; v_{n-1}^{RD} = 148.2, \;\; v_j^{RD} = 143.6, \qquad j \neq n, n-1
\end{aligned}$$

So, we see that $\max_{i \in N} v_i^{RD} < \min v_i^A$, and so we can be sure that appointment Pareto-dominates the representative democracy regime. □

[1]Recall however that, under symmetric incomplete information, the qualitative results for both democratic results are the same. Hence, a similar example can be constructed by comparing appointment against partial democracy.

C.2 The Normal-Quadratic Case

The example we use follows the specification of Dewatripont, Jewitt and Tirole (1999). The cost of effort function is quadratic (specifically $c(e) = e^2/2 + de$, with $d \geq 0$, so that $c'(0) \geq 0$), and the error term ε is Normally distributed with mean zero and variance σ^2. We now analyse the different sections of the model under our specific assumptions.

C.2.1 Uniqueness

We can now prove that when the technology is additive (i.e. $\mu = 1$), a unique equilibrium arises. In the appointment case, this is immediate as in this case there is no experimentation. For the democratic cases, when $\mu = 1$, it is easy to calculate that

$$\left.\frac{\partial E_{g_1}[w(\hat{\rho})]}{\partial e_1}\right|_{\mu=1} = \left[R - \delta - \frac{(e^*(\rho))^2}{2} - de^*(\rho)\right] \times \left(\frac{\rho}{\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{8\sigma^2}(\theta_L - \theta_H))^2\right] + \frac{(1-\rho)}{\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{8\sigma^2}(\theta_H - \theta_L))^2\right]\right)$$

which is decreasing in $e^*(\rho)$. On the other hand, the marginal cost of effort is upward sloping. Hence a unique equilibrium exists.

In the next two sub-sections we derive the equilibrium actions obtained under this Normal-Quadratic example. The simulations reported in the chapter are based on this special case.

C.2.2 Symmetric Incomplete Information and Appointment

The period 2 equilibrium effort is

$$e_2 = e^*(\hat{\rho}) = \mu + (1-\mu)(\hat{\rho}\theta_H + (1-\hat{\rho})\,\theta_L) - d$$

where,

$$\hat{\rho}(e_1, g_1) = \frac{\rho}{\rho + (1-\rho)\exp\left[-\frac{1}{2\sigma^2}\left(\zeta_L^2 - \zeta_H^2\right)\right]}$$

and $\zeta_i = g_1 - (1-\mu)\theta_i e_1 - \mu(\theta_i + e_1)$, with $i = H, L$. The period 1 equilibrium effort level is

$$e_1^* = [\mu + (1-\mu)(\rho\theta_H + (1-\rho)\,\theta_L) - d] + \frac{\partial E_{g_1}[v_o(\hat{\rho}(e_1, g_1))]}{\partial e_1}$$

where, after noticing that $v_o''(\hat{\rho}) = (1-\mu)^2(\theta_H - \theta_L)^2$, the experimentation term (4.16) can be written as

$$\begin{aligned}\frac{\partial E_{g_1}[v_o(\hat{\rho})]}{\partial e_1} &= \frac{\rho^2(1-\rho)^2(1-\mu)^3(\theta_H-\theta_L)^4}{\sigma^3\sqrt{2\pi}}\left[\mu + (1-\mu)\,e_1\right] \\ &\times \int_{-\infty}^{+\infty} \frac{\exp\left(\frac{-1}{2\sigma^2}\left(\zeta_H^2 + \zeta_L^2\right)\right)}{\left[(1-\rho)\exp\left(\frac{-1}{2\sigma^2}\zeta_L^2\right) + \rho\exp\left(\frac{-1}{2\sigma^2}\zeta_H^2\right)\right]^3} dg_1\end{aligned}$$

C.2.3 Symmetric Incomplete Information and Democracy with Exogenous Entry

Note that $\hat{\rho}^c(\tilde{g}_1) = \rho$, so $\tilde{g}_1 = \frac{1}{2}\left[(1-\mu)(\theta_H + \theta_L)\,e_1^* + \mu(\theta_H + \theta_L + 2e_1^*)\right]$.

The first-order condition to the office-holder's first period problem is

$$\mu + (1-\mu)(\rho\theta_H + (1-\rho)\,\theta_L) - d + \frac{\partial E_{g_1}[w(\hat{\rho}(e_1, g_1))]}{\partial e_1} = e_1^*$$

where

$$\frac{\partial E_{g_1}[w(\hat{\rho})]}{\partial e_1} = \frac{\rho^2(1-\rho)^2(1-\mu)^3(\theta_H-\theta_L)^4}{\sigma^3\sqrt{2\pi}}\left[\mu + (1-\mu)\,e_1\right]$$

$$\times \int_{\tilde{g}_0}^{+\infty} \frac{\exp\left(\frac{-1}{2\sigma^2}\left(\zeta_H^2+\zeta_L^2\right)\right)}{\left[(1-\rho)\exp\left(\frac{-1}{2\sigma^2}\zeta_L^2\right)+\rho\exp\left(\frac{-1}{2\sigma^2}\zeta_H^2\right)\right]^3} dg_1$$
$$+\left[R-\delta-\frac{(e_1)^2}{2}-de_1\right]\left(-\frac{\partial H(\tilde{g}_1,e_1)}{\partial e_1}\right)+\rho(1-\rho)(1-\mu)\frac{\partial v_o(\hat{\rho}(\tilde{g}_1,e_1))}{\partial\hat{\rho}}$$
$$\times\frac{\exp\left[-\frac{1}{2\sigma^2}\left(\tilde{g}_1-(1-\mu)\theta_H e_1-\mu(\theta_H+e_1)\right)^2\right]}{\sigma\sqrt{2\pi}}$$

and

$$\begin{aligned}-\frac{\partial H(\tilde{g}_1,e_1)}{\partial e_1} &= \rho\left[\mu+(1-\mu)\theta_H\right]\frac{\exp\left[-\frac{1}{2\sigma^2}\left(\tilde{g}_1-(1-\mu)\theta_H e_1-\mu(\theta_H+e_1)\right)^2\right]}{\sigma\sqrt{2\pi}} \\ &\quad +(1-\rho)\left[\mu+(1-\mu)\theta_L\right]\frac{\exp\left[-\frac{1}{2\sigma^2}\left(\tilde{g}_1-(1-\mu)\theta_L e_1-\mu(\theta_L+e_1)\right)^2\right]}{\sigma\sqrt{2\pi}}\end{aligned}$$

which is strictly positive as long as $\mu<1$, and

$$\frac{\partial v_o(\hat{\rho}(\tilde{g}_1,e_1))}{\partial\hat{\rho}}=\mu(\theta_H-\theta_L)(3-2\mu)+(1-\mu)^2\left(\theta_H^2\rho+\theta_L\theta_H(1-2\rho)-\theta_L^2(1-\rho)\right)$$

which is also strictly positive as long as $\mu<1$. □

C.2.4 Examples of Pareto-Ranked Equilibria with Democracy and Endogenous Entry

With asymmetric information, in a "revealing" equilibrium (representative democracy case), office-holder i citizens $j\neq n$ have expected pay-offs

$$\begin{aligned}v_n^{RD,R} &= 2\left[\mu(\theta_H+e_1(\theta_H)+(1-\mu)\theta_H e_1(\theta_H)+R-\delta-c\left(e^*(\theta_H)\right)\right] \\ v_j^{RD,R} &= 2\left[\mu(\theta_H+e_1(\theta_H))+(1-\mu)\theta_H e_1(\theta_H)\right]\end{aligned}$$

Under a representative democracy in which the equilibrium is "non revealing", citizens $n, n-1$, and $j\neq n-1, n$ have expected pay-offs

$$v_n^{RD,NR} = \rho v_n^{RD,NR}(\theta_H)+(1-\rho)v_n^{RD,NR}(\theta_L)$$

$$\begin{aligned}
v_{n-1}^{RD,NR} &= \rho v_{n-1}^{RD,NR}(\theta_H) + (1-\rho)v_{n-1}^{RD,NR}(\theta_L) \\
v_j^{RD,NR} &= \rho\phi(\theta_H, e_1(\theta_H)) + (1-\rho)\phi(\theta_L, e_1(\theta_L)) \\
&\quad + \rho\left[1 - F_H(\widetilde{g}_1, e_1(\theta_H))\right]\phi(\theta_H, e^*(\theta_H)) + (1-\rho)\left[1 - F_L(\widetilde{g}_1, e_1(\theta_L))\right]\phi(\theta_L, ea^*(\theta_L)) \\
&\quad + \left[\rho\phi(\theta_H, e^*(\theta_H)) + (1-\rho)\phi(\theta_L, e^*(\theta_L))\right]\left[\rho F_H(\widetilde{g}_1, e_1(\theta_H)) + (1-\rho)F_L(\widetilde{g}_1, e_1(\theta_L))\right]
\end{aligned}$$

where $\phi(a_i, e_1(a_i)) = \mu(a_i + e_1(a_i)) + (1-\mu)a_i e_1(a_i)$, and $a_i \in \{\theta_H, \theta_L\}$, and

$$\begin{aligned}
v_n^{RD,NR}(a_i) &= \phi(a_i, e_1(a_i)) + \left[1 - F_i(\widetilde{g}_1, e_1(a_i))\right]\left[\phi(a_i, e^*(a_i)) + R - \delta - c(e^*(a_i))\right] \\
&\quad + R - \delta - c(e^*(a_i)) + F_i(\widetilde{g}_1, e_1(a_i))\left[\rho\phi(\theta_H, e^*(\theta_H)) + (1-\rho)\phi(\theta_L, e^*(\theta_L))\right] \\
v_{n-1}^{RD,NR}(a_i) &= \rho\phi(\theta_H, e_1(\theta_H)) + (1-\rho)\phi(\theta_L, e_1(\theta_L)) \\
&\quad + \rho\left[1 - F_H(\widetilde{g}_1, e_1(\theta_H))\right]\phi(\theta_H, e^*(\theta_H)) + (1-\rho)\left[1 - F_L(\widetilde{g}_1, e_1(\theta_L))\right]\phi(\theta_L, e^*(\theta_L)) \\
&\quad + \left[\phi(a_i, e^*(a_i)) + R - \delta - c(e^*(a_i))\right]\left[\rho F_H(\widetilde{g}_1, e_1(\theta_H)) + (1-\rho)F_L(\widetilde{g}_1, e_1(\theta_L 0))\right]
\end{aligned}$$

Let us denote by E_R the "revealing" equilibrium, by E_{NR} the "non revealing" equilibrium, and by E_S the democratic equilibrium under symmetric information. We now present examples in which each of the three equilibrium can Pareto-dominate any of the other two depending on parameter values. In all examples, ε is Normal, with mean zero and $\sigma = 50$, and $c(e) = \chi(e^2/2)$, $\mu = 0.5$, $\theta_H = 25$, $\theta_L = 1$.

(i) Example: E_R Pareto-dominates E_{NR} which itself Pareto-dominates E_S.

Other parameters are $\chi = 1$, $\rho = 0.5$, and $R = 606$. In this case, equilibrium pay-offs are:

$$\begin{aligned}
v_n^{RD,R}(asym) &= 598, \quad v_j^{RD,R}(asym) = 363, \qquad \delta = 405 \\
v_n^{RD,NR}(asym) &= 444.1, \quad v_{n-1}^{RD,NR}(asym) = 320.6, \quad v_j^{RD,NR}(asym) = 240.9, \qquad \delta = 404
\end{aligned}$$

$$v_n^{RD}(sym) \;=\; 369.2,\;\; v_{n-1}^{RD}(sym) = 227.7,\;\; v_j^{RD}(sym) = 139, \qquad \delta = 405$$

So, we see that $\max_{i\in N} v_i^{RD,NR}(asym) < \max v_i^{RD,R}(asym)$, that $\max_{i\in N} v_i^{RD}(sym) < \max v_i^{RD,R}(asym)$, and also that $\max_{i\in N} v_i^{RD}(sym) < \max v_i^{RD,NR}(asym)$. Hence, we can be sure that E_R can Pareto-dominate both E_{NR} and E_S, and also that E_{NR} can Pareto-dominate E_S.

(ii) Example: E_S Pareto-dominates E_{NR} which itself Pareto-dominates E_R.

