Essays on Political Contracts

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Preface

This thesis originated during my work as a research assistant at the chair of Prof. Dr. Hans Gersbach, at first at the University of Heidelberg, Germany, and subsequently at the Swiss Federal Institute of Technology (ETH) Zurich. I want to briefly acknowledge several people who considerably helped me in my work.

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# Contents

Thesis Summary .................................................. 7

1 Introduction .................................................... 9
   1.1 Motivation .................................................. 9
   1.2 Political Contracts: Theoretical Concept .................. 10
   1.3 Political Contracts: Practical Examples .................... 12
   1.4 Issues ..................................................... 13
   1.5 Structure of the Thesis .................................... 14

2 Motivation of Politicians and Long-term Policies .......... 16
   2.1 Introduction ................................................ 16
   2.2 Model and Assumptions ..................................... 19
      2.2.1 Political Contracts ..................................... 19
      2.2.2 Sequence of Actions ..................................... 20
      2.2.3 Policy Projects .......................................... 21
      2.2.4 Politicians’ Utility ...................................... 23
      2.2.5 Tie-Breaking Rules ...................................... 25
   2.3 Elections alone .............................................. 25
   2.4 Competition for Political Contracts ....................... 28
      2.4.1 Competition in the Case of Voters’ Commitment ....... 29
      2.4.2 Competition without Commitment ...................... 31
   2.5 Extensions .................................................. 34
2.5.1 Asymmetric Information ................. 35
2.5.2 Punishment in the Case of poor Performance .......... 37
2.5.3 Validity when the Politician is no longer in Office ....... 42
2.5.4 Other Utility Functions .................. 43
2.6 Implementation Problems .................. 49
2.7 Conclusion and Perspectives ................. 51

3 Elections, Contracts, and Information Markets ......... 53

3.1 Introduction ................................ 53
3.2 The Basic Model ............................. 55
  3.2.1 The Election Framework .................. 55
  3.2.2 The Information Structure ................. 56
  3.2.3 Reelection Schemes ...................... 57
  3.2.4 Preferences of Politicians ................. 59
  3.2.5 Summary ................................ 59
3.3 Elections Only ............................... 60
  3.3.1 Behavior of Dissonant Politicians .......... 60
  3.3.2 Behavior of Congruent Politicians ......... 62
3.4 The Triple Mechanism ........................ 63
  3.4.1 Reelection Thresholds .................... 63
  3.4.2 Reelection Schemes ...................... 64
  3.4.3 Summary ................................ 64
  3.4.4 Robust Election Scheme ................... 65
  3.4.5 Equilibrium Notion ....................... 66
  3.4.6 Equilibria ............................... 66
3.5 Extensions .................................. 68
  3.5.1 Monotonic Election Scheme and Overpromising ....... 69
  3.5.2 Sophisticated Election Scheme ............. 70
3.5.3 Market-Based Voting ........................................... 71
3.5.4 Repeated Action .............................................. 71
3.6 Conclusion ....................................................... 71

4 Flexible Pensions for Politicians 73

4.1 Introduction .................................................... 73
4.2 Related Literature ............................................. 74
4.3 The Basic Model ............................................... 76
  4.3.1 The Effort Decision ....................................... 76
  4.3.2 The Utility ................................................... 76
  4.3.3 The Information Structure ................................ 78
  4.3.4 The Reelection Scheme .................................... 78
  4.3.5 Summary ..................................................... 79
4.4 Results under Fixed Pensions ............................... 80
  4.4.1 First-Best Solution ....................................... 80
  4.4.2 Fixed Pensions and the Reelection Mechanism ......... 81
4.5 The Model with Flexible Pensions ........................... 82
  4.5.1 The Information Market ................................... 82
  4.5.2 Flexible Pensions .......................................... 84
  4.5.3 Summary ..................................................... 84
4.6 Results under Flexible Pensions ............................. 85
  4.6.1 Pricing on the Information Market ....................... 85
  4.6.2 Linear Dependence of Pension and Effort ................ 86
  4.6.3 Welfare Effects ............................................ 88
4.7 Extensions ....................................................... 90
  4.7.1 Manipulations by the Incumbent ......................... 90
  4.7.2 Balanced Budgets .......................................... 91
4.8 Practical Considerations ...................................... 92
5 Vote-Share Contracts and Learning-by-Doing

5.1 Introduction ................................................. 94
5.2 Related Literature ........................................ 95
5.3 The Model .................................................. 98
  5.3.1 Agents and Incumbency Advantage ................. 98
  5.3.2 Policies and Utilities ................................. 98
  5.3.3 Assumptions and Equilibrium Concept .............. 101
  5.3.4 The Overall Game ..................................... 102
5.4 Elections Alone ............................................ 102
  5.4.1 The Second Period .................................... 103
  5.4.2 The First Period ..................................... 103
5.5 Results with Vote-Share Contracts ...................... 107
  5.5.1 Vote-Share Thresholds as Political Contracts ...... 107
  5.5.2 The Second and First Period ......................... 108
  5.5.3 Competition for Vote-Share Contracts .............. 109
5.6 Welfare Effects ............................................ 111
  5.6.1 Effects on Expected Effort ......................... 111
  5.6.2 Effects on Expected Ability in Period 2 .......... 112
  5.6.3 Total Welfare Effects ............................... 114
5.7 Extensions .................................................. 117
  5.7.1 No Output-Shift Policy ............................. 117
  5.7.2 Asymmetric Competition and Larger Time Horizon .. 117
  5.7.3 Alternative Institutional Settings .................. 118
5.8 Conclusion .................................................. 119

6 Conclusions .................................................. 120
Thesis Summary

In this thesis we deepen the theory of political contracts, which are proposed as a means of solving deficiencies in democracies. The purpose of this work is first to illustrate our proposals containing political contracts in simple political agency models and second to show that the adequate use of political contracts, combined with democratic elections, can – on balance – improve social welfare. Our analysis is a normative exercise in the sense that we search for improvements of existing democratic mechanisms.

We obtain the following main results: First, inefficient short-term public projects may be undertaken less often when politicians are more interested in holding office than in the performance of their policy projects. Second, political contracts may alleviate deficiencies in the provision of socially optimal long-term projects. Third, a combination of reelection threshold contracts and of data from political information markets can induce dissonant office-holders to choose socially optimal policies even if the performance of long-term projects is not observable in the short run. Fourth, flexible pensions for politicians may solve motivation problems of an incumbent who knows that he is in his final term of office. Fifth, we examine vote-share contracts, a special type of political contracts. As they limit the advantages of incumbency, one might expect vote-share contracts not to be desirable if incumbency brings about positive effects. Yet, we show that vote-share contracts seem to be welfare-enhancing even in the presence of socially beneficial incumbency effects due to learning-by-doing. Finally, it is possible to generate verifiable data upon which political contracts can be conditioned, either by using prediction figures from political information markets or by applying the result of the next election directly.
Zusammenfassung


Chapter 1

Introduction

1.1 Motivation

To our knowledge, the free and anonymous elections practiced in liberal democracy are the best field-tested system for collective decision-making. However, a range of potential inefficiencies of democracy remains to be alleviated, in particular as to the performance of office-holders. For instance, an office-holder might exert less effort than would be socially desirable, or he might concentrate his efforts on projects with short-term results, and neglect long-term policies.\(^1\)

These inefficiencies are connected with the democratic reelection mechanism. Although one would expect good performers to be reelected and bad ones deselected, that does not always happen. It may be due to the fact that sometimes, there is no direct connection between the reelection result of an office-holder and his past performance.

- If this performance can be evaluated on reelection day, which would permit *retrospective voting*, i.e., to make politicians accountable at the end of their term, it can prove rational for voters to disregard this performance in view of the expected performance of his opponent, be it that this opponent is expected to perform better or worse. Under such *prospective voting*, the assessment of an incumbent’s performance is altered by the (expected) quality

\(^1\)Inefficiencies in politics are identified e.g. in Buchanan and Tullock (1962), Olson (1965), Niskanen (1971), Olson (1982), Tollison (1982), Frey (1983), Mueller (1989), Stiglitz and Heertje (1989), Bernholz and Breyer (1994) and Dixit (1995). Current research results on political inefficiencies are summarized e.g. in Drazen (2000) and in Persson and Tabellini (2000).
CHAPTER 1. INTRODUCTION

of his opponent.²

• A politician’s performance may also yield results in the next term only, thus preventing the voters from evaluating it accurately on reelection day. This may deter office-holders from undertaking long-term public projects in spite of the social benefits they might yield. This occurs in particular when such long-term projects involve costs for voters today: To boost their reelection chances, office-holders might prefer to invest effort in short-term projects. This may explain, e.g., why reforms of labor markets are not undertaken.³

• Short-termism is particularly strong if persons who will benefit from a long-term project are not born or not old enough to vote yet. This type of deficiency, and lack of intergenerational fairness, might influence policies in various areas, such as global warming⁴ and public debt accumulation⁵.

Some of the inefficiencies of the reelection mechanism may be alleviated by concerns of incumbents about their further career in other positions than public office. However, this “career argument” partially suffers from drawbacks similar to those of the reelection mechanism: For instance, office-holders will have incentives to pursue short-term policies in order to improve their outside options and thus, socially optimal long-term policies or policies that benefit future generations may not be implemented.

1.2 Political Contracts: Theoretical Concept

As reelection is not directly linked to good performance, it may prove useful to propose a mechanism to strengthen this connection. One solution proposal to alleviate

²There exists a large literature on electoral accountability which was initiated by Barro (1973) and Ferejohn (1986) and extended by Persson, Roland, and Tabellini (1997). This literature has established the advantages and drawbacks of democratic elections in making office-holders accountable. For details concerning retrospective voting behavior see e.g. Key (1966) or Paldam (1981). The argument that rational voters should behave in a forward-looking manner goes back to Downs (1957). Lewis-Beck and Paldam (2000) provide empirical evidence on the weight of backward and forward looking components in voting.

³A detailed description of the roots of unemployment in Europe, including political deficiencies, can be found e.g. in Saint-Paul (2000) or Blanchard (2006).

⁴Temperature increases resulting from rapidly rising emissions of greenhouse gases may strongly and adversely affect the well-being of future generations (see e.g. Cline (1992), Fankhauser (1995), Nordhaus (2006), Stern (2006), and IPCC (2007)).

⁵See e.g. Drazen (2000).
political inefficiencies is to supplement liberal democracy with political contracts. This idea was introduced in Gersbach (2003) and advanced, e.g., in Gersbach and Liessem (2003), Gersbach (2007), and Gersbach and Liessem (2008)).

Political contracts are certified election promises, and define a remuneration to be awarded to (or an sanction to be imposed on) an office-holder, depending on whether his performance fulfills the electoral promises or not. Politicians are free to offer such contracts. Political contracts have to be approved by an independent body, and they are subordinated to the rules of liberal democracy, i.e. only contracts that do not alter the fundamental values of liberal democracy can become political contracts. Thus, a hierarchy of elections and political contracts is generated which we will sometimes call dual democracy. Political contracts differ from contracts in the private sector, as they are no agreement between two parties, but a one-sided written commitment to promises coupled with remunerations and sanctions.

Political contracts are sometimes also called incentive contracts for politicians. There exists an extensive literature on incentive contracts in general. The analysis of incentive problems in the classical principal-agent framework started with Mirrlees (1976), Holmström (1979), and Grossman and Hart (1983).

It is important for the application of political contracts that the performance of a politician can be measured adequately. Recent developments suggest that the set of political tasks allowing adequate performance measurement has grown. For instance, the Zurich Aircraft Noise Index is a standardized index to measuring the noise caused by airplanes. If 47000 people living close to the airport are experiencing noise above some threshold of this index, policy changes have to be enacted.

In the field of politics, it is plausible to assume that political contracts will be applicable mainly for members of the executive branch, as they have sufficient power to influence decisions and policy results. The contracts can be applied at

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6 A comprehensive presentation of initial results concerning ideas, opportunities, and obstacles of political contracts can be found in Gersbach (2008).

7 For contract theory in the private area see e.g. Bolton and Dewatripont (2005).

8 One can distinguish incentive schemes based on objective performance measurement (see e.g. Baker (1992) and Lazear (2000)) and incentive mechanisms based on subjective performance assessments (see e.g. Gibbons (1998)). We will use objective performance measures, namely an observable and verifiable result of a particular policy project in chapter 2, the price on a political information market in chapter 3 and 4, and finally an election result in chapter 5.
There are in principle two different kinds of political contracts:

- First, one could use *monetary political contracts*, where the remuneration of a politician depends on his performance in certain areas, e.g., on the amount of public debt or on the rate of unemployment he achieves. The incumbent may receive a monetary bonus if his performance is good, and may suffer a monetary loss in case of poor performance. This type of political contract parallels bonus payments for managers in the private sector. However, one cannot judge monetary political contracts by the theory of manager compensation, as politicians are selected and deselected by public elections.

- Second, one could use *threshold contracts*, where an office-holder is only allowed to run for reelection if he has fulfilled his political contract, e.g., if the rate of unemployment is below a certain threshold at the end of his term in office. Alternatively, the right to stay in office for a further term may be made directly dependent on whether the incumbent reaches a pre-specified share of votes above 50%. In the latter case, the threshold is called *vote-share threshold*.

Monetary contracts may be useful to solve long-term problems. Suppose for example that an office-holder will receive a higher remuneration in future terms if his policy reforms turn out to have been successful. This would motivate politicians to undertake far-sighted projects. The use of threshold contracts may encourage office-holders to exert higher effort. Finally, contracts with vote-share thresholds may be used to reduce socially detrimental advantages of incumbency.

### 1.3 Political Contracts: Practical Examples

In this section we provide some examples of incentive elements for politicians. One historical parallel can be found in ancient democratic Athens, about 460 - 330 B.C., where office-holders were selected by lot. Each politician had to justify his financial management at the end of his term of office and, upon request, was made liable. An office-holder could be punished for poor performance by losing
CHAPTER 1. INTRODUCTION

This page contains a discussion on the practical implementation of political contracts, as well as a section on issues related to the performance of office-holders.

More recent parallels can be found in Canada. In the “Balanced Budget Act” (1999), the province of Ontario forced a 25% salary reduction on members of the Executive Council if budget objectives were not achieved. Salaries were to be reduced by 50% if deficits occurred repeatedly. An excerpt of the “Balanced Budget Act” can be found in Appendix A. Similar mechanisms were implemented in the province of British Columbia, and in Manitoba. In the Canadian province Yukon, the “Taxpayer Protection Act” (1996) even required new elections in the case of a fiscal deficit. This situation did not remain stable. The “Balanced Budget Act” in Ontario was repealed in 2004 and replaced by the “Fiscal Transparency and Accountability Act”, which permits short-term fiscal deficits and no longer prescribes salary reductions for members of the Executive Council.

These examples illustrate that practical implementations of political contracts seem to be possible, at least for certain applications. However, most democracies do not allow political contracts. In this thesis, we will deepen the theory of political contracts and thus narrow the gap between theoretical concepts and practical implementation.

1.4 Issues

The current political contract theory leaves a number of issues open, which we would like to address from a normative perspective:

1.) How does the performance of an office-holder depend on his preferences? Which is preferable for society: incumbents who are motivated by the desire

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9 A detailed description of Athenian democracy can be found e.g. in Bleicken (1991), Elster (1999), and Schwartzberg (2004).

10 Such salary cuts have in fact taken place in Ontario.

11 Attempts to implement such salary cuts for ministers in Germany have been made by the leader of the Liberal Party of Baden-Württemberg, one of the Federal States in Germany. Homburger (2005) proposes a social contract where political parties commit themselves to objectives of the government before elections are held and where cabinet members lose 10 to 30% of their wages if these aims are not met.

12 Details about these mechanisms and about their effects on fiscal deficits can be found in Kennedy and Robbins (2001).

13 For details on the replacement of the “Balanced Budget Act” by the “Fiscal Transparency and Accountability Act” and on the party system in Ontario, see e.g. Pond (2005).
to hold office or by the desire to implement particular policies? How do political contracts affect this comparison?

2.) Political contracts must be based on verifiable data. However, project results may be unobservable in the short run or may even never be verifiable. Are there possibilities to make non-verifiable information verifiable, so that it can be used in political contracts?

3.) How can an office-holder be encouraged to exert high effort when he already knows that it is his final term in office? Can political contracts be used to alleviate this problem?

4.) How do incumbency advantages impact the effectiveness of political contracts? Are vote-share thresholds socially desirable when incumbency advantages are socially welcome?

1.5 Structure of the Thesis

The remainder of this thesis is structured as follows: In the next chapter\textsuperscript{14} we analyze the behavior of incumbents differing as to the utilities they derive from holding office and from project results. We show that inefficient provision of public projects decreases when politicians are mainly interested in holding office. Moreover, we show that political contracts can alleviate inefficiencies in the provision of long-term public projects, independent of the motivation of politicians. Office-motivated politicians, however, need smaller remunerations than policy-oriented politicians to be induced to undertake beneficial long-term policy projects.

We tackle the problem that verifiable data for political contracts may be unavailable in chapter 3.\textsuperscript{15} We propose to use political information markets. As to the political information market, we suggest a prediction market similar to www.intrade.com, setting a “market price” that estimates an office-holder’s chances of being reelected, based on aggregated information from experts. In this case, the political contract looks as follows: Before election, the candidate writes down the percentage of reelection chances he has to reach on such a market by the end of his term. This market price would serve as an indicator for the quality of the

\textsuperscript{14}A short version of chapter 2 has been published as Müller (2007). This publication is available at http://www.springerlink.com/content/u02n2113w2173853.

\textsuperscript{15}A precursor of chapter 3 has appeared as Gersbach and Müller (2006).
office-holder’s performance. We show in chapter 3 that a combination of threshold contracts and political information markets can induce dissonant politicians to choose socially optimal policies.

To address the third set of issues in chapter 4, we develop flexible pensions for politicians as a particular type of political contracts. We introduce a system where the pension of a politician depends on his performance during his last term in office, measured again by a price obtained from an information market. Such a scheme induces an incumbent to work hard even if he knows that he is in his final term.

In chapter 5 we analyze whether vote-share contracts are able to alleviate detrimental aspects of incumbency advantage without impairing socially beneficial advantages of incumbency. We show that this is indeed the case.

In chapter 6 we summarize our results, and open further avenues of research on political contracts. Finally, Appendices B - E contain a variety of proofs and some additional material from the subsequent chapters.

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16Political information markets perform quite well in predicting election results as has been shown in empirical contributions by Berg, Forsythe, and Rietz (1996) and Berlemann and Schmidt (2001).
Chapter 2

Motivation of Politicians and Long-term Policies

2.1 Introduction

Managers of private firms typically receive performance-related wages. Flexible wages for managers – like stock options for example – combine their remuneration not with an individual but with a company-wide success index. Such monetary incentives for managers are helpful to attenuate conflicts of interests in companies.

In the field of politics there are often decision problems concerning long-time horizons. Thus, it is important to give incentives to the incumbent to undertake the project that is socially optimal in the long run. We will analyze this problem of long-term policies and will search for incentives that motivate the politician to choose the efficient action. The problem of motivating people to use a long-dated perspective also exists in companies as becomes apparent in the statement of Murphy and Oyer (2003) that “paying an executive based on current accounting earnings rather than long-run shareholder value provides no incentives to take actions today that increase future profits.”

Monetary incentive settings are not common in contemporary politics. Politicians receive fixed wages, irrespective of their political performance. One may ask why it is not common to remunerate politicians in a performance-related way. Some people put forward the argument that the political process is unsuitable for flexible remuneration schemes. Another aspect is that the effect of monetary incen-

\[1\text{See Murphy and Oyer (2003), page 5.}\]
CHAPTER 2. MOTIVATION OF POLITICIANS

In politics, the motivation of politicians is not so clear. One could argue that politics should be a mission and that the remuneration would just be a distraction. In this chapter, we try to analyze the effects of performance-related wages for politicians by introducing the concept of monetary political contracts.

The analysis of incentive elements in politics has been initiated by Gersbach (2003), who investigates whether political contracts are able to mitigate the so-called “down-up-problem”: There is one policy project that is not efficient in the long run but leads to good results in the short run. Another option is to undertake a long-term orientated policy project that is less successful in the short run but leads to the socially efficient result in the long run. The paper shows that under certain circumstances the incumbent might prefer to implement the socially inefficient short-term orientated policy to increase his reelection chances. The major result of Gersbach (2003) is that political contracts may help to alleviate this dilemma.

There are some other relevant branches of literature for this chapter. First, there is a growing range of literature on the optimal remuneration of politicians (see e.g. Poutvaara and Takalo (2003), Besley (2004), and Messner and Polborn (2004)). Second, there is a discussion about the effects that term limits for politicians have on incentives of politicians. An extensive overview of the literature concerning term limits can be found in Smart and Sturm (2004).

Third, and directly relevant for our purposes, there is the literature on populist politicians (see e.g. Canovan (1981) and Gersbach (2004c)). Canovan (1981) criticizes verbally the prevalent opinion that populism is dangerous to democracy. She comes to the conclusion that popular decisions are central to democracy and thus populists might be considered as extremely democratic. We provide an analytical result in the same direction: Populism is not necessarily detrimental for society. This is in contrast to the results in Gersbach (2004c) where populism may lead to undesirable outcomes. These contrarious results emanate from some crucial differences in the assumptions. In Gersbach (2004c) voters do not know the type of politicians and whether a politician is competent or not. One result of Gersbach (2004c) is that populists try to mimic the behavior of statesmen and want to appear as competent in order to increase their reelection chances. As a consequence, policy decisions are distorted and thus populism leads to undesir-

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2The argument that higher wages might deteriorate the pool of candidates sounds quite plausible. This debate has not yet been resolved and we circumvent this problem by taking the pool of candidates as exogenously given in this chapter.
able outcomes. The focus in our work is different: In the basic version, there are no information asymmetries but politicians lack incentives to undertake long-term beneficial projects.

We present in this chapter the combination of elections and competition of politicians for monetary political contracts as a powerful control mechanism for democratic societies. Although we add contractual accountability to politicians, we are aware of the fact that the principles of democracy have to be adhered to. We use a similar model to that of Gersbach (2004a). Voters are assumed to be fully rational and we permit politicians to offer monetary contracts during their campaigns while there is also the familiar control mechanism of periodic, free and anonymous elections. The contract connects the remuneration of the incumbent to his political performance. The elected politician has to implement one type of policy. His options are a socially efficient policy, a socially inefficient policy and the status quo. The results are derived in two different scenarios: In the commitment scenario voters are able to commit themselves to a reelection scheme depending on the policy performance. This reelection scheme is announced before the elected politician starts his first term. The second case is the more realistic framework of non-commitment where the public is not able to commit itself to such a reelection scheme. In both scenarios the game is finished after the second period. This may be interpreted as a two-period term limit for politicians.

In contrast to Gersbach (2004a) we allow for different types of politicians concerning their utility function. One type of politician is mainly motivated by benefits from holding office. Hence, he will try to pursue a policy that gives him the best chances of being reelected. We will call this politician a “populist”. The other type of politician has private benefits from positive results of his implemented policy. Thus, we will refer to this politician as a “policy success-seeker”. Another contrast to Gersbach (2004) is the fact that we consider two different cases depending on whether political contracts are only a device to reward the incumbent or whether politicians can also be punished by the contract.

Our main results are as follows: First, without political contracts the incumbent will undertake the socially inefficient policy if he is mainly motivated by positive results of his implemented policy. Second, if politicians are permitted to offer incentive contracts, it will always be possible to motivate the incumbent to implement the socially optimal policy. This result is true both in the case where voters can commit themselves to a reelection scheme and in the case where voters are
not able to make such a commitment. The result that political contracts solve the
motivation problem is also robust under various extensions like asymmetric infor-
mation or modified utility functions of the politicians. While the helpfulness of
incentive contracts remains valid in each scenario, the necessary amount of transfer
changes from case to case. Finally, the third interesting issue is the fact that it
may be advantageous for society if politicians are to a certain extent populistic.
This result is also true both in the commitment scenario as well as in the non-
commitment case and is at least robust to some modifications of the politicians’
utility functions.

This chapter is organized in the following way: We present our model and the
assumptions in section 2.2. In section 2.3, we look at the efficiency of the election
mechanism when incentive contracts are prohibited. In section 2.4, we allow politi-
cians to offer incentive contracts and observe that the dual mechanism of elections
and political contracts solves the inefficiency problem. We extend our analysis
in various directions in section 2.5. In section 2.6, we focus on implementational
problems. Finally, section 2.7 concludes.

2.2 Model and Assumptions

Our model is close to that of Gersbach (2004a). We consider a dynamic game with
two periods. Before the first period starts, two risk-neutral politicians, indexed by
\( i = 1 \) and 2, compete for office. In the first period, the elected candidate makes
a policy decision about undertaking a project. An implemented project generates
returns in both periods, denoted by \( V^1 \) and \( V^2 \), respectively. Later on the returns
will be subscripted according to the type of project. In the basic version of the
model, all politicians and all voters are perfectly informed. Thus, there are no
problems of asymmetric information.

2.2.1 Political Contracts

In this chapter we use the monetary type of political contracts by making the
remuneration of a politician dependent on his political performance. We look
at one single political outcome, e.g. the unemployment rate, and we introduce
a performance-related remuneration based on this figure. We assume that each
politician $i$ offers a value $\beta_i$ that determines the share of the policy result that becomes a reward or punishment for the politician. We give a short numerical example neglecting the problems that arise when the social benefits of a project are quantified. Imagine, for example, that politician $i$ offered $\beta_i = 0.01$ and that he implemented a project that increased social welfare by 100 million Euro. In this case the politician gets a reward amounting to 1 million Euro if he is still in office.

Note that we assume that political contracts only cause payment transactions if the relevant politician is still in office. This assumption is made in the style of the private sector where incentive elements are only used as long as the managers work at the company. Otherwise there is the danger that a politician or manager will get punished for potential mistakes of his successor. Nevertheless, the assumption that incentive contracts are only relevant as long as the politician stays in office is not crucial for our qualitative results. We will discuss the effect of relaxing this assumption in the extensions.

We will distinguish different cases concerning the scope of political contracts. It is possible that incentive contracts contain rewards and punishments as incentive elements. Another possibility is that only punishments are used as in the historical example in ancient Greece where politicians were punished for poor performance (see section 1.3). Finally it is possible that politicians are rewarded in the case of good performances, while they are not punished in the case of poor performances.

This unequal treatment can be justified as follows: The suggested model of political contracts can only (at least in many democratic systems) be implemented by politicians themselves. While it seems to be easy to imagine that politicians will accept rewards for a successful term of office, it appears to be rather unlikely that they will pass a bill including punishments for a poor performance. Therefore, we will only allow rewarding politicians in the basic version of our model, while we will analyze the case of both rewards and punishments for politicians later on in section 2.5.

### 2.2.2 Sequence of Actions

The complete game is given as follows:

**Stage 1:** At the beginning of period 1 both politicians simultaneously offer incentive contracts $C_1(\beta_1 V^2)$ and $C_2(\beta_2 V^2)$ (with $0 \leq \beta_i \leq 1$) to the public.
These contracts have the following consequences: In the case of re-election in period 2, politician \( i \) receives a net transfer \( \beta_i V^2 \) if \( V^2 \geq 0 \), while a negative value of \( V^2 \) has no consequences, i.e. the politician receives neither a transfer nor has to pay any penalties.

Stage 2: The public decides which politician gets elected. We use \( p_i \) to denote the probability that politician \( i \) will be elected. We assume that \( p_1 + p_2 = 1 \) and that \( 0 \leq p_i \leq 1 \).

Stage 3: The incumbent has to make a decision about undertaking policy projects. There are three possibilities: He can choose a short-term policy (\( STP \)), he can undertake a long-term policy (\( LTP \)) or he can continue with the status quo and do nothing (\( NOT \)). We describe the policy projects in the next subsection.

Stage 4: Voters observe the returns from the first period. The incumbent decides whether he wants to run for office again. The public decides on the re-election of the politician and the incumbent \( i \) gets reelected with probability \( q_i \) \( (0 \leq q_i \leq 1) \).

### 2.2.3 Policy Projects

The returns to the public from the options \( STP \), \( LTP \) and \( NOT \) in period \( j \) are denoted by \( V^j_S \), \( V^j_L \), and \( V^j_N \), respectively. Note that we assume that the policy results are perfectly observable to voters.\(^3\) The short-term policy \( STP \) generates a positive return \( V^1_S > 0 \) in the first period, but a negative return \( V^2_S < 0 \) in the second period. The long-term policy \( LTP \) is assumed to have no short-term consequences (i.e. \( V^1_L = 0 \)),\(^4\) but generates positive payoffs \( V^2_L > 0 \) in the second period. If the politician continues with the status quo and thus chooses the option \( NOT \), the payoffs are \( V^1_N = V^2_N = 0 \), as the social returns from the status quo are

---

\(^3\)This assumption is made since we wish to show that the election mechanism is not always able to motivate the elected politician to undertake the socially efficient policy. If this is not possible in the case of perfectly observable project results then it will not be possible under any other scenario. When voters cannot perfectly observe the policy results, incentive contracts will still be efficient even though their costs might increase. Hence, one could extend the model to the case where there are errors in observing project results without changing the conclusions of this chapter.

\(^4\)The short term consequences of \( LTP \) can sometimes even be negative, but this would only reinforce the results of this chapter.
normalized to zero. Hence, the results of \( LTP \) and \( STP \) indicate the differences to the status quo.

The expected returns to the public from the options \( STP, LTP \) and \( NOT \) are denoted by \( EV_S, EV_L, \) and \( EV_N, \) respectively. Thus:

\[
EV_S = V^1_S + \delta V^2_S, \\
EV_L = \delta V^2_L, \\
EV_N = V^1_N + \delta V^2_N = 0.
\]

\( \delta \) is the discount factor of the public \((0 < \delta \leq 1)\). Furthermore, we assume that

\[
V^1_S > EV_L, \\
EV_L > EV_N > EV_S.
\]

The last assumption immediately implies that the socially optimal policy is \( LTP \).

There are many examples for the problem where a policy has only a poor (or even a negative) performance in the short term but is socially optimal in the long run. For instance, labor market reforms can cause higher unemployment by suspensions of staff for a short time, while resulting additional jobs only emerge gradually. Higher investments in education may lead to higher taxes in the short run, while there is a positive effect on public welfare in the long run caused by the growing human capital. The transition of centrally planned economies towards market economies may imply welfare deteriorations in the short term as existing structures of economy have to be destroyed. Nevertheless, the change of the economic system may generate benefits in the long term. Note that politicians often adopt short-term policies instead of long-term policies before elections in order to get fast successes to assure their reelection.\(^5\)

We assume that contracts can be conditioned on political results measured for instance by GDP growth, rate of unemployment or criminal statistics.\(^6\) However, we assume that contracts cannot be conditioned on the policy choice itself, as this would require complete contracts including all possible laws and policies, which seems to be impossible.\(^7\)

\(^{5}\)There is a widespread range of literature on such political business cycles (see, for example, Nordhaus (1975), Hibbs (1977) and Persson and Tabellini (1993)).

\(^{6}\)For simplicity of exposition, contracts are assumed to be linear in these figures. Since the results in the second period can only take three values, this assumption could easily be relaxed.

\(^{7}\)Detailed information concerning incomplete contracts can be found for example in the survey of Hart (1995).
2.2.4 Politicians’ Utility

We assume that the politician is genuinely concerned about the social return he generates, as long as the outcomes of policies occur while he is in office. The politician receives private benefit if the implemented project generates a social return larger than the return of the status quo as long as he is in office. The private benefit is given by \( \alpha \cdot \max\{V, 0\} \), with \( 0 < \alpha < 1 \). The parameter \( \alpha \) measures to what extent the candidates receive a private benefit of the social return generated by their implemented policy. Alternatively, the private benefit could arise from the fact that high returns enable the politician to pay some returns to interest groups that support him, as is suggested by a large range of literature on public choice (see e.g. Mueller (1989)). We follow the first interpretation, which simplifies the analysis.\(^8\)

A second source of private utility is benefits from holding office. These benefits are denoted by \( B > 0 \) and can include monetary rewards as well as non-monetary benefits like prestige or the satisfaction of being in power.\(^9\)

The utility of outside options is assumed to be zero. That means that the costs and benefits of a politician are normalized to zero, if he is not in office.

We consider the expected utility of politician \( i \), denoted by \( U_i \), in period 1 when he campaigns for office for the first time. We assume

\[
U_i = p_i \left\{ (1 - m_i) B + m_i \alpha V^1 + \delta q_i \left[ (1 - m_i) B + m_i (\alpha + \beta) \cdot \max\{0, V^2\} \right] \right\} \tag{2.1}
\]

We assume that the politicians and the public have the same discount factor \( \delta \). The parameter \( m_i \) is the significance agent \( i \) assigns to private returns from projects and to transfers according to the incentive contract, while \( (1 - m_i) \) is the significance of benefits from holding office. The values \( m_1 \) and \( m_2 \) are exogenously given for both candidates at the beginning of the game. For the moment we assume \( 0 \leq m_i \leq 1 \).\(^{11}\) A value of \( m_i \) close to 1 means that the agent is mainly motivated

---

\(^8\)Note that \( \max\{V^1, 0\} = V^1 \), since \( V^1 \) is assumed to be non-negative under all three possible projects.