Other parameters are $\chi = 0.01$, $\rho = 0.99$. In this case, equilibrium pay-offs are, with $R = 300$, and $\delta = 50$,

$$\begin{aligned} v_n^{RD}(sym) &= 890.8,\;\; v_{n-1}^{RD}(sym) = 407.9,\;\; v_j^{RD}(sym) = 400.4 \\ v_n^{RD,NR}(asym) &= 886.5,\;\; v_{n-1}^{RD,NR}(asym) = 401.4,\;\; v_j^{RD,NR}(asym) = 395.0 \end{aligned}$$

So, we see that $\max_{i\in N} v_i^{RD,NR}(asym) < \max v_i^{RD}(sym)$, so we can be sure that E_S can Pareto-dominate E_{NR}. Next, replacing R and δ with $R = 753$, and $\delta = 503$, equilibrium pay-offs become

$$\begin{aligned} v_n^{RD}(sym) &= 890.8,\;\; v_{n-1}^{RD}(sym) = 407.9,\;\; v_j^{RD}(sym) = 400.4 \\ v_n^{RD,R}(asym) &= 861.3,\;\; v_j^{RD,R}(asym) = 363 \end{aligned}$$

So, we can see that $\max_{i\in N} v_i^{RD,R}(asym) < \max v_i^{RD}(sym)$, so we can be sure that E_S can Pareto-dominate E_R. Decreasing δ to $\delta = 502.9$,[2] equilibrium pay-offs become

$$v_n^{RD,NR}(asym) = 886.7,\;\; v_{n-1}^{RD,NR}(asym) = 401.4,\;\; v_j^{RD,NR}(asym) = 395.0, \quad j \neq n, n-1$$

As we can see, $\max_{i\in N} v_i^{RD,R}(asym) < \max v_i^{RD,NR}(asym)$, and so we can be sure that E_{NR} can Pareto-dominate E_R.

[2] So that the economy switches from a revealing to a non revealing equilibrium.

C.3 Derivations

C.3.1 Derivation of (4.16)

(Adapted from the proof of Proposition 2 of Mirman et al., 1993). Before turning to the derivation of equation (4.16) itself, the following results are useful

$$\frac{d\hat{\rho}(g_1,e_1)}{dg_1} = \frac{\rho(1-\rho)}{[\rho f_H + (1-\rho) f_L]^2}\left(f_L f_H' - f_H f_L'\right) \geq 0 \tag{C3.1}$$

where $f_H = f(g_1 - (1-\mu)\theta_H e_1 - \mu(\theta_H + e_1))$, and $f_L = f(g_1 - (1-\mu)\theta_L e_1 - \mu(\theta_L + e_1))$. $\left(f_L f_H' - f_H f_L'\right) \geq 0$ follows from the MLR property.

$$\frac{d\hat{\rho}(g_1,e_1)}{de_1} = -[\mu + (1-\mu)\theta_H]\frac{d\hat{\rho}}{dg_1} - \frac{\rho(1-\rho)(1-\mu)(\theta_H-\theta_L)}{[\rho f_H + (1-\rho) f_L]^2} f_H f_L' \tag{C3.2}$$

$$= -[\mu + (1-\mu)\theta_L]\frac{d\hat{\rho}}{dg_1} - \frac{\rho(1-\rho)(1-\mu)(\theta_H-\theta_L)}{[\rho f_H + (1-\rho) f_L]^2} f_L f_H' \tag{C3.3}$$

We can now evaluate (4.16). Notice that $E_{g_1} v_o[\hat{\rho}(g_1,e_1)] = \int_{-\infty}^{+\infty} v_o[\hat{\rho}(g_1,e_1)]\, h(g_1,e_1)\, dg_1$, where $h(g_1,e_1) = \rho f_H + (1-\rho) f_L$. Thus

$$\Gamma \equiv \frac{dE_{g_1} v_o[\hat{\rho}(g_1,e_1)]}{de_1} \tag{C3.4}$$

$$= \int v_o' \frac{d\hat{\rho}}{de_1}[\rho f_H + (1-\rho) f_L]\, dg_1 - \int v_o \begin{bmatrix} \rho(\mu + (1-\mu)\theta_H) f_H' \\ +(1-\rho)(\mu + (1-\mu)\theta_H) f_L' \end{bmatrix} dg_1$$

Integrating by parts the second term of (C3.4) and then rearranging with the first term gives

$$\Gamma = \int v_o' \left(\frac{d\hat{\rho}}{de_1} + (\mu + (1-\mu)\theta_H)\frac{d\hat{\rho}}{dg_1}\right)\rho f_H dg_1 \tag{C3.5}$$

$$+ \int v_o' \left(\frac{d\hat{\rho}}{de_1} + (\mu + (1-\mu)\theta_L)\frac{d\hat{\rho}}{dg_1}\right)(1-\rho) f_L dg_1$$

Using (C3.2) and (C3.3), expression (C3.5) becomes

$$\begin{aligned}\Gamma &= -\int v_o' \frac{\rho(1-\rho)(1-\mu)}{[\rho f_H + (1-\rho) f_L]^2} (\theta^H - \theta^L) f_H f_L' \rho f_H dg_1 \\ &\quad -\int v_o' \frac{\rho(1-\rho)(1-\mu)}{[\rho f_H + (1-\rho) f_L]^2} (\theta^H - \theta^L) f_H' f_L (1-\rho) f_L dg_1\end{aligned} \quad \text{(C3.6)}$$

Because $\hat{\rho} = \rho f_H / [\rho f_H + (1-\rho) f_L]$ and $(1-\hat{\rho}) = (1-\rho) f_L / [\rho f_H + (1-\rho) f_L]$, equation (C3.6) becomes

$$\Gamma = -(\theta_H - \theta_L)\left\{\int v_o \hat{\rho}^2 (1-\rho)(1-\mu) f_L' dg_1 + \int v_o' (1-\hat{\rho})^2 \rho (1-\mu) f_H' dg_1\right\} \quad \text{(C3.7)}$$

Using the fact that $(1-\hat{\rho})^2 = (1-\hat{\rho}) - \hat{\rho}(1-\hat{\rho})$, we can rewrite (C3.7) as

$$\Gamma = -(\theta_H - \theta_L)\left\{\begin{array}{c}\int v_o'(1-\mu)\hat{\rho}\left[\hat{\rho}(1-\rho) f_L' - (1-\hat{\rho})\rho f_H'\right] dg_1 \\ +\int v_o' (1-\mu)(1-\hat{\rho})\rho f_H' dg_1\end{array}\right\} \quad \text{(C3.8)}$$

Rearranging the posterior belief $\hat{\rho}$, we have $\hat{\rho}[\rho f_H + (1-\rho) f_L] = \rho f_H$, which, after differentiating with respect to g_1 gives (after rearranging)

$$f_L' \hat{\rho}(1-\rho) - f_H' \rho (1-\hat{\rho}) = -\frac{d\hat{\rho}}{dg_1}[\rho f_H + (1-\rho) f_L] \quad \text{(C3.9)}$$

Inserting (C3.9) in (C3.8) yields,

$$\Gamma = (\theta_H - \theta_L)\left\{\begin{array}{c}\int v_o'(1-\mu)\hat{\rho}\frac{d\hat{\rho}}{dg_1}\rho f_H dg_1 + \int v_o'(1-\mu)\hat{\rho}\frac{d\hat{\rho}}{dg_1}(1-\rho) f_L dg_1 \\ -\int v_o'(1-\mu)(1-\hat{\rho})\rho f_H' dg_1\end{array}\right\} \quad \text{(C3.10)}$$

From the $\hat{\rho}$ expression, we have $f_L(1-\rho)\hat{\rho} = f_H \rho (1-\hat{\rho})$, so (C3.10) becomes

$$\Gamma = (\theta_H - \theta_L)\left\{\int v_o'(1-\mu)\frac{d\hat{\rho}}{dg_1}\rho f_H dg_1 - \int v_o'(1-\mu)(1-\hat{\rho})\rho f_H' dg_1\right\} \quad \text{(C3.11)}$$

Now we integrate the second term in (C3.11) by parts. This yields,

$$\begin{aligned}(1-\mu)\rho\int v_o'(1-\hat{\rho}) f_H' dg_1 &= -(1-\mu)\rho\int v_o''(1-\hat{\rho})\frac{d\hat{\rho}}{dg_1} f_H dg_1 \\ &\quad + (1-\mu)\rho\int v_o' \frac{d\hat{\rho}}{dg_1} f_H dg_1\end{aligned} \quad \text{(C3.12)}$$

Inserting (C3.12) in (C3.11) gives (4.16). □

C.3.2 Derivation of equation (4.24)

The derivation is similar to that of equation (4.16). First, note that $E_{g_1}\left[w\left(\hat{\rho}\left(g_1,e_1\right)\right)\right]$ can be written

$$\begin{aligned} E_{g_1}\left[w\left(\hat{\rho}\left(g_1,e_1\right)\right)\right] &= (v_c(\rho)-v_o(\rho))H\left(\tilde{g}_1,e_1\right)+\int_{\tilde{g}_1}^{+\infty}(v_o(\hat{\rho}(g_1,e_1))-v_o(\rho))h\left(g_1,e_1\right)dg_1 \\ &= \left[c(e^*(\rho))-R\right]H\left(\tilde{g}_1,e_1\right)+\int_{\tilde{g}_1}^{+\infty}\phi((\hat{\rho}(g_1,e_1))h\left(g_1,e_1\right)dg_1 \end{aligned}$$

where $\phi(\hat{\rho}(g_1,e_1))=v_o(\hat{\rho}(g_1,e_1))-v_o(\rho)$, so $\phi(\hat{\rho}(\tilde{g}_1,e_1^*))=0$, $\phi'=v_o'$. So,

$$\begin{aligned} \Gamma &\equiv \frac{dE_{g_1}\left[w^*\left(\hat{\rho}\left(g_1,e_1\right)\right)\right]}{de_1}=(v_c(\rho)-v_o(\rho))\left(-\frac{\partial H\left(\tilde{g}_1,e_1\right)}{\partial e_1}\right) \qquad \text{(C3.13)} \\ &+\int_{\tilde{g}_1}^{+\infty}\phi'\frac{d\hat{\rho}}{de_1}\left[\rho f_H+(1-\rho)f_L\right]dg_1 \\ &-\int_{\tilde{g}_1}^{+\infty}\phi\left[\rho\left(\mu+(1-\mu)\theta_H\right)f_H'+(1-\rho)\left(\mu+(1-\mu)\theta_L\right)f_L'\right]dg_1 \end{aligned}$$

Integrating by parts the third term of (C3.13) and then rearranging with the first two terms gives

$$\begin{aligned} \Gamma &= \int_{\tilde{g}_1}^{+\infty}\phi'\left(\frac{d\hat{\rho}}{de_1}+\left(\mu+(1-\mu)\theta_H\right)\frac{d\hat{\rho}}{dg_1}\right)\rho f_H dg_1 \qquad \text{(C3.14)} \\ &+\int_{\tilde{g}_1}^{+\infty}\phi'\left(\frac{d\hat{\rho}}{de_1}+\left(\mu+(1-\mu)\theta_L\right)\frac{d\hat{\rho}}{dg_1}\right)(1-\rho)f_L dg_1 \\ &+\left[R-c(e^*(\rho))\right]\left(-\frac{\partial H\left(\tilde{g}_1,e_1\right)}{\partial e_1}\right) \end{aligned}$$

After using similar manipulations as for the derivation of equation (4.16), we obtain

$$\begin{aligned} \Gamma &= \left(\theta_H-\theta_L\right)\left\{\int_{\tilde{g}_1}^{+\infty}\phi'(1-\mu)\frac{d\hat{\rho}}{dg_1}\rho f_H dg_1-\int_{\tilde{g}_1}^{+\infty}\phi'(1-\mu)(1-\hat{\rho})\rho f_H' dg_1\right\} \\ &+\left[R-c(e^*(\rho))\right]\left(-\frac{\partial H\left(\tilde{g}_1,e_1\right)}{\partial e_1}\right) \qquad \text{(C3.14)} \end{aligned}$$

Now we integrate the second term in (C3.14) by parts. This yields,

$$(1-\mu)\rho\int_{\tilde{g}_1}^{+\infty}\phi'(1-\hat{\rho})f_H' dg_1 = -(1-\mu)\rho\int_{\tilde{g}_1}^{+\infty}\left(\phi''\frac{d\hat{\rho}}{dg_1}\right)(1-\hat{\rho})f_H dg_1 \text{(C3.15)}$$

$$+\left(1-\mu\right)\rho\int_{\widetilde{g}_1}^{+\infty}\phi'\frac{d\hat{\rho}}{dg_1}f_H dg_1$$
$$-\frac{d\phi\left(\hat{\rho}\left(\widetilde{g}_1,e_1\right)\right)}{d\hat{\rho}}\left(1-\hat{\rho}\left(\widetilde{g}_1,e_1\right)\right)\rho\left(1-\mu\right)f_H\left(\widetilde{g}_1\right)$$

Inserting (C3.15) in (C3.14), and using $\phi' = v_0'$, and finally evaluating at $e_1 = e_1^*$ (and recalling $\hat{\rho}\left(\widetilde{g}_1, e_1\right) = \rho$) gives equation (4.24). □

C.4 Tables

Sources for the Tables of this Section:

(a) For the United States of America: The Internet Public Library, POTUS (Presidents of the United States) (http://www.ipl.org/ref/POTUS/) and authors' calculations

(b) For the United Kingdom: Whitaker's Almanack (various years) and authors' calculations.

Table C.1 Share of Cabinet Secretaries with Prior Cabinet Experience, USA 1789-2001

Date	Government	Experience (%)
1997-2001	William Jefferson (Bill) Clinton (D)	56.2
1993-97	William Jefferson (Bill) Clinton (D)	0.0
1989-93	George Herbert Walker Bush (R)	37.5
1981-89	Ronald Wilson Reagan (R)	13.3
1977-81	James Earl (Jimmy) Carter (D)	6.7
1974-77	Gerald Rudolph Ford (R)	85.7
1969-74	Richard Milhous Nixon (R)	13.3
1963-69	Lyndon Baines Johnson (D)	80.0
1961-63	John Fitzgerald Kennedy (D)	0.0
1953-61	Dwight David Eisenhower (R)	0.0
1945-53	Harry S. Truman (D)	92.3
1933-45	Franklin Delano Roosevelt (D)	0.0
1929-33	Herbert Clark Hoover (R)	30.8
1923-29	Calvin Coolidge (R)	92.3
1921-23	Warren Gamaliel Harding (R)	0.0
1913-21	Woodrow Wilson (D)	7.7
1909-13	William Howard Taft (R)	41.7
1901-09	Theodore Roosevelt (R)	75.0
1897-1901	William McKinley (R)	18.2
1893-97	Grover Cleveland (D)	27.3
1889-93	Benjamin Harrison (R)	18.2
1885-89	Grover Cleveland (D)	0.0
1881-85	Chester Alan Arthur (R)	100.0
1881	James Abram Garfield (R)	0.0
1877-81	Rutherford Birchard Hayes (R)	11.1
1869-77	Ulysses Simpson Grant (R)	0.0
1865-69	Andrew Johnson (D)	100.0
1861-65	Abraham Lincoln (R)	0.0
1857-61	James Buchanan (D)	33.3
1853-57	Franklin Pierce (D)	11.1
1850-53	Millard Fillmore (Whig)	100.0
1849-50	Zachary Taylor (Whig)	11.1
1845-49	James Knox Polk (D)	12.5
1841-45	John Tyler (Whig)	100.0
1841	William Henry Harrison (Whig)	0.0
1837-41	Martin Van Buren (D)	75.0
1829-37	Andrew Jackson (D)	12.5
1825-29	John Quincy Adams (D-R)	71.4
1817-25	James Monroe (D-R)	57.1
1809-17	James Madison (D-R)	71.4
1801-09	Thomas Jefferson (D-R)	42.9
1797-1801	John Adams (Federalist)	85.7
1789-97	George Washington (Federalist)	0.0

Table C.2 Share of Cabinet Secretaries with Prior Cabinet Experience, United Kingdom 1859-2001

Date	Government	Experience (%)
1997-2001	Anthony C. L. (Tony) Blair (L)	0.00
1990-97	John Roy Major (C)	86.4
1979-90	Margaret Hilda Thatcher (C)	34.6
1976-79	(Leonard) James Callaghan (L)	69.2
1974-76	(James) Harold Wilson (L)	60.9
1970-74	Edward Richard George Heath (C)	57.9
1964-70	(James) Harold Wilson (L)	15.4
1963-64	Alexander (Alec) Douglas-Home (C)	87.0
1957-63	(Maurice) Harold Macmillan (C)	52.2
1955-57	(Robert) Anthony Eden (C)	81.3
1951-55	Winston Spencer Churchill (C)	33.3
1945-51	Clement Richard Attlee (L)	28.6
1945	Winston Spencer Churchill (C)	56.2
1940-45	Winston Spencer Churchill (Coal)	73.7
1937-40	N. Chamberlain (Coal)	64.7
1937	N. Chamberlain (Coal)	85.7
1935-37	S. Baldwin (Coal)	80.0
1935	S. Baldwin (Coal)	73.3
1931-35	J.R. MacDonald (Coal)	80.0
1929-31	J.R. MacDonald (L)	46.7
1924-29	S. Baldwin (C)	73.3
1924	J.R. MacDonald (L)	7.1
1923-24	S. Baldwin (C)	100.0
1922-23	A. Bonar Law (C)	66.7
1916-22	D. Lloyd-George (Coal)	33.3
1915-16	H.H. Asquith (Coal)	66.7
1908-15	H.H. Asquith (Lib)	83.3
1905-08	Sir H. Campbell-Bannerman (Lib)	16.7
1902-05	A.J. Balfour (C)	75.0
1895-1902	Marquess of Salisbury (C)	54.5
1894-95	Earl of Rosebery (Lib)	90.9
1892-94	W.E. Gladstone (Lib)	81.8
1886-92	Marquess of Salisbury (C)	54.5
1886	W.E. Gladstone (Lib)	66.7
1885-86	Marquess of Salisbury (C)	72.7
1880-85	W.E. Gladstone (Lib)	63.6
1874-80	Benjamin Disraeli (C)	81.8
1868-74	W.E. Gladstone (Lib)	33.3
1868	Benjamin Disraeli (Lib)	83.3
1866-68	Earl of Derby (C)	58.3
1865-66	Earl Russell (Lib)	100.0
1859-65	Viscount Palmerston (Lib)	75.0

Table C.3 Percentage Share of Cabinet with Prior Cabinet Experience by Frequency

	0-10%	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
US	30.2	20.9	2.3	7.0	4.7	4.7	0.0	11.6	4.7	13.9
UK	4.8	4.8	2.4	9.5	2.4	14.3	19.0	16.7	19.0	7.1

Table C.4 Percentage Share of Cabinet with Prior Cabinet Experience by Deciles

	1	2	2.5	3	4	5	6	7	7.5	8	9	10
US	0.0	0.0	3.3	9.7	12.5	18.2	38.3	62.8	73.2	78.0	92.3	100.0
UK	29.1	37.0	52.8	55.0	62.0	66.7	73.3	78.5	81.0	81.8	86.3	100.0

Appendix D

Appendix to Chapter 5

D.1 Qualifications and Requirements for Candidacy: The US Example

In this Appendix,[1] we highlight some of the qualifications and requirements, including financial ones that citizens have to pay in order to be officially registered as candidate and stand for election in the United States. As can be seen below, the requirements validate the assumptions made in modelling the representative democracy regime used in Chapter 5 (and also in Chapter 4). At a minimum, in all the States, citizens can only stand for office if they satisfy some age requirement, and either pay a filing fee or submit a petition with a specified number of signatures. Both of these features validate our assumptions that (1) candidates can only come from a subset of the population, and (2) that standing for election is costly. This is true even when citizens only need to submit a petition to become candidates: to collect the required number of signatures is costly - at least in terms of leisure foregone. This can be verified

[1] Sources for this Appendix: web site of the different States' appropriate authority (often Elections Division of the Secretary of State). The Federal Election Commission's web site (www.fec.gov) provides a listing of each States' appropriate authority.

by looking at States (e.g. California, Idaho) that give candidates the choice between paying a filing fee (amounting to a few thousand dollars) or to collect signatures. In these States, a substantial fraction of candidates opt for paying the fee.[2]

In the State of *Alaska*, the filing fees are as follows: office of governor, lieutenant governor, United States senator, and United States representative is $100.00; office of state senator and state representative is $30.00.

In *Arkansas* the filing fees structure is as follows: if a candidate files as a party candidate he pays a filing fee to the party set by the party; If a candidate files as a write-in they do so by a letter to the Secretary of State and to each county involved in their district; If a candidate files as an independent then they meet the filing requirements by submitting petitions signed by the voters in their district. The amount of signatures required is 3% of the voters that voted in the last election.

In the State of *California*, the qualifications for the Office of the US Senator are: be at least 30 years of age, a US citizen for nine years, and a resident of California when elected. The requirements are twofold: (1) pay a filing fee or collect signatures in lieu of filing fee. The filing fee that the candidate must pay is equal to 2% of the first year's salary. Currently (as of year 2000), the fee for a Senatorial candidate is $2,734.00. In lieu of a filing fee, a candidate can submit a minimum of 10,000 valid signatures on petitions.

In the State of *Colorado*, only candidates running for the US Presidency have to pay a "fee for ballot access" (of $500).

[2] Private correspondance with the Elections Division, Secretary of State, California, reveals that their office does "not track the number of candidates who submit signatures in lieu of filing fees. However, on average 800 candidates file for state-level office for statewide elections. Experience tells us that approximately 1/3 to 1/2 of them submit signatures to defray all or part of the filing fee."

In the State of *Connecticut*, no filing fees exist for candidates.

In the *District of Columbia*, the filing of a nominating petition containing the signatures of registered voters is the only way a candidate can get his or her name on the ballot. The number of signatures required varies by the type of office and the political party registration.

In *Georgia*, the qualifying fee for any office is 3% of the salaried office. If not a salaried office, a reasonable fee shall be set by the governing authority of the municipality or not more than $35.00. The qualifying fees are shown on the schedule below.

Table D.1 Filing Fees in the State of Georgia

Office	Salary	Filing Fee (% of salary)	Filing Fee
Presidential Elector	$50.00	3%	$1.50
U.S. Representative	$136,700.00	3%	$4,101.00
Public Service Commissioner	$99,554.00	3%	$2,986.62
Justice of the Supreme Court	$143,601.00	3%	$4,308.03
Judge of the Court of Appeals	$142,713.00	3%	$4,281.39
Judge of Superior Court	$102,852.00	3%	$3,085.56
District Attorney	$91,294.00	3%	$2,738.82

In *Idaho*, the state candidate filing requirements are the following. Partisan and judicial candidates have two options to be placed on the ballot: (1) file a declaration of candidacy and pay the filing fee; or (2) in lieu of paying the filing fee, file a nominating petition, with a certain number of verified signatures and a declaration of candidacy. Independent candidates do not have the two options. An independent candidate must file the declaration and petition. Independent candidates do not pay a filing fee. Independent candidate residency, age and disclosure requirements for federal and all statewide offices are the same as the requirements for partisan candidates.

Table D.2 Filing Fees and Qualifications in the State of Idaho

Office	Fee ($)	Signatures	Age	Residency
U.S. Senator	$500	1,000	30	a
U.S. Representative	$300	500 from cong. dist.	25	a
Governor	$300	1,000	30	b
Lieutenant Governor	$200	1,000	30	b
Secretary of State	$200	1,000	25	b
State Controller	$200	1,000	25	b
State Treasurer	$200	1,000	25	b
Attorney General	$200	1,000	30	b,c
Supt. of Public Instruction	$200	1,000	25	b,d
State Senator	$30	50 within leg. dist.	21	e
State Representative	$30	50 within leg. dist.	21	e
Supreme Court	$300	1,000	30	f,g
Appellate Court	$300	1,000	30	f,g
District Judge	$150	200 within judl. dist.	30	h

Notes: a=reside within state at time of general election; b=reside within state 2 years preceding general election; c=admitted to practice of law within the state; d=Bachelor's degree from an accredited college or university; e=elector 1 year within legislative district preceding general election; f=2 years within state preceding election; g=admitted to the practice of law for at least 10 years prior to taking office, admitted to the practice of law within Idaho; h=1 year within judicial district preceding election, admitted to the practice of law within Idaho.

In the State of *Illinois*, only a petition is required; In *Indiana*, a declaration of candidacy and a petition of nomination are required; In *Iowa*, an affidavit and a petition are required.

In *Kentucky*, the filing fee schedule is represented in the Table below for Party candidates. For write-in candidates, the requirements and fees are, depending of the jurisdiction/district that one applies for: (a) file a declaration of intent for office other than municipal office in a city of the fifth or sixth class (and pay a filing fee of $50.00);

or (b) file a declaration of intent for municipal office in a city of the fifth or sixth class (and pay a filing fee of $20.00).

Table D.3 Filing Fees in the State of Kentucky

Candidates for:	Filing Fee
statewide elected state office or the congress	$500.00
commonwealth's attorney, the general assembly, the district court	$200.00
the circuit court, the court of appeals or the supreme court	$200.00
office in cities of the fifth or sixth class	$20.00
county and independent boards of education	$20.00
soil and water conservation districts	$20.00
All other candidates who file with the secretary of state and/or county clerk	$50.00

In the State of *Maine*, a citizen becomes officially a candidate if any one or a combination of the following points is satisfied:

Table D.4 Running for Office: Qualifications and Requirements in the State of Maine

1. A person who has filed a petition and has qualified to be nominated by Primary Election as a party candidate;
2. A person who has filed a petition and has qualified as a "non-party" candidate;
3. A person who has filed a declaration with the Secretary of State as a Write-In candidate;
4. A person who has received contributions or made expenditures with the intent of qualifying as a candidate; or
5. A person who has given his or her consent to any other person to receive contributions or make expenditures with the intent of qualifying as a candidate.

In *New York State*, most candidates get on the ballot by filing a petition containing a specified number of signatures. The required amount varies, depending on the office sought and whether the candidate is seeking a party nomination or a spot on the ballot as an independent. Only enrolled party members may sign petitions for candidates who seek their party's nomination. However, any registered voter living within the appropriate district may sign a petition for a candidate seeking to run as an independent in the general election as long as s/he has not already signed on behalf of another candidate.