\(^9\)The second interpretation yields the same qualitative conclusions, but voters must consider that some returns from projects are lost for the public, as they are removed by the politician to compensate the interest groups supporting him. Furthermore, there is somehow a “moral” difference between these two interpretations which will be mentioned again in the extensions.

\(^{10}\)We assume that the non-monetary benefits of \( B \) are converted into a monetary value so that we are able to calculate with all utility components in one utility function.

\(^{11}\)Later we consider a higher minimum level for \( m_i \).
by the policy he implements. A low value of \( m_i \) corresponds to a politician who is mainly concerned with holding office. In other words, one could call a politician with high-valued \( m_i \) a “policy success-seeker”, while a politician with \( m_i \) close to 0 appears to be rather an “office-seeker” who is concerned about being reelected. We allow for the fact that politicians may differ in the factor \( m_i \) \((i = 1, 2)\). The values \( m_i \) are known to both politicians. Furthermore, we assume in the following that \( m_1 \) and \( m_2 \) are known to the public. It is often well-known whether a politician is more interested in the results of his policy or in benefits from holding office, especially if the incumbents have already had long political careers. We will relax the informational assumptions about \( m_i \) in section 2.5.1. Without loss of generalization we label candidates such that \( m_1 \geq m_2 \).\(^{12}\) We immediately obtain

- the utility of an elected politician \( i \) if he has offered the contract \( C_i(\beta_iV^2) \), undertakes \( LTP \) and is reelected:

\[
U^L_i(\beta_i, q_i = 1) = (1 - m_i)B + \delta \left\{ (1 - m_i)B + m_iV^2_L(\alpha + \beta_i) \right\} \tag{2.2}
\]

- the utility of an elected politician \( i \) if he has offered \( C_i(\beta_iV^2) \), undertakes \( STP \) and is reelected:\(^{13}\)

\[
U^S_i(\beta_i, q_i = 1) = (1 - m_i)B + m_i\alpha V^1_S + \delta(1 - m_i)B \tag{2.3}
\]

- the utility of an elected politician \( i \) if he has offered \( C_i(\beta_iV^2) \), undertakes \( STP \) and is not reelected:

\[
U^S_i(\beta_i, q_i = 0) = (1 - m_i)B + m_i\alpha V^1_S \tag{2.4}
\]

Note that \( U^S_i(\beta_i, q_i = 1) \geq U^S_i(\beta_i, q_i = 0) \), as \( B > 0 \). Therefore, voters can always punish a politician by not reelecting him. Furthermore, running for reelection is a weakly dominant strategy for a politician irrespective of his project choice. Thus, in our analysis we do not have to consider the case where a politician does not want to run for reelection.

\(^{12}\)Our main results can easily be extended to more than two politicians and to values \( m_i \) picked from a continuous set. For instance, in the case of three or more politicians, only those two politicians with the lowest values \( m_i \) matter for Propositions 2.3, 2.4 and 2.5 and the corresponding Corollaries.

\(^{13}\)Note that the utility from private returns and from transfers according to the incentive contract in the second period is 0, as \( \max\{V^2_S, 0\} = 0 \).
2.2.5 Tie-Breaking Rules

We use the following three tie-breaking rules which simplify our exposition but are not essential for the results:

- First, if two politicians generate the same social welfare, the public will elect the politician with the lower factor $m_i$.\footnote{This rule perhaps sounds surprising as a “policy success-seeker” – corresponding to a high value of $m_i$ – seems to be preferable to a populist. Nevertheless, as we will see later, the situation is the other way around: The lower the value of $m_i$, the easier it gets to implement $LTP$.}

- Second, if both politicians generate the same social welfare and are identical in terms of the factor $m_i$, both politicians will have the election probability $p_1 = p_2 = \frac{1}{2}$.

- Third, if two policies yield the same utility for the incumbent, he will select the policy that yields higher social welfare.

2.3 Elections alone

By assumption, the optimal policy for the public is $LTP$. In this section we analyze how voters can induce the politician to undertake $LTP$ if their only influence on him is the election mechanism. Hence, no political contracts can be offered in this first part of the analysis. At first we assume that voters can commit themselves in stage 1 to their reelection scheme in stage 4 in order to give the election mechanism the largest possible power to motivate the elected politician to undertake $LTP$. Voters announce two reelection probabilities depending on the result they observe. If the politician undertakes $STP$, the public will observe $V_1$ and will reelect the politician with probability $q(V_1)$. If the politician undertakes $LTP$ or $NOT$, voters will observe a result of 0 and will reelect the politician with probability $q(0)$. Under these assumptions we obtain our first Proposition:

Proposition 2.1

Suppose that voters can commit to a reelection scheme in stage 1, but no incentive contracts can be offered. If $m_i > \hat{m}(\delta)$ with

$$
\hat{m}(\delta) = \frac{\delta B}{\alpha V_1^1 + \delta B - \delta \alpha V_1^2},
$$

(2.5)
then there is no reelection scheme of voters that can motivate the elected politician to undertake LTP.

Proof
First, the politician will never choose NOT under any reelection scheme. He has the same reelection probability under LTP and NOT as voters are not able to distinguish between the two policy results after period 1. For \( q(0) \neq 0 \) and \( m_i \neq 0 \) the benefits of the incumbent under LTP are larger than his benefits under NOT. For \( q(0) = 0 \) or \( m_i = 0 \) his benefits are equal under LTP and NOT. In the case of equal benefits under LTP and NOT, the politician will choose LTP according to our third tie-breaking rule.

Second, the optimal reelection scheme for the public is setting \( q(0) = 1 \) and \( q(V_2^S) = 0 \), which is the largest possible spread to deter the politician from choosing STP. Not reelecting a politician who has implemented STP is optimal for voters, as he has no negative private utility from a negative result in period 2. Hence, the critical value \( \hat{m}(\delta) \) is calculated by setting \( U_i^L(0, q_i = 1) = U_i^S(0, q_i = 0) \) which yields:

\[
\hat{m}(\delta) = \frac{\delta B}{\alpha V_1^S + \delta B - \delta \alpha V_2^L}.
\]

If \( m_i < \hat{m}(\delta) \), then \( U_i^L(0, q_i = 1) > U_i^S(0, q_i = 0) \). Therefore, a politician with \( 0 < m_i \leq \hat{m}(\delta) \) will choose LTP under the reelection scheme \( q(0) = 1 \) and \( q(V_2^S) = 0 \) and STP otherwise.

\[\square\]

This result seems to be quite surprising, as one could think that a politician who is mainly concerned with holding office would be worse for the public than a politician who is interested in the policy he implements. But surprisingly the reverse is true. A politician who has only a low estimation of his policy result \( V_i \) obtains a better performance. The reason for this somewhat paradoxical result is the shape of the politicians’ utility function. LTP will only be implemented

\[\text{Note that this is only true since we assume that there are no effort costs for the incumbent. The result would not inevitably be true any more in the case of effort costs. In this case doing nothing could be advantageous for the elected politician.}\]

\[\text{Note that it might be possible for the public to punish a politician by reelecting him if the incumbent had negative private utility from a negative result in period 2.}\]

\[\text{Note that the term } (\alpha V_2^L + \delta B - \delta \alpha V_2^L) \text{ is strictly positive, as we have assumed that } V_2^L > EV_L.\]
if $U^L_i(0, q_i = 1) \geq U^S_i(0, q_i = 0)$. If the politician undertakes $STP$ he will not be reelected.\footnote[18]{Furthermore, we assumed that even in the case of getting reelected the politician has no negative private utility from a negative result in period 2.} Hence, he benefits from $V^S_S$ but suffers no damages from $V^S_L$. By assumption we have $V^1_S > \delta V^2_L$. The politician can only get higher utility from implementing $LTP$ if the effect of $V^S_S > \delta V^2_L$ is compensated by the benefits from holding office in the second period. Hence, a low value of $m_i$ facilitates the implementation of $LTP$. As $\tilde{m} < 1$, we immediately obtain the following Corollary:

**Corollary 2.1**

Suppose the extreme case $m_i = 1$. Then $LTP$ can never be implemented irrespective of the other parameters.

The case $m_i < \tilde{m}(\delta)$ is not possible for $m_i = 1$, irrespective of the values of $\alpha$, $B$, $\delta$, $V^1_S$, $V^2_S$ and $V^1_L$. This again shows that the larger the value of $m_i$, the more difficult it gets to motivate the politician to $LTP$. This fact can also be observed in our next Corollary, which follows directly from Proposition 2.1, since $\tilde{m}(\delta)$ can never be negative.

**Corollary 2.2**

Suppose that voters can commit to a reelection scheme in stage 1 and that they use $q(0) = 1$ and $q(V^1_S) = 0$. If $m_i = 0$, then $LTP$ is always implemented irrespective of the other parameters.

Thus, a politician who is only interested in the benefits from holding office will always undertake the optimal policy. In the following we examine the connection of $\tilde{m}$ and $\delta$. From equation (2.5) we obtain $\lim \tilde{m}(\delta) = 0$ for $\delta \to 0$ and

$$\frac{\partial \tilde{m}(\delta)}{\partial \delta} = \frac{\alpha V^1_S B}{[\alpha V^1_S + \delta B - \alpha \delta V^2_L]^2} > 0.$$  \hspace{1cm} (2.6)

So for $\delta \to 0$ the politician chooses the efficient policy only if $m_i \to 0$. This is not surprising as $\delta$ close to 0 means that the politician has almost no valuation for the future. Thus, the benefits from holding office in the second period, which are the only means to motivate the incumbent to $LTP$, are irrelevant. With growing $\delta$ the range for $m_i$ increases at which point politicians will choose the socially efficient policy. Note that voters are assumed to be fully rational and infer negative future returns from the positive returns of short-term projects in the first election period.
CHAPTER 2. MOTIVATION OF POLITICIANS

The public’s inability to motivate the elected politician to undertake LTP for some parameter constellations gets even worse when voters cannot commit to a reelection scheme. This assumption of non-commitment is more realistic for democratic decision-making. As an example for the severity of the problem in such cases, suppose that the public votes foresightedly so that the past policy performance does not influence the reelection chances at all.\textsuperscript{19} Imagine for example that \( q(0) = q(V_1^S) = \frac{1}{2} \). This means that the ex ante reelection probability of the incumbent is \( \frac{1}{2} \), independent of the undertaken policy. Under this assumption we obtain:

**Proposition 2.2**
Suppose that \( q(0) = q(V_1^S) = \frac{1}{2} \) and that \( m_i \neq 0 \). Then the politician cannot be motivated by elections to undertake LTP.

**Proof**
The proof is similar to the proof of Proposition 2.1. This time we have to compare \( U_i^L(q_i = \frac{1}{2}) \) with \( U_i^S(q_i = \frac{1}{2}) \). This yields the following condition, which must be satisfied to motivate the politician to undertake LTP:

\[
delta m_i V_1^2 \geq 2m_i V_1^1.
\]

By assumption, this condition can not be fulfilled for \( m_i \neq 0 \), which completes the proof.

\[\square\]

The Proposition illustrates that it is impossible to motivate a politician (except for the case of a 100% office-seeker) to adopt LTP if his reelection prospects are not connected with the result of the policy he has undertaken in the past. In the following section we begin to analyze how political contracts can be helpful in solving the discovered inefficiencies.

### 2.4 Competition for Political Contracts

In this section we consider the whole game including political contracts. The contracts are offered by the politicians before the first election takes place. We

\textsuperscript{19}This is an extreme assumption and solely made for expositional purposes.
derive the results in the commitment and in the non-commitment case and denote the equilibrium values for $\beta$ by $\overline{\beta}^C$ and $\overline{\beta}^{NC}$, respectively.

2.4.1 Competition in the Case of Voters’ Commitment

We assume in this subsection that voters can commit themselves to a reelection scheme at the beginning of stage 1 (i.e. before the politicians offer their incentive contracts). By doing so it is possible to compare the scenario with both competition for incentive contracts and elections to the scenario in the previous section with elections only. We obtain:

**Proposition 2.3**

Suppose that voters can commit to a reelection scheme in stage 1, that incentive contracts can be offered by the politicians and that $m_1 > m_2 \geq \tilde{m} = \frac{\delta B}{\alpha V_L^1 + 4B - \delta \alpha V_L^2}$. Then there will exist a unique subgame perfect equilibrium

\[
\{C_1(\beta_1V^2), C_2(\beta_2V^2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = 1, q_1(V^1_S) = q_2(V^1_S) = 0\}
\]

with

\[
\beta_1 = \beta_2 = \overline{\beta}^C = \frac{m_1 \alpha V_L^2}{m_1 \delta V_L^2} - \delta \{ (1 - m_1) B + m_1 \alpha V_L^2 \}
\]  

(2.7)

and with candidate 2 being elected and implementing LTP if

\[
\delta \cdot \overline{\beta}^C V_L^2 < EV_L - EV_S.
\]  

(2.8)

The proof is given in Appendix B.1.

Proposition 2.3 shows that the combination of elections and political contracts prevents inefficient decision-making in politics by the possibility of future transfers to the elected politician. Both politicians offer the same incentive contract. The equilibrium contract is shaped in such a way that the politician with the higher value of $m_i$ is indifferent about choosing the long-term project or the short-term project. The politician with the lower value of $m_i$ is elected according to our first tie-breaking rule. He will take the socially efficient long-term decision and will get reelected with certainty.

\[\text{Note that without our first tie-breaking rule both politicians would have election probabilities of one-half since the public expects them to generate the same social welfare. In this case politician 2 would deviate to } \overline{\beta}^C - \epsilon \text{ in order to reobtain an election probability of 1. We use the first tie-breaking rule in order to avoid these } \epsilon \text{-considerations, but our results would still be valid if we dropped this tie-breaking rule.}\]
Note that, in the case of elections only, LTP would never be implemented because of the assumption $m_1 > m_2 \geq \tilde{m}$. In the next step we examine what happens to the incentive contracts in the case $m_i < \tilde{m}$. For $m_i < \tilde{m}$ we would have $\tilde{\beta} < 0$, because politicians with such a low $m_i$ receive so much benefit from holding office that they would even pay money to have LTP implemented in order to get elected. The more so as the low value of $m_i$ means that the utility damage of a negative $\beta$ is relatively small. The extreme case $m_i \to 0$ would result in $\tilde{\beta} \to -\infty$. But by assumption we have the restriction $0 \leq \beta_i \leq 1$, so we get a lower limit $\tilde{m} = \frac{\delta B}{\alpha V_{S1} + \delta B - \delta \alpha V_{L2}^2} > 0$ for $m_i$. This means that, when using incentive contracts, the permitted values for $m_i$ are restricted by the following term:

$$0 < \frac{\delta B}{\alpha V_{S1}^2 + \delta B - \delta \alpha V_{L2}^2} \leq m_i \leq 1.$$  

In the following we analyze how the amount of money transferred by the political contract depends on the value of $m_1$. From equation (2.7) we obtain

$$\frac{\partial \tilde{\beta}^C}{\partial m_1} = \frac{B}{(m_1)^2 V_{L2}^2} > 0.$$  

(2.9)

$\tilde{\beta}^C$ depends positively on $m_1$. Therefore, a small $m_1$ hits the elected politician 2 and decreases the costs of transfers to him.

In Proposition 2.3, voters could commit themselves to a state-dependent reelection scheme. In the following Corollary we relax this assumption and suppose that voters can only commit themselves to one single fixed reelection probability which is applied when they observe $V_{S1}$, as well as when they observe 0. We denote the equilibrium value for $\beta$ in this case of a fixed reelection probability by $\tilde{\beta}^{C,FRP}$.

**Corollary 2.3**

Suppose the public could only commit itself to a fixed reelection probability. Then there exists the following subgame-perfect equilibrium

$$\{C_1(\beta_1 V^2), C_2(\beta_2 V^2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = q_1(V_{S1}^3) = q_2(V_{S1}^3) = 1\}$$

with

$$\beta_1 = \beta_2 = \tilde{\beta}^{C,FRP} = \frac{m_1 \alpha V_{S1} - \delta m_1 \alpha V_{L2}^2}{m_1 \delta V_{L2}^2}$$

and with candidate 2 being elected and implementing LTP if

$$\delta \cdot \tilde{\beta}^C V_{L2}^2 < EV_L - EV_S.$$
The proof is analogous to the proof of Proposition 2.3, but this time we have to compare $U_L^i(\beta^{C,FRP}, q_i = 1)$ with $U_S^i(\beta^{C,FRP}, q_i = 1)$. Corollary 2.3 shows that the combination of political contracts and elections can still work in the case of a fixed reelection scheme, but this time the contract is more expensive for the society as $\beta^{C,FRP} > \beta^C$. With incentive contracts $C(\beta^{C,FRP} V^2)$, neither politician has an incentive to adopt STP and to stand for reelection.

Proposition 2.3 can also be extended to the case when both politicians are identical:

**Corollary 2.4**

Suppose $m_1 = m_2 \geq \tilde{m}$. There then exists a unique subgame perfect equilibrium

\[
\begin{align*}
&\left\{ C_1(\beta_1 V^2), C_2(\beta_2 V^2), p_1 = \frac{1}{2}, p_2 = \frac{1}{2}, q_1(0) = q_2(0) = 1, q_1(V^1_S) = q_2(V^1_S) = 0 \right\}
\end{align*}
\]

with

\[
\beta_1 = \beta_2 = \beta^C = \frac{m_1 \alpha V^1_S - \delta \left\{(1 - m_1)B + m_1 \alpha V^2_L\right\}}{m_1 \delta V^2_L}
\]

(2.10)

and with the elected candidate implementing LTP if

\[
\delta \beta^C V^2_L < EV_L - EV_S
\]

(2.11)

The proof follows the same logic as the proof of Proposition 2.3 and is therefore omitted here.

### 2.4.2 Competition without Commitment

Up to now we have analyzed how political contracts work when voters can commit themselves to a reelection scheme. Even though this gives the election mechanism the largest possible power to motivate politicians to undertake LTP, the commitment assumption is contrary to a fundamental democratic principle. The assumption that the public commits future citizens to adhere to a particular voting behavior infringes the principle of liberal democracies to allow for free and anonymous elections. A second argument against the commitment assumption is that voters may have incentives to not reelect the incumbent in order to save the remuneration according to his incentive contract.

We first deal with the democratic requirement for unconstrained voting. Suppose the extreme case that there is complete uncertainty about the voting behavior of
CHAPTER 2. MOTIVATION OF POLITICIANS

future generations. Then the elected politician has an a priori expected reelection probability of \( q_i = \frac{1}{2} \), independent of his undertaken policy.\(^{21}\) For this extreme non-commitment case we obtain:

**Proposition 2.4**
Suppose \( m_1 > m_2 \geq \hat{m} \). Then, there exists a unique subgame perfect equilibrium

\[
\left\{ C_1(\beta_1 V^2), C_2(\beta_2 V^2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = q_1(V^1_S) = q_2(V^1_S) = \frac{1}{2} \right\}
\]

with

\[
\beta_1 = \beta_2 = \beta^{NC} = \frac{2\alpha V^1_S - \delta \alpha V^2_L}{\delta V^2_L}
\] (2.12)

and with candidate 2 being elected and implementing LTP if

\[
\delta \beta^{NC} V^2_L < EV_L - EV_S
\] (2.13)

**Proof**
The proof is analogous to the commitment case. Here we have to compare \( U^L_1(\beta^{NC}, q_1 = \frac{1}{2}) \) with \( U^S_1(\beta^{NC}, q_1 = \frac{1}{2}) \). This yields the following condition:

\[
\beta^{NC} \geq \frac{2m_1 \alpha V^1_S - \delta m_1 \alpha V^2_L}{m_1 \delta V^2_L}
\]

and we achieve equation (2.12).

\[\square\]

As

\[
\frac{\alpha (2V^1_S - \delta V^2_L)}{\delta V^2_L} > \frac{m_1 \alpha V^1_S - m_1 \alpha \delta V^2_L}{m_1 \delta V^2_L} \geq \frac{m_1 \alpha V^1_S - \delta (1 - m_1) B + m_1 \alpha V^2_L}{m_1 \delta V^2_L},
\]

we get the following Corollary as an immediate consequence:

**Corollary 2.5**

\[
\beta^{NC} > \beta^C
\] (2.14)

\(^{21}\)Note that this is the opposite case to the commitment scenario where the politician knew his reelection probability depending on his policy result. These two extreme cases act as benchmarks, while in reality intermediate cases are much more plausible.
In the non-commitment case it requires a higher remuneration to make the politician with the higher factor $m_i$ indifferent as to $LTP$ and $STP$. The uncertainty of reelection in the case of having adopted $LTP$ must be compensated by a higher remuneration.

Now we analyze the other kind of non-commitment: It is possible that voters do not reelect the incumbent in order to save the remuneration according to his political contract. This problem can be solved by golden parachute contracts, which are denoted by $C_{Pa}$ and work as follows: The contract will inure not only if the incumbent is reelected but also if he stands for reelection and is not reelected. Therefore, the incumbent will profit from the positive value of $V_2^L$ even if he is no longer in office. Golden parachute contracts decrease pecuniary interests of the public to not reelect the incumbent, hence enlarging the motivation of politicians to undertake $LTP$. $U_{Pa,L}^i(\beta_i, q_i = 0)$ denotes the utility of a politician who has offered $C_{Pa}$, implements $LTP$ and is not reelected. This utility is given by

$$U_{Pa,L}^i(\beta_i, q_i = 0) = p_i \left( (1 - m_i)B + m_i(\alpha V^1_L + \delta \beta_i V^2_L) \right).$$

We denote the critical value for $\beta$ in the non-commitment case with golden parachute contracts by $\beta_{NCPa}$ and obtain the following Proposition:

**Proposition 2.5**

Suppose that $m_1 > m_2 \geq \tilde{m}$. We assume that politicians can offer golden parachute contracts and that the incumbent is never reelected. There exists a unique subgame perfect equilibrium where politicians offer golden parachute contracts

$$\{C_{Pa}^1(\beta_1 V^2), C_{Pa}^2(\beta_2 V^2), p_1 = 0, p_2 = 1\}$$

with

$$\beta_1 = \beta_2 = \beta_{NCPa} = \frac{\alpha V^1_S}{\delta V^2_L}$$

and with candidate 2 being elected, implementing $LTP$ and not getting reelected if

$$\delta \cdot \beta_{NCPa} V^2_L < EV_L - EV_S.$$
politicians. We have assumed an extreme case of non-commitment in Proposition 2.5, but the option to offer golden parachute contracts also works for intermediate values of positive reelection probabilities.

The comparison of $\beta^C$ and $\beta^{NCPa}$ yields the following Corollary:

**Corollary 2.6**

$$\beta^{NCPa} > \beta^C.$$  (2.19)

An immediate consequence is that golden parachute contracts are not able to guarantee the implementation of $LTP$ to such low costs for the public as in the commitment case. This is obvious as larger monetary incentives are necessary to compensate for the fact that undertaking $LTP$ does no longer result in higher reelection chances. Finally, we compare $\beta^{NC}$ and $\beta^{NCPa}$. Since $\beta^{NC}$ can be written as $\beta^{NCPa} + \frac{m_1\alpha V_1}{\delta V_2} - \frac{\delta m_1\alpha V_2}{\delta V_2}$ we get the following Corollary:

**Corollary 2.7**

$$\beta^{NCPa} < \beta^{NC}.$$  (2.20)

Thus, golden parachute contracts are cheaper for voters than ordinary incentive contracts in the non-commitment case. This is due to the positive effect from always receiving the payments from the contract in the golden parachute case, while the probability of receiving the contract payments is only $\frac{1}{2}$ in the non-commitment case. This positive effect in the golden parachute case is larger than the negative effect of not having the utility $\frac{1}{2}\delta m_1 V_2^2$ that the politician receives in the non-commitment case from the project.

### 2.5 Extensions

Our basic model from section 2.2 shows that it is not possible to motivate politicians to undertake the welfare optimal policy $LTP$ under certain conditions in the absence of political contracts. However, the implementation of $LTP$ is assured if politicians are allowed to offer incentive contracts and if the necessary remuneration caused by the contracts is not too high. This is valid not only in the case of voters’ commitment but also in the more realistic non-commitment case. In
this section we will extend the basic model in various directions. At first, we will analyze a situation with asymmetric information. Afterwards, we will examine the consequences of punishments for poor performance. We will continue with the case where political contracts also have consequences when the relevant politician is no longer in office. Finally, we will check whether our results are robust under various modifications of the politicians’ utility functions.

### 2.5.1 Asymmetric Information

Up to now we have assumed that the public knows the politicians’ values of $m_i$. But this seems to be rather unlikely in certain circumstances. Especially when two politicians run for office for the first time, voters may be uncertain about the values $m_i$ of the politicians. We want to analyze how an asymmetric distribution of information affects the chances of success of the competition for incentive contracts and elections. We introduce asymmetric information into our model by assuming that voters do not know exactly the values $m_i$. The only information known to the public is that both politicians have the valuation $m = \tilde{m}$ with probability $z$ and $m = 1$ with probability $1 - z$. $\tilde{m} = \frac{\delta B}{\alpha V_2 + \delta B - \alpha V_1}$ is the lowest permitted value for $m$ ($0 < \tilde{m} < 1$), while the other case $m = 1$ is the highest possible value for $m$. In contrast to the information of voters, we make the assumption that both politicians know the factor $m$ of their opponent, which seems to be quite realistic, because of the superior knowledge politicians have about each other through their daily interaction. $b_1$ and $b_2$ denote the beliefs of the public that the politicians 1 and 2 have the valuation $\tilde{m}$ when they offer incentive contracts $C_1(\beta_1 V^2)$ or $C_2(\beta_2 V^2)$, respectively. We look for perfect Bayesian equilibria of the election and the political contract game. When the public can commit to a reelection scheme we obtain:

**Proposition 2.6**

There exists a Bayesian Nash equilibrium\(^{22}\)

$$\{C_1(\beta_1^*), C_2(\beta_2^*), p_1^*, p_2^*, q_1^*(0), q_2^*(0), q_1^*(V_S^1), q_2^*(V_S^1), b_1^*, b_2^*\}$$

if

$$\delta \cdot \bar{\beta}^{AI} V_L^2 < EV_L - EV_S \tag{2.21}$$

\(^{22}\)Other equilibria exist. For instance, lower values than $\bar{\beta}^{AI}$ can be supported as equilibrium when the public assumes that the deviating player is of the myopic type.
with

(i) \[ \beta_1^* = \beta_2^* = \beta^{AI} = \frac{\alpha V_S^1 - \delta \alpha V_L^2}{\delta V_L^2} \] (2.22)

(ii) An elected politician chooses LTP in equilibrium

(iii) \[ b_1^*(\beta_1, \beta_2) = \begin{cases} z & \text{if } \beta_1 = \beta^{AI} \\ 0 & \text{otherwise} \end{cases} \] (2.23)

\[ b_2^*(\beta_1, \beta_2) = \begin{cases} z & \text{if } \beta_2 = \beta^{AI} \\ 0 & \text{otherwise} \end{cases} \] (2.24)

(iv) \[ p_1^*(\beta_1, \beta_2) = \begin{cases} \frac{1}{2} & \text{if } \beta_1 = \beta_2 \\ \frac{1}{2} & \text{if } \beta^{AI} > \beta_1 > \beta_2 \quad \text{or} \quad \beta^{AI} > \beta_2 > \beta_1 \\ 1 & \text{if } \beta_1 = \beta^{AI} \quad \text{and} \quad \beta_2 \neq \beta^{AI} \\ 1 & \text{if } \beta_1 > \beta^{AI} > \beta_2 \quad \text{or} \quad \beta^{AI} < \beta_1 < \beta_2 \\ 0 & \text{otherwise} \end{cases} \] (2.25)

\[ p_2^*(\beta_1, \beta_2) = \begin{cases} \frac{1}{2} & \text{if } \beta_1 = \beta_2 \\ \frac{1}{2} & \text{if } \beta^{AI} > \beta_1 > \beta_2 \quad \text{or} \quad \beta^{AI} > \beta_2 > \beta_1 \\ 1 & \text{if } \beta_2 = \beta^{AI} \quad \text{and} \quad \beta_1 \neq \beta^{AI} \\ 1 & \text{if } \beta_2 > \beta^{AI} > \beta_1 \quad \text{or} \quad \beta^{AI} < \beta_2 < \beta_1 \\ 0 & \text{otherwise} \end{cases} \] (2.26)

(v) \[ q_1^*(0) = q_2^*(0) = 1 \]

\[ q_1^*(V_S^1) = q_2^*(V_S^1) = 0 \] (2.27)

The proof of Proposition 2.6 is given in the Appendix. Proposition 2.6 shows that the hierarchy of political contracts and elections also works under incomplete information. However, we have \( \beta^{AI} > \beta^C \), as \( \beta^{AI} \) is evaluated at the value \( m = 1 \), whereby the contract gets more expensive. So the public is forced to accept higher transfers to the politician than under complete information. On the other hand we have \( \beta^{AI} < \beta^{NC} \). Thus, solving the problem of asymmetric information is less expensive for society than solving the problem of non-commitment.

\(^{23}\)Note that \( \beta^C \) is equal to \( \beta^{AI} \), when \( m_1 = 1 \) is inserted in equation (2.7).
CHAPTER 2. MOTIVATION OF POLITICIANS

2.5.2 Punishment in the Case of Poor Performance

In our basic model we apply political contracts that use an asymmetric mechanism: In the case of a positive result in period 2, the politician gets a reward. However, the politician is not punished for a negative result in the second period. This seems to be quite realistic under the assumptions that politicians decide about the introduction of political contracts themselves and that politicians will pass no bill that could diminish their utility. However, if incentive contracts were introduced by a referendum, it might be possible to design contracts such that poor performances are punished. Moreover, remember that the examples for incentive elements in politics from Athens and Canada that we mentioned in the last chapter use actually only mechanisms of control and punishment, while politicians are not motivated by rewards. In this respect, the following extension of the model is a middle course between the two extremes of only rewarding or only punishing politicians.

We will now extend our basic model to the case where politicians are punished for negative results in the second period. However, with this extension the convenience of the Propositions is partially lost. This can be explained as follows: In our basic model it was always optimal for voters to punish a politician for \( STP \) by not reelecting him. This is not necessarily true any more in the extended version of the model. If a reelected politician had negative utility in the second period, he would prefer not to be reelected. Hence, the optimal reelection scheme is no longer exogenous but depends on the politician’s utility. Furthermore, voters have to keep in mind that they will receive money from a reelected politician who has a negative result in the second period - this reinforces the incentives to reelect a politician who has implemented \( STP \).\(^\text{24}\)

We consider the following modification of our original model:

Stage 1’: At the beginning of period 1 both politicians simultaneously offer incentive contracts \( C_1' (\beta_1 V^2) \) and \( C_2' (\beta_2 V^2) \) to voters. The contracts have the following consequences: In the case of reelection in period 2, politician \( i \)

\(^{24}\) One could ask why politicians should only be punished if they are reelected. Why is it not optimal to punish all politicians for bad policies no matter if they were reelected or not? There is room for controversial debates about this point. We think that it is preferable to punish only politicians who are still in office, as otherwise there is the danger that the new incumbent will try to arbitrarily enhance the punishment of his predecessor.
receives a net transfer $\beta_i V^2$ if $V^2 \geq 0$, and he has to pay $\beta_i |V^2|$ to the public if $V^2 < 0$.\footnote{Note that this punishment will only be possible if the politician has enough money which can be taken away from him. We assume that the politician gets enough money by his remuneration of the office and by the pension. Hence, this punishment is possible by a reduction of the remuneration and the pension.} We assume that $0 \leq \beta_i \leq 1$.