Table D.5 Running for Office: Requirements to Hold Federal and State Offices in New York State

Office	Citizenship	Age	Residency
President of the United States	Born a citizen	35	14 years in country
U.S. Senator	Citizen 9 years	30	Resident of state when elected
NYS Governor/Lt. Governor	Citizen	30	(b)
Representative in Congress	Citizen 7 years	25	Resident of state when elected
NYS Senator	Citizen	18	Resident of state for 5 years and (a)
NYS Assembly	Citizen	18	Resident of state for 5 years and (a)

Notes: (a)=resident of district for 12 months immediately preceding election; (b)=Resident of state 5 years immediately preceding election.

In the State of *Massachusetts*, the requirements for US Representative, State Senator, State Representative are shown in the Table below.

Table D.6 Running for Office: Requirements to Hold Federal and State Offices in Massachusetts

Office	Citizenship	Age	Residency	Signatures
US Representative	Citizen 7 years	25	Resident of state when elected; (a)	2000
State Senator	Citizen	18	Resident of state for 5 years, (a), (b)	300
State Representative	Citizen	18	Resident of state for 1 year, (a) (b)	150

Notes: (a)=Must be a registered voter; (b)=habitant of the district.

In the State of *Maryland*, the qualifications required for candidacy are the following:

Table D.7 Qualifications and Requirements to Hold Elected Offices in Maryland

Office	Qualifications & Residency	Filing Fee
Governor – Lt. Governor	Registered voter, 30 years old; (a) (b)	$290 (each)
Comptroller	Registered voter	$290
Attorney General	Qualified voter; (r), (c)	$290
U.S. Senator	Registered Voter (*), 30 years old; (d) (r)	$290
U.S. Congress	Registered Voter (*), 25 years old; (e) (r)	$100
State Senator	Registered voter, 25 years old, (r) (f) (g)	$50
House of Delegates	Registered voter, 21 years old, (r) (f) (g)	$50
Judge of the Circuit Court	Qualified Voter, 30 years old; (j) (h) (i)	(k)
County Executive	Registered voter, (l)	$25
County Council	Registered voter, (l)	$25
County Commissioners	Registered voter, (n)	$25
County Treasurer	Registered voter, (m), (n)	$25
State Attorney	Registered Voter, (o) (j)	(p)
Clerk of the Circuit Court	Registered Voter, Resident of the County	(p)
Register of Wills	Registered Voter, Resident of the County	(p)
Judge of the Orphans' Court	Registered Voter, (r) (f)	(p)
Sheriff	Registered Voter, 25 years old, (b) (f)	(p)
Board of Education:		
For each County	(s), (q)	$25

Notes: (a)= Has not served 2 immediately preceding elective terms; (b)=resident of the State 5 years immediately preceding election; (c)=Resided and practiced law in the State for 10 years; (*)=The registration requirement only applies to candidates seeking nomination by Primary Election. Candidates for federal office seeking nomination by petition need not be registered, but must meet the other listed criteria; (d)=Citizen of United States for 9 years; (e)=Citizen of United States for 7 years; (f)=Resident at least 1 year preceding the day of the election; (g)=Resident of legislative district at least 6 months; (h)=Resident of the State at least 5 years; (i)=Resident of the judicial circuit for which he/she is seeking election at least 6 months prior to election; (j) Member of Maryland Bar; (k)=Circuits 1-7: $50, Circuit 8: $300 (fees based on candidates cross-filing); (l)=Qualifications specified in local charters; (m)=applies only to candidates seeking nomination by Primary Election. Candidates seeking nomination by petition need not be registered voters unless required by the County Charter, but must meet any other qualifications; (n)=Qualifications specified in public local law; (o)=Resident of the county for at least 2 years; (p)=Counties: $25, Baltimore City: $150; (q)=For Calvert County: Resident of County or district (if a district seat) 2 years prior to the date of beginning of term of office, and (a); (r)=Citizen of Maryland; (s)=Qualified voter and Resident of County for at least 3 years.

Finally, to conclude this Appendix, it should be noted that, although the legal financial requirements can amount to a few thousand dollars depending on the State and the office candidates are competing for, these costs are only a very small fraction of the financing resources that candidates spend in US elections. The legal requirements however have to be paid directly by candidates, while the campaign funds are mostly (but not necessarily) raised outside of the candidates' personal funds. Section 5.2 gives a brief overview of the role that campaign funds play in US politics.

D.2 Proofs of Propositions

D.2.1 Proof of Lemma 5.0

Say that i *is pivotal for* $P_i \subset C$ if given the realizations of the voting strategies of $j \neq i$, P_i is the set of alternative that gets x or $x-1$ votes, where x is the maximum number of votes of any $k \in C$. Then i can affect the probability of winning of only candidates in P_i. Now, given the random voting strategies of the other players, there are m possible sets $P_i^1, ..., P_i^m$ for which i is pivotal, with probabilities $\xi^1, ..., \xi^m$.

(a) Consider first $i \in NC = N/C$. We show first that $P_i^h \subset B$, all $h = 1, ..., m$. First, given the strategies of $j \neq i$ described in the Lemma, some $j \in B$ will get at least two votes. (To see this, note that every $j \in B$ gets j's vote, and also $n-b-1$ additional votes are distributed randomly among members of B, where $b = \#B$. As $n-b-1 \geq n-c-1 \geq n-k-1 \geq 1$, where $c = \#C$, at least one $j \in B$ must get an additional vote). Also, all $j \notin B$ get zero votes. So, no $j \notin B$ can ever be in P_i^h. So, j is indifferent between all candidates between whom he can ever be pivotal ($\cup_{h=1}^m P_i^h \subset B$). So, it obviously is a best response for i to randomize over B.

(b) Now consider $i \in B$. By Assumption 5.1, i most prefers to vote for himself. Then, he is indifferent between all other members of B, and finally ranks all C/B last. By a similar argument to (a) above, $P_i^h \subset B$, all $h = 1, ..., m$. So, with some positive probability ξ, i will be pivotal between himself and other member(s) of B, and with probability ξ, he will only be pivotal between other members of B. Given this, it is clear that i's unique best response is to vote for himself.

(c) Now consider $i \in C/B$. By Assumption 5.1, i most prefers to vote for himself. Then, he is indifferent between all other members of B, and finally ranks all C/B last. By a similar argument to (a) above, $P_i^h \subset B$, all $h = 1, ..., m$. So, i is never pivotal between himself and member(s) of B; he is only pivotal between members of B. So, it obviously is a best response for i to randomize over B. □

D.2.2 Proof of Proposition 5.1

(a) *Pooling Equilibrium*

We assume the following off-the-equilibrium path beliefs: $\pi_i(j, \mathbf{s}) = 0$, $j \in C$, all $\delta \neq \hat{\delta}$. Given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$, as she anticipates that she will win with probability 0 if $\delta_j < \hat{\delta}$. We now derive the condition under which it is a best response for every $i \in K$ to stand for election and spend $\hat{\delta}$, given that all $j \in K$, $j \neq i$ are following this strategy. The critical case is where i is type L. If $i \in K$ is type-L, $s_i = (1, \hat{\delta})$ it is a best response iff

$$\frac{1}{k}(R_L + W_L) + \frac{k-1}{k}[\rho W_H + (1-\rho)W_L] - \hat{\delta} \geq \rho W_H + (1-\rho)W_L$$

where the left-hand-side is the expected payoff to entering and being elected with probability $1/k$, and the right-hand-side is the expected payoff to not entering. Rearranging, this gives

$$\hat{\delta} \leq \frac{R_L - \rho(W_H - W_L)}{k} = \delta_p$$

This must clearly hold in equilibrium.

(b) *Separating Equilibrium*

We assume the following off-the-equilibrium path beliefs: $\pi_i(j, \mathbf{s}) = 0$, $j \in C$, all $\delta \neq \hat{\delta}$. Given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$, as she anticipates that she will win with probability 0 if $\delta_j < \hat{\delta}$. We now derive conditions under which $e(H) = (1, \hat{\delta})$, $e(L) = 0$ is a best response for i to this same strategy by all $j \in K$, $j \neq i$. Suppose that all $j \in K$, $j \neq i$ are following $e(H) = (1, \hat{\delta})$, $e(L) = 0$. Then, from i's point of view, the number of entrants other than i is c, where c is distributed Binomially with parameters $\rho, k-1$. Let $\mu = E[\frac{1}{c}]$, and $\lambda = 1 - (1-\rho)^{k-1}$. But then if i does not enter, his payoff will be $(1-\lambda)W_H$, no matter what his type, and if he does enter, his payoff will be $\mu(W_a + R_a) + (1-\mu)W_H - \hat{\delta}$ if his type is a. So, we need

$$\mu(W_H + R_H) + (1-\mu)W_H - \hat{\delta} \geq (1-\lambda)W_H > \mu(W_L + R_L) + (1-\mu)W_H - \hat{\delta}$$

or, rearranging

$$\lambda W_H + \mu R_H \geq \hat{\delta} > \mu(W_L + R_L) + (\lambda - \mu)W_H$$

as required.

(c) *No other equilibria*

There cannot be an equilibrium where nobody enters, i.e. $e(a) = 0$, $a = H, L$. For suppose there were: then some $i \in K$ could deviate by entering and spending $\underline{\delta}$. Moreover, such a deviant will be elected, as all voters prefer even a low-ability office-holder to none at all. Such a deviation is profitable as long as $R_H + W_H > \underline{\delta}$. Also, there cannot be an equilibrium where $i \in K$ enters only if he is a low-type, i.e. $e(L) = (1, \delta)$, $e(H) = 0$, as by Lemma 5.1, if $i \in K$ is type H, he benefits by $\frac{1}{k}(W_H - W_L)$ more from entry than if he is type L. □

D.2.3 Proof of Proposition 5.2

(a) *Pooling Equilibrium*

The argument here is the same as in the proof of Proposition 5.1, except that now the critical condition is for a type H. For this type to wish to stand and spend $\hat{\delta}$, it must be that

$$\frac{1}{k}(R_H + W_H) + \frac{k-1}{k}\left[\rho W_H + (1-\rho)W_L\right] - \hat{\delta} \geq \rho W_H + (1-\rho)W_L$$

Rearranging, this gives

$$\hat{\delta} \leq \delta_p = \frac{R_H + (1-\rho)(W_H - W_L)}{k}$$

(b) *Separating Equilibrium*

First, note that a necessary condition for a separating equilibrium where only low-types enter is that $\hat{\delta}$ is such that high-types do not want to enter but low ones do. An argument similar to the proof of Proposition 5.1 (except that μ, λ are redefined, and the subscripts H, L transposed) establishes that this is the case when $\underline{\delta}_s \leq \hat{\delta} \leq$

$\overline{\delta}_s$, where $\underline{\delta}_s, \overline{\delta}_s$, are defined in Proposition 5.2. But now suppose that $\underline{\delta} < \underline{\delta}_s$at a separating equilibrium, some $i \in K$ deviates to $(1, \delta')$, $\delta' < \underline{\delta}_s < \hat{\delta}$. By making this deviation, he cannot lower the belief (on the part of voters) that he is a H type, as it is already zero. So, his probability of election cannot fall, and he is spending less, so he must profit from this deviation. So, no separating equilibrium can exist. This argument fails if $\underline{\delta} \geq \underline{\delta}_s$; then, there can exist a separating equilibrium with $\hat{\delta} = \underline{\delta}_s$.

(c) *No other equilibria*

As in the proof of Proposition 5.1. □

D.2.4 Proof of Proposition 5.3

(a) Assume that the equilibrium is pooling. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta$, Moreover, equilibrium pay-offs are

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\left[\rho W_H + (1-\rho) W_L\right] - \hat{\delta}, \qquad a = H, L$$

So, simple computation gives $J(1, \delta) = \{L\}$ if $x < \delta \leq y$ where $x = \left(\frac{k-1}{k}\right)(W_L + R_L) + A$, $y = \left(\frac{k-1}{k}\right)(W_H + R_H) + A$, $A = \hat{\delta} - \left(\frac{k-1}{k}\right)\left[\rho W_H + (1-\rho) W_L\right]$. So, then $\phi(J(1, \delta)) = 1$ if $\delta \in (x, y]$. But then

$$u_H((1, \delta), \phi(J(1, \delta)), \hat{\pi}) = R_H + W_H - \delta, \qquad \delta \in (x, y]$$

So for ε small,

$$\begin{aligned}
\hat{u}_H &= \frac{1}{k}(R_H + W_H) - A \\
&< \frac{1}{k}(R_H + W_H) - A + \left(\frac{k-1}{k}\right)(R_H + W_H - W_L - R_L) - \varepsilon \\
&= R_H + W_H - \left(\frac{k-1}{k}\right)(W_L + R_L) - A - \varepsilon
\end{aligned}$$

$$= R_H + W_H - (x+\varepsilon)$$
$$= u_H((1, x+\varepsilon), \phi(J_i(1, x+\varepsilon)), \hat{\pi})$$

so the equilibrium fails the Intuitive Criterion, as claimed.

(b) Assume that the equilibrium is separating. Also, assume without loss of generality that $\underline{\delta} < \underline{\delta}_s$. Then $\hat{\pi}(j,(1,\hat{\delta})) = 1,\ j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = \mu(R_a + W_a) + (1-\mu)W_H - \delta$. So, $u_H((1,\delta),1,\hat{\pi}) = \hat{u}_H + \hat{\delta} - \delta$. So, $(1,\delta)$ is dominated for H if and only if $\delta > \hat{\delta}$. Moreover, $(1,\delta)$ is dominated for L as long as $\delta > \underline{\delta}_s$. So, for $\underline{\delta}_s < \delta \leq \hat{\delta}$, $H \notin J(1,\delta) = \{L\}$, so $\phi(J(1,\delta)) = 1,\ \underline{\delta}_s < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_H < \hat{u}_H + \hat{\delta} - \delta = u_H((1,\delta), \phi(J(1,\delta)), \hat{\pi}), \qquad \underline{\delta}_s < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_s < \hat{\delta}$, the separating equilibrium fails the Intuitive Criterion. Obviously, if $\underline{\delta}_s = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the Intuitive Criterion. □

D.2.5 Proof of Proposition 5.4

Assume that the equilibrium is pooling. Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho,\ j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \delta$. Moreover, equilibrium pay-offs are:

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\left[\rho W_H + (1-\rho)W_L\right] - \hat{\delta}, \qquad a = H, L$$

So, if $R_L + W_L - \delta \geq \hat{u}_L,\ R_H + W_H - \delta \geq \hat{u}_H$, action $(1,\delta)$ is dominated for neither type. Simple computation tells us that this occurs when $\delta \leq x = \hat{\delta} + \left(\frac{k-1}{k}\right)[R_H + (1-\rho)(W_H - W_L)]$. So, then $J(1,\delta) = \{\emptyset\},\ \delta \leq x$. But as $\phi(J(1,\delta)) = \rho$, we have:

$$u_a((1,\delta), \phi(J(1,\delta)), \hat{\pi}) = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\left[\rho W_H + (1-\rho)W_L\right] - \delta,\ \delta \leq x$$

Now, $\hat{\delta} < x$ by construction. So, it follows that for any $\hat{\delta} > \delta > \underline{\delta}$,

$$u_a((1,\delta), \phi(J(1,\delta)), \hat{\pi}) = \hat{u}_a + \hat{\delta} - \delta > \hat{u}_a$$

so that the equilibrium fails the Intuitive Criterion. Obviously, when $\hat{\delta} = \underline{\delta}$, this cannot happen, so the pooling equilibrium where $\hat{\delta} = \underline{\delta}$ passes the Intuitive Criterion.

□

D.2.6 Proof of Proposition 5.5

There are then two cases. First, $B_H \in Q$. In this case, with sophisticated beliefs, $\hat{\pi}(B_H) = 1$, so B_H clearly solves maximization problem (i), implying $(\hat{\tau}_1(\theta_a), \hat{g}_1(\theta_a)) = B_H \equiv (g_1^*(\theta_H), \tau_1^*(\theta_H))$. Second, $B_H \notin Q$. Then, there are two candidate solutions to (i); $(\hat{\tau}_1(\theta_a), \hat{g}_1(\theta_a))$ as defined in the Proposition, and $(g_1^*(\theta_H), \tau_1^*(\theta_H))$. They give pay-offs $V_a^1(\hat{\tau}_1(\theta_a), \hat{g}_1(\theta_a), 1)$ and $V_a^1(\tau_1^*(\theta_a), g_1^*(\theta_a), 0)$ respectively. Moreover, $\hat{\tau}_1(\theta_a)$, $\hat{g}_1(\theta_a)$ is in the interior of S_a. So, by construction of S_a, $V_a^1(\hat{\tau}_1(\theta_a), \hat{g}_1(\theta_a), 1) > V_a^1(\tau_1^*(\theta_a), g_1^*(\theta_a), 0)$. This establishes Proposition 5.5. □

D.2.7 Proof of Lemma 5.5

Note first that from (5.24),

$$\tilde{V}_a^2(1) = \xi[R + W_a] + (1-\xi)Z,$$

$$\tilde{V}_a^2(0) = \xi[\rho W_H + (1-\rho)W_L] + (1-\xi)Z$$

where $Z = [0.5W^{pp}(\theta_a) + 0.5[\rho W^{qp}(\theta_H) + (1-\rho)W^{qp}(\theta_L)]]$, and we have used $W^{pp}(\theta_a) = W_a$. So, by direct calculation,

$$\tilde{S}_a = \{(g_1, \tau_1) \,|\, u(y - \tau_1, g_1) + v(\tau_1 + \theta_a - g_1) \geq \tilde{\underline{b}}_a\}$$

$$S_a = \{(g_1, \tau_1) \,|\, u(y - \tau_1, g_1) + v(\tau_1 + \theta_a - g_1) \geq \underline{b}_a\}$$

where

$$\tilde{\underline{b}}_a = u(y - \tau_1^*(\theta_a),\ g_1^*(\theta_a)) + v(\tau_1^*(\theta_a) + \theta_a - g_1^*(\theta_a)) - \xi L_a$$

$$\underline{b}_a = u(y - \tau_1^*(\theta_a),\ g_1^*(\theta_a)) + v(\tau_1^*(\theta_a) + \theta_a - g_1^*(\theta_a)) - L_a$$

and

$$L_a = W_a + R - \rho W_H - (1-\rho)W_L, \qquad a \in \{\theta_H, \theta_L\}$$

is the loss of utility from losing power at the beginning of the second period. Now, by assumption, $L_a > 0$. So, $\tilde{\underline{b}}_a > \underline{b}_a$. It follows immediately from the concavity of u, v that $\tilde{S}_a \subset S_a$ as required. □

D.2.8 Proof of Proposition 5.10

We show that the equilibrium described is a perfect Bayesian equilibrium. Consider period $t = 2$. It is clear that any $i \in N$ of type (a, p) who is elected at period 1 chooses $g_2^p = \tau_2^*(\theta_a)$, $g_2^q = 0$. Next, consider the behaviour of the voters, given candidate set C_2 that is either the equilibrium one or arises from unilateral deviations from equilibrium entry behaviour. Suppose, without loss of generality, that the incumbent $i = n_D$. Let

$$d = \begin{cases} n_D & \text{if } \hat{\pi} \geq \rho \\ n_D^- & \text{if } \hat{\pi} < \rho \end{cases} \tag{A3}$$

First, in equilibrium, $C_2 = \{d\}$. In this case, it is trivial the candidate d is elected.

Now suppose that an additional candidate j enters, i.e. $C_1 = \{d, j\}$. The first case is where $j \in N_D$. If $d = n_D$, by Bayesian updating, voters $k \neq d$ know that d is high-ability with probability $\hat{\pi}$, and if $d = n_D^-$, we suppose that voters $k \neq d$ conjecture that this candidate is high-ability with probability ρ. Also, we suppose that voters $k \neq j$ conjecture that j is high-ability with probability ρ. Then, it is easy to check that all voters $k \neq d, j$ strictly prefer d to j and so will vote for d. As $n \geq 3$, d will surely win the election.

The second case is where $j \in N_R$. In this case, by the arguments of the partial democracy case of Section 5.7.4, voters will vote according to type, and so both d and j will win with probability 0.5.

We now check that the entry decisions of potential candidates are mutual best responses. As $W^{pp}(\theta_L) + R - \delta > 0$, the candidate d does not wish to withdraw. By the above argument, any $j \neq d$, $j \in N_D$ loses δ if she enters. So, it is optimal for no other candidate $j \in N_D$ to enter. Finally, if $j \neq d$, $j \in N_R$ does not enter, she expects payoff

$$\tilde{\rho} W^{DR}(\theta_H) + (1 - \tilde{\rho}) W^{DR}(\theta_L) = \psi$$

where $\tilde{\rho} = \hat{\pi}$ if $d = n_D$, and $\tilde{\rho} = \rho$ if $d = n_D^-$. On the other hand, if she enters, she expects payoff $0.5(W^{RR}(\theta^j) + R) + 0.5\psi - \delta$. So, it is optimal not to enter if

$$\delta > 0.5(W^{RR}(\theta^j) + R - \psi)$$

As $\tilde{\rho} \geq \rho$, $\theta^j \leq \theta_H$, it is sufficient for this to hold that

$$\delta > 0.5(W^{RR}(\theta_H) + R - \rho W^{DR}(\theta_H) - (1 - \rho) W^{DR}(\theta_L)) = \underline{\delta}_2$$

Now go to period $t = 1$. Assume that n_D wins the election. Rationally anticipating that he will only stand (and win) in the next period if $\hat{\pi} \geq \rho$, his first-period policy maximizes $V_a^1(g_1, \tau_1, \ \hat{\pi}(g_1, \tau_1))$ as defined in (5.25), where a is n_D's ability type. So, the type-a chooses $(\widehat{g}_1(\theta_a), \hat{\tau}_1(\theta_a))$, $a \in \{\theta_H, \theta_L\}$.

Next, consider the behaviour of the voters, given a candidate set C_1 that is either the equilibrium one or arises from unilateral deviations from equilibrium entry behaviour. First, in equilibrium, $C_1 = \{n_D\}$, so n_D will be elected. Now, suppose that an additional candidate j enters (i.e. $C_1 = \{n_D, j\}$). The first case is where $j \in N_D$. In this case, we assume that voters $k \notin C_1$ conjecture that any member of C_1 is high-ability with probability ρ. Then, all voters $k \neq n_D, j$ strictly prefer n_D to j, and so all $k \neq n_D, j$ will vote for n_D. As $n \geq 3$, n_D will surely win the election. Consequently, j will not enter.

The second case is where $j \in N_R$. In this case, voters vote according to type. If j does not enter, he can expect a payoff in the two periods of

$$\begin{aligned} V_{NE} &= \rho\left[u(y-\hat{\tau}_1(\theta_H),0)+v(\hat{\tau}_1(\theta_H)+\theta_H-\widehat{g}_1(\theta_H))+W^{DR}(\theta_H)\right] \\ &\quad +(1-\rho)\left[u(y-\hat{\tau}_1(\theta_L),0)+v(\hat{\tau}_1(\theta_L)+\theta_L-\widehat{g}_1(\theta_L))+\rho W^{DR}(\theta_H)+(1-\rho)W^{DR}(\theta_L)\right] \end{aligned}$$

This can be explained as follows. With probability ρ, n_D is competent, so he stays in power for two periods, but with probability $1-\rho$, n_D is incompetent, so loses power (as the equilibrium is revealing) at the beginning of the second period.

If j enters, he can expect a payoff in the two periods of at most $0.5\tilde{V}+0.5V_{NE}-\delta$, (assuming he is competent), where

$$\tilde{V} = u(y-\hat{\tau}_1(\theta_H),\widehat{g}_1(\theta_H))+v(\hat{\tau}_1(\theta_H)+\theta_H-\widehat{g}_1(\theta_H))+R+\left(W^{RR}(\theta_H)+R\right)$$

So, he will not enter if $\delta > 0.5(\tilde{V}-V_{NE}) = \underline{\delta}_1$. Let

$$\Delta_1 \equiv 0.5\left\{\begin{array}{c} u(y-\hat{\tau}_1(\theta_H),\widehat{g}_1(\theta_H))+v(\hat{\tau}_1(\theta_H)+\theta_H-\widehat{g}_1(\theta_H))+R \\ -\rho\left[u(y-\hat{\tau}_1(\theta_H),0)+v(\hat{\tau}_1(\theta_H)+\theta_H-\widehat{g}_1(\theta_H))\right] \\ -(1-\rho)\left[u(y-\hat{\tau}_1(\theta_L),0)+v(\hat{\tau}_1(\theta_L)+\theta_L-\widehat{g}_1(\theta_L))\right] \end{array}\right\}$$

We can conclude that for this to be a perfect Bayesian equilibrium, we need $R+W^{pp}(\theta_L) > \max\{\underline{\delta}_1, \underline{\delta}_2\}$. □

D.2.9 Proof of Proposition 5.12

Consider period $t = 2$. First, it is clear that any $i \in N$ of type a, p who is elected at period 1 chooses $g_2^p = \tau_2^*(\theta_a)$. Next, note that from Bayes' rule, the probability that a candidate has high-ability given a signal s is

$$P(\theta = \theta_H \,|s = 1\,) = \vartheta, \quad P(\theta = \theta_H \,|s = 1\,) = 1 - \vartheta$$

So, the payoff to a p-voter from a type-p office-holder who has a good or bad signal s is

$$\begin{aligned} W_1 &= \vartheta W^{pp}(\theta_H) + (1 - \vartheta) W^{pp}(\theta_L) \\ W_0 &= (1 - \vartheta) W^{pp}(\theta_H) + \vartheta W^{pp}(\theta_L) \end{aligned}$$

Now consider the behaviour of the voters, given a candidate set C_2 that is either the equilibrium one or arises from unilateral deviations from equilibrium entry behaviour.