Stage 4': Voters observe the returns from the first period. The public decides on the reelection of the politician. Politician $i$ gets reelected with probability $q_i$ ($0 \leq q_i \leq 1$). Note that the incumbent is not asked whether he wants to run for office again, because then a politician would not campaign again, if his utility in the second period was negative. Hence, no punishment by reelection would be possible.\footnote{This enforcement to campaign for a second term might appear undemocratic, but one could replace this by the following procedure: A politician cannot be forced to run for office again, but he has to pay $\beta_i V^2$, for $V^2 < 0$. This seems to be unproblematic and politicians would be even worse off by this procedure so that politicians will prefer the enforcement for re-campaigning.}

The other stages of the game are not modified. The politician’s utility in period 1, when he campaigns for the first time, is now given by

$$U'_i = p_i \left\{ (1 - m_i)B + m_i \alpha V^1 + \delta q_i \left[ (1 - m_i)B + m_i (\alpha \max\{0, V^2\} + \beta_i V^2) \right] \right\}.\footnote{We assume that 0 \leq \beta_i \leq 1.}$$

Thus, the utility of an elected politician $i$ who has offered $C_i(\beta_i V^2)$, undertakes STP and is reelected changes to

$$U'_i^S(\beta_i, q_i = 1) = (1 - m_i)B + m_i \alpha V^1 + \delta \left\{ (1 - m_i)B + m_i \beta_i V^2 \right\}.\footnote{Note that this punishment will only be possible if the politician has enough money which can be taken away from him. We assume that the politician gets enough money by his remuneration of the office and by the pension. Hence, this punishment is possible by a reduction of the remuneration and the pension.} (2.28)$$

$U'_i^L(\beta_i, q_i = 1)$ and $U'_i^S(\beta_i, q_i = 0)$ remain the same as in the basic model. Note that the relation $U'_i^S(\beta_i, q_i = 1) \geq U'_i^S(\beta_i, q_i = 0)$ is not always valid any more.

Obviously the results when no political contracts can be offered are not affected by the modifications in our model. Therefore Propositions 2.1 and 2.2 in section 2.3 are still valid in the case of pecuniary punishments for a poor performance. We now reconsider the whole game including incentive contracts that are offered by the politicians before the first election takes place. We derive the results in the commitment and in the non-commitment case. As the politician is punished for $V^2 < 0$, we denote the equilibrium values for $\beta$ with $\beta^{CP}$ and $\beta^{NCP}$, respectively. In the case of voters’ commitment, we obtain:
Proposition 2.7

Suppose that the following assumptions are fulfilled: Voters can commit to a reelection scheme in stage 1, incentive contracts can be offered by the politicians, and \( m_1 > m_2 \geq \bar{m} \). Then,

(i)(a) \[
\{ C_1(\beta V^2), C_2(\beta V^2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = q_1(V_S^1) = q_2(V_S^1) = 1 \}
\]
is a unique subgame perfect equilibrium with
\[
\beta_1 = \beta_2 = \beta^{CP(i)} = \frac{\alpha(V_S^2 - \delta V_L^2)}{\delta(V_L^2 - V_S^2)}
\]
(2.29) and with candidate 2 being elected, implementing LTP and getting reelected if
\[
m_2 > m^{crit} = \frac{1}{1 - \bar{m}}
\]
(2.30) and if
\[
\delta \cdot \bar{\beta}^{CP(i)}(V_L^2 - V_S^2) < EV_L - EV_S.
\]
(2.31)

(i)(b) \[
\{ C_1(\beta V^2), C_2(\beta V^2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = q_1(V_S^1) = q_2(V_S^1) = 0 \}
\]
is a unique subgame perfect equilibrium with
\[
\beta_1 = \beta_2 = \beta^{CP(i)} = \frac{\alpha(V_S^2 - \delta V_L^2)}{\delta(V_L^2 - V_S^2)}
\]
and with candidate 2 being elected, implementing LTP and getting reelected if
\[
m_2 \leq m^{crit} = \frac{1}{1 - \bar{m}}
\]
(2.32) and if
\[
\delta \cdot \bar{\beta}^{CP(i)}(V_L^2 - V_S^2) < EV_L - EV_S.
\]
(ii) \[
\{ C_1(\beta V^2), C_2(\beta V^2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = 1, q_1(V_S^1) = q_2(V_S^1) = 0 \}
\]
is a unique subgame perfect equilibrium with

\[
\beta_1 = \beta_2 = \overline{\beta}_{CP(ii)} = \frac{m_1 \alpha V_1^1 - \delta \{(1 - m_1)B + m_1 \alpha V_2^2\}}{m_1 \delta V_L^2}
\]  
(2.33)

and with candidate 2 being elected, implementing LTP and getting reelected if

\[
m_1 \leq m^{\text{crit}} = \frac{1}{1 - \frac{\alpha V_1^1 (V_1^1 - \delta V_L^2)}{\delta B (V_L^2 - V_S^2)}}
\]  
(2.34)

and if

\[
d \cdot \overline{\beta}_{CP(ii)} (V_L^2 - V_S^2) < EV_L - EV_S.
\]

The proof is given in Appendix B.1.

Proposition 2.7 shows that the reelection scheme with \(q(V_1^1) = 0\) is no longer always optimal for voters. If a reelected politician has negative utility in the second period, voters can punish him by reelection. Hence, in this case a reelection scheme with \(q(V_1^1) = 1\) is more appropriate to motivate the politician to LTP. The public will prefer a reelection scheme with \(q(V_1^1) = 1\) if the associated value of \(\overline{\beta}_{CP}\) is smaller than under \(q(V_1^1) = 0\). It depends on the value of \(m_1\), as to whether the equilibrium is located in the first or in the second case of the Proposition. If politician 1 has a high value of \(m_1\) (case (i)), he could be punished by being reelected, while for a low value of \(m_1\) (case (ii)), he would be worse off by not being reelected. Note that it is always assured that only one of the two cases can occur. Nevertheless, if condition (2.31) is violated, no equilibrium will exist.

In the next step we compare \(\hat{m}\) and \(m^{\text{crit}}\) to analyze whether the equilibrium with \(\overline{\beta}_{CP(ii)}\) always exists. Remember that the Proposition only holds for \(m_1 > \hat{m}\) and that the equilibrium with \(\overline{\beta}_{CP(ii)}\) only exists for \(m_1 \leq m^{\text{crit}}\). Hence, a necessary condition for the equilibrium with \(\overline{\beta}_{CP(ii)}\) to exist is that \(m^{\text{crit}} > \hat{m}\).

The comparison yields the following result:

**Corollary 2.8**

\[
m^{\text{crit}} > \hat{m}
\]  
(2.35)
Proof
We want to show that \( m_{\text{crit}} > \tilde{m} \):

\[
\frac{1}{1 - \frac{\alpha V_1^2 (V_2^1 - \delta V_2^2)}{\delta B (V_2^1 - V_2^2)}} > \frac{\delta B}{\alpha V_2^1 + \delta B - \delta \alpha V_L^2}
\]

Note that the common denominator is positive. Hence, multiplying with the common denominator yields:

\[
\alpha V_1^1 - \delta \alpha V_2^2 > -\frac{\alpha V_2^2 (V_2^1 - \delta V_2^2)}{V_2^1 - V_2^2}
\]

\[\Leftrightarrow V_2^1 > 0\]

which is fulfilled by assumption.

\[\square\]

Furthermore, we know that \( m_{\text{crit}} < 1 \), as \( \frac{\alpha V_2^2 (V_2^1 - \delta V_2^2)}{\delta B (V_2^1 - V_2^2)} < 0 \). Using Corollary 2.8, we can write \( \tilde{m} < m_{\text{crit}} < 1 \). Hence, both the equilibrium with \( \tilde{\beta}^{CP(i)} \) and the equilibrium with \( \tilde{\beta}^{CP(ii)} \) can always occur if candidate 1 has the appropriate value of \( m_1 \) – and under the condition that equation (2.31) is fulfilled. However, there only exists either the one or the other equilibrium for a given value of \( m_1 \).

Finally, we will consider the non-commitment case, when politicians can be punished by political contracts. We assume the extreme case \( q(0) = q(V_1^S) = 1 \). Thus, voters cannot adapt the reelection scheme in order to punish the incumbent as much as possible for undertaking \( STP \) this time and we obtain a less complicated equilibrium. For this extreme form of non-commitment we get:

**Proposition 2.8**

Suppose \( m_1 \geq m_2 \geq \tilde{m} \). There then exists a unique subgame perfect equilibrium

\[
\left\{ C_1(\beta_1 V_2), C_2(\beta_2 V_2), p_1 = 0, p_2 = 1, q_1(0) = q_2(0) = q_1(V_1^1) = q_2(V_1^1) = \frac{1}{2} \right\}
\]

with

\[
\beta_1 = \beta_2 = \beta^{NCP} = \max \left\{ \frac{2 \alpha V_1^1 - \delta \alpha V_2^2}{\delta (V_2^1 - V_2^2)}, \frac{2 m_1 \alpha V_1^1 - \delta \{(1 - m_1) B + m_1 \alpha V_2^2\}}{m_1 \delta V_2^2} \right\}
\]

if

\[
\delta \beta^{NCP} (V_2^1 - V_2^2) < EV_2 - EV_2^S
\]
Both politicians offer the same value for $\beta$. The second candidate is elected in equilibrium. He adopts $LTP$ and is reelected with probability $\frac{1}{2}$. We get $\beta^{NCP}$ by comparing $U_i(\beta^{NCP}, q_i = \frac{1}{2})$ with $U_i(\beta^{NCP}, q_i = \frac{1}{2})$.

As
\[
\frac{2\alpha V^1_S - \delta \alpha V^2_L}{\delta (V^2_L - V^2_S)} > \frac{\alpha V^1_S - \delta \alpha V^2_L}{\delta (V^2_L - V^2_S)} = \beta^{CP(i)}
\]
and
\[
\frac{2m_1\alpha V^1_S - \delta \{(1 - m_1)B + m_1\alpha V^2_L\}}{m_1\delta V^2_L} > \frac{m_1\alpha V^1_S - \delta \{(1 - m_1)B + m_1\alpha V^2_L\}}{m_1\delta V^2_L} = \beta^{CP(ii)}
\]
we get the following Corollary as an immediate consequence:

**Corollary 2.9**

\[
\beta^{NCP} > \beta^{CP} \quad (2.37)
\]

In the non-commitment case it is again more expensive to motivate the incumbent to undertake $LTP$. The uncertainty of reelection in the case of having adopted $LTP$ must be compensated by a higher remuneration.

### 2.5.3 Validity when the Politician is no longer in Office

In this subsection we examine what happens if political contracts also have consequences when the relevant politician is no longer in office. We start with our basic scenario, i.e. without punitive measures. In this case the results do not change. To understand this fact, note that a politician who undertakes $LTP$ is reelected anyway,\textsuperscript{27} and that incentive contracts do not matter for a politician who undertakes $STP$, since $V^2$ is negative for him. Hence, the utilities are the same as in our basic model, and there is no effect if political contracts are still valid when the politician is no longer in office. However, this is not true in the extended version, when not only rewards but also punishments act as incentives. Remember that, in this case, it was sometimes better for voters to reelect a politician, since this was the largest possible threat of punishment. If incentive contracts are still valid when the politician has been deselected, then this sophisticated reelection scheme

\textsuperscript{27}Recall that in subsection 2.4.2 we discussed the case where voters do not reelect an incumbent after undertaking $LTP$. Then golden parachute contracts valid when the politician is no longer in office are a means of motivating the incumbent to undertake $LTP$. 
is no longer necessary. In this case, the best reelection strategy for voters is to punish a politician for undertaking $\text{STP}$ by not reelecting him. Hence, we obtain a much easier equilibrium than in Proposition 2.7. However, the finding that the dual mechanism of competition for political contracts and elections motivates the incumbent to implement the socially efficient policy is still valid.

One could imagine another extension of our basic model. Each politician could decide himself whether his contract should also be valid when he is no longer in office in the second period. Thus, incentive contracts offered by the politicians would now have the form $C(\beta V^2, O_2)$, where $O_2 = 1$ means that the contract is only valid as long as the politician is in office, while $O_2 = 0$ means that the politician also wants the political contract to involve payment transactions when he is no longer in office. Under this scenario we would obtain the following results: A politician who undertakes $\text{LTP}$ will always offer $O_2 = 0$, as he knows that the incentive contract is advantageous for him. A politician who undertakes $\text{STP}$ will also offer $O_2 = 0$ if there are no punishments. In this case, it will never be detrimental if the political contract is valid. We get a different situation in the scenario with punishments. A politician who undertakes $\text{STP}$ will now offer $O_2 = 1$ to avoid penalties in the second period. Furthermore, the politician will not want to be reelected if the punishment is larger than the benefits he gets from holding office in the second period. Voters will anticipate that fact and will threaten the politician with reelection if this is bad for him. Hence, this extension does not change any of our qualitative results. The only difference is that voters may obtain an even clearer picture of the kind of policy the candidate is likely to implement by looking at the contract offered by the politician.

### 2.5.4 Other Utility Functions

So far, we have used the utility function from equation (2.1), where the parameter $m_i$ denotes whether a politician is more a “policy success-seeker” or a populist. Even more interesting could be an investigation about statesmen and populists. A politician will be called statesman-like if he has an intrinsic motivation to implement the socially optimal policy. That means he is mainly motivated by the policies he implements, while he has only little utility from holding office and from monetary rewards. On the other hand, a politician who is mainly concerned with being reelected is regarded as a populist.
In the form of equation (2.1), it is difficult to separate the utility components into an intrinsic part and an extrinsic part, as there is a combined effect between $\alpha$ and $\beta$. A politician with a high value of $m_i$ might be expected to be a statesman satisfied by implementing good policies. But as $m_i$ is also the parameter measuring the impact of the monetary incentive contract, this utility function is not really precise enough to decide the question about statesmen and populists. For this inquiry it will be better to use another form of the utility function. In the following, we will discuss the effect of several modifications to our original utility function.

**Separated effect of $\alpha$, $\beta$, and $B$**

In this first case, we analyze the utility function with the highest possible distinction potential. The three utility components $\alpha \max\{0; V^2\}$, $\beta \max\{0; V^2\}$, and $B$ are not combined at all. To keep the analysis simple, we assume that the parameter for utility from monetary rewards provided by the political contract is 1. We compare only the impact of utility from projects with the benefits from holding office. This seems to be an appropriate procedure if we assume that a populist mainly receives benefits from $B$, while the monetary rewards of the incentive contract are less important to him. Under these assumptions we obtain the following utility function:

$$U_{i1}^{\text{New}} = p_i \left\{ (1 - m_i)B + m_i \alpha V^1 + \delta q_i \left[ (1 - m_i)B + (m_i\alpha + \beta) \cdot \max\{0, V^2\} \right] \right\}. \tag{2.38}$$

Proposition 2.1 and Corollaries 2.1 and 2.2 are still valid under the new utility function, as no contracts could be offered in this scenario. So, it is still true that implementing $LTP$ becomes more difficult with growing $m_i$, which further substantiates the surprising result that it is easier to motivate a populist to undertake $LTP$.

\[\text{28}\text{When we assume that the expression } m_i\alpha V \text{ characterizes a statesman, it is important that the parameter } \alpha \text{ measures the extent to which the candidates receive private benefit from the social return generated by the policy. The alternative explanation that private benefit could arise from the fact that high returns enable the politician to pay some returns to interest groups supporting him would not be statesman-like.}\]

\[\text{29}\text{Another fixed weight for utility from monetary rewards provided by the incentive contract is possible and changes only the results of } \beta_{C,\text{New}1} \text{ and } \beta_{NC,\text{New}1} \text{ in equations (2.39) and (2.41), while the algebraic sign for the derivations (2.40) and (2.42) remains unchanged.}\]

\[\text{30}\text{This will be the case if the populist politician obtains utility mainly from the non-monetary benefit components of } B \text{ like prestige or the satisfaction of being in power.}\]
In cases where politicians can offer incentive contracts and voters can commit to a reelection scheme, the result of Proposition 2.3 continues to be valid with the new equilibrium value

$$\beta_1 = \beta_2 = \beta^{C, New 1} = \frac{m_1 \alpha V^1_S - \delta \{ (1 - m_1) B + m_1 \alpha V^2_L \}}{\delta V^2_L}.$$ (2.39)

This equilibrium value is calculated in the same way as in the proof of Proposition 2.3, but this time using the utility function $U_{i, New 1}$. From equation (2.39) we obtain

$$\frac{\partial \beta^{C, New 1}}{\partial m_1} = \alpha (V^1_S - \delta V^2_L) + \delta B > 0.$$ (2.40)

$\beta^{C, New 1}$ depends positively on $m_1$. Therefore, a small $m_1$ decreases the costs of transfers to the elected politician 2. Again it will be advantageous for voters if both politicians are of the populist type.

When politicians can offer incentive contracts and voters are not able to commit to a reelection scheme, the result of Proposition 2.4 continues to be valid with the new equilibrium value

$$\beta_1 = \beta_2 = \beta^{NC, New 1} = \frac{m_1 \alpha (2V^1_S - \delta V^2_L)}{\delta V^2_L},$$ (2.41)

which is calculated in the same way as in the proof of Proposition 2.4 but this time using the utility function $U_{i, New 1}^{NC}$. From equation (2.41) we obtain

$$\frac{\partial \beta^{NC, New 1}}{\partial m_1} = \alpha (2V^1_S - \delta V^2_L) > 0.$$ (2.42)

It is straightforward to see that political contracts become cheaper for voters when $m_1$ decreases. Hence, populism is again useful for voters. Note that in our original model $\beta^{NC}$ did not depend on $m_1$.

**Combined effect of $\beta$ and $B$**

In this case we assume that a populist obtains utility both in the form of benefits from holding office and of monetary rewards from the incentive contract. Accordingly, we now use a utility function with a combined effect of $\beta \max \{0; V^2\}$ and $B$:

$$U_{i, New 2} = p_i \left\{ (1 - m_i) B + m_i \alpha V^1 + \delta q_i \left[ (1 - m_i) \beta + \max \{0, V^2\} \right] + m_i \alpha \max \{0, V^2\} \right\}.$$ (2.43)
As Proposition 2.1 and Corollaries 2.1 and 2.2 are also valid under this second new utility function, it is still true that implementing \( LTP \) is more difficult with growing \( m \). Thus, it is again easier to motivate a populist to undertake \( LTP \).

Under the assumptions that politicians can offer political contracts and voters can commit to a reelection scheme, the result of Proposition 2.3 is still valid with the new equilibrium value

\[
\beta_1 = \beta_2 = \beta_{C,\text{New}^2} = \frac{m_1 \alpha V_S^1 - \delta \{(1 - m_1)B + m_1 \alpha V_L^2\}}{(1 - m_1) \delta V_L^2}.
\]

(2.44)

The equilibrium value is calculated in the same way as in the proof of Proposition 2.3, but this time using the utility function \( U_{i,\text{New}^2} \). From equation (2.44) we obtain

\[
\frac{\partial \beta_{C,\text{New}^2}}{\partial m_1} = \frac{\alpha (V_S^1 - \delta V_L^2)}{(1 - m_1)^2 \delta V_L^2} > 0.
\]

(2.45)

Hence, a small value of \( m_1 \) decreases the monetary transfer to the elected politician. Under this new form of the utility function, it will again be advantageous for voters if both politicians are of the populist type.

Next we assume that politicians can offer incentive contracts, but voters are not able to commit to a reelection scheme. In this case, the results of Proposition 2.4 are still valid with the new equilibrium value

\[
\beta_1 = \beta_2 = \beta_{NC,\text{New}^2} = \frac{m_1 \alpha (2V_S^1 - \delta V_L^2)}{(1 - m_1) \delta V_L^2},
\]

(2.46)

which is calculated in the same way as in the proof of Proposition 2.4, but this time using the utility function \( U_{i,\text{New}^2} \). From equation (2.46) we obtain

\[
\frac{\partial \beta_{NC,\text{New}^2}}{\partial m_1} = \frac{\alpha (2V_S^1 - \delta V_L^2)}{(1 - m_1)^2 \delta V_L^2} > 0.
\]

(2.47)

Again political contracts become cheaper for voters when \( m_1 \) decreases. Therefore, populism is useful for voters under both of our modified utility functions. Nevertheless, it does not seem possible to definitively answer the question about the desirability of populists, as there are still many potential modifications of the model. Some of these are discussed below.

**Other modifications**

Several other modifications of the politician’s utility function suggest themselves. In our model, the politician is only concerned about the social returns of his pol-
icy as long as the outcomes occur while he is in office. One might also imagine
the politician having private utility from implemented projects with social returns
larger than the status quo, even when he is no longer in office. This would actually be
more statesman-like. Another possible extension would be that a politician
has private welfare losses when his implemented project generates lower social re-
turns than the status quo. Neither of these modifications will totally reverse the
results concerning the introduction of incentive contracts. The only thing that
happens is that under these modified utility functions undertaking STP becomes
less attractive. $U_i^S(\beta_i, q_i = 0)$ decreases, while $U_i^L(\beta_i, q_i = 1)$ is not affected by
the modifications. Hence, the inefficiency problem is alleviated. While this is no
argument against introducing political contracts, the results concerning the desir-
ability of populists versus policy success-seekers may change under the modified
utility functions. We will now look at this aspect in detail.

We assume that no political contracts can be offered and change the utility
function in such a way that politicians also have benefits from implemented projects
with social returns larger than the status quo when they are no longer in office, and
even from projects they have not implemented themselves. Politicians with a high
value of $m_i$ seem to be really statesman-like in this case. They are only concerned
about public welfare, no matter whether the projects have been implemented by
themselves or not. The utility function of the politician now has the following
form:

$$U_{i}^{New3} = p_i \left\{(1 - m_i)B + m_i \alpha V^1 + \delta m_i \alpha \max\{0, V^2\} + \delta q_i (1 - m_i)B\right\}$$
$$+ (1 - p_i)\left\{m_i \alpha V^1_{Op} + \delta m_i \alpha \max\{0, V^2_{Op}\}\right\}$$
(2.48)

where $V_{Op}$ denotes the project return when the opponent is elected.

A politician who is totally populistic will have $m_i = 0$. His utility is given by

$$U_{i}^{New3,P} = p_i (B + \delta q_i B).$$
(2.49)

The populist will choose $LTP$ if his reelection chances are at least no smaller under
$LTP$ than under the other policy options. As it is rational for voters to choose
$q(0) \geq q(V^2_i)$, we get the following result: A politician who is totally populistic
will always implement the socially optimal policy.\footnote{Note that according to our third tie-breaking rule the politician will not choose the status quo policy.}
A pure statesman with $m_i = 1$ has the following utility:

$$U_{i^{\text{New3,}S}} = p_i \left\{ \alpha V^1 + \delta \alpha \max\{0, V^2\} \right\} + (1 - p_i) \left\{ \alpha V^1_{Op} + \delta \alpha \max\{0, V^2_{Op}\} \right\}. \quad (2.50)$$

Note that reelection probability has no impact on the utility of a statesman since his private benefits are equal, regardless of whether he is reelected or not. Furthermore, the politician is not able to influence his utility if he is not elected. Thus, in order to predict the behavior of a statesman, we have to solve the following optimization problem: An elected statesman maximizes $\alpha V^1 + \delta \alpha \max\{0; V^2\}$. We obtain the following result: A pure statesman will never undertake the optimal policy $LTP$, since his utility is lower under $LTP$ than under $STP$. This result derives from the fact that $V^3 > \delta V^2_L$ and from our assumption that there are no private welfare losses when the implemented project generates a negative result. If we allow for private welfare losses in the case of a project that leads to a deterioration in comparison to the status quo, then a statesman has to maximize $\alpha V^1 + \delta \alpha V^2$ and will thus always choose $LTP$ because of our assumption $EV_L > EV_S$.

Hence, we can summarize our considerations from above in the following way: In our model frame, a pure populist will always behave in a socially optimal way, while the behavior of a pure statesman depends on whether a negative project result inflicts private welfare losses on him. The assumption of a statesman-like politician having private welfare losses in the case of a negative project result is not implausible. Therefore, we are no longer able to make a definite statement about the welfare effects of statesmen versus populists in the scenario without political contracts. There is no need for political contracts under these assumptions as pure populists and statesmen with private welfare losses following negative project results already act in a socially optimal way with elections alone. Thus, to resume our argument, we can say that political contracts can improve social welfare in our basic model, and populists are more easily motivated to implement the socially optimal project than policy success-seekers. While it is possible to create situations where political contracts are no longer necessary, incentive contracts for politicians always have at least a non-negative effect.\textsuperscript{32} The question as to whether populists or statesmen are more advantageous for society seems to be more complicated. Although the result that populists are desirable for a society might not be robust under all extensions, we have at least shown that it is possible for a society to prefer populists to statesmen. A detailed analysis of this issue must be left to

\textsuperscript{32}Note that here we disregard the administrative and wage-related costs of the incentive contracts.
2.6 Implementation Problems

The results of our simple model show that inefficiencies in democracies may arise when elections are the only incentive device. These inefficiencies may be reduced by the dual mechanism of competition for elections and political contracts. Hence, our theoretical analysis would suggest the introduction of political contracts.

One drawback in the incentive contract theory is the fact that it is often impossible to base the payoff of the agent directly on the objective of the principal. Baker (1992) shows that in general it is not possible to motivate the agent in a first-best manner when the objective of the principal is not used in the contract. This problem is not relevant in our model, as we assume that the objective of the principal can be submitted to a contract, i.e. the incentive payment to the politician depends directly on the project result. Nevertheless, there are several other problems concerning the practical implementation.

First of all, there is the problem of measurability and manipulation. It is important that the policy result \( V^2 \) be measurable, as otherwise the reward or punishment \( \beta V^2 \) cannot be calculated. In some political areas, like unemployment or public debts, this does seem to be warranted. However, the results of many political projects, like reforms in the educational system or judiciary reforms, may not be measurable at all. Another important issue is that there should be no possibility for manipulation of \( V^2 \). For example, a politician might try to reduce unemployment by changing its definition. Another example might be a decrease in public debts by a revaluation of the central bank’s gold holdings. Fixed definitions of \( V^2 \) are necessary to avoid such manipulations.

Another important problem is the question of accountability. A politician may not be responsible for his own poor performance. Especially in countries where the head of government has no absolute power, it is conceivable that he might try to implement a desirable policy but be blocked by the opposing party or by oppositional members of Parliament in his own party.\(^{33}\) The opposing party has

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\(^{33}\)Consider, for example, the German bicameral system. There are often constellations where an oppositional majority in the Federal Council is able to constrain the power of the Federal Chancellor.
strong incentives to thwart the proposals of the government so that the head of government cannot honor his political contract. So there must be some arrangement determining what should happen in such cases. One possibility would be for the political contract to be invalidated if the government’s proposals are blocked by the opposition. But then another problem arises. If the head of government wants to invalidate the contract, he just needs to propose counterproductive suggestions that will certainly be rejected by the opposition. A related subject is the problem of outside influences. A world economic crisis might, for example, ruin the effects of a politician’s economic policy. Then it would be difficult to evaluate the quality of his policies. Here the political contract should lose its validity, as it would be unfair for parameters beyond a politician’s control to be a decisive factor for his rewards or punishments.\footnote{This problem might be solved by a risk premium for the politician.}

In our model we assume that the politician must only decide about one project. In reality, however, we typically have multi-task problems. This raises an important question: Which policy areas should be part of the political contract? Suppose, for example, the contract included the unemployment rate but not public debts. Then a politician might be tempted to decrease the unemployment rate by inflating the public sector, as the increase of public debts has no consequences for his contract.\footnote{Nevertheless, the politician has to keep in mind that such misconduct might be punished by voters. They can simply refuse to reelect him, thus making the contract worthless anyway.} On the other hand, incentive contracts would be very complex if they included lots of different fields of policy, so it is not easy to decide which topics should be part of the contract.

The fourth issue is a “time inconsistency” problem. It is possible that ex post compliance with the political contract may be undesirable or even detrimental for the public because general conditions or voter preferences may have changed. The politician faces the following dilemma: He can pursue the aims of the contract and damage social welfare, or he can violate the contract and incur private disadvantages. One solution would be for renegotiation of the contract to be possible, allowing the contract to be rewritten when a large majority (e.g. a majority of $\frac{2}{3}$ in a referendum) is in favor of doing so.\footnote{Note that it is important for the changed contract to be approved by a $\frac{2}{3}$ majority of the public in a referendum and not by a $\frac{2}{3}$ majority in parliament, as otherwise the following scenario might occur: A candidate for office could offer a political contract that would punish him heavily in the case of poor performance. This would make him attractive for voters, he could achieve a $\frac{2}{3}$ majority in parliament and then simply renegotiate the contract.}
Furthermore, political contracts generate administrative costs, since legitimacy and compliance with the contracts have to be controlled. However, we assume that these costs are small in comparison to the welfare difference between $LTP$ and $STP$. A sufficient condition making this problem non-existent would be for the welfare benefits according to the contract to be larger than the administrative and wage costs caused by the contract.

Finally, one might generally ask whether politicians would be interested in introducing political contracts. On the one hand, they might be deterred by the possibility of monetary punishments. In addition, incentive contracts make election promises more difficult for politicians. On the other hand, a politician might have advantages in the election campaign because political contracts can make him look more credible. If contracts are advantageous to a politician in the election campaign, then his opponent will have to follow suit and offer an incentive contract in turn. So, if offering political contracts were allowed, the mechanisms of competition might force the politicians to make use of this possibility.\footnote{Note that at present political contracts are not permissible in modern democracies.}

\section*{2.7 Conclusion and Perspectives}

This chapter largely suggests that adding incentive contracts for politicians to the reelection mechanism might be advantageous for democratic societies. If politicians were allowed to offer political contracts, the mechanisms of competition would lead to equilibria with more efficient outcomes. As noted above, however, there remain a number of problems in connection with practical implementation.

Another interesting aspect is the topic of populists versus “policy success-seekers”. In our simple model we have established that surprisingly populists are better for social welfare than “policy success-seekers”. However, in a more realistic framework the more interesting comparison between statesmen and populists might differ from this result as it is at least partially caused by the form of the utility function selected.

Looking at the optimal design of political constitutions, there are some other interesting issues. One is the optimal setting of wages for politicians. Will an increase of remuneration have positive effects? On the one hand, higher wages might motivate the incumbent to initiate better policy projects, since he has larger
incentives to behave in a socially optimal way in order to get reelected. On the other hand, higher wages might have an adverse effect on the pool of candidates. Low wages may favor candidates who are intrinsically motivated. They are really interested in the results of their policy and think that political activity is their civic duty. With more generous remuneration there might be more and more candidates aiming for a political career because of the monetary rewards involved.\textsuperscript{38} Another interesting topic is the effect of term limits. If the socially optimal policy diverges from the opinion of the median voter, then politicians who are mainly interested in benefits from holding office will not implement the socially efficient policy, since they have no chance of getting reelected in this case. In a scenario with term limits, the incumbent might undertake the socially optimal policy during his final term of office. On the other hand, the control effect of the reelection mechanism is normally advantageous for society. A formal discussion of these interrelated topics and their influence on the efficiency of political contracts must be left to future research.

\textsuperscript{38}However, as shown above, it is not true that politicians who are mainly interested in the benefits of holding office are necessarily worse for society than intrinsically motivated politicians.
Chapter 3

Elections, Contracts, and Information Markets

3.1 Introduction

In democracies elections are the primary mechanisms for making politicians accountable. Holding reelections may induce incumbents to act in the public interest and enable the electorate to replace them with more promising candidates. However, at a particular election date citizens may sometimes lack the information required to decide wisely about whether an incumbent deserves to be reelected. There may be various reasons for this lack of information. Voters may be rationally ignorant, since in a large electorate the likelihood of a single citizen affecting the outcome of an election is negligible. Alternatively, voters may have no access to information, e.g. in cases where policies have mainly long-term effects and precise information about the consequences of a project is not available at the election date. Typical examples of long-term policies are reforms of the labor market or – as a policy problem with a very long time horizon – measures to abate global warming.

In this chapter we propose a triple mechanism involving political information markets, threshold incentive contracts, and democratic elections to solve this fundamental information problem. At the end of the first term, a political information market is held. Here investors can bet on whether the incumbent will be reelected at the end of the second term and hence whether he has undertaken socially beneficial long-term policies. As it is uncertain whether the politician will be reelected
for the first time at the end of period 1, this is a conditional information market. It aggregates the information on whether the incumbent has undertaken socially desirable long-term projects or whether the incumbent has merely pandered to current public opinion. A high price on the political information market indicates high probability that the incumbent will be elected a second time.

The second mechanism of our proposal involves reelection threshold contracts that competing politicians can offer before they start on their first term. The reelection threshold contract stipulates a critical price threshold the information market must reach or exceed for the incumbent to have the right to stand for first reelection. The critical price thresholds are offered competitively by politicians campaigning for their first term in office.

Political information markets, price thresholds on these markets, and democratic elections increase the motivation of politicians to undertake long-term beneficial policies that may be unpopular at the time they are introduced. This is the main idea of this chapter. We develop it in the framework of a simple political agency model. We show that a carefully designed combination of political information markets and threshold contracts can – on balance – improve welfare.

Our model is most closely related to the proposal for combining contracts and democratic elections introduced by Gersbach (2003) and extended by Gersbach and Liessem (2008). These papers show how the dual mechanism – contracts offered competitively during campaigns and elections – can improve political outcomes. All these papers rely on verifiable data by which contracts can be conditioned. As a contrast, we also analyze the case where the results from current policy can only be observed in a future period and may never be verifiable. We propose a novel triple mechanism where a political information market produces verifiable information in the form of prices at a time when policy results are not observable.