By hypothesis, $C_2 = \{d_2, r_2\}$. Then, voting will be according to type, so each will win with probability 0.5. The payoff to members of the p-party from entering a candidate of "type" s is therefore

$$0.5(W_s + R') + 0.5\left[\vartheta W^{qp}(\theta_H) + (1 - \vartheta) W^{qp}(\theta_L)\right] - \frac{\delta}{m}$$

On the other hand, if no candidate is entered, the payoff is

$$\vartheta W^{qp}(\theta_H) + (1 - \vartheta) W^{qp}(\theta_L)$$

So, we require it to be desirable to enter for a candidate iff he is "type" $s = 1$. For this, we need

$$0.5(W_1 + R') - \frac{\delta}{m} \geq 0.5\left[\vartheta W^{qp}(\theta_H) + (1 - \vartheta) W^{qp}(\theta_L)\right] > 0.5(W_o + R') - \frac{\delta}{m}$$

But this condition reduces to the one in the Proposition. At the beginning of period 1, exactly the same argument applies, except that agents add to their pay-offs the equilibrium continuation pay-offs in period 2. But is it easily checked that this does not affect the arguments above. □

D.2.10 Proof of Proposition 5.13

We assume the following off-the-equilibrium path beliefs: $\pi_i(j, \mathbf{s}) = 0$, $j \in C$, all $\delta \neq \hat{\delta}$. Given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$, as she anticipates that she will win with probability 0 if $\delta_j < \hat{\delta}$.

(a) *Pooling Equilibrium.* We now derive the condition under which it is a best response for every $i \in K$ to stand for election and spend $\hat{\delta}$, given that all $j \in K$, $j \neq i$ are following this strategy. The critical case is where i is of type $(a, b) = (L, H)$. If $i \in K$ is a low-ability type and has a high cost of campaign spending, $s_i = (1, \hat{\delta})$ it is a best response iff

$$\frac{1}{k}(R_L + W_L) + \frac{k-1}{k}(\rho W_H + (1-\rho)W_L) - \varphi_H \hat{\delta} \geq \rho W_H + (1-\rho)W_L$$

where the LHS is the expected payoff to entering and being elected with probability $1/k$, and the RHS is the expected payoff to not entering. Rearranging, this gives

$$\hat{\delta} \leq \frac{R_L - \rho(W_H - W_L)}{k\varphi_H} = \frac{\delta_p}{\varphi_H} = \delta'_p$$

This must clearly hold in equilibrium.

(b) *Separating Equilibrium.* Throughout, we use the following notation: $e(a, b)$. Part (i), i.e. *strongly separating equilibrium.* We derive conditions under which

$e(H,H) = (1,\hat{\delta})$, $e(H,L) = e(L,L) = e(L,H) = 0$ is a best response for i to this same strategy by all $j \in K$, $j \neq i$. Suppose that all $j \in K$, $j \neq i$ are following $e(H,H) = (1,\hat{\delta})$, $e(H,L) = e(L,L) = e(L,H) = 0$. Then, from i's point of view, the number of entrants other than i is x_0, where x_0 is distributed Binomially with parameters $\rho_0, k-1$, where $\rho_0 = \rho\omega$. Let $\mu_0 = E[\frac{1}{x_0+1}]$, and $\lambda_0 = 1-(1-\rho_0)^{k-1}$. But then if i does not enter, his payoff will be $(1-\lambda_0)W_H$, no matter what his type is, and if he does enter, his payoff will be $\mu_0(W_a + R_a) + (1-\mu_0)W_H - \varphi_b\hat{\delta}$ if his ability type is a and his burning cost is b. So, we need

$$\mu_0(W_H+R_H)+(1-\mu_0)W_H-\varphi_L\hat{\delta} \geq (1-\lambda_0)W_H > \min\left\{\begin{array}{c} \mu_0(W_H + R_H) + (1-\mu_0)W_H - \varphi_H\hat{\delta}, \\ \mu_0(W_L + R_L) + (1-\mu_0)W_H - \varphi_L\hat{\delta} \end{array}\right\}$$

or, rearranging

$$\overline{\delta}_{st} = \frac{\lambda_0 W_H + \mu_0 R_H}{\varphi_L} \geq \hat{\delta} > \min\left\{\begin{array}{c} \frac{\mu_0(W_H+R_H)+(\lambda_1-\mu_1)W_H}{\varphi_H}, \\ \frac{\mu_0(W_L+R_L)+(\lambda_0-\mu_0)W_H}{\varphi_L} \end{array}\right\} = \underline{\delta}_{st}$$

Inspection of the above inequalities reveals that these are satisfied only when φ_H is not too large compared to φ_L.[3] If this is not the case, then $\underline{\delta}_{st} > \overline{\delta}_{st}$, in which case we cannot have a separating equilibrium.

Part (ii), i.e. *weakly separating equilibrium.* We derive conditions under which $e(a = H, b) = (1,\hat{\delta})$, $e(a = L, b) = 0$, $b = H, L$ is a best response for i to this same strategy by all $j \in K$, $j \neq i$. Suppose that all $j \in K$, $j \neq i$ are following $e(a = H, b) = (1,\hat{\delta})$, $e(a = L, b) = 0$. Then, from i's point of view, the number of entrants other than i is x_1, where x_1 is distributed Binomially with parameters $\rho_1, k-1$, where $\rho_1 = \rho(1-\rho\omega(1-\omega))$. Let $\mu_1 = E[\frac{1}{x_1+1}]$, and $\lambda_1 = 1-(1-\rho_1)^{k-1}$. But then if i does not enter, his payoff will be $(1-\lambda_1)W_H$, no matter what his type

[3] We have defined in (5.29) the maximum spread between φ_H and φ_L.

is, and if he does enter, his payoff will be $\mu_1(W_a + R_a) + (1 - \mu_1)W_H - \varphi_b\hat{\delta}$. So, we need

$$\mu_1(W_H + R_H) + (1 - \mu_1)W_H - \varphi_H\hat{\delta} \geq (1 - \lambda_1)W_H > \mu_1(W_L + R_L) + (1 - \mu_1)W_H - \varphi_L\hat{\delta}$$

or, rearranging

$$\overline{\delta}_{ws} = \frac{\lambda_1 W_H + \mu_1 R_H}{\varphi_H} \geq \hat{\delta} > \frac{\mu_1(W_L + R_L) + (\lambda_1 - \mu_1)W_H}{\varphi_L} = \underline{\delta}_{ws}$$

Inspection of the above inequalities reveals that these are satisfied only when φ_H is not too large compared to φ_L.[4] If this is not the case, then $\underline{\delta}_{ws} > \overline{\delta}_{ws}$, in which case we cannot have a separating equilibrium.

Part (iii), i.e. *semi-separating equilibrium.* We derive conditions under which $e(H,L) = e(H,H) = e(L,L) = (1,\hat{\delta})$, and $e(L,H) = 0$ is a best response for i to this same strategy by all $j \in K$, $j \neq i$. Suppose that all $j \in K$, $j \neq i$ are following $e(H,L) = e(H,H) = e(L,L) = (1,\hat{\delta})$, $e(L,H) = 0$. Then, from i's point of view, the number of entrants other than i is x_2, where x_2 is distributed Binomially with parameters $\rho_2, k-1$, and $\rho_2 = 1 - \omega - \rho(1 - 2\omega) + \rho^2(1+\omega)(\omega - 1)^2 - \omega\rho^3(\omega - 1)^2$. Let $\mu_2 = E[\frac{1}{x_2+1}]$, and $\lambda_2 = 1 - (1 - \rho_2)^{k-1}$. But then if i does not enter, his payoff will be $(1 - \lambda_2)[(\rho\omega + \rho(1-\omega))W_H + (1-\rho)(1-\omega)W_L] / [1 - (1-\rho)\omega]$, no matter what his type is, and if he does enter, his payoff will be $\mu_2(W_a + R_a) + (1 - \mu_2)$ $[(\rho\omega + \rho(1-\omega))W_H + (1-\rho)(1-\omega)W_L] / [1 - (1-\rho)\omega] - \varphi_b\hat{\delta}$. So, we need

$$\begin{aligned} &\min\left\{\mu_2(W_L + R_L) + (1 - \mu_2)\Psi - \varphi_L\hat{\delta},\quad \mu_2(W_H + R_H) + (1 - \mu_2)\Psi - \varphi_H\hat{\delta}\right\} \\ &\geq\ (1 - \lambda_2)\Psi > \mu_2(W_L + R_L) + (1 - \mu_2)\Psi - \varphi_H\hat{\delta} \end{aligned}$$

[4] We have defined in (5.29) the maximum spread between φ_H and φ_L.

where $\Psi = [(\rho\omega + \rho(1-\omega))W_H + (1-\rho)(1-\omega)W_L]/[1-(1-\rho)\omega]$. After rearranging we obtain

$$\overline{\delta}_{se} = \min\left\{\begin{array}{c}\frac{\mu_2(R_H+W_H)+(\lambda_2-\mu_2)\Psi}{\varphi_H},\\ \frac{\mu_2(R_L+W_L)+(\lambda_2-\mu_2)\Psi}{\varphi_L}\end{array}\right\} \geq \hat{\delta} > \frac{\mu_2(W_L+R_L)+(\lambda_2-\mu_2)\Psi}{\varphi_H} = \underline{\delta}_{se}$$

Again, inspection of the above inequalities reveals that these are satisfied only when φ_H is not too large compared to φ_L (where we have defined in (5.29) the maximum spread between φ_H and φ_L). If this is not the case, then $\underline{\delta}_{se} > \overline{\delta}_{se}$, in which case we cannot have a separating equilibrium. □

D.2.11 Proof of Proposition 5.14

(a) Assume that the equilibrium is pooling. Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho$, $j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \varphi_b\delta$, Moreover, equilibrium pay-offs are

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}(\rho W_H + (1-\rho)W_L) - \varphi_b\hat{\delta}, \qquad a = H, L, \quad b = H, L$$

Let $x' = [\left(\frac{k-1}{k}\right)(W_L + R_L) + A_L]/\varphi_L$, $y' = [\left(\frac{k-1}{k}\right)(W_H + R_H) + A_H]/\varphi_H$, $A_b = \varphi_b\hat{\delta} - \left(\frac{k-1}{k}\right)[\rho W_H + (1-\rho)W_L]$, where $b = H, L$. Again, as in Proposition 5.13, and contrarily to the proof of Proposition 5.3, we can see that now two cases are possible depending on whether $\varphi_H - \varphi_L$ is "too large" or not (where we have defined in (5.29) the maximum spread between φ_H and φ_L).

(i) Case 1: $\varphi_H - \varphi_L$ is small enough. In this case, simple computation give $J(1,\delta) = \{L\}$ if $x' < \delta \leq y'$. So, then $\phi(J(1,\delta)) = 1$ if $\delta \in (x', y']$. But then

$$u_H((1,\delta),\phi(J(1,\delta)),\hat{\pi}) = R_H + W_H - \varphi_b\delta, \qquad \delta \in (x', y']$$

So for ε small,

$$\begin{aligned}
\hat{u}_H &= \frac{1}{k}(R_H + W_H) - A_H \\
&< \frac{1}{k}(R_H + W_H) - A_L - \varepsilon, \qquad \text{since } A_H > A_L \\
&< \frac{1}{k}(R_H + W_H) - \frac{A_L}{\varphi_L} - \varepsilon, \qquad \text{since } \varphi_L > 1 \\
&< \frac{R_H + W_H}{k} - \frac{A_L}{\varphi_L} + \left(\frac{k-1}{k}\right)(R_H + W_H) - \frac{1}{\varphi_L}\left(\frac{k-1}{k}\right)(W_L + R_L) - \varepsilon \\
&= R_H + W_H - \frac{1}{\varphi_L}\left[\left(\frac{k-1}{k}\right)(W_L + R_L) + A_L\right] - \varepsilon \\
&= R_H + W_H - (x' + \varepsilon) \\
&= u_H((1, x' + \varepsilon), \phi(J_i(1, x' + \varepsilon)), \hat{\pi})
\end{aligned}$$

where we have used the fact that $R_H + W_H - W_L - R_L > 0$ since we are in the congruence case. And therefore $\left(\frac{k-1}{k}\right)(R_H + W_H) - \frac{1}{\varphi_L}\left(\frac{k-1}{k}\right)(W_L + R_L) > 0$ since $\varphi_L > 1$. So the pooling equilibrium fails the IC, as claimed.

(ii) Case 2: $\varphi_H - \varphi_L$ is large enough. In this case, simple computation gives $J(1, \delta) = \{H\}$ if $y' < \delta \leq x'$. So, then $\phi(J(1, \delta)) = 0$ if $\delta \in (y', x']$. Therefore, any citizens that deviates from the equilibrium strategy is believed to be a low-type with probability one, and will therefore never be elected but will lose the entry cost δ, i.e.

$$u_L((1, \delta), \phi(J(1, \delta)), \hat{\pi}) = \rho W_H + (1 - \rho) W_L - \varphi_L \delta, \qquad \delta \in (y', x']$$

This obviously is a dominated strategy since the equilibrium payoff is

$$\begin{aligned}
\hat{u}_L &= \frac{1}{k}(R_L + W_L) - A_L \\
&= \frac{1}{k}(R_L + W_L) + \left(\frac{k-1}{k}\right)(\rho W_H + (1 - \rho) W_L) - \varphi_L \hat{\delta} \\
&> \frac{1}{k}(R_L + W_L) + \left(\frac{k-1}{k}\right)(\rho W_H + (1 - \rho) W_L) - \varphi_L \delta \\
&> \rho W_H + (1 - \rho) W_L - \varphi_L \delta = u_L((1, \delta), \phi(J(1, \delta)), \hat{\pi})
\end{aligned}$$

were we have used Assumption 5.1: i.e. $R_L + W_L > W_H$, and the fact that $\delta \in (y', x'] > \hat{\delta}$ by construction. So the pooling equilibrium does not fails the IC when $\varphi_H - \varphi_L$ is large enough.

(b) (i) Assume that the equilibrium is *strongly separating* (as defined in part (i) of Proposition 5.13) and that $\varphi_H - \varphi_L$ is not "too large" so that $\underline{\delta}_{st} < \overline{\delta}_{st}$. Also, assume w.l.o.g. that $\underline{\delta} < \underline{\delta}_{st}$. Then $\hat{\pi}(j, (1, \hat{\delta})) = 1,\ j \in K$, and $u_a((1, \delta), 1, \hat{\pi}) = \mu_0(R_a + W_a) + (1 - \mu_0)W_H - \varphi_b\delta$. Thus, $u_H((1, \delta), 1, \hat{\pi}) = \hat{u}_H + \varphi_L\hat{\delta} - \varphi_L\delta$. So, $(1, \delta)$ is dominated for $(a, b) = (H, L)$ iff $\delta > \hat{\delta}$. Moreover, $(1, \delta)$ is dominated for a types $(a, b) = \{(H, H), (L, L), (L, H)\}$ as long as $\delta > \underline{\delta}_{st}$. So, for $\underline{\delta}_{st} < \delta \leq \hat{\delta}$, $(H, L) \notin J(1, \delta) = \{(H, H), (L, L), (L, H)\}$, so $\phi(J(1, \delta)) = 1$, for $\underline{\delta}_{st} < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_H < \hat{u}_H + \varphi_L\hat{\delta} - \varphi_L\delta = u_H((1, \delta), \phi(J(1, \delta)), \hat{\pi}), \qquad \underline{\delta}_{st} < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_{st} < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_{st} = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC.

(ii) Assume that the equilibrium is *weakly separating* (as defined in part (ii) of Proposition 5.13) and that $\varphi_H - \varphi_L$ is not "too large" so that $\underline{\delta}_{ws} < \overline{\delta}_{ws}$. Also, assume w.l.o.g. that $\underline{\delta} < \underline{\delta}_{ws}$. Then $\hat{\pi}(j, (1, \hat{\delta})) = 1,\ j \in K$, and $u_{ab}((1, \delta), 1, \hat{\pi}) = \mu_1(R_a + W_a) + (1 - \mu_1)W_H - \varphi_b\delta$. Thus, $u_{Hb}((1, \delta), 1, \hat{\pi}) = \hat{u}_H + \varphi_b(\hat{\delta} - \delta)$. So, $(1, \delta)$ is dominated for $a = H$ only if $\delta > \hat{\delta}$. Moreover, $(1, \delta)$ is dominated for a low-ability type (regardless of its burning cost) as long as $\delta > \underline{\delta}_{ws}$. So, for $\underline{\delta}_{ws} < \delta \leq \hat{\delta}$, $a = H \notin J(1, \delta) = \{a = L\}$, so $\phi(J(1, \delta)) = 1$, for $\underline{\delta}_{ws} < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_H < \hat{u}_H + \varphi_b(\hat{\delta} - \delta) = u_{HL}((1, \delta), \phi(J(1, \delta)), \hat{\pi}), \qquad \underline{\delta}_{ws} < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_{ws} < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_{ws} = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC.

(iii) Assume that the equilibrium is *semi separating* (as defined in part (iii) of Proposition 5.13) and that $\varphi_H - \varphi_L$ is not "too large" so that $\underline{\delta}_{se} < \overline{\delta}_{se}$, and $x_2 < \delta \leq y_2$. Also, assume w.l.o.g. that $\underline{\delta} < \underline{\delta}_{se}$. Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho_2 > 0$,[5] $j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \varphi_b\delta$, and

$$\hat{u}_a = \mu_2(W_a + R_a) + (1-\mu_2)\Psi - \varphi_b\hat{\delta}$$

$$\hat{u}_H = \mu_2(W_H + R_H) + (1-\mu_2)\Psi - \varphi_b\hat{\delta}$$

where, from the proof of Proposition 5.13, $\Psi = \frac{(\rho\omega+\rho(1-\omega))W_H+(1-\rho)(1-\omega)W_L}{1-(1-\rho)\omega}$. So, simple computation give $J(1,\delta) = \{L\}$ if $x_2 < \delta \leq y_2$, where $x_2 = \frac{1-\mu_2}{\varphi_L}(R_L + W_L - \Psi) + \hat{\delta}$, and $y_2 = \frac{1-\mu_2}{\varphi_H}(R_H + W_H - \Psi) + \hat{\delta}$. So, then $\phi(J(1,\delta)) = 1$ if $\delta \in (x_2, y_2]$. But then

$$u_H((1,\delta),\phi(J(1,\delta)),\hat{\pi}) = R_H + W_H - \varphi_b\delta, \qquad \delta \in (x_2, y_2]$$

So, for ε small,

$$\begin{aligned}
\hat{u}_H &= \mu_2(W_H + R_H) + (1-\mu_2)\Psi - \varphi_L\hat{\delta} \\
&< R_H + W_H - (1-\mu_2)(R_L + W_L) + (1-\mu_2)\Psi - \varphi_L\hat{\delta} - \varphi_L\varepsilon, \qquad \mu_2 < 1 \\
&= R_H + W_H - \varphi_L\left[\frac{1-\mu_2}{\varphi_L}(R_L + W_L - \Psi) + \hat{\delta}\right] - \varphi_L\varepsilon \\
&= R_H + W_H - \varphi_L(x_2 + \varepsilon) \\
&= u_H((1, x_2+\varepsilon), \phi(J(1, x_2+\varepsilon)), \hat{\pi})
\end{aligned}$$

So the semi-separating equilibrium fails the IC, as claimed. □

[5] where $\rho_2 = 1 - \omega - \rho(1-2\omega) + \rho^2(1+\omega)(\omega-1)^2 - \omega\rho^3(\omega-1)^2$ (c.f. proof of Proposition 13).

D.2.12 Proof of Proposition 5.15

(a) *Pooling Equilibrium.* The argument here is the same as in the proof of Proposition 5.13, except that now the critical condition is for a high-ability and low cost type (i.e. $(a,b) = (H,H)$). For this type to wish to stand and spend $\hat{\delta}$, it must be that

$$\frac{1}{k}(R_H + W_H) + \frac{k-1}{k}(\rho W_H + (1-\rho)W_L) - \varphi_H\hat{\delta} \geq \rho W_H + (1-\rho)W_L$$

Rearranging, this gives

$$\hat{\delta} \leq \delta_p' = \frac{\delta_p}{\varphi_H} = \frac{R_H + (1-\rho)(W_H - W_L)}{\varphi_H k}$$

(b) *Semi Separating Equilibrium.* We assume the following off-the-equilibrium path beliefs: $\pi_i(j, \mathrm{s}) = 0$, $j \in C$, all $\delta \neq \hat{\delta}$. Given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$, as she anticipates that she will win with probability 0 if $\delta_j < \hat{\delta}$. A necessary condition for a semi separating equilibrium where only the following types enter: $(a,b) = \{(L,L),(L,H),(H,L)\}$, is that $\hat{\delta}$ is such that type $(a,b) = (H,H)$ do not want to enter. An argument similar to the proof of Proposition 5.13 (except that μ_2, λ_2 are redefined, and the ability subscripts $a = H, L$ transposed) establishes that this is the case when $\underline{\delta}_{se} \leq \hat{\delta} \leq \overline{\delta}_{se}$ provided that $\varphi_H - \varphi_L$ is not too large, and where $\underline{\delta}_{se}, \overline{\delta}_{se}$, are defined in Proposition 5.15.[6]

(c) *No other equilibria.* It is easy to see that, following the argument of the proof of Proposition 5.2 part (b) and applying it directly from the proof of Proposition 5.13 (except that the μ's and the λ's need to be redefined, and the ability subscripts $a = H, L$ transposed), both a *strongly (and a weakly) separating equilibrium* cannot

[6]Similar to the proof of Proposition 5.13, if $\varphi_H - \varphi_L$ becomes sufficiently large, then we will have $\overline{\delta}_{se} > \underline{\delta}_{se}$, in which case a semi separating equilibrium is not possible.

exist when $\underline{\delta} \geq \underline{\delta}_{st}$ (and $\underline{\delta} \geq \underline{\delta}_{ws}$) (where $\underline{\delta}_{st}$ and $\underline{\delta}_{ws}$ are appropriately redefined). However, both a strongly and a weakly separating equilibrium are possible iff $\hat{\delta} = \underline{\delta}_{st}$ and $\hat{\delta} = \underline{\delta}_{ws}$ respectively. As in Section 5.3.2, given that in the non congruent case the strongly and weakly separating equilibria are undesirable from voters point of view, we assume that $\delta < \min\{\underline{\delta}'_p, \underline{\delta}_{st}, \underline{\delta}_{ws}\}$ so that both the strongly and weakly separating equilibria are eliminated. □

D.2.13 Proof of Proposition 5.16

(i) Assume that the equilibrium is *pooling*. Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho,\ j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \varphi_b\delta$. Moreover, equilibrium pay-offs are:

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\left[\rho W_H + (1-\rho)W_L\right] - \varphi_b\hat{\delta}, \qquad a = H, L; \quad b = H, L$$

So, if $R_L + W_L - \varphi_H\delta \geq \hat{u}_L,\ R_H + W_H - \varphi_H\delta \geq \hat{u}_H$, action $(1,\delta)$ is dominated for neither ability type. Simple computation tells us that this occurs when $\delta \leq x' = \hat{\delta} + \frac{1}{\varphi_H}\left(\frac{k-1}{k}\right)\left[R_H + (1-\rho)(W_H - W_L)\right]$. So, then $J(1,\delta) = \{\emptyset\},\ \delta \leq x'$. But as $\phi(J(1,\delta)) = \rho$, we have:

$$u_a((1,\delta),\phi(J(1,\delta)),\hat{\pi}) = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\left[\rho W_H + (1-\rho)W_L\right] - \varphi_b\delta, \qquad \delta \leq x'$$

Now, $\hat{\delta} < x'$ by construction. So, it follows that for any $\hat{\delta} > \delta > \underline{\delta}$,

$$u_a((1,\delta),\phi(J(1,\delta)),\hat{\pi}) = \hat{u}_a + \varphi_b\hat{\delta} - \varphi_b\delta > \hat{u}_a$$

so that the equilibrium fails the IC. Obviously, when $\hat{\delta} = \underline{\delta}$, this cannot happen, so the pooling equilibrium where $\hat{\delta} = \underline{\delta}$ passes the IC.