Political information markets have attracted a lot of attention recently. Information markets have been proposed to improve public policy decisions. (See e.g. the recent surveys and discussions by Wolfers and Zitzewitz (2004), or Hanson (2008), who proposes to use information markets to select policies that are expected to raise GDP.) A comprehensive summary on this relatively new topic can be found, for example, in Hahn and Tetlock (2004). The basic idea behind information markets is the accumulation of scattered information in order to predict uncertain future events. Political information markets have turned out to be very
successful in predicting election results (see e.g. Berg, Forsythe, and Rietz (1996) or Berlemann and Schmidt (2001)) and are already established in practice. We propose a new type of information market. While standard markets predict the result of the next election, we use a market that predicts the result of the next but one election in order to obtain an approximation of the long-term effects of current policies. The idea is that the incumbent will only be reelected in the next but one election if the voters are satisfied with the long-term project results they learn about over time.

The chapter is organized as follows: In the next section we introduce the model. The results for elections only are analyzed in section 3.3. In section 3.4 we examine the triple mechanism involving political information markets, threshold incentive contracts, and democratic elections. In section 3.5 we look at some extensions to our basic model. Section 3.6 concludes. Appendix C.1 contains the proofs. Appendices C.2 and C.3 describe the political information market in more detail. In Appendix C.4 we provide a numerical example.

### 3.2 The Basic Model

Our basic model draws on Maskin and Tirole (2004) and Gersbach and Liessem (2008). There are three periods, denoted by \( t = 1, 2, 3 \).

#### 3.2.1 The Election Framework

We assume that there are two politicians denoted by \( i = 1, 2 \). They compete for office before the first period starts. The elected politician has to take some kind of action during the first period. He can choose between action \( a_1 = 1 \) and action \( a_1 = 0 \). All voters have the same preference ranking for the two possible actions,\(^1\) but they do not know their preferences when they decide about the office-holder for the first term. There are two possible states of the world \( s_1 = 1 \) and \( s_1 = 0 \), which are drawn randomly. State \( s_1 = 1 \) will occur with probability \( z \), and state \( s_1 = 0 \) will occur with probability \( 1 - z \). We assume that \( \frac{1}{2} < z < 1 \). The state of the world determines which action is optimal for the voters. If state \( s_1 = 1 \) is

\(^1\)For the relevance of this assumption and for an outline of how to accommodate heterogeneous preferences of voters, see Maskin and Tirole (2004).
drawn, then the optimal action for the voters will be $a_1 = 1$. The optimal action for the voters will be $a_1 = 0$ in state $s_1 = 0$. If $a_1 = s_1$, voters get a payoff of 1, otherwise they get a payoff of 0. Voters are risk-neutral and want to maximize their expected utility. As $z > \frac{1}{2}$, we will refer to $a_1 = 1$ as the popular action and to $a_1 = 0$ as the unpopular action.

There are two types of politicians, either congruent or dissonant. Both politicians know their own type and the type of their opponent.\footnote{The assumption that politicians have knowledge about each other’s type may appear to be plausible because of their daily interaction. However, a candidate cannot use his knowledge about the type of his opponent in his election campaign, since he is not able to credibly communicate this information.} However, voters cannot observe the politicians’ types. A politician is congruent with a probability of $\frac{1}{2}$. In this case he has the same preferences as the voters. A politician is dissonant with a probability of $\frac{1}{2}$, i.e. if $a_1 = 1$ is optimal for the voters, then $a_1 = 0$ is optimal for the dissonant politician and vice versa. The two political candidates may differ as to congruence or dissonance. In all other respects they are identical.

### 3.2.2 The Information Structure

At the beginning of the whole game, voters and politicians have a priori probabilities of $z$ that state $s_1 = 1$ will occur and of $1 - z$ that state $s_1 = 0$ will occur. In the first period, the elected politician can learn precisely which state of the world has occurred, thus knowing with certainty which action is best for the voters and which action is best for himself.

We assume that voters are able to observe the action of the incumbent immediately and that the action is verifiable.\footnote{Verification means that it can be proved in a court of law.} We also assume that, while it is impossible to verify which state of the world has occurred, the voters will be able to observe it. However, it is not clear when the voters will make this observation. We assume that before their first reelection decision voters will observe with probability $\mu$ which state of the world has realized, while the probability that they will observe the state in period 2 (i.e. after their first reelection decision) is $1 - \mu$. Further, we assume that $0 \leq \mu \leq \frac{1}{2}$ to analyze a situation where the possibility that the performance of a project is not observable in the short term is a serious problem.\footnote{The assumption that $\mu \leq \frac{1}{2}$ is not crucial for our qualitative results. It is only of importance for our quantitative welfare analysis in Appendix C.4.}
Note that regardless of whether there is early observability or not, the project result will never be verifiable. Thus, the problem of non-verifiability is given in all cases.

We assume that the value of $\mu$ does not depend on the realized state of the world. This means that early observability is as likely in state $s_1 = 1$ as in state $s_1 = 0$. The incumbent has to undertake the action in the first period before he knows whether the voters will be able to observe the realized state in period 1.

Some remarks about our informational assumptions are in order here. We model a situation where politicians obtain information earlier than voters. At the time the policy is undertaken, the incumbent can precisely identify the correct state of the world, while voters are still completely ignorant. Voters will observe the state of the world at a later point in time. If voters only observe the realized state in period 2, they do not know whether the incumbent has undertaken the socially optimal action at the time of their first reelection decision.

### 3.2.3 Reelection Schemes

We use $r_1$ to denote reelection probability for the incumbent after his first period in office. Voters are able to observe the realized state in period 1 with a probability of $\mu$. In this case they know whether the politician has undertaken the socially optimal action, and we assume that they will reelect the incumbent if $a_1 = s_1$, while they will deselect him if $a_1 \neq s_1$. If voters are not able to observe the state of the world in period 1, which happens with a probability of $1 - \mu$, they do not know whether the incumbent has acted congruently. We assume that in this case voters will act in a somewhat unsophisticated way and will reelect the politician if $a_1 = 1$, while they will deselect him if $a_1 = 0$. When politicians undertake their

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5 Note that voters are indifferent between reelection schemes, as the politician will undertake no further action during his second or third term in office. The retrospective voting scheme used in this chapter is an optimal response of voters in our simple model and hence an equilibrium outcome. Retrospective voting is a particular resolution of the indifference of voters creating the highest possible disciplining device. The voting behavior can be further justified as a unique equilibrium outcome when we allow for an arbitrarily small amount of reciprocity. This justification has been developed by Hahn (2007). Of course, retrospective voting is a polar case and thus highlights the trade-offs the politician faces.

6 The assumption of voters acting unsophisticatedly can be justified as follows: Suppose that only a share of voters is totally rational and bases its reelection decision on the equilibrium outcome and on its expectations as to the politicians’ behavior, while the other part of the electorate is impressionable and reelects a politician if he has undertaken the popular action
actions, their beliefs regarding re-election are given as

\[
 r_1 = \begin{cases} 
 \mu + (1 - \mu) = 1 & \text{if } a_1 = 1, s_1 = 1 \\
 0 & \text{if } a_1 = 0, s_1 = 1 \\
 1 - \mu & \text{if } a_1 = 1, s_1 = 0 \\
 \mu & \text{if } a_1 = 0, s_1 = 0 
\end{cases}
\] (3.1)

We assume that re-election probability at the end of period 2 depends only on the outcomes realized in period 2 from the policy action undertaken in period 1. Further policy actions during the second term are assumed to be irrelevant for re-election chances at the end of period 2. This assumption greatly simplifies our analysis and can be justified in several ways. First, if the politician undertakes only long-term policies in the second period, then no new information may be available at the end of the second period when the second re-election decision takes place. Second, the policy actions during his second term in office may be much less relevant than the first-period choices, so the performance of his policy depends only on his first-period action. Later we will extend our model to cover the case where the incumbent has to undertake further actions and discuss how this influences our result.

We use \( r_2 \) to denote the re-election probability for the incumbent at the end of period 2, and we assume that voters will re-elect the incumbent if and only if he has acted congruently. This means that both types of politician are deselected with certainty after the second period at the latest if they behaved dissonantly in the first period, while both types of politicians are re-elected with certainty at the end of the second period\(^7\) if they behaved congruently in the first period. Thus, the beliefs of the politicians regarding re-election at the end of period 2 are given as:

\[
 r_2 = \begin{cases} 
 1 & \text{if } a_1 = 1 \text{ and } s_1 = 1 \text{ or if } a_1 = 0 \text{ and } s_1 = 0 \\
 0 & \text{if } a_1 = 1 \text{ and } s_1 = 0 \text{ or if } a_1 = 0 \text{ and } s_1 = 1 
\end{cases}
\] (3.2)

\(^{a_1 = 1}\) if the true state of the world is unknown. If the share of impressionable voters is sufficiently large, this will result in the re-election scheme described above. The concept of impressionable voters has been introduced and used by McKelvey and Ordeshook (1987), Baron (1994), and Grossman and Helpman (1996) in the context of campaign spending.

\(^{7}\)Note that it is possible that a politician who behaved congruently in his first term may be ousted from office by the voters when they make their first re-election decision.
3.2.4 Preferences of Politicians

The elected politician has personal benefits $R$ from being in office. Furthermore, he obtains a private benefit or personal satisfaction $G$ if he undertakes the action that is optimal for himself. This benefit $G$ accrues to the politician in the period in which he performs the action. We assume that the candidate receives no utility from the realization of his preferred action if another politician undertakes the action.\(^8\) We use $\delta$ with $0 < \delta \leq 1$ to denote the discount factor for the politician. The utility of the politician in office is denoted by $U^p$ and given by

$$U^p = R + r_1[\delta R + r_2\delta^2 R] + \begin{cases} 
G & \text{if a congruent politician acts congruently} \\
G & \text{if a dissonant politician acts dissonantly} \\
0 & \text{if a congruent politician acts dissonantly} \\
0 & \text{if a dissonant politician acts congruently}
\end{cases} \quad (3.3)$$

where $r_1$ is given by equation (3.1) and $r_2$ is given by equation (3.2). Some examples will illustrate the point. An elected politician who is congruent has utility $R + (1 - \mu)\delta R$ if he chooses $a_1 = 1$ in state $s_1 = 0$, while his utility is $R + G + \mu[\delta R + \delta^2 R]$ if he chooses $a_1 = 0$ in state $s_1 = 0$. A politician of the dissonant type has utility $R + G + (1 - \mu)\delta R$ if he chooses $a_1 = 1$ in state $s_1 = 0$, while his utility is $R + [\delta R + \delta^2 R]$ if he chooses $a_1 = 1$ in state $s_1 = 1$.

We now need to examine the circumstances under which the elected politician will act congruently. Obviously, it is always optimal for the voters if the incumbent behaves congruently.\(^9\) We will use the following tie-breaking rule: If the elected politician is indifferent as to the two actions, he will undertake the action that is optimal for the voters.

3.2.5 Summary

The timing of the whole game in its basic version is summarized in the following figure:

---

\(^8\)We might also assume that the politician receives the same utility as an ordinary voter if his opponent performs the action. However, this assumption may be less plausible in the case of a dissonant politician. At all events, the results of our analysis are not affected as long as the value of $G$ is sufficiently large in comparison to the utility of ordinary voters.

\(^9\)Note that, in contrast to Maskin and Tirole (2004), there is no “selection effect” in our model, as the politician only acts during his first term in office. Thus there is no welfare-enhancing effect when the voters discover that the incumbent is of the dissonant type and accordingly select a new one.
3.3 Elections Only

In this section we consider the behavior of both types of politicians in the scenario without threshold contracts and information markets. Here elections are the only instrument used to discipline the incumbent.

### 3.3.1 Behavior of Dissonant Politicians

We first look at case \( s_1 = 1 \), where the popular action is optimal from the voters’ point of view but the politician would prefer the unpopular action. The dissonant politician will only undertake the socially optimal action if

\[
R + \delta R + \delta^2 R \geq R + G \\
\iff \delta R (1 + \delta) \geq G. 
\]  

(3.4)

Condition (3.4) will be violated if the personal gain from choosing the individually optimal action is sufficiently larger than the gains from holding office.
We next examine $s_1 = 0$. Here voters prefer the unpopular action while the politician prefers the popular action. The dissonant politician will only undertake the socially optimal action if

$$R + \mu(\delta R + \delta^2 R) \geq R + G + (1 - \mu)\delta R$$

$$\Leftrightarrow \delta R(2\mu + \delta \mu - 1) \geq G.$$  (3.5)

This condition can only be fulfilled for certain values of $\delta$ and $\mu$, as (3.5) cannot be satisfied if $(2\mu + \delta \mu - 1)$ is not positive. Note that $(2\mu + \delta \mu - 1)$ is monotonically increasing in $\delta$. For $\delta = 1$ the condition $(2\mu + \delta \mu - 1) > 0$ is equivalent to $\mu > \frac{1}{3}$. This means that, even in the case of $\delta = 1$ (which is the value of $\delta$ that makes the condition most likely to be fulfilled), it is only possible to fulfill equation (3.5) for $\frac{1}{3} < \mu < \frac{1}{2}$. Hence, there are large parameter ranges where a dissonant politician cannot be motivated to perform the socially optimal action if the unpopular state has occurred. In particular, this will not be possible if the probability of early observation by voters is small, as reflected in a low value for $\mu$. Further, it is obvious that condition (3.4) is easier to fulfill than condition (3.5).

Finally, we obtain the following intuitive results. If the parameters are such that condition (3.4) is fulfilled while condition (3.5) is not fulfilled, then there will be a distortion in favor of the popular action $a_1 = 1$. If neither condition (3.4) nor condition (3.5) are fulfilled, then there will be a distortion in favor of the unpopular action $a_1 = 0$.\textsuperscript{10} It is useful to summarize the key observations in the following Proposition.

**Proposition 3.1**

Dissonant politicians will not choose the socially optimal action

(i) if $s_1 = 1$ and $\delta R(1 + \delta) < G$ or

(ii) if $s_1 = 0$ and $\delta R(2\mu + \delta \mu - 1) < G$.

Three particularly interesting special cases of Proposition 3.1 are summarized in the following Corollary:

**Corollary 3.1**

Suppose $\delta = 1$. A dissonant politician will not choose the socially optimal action,
A) if $s_1 = 1$ has occurred and $G > 2R$ or

B) if $s_1 = 0$ has occurred and $G > \frac{1}{2}R$ or

C) if $s_1 = 0$ has occurred and $\mu < \frac{1}{3}$.

Note that $\delta = 1$ is most favorable for the public. If a dissonant incumbent cannot be motivated to act congruently in case $\delta = 1$, then it will never be possible.

### 3.3.2 Behavior of Congruent Politicians

The congruent politician will undertake the socially optimal action in state $s_1 = 1$ if

$$R + G + \delta R + \delta^2 R \geq R. \quad (3.6)$$

This condition is always fulfilled, which means that, in this state of the world, congruent politicians always undertake the socially optimal action, as both voters and the politician prefer the popular action.

We now look at case $s_1 = 0$, meaning that voters and the politician prefer the unpopular action. The congruent politician will only undertake the optimal action for the voters if

$$R + G + \mu(\delta R + \delta^2 R) \geq R + (1 - \mu)\delta R$$

$$\Leftrightarrow G + \delta R(2\mu + \delta\mu - 1) \geq 0. \quad (3.7)$$

In contrast to the case of $s_1 = 1$, it may now be the case that even a congruent politician will not undertake the socially optimal policy, although he too would prefer this policy, since the socially optimal action is unpopular but the politician would like to be reelected. This condition resembles equation (3.5), but now $G$ is on the left-hand side because a congruent politician receives personal benefits $G$ by acting congruently, while a dissonant politician receives $G$ by acting dissonantly. Hence, if condition (3.5) is fulfilled, then condition (3.7) will also hold. Obviously, if it is possible to motivate a dissonant politician to undertake the socially optimal action, then it is always possible to motivate a congruent politician to undertake the socially optimal action. Clearly, the reverse is not true. Furthermore, we have a distortion in favor of the popular action, given that it is possible for $a_1 = 1$ to be chosen too often, while the incumbent may not always carry out the
unpopular action $a_1 = 0$ when he should. We summarize the results in the following Proposition:

**Proposition 3.2**

A politician of the congruent type will not undertake the socially optimal action if $s_1 = 0$ and $G + R(2\mu + \delta R - 1) < 0$.

### 3.4 The Triple Mechanism

We now introduce reelection threshold contracts and analyze their effect on the behavior of politicians and on social welfare. We assume that there exists a political information market that yields a price predicting the reelection chances of the incumbent in the second reelection decision. Investors receive private signals about which state of the world has occurred, and information is aggregated in the information market. In Appendix C.2 we provide a detailed microfoundation of how prices are formed in this information market. The basic result is that the equilibrium price $p^*$ in the information market will be higher if the incumbent undertakes the socially optimal action, as choosing the optimal action ensures his success in the second reelection decision. In Appendix C.2 we prove the following result:

**Proposition 3.3 (short version)**

*If the signals of investors are sufficiently informative, then the equilibrium price on the information market is larger than one-half if the incumbent undertakes the action that is socially optimal, while it is smaller than one-half if the incumbent chooses the socially undesirable action.*

The detailed version of Proposition 3.3 and its proof can be found in Appendix C.2.

#### 3.4.1 Reelection Thresholds

Before the first period starts, politician $i$ can offer conditional reelection threshold contracts $C_i(p_i^1, p_i^0)$ with $0 \leq p_i^1 \leq 1$ and $0 \leq p_i^0 \leq 1$, which means that the incumbent will only be allowed to stand for reelection after the first period if the
price $p^*$ on a political information market fulfills the condition

$$p^* \geq \begin{cases} p_1^i & \text{if } a_1 = 1 \\ p_0^i & \text{if } a_1 = 0, \end{cases}$$

where $p_1^i$ is the threshold price if the incumbent undertakes $a_1 = 1$ and $p_0^i$ is the threshold price if he chooses $a_1 = 0$. As the action of the politician is observable and verifiable, politicians can condition the threshold prices on the action, therefore $p_1^i$ and $p_0^i$ may differ. Note that offering a contract with $p_1^i = p_0^i = 0$ is equivalent to offering no contract at all.

### 3.4.2 Reelection Schemes

Reelection schemes are given by equation (3.1) for the first reelection and by equation (3.2) for the second reelection.\footnote{If information markets are allowed and actually used, they might be taken into account by voters when making reelection decisions. Such feedback effects will be discussed in our extensions.} Recall from equation (3.1) that the scheme for the first reelection is such that a politician will always be deselected if he acts dissonantly in state $s_1 = 1$. Thus, threshold contracts will have no effect in state $s_1 = 1$, as in this state the reelection scheme from equation (3.1) effectively deters the politician from acting dissonantly. Adding threshold contracts prohibiting a politician who has behaved dissonantly from running for reelection will not change the results, as the politician would not be reelected anyway. By contrast, threshold contracts will have a positive effect in state $s_1 = 0$. As a consequence, only the threshold price $p_1^i$ will impact on the behavior of the politician, as dissonant behavior in state $s_1 = 0$ means choosing $a_1 = 1$ and thus $p_1^i$ applies.

### 3.4.3 Summary

The timing of the whole game including threshold contracts and political information markets is summarized in the following figure:
3.4.4 Robust Election Scheme

We assume that both politicians have to decide simultaneously about offering conditional threshold contracts. Moreover, we assume that voters use the following election scheme, where \( e_1(p_1^1, p_1^0, p_2^1, p_2^0) \) denotes the probability of candidate 1 being elected at the first election decision:

\[
e_1(p_1^1, p_1^0, p_2^1, p_2^0) = \begin{cases} 
1 & \text{if } p_1^k \geq \frac{1}{2} \text{ and } p_2^l < \frac{1}{2}, \\
1 & \text{if } \exists k \in \{0, 1\} : p_1^k \geq \frac{1}{2} \text{ and } p_2^l < \frac{1}{2} \forall l \in \{0, 1\}, \\
0 & \text{if } p_1^k < \frac{1}{2} \text{ and } p_2^l \geq \frac{1}{2} \forall l \in \{0, 1\}, \\
0 & \text{if } \exists k \in \{0, 1\} : p_1^k < \frac{1}{2} \text{ and } p_2^l \geq \frac{1}{2} \forall l \in \{0, 1\}, \\
\frac{1}{2} & \text{otherwise.}
\end{cases} \tag{3.8}
\]

We call this voting scheme robust election scheme (RES). The idea behind it is the following: Voters will elect a politician if and only if the threshold offers indicate that the politician will choose the socially optimal action, i.e. if \( p \geq \frac{1}{2} \).\(^{12}\) The precise values of \( p \) do not matter. Under RES a politician is elected with certainty if he offers prices for both actions that are equal to or above \( \frac{1}{2} \) if the other politician does not do the same. If both candidates offer threshold \( \frac{1}{2} \) the equilibrium price on the information market will be larger than one-half if and only if the incumbent undertakes the action that is socially optimal.

\(^{12}\) Recall that the equilibrium price on the information market will be larger than one-half if and only if the incumbent undertakes the action that is socially optimal.
values that are qualitatively similar with regard to the comparison to $\frac{1}{2}$, then both candidates will be elected with a probability of one-half. Later we will show that the assumptions of the voters in equilibrium are correct regarding the behavior of politicians. Accordingly, we call this an optimal voting scheme.

3.4.5 Equilibrium Notion

We are looking for perfect Bayesian equilibria of the game depicted in Figure 3.2 among politicians and investors. Voters are not highly sophisticated players. They vote according to RES, as described above, and to the reelection schemes given in equations (3.1) and (3.2). Henceforth a Bayesian equilibrium will simply be called “equilibrium”. The entire game is solved by assuming RES and the property that a price equal to or above $\frac{1}{2}$ indicates that the politician has chosen the optimal action, while a price below $\frac{1}{2}$ indicates the opposite. The optimality of RES will be shown later. The property of the prices in the information market is established in Appendix C.2. There we show that sophisticated investors use their private signals and their updated beliefs from the signalling subgame when politicians choose their action to trade on the information market. The equilibrium price indicates whether the office-holder has chosen the socially desirable action.

3.4.6 Equilibria

In this subsection we examine equilibria that involve robust election schemes. It is important to note that, when threshold contracts are offered, politicians do not know which state of the world will occur. We use the following plausible refinement:

**Minimal Price Offer (MPO)**

If a candidate is indifferent between two sets of prices for $p_1^i$ and $p_0^i$ given the contract choice of the other politician and RES, then he will choose the contract with the minimal values for $p_1^i$ and $p_0^i$ in the corresponding sets.

A formal description of MPO is as follows: Suppose a politician is indifferent between $C_i(p_1^i, p_0^i)$ and $\tilde{C}_i(\tilde{p}_1^i, \tilde{p}_0^i)$. Then he will choose $C_i(p_1^i, p_0^i)$ if $p_k^i \leq \tilde{p}_k^i \quad \forall k \in \{0, 1\}$ and \(\exists l \in \{0, 1\} : p_l^i < \tilde{p}_l^i\), but $\tilde{C}_i(\tilde{p}_1^i, \tilde{p}_0^i)$ if $p_k^i \geq \tilde{p}_k^i \quad \forall k \in \{0, 1\}$ and \(\exists l \in \{0, 1\} : p_l^i > \tilde{p}_l^i\).
The refinement can be justified by weak dominance, as the likelihood of fulfilling a given threshold is non-increasing in the value of the prices. Through the observation that the utility of an elected politician weakly decreases in his price offers we obtain the following Lemma:

**Lemma 3.1**

Under MPO and RES, equilibrium price offers satisfy $p^k_i \leq \frac{1}{2}$ $\forall k \in \{0, 1\}, i = 1, 2$.

Next, as a consequence of Lemma 3.1 and RES, we can restrict ourselves to four cases:

(i) $p^1_i = \frac{1}{2}, p^0_i = \frac{1}{2}$

(ii) $p^1_i = \frac{1}{2}, p^0_i < \frac{1}{2}$

(iii) $p^1_i < \frac{1}{2}, p^0_i = \frac{1}{2}$

(iv) $p^1_i < \frac{1}{2}, p^0_i < \frac{1}{2}$

As only the threshold price $p^1_i$ will impact on the behavior of the incumbent, we thus obtain the following Lemma:

**Lemma 3.2**

A) Cases (i) and (ii) induce the same behavior by an elected politician.

B) Cases (iii) and (iv) induce the same behavior by an elected politician.

In Appendix C.1 we show

**Proposition 3.4**

Both politicians will offer threshold contracts $C_i(p^1_i = p^0_i = \frac{1}{2})$ under election scheme RES, irrespective of their own type and irrespective of the type of their opponent.

Given this result of Proposition 3.4, we next show that the voting behavior of the RES is indeed optimal:

**Proposition 3.5**

The robust election scheme (RES) is optimal for voters.

---

13Strictly speaking, weak dominance refers to the contract choices of politicians given the voting scheme RES of voters and the behavior of investors in the information market.
The proof is given in Appendix C.1. The strength of \( \text{RES} \) is that voters do not need to have specific information regarding the parameters of projects or the signals of investors in the information market. They simply judge whether politicians are willing to compete against a fair coin. The next Proposition is our main result.

**Proposition 3.6**

*The conditions under which politicians in state \( s_1 = 0 \) behave congruently with threshold contracts are less strict, and dissonant behavior is less attractive, than without threshold contracts. This holds for both types of politicians. In particular, with the triple mechanism we obtain:*

(i) A dissonant politician behaves congruently in state \( s_1 = 1 \) if and only if \( \delta_R (1 + \delta) \geq G \).

(ii) A dissonant politician behaves congruently in state \( s_1 = 0 \) if and only if \( \delta_R \mu (1 + \delta) \geq G \).

(iii) A congruent politician always behaves congruently in both states.

The proof is given in Appendix C.1. The intuition is as follows: Given equilibrium threshold contracts \( C_i(p_1^i = \frac{1}{2}) \), politicians have no chance of being reelected in state \( s_1 = 0 \) if they behave dissonantly, i.e. if they undertake \( a_1 = 1 \). If they behave congruently, their reelection chances are given by probability \( \mu \). If threshold contracts are absent, a politician who behaves dissonantly still has a chance to get reelected, while congruent behavior does not yield higher reelection probabilities than \( \mu \). Hence, threshold contracts make dissonant behavior in state \( s_1 = 0 \) less attractive than congruent behavior.

In Appendix C.4 we provide a brief example of the welfare gains that can be achieved with the triple mechanism. The example illustrates, among other things, that threshold contracts have the largest effect on welfare when \( R \) is larger than \( G \) and when the probability of the unpopular state \( s_1 = 0 \) is rather high (i.e. \( z \) close to \( \frac{1}{2} \)).

### 3.5 Extensions

In the following we first extend our analysis by considering other election schemes. Then we briefly discuss two further extensions.
3.5.1 Monotonic Election Scheme and Overpromising

As we showed in Proposition 3.5 the robust election scheme used in the last section is optimal for voters. However, it is not clear whether the scheme is unique. In this section we consider further candidates for election schemes. We start with a simple and intuitive scheme that we call the monotonic election scheme (MES):

\[
e_1(p^1_1, p^0_1, p^1_2, p^0_2) = \begin{cases} 
1 & \text{if } p^k_1 \geq p^k_2 \forall k \in \{0, 1\} \text{ and } \exists k \in \{0, 1\} : p^k_1 > p^k_2, \\
0 & \text{if } p^k_1 \leq p^k_2 \forall k \in \{0, 1\} \text{ and } \exists k \in \{0, 1\} : p^k_1 < p^k_2, \\
\frac{1}{2} & \text{otherwise.}
\end{cases}
\]

The MES is intuitive in the sense that voters simply elect the candidate who offers tighter constraints on his reelection thresholds. The problem is, however, that overpromising may occur under MES. We call a threshold contract with prices \(p^1, p^0\) overpromising if at the date of the offer the politician already knows that at least one of the thresholds can never be reached. Such overpromising may occur if it is more profitable for a politician to be elected with certainty in the first election and to be certainly not reelected in the next election, in comparison to being elected with probability \(\frac{1}{2}\) in the first election and having a positive reelection probability. In Appendix C.1 we show

**Proposition 3.7**

*Under the monotonic election scheme, overpromising may occur.*

Overpromising invites extreme short-termism, where both types of politicians simply behave in accordance with their first-period preferences and maximize their first period utility. In the case of overpromising, dissonant politicians will always behave dissonantly, while a congruent politician will behave congruently.\(^{14}\) Hence, the monotonic election scheme is not optimal and thus is not an equilibrium response by voters.

\(^{14}\)It is obvious that overpromising is socially detrimental in the case of dissonant politicians. If the incumbent is congruent, there will be no immediate negative effect on social welfare. However, as a congruent incumbent who overpromises will be replaced by a new politician who can either be congruent or dissonant, overpromising by congruent politicians would have negative effects on social welfare in an extended version of the model, where the incumbent would undertake further action in periods 2 or 3.
CHAPTER 3. ELECTIONS, CONTRACTS, AND MARKETS

3.5.2 Sophisticated Election Scheme

We next examine a voting scheme which we call the sophisticated election scheme (SES):

\[
e_1(p^1_1, p^0_1, p^1_2, p^0_2) = \begin{cases} 
1 & \text{if } p^1_1 \geq z, \ p^0_1 \geq 1 - z, \text{ and } p^1_2 < z \text{ or } p^0_2 < 1 - z, \\
1 & \text{if } p^2_1 < z, \ p^0_2 < 1 - z, \text{ and } p^1_1 \geq z \text{ or } p^0_1 \geq 1 - z, \\
0 & \text{if } p^1_1 < z, \ p^0_1 < 1 - z, \text{ and } p^1_2 \geq z \text{ or } p^0_2 \geq 1 - z, \\
0 & \text{if } p^2_1 \geq z, \ p^0_2 \geq 1 - z, \text{ and } p^1_1 < z \text{ or } p^0_1 < 1 - z, \\
\frac{1}{2} & \text{otherwise.}
\end{cases}
\]  

This voting scheme is similar to RES but the critical values are not \( \frac{1}{2} \) but \( z \) for action \( a_1 = 1 \) and \( 1 - z \) for action \( a_1 = 0 \). This reflects the fact that the a priori probability for \( s_1 = 1 \) (where \( a_1 = 1 \) is socially optimal) is \( z \) and for \( s_1 = 0 \) (where \( a_1 = 0 \) is socially optimal) is \( 1 - z \). With a sophisticated election scheme, voters demand that the prices on the information market at least reach the a priori probabilities. In this voting scheme voters use the following result:

**Proposition 3.8 (short version)**

If the signals of investors in the information market are sufficiently informative, then the following holds:

1. **(i)** If the incumbent undertakes \( a_1 = 1 \), then the price on the information market will be larger than \( z \) if \( s_1 = 1 \) and smaller than \( z \) if \( s_1 = 0 \).
2. **(ii)** If the incumbent chooses \( a_1 = 0 \), then the price on the information market will exceed \( 1 - z \) if \( s_1 = 0 \), while the price will be below \( 1 - z \) if \( s_1 = 1 \).

The detailed version of Proposition 3.8 and its proof can be found in Appendix C.2. Furthermore, one can show that under SES both politicians will offer \( C_i(p^1_1 = z, p^0_1 = 1 - z) \) and that SES is also optimal for voters. The proof follows the same lines as the proof of Propositions 3.4 and 3.5 and is therefore omitted here. Note that, with a sophisticated election scheme, voters anticipate that the market price will be higher under congruent behavior of the politician in state \( s_1 = 1 \) than under congruent behavior of the politician in state \( s_1 = 0 \). While both RES and SES are optimal for voters, we will show in Corollary C.1 of Appendix C.2 that
the conditions for Proposition 3.8 to hold are weaker than the conditions required for Proposition 3.3 to hold.

3.5.3 Market-Based Voting

In our basic model we have assumed that the price on the information market has no influence on reelection probability. Now we assume the other extreme case, where voters only use the price on the information market as a basis for their first reelection decision. In this case, threshold contracts are without effect (either positive or negative). The existence of a political information market that predicts the reelection chances after the next term is sufficient to generate all efficiency gains when voters solely use information markets as their forward-looking reelection scheme. The reason is that the price on the information market is the best predictor regarding the quality of the decisions of the politician. The case where voters solely rely on the information market regarding their voting behavior is, however, less plausible.

3.5.4 Repeated Action

Another potential extension is to examine repeated actions by the politician. Suppose that the incumbent stays in office as long as he gets reelected, that he undertakes an action \( a_t \) in each period \( t \) in office,\(^\text{15}\) and that the candidates are allowed to offer threshold contracts before each election. In the precursor of this chapter (Gersbach and Müller (2006)), we have shown that the results of the two-period case still hold when actions are repeated. In particular, threshold contracts are always socially advantageous compared to elections alone, since the probability of a politician behaving congruently is higher when threshold contracts are used.

3.6 Conclusion

In this chapter we have proposed a triple mechanism for improving the functioning of democracies when information is not observable or not verifiable. The results

\(^\text{15}\)We assume that the politician will undertake no action in the last two periods, which corresponds to our assumption in the basic model where the politician does not take any action in the second and third period.
seem to be quite robust for various extensions. Moreover, the idea of the triple mechanism could be extended to multi-task settings, where the politician decides on many issues in his first term. As the threshold contract depends on the average long-term performance of the politician, the standard problem may aggravate distortions in favor of tasks with better observability.

Political information markets are an instrument for solving the problem of short-term unobservability coupled with long-term non-verifiability. Hence threshold contracts combined with information markets can be used successfully when projects have long-term effects and information on project results is not available in the short term. Of course, any proposal for a new institution, such as the one we have made in this chapter, has to be subjected to further scrutiny.\footnote{One might, for example, wonder how the triple mechanism could be introduced. We think that this might be triggered in election campaigns. If one party proposes the idea, then competing parties might be forced to offer the same in order to avoid losing votes.} Such scrutiny will be undertaken in our future research work.
Chapter 4

Flexible Pensions for Politicians

4.1 Introduction

In this chapter we examine the last-period problem in connection with politicians, i.e. the problem of motivating an office-holder to work hard for the benefit of the public if he knows that it is his final term in office. Such incumbents may be tempted to shy away from working hard on socially desirable public projects.

We propose a combination of a political information market and a flexible pension scheme to deal with the problem of a lack of disciplining devices during the last term in office. Our proposal can be outlined as follows: Suppose an office-holder learns that he would not like to run for reelection. This information is private. The politician has to decide how much effort he is still willing to expend on current policy projects. The effort choice is not verifiable. The public does not know whether or not the politician wants to run again, so it organizes an information market predicting the chances of the incumbent being reelected. A high price on the information market indicates high probability that the incumbent will be reelected.\footnote{Alternatively, one might use an information market that predicts the percentage rate of votes the incumbent’s party will receive, or even directly the shares of votes the incumbent party will be given. Such variations would not change the basic idea behind our proposal.} At some point in time, the incumbent announces whether he will seek a further term or not. In the former case, the information market is concluded when the next election has taken place. In the latter case, the information market is neutralized, i.e. the investors simply get their money back. The last price realized, however, is used in this case to determine the pension of the
retiring incumbent. A higher price, and thus higher assessment of the incumbent’s reelection chances, yields a higher pension.\footnote{Note that it is not possible to make the amount of pension directly dependent on the effort of the incumbent as the effort is not verifiable. Thus, a political information market is used to produce verifiable information in the form of a market price.} In contrast to the last chapter where we used an information market to predict the result of the next but one election to obtain an approximation of the long-term effects of the current policies we now use the information market to predict the result of the next election to estimate the performance on which politicians’ pensions depend.

Such a scheme of flexible pensions involves two effects. On the one hand, the politician can increase his pension by increasing his efforts. On the other hand, flexible pensions decrease the marginal value of getting reelected as the gap between remuneration in office and the pension decreases with higher effort. The purpose of this chapter is first to illustrate the idea in a simple political agency model and second to show that a carefully designed combination of political information markets and flexible pensions can – on balance – improve welfare.

Like in chapter 3, we analyze again the case where the results from current policy can only be observed but are never verifiable. A political information market is used to produce verifiable information in the form of prices at a time when policy results are not observable. Note that in this chapter we use a much simpler version of a political information market than in Appendix C.2 to chapter 3.

This chapter is organized as follows: In the next section we discuss the related literature. We introduce the basic model in section 4.3. The results with fixed pensions are analyzed in section 4.4. In section 4.5 we introduce flexible pensions. Section 4.6 contains our main results. In section 4.7 we discuss several extensions. Section 4.8 contains practical considerations. Section 4.9 concludes. Appendix D.1 contains selected proofs of this chapter.

4.2 Related Literature

Our work is related to the literature about pensions for politicians and about the incentive problem in an incumbent’s last term. The problem that the reelection mechanism can no longer motivate the incumbent when he knows that the term in
question is his final one, is described e.g. in Barro (1973) and Carey (1994). Barro (1973) suggests solving the last-period problem in the following way: Political parties might provide a control mechanism for ex-office-holders based on their performance during their last term in office by appointing them to special positions in the party, such as honorary chairman. Another solution to the last-period problem has been proposed by Becker and Stigler (1974). They suggest that office-holders should be threatened with the loss of their pension in the case of malfeasance during their last term. Our solution to the last-term problem is to introduce an information market and design a flexible pension scheme depending on the resulting market price. Another paper proposing a solution to the last-term problem in politics is Alesina and Spear (1988). In an overlapping generations model, they analyze a scenario where politicians choose a platform in a one-dimensional policy space. Without a reward, an incumbent will select his most preferred policy in his last term, which may deviate from the socially optimal one. They propose a solution where the current incumbent receives a transfer from his own party’s next candidate for office if he does not choose his own bliss point, but a policy which increases this candidate’s election chances. There are four main differences between Alesina and Spear (1988) and our solution. First, the Alesina and Spear approach is based on the belief that rewarding incumbents for good performance today will be honored by the same reward scheme in the future. In our case, the reward for good performance is solely determined by the performance of the incumbent and does not depend on the future. Second, the Alesina and Spear approach exhibits multiplicity of equilibria. In one equilibrium, the last period problem is not solved. We have a unique equilibrium. Third, we introduce an information market to produce a verifiable outcome of the politician’s effort. Such a mechanism is missing in Alesina and Spear. Fourth, our approach requires the implementation through public pension laws, while the Alesina and Spear solution can work through conventions.

3 Note that there may also be positive last-term effects as the probability that the incumbent undertakes long-term efficient policies that are unpopular in the short term may be higher when the politician knows that he is in his last term. The question of whether the overall effects of last terms are positive or negative is controversial in the literature (see for example Smart and Sturm (2004)).

4 We note that office-holders performing well may have better career opportunities after they leave office than less performing ones, which alleviates the last-term problem.

5 In this chapter we concentrate on the case of politicians voluntarily retiring from their political career or losing in the reelection decision. We neglect the case where politicians have to leave office due to term limits. We will discuss how the last-term problem might be solved in the case of term limits in section 4.8.
4.3 The Basic Model

We consider a political agency problem with asymmetric information regarding the incumbent’s decision about running for reelection. There are 2 periods denoted by $t = 1, 2$. The public consists of a large number of homogeneous voters. A representative voter is denoted by $v$.

4.3.1 The Effort Decision

We assume that there is one risk-neutral incumbent in office who has to decide about his amount of effort on a task creating a public project in period 1. The chosen amount of effort in period 1 is denoted by $e$. We assume that due to physical constraints there is an upper bound $\bar{e} > 0$ such that $0 \leq e \leq \bar{e}$. We use $b$ to denote the social benefits per capita deriving from the expenditure of effort and assume that they are proportional to the amount of effort, i.e.

$$b = k \cdot e$$  \hspace{1cm} (4.1)

with $0 < k < 1$. On the other hand exerting effort is costly for a politician. Effort $e$ in period 1 is associated with costs $ce^2$ for the incumbent. The factor $c$ (where $c > 0$) can be interpreted as the competence of the incumbent. A small value for $c$ is equivalent to high competence, i.e. undertaking a given project does not result in high effort costs for the politician. We will use the following standard rule to break ties: If the incumbent is indifferent as to two effort options, he will choose the amount of effort that leads to higher social welfare.

4.3.2 The Utility

We use $W_t$ to denote the utility from holding office in period $t$. The variable $m$ denotes the level of the pension the politician will receive in period 2 if period 1 is his last term in office. We start with a fixed pension scheme where pensions are fixed to $\bar{m}$ and $\bar{m} > 0$.

At the beginning of period 1, the incumbent observes the utility he would derive from holding office in the next period. This can either be low utility $\underline{W}_2$ or high utility $\overline{W}_2$. The a priori probability that the incumbent will obtain $\overline{W}_2$ in the next period is $q$ (where $0 < q < 1$), while the probability of obtaining $\underline{W}_2$ is $1 - q$. 
We assume that $q$ is common knowledge. There are a variety of reasons why $W_2$ may be stochastic. For instance, an incumbent may be physically exhausted so that staying in office would be a risk to his health. Also, challengers in his own party may threaten to make life in office difficult for the politician. Finally, the incumbent may forgo career opportunities if he stays in office.

The incumbent will run for reelection if and only if his utility from holding office in the next period is at least as large as his outside option, which consists of his pension. We assume that $W_2 \geq m$ and that $W_2 < \bar{m}$. Thus, at the end of period 1 the incumbent will run for reelection if he observes $W_2$, while he will not want to run for reelection if he observes $\bar{W}_2$.

We assume that – just like every other citizen – the politician receives per capita benefits $b = ke$. We use $r_1$ to denote the incumbent’s probability of getting reelected at the end of period 1 and $\delta$ to denote his discount factor ($0 < \delta < 1$). As $W_1$ (i.e. the utility from holding office in period 1) is sunk when the politician chooses his amount of effort, we will neglect $W_1$ in the subsequent analysis. The remaining utility of incumbent $i$ is denoted by $U_i$. After he has learned $W_2$, $U_i$ is either
\[
U^{i}_{NR} = ke - ce^2 + \delta m
\] (4.2)
if he knows that he will not run for reelection ($W_2 = \bar{W}_2$) or
\[
U^{i}_{R} = ke - ce^2 + \delta[(1 - r_1)m + r_1\bar{W}_2]
\] (4.3)
in the case where he knows that he will run for reelection ($W_2 = W_2$).

It is obvious that the incumbent will never choose $e = 0$, as he benefits from the public project. Finally, we make the assumption
\[
\bar{e} \geq \frac{k}{2c} + \sqrt{\frac{\delta \bar{W}_2}{c}}
\] (4.4)
which ensures that the incumbent will never want to choose a corner solution as we show in Appendix D.2. Accordingly, we can concentrate on interior solutions.

The expected utility function of a representative voter $v$ is:\footnote{Note that we disregard the wage and pension costs of the politician in the utility function of the voters, which is a good approximation if the number of voters is large.}
\[
U^v = b.
\] (4.5)
4.3.3 The Information Structure

We assume that at the beginning of period 1 the incumbent knows whether he will run for reelection at the end of this period or whether this will be his final term in office. However, he will not yet disclose this to the public in order to avoid a loss of political power (in particular in his own party). In politics, an incumbent who is known not to be seeking reelection but continuing to hold office up to the election date is called a \textit{lame duck}.\footnote{The “lame duck” phenomenon is well documented in the literature (see e.g. Millimet, Sturm, and List (2004)).} In extreme cases incumbents known to be lame ducks are unable to implement any more projects during the rest of their final term.

We assume that voters are able to perfectly observe the value of $b$ at the date of the reelection decision and can thus perfectly infer $e$. We assume that, in contrast to ordinary voters, investors receive early signals about the performance of the politician.\footnote{One could assume that investors spend time on collecting information concerning the quality of the incumbent’s policy and thus obtain such knowledge earlier than ordinary voters.} In particular, each investor $j$ obtains a noisy signal $\beta_j$ before the incumbent informs the public about whether he will run for reelection or not. We assume that signal $\beta_j$ is given as

$$\beta_j = b + \epsilon_j$$

where the error term $\epsilon_j$ is a random variable with support $[-a; a]$ ($a > 0$), distributed with the density function $f(\epsilon)$ and $E(\epsilon) = 0$. Thus the signal $\beta$ is distributed with the density function $f(\beta) = f(b + \epsilon)$ on $[b - a; b + a]$ and $E(\beta) = b$.\footnote{Note that any signal $\beta_j < 0$ will be interpreted as $b = 0$ and that any signal $\beta_j > k\bar{\epsilon}$ will be interpreted as $b = k\bar{\epsilon}$.}

4.3.4 The Reelection Scheme

In modeling reelections, we only have to look at the case where the incumbent runs for office again. Voters are assumed to make their reelection decision dependent on benefit and thus on the effort the politician has exerted. From the perspective of the incumbent at the beginning of period 1, the probability $r_1$ that he will be reelected when he runs for reelection and voters observe effort $e$ is assumed to be given by
\[ r_1(e) = \begin{cases} 0 & \text{if } e = 0 \\ \phi e & \text{if } 0 < e < \overline{e} \\ 1 & \text{if } e = \overline{e} \end{cases} \quad (4.7) \]

where \( \phi = \frac{1}{\overline{e}} > 0 \). Note that the incumbent will never get reelected if he exerts no effort at all and that he will only get reelected with certainty if he chooses the maximum possible amount of effort.

The fact that reelection probability depends monotonically on \( e \) can be interpreted as a mixture of prospective and retrospective voting behavior (see Gersbach and Liessem (2008) for detailed justification and discussion). The essential assumption is that the reelection scheme is a continuous function of effort.

### 4.3.5 Summary

The timing of the game is summarized in the following figure:
4.4 Results under Fixed Pensions

In this section we assume that the amount of the pension is fixed at $m$. Recall that we assume that $m \leq W_2$, as otherwise incumbents would never aspire to get reelected.

4.4.1 First-Best Solution

We start by characterizing the first-best solution. To derive the first-best solution we assume that voters observe the realization of $W_2$ and can write a forcing contract contingent on $W_2$ and on the effort level. If the incumbent fulfills the contract, he will be reappointed (in case $W_2 = W_2$) or he receives the fixed pension $m$ (in case $W_2 = W_2$). We denote the first-best amount of effort by $e_{fix,FB}^R$ if $W_2$, and by $e_{fix,FB}^{NR}$ if $W_2$.

**Proposition 4.1**

The first-best amount of effort is given by

$e_{fix,FB}^R = \frac{k}{2c} + \sqrt{\frac{\delta W_2}{c}}$ \hspace{1cm} (4.8)

$e_{fix,FB}^{NR} = \frac{k}{2c} + \sqrt{\frac{\delta m}{c}}$. \hspace{1cm} (4.9)

The proof is given in Appendix D.1. First-best efforts are given straightforwardly by the maximum effort at which the politician is indifferent between exerting first-best effort and renouncing the contract. Note that the first-best solution is achieved e.g. by the following punishment scheme:

- If the incumbent wants to stay in office and chooses a lower level of effort than $e_{fix,FB}^R$, then he will not be re-appointed.
- If the incumbent wants to retire and chooses a lower level of effort than $e_{fix,FB}^{NR}$, then he will receive no pension.

Such harsh punishment would require that voters were able to observe $W_2$, which, however, is private information in our model. In the following, we assume that voting is given by equation (4.7), which we discussed in subsection 4.3.4.\(^{10}\)

\(^{10}\)We would like to stress that a purely retrospective voting scheme, i.e. a threshold voting scheme, would also be an equilibrium response of voters in our model.
CHAPTER 4. FLEXIBLE PENSIONS FOR POLITICIANS

4.4.2 Fixed Pensions and the Reelection Mechanism

In this subsection we derive subgame-perfect equilibria for the game in the case where reelection takes place or the politician opts for a fixed pension scheme.

As the politician knows whether he will run for reelection or not at the date when he chooses his amount of effort, two incentive constraints are important: $IC_{fix}^R$ when the politician runs for reelection and $IC_{fix}^{NR}$ when he does not.

The incentive constraints are given as follows:

$$IC_{fix}^R e = \arg \max_e \{ke - ce^2 + \delta[r_1 W_2 + (1 - r_1)m]\}, \quad (4.10)$$

$$IC_{fix}^{NR} e = \arg \max_e \{ke - ce^2 + \delta m\}. \quad (4.11)$$

We start with the case where the politician does not run for reelection.

**Proposition 4.2**

In the case where the politician knows that he will not run for reelection, his effort choice is

$$e_{fix}^{NR} = \frac{k}{2c}. \quad (4.12)$$

Similarly, we obtain

**Proposition 4.3**

In the case where the politician knows that he will run for reelection, his effort choice under the reelection scheme $r_1$ is

$$e_{fix}^R = \frac{k + \delta \phi(W_2 - \bar{m})}{2c}. \quad (4.13)$$

The incumbent’s effort choice under the reelection mechanism is smaller than in the first-best solution for two reasons. If the politician does not want to run for reelection, fixed pensions do not create incentives to work hard and the effort choice is determined solely by personal benefits. If the politician runs for reelection, he has a chance of staying in office for lower efforts than in the first-best solution, which in turn induces him to exert less effort.

**Corollary 4.1**

(i) $e_{fix}^{NR} < e_{fix,FB}^{NR}$

(ii) $e_{fix}^{R} < e_{fix,FB}^{R}$

Proposition 4.2, 4.3 and Corollary 4.1 are proven in Appendix D.1.
CHAPTER 4. FLEXIBLE PENSIONS FOR POLITICIANS

4.5 The Model with Flexible Pensions

In the following, we introduce information markets and flexible pensions to investigate whether such a scheme can improve welfare.

4.5.1 The Information Market

We introduce a political information market that is organized in the first period, after the incumbent has chosen his amount of effort, but before he announces whether he will run for reelection.\footnote{Note that at this point of time, there will usually be uncertainty about the opponent in the reelection race. Then participants in the information market will evaluate the reelection chances of the incumbent against an unknown opponent. Such markets are already used in practice, e.g. there is a market which predicts the chances of a candidate for becoming US-President versus an unknown opponent.} We assume that there is an uneven number $N$ of potential investors and that each investor is only allowed to trade up to $\overline{s}$ assets.\footnote{It makes sense to restrict trade in such information markets to individuals and to limit trading volume per person to avoid large-scale manipulation attempts.} We assume that $\overline{s}$ is not too large, so that no investor is liquidity-constrained. Investors are assumed to be a small group of the electorate, so they have no influence on the voting outcome. For ease of exposition we assume in contrast to Appendix C.2 that investors are risk-neutral and have the following utility:

$$U_j(Y_j) = Y_j,$$ \hspace{1cm} (4.14)

where $Y_j$ is gain or loss in the information market.\footnote{Note that we neglect the utility from the chosen effort of the politician in the utility function of the investors, as policy outcomes have no influence on the trading behavior of the investors.} Investor $j$ obtains a signal $\beta_j$ and uses this signal to assess whether the politician is likely to get reelected or not.

Like in Appendix C.2 to chapter 3, there are two assets $D$ and $E$. If the politician is successfully reelected, then the owners of asset $D$ receive one monetary unit per unit of $D$. If the politician stands for reelection but is not reelected, then the owners of asset $E$ receive one monetary unit per unit of $E$. If the politician does not run for reelection, the market will be neutralized, i.e. each investor will be paid back the money he has invested.\footnote{Note that the politician may use his information about the fact whether he will run for reelection to make riskless profits in the information market. At the moment, we assume that politicians are not allowed to trade in the information market to circumvent this problem.} The entire information market works as
follows: A bank or an issuer offers an equal amount of assets \( D \) and \( E \). On the secondary market, traders can buy assets \( D \) or \( E \).\(^{15}\) Trading in the secondary market results in a price \( p \) for one unit of asset \( D \). As buying one unit of \( D \) and one unit of \( E \) pays one monetary unit with certainty, no arbitrage implies that the price of asset \( E \) must be \( 1 - p \). Otherwise either traders or the issuer could make risk-less profits. An equilibrium in the information market is a price \( p^* \) such that traders demand an equal amount of assets \( D \) and \( E \).

If the incumbent runs for reelection but loses against his rival candidate, his pension may be based either on the price in the information market or on the election result. When the information market works perfectly and correctly predicts the result of the next election, both measures are identical, and we will use the market price as a reference base for the determination of the pension, including the case where an incumbent loses.

It is useful to look more closely at the event tree associated with the assets. If, for example, an investor buys one unit of asset \( D \) at price \( p \), then the event tree, the payoffs on the information market, and the pension of the incumbent are given as

- Investor buys one unit of asset \( D \) at price \( p \)
  - If the incumbent runs for reelection
    - If the incumbent is reelected
      - Investor receives 1; pension not yet fixed
    - If the incumbent is not reelected
      - Investor receives 0; pension is \( m(p) \)
  - If the incumbent does not run for reelection
    - Investor receives \( p \); pension is \( m(p) \)

Figure 4.2

\(^{15}\)We could allow for short-selling, but this is immaterial to our analysis.
4.5.2 Flexible Pensions

Our central assumption is that the level of pension $m$ depends positively on price $p$ on the information market predicting the probability that the incumbent will be reelected. The basic idea is the following: If the incumbent has performed well during his last term and his reelection chances are high, price $p$ will be high, and this will engender a larger pension. Through price $p$ the pension will depend on the effort exerted by the politician. We maintain our assumption that the incumbent will run for reelection if and only if he observes $W_2$ to be his utility from office in period 2. The formal version of the necessary conditions for this assumption will be given in the next section.

4.5.3 Summary

The timing of the whole game, including information markets and flexible pensions, is summarized in the following figure:

![Figure 4.3](image-url)
4.6 Results under Flexible Pensions

In this section we derive the main results when flexible pensions are used.

4.6.1 Pricing on the Information Market

In the first step we determine the equilibrium price in the information market. An investor $j$ with signal $\beta_j$ takes into account his own information and the information the market price reveals. A standard way of modeling the information aggregation process is as follows:

$$Pr_j(RE|p) = z Pr_j(RE|\beta_j) + (1 - z)p.$$  

\[ (4.15) \]

$Pr_j(RE|p)$ is the probability assessment of investor $j$ on the chances that the incumbent will be reelected, where $z$ (with $0 \leq z \leq 1$) is a weighting term describing self-assessed confidence, i.e. the subjective confidence of an investor in his own signal $\beta_j$ relative to the market belief expressed by price $p$.\footnote{For a statistical foundation see Morris (1983) and Rosenblueth (1992). This information aggregation procedure is also used in Wolfers and Zitzewitz (2006).} We assume that $z$ is the same across all investors.

We next derive the investor’s reelection assessment for the incumbent. As $e = \frac{b}{k}$ and $r_1(e) = \phi e$ and taking into account the boundary conditions, we obtain

$$Pr_j(RE|\beta_j) = \begin{cases} 
0 & \text{if } \frac{\phi}{k} \beta_j < 0 \\
\frac{\phi}{k} \beta_j & \text{if } 0 \leq \frac{\phi}{k} \beta_j \leq 1 \\
1 & \text{if } \frac{\phi}{k} \beta_j > 1.
\end{cases}$$

\[ (4.16) \]

Given price $p$ and belief $\beta_j$, an investor $j$ maximizes

$$\max_{d_j} EU_j = (1 - q)[Pr_j(RE|p) (d_j(1 - p)) + (1 - Pr_j(RE|p)) (-d_jp)] + q \cdot 0$$

where $-\bar{s} \leq d_j \leq \bar{s}$. If $d_j$ is positive, investor $j$ wants to buy $d_j$ units of asset $D$. If $d_j$ is negative, investor $j$ wants to buy $d_j$ units of asset $E$. We obtain

$$\frac{\partial EU_j}{\partial d_j} = (1 - q)[(zPr_j(RE|\beta_j) + (1 - z)p)(1 - p) - (1 - zPr_j(RE|\beta_j) - (1 - z)p)p].$$

The derivative of the expected utility regarding $d_j$ does not depend on $d_j$, so each investor will choose a corner solution. If his signal $\beta_j$ is larger than the median...
signal, which is denoted by \( \beta^m_j \), then he will buy the largest possible amount of assets \( D \), i.e. \( d_j = \bar{s} \). If his signal \( \beta_j \) is smaller than \( \beta^m_j \), then he will buy the largest possible amount of assets \( E \), i.e. \( d_j = -\bar{s} \). As all investors will buy the largest allowed amount of assets, the number of investors who want to buy assets \( D \) is equal, in equilibrium, to the amount of investors who want to buy assets \( E \).

Accordingly we obtain the following Proposition:

**Proposition 4.4**

(i) There is a unique equilibrium in the information market given by

\[
p^* = \frac{\phi \beta^m_j}{k}.
\]

(ii) The expected price \( p^{*E} \) is given by

\[
p^{*E} = \frac{e}{\bar{e}}.
\]

The proof is given in Appendix D.1. The expected price \( p^{*E} \) is given by the ratio of the effort \( e \) that the incumbent actually exerts and the maximum effort level \( \bar{e} \). Note that \( 0 \leq p^{*E} \leq 1 \) and that the expected equilibrium price depends positively on \( e \). If the incumbent chooses a higher amount of effort \( e \), the expected signal \( E[\beta^m] \) will increase, which in turn raises \( p^{*E} \). This property will be used to design a flexible pension scheme in the next subsection.

### 4.6.2 Linear Dependence of Pension and Effort

We next introduce flexible pensions in the form of a two-part scheme:

\[
m = m^0 + \alpha p^*.
\]

Thus, the pension scheme is composed of a constant part \( m^0 \) where \( 0 \leq m^0 \leq \bar{m} \), and of a flexible part that depends in a linear way on the price in the information market with \( \alpha > 0 \). The expected pension \( m^{E} \) for the politician depends on the expected equilibrium price and is thus given by

\[
m^{E} = m^0 + \alpha p^{*E}.
\]

We construct the pension scheme in such a way that the expected flexible part of the pension that is paid in the case of the highest possible effort is equal to \( \bar{m} \). This requires

\[
\alpha \frac{\bar{e}}{\bar{e}} = \bar{m}
\]
which yields $\alpha = \overline{m}$ and
\[ m^E = m^0 + \overline{m} \frac{e}{e}. \tag{4.23} \]

We define $\lambda := \frac{\overline{m}}{q}$ and obtain
\[ m^E = m^0 + \lambda e. \tag{4.24} \]

Finally, using $\overline{e} = \frac{1}{\phi}$ leads to
\[ \lambda = \phi \overline{m}. \tag{4.25} \]

To ensure that the incumbent will run for reelection if and only if he observes $\overline{W}_2$, we sharpen our technical assumptions concerning $\overline{W}_2$ and $W_2$. We assume that $\overline{W}_2 \geq \overline{m} + m^0$, which ensures that $0 \leq m^E(e) \leq \overline{W}_2$ for all feasible values of $e$. Furthermore, we assume that $\overline{W}_2 < 0$.

Again we have to distinguish two cases. Either the politician decides that he will run for reelection ($IC^{flex}_R$) or he decides to drop out ($IC^{flex}_NR$). The optimum effort choices in both cases follow from the incentive constraints:

\[ IC^{flex}_R e = \arg \max_e \{ke - ce^2 + \delta [r_1 \overline{W}_2 + (1 - r_1)m^E(p(e))]\}, \tag{4.26} \]

\[ IC^{flex}_NR e = \arg \max_e \{ke - ce^2 + \delta m^E(p(e))\}. \tag{4.27} \]

We start with the latter case and obtain

**Proposition 4.5**

When the politician knows that he will not run for reelection, he chooses
\[ e^{flex}_{NR} = \frac{k + \delta \lambda}{2c}. \tag{4.28} \]

The proof of Proposition 4.5 is given in Appendix D.1. The former case yields

**Proposition 4.6**

In the case where the politician knows that he will run for reelection, his effort choice under a system with flexible pensions will be the following:
\[ e^{flex}_R = \frac{k + \delta \lambda + \delta \phi (\overline{W}_2 - m^0)}{2c + 2\delta \phi \lambda}. \tag{4.29} \]

The proof of Proposition 4.6 is given in Appendix D.1. It follows immediately from Proposition 4.6 that the amount of effort is decreasing in $m^0$, which is the fixed part. The intuition for this result is as follows: The disciplining effect of the reelection mechanism becomes weaker when the gap between the pension and $\overline{W}_2$ becomes smaller. As the spread decreases with $m^0$, the result follows.
4.6.3 Welfare Effects

In the following, we analyze two polar cases in order to shed light on the welfare effects of flexible pensions. The pure flexible pensions system is \( m^0 = 0 \). This represents a scheme where the incumbent receives no pension when he exerts no effort and where the highest possible pension for him is equal to \( \overline{m} \). Hence, in comparison to the system with fixed pensions, this is a pure penalty system. The other polar case is \( m^0 = \overline{m} \), which represents a pure bonus system where the incumbent is never worse off in comparison to the fixed pension scheme.

We compare the pure penalty and the pure bonus system with fixed pensions and start with the case where the incumbent is not running for reelection:

**Proposition 4.7**

*If the incumbent is not running for reelection, then the amount of effort under flexible pensions is strictly larger than the effort amount under fixed pensions for any \( m^0 \) where \( 0 \leq m^0 \leq \overline{m} \).*

This result follows directly from Propositions 4.2 and 4.5. This result is intuitively clear. Under a scheme with fixed pensions, the only motive to exert effort for an incumbent who knows that he will not run for reelection is private utility from policy projects. Under the two-part pension scheme, a higher effort choice increases his pension, and the politician has larger benefits from exerting effort, which in turn increases public welfare. Note that Proposition 4.7 holds for all types of two-part flexible pension schemes.

Now we look at the case where the politician knows that he will run for reelection. Here it will be important to distinguish pure penalty and pure bonus systems. We start with the former. In Appendix D.1 we show:

**Proposition 4.8**

*If the incumbent runs for reelection and if \( m^0 = 0 \), then the amount of effort under flexible pensions will always be weakly larger than the effort amount under fixed pensions.*

Proposition 4.7 and Proposition 4.8 imply that a pure penalty pension scheme is weakly welfare-improving in all cases. However, pure penalty schemes are difficult to use in practice, as they imply that people may fall below minimum consumption and starve. Hence we next consider a pure bonus system.
Proposition 4.9
If the incumbent runs for reelection and if \( m^0 = \bar{m} \), then the level of effort under flexible pensions will be smaller than the level of effort under fixed pensions if and only if
\[
\bar{W}_2 - \bar{m} > \frac{c - k\phi}{\delta \phi^2}.
\]
(4.30)

The proof is given in Appendix D.1. Proposition 4.9 shows that flexible pensions are not always welfare-enhancing if \( m^0 = \bar{m} \). The intuition for the result that flexible pensions may decrease welfare is as follows: On the one hand, a system with flexible pensions motivates the incumbent \textit{ceteris paribus} to choose a higher amount of effort, as this increases his pension in the case where he loses the reelection. On the other hand, flexible pensions result \textit{ceteris paribus} in a lower effort choice by the incumbent, as the disciplining effect of the reelection mechanism becomes weaker when the gap between the pension and \( \bar{W}_2 \) narrows. If the latter effect is larger, then flexible pensions under a pure bonus system will result in a lower effort choice than fixed pensions. It is obvious that the latter effect is growing in \( m^0 \), and this explains our result that the positive welfare effects of flexible pensions are decreasing in \( m^0 \). As we see in condition (4.30) flexible pensions will tend towards being worse than fixed pensions if the gap between \( \bar{W}_2 \) and \( \bar{m} \) is large, which means that the motivation due to the reelection mechanism is quite large.

Finally, we determine the scheme of flexible pensions with the highest value of \( m^0 \) that is universally welfare-enhancing, i.e. we determine a critical value, denoted by \( m^{\text{crit}} \), such that flexible pensions are always welfare-improving for all \( m^0 < m^{\text{crit}} \). We obtain

Proposition 4.10
There exists a \( m^{\text{crit}} > 0 \) such that for all \( m^0 \leq m^{\text{crit}} \) flexible pensions are weakly welfare-increasing in comparison to fixed pensions. This critical value is given by
\[
m^{\text{crit}} = \frac{2\bar{m} - k\lambda + \delta \phi \lambda (\bar{W}_2 - \bar{m})}{c}.
\]
(4.31)

The proof of Proposition 4.10 is given in Appendix D.1. Proposition 4.10 shows that a pension scheme using \( m^0 < m^{\text{crit}} \) is always weakly welfare-increasing.
4.7 Extensions

In this section, we will explore two extensions. First, we will design information markets that are robust to manipulations by the incumbent. Then, we construct a budget-neutral flexible pension scheme.

4.7.1 Manipulations by the Incumbent

As we already mentioned above, the incumbent may have incentives to manipulate the information market in the following way: Suppose that the incumbent knows that he will not run for reelection. Then he has an incentive to buy large amounts of assets $D$ in order to trigger a higher equilibrium price, as this would raise his pension. As the politician knows that the information market will be neutralized anyway and he will be paid back the money invested, the gains in terms of higher pensions are riskless.

There are several possibilities to prevent this kind of manipulation. The easiest way is to prohibit trading by politicians and to punish the use of stooges. In the following, we briefly discuss two alternative and robust schemes that will ensure that the incumbent is not interested in manipulating the market.

Our first proposal of a scheme is called *distorted neutralization*, which works as follows: Owners of asset $D$ only receive $(1 - \eta)p$ for each asset $D$ in the case of market neutralization (with $0 < \eta, \eta$ small), while owners of asset $E$ receive $(1 - p) + \eta p$ for each unit of $E$. As the incumbent would lose money if he buys assets $D$ in order to boost his pension, manipulations by the incumbent can be avoided for appropriate values of $\eta$.\(^{18}\)

The second scheme is to avoid neutralization at all. If investors receive nothing if an incumbent does not run for reelection\(^ {19}\) the incumbent has no incentive to manipulate the market. With such a scheme, prices $p_D$ and $p_E$ for assets $D$ and $E$ will depend on his beliefs regarding whether or not the politician will run for reelection. As the signal $\beta_j$ allows to update these beliefs, the determination of prices in the information market becomes much more cumbersome.