(ii) Assume that the equilibrium is *semi separating* and that $\varphi_H - \varphi_L$ is not "too large". Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho_2$, $j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \varphi_b\delta$, and

$$\hat{u}_a = \mu_2(W_a + R_a) + (1-\mu_2)\Psi - \varphi_b\hat{\delta}$$

where, from the proof of Proposition 5.15, $\Psi = [(\rho\omega + \rho(1-\omega))W_L + (1-\rho)(1-\omega)W_H]/[1-(1-\rho)\omega]$. So, if $R_L+W_L-\varphi_H\delta \geq \hat{u}_L$, $R_H+W_H-\varphi_L\delta \geq \hat{u}_H$, action $(1,\delta)$ is dominated for neither ability type. Simple computation give $J(1,\delta) = \{\emptyset\}$ if $\delta \leq x_\emptyset$, where $x_\emptyset = (1-\mu_2)[W_H + R_H - \Psi]/\varphi_L + \hat{\delta}$. So, then $\phi(J(1,\delta)) = \emptyset$ if $\delta \leq x_\emptyset$. But as $\phi(J(1,\delta)) = \rho_2$, then

$$u_a((1,\delta),\phi(J(1,\delta)),\hat{\pi}) = \mu_2(W_a + R_a) + (1-\mu_2)\Psi - \varphi_b\delta, \qquad \delta \leq x_\emptyset$$

But we know that $\hat{\delta} < x_\emptyset$ by construction. So, it follows that for any $\hat{\delta} > \delta > \underline{\delta}$,

$$u_a((1,\delta),\phi(J(1,\delta)),\hat{\pi}) = \hat{u}_a + \varphi_b\hat{\delta} - \varphi_b\delta > \hat{u}_a$$

so that the equilibrium fails the IC. Obviously, when $\hat{\delta} = \max\{\underline{\delta}, \underline{\delta}_{se}\}$, this cannot happen, so the pooling equilibrium where $\hat{\delta} = \max\{\underline{\delta}, \underline{\delta}_{se}\}$ passes the IC. □

D.2.14 Proof of Proposition 5.17

(a) *Pooling Equilibrium*

We assume the following off-the-equilibrium path beliefs: $\pi(j, \mathbf{e}) = 0$ if $j \notin C$. We first derive conditions under which it is a best response for every $i \in K$ to stand for election. The critical case is where i is a type-L citizen. If $c = 1$, as there is only one candidate, i will surely be elected, and so will get $R + W_L - \delta$. If he does not stand, the default option is implemented. So $i \in K$ prefers to stand iff $R + W_L - \delta \geq 0$, or $\delta \leq R + W_L = \delta_1^p$. If $c > 1$, if $i \in C$ is a type-L citizen, it is a best response to stand for election iff

$$\frac{1}{c}(R+W_L)+\frac{c-1}{c}\left[\rho W_H+(1-\rho)W_L\right]-\delta \geq \rho W_H+(1-\rho)W_L$$

where the left hand side of the inequality is the expected payoff to entering and being elected with probability $1/c$, and the right hand side is the expected payoff to not entering. Rearranging, this gives

$$\delta \leq \frac{R-\rho(W_H-W_L)}{c}=\delta_c^p$$

This must clearly hold in equilibrium.

Given the above off-the-equilibrium path beliefs, no $j \in C$ will wish to stand for election and spend less at least $\underline{\delta}$ as she anticipates that she will win with probability 0. The reason being that, by Bayes' rule, all voters (other than i) believe $i \in C$ to be high-ability with probability ρ. However, by the assumption on off-the-equilibrium path beliefs, all voters (other than j) believe j to be high-ability with probability 0. So, j will lose if he enters and forfeit at least $\underline{\delta}$; consequently, he will not enter.

(b) *Separating Equilibrium*

We assume the following off-the-equilibrium path beliefs; $\pi(j,\mathbf{s})=0$ if $j \notin C$. We first derive conditions under which it is a best response for every $i \in C$ to stand for election. If $c=1$, as there is only one candidate, i will surely be elected, and so will get $R+W_H-\delta$. If he does not stand, the default option is implemented. So $i \in N$ prefers to stand iff $R+W_H-\delta \geq 0$, or $\delta \leq R+W_H=\delta_1^s$.

If $c>1$, it is a best response to stand for election iff

$$\frac{1}{c}(R+W_H)+\frac{c-1}{c}W_H-\delta \geq W_H$$

where the left hand side of the inequality is the expected payoff to entering and being elected with probability $1/c$, and the right hand side is the expected payoff to not entering. Rearranging, this gives $\delta \leq \frac{R}{c} = \delta_c^s$, which must clearly hold in equilibrium.

As in case (a) above, suppose now that j stands against C. By Bayes' rule, all voters (other than i) believe $i \in C$ to be high-ability with probability 1. But by the assumption on off-the-equilibrium path beliefs, all voters (other than j) believe j to be high-ability with probability 0. So, j will lose if he enters and forfeit at least $\underline{\delta}$; consequently, he will not enter.

(c) *No other equilibria*

There cannot be an equilibrium where nobody enters, i.e. $e(a) = 0$, $a = H, L$. The proof follows that of part (c) of the proof of Proposition 5.1. □

D.2.15 Proof of Proposition 5.19

We assume the following off-the-equilibrium path beliefs: $\pi_i(j, \mathbf{s}) = 0$, $j \in C$, all $\delta \neq \hat{\delta}$. Given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$, as she anticipates that she will win with probability 0 if $\delta_j < \hat{\delta}$.

(a) *Pooling Equilibrium.* We now derive the condition under which it is a best response for every $i \in K$ to stand for election and spend $\hat{\delta}$, given that all $j \in K$, $j \neq i$ are following this strategy. The critical case is where i is for type-1. If $i \in K$ is type-1, $s_i = (1, \hat{\delta})$ it is a best response iff

$$\frac{1}{k}(R_1 + W_1) + \frac{k-1}{k}\sum_{i=1}^{m} \rho_i W_i - \hat{\delta} \geq \sum_{i=1}^{m} \rho_i W_i$$

where the LHS is the expected payoff to entering and being elected with probability $1/k$, and the RHS is the expected payoff to not entering. Rearranging, this gives

$$\hat{\delta} \leq \frac{R_1 + W_1 - \sum_{i=1}^{m} \rho_i W_i}{k} = \delta_p''$$

This must clearly hold in equilibrium.

(b) *Separating Equilibrium.* We now derive conditions under which $e(m) = (1, \hat{\delta})$, $e(L) = 0$ is a best response for i to this same strategy by all $j \in K,\ j \neq i$. Suppose that all $j \in K,\ j \neq i$ are following $e(m) = (1, \hat{\delta})$, $e(L) = 0$. Then, from i's point of view, the number of entrants other than i is x_m, where x_m is distributed Binomially with parameters $\rho_m, k-1$. Let $\mu_m = E[\frac{1}{x_m+1}]$, and $\lambda_m = 1 - (1-\rho_m)^{k-1}$. But then if i does not enter, his payoff will be $(1-\lambda_m)W_m$, no matter what his type, and if he does enter, his payoff will be $\mu_m(W_a + R_a) + (1-\mu_m)W_m - \hat{\delta}$ if his type is a. So, we need

$$\mu_m(W_m + R_m) + (1-\mu_m)W_m - \hat{\delta} \geq (1-\lambda_m)W_m > \mu_m(W_{m-1} + R_{m-1}) + (1-\mu_m)W_m - \hat{\delta}$$

or, rearranging

$$\lambda_m W_m + \mu_m R_m \geq \hat{\delta} > \mu_m(W_{m-1} + R_{m-1}) + (\lambda_m - \mu_m)W_m$$

as required.

(c) *Semi-separating equilibria.* With many ability types, there is a multitude of semi-separating equilibria, where only a subset Z of high-types enter (i.e. types above and including type-$(m-z)$, so $Z = m-z, m-z+1, ..., m-1, m$), and those below these ability types do not enter. We now derive conditions under which $e(Z) = (1, \hat{\delta})$, $e(\overline{Z}) = 0$ (where $\overline{Z} = 1, ..., m-z-1$) is a best response for i to this same strategy by all $j \in K,\ j \neq i$. Suppose that all $j \in K,\ j \neq i$ are following $e(Z) = (1, \hat{\delta})$, $e(\overline{Z}) = 0$. Then, from i's point of view, the number of entrants other than i is x_z, where x_z is distributed Binomially with parameters $\rho_z, k-1$. Let $\mu_z = E[\frac{1}{x_z+1}]$, and $\lambda_z = 1-(1-\rho_z)^{k-1}$. But then if i does not enter, his payoff will be $(1-\lambda_z)\sum_{i=z}^{m} \rho_i W_i$, and if he does enter, his payoff will be $\mu_z(W_a + R_a) + (1-\mu_z)\sum_{i=z}^{m} \rho_i W_i - \hat{\delta}$ if his type is a. So, we need

$$\mu_z(W_{m-z}+R_{m-z})+(1-\mu_z)\sum_{i=z}^{m}\rho_i W_i-\hat{\delta} \geq (1-\lambda_z)\sum_{i=z}^{m}\rho_i W_i > \left[\begin{array}{c}\mu_z(W_{m-z-1}+R_{m-z-1}) \\ +(1-\mu_z)\sum_{i=z}^{m}\rho_i W_i - \hat{\delta}\end{array}\right]$$

or, rearranging

$$\mu_z(W_{m-z}+R_{m-z})+(\lambda_z-\mu_z)\sum_{i=z}^{m}\rho_i W_i \geq \hat{\delta} > \mu_z(W_{m-z-1}+R_{m-z-1})+(\lambda_z-\mu_z)\sum_{i=z}^{m}\rho_i W_i$$

as required. □

D.2.16 Proof of Proposition 5.20

(a) Assume that the equilibrium is *pooling*. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho_1,\ j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta$, Moreover, equilibrium pay-offs are

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\sum_{i=1}^{m}\rho_i W_i - \hat{\delta}$$

So, simple computation gives $J(1, \delta) = \{L\}$ (where L now regroup all types $a = \{1, ..., m-1\}$ except the highest ability type-m agent) if $x^{\#} < \delta \leq y^{\#}$ where $x^{\#} = \left(\frac{k-1}{k}\right)(W_{m-1} + R_{m-1}) + A^{\#}$, $y^{\#} = \left(\frac{k-1}{k}\right)(W_m + R_m) + A^{\#}$, $A^{\#} = \hat{\delta} - \left(\frac{k-1}{k}\right)\sum_{i=1}^{m}\rho_i W_i$. So, then $\phi(J(1, \delta)) = 1$ if $\delta \in (x^{\#}, y^{\#}]$. But then

$$u_m((1, \delta), \phi(J(1, \delta)), \hat{\pi}) = R_m + W_m - \delta, \quad \delta \in (x^{\#}, y^{\#}]$$

So for ε small,

$$\hat{u}_m = \frac{1}{k}(R_m + W_m) - A^{\#}$$

$$
\begin{aligned}
&< \frac{1}{k}(R_m + W_m) - A^{\#} + \left(\frac{k-1}{k}\right)(R_m + W_m - W_{m-1} - R_{m-1}) - \varepsilon \\
&= R_m + W_m - \left(\frac{k-1}{k}\right)(W_{m-1} + R_{m-1}) - A^{\#} - \varepsilon \\
&= R_m + W_m - (x^{\#} + \varepsilon) \\
&= u_m((1, x^{\#} + \varepsilon), \phi(J_i(1, x^{\#} + \varepsilon)), \hat{\pi})
\end{aligned}
$$

so the equilibrium fails the IC, as claimed.

(b) Assume that the equilibrium is *separating*. Also, assume w.l.o.g. that $\underline{\delta} < \underline{\delta}_{se}$. Then $\hat{\pi}(j, (1, \hat{\delta})) = 1$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = \mu(R_a + W_a) + (1 - \mu)W_m - \delta$. So, $u_m((1, \delta), 1, \hat{\pi}) = \hat{u}_m + \hat{\delta} - \delta$. So, $(1, \delta)$ is dominated for m iff $\delta > \hat{\delta}$. Moreover, $(1, \delta)$ is dominated for L as long as $\delta > \underline{\delta}_{se}$. So, for $\underline{\delta}_{se} < \delta \leq \hat{\delta}$, $m \notin J(1, \delta) = \{L\}$, so $\phi(J(1, \delta)) = 1$, $\underline{\delta}_{se} < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_m < \hat{u}_m + \hat{\delta} - \delta = u_m((1, \delta), \phi(J(1, \delta)), \hat{\pi}), \qquad \underline{\delta}_{se} < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_{se} < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_{se} = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC.

(c) Assume that the equilibrium is *semi separating*. Also, assume w.l.o.g. that $\underline{\delta} < \underline{\delta}_{ss}$. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho_z$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta$, and $\hat{u}_a = \mu_z(W_a + R_a) + (1 - \mu_z)\sum_{i=z}^{m} \rho_i W_i - \hat{\delta}$. So, simple computation give $J(1, \delta) = \{L\}$ if $x_z < \delta \leq y_z$, where $x_z = (1 - \mu_z)(W_{m-1} + R_{m-1} - \sum_{i=z}^{m} \rho_i W_i) + \hat{\delta}$, and $y_z = (1 - \mu_z)(W_m + R_m - \sum_{i=z}^{m} \rho_i W_i) + \hat{\delta}$. So, then $\phi(J(1, \delta)) = 1$ if $\delta \in (x_z, y_z]$. But then

$$u_m((1, \delta), \phi(J(1, \delta)), \hat{\pi}) = R_m + W_m - \delta, \qquad \delta \in (x_z, y_z]$$

So, for ε small,

$$\begin{aligned}
\hat{u}_m &= \mu_z(W_m + R_m) + (1-\mu_z)\sum_{i=z}^{m} \rho_i W_i - \hat{\delta} \\
&< R_m + W_m - (1-\mu_z)(R_{m-1} + W_{m-1}) + (1-\mu_z)\sum_{i=z}^{m} \rho_i W_i - \hat{\delta} - \varepsilon, \quad \mu_z < 1 \\
&= R_m + W_m - (1-\mu_z)\left(R_{m-1} + W_{m-1} - \sum_{i=z}^{m} \rho_i W_i\right) - \hat{\delta} - \varepsilon \\
&= R_m + W_m - (x_z + \varepsilon) \\
&= u_m((1, x_z + \varepsilon), \phi(J(1, x_z + \varepsilon)), \hat{\pi})
\end{aligned}$$

So the semi-separating equilibrium fails the IC, as claimed. □