\(^{17}\)As the amount of assets $D$ per person is limited by $\overline{s}$, the politician would have to use stooges to undertake large scale manipulations.

\(^{18}\)Under such a scheme, the demand of an investor for assets $D$ or $E$ will depend on his beliefs regarding whether or not the politician will run for reelection. As the signal $\beta_j$ allows to update these beliefs, the determination of prices in the information market becomes much more cumbersome.

\(^{19}\)One might assume that the money is used as revenues for the government, e.g. it might be used to finance the pensions of politicians.
E will be lower,\(^{20}\) as investors have to take into account the case where they lose their invested money due to the incumbent’s not running for reelection. However, if one uses the ratio \(\frac{p_D}{p_E}\) for the variable part of a flexible pension scheme, all results from Propositions 4.5 - 4.10 will still hold.

### 4.7.2 Balanced Budgets

Another useful extension is to explore budget-neutral design of flexible pensions, i.e. to impose the requirement that expected expenditures are equal under flexible and under fixed pensions. One might argue that the public does not want to spend more on flexible pensions than on fixed pensions. We start by explicitly introducing the salary of politicians in office, denoted by \(S\), which is assumed to be fixed. Total benefits \(W_2\) are then composed of \(S\) and a personal, non-monetary benefit from holding office, denoted by \(P_2\). \(P_2\) is either \(P_2 < 0\) or \(P_2 > 0\) such that \(W_2 = S + P_2\) and \(W_2 = S + P_2\) are the two possible realizations of utilities of the incumbent. We use \(r_1^{fix}\) and \(r_1^{flex}\) to denote reelection probability depending on the pension scheme. The flexible pension scheme is given by \(m = m^0 + \mu e\), where \(m^0\) and \(\mu\) (with \(\mu > 0\)) are treated as variables selected by the public. The public’s problem is given by:\(^{21}\)

\[
\max_{m^0, \mu} q e^{flex}_{NR} + (1 - q) e^{flex}_R \tag{4.32}
\]

subject to

\[
q(m^0 + \mu e^{flex}_{NR}) + (1-q)[r_1^{flex} S + (1-r_1^{flex})(m^0 + \mu e^{flex}_R)] = q m + (1-q)[r_1^{fix} S + (1-r_1^{fix})m],
\]

\[
e^{flex}_{NR} = \frac{k + \delta \mu}{2c},
\]

\[
e^{flex}_R = \frac{k + \delta \mu + \delta \phi (P_2 + S - m^0)}{2c + 2 \delta \phi \mu},
\]

\[
r_1^{fix} = \frac{k + \delta \phi (P_2 + S - m)}{2c}
\]

and

\[
r_1^{flex} = \frac{k + \delta \mu + \delta \phi (P_2 + S - m^0)}{2c + 2 \delta \phi \mu}
\]

\(^{20}\)Note that \(p_D\) and \(p_E\) will no longer add to 1.

\(^{21}\)We focus on parameter constellations where interior solutions hold.
CHAPTER 4. FLEXIBLE PENSIONS FOR POLITICIANS

Note that the public aims at maximizing the expected effort under the flexible pension scheme, subject to the requirement that the expected remuneration of the politician is the same under flexible and fixed pensions. The optimization problem yields a unique solution involving $m^0 = 0$. The solution for $\mu$ is straightforward, but tedious to calculate and therefore omitted.

4.8 Practical Considerations

In this section we will address the practical implementation of our proposal. First, as already mentioned at the beginning, our proposal cannot be applied when there are term limits, as the information market will not work if it is certain that the incumbent is in his last term. In this case, one may conceive other ways, to make pensions dependent on performance in the last term. For instance, one could make the pension depend on the vote share the party of the incumbent will receive in the next election. As long as voters punish or reward parties for the behavior of their past office-holders, such a scheme would have effects similar to the ones of flexible pension schemes. Making pensions dependent on the future vote share of the ruling party would be applicable even in the case of binding term limits.

Second, in practice, the reelection probability of the incumbent will not only depend on the amount of effort, as there are many other influences beyond the incumbent’s control. However, as long as the incumbent can affect his reelection chances by working harder, our solution can work. Moreover, using an average price over a longer horizon to determine the pension diminishes the impact of a single factor outside the control of office-holders.

Third, manipulation by the incumbent is a real concern. Recall that an incumbent who knows that he is in his final term has an incentive to buy large amounts of assets $D$ in order to trigger a higher equilibrium price and to obtain a higher pension, as long as the market is neutralized in case the incumbent does not stand.

We have proposed two mechanisms to make manipulation costly: either to use a distorted neutralization or to abstain from any neutralization at all. We argue that these mechanisms can prevent manipulations by the incumbent, as long as the trading amount on the market is sufficiently large. The intuition runs as follows:

\footnote{Empirical evidence for a positive link between economic performance and election prospects for the incumbent party has been provided e.g. by Fair (1996) and Hibbs (2000).}
Suppose the incumbent wants to boost the equilibrium market price from \( p^* \) to a higher price, say \( p^+ \). Then he must pay \( 2\sigma \) times the number of investors who receive signals that suggest a reelection probability in the interval \([p^*, p^+]\) in the equilibrium without manipulation.\(^{23}\) If there are many investors, manipulations to induce a large difference \( p^+ - p^* \) will become very costly. In the case with distorted neutralization, the incumbent will lose some part of the expenditures for assets \( D \); if either the value \( \eta \) (i.e. the loss per asset \( D \)) or the trading amount on the market are sufficiently large, then the total losses for the incumbent will be high. In the case without market neutralization, all money spent for additional assets \( D \) is lost for the incumbent.

There is a further way to make manipulation very costly and to deter incumbents from doing it. One can use an average price over a larger horizon to determine the incumbent’s pension. Then, the incumbent would be forced to manipulate the price in the information market every day, which would become very costly over time.

### 4.9 Conclusion

In this chapter we have proposed a new procedure to solve the motivation problem of a politician in his last term. Several useful extensions of our model might be pursued in future research. For example, the model could be enriched by considering a heterogeneous electorate and interest groups lobbying for particular policies. Such an extension might strengthen the value of our mechanism, as politicians are less vulnerable to outside influence when their pensions are at stake. Moreover, we have proposed a mechanism mitigating the motivation problem of an incumbent knowing he is in his final term, but having the same interests in policies as voters. Whether flexible pensions might crowd out the incentive of incumbents to undertake unpopular, but socially desirable long-term policies in their last term is left to future research.

\(^{23}\)The reason is as follows: Investors in the interval \([p^*, p^+]\) originally buy assets \( D \), but if the price is boosted to \( p^+ \), they switch and buy assets \( E \). Thus, to induce an equilibrium price \( p^+ \), the incumbent has to buy an amount of assets \( D \) equal to the excess demand of assets \( E \) by private investors.
Chapter 5

Vote-Share Contracts and Learning-by-Doing

5.1 Introduction

The holder of a political office may enjoy an incumbency advantage that increases his chances of getting reelected. This will be socially detrimental if incumbency advantages lead to the reelection of a politician with ability, or effort, below average. On the other hand, incumbency advantages may also be beneficial for society if the incumbent experiences learning effects while being in office. Such learning-by-doing effects may increase his reelection chances and will be socially beneficial if they result in higher ability, or effort, of the office-holder in the next period.

In this chapter, we propose that candidates who compete for office should be allowed to offer vote-share contracts that diminish the incumbency advantage. Such a contract contains a vote-share threshold which may be above one-half or equal to one-half.\(^1\) In the next reelection, the elected politician has to achieve this threshold value at least to stay in office for a further term. Thus, by increasing the reelection hurdle vote-share contracts are an instrument to eliminate welfare-reducing incumbency advantages. We show that this positive aspect of vote-share contracts is not outweighed by the negative aspect brought up by the diminution of socially beneficial learning-by-doing effects.

Vote-share thresholds above one-half might have several effects. They might raise

\(^1\)Offering a vote-share contract with a vote-share threshold of exactly one-half would be equivalent to the usually applied system of majority voting.
the amount of effort exerted by the incumbent in order to increase his reelection chances. On the other hand, high vote-share thresholds might cause an incumbent to exert less effort if his reelection chances get too small. Furthermore, vote-share contracts might reduce the reelection probability of the incumbent. This might be beneficial if the reelection chances of an incumbent with an ability level below average get smaller. On the other hand, a lower reelection probability would be socially detrimental if a high vote-share threshold causes the deselection of an incumbent with ability above average. Finally, a lower reelection probability caused by vote-share contracts means that socially beneficial learning-by-doing effects will occur less often.

We illustrate the working of vote-share contracts in a simple two-period model and show that competition for vote-share contracts induces the candidates to offer voluntarily vote-share thresholds above one-half. If learning-by-doing effects are rather small, the introduction of vote-share contracts increases overall effort of the incumbent in our model. If learning-by-doing effects are rather large, introducing vote-share contracts increases the expected ability of the office-holder in the second period. Total welfare is increasing for all sizes of learning-by-doing effects if vote-share contracts are introduced.

This chapter is organized as follows: In the next section we present the related literature. We introduce our basic model in section 5.3. In section 5.4 we derive the results in the benchmark case with elections only. We analyze the results in a scenario with vote-share contracts and elections in section 5.5. In section 5.6 we examine the effect of vote-share contracts on public welfare. Section 5.7 contains several extensions of our basic model. Finally, section 5.8 concludes. Appendix E.1 contains the proofs.

5.2 Related Literature

The paper most closely related to this one is Gersbach (2007), where the concept of vote-share contracts, which are one particular type of political contracts, is proposed to alleviate negative aspects of incumbency advantage. In contrast to this work, incumbency advantages have solely negative effects in Gersbach (2007). We show in this chapter that the welfare-enhancing effect of vote-share contracts still holds when incumbency advantages also have positive aspects.
CHAPTER 5. VOTE-SHARE CONTRACTS

Vote-share contracts may also be seen as a special form of flexible majority rule. This concept was introduced by Gersbach (2004b). Under a flexible majority rule, the required majority depends on the voting issue. However, the majority threshold under a flexible majority rule is set by an institution not involved in the voting process, whereas in the case of vote-share contracts, the threshold value is proposed by the politicians running for office. Nevertheless, vote-share contracts are positioned in the interface of political contracts and flexible majority rules.

Finally, this chapter is closely related to the large literature on above-average success of incumbents in reelection results. The existence of such incumbency advantages has been shown e.g. by Ansolabehere and Snyder (2002), who document these advantages for state executives and legislators in the United States. Moreover, they show that incumbency advantages have become more influential over time.

Several reasons are proposed in the literature for the existence of incumbency advantages. First, we look at the case where candidates for office are ex ante homogeneous (i.e. before one of them is in office) and differ only with regard to their being incumbent or new candidate. Many advantages of incumbents may accrue from having already been in office: Campaigns are less expensive for incumbents, e.g. due to greater media coverage and face-recognition effects (Ansolabehere, Snyder, and Stewart (2000) and Prior (2006)), whereas challengers may have less access to campaign funds (Gerber (1988)). Next, vote decisions may be influenced by the endorsement from respected elites, to which incumbents have easier access (Grossman and Helpman (1999)). Furthermore, incumbents may increase their reelection chances by providing constituency services (Cain, Ferejohn, and Fiorina (1987)) and socially costly actions (Rogoff and Sibert (1988), Alesina and Cukierman (1990), Hess and Orphanides (1995), Hess and Orphanides (2001), and Cukierman and Tommasi (1998)). Finally, the incumbent may have increased his value for society by improving his skills during his time in office. This process of enlarging capabilities is explained by learning-by-doing effects (Arrow (1962)). Similarly, incumbents may have a larger value for the inhabitants of their district, due to the principle of seniority, which means that the agenda-setting power of

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2See e.g. Ashworth and Bueno de Mesquita (2008) or Gordon and Landa (2008) for a recent discussion of the literature.

3Arrow does not explicitly consider learning-by-doing effects of politicians, but analyzes the economic implications of learning-by-doing in general. However, his view that “Learning is the product of experience (...) and therefore only takes place during activity” is the same perspective of learning-by-doing than the one we have in mind here.
politicians increases with experience (McKelvey and Riezman (1992)). Thus, the incumbent will tend to be more successful in reaping benefits for his district and – as rational voters anticipate this effect – he will have higher reelection chances. Note that while learning-by-doing effects for politicians are assumed to be beneficial for the whole society, the effects of seniority will normally be beneficial only for a specific part of the population, while they will tend to be detrimental for society as a whole.\(^4\)

Second, there may be further forms of incumbency advantage when politicians are ex ante heterogeneous, which means that they differ beyond the dimension of their being incumbents or new candidates. There may be an ex ante quality difference and incumbents may have higher quality due to electoral selection (Samuelson (1984), Londregan and Romer (1993), Banks and Sundaram (1998), Zaller (1998), Ashworth (2005), Diermeier, Keane, and Merlo (2005), and Ashworth and Bueno de Mesquita (2008)), or politicians may differ with respect to their ideological position. Then there might exist a pro-incumbent district partisan bias, as the ideological characteristics of a district will be relatively stable and hence, the incumbent may have an advantage against challengers with a different ideological position (Gelman and King (1990)).

Third, even for candidates being equal in their expectation value, there may exist an incumbency advantage, as in the case of risk-averse voters, the incumbent may be perceived as a safer bet than an unknown challenger (Bernhardt and Ingberman (1985), Anderson and Glomm (1992)).

Finally, beyond characteristics of the candidates, there may be a further reason for the higher reelection probability of incumbents, which just stems from the timing of the game. Strategic entry into the election process might favor the incumbent: Challengers may be deterred from running against incumbents perceived to be of high quality (Cox and Katz (1996), Stone, Maisel, and Maestas (2004), and Gordon, Huber, and Landa (2007)), while on the other hand, incumbents facing a likely defeat may retire strategically (Jacobsen and Kernell (1983)).

In this work, we will only model two forms of incumbency advantage, namely socially costly actions and socially beneficial learning-by-doing effects. Nevertheless, as our model includes positive and negative aspects of incumbency advantages this

\(^4\)Under this perspective, the seniority argument seems to be related to the incumbency advantage accruing from providing constituency services and socially costly actions.
way of proceeding allows to analyze the welfare effects of introducing vote-share contracts.

5.3 The Model

The model draws on Gersbach (2007). We use a similar notation to allow an easy comparison of the results. There are two periods, denoted by $t = 1, 2$.

5.3.1 Agents and Incumbency Advantage

There is a continuum of voters indexed by $i \in [0, 1]$. Voters elect one politician at the beginning of each period $t$. At both election dates, the same two candidates compete for office. Candidates are denoted by $k$ or $k' \in [L, R]$ where candidate $L$ ($R$) is the left-wing (right-wing) candidate. The victorious candidate of the first election may have a twofold incumbency advantage at the second election date:

- Due to learning-by-doing effects, the incumbent is of higher competence, which is a socially beneficial kind of incumbency advantage.

- An incumbent $k$ may shift some part of the output to period 2, which will only be realized if he is still in office in $t = 2$. This type of incumbency advantage is socially detrimental for two reasons in our model frame. If there is a new office-holder $k'$ in $t = 2$, then the shifted amount of output is totally lost. If $k$ is still in office in $t = 2$, we assume that some part of the shifted output will get lost.

5.3.2 Policies and Utilities

The elected politician has to decide on three policy problems.

- Public Project: $P$

  In each period, the incumbent undertakes a public project. We use $g_t$ to denote the amount of this project that is provided in period $t$ and assume that all voters $i$ have $g_t$ as utility from the project. The amount $g_t$ is given as

  $$g_t = \gamma(e_{kt} + a_k), \gamma > 0,$$  

  (5.1)
where $a_k$ represents the ability of the incumbent, which is a random variable distributed uniformly on $[-A, A]$ with $A > 0$, while $e_{kt}$ stands for the effort exerted by the office-holder in period $t$. The incumbent incurs costs of $C(e_{kt})$ from exerting effort. $C(e_{kt}) = c_h e_{kt}^2$ if he is in his first term in office and $C(e_{kt}) = c_l e_{kt}^2$ during the second term. We assume that $c_h > c_l > 0$, i.e. there are learning-by-doing effects. As the amount of public project depends on the effort and thus on the effort costs, there may be different policy outcomes, depending on whether the incumbent is in his first or his second term in office. We will denote the amount of public project provided in the first term by $g_t(c_h)$ and the amount provided in the second term by $g_t(c_l)$.

- **Ideological (or Redistribution) Policy: $I$**
  The incumbent decides in both periods on a one-dimensional ideological policy $I \in [0, 1]$. Voters are ordered according to their ideal points regarding $I$, such that $i$ is the ideal point of voter $i$. Voter $i$ is affected by $I$ according to
  \[
  -(i_{kt} - i)^2, \tag{5.2}
  \]
  where $i_{kt}$ is the platform chosen by policy-maker $k$ in period $t$.

- **Output-shift Policy: $O$**
  The incumbent can shift the realization of a fixed amount $\Delta > 0$ of the output from period $t = 1$ to period $t = 2$ if $\gamma(e_{k1} + a_k) > \Delta$. If the incumbent shifts $\Delta$ to the next period, then the realized output in period $t = 1$ will be reduced to $\gamma(e_{k1} + a_k) - \Delta$. If the politician is still in office in $t = 2$, output $f\Delta$ ($0 < f < 1$) is realized in $t = 2$ from the activities in $t = 1$. A new office-holder in $t = 2$ cannot reap the benefits from shifted output. We use $\epsilon_k$ to denote the output-shift decision of candidate $k$ with $\epsilon_k = 1$ if policy-maker $k$ shifts output in period 1, and $\epsilon_k = 0$ otherwise. Policy option $O$ represents a policy that requires policy-specific efforts from the incumbent and enables him to determine the time of output realization. Examples from the executive branch are international treaties or foreign policy which require policy-specific human capital that is lost, at least partially, if a new

\[^5\text{Alternatively, one could model learning-by-doing effects by modifying the ability parameter } a_k, \text{ such that } a_k \text{ increases when a politician enters his second term in office. Using this model framework instead of our approach using a high/low effort-cost parameter would not change the results.}\]
government comes into office. The option to shift output is a simple device generating a socially detrimental aspect of incumbency advantage.

To simplify the analysis, we assume that voters and politicians have a discount factor equal to 1. We use $V_i(\cdot, \cdot)$ to denote the lifetime utility of voter $i$ depending on who is in office in $t = 1$ and $t = 2$. For example, $V_i(L, R)$ denotes lifetime utility of $i$, given that $L$ holds office in $t = 1$, while $R$ is incumbent in $t = 2$. $V_i(\cdot, \cdot)$ is given by the sum of the benefits from the ideological policy and from the public project. We have to distinguish four cases:

- $V_i(R, R) = g_1(c_h) - \epsilon_R \Delta - (i_{R1} - i)^2 + g_2(c_i) + \epsilon_R f \Delta - (i_{R2} - i)^2$,
- $V_i(R, L) = g_1(c_h) - \epsilon_R \Delta - (i_{R1} - i)^2 + g_2(c_h) - (i_{L2} - i)^2$,
- $V_i(L, R) = g_1(c_h) - \epsilon_L \Delta - (i_{L1} - i)^2 + g_2(c_h) - (i_{R2} - i)^2$,
- $V_i(L, L) = g_1(c_h) - \epsilon_L \Delta - (i_{L1} - i)^2 + g_2(c_i) + \epsilon_L f \Delta - (i_{L2} - i)^2$.

The candidates derive utility from two sources:

- Benefits from policies
  We use $\mu_R$ to denote candidate $R$’s most preferred point with regard to policy $I$ and assume that $\mu_R > \frac{1}{2}$. For ease of exposition, we assume that the candidates’ ideal points are symmetrically distributed around the median’s ideal point which is located at one-half. Thus, candidate $L$’s ideal point $\mu_L$ is given by

$$\mu_L = 1 - \mu_R.$$  \hspace{1cm} (5.3)

Moreover, the candidates derive the same benefits from public projects as voters.

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6Note that output shift may also occur in the legislative sector, e.g. if a member of parliament engages in lobbying to have government funds or infrastructure projects channeled to his district, and postpones some of the benefits from these activities to make it costly to replace him.

7Our model can also be applied to the case $f \geq 1$, when output shifting may be socially valuable.

8The extension to a discount factor smaller than 1 is straightforward.

9Note that there is no incumbency advantage due to ideological positions in our model, although candidates and voters differ in their ideological opinion. However, as both candidates are symmetric to the median voter with regard to their ideological position, there is no pro-incumbent district partisan bias in our work.
• Office-holding
  The incumbent derives private benefits \( b \) from holding office, including monetary and non-monetary benefits such as power and enhanced career prospects.

We use \( V_k(\cdot, \cdot) \) to denote politician \( k \)'s lifetime utility depending on who is in office in \( t = 1 \) and \( t = 2 \). We look at politician \( R \), for example, and have to distinguish four cases again:

- \( V_R(R, R) = b - (i_{R1} - \mu_R)^2 - c_h e_{R1}^2 + g_1(c_h) - \epsilon_R \Delta + b - (i_{R2} - \mu_R)^2 - c_l e_{R2}^2 + g_2(c_l) + \epsilon_R f \Delta, \)
- \( V_R(R, L) = b - (i_{R1} - \mu_R)^2 - c_h e_{R1}^2 + g_1(c_h) - \epsilon_R \Delta - (i_{L2} - \mu_R)^2 + g_2(c_h), \)
- \( V_R(L, R) = -(i_{L1} - \mu_R)^2 + g_1(c_h) - \epsilon_L \Delta + b - (i_{R2} - \mu_R)^2 - c_h e_{R2}^2 + g_2(c_h), \)
- \( V_R(L, L) = -(i_{L1} - \mu_R)^2 + g_1(c_h) - \epsilon_L \Delta - (i_{L2} - \mu_R)^2 + g_2(c_l) + \epsilon_L f \Delta. \)

### 5.3.3 Assumptions and Equilibrium Concept

We assume that politicians cannot commit to a policy platform. After the incumbent has exerted \( e_{kt} \), he will know his ability, but this will remain private information. Thus, we assume that with regard to policy \( P \), voters observe only output \( g_t \), but not how much of it is due to effort and how much to ability.\(^{10}\) Output \( g_t \) is not contractible, so it cannot be used to generate remunerations for politicians beyond elections. The incumbent is assumed to observe his own ability \( a_k \) before he has to make his decision about shifting output. Thus, he can make \( \epsilon_k \) dependent on \( a_k \). Finally, we assume that voters observe the outcome of policies \( I \) and \( O \) and that they vote sincerely, i.e. they vote for the candidate who generates a higher expected utility.\(^{11}\) We are looking for perfect Bayesian Nash equilibria of the game under these assumptions.

Throughout this chapter, we assume \( \frac{\gamma (c_h - c_l)}{2 a_k c_l} + \frac{I \Delta}{\gamma} < A \) to ensure that reelection probability in equilibrium is below 1. Moreover, we assume that \( b \) is sufficiently

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\(^{10}\)This assumption follows Alesina and Tabellini (2007). However, note that although voters are not able to observe the composition between effort and ability, they may nevertheless be able to infer it in equilibrium.

\(^{11}\)Although the individual voter has no influence on the election outcome in the case of a continuum of voters, it is optimal for the electorate to vote sincerely, as this is the only sensible strategy for rational voters in a two-party system (see e.g. Austen-Smith (1989)).
large, so that candidates will prefer to be in office under any of the circumstances we consider.

### 5.3.4 The Overall Game

We summarize the overall game in the following figure:

![Figure 5.1: Time-line with elections alone](#)

#### 5.4 Elections Alone

In this section, we examine the standard case with elections before the start of the first and second term and restate the results of Gersbach (2007) in the context of our model frame. We assume that the candidate with more votes is elected. If both candidates obtain the same share of votes, the probability of each candidate winning is \( \frac{1}{2} \) in \( t = 1 \), while we assume that the incumbent is reelected in the case of a tie in period two.
5.4.1 The Second Period

As candidates cannot commit to policy platforms, a policy-maker will choose his most preferred platform in $t = 2$. The amount of public project in $t = 2$ depends on whether the policy-maker is in his first term (where he does not know his ability $a_k$ and where he has a high effort-cost parameter $c_h$), or in his second term (where he knows his ability $a_k$ and where he has a low cost parameter $c_l$). In Appendix E.1, we show:

**Proposition 5.1**

Suppose, e.g., that candidate $R$ is elected as office-holder for period 2. Then

(i) he will choose

\[
\alpha) \quad i_{R2}^* = \mu_R \quad \text{and} \quad e_{R2}^* = \frac{\gamma}{4c_l} \quad \text{if} \quad R \quad \text{has been in office in the first period;}
\]

\[
\beta) \quad i_{R2}^* = \mu_R \quad \text{and} \quad e_{R2}^* = \frac{\gamma}{2c_h} \quad \text{if} \quad R \quad \text{has not been in office in the first period;}
\]

(ii) the expected utility of $R$ at the beginning of period 2 is given by

\[
\alpha) \quad V_{R2}^*(R, R) = b + \frac{\gamma^2}{4c_l} + \gamma a_R + \epsilon_R f \Delta,
\]

\[
\beta) \quad V_{R2}^*(L, R) = b + \frac{\gamma^2}{4c_h}.
\]

5.4.2 The First Period

Both candidates win with a probability of one-half in the first election, as their ideal points are distributed symmetrically around the ideal point of the median voter. Without loss of generality, we will assume throughout the remaining part of this chapter that candidate $R$ is elected in the first election. We obtain the following fact, which will hold in every equilibrium with pure strategies.

**Fact 5.1**

Suppose that candidate $R$ is elected as office-holder for period 1. Then

(i) he will choose $i_{R1} = \mu_R$ for policy $I$;

(ii) voters will perfectly infer his ability $a_R$ at the end of period 1.

Politician $R$ cannot gain more votes in the second election by choosing $i_{R1} \neq \mu_R$, as voters know that he will choose his ideal point in period 2 anyway. Part (ii)
follows from the informational structure of the game. As the incumbent does not observe his ability before he exerts effort, in any pure strategy equilibrium, exactly one level of effort will be chosen, and expected by the voters. Any deviation of $g_t$ from the expected effort times $\gamma$ will be interpreted correctly as variation in ability, since $a_R = \frac{g_t - \hat{e}_1}{\gamma}$, where $\hat{e}_1$ denotes the public’s expectations about the incumbent’s effort level in $t = 1$.

Now we want to derive the optimal behavior of the office-holder concerning $P$ and $O$ in $t = 1$. First, there may occur three cases regarding $a_R$:

(i) Candidate $R$’s ability may be so high that he will be reelected even without output-shift policy. Then he will choose $\epsilon_R = 0$ and will be reelected. We use $p^0(e_{R1}, \hat{e}_1)$ to denote the probability the office-holder assigns to this eventuality.

(ii) The incumbent may have an intermediate level of ability where he will be reelected only if he shifts output ($\epsilon_R = 1$). As $b$ is sufficiently high, the office-holder will choose the socially detrimental option $\epsilon_R = 1$, which implies reelection. We use $p^1(e_{R1}, \hat{e}_1)$ to denote the incumbent’s estimate of the probability of this case.

(iii) If $R$’s ability is so low that he will never be reelected, irrespective of $\epsilon_R$, then he will choose $\epsilon_R = 0$. The probability of this case is $1 - p^0(e_{R1}, \hat{e}_1) - p^1(e_{R1}, \hat{e}_1)$.

Second, we introduce $\tilde{a}_R(e_{R1}, \hat{e}_1)$ as candidate $R$’s expected level of ability, conditional on the fact that he is reelected, and show in Appendix E.1:

**Fact 5.2**

\begin{align*}
p^0(e_{R1}, \hat{e}_1) &= \frac{1}{2} + \frac{1}{2A} \left( e_{R1} - \hat{e}_1 + \frac{\gamma(c_h - c_l)}{2c_h c_l} \right), \quad (5.4) \\
p^1(e_{R1}, \hat{e}_1) &= \frac{f \Delta}{2A\gamma}, \quad (5.5) \\
\tilde{a}_R(e_{R1}, \hat{e}_1) &= \frac{A + \hat{e}_1 - e_{R1}}{2} - \frac{f \Delta}{2\gamma} - \frac{\gamma(c_h - c_l)}{4c_h c_l}. \quad (5.6)
\end{align*}

Note that the probability of $R$ being reelected, i.e. $p^0(e_{R1}, \hat{e}_1) + p^1(e_{R1}, \hat{e}_1)$, increases in $e_{R1}$, as for a given expectation $\hat{e}_1$, the incumbent can improve the public’s
estimate of his ability by exerting more effort. A more favorable evaluation of his ability increases his reelection chances. However, the expected level of R’s ability, contingent on the fact of his reelection, decreases with \( e_{R1} \) as an increase in \( e_{R1} \) implies that \( R \) will be reelected even for lower levels of ability. Thus, \( \tilde{a}_R(e_{R1}, \hat{e}_1) \) is lowered.

Finally, the incumbent’s optimization problem can be stated in the following way:\(^{12}\)

\[
\begin{align*}
\max_{e_{R1} \geq 0} & \left\{ b + \gamma e_{R1} - c_h e_{R1}^2 - p^1(e_{R1}, \hat{e}_1) \Delta (1 - f) \\
& + (p^0(e_{R1}, \hat{e}_1) + p^1(e_{R1}, \hat{e}_1)) \left( b + \gamma \left( \frac{\gamma}{2c_l} + \tilde{a}_R(e_{R1}, \hat{e}_1) \right) - \frac{\gamma^2}{4c_l} \right) \\
& + (1 - p^0(e_{R1}, \hat{e}_1) - p^1(e_{R1}, \hat{e}_1)) \left( \frac{\gamma^2}{2c_h} - (\mu_R - \mu_L)^2 \right) \right\} \\
\end{align*}
\]

(5.7)

In Appendix E.1, we show:

**Proposition 5.2**

(i) \( R \) chooses \( e_{R1}^* = \frac{1}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} - f \Delta + (\mu_R - \mu_L)^2 \right] \right\} \).

(ii) \( R \) chooses \( \epsilon_R = 0 \) and is reelected with probability

\[
p^0(e_{R1}^*, e_{R1}^*) = \frac{1}{2} + \frac{\gamma(c_h - c_l)}{4Ac_hc_l}.
\]

(5.8)

(iii) \( R \) chooses \( \epsilon_R = 1 \) and is reelected with probability

\[
p^1(e_{R1}^*, e_{R1}^*) = \frac{f \Delta}{2A\gamma}.
\]

(5.9)

(iv) The average ability level of a reelected candidate is given by

\[
\tilde{a}_R(e_{R1}^*, e_{R1}^*) = \frac{A}{2} - \frac{f \Delta}{2\gamma} - \frac{\gamma(c_h - c_l)}{4c_hc_l}.
\]

(5.10)

In part (i) we observe how equilibrium effort \( e_{R1}^* \) depends on the parameters. A deselected politician has utility losses due to the distance from the ideological

---

\(^{12}\)Note that \( R \) is reelected with probability \( p^0(e_{R1}, \hat{e}_1) + p^1(e_{R1}, \hat{e}_1) \), while \( L \) becomes the new incumbent with probability \( 1 - p^0(e_{R1}, \hat{e}_1) - p^1(e_{R1}, \hat{e}_1) \). With probability \( p^1(e_{R1}, \hat{e}_1) \), net losses \( \Delta(1 - f) \) occur due to output-shift policies.
policy of his opponent to his own ideal point and due to the fact that he has no private benefits from holding office in $t = 2$. Thus, the larger $(\mu_R - \mu_L)$ and $b$, the higher the effort the politician is willing to invest. The higher $A$, the lower the marginal gain in reelection chances when $R$ increases effort marginally. Hence, greater uncertainty regarding quality will reduce effort. The higher $c_h$, the lower $e_{R1}^*$, as exerting more effort in period 1 gets more costly for the politician. The higher $c_l$, the lower the learning-by-doing effects. This decreases the incumbency advantage and thus, the effort exerted in the first period is higher. The impact of $\gamma$ is more subtle. On the one hand, higher $\gamma$ increases the marginal value of higher effort today and the value of office tomorrow, which both raise $e_{R1}^*$. On the other hand, higher $\gamma$ results in lower effort, as the utility of the opponent being in office in period 2 and the losses due to an incumbent with lower ability than average being reelected are increasing. Part (ii) of the Proposition reflects the incumbency advantage due to learning-by-doing effects. The probability of the incumbent to get reelected is larger than one-half, even without shifting output. Part (iii) reflects the additional incumbency advantage due to the output-shift policy.

In the last step, we want to analyze the inefficiencies of the equilibrium results in the first period. In Appendix E.1, we show:

**Fact 5.3**

*From the voters’ point of view, candidate $R$ should be reelected if and only if*

$$a_R \geq \frac{\gamma(c_l - c_h)}{2c_h c_l}. \quad (5.11)$$

*Thus, the socially optimal average ability level of a reelected candidate would be*

$$a_R^* = \frac{A}{2} - \frac{\gamma(c_h - c_l)}{4c_h c_l}. \quad (5.12)$$

Thus, Proposition 5.2 reveals two types of inefficiency. First, with probability $p^1(e_{R1}^*, e_{R1}^*)$, incumbents with an ability level below average shift output to ensure reelection. Second, the average ability level of a reelected politician $\tilde{a}_R(e_{R1}^*, e_{R1}^*)$ from equation (5.10) is lower than the socially optimal average ability level from equation (5.12). In the following, we will see that vote-share contracts can alleviate the second type of inefficiency and can additionally increase the effort of the incumbent in period 1. However, the probability of the socially wasteful output-shift does not change if vote-share contracts are introduced.
5.5 Results with Vote-Share Contracts

In this section, we examine the combination of democratic elections and vote-share contracts, and restate the results of Gersbach (2007) in the context of our model frame.

5.5.1 Vote-Share Thresholds as Political Contracts

Each candidate $k$ is allowed to offer a vote-share contract, which occurs by stipulating a vote-share threshold $s_k$ with $\frac{1}{2} \leq s_k \leq 1$. If politician $k$ takes over office in $t = 1$, he must win a share of votes at least equal to $s_k$ at the next election date to remain in office. Otherwise, the challenger $k'$ will take office. Hence, the incumbent faces a self-imposed vote-share threshold in the election at the end of period 1. Throughout the section, we assume that $2\mu_R - 1 < A\gamma$, which ensures interior solutions.\(^{13}\) To give a short summary, we display the two additions in the extended game, in comparison to our basic model, in the following figure:

---

Figure 5.2: Changes in the time-line with elections and vote-share contracts

---

\(^{13}\)Corner solutions are an interesting variant of our model. If $2\mu_R - 1 > A\gamma$, the incumbent may renounce exerting high effort, as his reelection chances are too low if vote share thresholds are high.
The first change is the additional step where both candidates are allowed to offer vote-share contracts before the first election decision takes place. Secondly, the result of the reelection decision is used to check whether the office-holder has been successful in reaching his vote-share threshold. The rest of the timeline is the same as in Figure 5.1 and is omitted here for the sake of clarity.

5.5.2 The Second and First Period

We denote the results in the scenario with vote-share contracts by the superscript $V$ and assume without loss of generalization that $R$ is elected in $t = 1$ with a vote-share threshold $s_R \geq \frac{1}{2}$. In the second period, $R$ will choose $i_{R2}^V = \mu_R$ and $e_{R2}^V = \frac{\gamma}{2\epsilon^V}$ if he is still in office, while a new office-holder $L$ will choose $i_{L2}^V = \mu_L$ and $e_{L2}^V = \frac{\gamma}{2\epsilon^V}$. Thus, the results will remain the same as in Proposition 5.1. In Appendix E.1, we show that equations (5.4), (5.5), and (5.6) have to be modified to:

**Fact 5.4**

\[
\begin{align*}
& p_0^V(e_{R1}^V, \hat{e}_{1}^V) = \frac{1}{2} + \frac{1}{2A} \left( e_{R1}^V - \hat{e}_{1}^V + \frac{\gamma(c_h - c_l)}{2c_h c_l} - \frac{1}{\gamma} (2\mu_R - 1)(2s_R - 1) \right), \quad (5.13) \\
& p_1^V(e_{R1}^V, \hat{e}_{1}^V) = \frac{f\Delta}{2A\gamma}, \quad (5.14) \\
& \tilde{a}_R^V(e_{R1}^V, \hat{e}_{1}^V) = \frac{A + \hat{e}_{1}^V - e_{R1}^V}{2} - \frac{f\Delta}{2\gamma} - \frac{\gamma(c_h - c_l)}{4c_h c_l} + \frac{(2\mu_R - 1)(2s_R - 1)}{2\gamma}. \quad (5.15)
\end{align*}
\]

These equations coincide with equations (5.4), (5.5) and (5.6) for $s_R = \frac{1}{2}$. The optimal choice of $e_{R1}^V$ is obtained by solving the optimization problem (5.7), where $p^0(e_{R1}, \hat{e}_1), p^1(e_{R1}, \hat{e}_1)$ and $\tilde{a}_R(e_{R1}, \hat{e}_1)$ are replaced by $p_0^V(e_{R1}^V, \hat{e}_{1}^V), p_1^V(e_{R1}^V, \hat{e}_{1}^V)$ and $\tilde{a}_R^V(e_{R1}^V, \hat{e}_{1}^V)$ from equations (5.13), (5.14), and (5.15), respectively. In Appendix E.1, we show:

**Proposition 5.3**

(i) $e_{R1}^V = \frac{1}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} - f\Delta + (\mu_R - \mu_L)^2 + (2\mu_R - 1)(2s_R - 1) \right] \right\}$.  

(ii) $R$ chooses $\epsilon_R = 0$ and is reelected with probability

\[
p_0^V(e_{R1}^V, e_{R1}^V) = \frac{1}{2} + \frac{\gamma(c_h - c_l)}{4A c_h c_l} - \frac{(2\mu_R - 1)(2s_R - 1)}{2A\gamma}. \quad (5.16)
\]
(iii) $R$ chooses $\epsilon_R = 1$ and is reelected with probability
\[ p^{1V}(e^*_V, e^*_V) = \frac{f \Delta}{2A\gamma}. \] (5.17)

(iv) The average ability level of a reelected candidate is given by
\[ \tilde{a}_R(V_R)(e^*_V, e^*_V) = \frac{A}{2} - \frac{f \Delta}{2 \gamma} - \frac{\gamma (c_h - c_l)}{4 c_h c_l} + \frac{(2\mu_R - 1)(2\sigma_R - 1)}{2 \gamma}. \] (5.18)

From part (i), we observe that for $s_R > \frac{1}{2}$, the equilibrium effort level is higher, compared to elections only. The intuition is that the marginal gain from higher effort is increasing with a higher vote-share threshold. Note that the average ability level of a reelected candidate, given by $\tilde{a}_R(V_R)(e^*_V, e^*_V)$, is increasing in $s_R$. Thus, larger vote shares increase the average ability of reelected incumbents.

### 5.5.3 Competition for Vote-Share Contracts

Now, we consider the initial stage when both candidates compete for office with vote-share contracts. The ex ante optimal vote-share threshold\(^{14}\) from the perspective of the median voter is denoted by $s^*$ and is the solution of the following problem:
\[ \max_{\frac{1}{2} \leq s_R \leq 1} \left\{ \gamma e^*_V + \left( p^{0V}(e^*_V, e^*_V) + p^{1V}(e^*_V, e^*_V) \right) \left( \gamma \tilde{a}_R(V_R)(e^*_V, e^*_V) + \gamma e^*_V \right) \right. \]
\[ + \left. \left( 1 - p^{0V}(e^*_V, e^*_V) - p^{1V}(e^*_V, e^*_V) \right) \left( \gamma a_L + \gamma e^*_V \right) \right\}, \] (5.19)

where $e^*_L$ denotes the second-term equilibrium effort of the left-wing candidate if he is new in office in $t = 2$. We obtain

**Fact 5.5**

\[ s^* = \min \left\{ \frac{1}{2} + \frac{f \Delta}{2(2\mu_R - 1)} + \frac{\gamma^2}{4 c_h(2\mu_R - 1)}; 1 \right\}. \] (5.20)

The fact is proven in Appendix E.1. Note that the value of $s^*$ is decreasing in $c_h$. A larger value of $c_h$ means, *ceteris paribus*, that the learning-by-doing effects

\(^{14}\)The ex ante optimal vote-share threshold maximizes expected aggregate utility when voters can impose vote-share thresholds and use elections to select a candidate.
are larger. Thus, voters are more interested in having the same politician in office during both periods and therefore the optimal vote-share, from the perspective of the median voter, is lower. In Appendix E.1, we show the following Proposition:

**Proposition 5.4**

(i) Both candidates $R$ and $L$ offer $s^\ast$. The probability of winning the first election is one-half for each candidate.

(ii) $s^\ast > \frac{1}{2}$

(iii) $s^\ast$ is the ex ante optimal vote-share.

From part (i) of the Proposition, we see that both candidates will offer exactly $s^\ast$. Part (ii) of the Proposition is a first evidence for the fact that the introduction of vote-share contracts is at least not welfare-reducing from the perspective of the median voter, as otherwise, he would choose $s^\ast = \frac{1}{2}$. We will discuss the welfare effects of vote-share contracts in detail later. Part (iii) of the Proposition shows that the optimal vote-share threshold, from the perspective of the median voter, is also socially optimal.

Finally, we use $\tilde{s}$ to denote the vote-share threshold which ensures that the incumbent will be reelected if and only if his ability is equal to or greater than $\frac{\gamma(c_l-c_h)}{2c_hc_l}$. Remember that this is the socially optimal lower ability border from equation (5.11) in Fact 5.3. By inserting $a_R = \frac{\gamma(c_l-c_h)}{2c_hc_l}$ into condition (E.4), we obtain

$$\tilde{s} = \min \left\{ \frac{1}{2} + \frac{f \Delta}{2(2\mu_R - 1)}, 1 \right\}$$

(5.21)

This results immediately in the following Corollary:

**Corollary 5.1**

$s^\ast \geq \tilde{s}$

Thus, the optimal vote-share choice from the perspective of the median voter is larger than the vote-share threshold, which ensures that no politician with ability level below the socially optimal lower border has a chance of getting reelected.

\[\text{Note that in contrast to subsection 3.5.1, there will occur no overpromising here, as } s^\ast \text{ is the unique optimal point for voters and social welfare is decreasing for higher values than } s^\ast. \text{ Thus, overpromising by offering a threshold above } s^\ast \text{ is not profitable for a candidate, as this would result in the certain election of his opponent.}\]
The reason for this result is as follows: On the one hand, under the higher vote-share threshold $s^*$, politicians will be deselected even if their ability is slightly above the socially optimal lower border. On the other hand, this negative effect is outweighed by the positive effect of the larger threshold value $s^*$ on effort. The interaction of these contrarian forces determines the optimal value $s^*$.

5.6 Welfare Effects

In this section, we analyze the effect of introducing vote-share contracts on public welfare in detail. We compare welfare in a scenario with and without vote-share contracts. It is intuitively clear that welfare does not change with a threshold $s_R = \frac{1}{2}$, since a scenario with a vote-share threshold of one-half is equivalent to the scenario with elections alone. The introduction of vote-share contracts larger than one-half has three effects, as shown in Proposition 5.3: The effort choice in period 1 increases, the expected ability of a reelected politician increases, while the reelection probability decreases. In the following, we examine how these three effects influence expected effort over both periods, expected ability of the office-holder in the second period and overall welfare.

5.6.1 Effects on Expected Effort

We start by analyzing the effect of introducing vote-share contracts on expected effort over both periods. We assume that $R$ is elected in period 1 and use $E[e^*_2]$ to denote the expected effort of the office-holder in the second period, i.e. the effort of a reelected incumbent, weighted with his probability of being in office, plus the effort of a new office-holder, weighted with his probability of being in office. We define

$$E[e^*] := E[e^*_R] + E[e^*_2]$$

as expected overall effort and obtain:

$$E[e^*] = e^*_R + \gamma \frac{1}{2c_l} \left( p^0(e^*_R, e^*_R) + p^1(e^*_R, e^*_R) \right) + \gamma \frac{1}{2c_h} \left( 1 - p^0(e^*_R, e^*_R) - p^1(e^*_R, e^*_R) \right).$$

Analogously, we define $E[e^{*V}]$ as expected effort over both periods in the scenario with vote-share contracts and obtain:

$$E[e^{*V}] = e^{*V}_R + \gamma \frac{1}{2c_l} \left( p^{0V}(e^{*V}_R, e^{*V}_R) + p^{1V}(e^{*V}_R, e^{*V}_R) \right) + \gamma \frac{1}{2c_h} \left( 1 - p^{0V}(e^{*V}_R, e^{*V}_R) - p^{1V}(e^{*V}_R, e^{*V}_R) \right).$$
CHAPTER 5. VOTE-SHARE CONTRACTS

In Appendix E.1, we show:

**Proposition 5.5**

(i) The effect of introducing vote-share contracts on expected overall effort is given by

\[ E[e^*_{RV}] - E[e^*] = \frac{(2\mu_R - 1)(2s_R - 1)}{4Ac_hc_l}(2c_l - c_h). \tag{5.23} \]

(ii) For \( c_h < 2c_l \), the introduction of vote-share contracts with a threshold value larger than one-half increases the expected effort over both periods.

(iii) For \( c_h > 2c_l \) the introduction of vote-share contracts with a threshold value larger than one-half decreases the expected effort over both periods.

Hence, we learn from Proposition 5.5 that it depends on the relationship of \( c_h \) and \( c_l \) whether the effect of vote-share contracts on the expected effort over both periods is positive or negative.\(^{16}\) The intuition for this result is as follows: An increasing spread between \( c_h \) and \( c_l \) is bad for the effect of vote-share contracts on expected overall effort, as the effect of the lower reelection probability under vote-share contracts is weighted more under larger learning-by-doing effects. Furthermore, the increase in the first period effort, under vote-share thresholds, is decreasing in \( c_h \), i.e. a higher value of \( c_h \) reduces the positive effect of vote-share contracts on the effort in period 1.

From equation (5.23), we see that a vote-share threshold of \( \frac{1}{2} \) has no effect on expected effort and that the (positive or negative) effect of vote-share contracts on expected effort increases with \( s_R \), i.e. a higher threshold increases the absolute value \( |E[e^*_{RV}] - E[e^*_R]| \).

### 5.6.2 Effects on Expected Ability in Period 2

In this subsection, we analyze the effect of vote-share contracts on the expected ability of the office-holder in period 2, given that \( R \) chooses \( e^*_{R1} \) in \( t = 1 \). On the one hand, there is a positive effect of vote-share contracts, as the ability of reelected candidates is raised. On the other hand, there is a negative effect, as the

---

\(^{16}\)Note that the result from Proposition 5.5 would have to be modified under the assumption of a discount factor smaller than 1. Then the introduction of vote-share contracts would have a better effect on expected effort over both periods, as the lower probability of \( \gamma^2 \) being the second period effort would obtain a minor weight.
reelection probability gets smaller. Thus, the probability that a new office-holder with an expected ability of zero comes into office increases. We define the expected ability of the incumbent in period 2, given that $R$ chooses $e^*_R$ in $t = 1$, as:

$$E[a_R(e^*_R, e^*_R)] := E\left[\left(p^0(e^*_R, e^*_R) + p^1(e^*_R, e^*_R)\right) \cdot \tilde{a}_R(e^*_R, e^*_R) + \left(1 - p^0(e^*_R, e^*_R) - p^1(e^*_R, e^*_R)\right) \cdot a_L\right]$$

(5.24)

In an analogical way, we define $E[a^V_R(e^*_V, e^*_V)]$ in the scenario with vote-share contracts as the expected ability of the incumbent in the second period given that $R$ chooses $e^*_V$ in the first period. In Appendix E.1, we show:

**Fact 5.6**

The effect of introducing vote-share contracts on the expected ability of the incumbent in the second period, given that the elected politician chooses $e^*_V$ in the first period, i.e. $E[a^V_R(e^*_V, e^*_V)] - E[a_R(e^*_R, e^*_R)]$, is given by the following term:

$$\frac{(2\mu_R - 1)(2s_R - 1)}{4A\gamma^2} \left(\frac{\gamma^2(c_h - c_l)}{c_h c_l} + 2f\Delta - (2\mu_R - 1)(2s_R - 1)\right).$$

(5.25)

Thus, a larger spread $c_h - c_l$ is positive for the effect of vote-share contracts on expected ability of the incumbent in period 2. There are two intuitive reasons for this result:

- The reelection probability of the incumbent increases if either $c_l$ decreases for given $c_h$ or if $c_h$ increases for given $c_l$. Thus, the reelection probability increases with the spread between $c_h$ and $c_l$. The positive effect of vote-share contracts on expected ability, via higher ability of reelected candidates, has relatively more weight if the reelection probability is higher. Hence, a larger spread between $c_h$ and $c_l$ increases the expected ability in period 2.

- The ability of a reelected candidate decreases if either $c_l$ decreases for given $c_h$ or if $c_h$ increases for given $c_l$. Thus, the ability of a reelected candidate decreases with the spread between $c_h$ and $c_l$. The negative effect of vote-share contracts on expected ability, via lower reelection probability, has relatively less weight if the ability of a reelected candidate is lower. Hence, a larger spread between $c_h$ and $c_l$ increases the expected ability in period 2.

From equation (5.25), we see directly that vote-share contracts with threshold $s_R = \frac{1}{2}$ have no effect on the expected ability. In the next step, we analyze the effect...
of vote-share contracts with threshold $s^*$ on the expected ability of the incumbent in period 2. In Appendix E.1, we show:

**Proposition 5.6**

(i) For $c_h > \frac{3}{2} c_l$, the introduction of vote-share contracts with threshold $s^*$ certainly increases the expected ability of the incumbent in the second period.

(ii) For $c_h < \frac{3}{2} c_l$, the introduction of vote-share contracts with threshold $s^*$ may decrease the expected ability of the incumbent in the second period.

Thus, if vote-share contracts with threshold $s^*$ are applied, the expected ability of the incumbent in $t = 2$ is certainly higher than under elections alone if $c_h > \frac{3}{2} c_l$, i.e., if learning-by-doing effects are not too small. For $c_l < c_h < \frac{3}{2} c_l$, it depends on the other parameter values whether vote-share contracts with threshold $s^*$ have positive or negative effects on the expected ability of the office-holder in period 2. For $f\Delta$ sufficiently large, the effect of vote-share thresholds on expected ability will certainly be positive. The reason is that a large value of $f\Delta$ means that the ability of a reelected candidate is smaller than zero and then, the lower reelection probability of the incumbent is socially beneficial, as a new candidate has an expected ability of zero.

### 5.6.3 Total Welfare Effects

In this subsection, we examine the total welfare effects of vote-share contracts in detail. During this analysis, we will show that vote-share contracts lead to higher welfare than elections alone, a result that could already be seen in Proposition 5.4. In the following, we summarize all effects of vote-share contracts on overall welfare.

- Effects on welfare via effort:
  - Vote-share contracts induce a higher effort choice in period 1.
  - Vote-share contracts reduce the expected effort in period 2, as the probability decreases that the incumbent is reelected. Hence, the probability of $\frac{f}{2\gamma}$ being the second period effort decreases when vote-share contracts are applied.
CHAPTER 5. VOTE-SHARE CONTRACTS

• Effects on welfare via ability:
  
  – Vote-share contracts increase the average ability of reelected incumbents.\(^\text{17}\)
  
  – Vote-share contracts reduce the reelection probability of the incumbent, which means that the probability increases that a new incumbent with an expected ability of zero comes into office. This may be positive or negative for society depending on whether the expected ability of the first period office-holder is smaller or larger than zero.

Remember that we showed in Proposition 5.5 and Proposition 5.6 that it may depend on the relationship of \(c_h\) and \(c_l\) whether introducing vote-share contracts increases or decreases expected effort and expected ability in period 2. In the following Theorem, we show that the overall effect of introducing vote-share contracts is welfare-enhancing, independent of the relationship of \(c_h\) and \(c_l\):

**Theorem 5.1**

(i) Welfare under vote-share contracts with a vote-share threshold \(s^*\) is higher than under elections alone.

(ii) The welfare-enhancing effect of vote-share contracts is increasing in \(f\), \(\Delta\) and \(\gamma\), it is decreasing in \(c_h\) and is independent of \(c_l\).

Theorem 5.1 is our main result and is proven in Appendix E.1. The consequence of the first part is that vote-share contracts lead to higher welfare than standard elections alone. The second part shows how the welfare-enhancing effect of vote-share contracts depends on some of the parameters. The intuition for the effect of \(f\) and \(\Delta\) is as follows: The average ability level of a reelected candidate is decreasing in \(f\) and \(\Delta\). As vote-share contracts decrease the probability of the incumbent to get reelected, the positive effect of introducing vote-share contracts on total welfare is increasing in \(f\) and \(\Delta\).\(^\text{18}\) The reasons for the other dependences in part (ii) are more subtle, as there are many channels by which \(\gamma\), \(c_h\) and \(c_l\)
get effective on total welfare. These channels work in opposing directions and, in
the case of \( c_l \), just outweigh each other.\(^{19}\) Details of these subtle dependences are
omitted here. Nevertheless, we want to point at the fact that vote-share contracts
get, \textit{ceteris paribus}, more effective if learning-by-doing effects are relatively small.
This result is intuitive, as the aim of vote-share contracts is to alleviate negative
aspects of incumbency advantage. However, thereby, positive aspects of incum-
bency advantage, i.e. learning-by-doing effects, are also reduced. If the positive
aspects are rather small, then vote-share contracts cause less damage in reducing
these positive effects and get more effective. Vote-share contracts would be most
effective if there was no learning-by-doing at all, i.e. for \( c_h = c_l \).

As we showed in the previous two subsections, introducing vote-share contracts
increases expected overall effort if \( c_h < 2c_l \), while introducing vote-share contracts
may decrease expected ability of the office-holder in period 2 if \( c_h < \frac{3}{2} c_l \). Hence,
there may be a trade-off between the effect on expected overall effort and the effect
on expected ability of the office-holder in period 2. However, total welfare effects
of introducing vote-share contracts are always positive, independently of \( c_h \) and
\( c_l \). The following four cases may occur, which all yield a positive effect on overall
welfare:

(i) For \( c_l < c_h \leq \frac{3}{2} c_l \), introducing vote-share contracts increases expected overall
effort, while it may decrease expected ability of the office-holder in period 2.
However, if there is an ability-decreasing effect, then it is dominated by the
effort-increasing effect.

(ii) For \( \frac{3}{2} c_l < c_h < 2c_l \), introducing vote-share contracts increases both the
expected overall effort and the expected ability of the office-holder in period
2.

(iii) For \( c_h = 2c_l \), introducing vote-share contracts has no influence on expected
overall effort, while it increases expected ability of the office-holder in period
2.

(iv) For \( c_h > 2c_l \), introducing vote-share contracts decreases expected overall
effort, while it increases expected ability of the office-holder in period 2.
However, the ability-increasing effect dominates the effort-decreasing effect.

\(^{19}\)One reason for the fact that the efficiency of vote-share contracts depends on \( c_h \), but not on
\( c_l \), might be that \( c_l \) is not contained in the first period of the optimization problem.
5.7 Extensions

In our basic model, we have described the working of vote-share contracts in a simple setup. In the following, we sketch some fruitful extensions that could be pursued to address the robustness of our result, i.e. that using vote-share contracts is welfare-enhancing.

5.7.1 No Output-Shift Policy

First, one variant of our model is to assume that the socially wasteful output-shift policy is not available for the incumbent, i.e. to set $\Delta$ equal to zero. This assumption enables us to analyze potential risks of using vote-share thresholds in the case where the incumbency advantage may only have positive effects on welfare. As one can see from Fact 5.5 and Theorem 5.1, under absence of output-shift policy, $s^*$ will be lower and the welfare-increasing effect of vote-share contracts will be smaller. However, even for $\Delta = 0$, welfare under vote-share contracts with vote-share threshold $s^*$ will be higher than under elections alone. The intuition for this result is that vote-share contracts will still be welfare-enhancing, as they result in higher expected effort and/or in higher expected ability of the office-holder in the second period.

5.7.2 Asymmetric Competition and Larger Time Horizon

A useful extension of the model is to consider two candidates who are \textit{ex ante} non-symmetric. There are several possibilities to introduce \textit{ex ante} asymmetry, e.g. by differing effort-cost parameters in the first term of a politician or by abandoning the assumption of symmetric ideal points concerning the ideological policy. If, for example, $\mu_R$ is located closer to the ideal point of the median voter than $\mu_L$, i.e. $\mu_L < 1 - \mu_R$, then candidate $R$ will have an \textit{ex ante} advantage over his opponent $L$. Analyzing the consequences of such an asymmetric competition for office in $t = 1$ on the effort choice, on the incumbency advantage in $t = 2$, and on the welfare-effects of vote-share contracts promises to be a fruitful extension of our model.

Moreover, a model with two periods and two candidates being already asymmetric before the first period starts may also be interpreted as the last two periods
in a game with a longer time-horizon. The ex-ante asymmetry would then have been initiated by the incumbency advantage in previous periods of this repeated game. Such a model with a larger time horizon, where candidates for public office compete in each term on the basis of vote-share contracts, might be an interesting extension. First, this would make the model much more applicable for real-world situations, whereas our basic model with just two periods covers, in principle, only the case of two-period term limits, as common in the U.S. presidential elections. Second, we assume that increasing the time horizon of the model would reinforce the positive result of our basic model. For a detailed solution of a multi-period model, it would be necessary to specify the assumptions about learning-by-doing effects, i.e. to make precise assumptions whether they occur in each term, only sometimes, or even only once. However, we may state the following, even without precise assumptions about the multi-period model: As the incumbent will work hard to get reelected, the effort choice under vote-share contracts will be higher with vote-share contracts in each period, except from the last. The lower expected effort in the last period will be weighted less if there are more than two periods. Thus, we conjecture that the welfare-improving effect of vote-share thresholds will even be higher in dynamic versions of our model.

5.7.3 Alternative Institutional Settings

Suppose that voters directly impose a term-dependent vote-share threshold, instead of the candidates offering vote-share contracts. Under such an institutional framework, the public would determine $s^*$ as vote-share threshold and hence, this variant of the model yields the same results than our basic version.

Finally, an alternative election procedure with regard to vote-share contracts might be used. If incumbent $R$ does not obtain at least the self-imposed share of votes $s_R$ in the reelection result, then an additional election between a new right-wing candidate $R'$ and candidate $L$ would be organized. Such a procedure would ensure that politicians only come into office if they receive a real majority of votes. This variant of the model would yield qualitatively similar results.
5.8 Conclusion

In a simple model frame, we have proposed to use vote-share contracts as an instrument for restraining incumbency advantage. Vote-share contracts would imply higher effort and/or higher ability of incumbents, and therefore improve the efficiency of political systems. However, the implementation of such vote-share contracts might induce unintended consequences that are still unknown at the current point of research. Nevertheless, we have shown that under the assumptions of our framework, it is optimal for societies to restrain the incumbency advantage of their office-holders, even if there exists a socially beneficial aspect of incumbency advantage.

One may wonder why politicians do not already use other methods today to restrain their incumbency advantage. If the election chances of a politician increase when he cuts his future incumbency advantage, then one should expect politicians to make use of this mechanism in practice. A politician might, for example, announce he will spend less money for his reelection campaign in order to reduce his incumbency advantage. At first glance, this would have the same effect as a vote-share threshold above one-half. The problem is, however, that such announcements are no credible commitments, as they are not enforceable by voters. Thus, such announcements are completely worthless. The only way to avoid that announcements are just cheap talk is to embed them into the framework of enforceable political contracts. The most suitable kind of political contract to reduce welfare losses which arise from incumbency advantages are vote-share thresholds. Thus, we believe that exploring the potential of vote-share contracts as a new institution may be a fruitful path for liberal democracies.
Chapter 6

Conclusions

Our results from the previous chapters show that liberal democracy might get improved substantially by using political contracts. In detail, our main results concerning political contracts are as follows. First, political contracts may alleviate deficiencies in the provision of socially optimal long-term projects. Second, flexible pensions for politicians are a means of solving motivation problems of an incumbent who knows that he is in his final term. Third, as they limit advantages of incumbency, one might expect vote-share contracts not to be desirable if incumbency brings about positive effects. Yet, we show that vote-share contracts seem to be welfare-enhancing even if there are positive effects of incumbency advantage. And fourth, it is possible to generate verifiable data upon which political contracts can be conditioned, be it by using either prediction figures from political information markets or by directly using the next election result, like in the scenario with vote-share contracts. Finally, as a side-effect of our research on political contracts we obtain the result that politicians who are mainly interested in holding office may be better for society than office-holders who mainly receive utility from the outcome of policy projects.

As already mentioned in the previous chapters, there are still open questions and many ideas for future research. In the following, we want to conclude this work by proposing three paths for further research.

First, the applicability of political contracts in the case of ideologically-motivated politicians remains an open issue.¹ One main idea of incentive contracts is that

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¹A politician is called *ideologically motivated* if he prefers a different policy than the median voter. Note that the issue of ideology is only relevant in models where the incumbent has to
they should motivate the incumbent to implement the policy preferred by the median voter. However, if the incumbent is very ideological (i.e. if his preferred policy is far away from the median voter’s and/or if the incumbent receives a large personal utility from undertaking his preferred policy), it may happen that he will not fulfill his contract and the disciplining effect of political contracts is lost.\(^2\)

On the other hand, as we showed in chapter 3, political contracts can even help to alleviate deficiencies in the case of “dissonant” politicians, who have personal benefits if they deviate from the socially optimal policy.\(^3\) Thus, the question under which conditions political contracts are able to discipline ideologically-motivated politicians is an open issue for future research.

Another interesting question is the potential of political contracts in the case of coalition governments. Note that parties or candidates who offer political contracts in the election race may use the contracts to bindingly restrict their policy space in certain dimensions. This may be of special interest in cases where a coalition of two or more parties is necessary to reach a majority in parliament. Suppose a situation where political parties credibly commit to a policy interval (e.g. of tax rates) in their political contracts. Then it might be that two parties offer contracts that prevent a coalition between them.\(^4\) If all parties would commit to a very narrow range around their ideal policy, this might lead to contracts which would foreclose all coalitions, and a new election would be necessary. On the other hand, parties also have incentives not to commit to a narrow policy interval, in order to retain potential coalition partners. Thus, it is not clear which policy intervals parties will offer in their contracts.\(^5\) Designing political contracts suitable for coalition governments would permit them to be also welfare-enhancing in countries which are usually governed by coalitions. This seems to be a fruitful path for research.

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\(^2\)Liessem (2002) shows that it may be that an incumbent who is very ideological does not fulfill his political contract, but rather invests in the policy preferred by himself.

\(^3\)The concept of dissonant politicians is similar to the concept of ideology in the sense that the incumbent prefers to undertake a policy that differs from the policy preferred by the median voter. However normally, the policy preferred by an ideologically-motivated politician is still beneficial for a minority of society, while the optimal policy for a dissonant politician was detrimental for all voters in our model frame.

\(^4\)Note that offering policy intervals without any intersection would be one possibility to credibly commit against a coalition with a certain party. In a scenario with a socially undesirable extremist party, this might be a positive side-effect of political contracts.

\(^5\)Note, however, that according to a recent paper by Gersbach and Schneider (2008), in highly polarized societies political contracts which contain tax rates yield more moderate political outcomes in the case of coalition governments.
Finally, as already mentioned in section 2.6, the working of political contracts in the case of divided government is an open issue.\(^6\) Remember that in chapter 1, we mentioned that political contracts are mainly applicable for members of the executive branch, as they have sufficient power to influence policy results. What happens, however, if the executive is less powerful because the opposition has a legislative majority? Suppose, for example, that the U.S. President is a member of the democratic party while a majority of members of the Senate and of the House of Representatives are republicans. Then the president’s scope for decision-making may be much lower, due to additional restrictions, and he will make compromises to pass laws successfully. It is not clear whether an incumbent who fails to fulfill a threshold contract in such a situation should really lose the right to run for reelection. One may argue that without the restrictions due to divided government, the incumbent might have performed better in the policy fields he included in his contract and therefore, that he should not have to be punished for his failure. On the other hand, one may argue that politicians should already take the possibility of divided government into account when they offer their contracts, and that they should therefore adapt their offers to these prospects. Thus, the design of political contracts with appropriate rules for divided government is an open issue for future research.

\(^6\)Divided government denotes a situation in US-American politics where the executive has to govern against an oppositional majority in the legislative. For details concerning divided government, see e.g. Coleman (1999). In Germany, a similar situation may occur if the Chancellor has to govern under an oppositional majority in the Federal Council. A related case may occur in the French system if the state president (“Président de la République”) belongs to another party than the Prime Minister and the majority of parliament (“Assemblée Nationale”). Such a scenario is called cohabitation.
Appendix A

Appendix to Chapter 1

A.1 Balanced Budget Act of Ontario (1999, Section 3)

(1) This section applies if the Province has a deficit.

(2) The salary of each member of the Executive Council shall be reduced in accordance with subsection (3) if the deficit for a fiscal year (the “first year”) is greater than 1 per cent of the revenues for the year, and if there was no deficit in the preceding fiscal year.

(3) In the circumstances described in subsection (2), the salary is reduced by 25 per cent for a period of 12 months beginning on the thirty-first day after the Public Accounts that show the deficit for the first year are given to the Clerk of the Assembly or laid before the Assembly, whichever occurs first.

(4) The salary of each member of the Executive Council shall be reduced in accordance with subsection (5),

(a) if the deficit for a fiscal year (the “first year”) is less than or equal to 1 per cent of the revenues for the year, and if there was no deficit in the fiscal year preceding the first year; and

(b) if, in the following fiscal year (the “second year”), there is no deficit but the revenues do not exceed the expenditures by at least the amount of the deficit in the first year.
(5) In the circumstances described in subsection (4), the salary is reduced by 25 per cent for a period of 12 months beginning on the thirty-first day after the Public Accounts for the second year are given to the Clerk of the Assembly or laid before the Assembly, whichever occurs first.

(6) In either of the following circumstances, the salary of each member of the Executive Council shall be reduced by 50 per cent for the period specified in subsection (7):

1. If there is a deficit in the fiscal year (the “second year”) following the first year described in subsection (2).

2. If there is a deficit in the second year described in subsection (4).

(7) The salary is reduced for a period of 12 months beginning on the thirty-first day after the Public Accounts for the second year are given to the Clerk of the Assembly or laid before the Assembly, whichever occurs first.

(8) Subsection (7) applies, with necessary modifications, with respect to each consecutive fiscal year in which there is a deficit after the second year.

(9) If the party that forms the government is replaced, the fiscal year in which the new government takes office shall be deemed, for the purposes of this section, to be a year in which there is no deficit. Subsection (4) does not apply until the following fiscal year.

(10) The Minister of Finance shall pay into the Ontario Opportunities Fund (established under the Financial Administration Act) an amount equal to the salary reductions required by this section.

(11) In this section, “salary” means the salary payable to a member of the Executive Council under section 3 of the Executive Council Act.
Appendix B

Appendix to Chapter 2

B.1 Proofs

Proof of Proposition 2.3
As long as condition (2.8) is fulfilled, the welfare advantage of $LTP$ compared to $STP$ (i.e. $EV_L - EV_S$) is larger than the costs that accrue to the public by the incentive contract (i.e. $\delta \bar{\beta}^C V^2_L$) for a given value of $\bar{\beta}^C$. Hence, condition (2.8) ensures that the voters are better off by committing themselves to reelect a politician who has implemented $LTP$ than by choosing the reelection scheme $q_1(0) = q_2(0) = 0$ which avoids the transfer $\bar{\beta}^C V^2_L$ but leads to $STP$.

We use the reelection scheme $q(0) = 1$ and $q(V^1_S) = 0$ for the public, which is the largest possible spread to punish politicians for undertaking $STP$. We assume $m_1 > m_2$ and we construct $\bar{\beta}^C$ in such a way that the first candidate will be indifferent as to choosing $STP$ or $LTP$, if he gets elected. Thus, $\bar{\beta}^C$ is determined by setting

$$U^L_1(\bar{\beta}^C, q_1 = 1) = U^S_1(q_1 = 0)$$

(B.1)

which gives equation (2.7). In the next step we look at candidate 2. He will offer no higher value than $\bar{\beta}^C$, as he would not get elected in this case. The important question is whether candidate 2 will implement $LTP$ or $STP$ if he offers $\bar{\beta}^C$. To answer this question we have to compare $U^L_2(\bar{\beta}^C, q_i = 1)$ and $U^S_2(q_i = 0)$. For $U^L_2(\bar{\beta}^C, q_2 = 1) > U^S_2(q_2 = 0)$ to be true, it must hold that:

$$\delta[(1-m_2)B + m_2V^2_L \alpha + m_2V^2_L \frac{m_1 \alpha V^1_S}{m_1 \delta V^2_L} - \delta \{(1-m_1)B + m_1 \alpha V^2_L\}] > m_2 \alpha V^1_S$$

(B.2)
This expression can be simplified to $1 - \frac{m_2}{m_1} > 0$. This is true, since $m_2 < m_1$.

Therefore, we have $U^L_2(\overline{\beta}^C, q_2 = 1) > U^S_2(q_2 = 0)$.

Hence, candidate 2 has a strict preference for $LTP$ if elected, in contrast to the indifference as to $LTP$ and $STP$ of candidate 1 if elected – given that both candidates announced $\overline{\beta}^C$. Following our first tie-breaking rule, candidate 2 gets elected and thus $p_2 = 1$.

To establish the equilibrium, we consider four possible deviations from the equilibrium described in Proposition 2.3.

First, suppose that candidate 2 deviates and offers $C_2(\beta_2)$ with $\beta_2 > \overline{\beta}^C$. The deviation is not profitable as candidate 2 is not elected in this case because candidate 1 also implements $LTP$ and demands a lower transfer.

Second, suppose candidate 1 deviates to $C_1(\beta_1 V^2)$ with $\beta_1 > \overline{\beta}^C$. Then the public will not elect politician 1, even if he were to undertake $LTP$, because it is cheaper for the voters to elect the second candidate. Therefore, the deviation is not profitable.

Third, suppose candidate 1 deviates to $C_1(\beta_1)$ with $\beta_1 < \overline{\beta}^C$. This would imply $U^L_1(\beta_1, q_1 = 1) < U^S_1(q_1 = 0)$. Thus, candidate 1 would implement $STP$. The public will not elect candidate 1, and therefore the deviation is not profitable.

Finally, it is obvious that the second candidate has no incentive to offer a contract $C_2(\beta_2 V^2)$ with $\beta_2 < \overline{\beta}^C$, because he would receive lower transfers in the second period and $\beta_2 < \overline{\beta}^C$ does not increase his chances of being elected.

Uniqueness follows in a similar way. For any offer constellation $C_1(\beta_1 V^2), C_2(\beta_2 V^2)$ with $\beta_i \neq \overline{\beta}^C$ for at least one candidate, one of the politicians has an incentive to deviate by offering $C_i(\overline{\beta}^C V^2)$ or by offering a political contract that requires slightly fewer transfers from the public\(^1\).

\[\square\]

\(^1\)We omit the tedious but easy description of all possible cases.
Proof of Proposition 2.6
We obtain $\beta^{AI}$ by setting $U^L_i(\beta^{AI}, q_i = 1) = U^S_i(q_i = 0)$ for $m = 1$.

In the next step we have to show that for $\beta_i \geq \beta^{AI}$ both types of politicians choose LTP independently of whether they have high or low values for $m$. So we have to show that $U^L_i(\beta^{AI}, q_i = 1) \geq U^S_i(q_i = 0)$ for $m = 1$ and for $m = \tilde{m}$. For $m = 1$ this leads to $\delta V^2_L(\alpha + \frac{\alpha V^1_L - \delta \alpha V^2_L}{\delta V^1_L}) \geq \alpha V^1_S$, which is fulfilled with equality by construction. For $m = \tilde{m}$ the condition results in $\delta [(1 - \tilde{m})B + \tilde{m}V^2_L(\alpha + \beta_i)] \geq \tilde{m} \alpha V^1_S$. This expression can be simplified to $\delta (1 - \tilde{m})B \geq 0$, which is always fulfilled. Thus, in equilibrium politicians choose LTP which validates (ii).

Given the equilibrium and out-of-equilibrium beliefs, $\beta_1^* = \beta_2^* = \beta^{AI}$ are best responses from politicians. Given the strategy of other politicians, any choice $\beta_i \neq \beta^{AI}$ would result in zero probability of election.

Equilibrium beliefs of voters obey Bayes’ law. Finally, we have to check the election strategy of voters. Equilibrium election and reelection strategies are optimal as both politicians are identical and will choose LTP. Suppose that voters observe a pair $(\beta_1, \beta_2)$ which is different from the equilibrium strategies.

First, note that a politician with $m_i = \tilde{m}$ who offers $\beta_i < \beta^{AI}$ could possibly implement LTP, as $U^L_i(\beta^{AI}, q_i = 1) > U^S_i(q_i = 0)$. However, voters will assume that a politician has $m_i = 1$, if they observe $\beta_i \neq \beta^{AI}$. Consequently, they will assume that the politician will undertake STP, if he offers $\beta_i < \beta^{AI}$. Since voters do not change their a priori beliefs, the following cases can occur:

- $\beta_1 = \beta_2$
  As politicians offer the same contract and are ex ante identical, they are elected with probability $\frac{1}{2}$.

- $\beta^{AI} > \beta_1 > \beta_2$ or $\beta^{AI} > \beta_2 > \beta_1$
  Voters assume that both politicians will choose STP, if they are elected. So both politicians are elected with probability $\frac{1}{2}$.

- $\beta_1 = \beta^{AI}$ and $\beta_2 < \beta^{AI}$
  The first politician chooses LTP, while the second is assumed to select STP. According to our assumption, the public is better off by electing the first candidate.
• $\beta_1 = \beta_{AI}$ and $\beta_2 > \beta_{AI}$
  Both politicians select $\text{LTP}$. It is cheaper to elect the first politician.

• $\beta_{AI} < \beta_1 < \beta_2$
  Both politicians choose $\text{LTP}$. The first politician is elected since he requires lower transfers from the public.

• $\beta_1 > \beta_{AI} > \beta_2$
  The first politician chooses $\text{LTP}$, while the second is assumed to select $\text{STP}$. According to our assumption the public is better off by electing the first candidate.

• In all other cases the utility associated with the election of the second candidate is always higher for the voters.

Note that we used the assumption that the public is better off by $\text{LTP}$ and paying transfers to an elected politician than by inducing $\text{STP}$.

\[ \Box \]

\textbf{Proof of Proposition 2.7}

(i)(a)

In this case, we use the reelection scheme $q(0) = 1$ and $q(V^L_2) = 1$ for the public, which will be justified later. We construct $\beta_{CP(i)}$ in such a way that the first candidate will be indifferent as to $\text{STP}$ and $\text{LTP}$ if he gets elected. Thus, $\beta_{CP(i)}$ is determined by setting

\[ U^L_1(\beta_{CP(i)}, q_1 = 1) = U'^S_1(\beta_{CP(i)}, q_1 = 1) \] (B.3)

which gives equation (2.29). In the next step we have to compare $U^L_2(\beta_{CP(i)}, q_2 = 1)$ and $U'^S_2(\beta_{CP(i)}, q_2 = 1)$. For $U^L_2(\beta_{CP(i)}, q_2 = 1) \geq U'^S_2(\beta_{CP(i)}, q_2 = 1)$ to be true, it must hold that:

\[ (1 - m_2)B + \delta[(1 - m_2)B + m_2V^2_L(\alpha + \frac{\alpha(V^L_S - \delta V^L_L)}{\delta(V^2_L - V^2_S)})] \geq \] (B.4)

\[ (1 - m_2)B + m_2\alpha V^1_S + \delta[(1 - m_2)B + m_2V^2_S\frac{\alpha(V^1_S - \delta V^2_L)}{\delta(V^2_L - V^2_S)}]. \]
Simplifying yields $1 \geq \alpha$, which is true by assumption. Hence, candidate 2 will implement $LTP$ if elected. Thus, candidate 2 gets elected according to our tie-breaking rules if both candidates offer $\overline{\beta}^{CP(i)}$.

Afterwards we have to check which reelection scheme is worse for the politicians, or alternatively which is best for the public. Note that voters can commit themselves to reelect or not reelect a politician. We must compare $U_{r_{S}}^{i}(\beta, q_{2} = 1)$ and $U_{S}^{\overline{\beta}}(\beta, q_{2} = 0)$ to examine whether or not the elected candidate 2 who undertakes $STP$ is worse off by getting reelected. The reelection scheme with $q(0) = 1$ and $q(V_{S}^{i}) = 1$ will be worse for the politician than the one with $q(0) = 1$ and $q(V_{S}^{i}) = 0$, if the following condition holds:

\[(1 - m_{2})B + m_{2}\alpha V_{S}^{1} + \delta [(1 - m_{2})B + m_{2}\overline{V}_{S}^{2}] < (1 - m_{2})B + m_{2}\alpha V_{S}^{1}.\]

This can be simplified to

\[\overline{\beta} > \frac{(1 - m_{2})B}{m_{2}|V_{S}^{2}|}.\]

Hence, we can only use the reelection scheme with $q(0) = 1$ and $q(V_{S}^{i}) = 1$ if $\overline{\beta} > \frac{(1 - m_{2})B}{m_{2}|V_{S}^{2}|}$. Moreover, we have the equilibrium value for $\overline{\beta}$ from equation (2.29) in this case. The combination of these two conditions yields

\[\frac{\alpha V_{S}^{1} - \delta V_{S}^{2}}{\delta V_{L}^{2} - V_{S}^{2}} > \frac{(1 - m_{2})B}{m_{2}|V_{S}^{2}|}.\]

This expression can be simplified to

\[m_{2} > \frac{1}{1 - \frac{\alpha V_{S}^{1}(V_{S}^{1} - \delta V_{S}^{2})}{\delta B(V_{L}^{2} - V_{S}^{2})}}.\]

We denote this boundary by $m_{crit}$ and obtain the condition from equation (2.30). Note that $m_{1} > m_{crit}$, since $m_{1} > m_{2}$. Hence, this reelection scheme is also the best to motivate the first candidate to undertake $LTP$, if condition (2.30) is fulfilled. Therefore, this reelection scheme is optimal for voters.

Finally, if condition (2.31) is fulfilled, the welfare advantage of $LTP$ compared to $STP$ (i.e. $EV_{L} - EV_{S}$) is larger than the costs that accrue to the public by the implementation of $LTP$. These costs consist of two components: First, the public has to pay $\overline{\beta}^{CP(i)}V_{L}^{i}$ to the politician if he undertakes $LTP$. Second, voters do not receive $\overline{\beta}^{CP(i)}|V_{S}^{2}|$ from the politician, which is the amount of money the politician
would have to pay, if he implemented STP. Hence, condition (2.31) ensures that voters will be better off if the politician undertakes LTP than if he undertakes STP. That means, if the first politician offers a slightly lower $\beta_1$ and undertakes STP, he will not be elected. Note that, if condition (2.31) was violated, this deviation of the first politician would lead to his election: It would be profitable for the first politician to undertake STP and the public would be better off by STP than under LTP.

To establish the equilibrium, we consider four possible deviations from the equilibrium and check if the deviating politician can gain by his deviation.

First, suppose that candidate 2 deviates and offers $C_2(\beta_2)$ with $\beta_2 > \bar{\beta}_{CP(i)}$. The deviation will not be profitable for candidate 2 as he is not elected any more in this case because candidate 1 also implements LTP and demands a lower transfer.

Second, suppose candidate 1 deviates to $C_1(\beta_1V^2)$ with $\beta_1 > \bar{\beta}_{CP(i)}$. Then the public will not elect politician 1, even if he were to undertake LTP, because for voters the payments to the politician are lower when the second candidate is elected. The deviation does not change the result and is therefore not profitable.

Third, suppose candidate 1 deviates to $C_1(\beta_1)$ with $\beta_1 < \bar{\beta}_{CP(i)}$. We know by construction that $U_{1L}(\bar{\beta}_{CP(i)}, q_1 = 1) = U_{1S}(\bar{\beta}_{CP(i)}, q_1 = 1)$. For $\beta < \bar{\beta}_{CP(i)}$, we have $U_{1L}(\beta, q_1 = 1) < U_{1S}(\beta, q_1 = 1)$. Therefore politician 1 would undertake STP and is not elected. Hence, this deviation is not profitable.

Finally, it is obvious that the second candidate has no incentive to offer a contract $C_2(\beta_2V^2)$ with $\beta_2 < \bar{\beta}_{CP(i)}$, because he would receive lower transfers in the second period and $\beta_2 < \bar{\beta}_C$ does not increase his chances of being elected.

Uniqueness follows in a similar way. For any offer constellation $C_1(\beta_1V^2), C_2(\beta_2V^2)$ with $\beta_i \neq \bar{\beta}_{CP(i)}$ for at least one candidate, one of the politicians has an incentive to deviate by offering $C_i(\bar{\beta}_{CP(i)}V^2)$ or by offering a contract that requires slightly fewer transfers from the public\(^2\).

(i)(b)

The only difference in comparison with case (ia) is that $m_2 \leq m^{crit}$, while we still have $m_1 > m^{crit}$. It is optimal for the public to use the reelection scheme

\(^2\)We omit the tedious but simple description of all possible cases.
We again obtain equation (2.29) by setting $U^L_1(\beta^{CP(i)}, q_1 = 1) = U^S_1(\beta^{CP(i)}, q_1 = 1)$. Afterwards we have to compare $U^L_2(\beta^{CP(i)}, q_2 = 1)$ and $U^S_2(q_2 = 0)$. For $U^L_2(\beta^{CP(i)}, q_2 = 1) \geq U^S_2(q_2 = 0)$ to be true, it must hold that:

$$\delta[(1 - m_2)B + m_2V^2_L(\alpha + \frac{\alpha V^1_S - \delta V^2_L}{\delta V^2_L - V^2_S})] \geq m_2\alpha V^1_S$$

This condition is fulfilled for $m_2 \leq m^{crit}$, which is assumed in this case.\(^3\)

Hence, candidate 2 will implement $LTP$ if elected and therefore candidate 2 gets elected according to our tie-breaking rules.

In the next step, we have to check which reelection scheme is the best for the public. Note that $q_1(V^1_S) = 1$ is still optimal as $m_1 > m^{crit}$. The proof that the reelection scheme with $q_2(V^1_S) = 0$ is optimal for voters if $m_2 \leq m^{crit}$ follows the same logic as in case (i)(a) and is therefore omitted here.

Finally, condition (2.31) again has to be fulfilled.

To establish the equilibrium, one can again consider four possible deviations from the equilibrium and check if the deviating politician can gain by his deviation. These deviations and their consequences are identical to case (i)(a) and are therefore omitted here.

(ii)

In the second case, we use the reelection scheme $q(0) = 1$ and $q(V^1_S) = 0$ for the public, which will be justified later. We construct $\beta^{CP(ii)}$ in such a way, that the first candidate will be indifferent as to $STP$ and $LTP$ if he gets elected. Thus, $\beta^{CP(ii)}$ is determined by setting

$$U^L_1(\beta^{CP(ii)}, q_1 = 1) = U^S_1(q_1 = 0) \quad \text{(B.5)}$$

which gives equation (2.33). Afterwards we have to compare $U^L_2(\beta^{CP(ii)}, q_2 = 1)$ and $U^S_2(q_2 = 0)$. For $U^L_2(\beta^{CP(ii)}, q_2 = 1) \geq U^S_2(q_2 = 0)$ to be true, it must hold:

$$\delta[(1 - m_2)B + m_2V^2_L(\alpha + \frac{m_1\alpha V^1_S - \delta}{\delta V^2_L - V^2_S})] \geq m_2\alpha V^1_S \quad \text{(B.6)}$$

\(^3\)Note that we have $\frac{\partial U^L_2(\beta^{CP(ii)}, q_2 = 1)}{\partial m_2} < 0$, $\frac{\partial U^S_2(q_2 = 0)}{\partial m_2} > 0$. 

$q_1(V^1_L) = 1$ and $q_2(V^1_L) = 0$, which will be justified later.
This expression can be simplified to $1 - \frac{m_2}{m_1} \geq 0$, which is fulfilled as $m_2 < m_1$.

Hence, candidate 2 will implement LTP if elected and therefore candidate 2 gets elected according to our tie-breaking rules.

In the next step we have to check which reelection scheme is best for the public. We must compare $U_1^S(\beta_i, q_1 = 1)$ and $U_1^S(\beta_i, q_1 = 0)$ to examine whether candidate 1 is worse off by getting reelected or not, if he undertakes STP. The reelection scheme with $q(0) = 1$ and $q(V_2^S) = 0$ will be worse (or equal) for the politician than the one with $q(0) = 1$ and $q(V_2^S) = 1$, if the following condition holds:

$$(1 - m_1)B + m_1\alpha V_2^L + \delta[(1 - m_1)B + m_1\beta V_2^S] \geq (1 - m_1)B + m_1\alpha V_2^L.$$  

This can be simplified to

$$\beta \leq \frac{(1 - m_1)B}{m_1|V_2^L|}.$$  

Inserting the equilibrium value for $\beta$ yields:

$$\frac{m_1\alpha V_2^L - \delta \{ (1 - m_1)B + m_1\alpha V_2^S \}}{m_1\delta V_2^S} \leq \frac{(1 - m_1)B}{m_1|V_2^S|}.$$  

This expression can be simplified to

$$m_1 \leq \frac{1}{1 - \frac{\alpha V_2^S(V_2^S - \delta V_2^L)}{\delta B(V_2^S - V_2^L)}} = m^{crit},$$  

and we obtain the condition from equation (2.34). Note that $m_2 < m^{crit}$, since $m_2 < m_1$. Hence, this reelection scheme is also optimal to motivate the second candidate to undertake LTP, if condition (2.30) is fulfilled.

Finally, condition (2.31) again has to be fulfilled.

To establish the equilibrium, we consider four possible deviations from the equilibrium and check if the deviating politician can gain by his deviation.

First, suppose that candidate 2 deviates and offers $C_2(\beta_2)$ with $\beta_2 > \beta^{CP(ii)}$. The deviation will not be profitable for candidate 2 as he is not elected any more in this case because candidate 1 also implements LTP and demands a lower transfer.

Second, suppose candidate 1 deviates to $C_1(\beta_1 V^2)$ with $\beta_1 > \beta^{CP(ii)}$. Then the public will not elect politician 1, even if he were to undertake LTP, because
for voters the payments to the politician are lower when the second candidate is elected. The deviation does not change the result and is therefore not profitable.

Third, suppose candidate 1 deviates to $C_1(\beta_1)$ with $\beta_1 < \beta^{CP(ii)}$. We know by construction that $U^L_1(\beta^{CP(i)}, q_1 = 1) = U^S_1(q_1 = 0)$. For $\beta < \beta^{CP(ii)}$, we have $U^L_1(\beta, q_1 = 1) < U^S_1(q_1 = 0)$. Therefore, politician 1 would undertake $STP$ and is not elected. Hence, this deviation is not profitable.

Finally, it is obvious that the second candidate has no incentive to offer a contract $C_2(\beta_2 V^2)$ with $\beta_2 < \beta^{CP(ii)}$, because he would receive lower transfers in the second period and $\beta_2 < \beta^C$ does not increase his chances of being elected.

Uniqueness follows in a similar way. For any offer constellation $C_1(\beta_1 V^2), C_2(\beta_2 V^2)$ with $\beta_i \neq \beta^{CP(ii)}$ for at least one candidate, one of the politicians has an incentive to deviate by offering $C_i(\beta^{CP(ii)} V^2)$ or by offering a political contract that requires slightly fewer transfers from the public.
Appendix C

Appendix to Chapter 3

C.1 Proofs

Proof of Proposition 3.4
Suppose that voters use the robust election scheme RES. Both candidates decide simultaneously about their threshold contracts. We show that $C_i(p_1^i = p_0^i = \frac{1}{2})$ for $i = 1, 2$ is the unique equilibrium of the politician’s contract choice, given that voters will use $RES$.

Step 1: Given that candidate $g \in \{1, 2\}$ offers $C_g(p_1^g = p_0^g = \frac{1}{2})$, politician $h \neq g, h \in \{1, 2\}$ will not offer $p_k^h < \frac{1}{2}$ for any $k \in \{0, 1\}$, since he would have no chance of winning the election. Furthermore, he has no incentive to offer $p_k^h > \frac{1}{2}$ for any $k \in \{0, 1\}$, since this does not increase his chances of winning the election. Thus, given that candidate $g$ offers $C_g(p_1^g = p_0^g = \frac{1}{2})$, a best response for candidate $h$ is to offer $C_h(p_1^h = p_0^h = \frac{1}{2})$, independently of his type. Hence, offering $C_i(p_1^i = p_0^i = \frac{1}{2}) \forall i \in \{1, 2\}$ is an equilibrium. In the next steps we show that it is unique.

Step 2: We know from Lemma 3.1 that $p_k^i \leq \frac{1}{2} \forall k \in \{0, 1\}, i = 1, 2$, so we only have to examine whether there may exist other equilibria with threshold offers below $\frac{1}{2}$. Suppose that candidate $g$ offers a contract with $p_k^g \leq \frac{1}{2} \forall k \in \{0, 1\}$ and $p_k^g < \frac{1}{2}$ for at least one $k \in \{0, 1\}$. We distinguish three cases:

Step 2a: First, consider a constellation with candidates $g$ and $h$ offering contracts $C_g(p_1^g < \frac{1}{2}, p_0^g < \frac{1}{2})$ and $C_h(p_1^h < \frac{1}{2}, p_0^h < \frac{1}{2})$. Then candidate $h$ has an incentive to deviate by offering $C_h(p_1^h < \frac{1}{2}, p_0^h = \frac{1}{2})$, as his election chances are higher with
Then inequality (C.1) can be simplified to

\[ C(g) < \frac{1}{2}, p^0_g = \frac{1}{2} \] and because offering \( p^0_h = \frac{1}{2} \) does not reduce the reelection chances of \( h \), whether he behaves congruently or dissonantly.\(^1\)

**Step 2b:** Consider next a constellation with candidates \( g \) and \( h \) offering contracts \( C_g(p^1_g = \frac{1}{2}, p^0_g < \frac{1}{2}) \) and \( C_h(p^1_h = \frac{1}{2}, p^0_h < \frac{1}{2}) \). Then candidate \( h \) can profitably deviate by offering \( C_h(p^1_h = \frac{1}{2}, p^0_h = \frac{1}{2}) \) as – according to Lemma 3.2 – this induces the same behavior and gives the same reelection chances, while increasing the election chances from \( \frac{1}{2} \) to 1.

**Step 2c:** We are left with the optimal response of politician \( h \neq g \) if candidate \( g \) offers \( C_g(p^1_g < \frac{1}{2}, p^0_g = \frac{1}{2}) \). There are two possibilities for optimal responses: \( C_h(p^1_h = p^0_h = \frac{1}{2}) \) and \( C_h(p^1_h < \frac{1}{2}, p^0_h = \frac{1}{2}) \). We show now that both types of politicians will prefer to offer \( C_h(p^1_h = p^0_h = \frac{1}{2}) \) rather than \( C_h(p^1_h < \frac{1}{2}, p^0_h = \frac{1}{2}) \) in response to a contract \( C_g(p^1_g < \frac{1}{2}, p^0_g = \frac{1}{2}) \). Suppose that a candidate, say candidate 2, offers \( C_2(p^1_2 < \frac{1}{2}, p^0_2 = \frac{1}{2}) \).

We consider candidate 1 and assume first that he is of the congruent type. If a congruent politician offers a contract with \( p^1_1 = p^0_1 = \frac{1}{2} \) and gets elected, then he will always behave congruently.\(^2\) If a congruent politician offers a contract with \( p^1_1 < \frac{1}{2} \) and \( p^0_1 = \frac{1}{2} \) and gets elected,\(^3\) then his behavior in state \( s_1 = 0 \) will depend on whether \( R + G + \mu[\delta R + \delta^2 R] \) is larger or smaller than \( (R + (1 - \mu)\delta R) \). Candidate 1 is better off by choosing \( p^1_1 = p^0_1 = \frac{1}{2} \) if

\[
\begin{align*}
\frac{1}{2}z[R + G + \delta R + \delta^2 R] + & (1 - z)\{R + G + \mu[\delta R + \delta^2 R]\} \\
& \geq \frac{1}{2}(1 - z)\max\{R + G + \mu[\delta R + \delta^2 R]; R + (1 - \mu)\delta R\}.
\end{align*}
\]

To analyze this inequality, we consider the two possible cases, starting with \( R + G + \mu[\delta R + \delta^2 R] \geq (R + (1 - \mu)\delta R) \). In this case, inequality (C.1) simplifies to \( 1 \geq \frac{1}{2} \) and thus holds. Next we look at \( R + G + \mu[\delta R + \delta^2 R] < (R + (1 - \mu)\delta R) \). Then inequality (C.1) can be simplified to

\[
\frac{1}{2}z[R + G + \delta R + \delta^2 R] + (1 - z)\{R + G + \mu[\delta R + \delta^2 R]\} \\
& \geq \frac{1}{2}(1 - z)[R + (1 - \mu)\delta R].
\]

\(^1\)Recall that only threshold \( p^1_1 \) can affect the reelection chances of the incumbent.

\(^2\)This is obvious in state \( s_1 = 1 \). In state \( s_1 = 0 \), the politician has utility \( R + G + \mu[\delta R + \delta^2 R] \) when he behaves congruently and utility \( R \) when he behaves dissonantly. Hence, the politician will always behave congruently. Closer reasoning will be given in Proposition 3.6.

\(^3\)Note that in this case the election probability is only \( \frac{1}{2} \).
This condition is always fulfilled because
\[ \frac{1}{2} z [R + \delta R] > \frac{1}{2} (1 - z) [R + (1 - \mu) \delta R] \]
and the other terms on the left hand side of the condition are positive. Thus, a congruent politician 1 will offer a contract with \( p_1^1 = p_0^1 = \frac{1}{2} \) in response to \( C_2(p_2^1 < \frac{1}{2}, p_2^0 = \frac{1}{2}) \).

Next we analyze the behavior of politician 1 if he is dissonant and candidate 2 offers \( C_2(p_2^1 < \frac{1}{2}, p_2^0 = \frac{1}{2}) \). In contrast to our considerations for congruent politicians above, it is no longer clear this time whether politician 1 will behave congruently or dissonantly. Nevertheless, it still holds that he will offer a contract \( C_1(p_1^1 = p_0^1 = \frac{1}{2}) \). To substantiate this claim we distinguish four cases:

(i) Suppose candidate 1 is elected and behaves in a dissonant manner regardless of the threshold contract he has offered.\(^4\) Then we obtain
\[
EU^1 \left( p_1^1 = p_0^1 = \frac{1}{2} \right) = z(R + G) + (1 - z)(R + G) = R + G
\]
and
\[
EU^1 \left( p_1^1 < \frac{1}{2}, p_0^1 = \frac{1}{2} \right) = \frac{1}{2} \{ z[R + G] + (1 - z)[R + G + (1 - \mu)\delta R] \} \\
= \frac{1}{2} [R + G + (1 - z)(1 - \mu)\delta R] < R + \frac{G}{2}, \quad (C.3)
\]
where \( EU^1 \) denotes the expected utility of politician 1 depending on the contract he has offered. Hence, expected utility will be larger if he offers \( p_1^1 = p_0^1 = \frac{1}{2} \).

(ii) Suppose candidate 1 is elected and behaves in a congruent manner, regardless of the threshold contract he has offered.\(^5\) For such circumstances we obtain
\[
EU^1 \left( p_1^1 = p_0^1 = \frac{1}{2} \right) = z[R + \delta R + \delta^2 R] + (1 - z)[R + \mu(\delta R + \delta^2 R)] \\
= R + [z + (1 - z)\mu](1 + \delta)\delta R
\]
and
\[
EU^1 \left( p_1^1 < \frac{1}{2}, p_0^1 = \frac{1}{2} \right) = \frac{1}{2} \{ z[R + \delta R + \delta^2 R] + (1 - z)[R + \mu(\delta R + \delta^2 R)] \} \\
= \frac{1}{2} [R + [z + (1 - z)\mu](1 + \delta)\delta R]. \quad (C.5)
\]

As the expression (C.4) is larger than the expression in (C.5), candidate 1 is better off by offering \( p_1^1 = p_0^1 = \frac{1}{2} \).

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\(^4\)Intuitively, this will occur if the value of \( G \) is sufficiently large.

\(^5\)This will occur if the value of \( G \) is sufficiently small.
APPENDIX C. APPENDIX TO CHAPTER 3

(iii) Suppose candidate 1 is elected and behaves dissonantly with a contract $C_1(p^*_1 = p^0_1 = \frac{1}{2})$ and congruently with a contract $C_1(p^*_1 < \frac{1}{2}, p^0_1 = \frac{1}{2})$. According to equations (C.3) and (C.5) acting congruently after having offered $p^*_1 < \frac{1}{2}$ is only optimal if $G < [z + (1 - z)\mu](1 + \delta)\delta R$. However, for $G < [z + (1 - z)\mu](1 + \delta)\delta R$ the politician would act congruently after having offered $p^*_1 = \frac{1}{2}$ according to equations (C.2) and (C.4). This is a contradiction. Hence, case (iii) cannot occur.

(iv) Suppose candidate 1 is elected and behaves congruently with the contract $C_1(p^*_1 = p^0_1 = \frac{1}{2})$ while behaving dissonantly with $C_1(p^*_1 < \frac{1}{2}, p^0_1 = \frac{1}{2})$. The utility of acting dissonantly with contract $C_1(p^*_1 < \frac{1}{2}, p^0_1 = \frac{1}{2})$ is smaller than the utility of acting dissonantly with contract $C_1(p^*_1 = p^0_1 = \frac{1}{2})$. As we have assumed that the candidate behaves congruently under $C_1(p^*_1 = p^0_1 = \frac{1}{2})$ and thus achieves higher or equal utility than by acting dissonantly, the utility of acting dissonantly with $C_1(p^*_1 < \frac{1}{2}, p^0_1 = \frac{1}{2})$ is smaller than the utility of behaving congruently with contract $C_1(p^*_1 = p^0_1 = \frac{1}{2})$.

Hence, we can conclude that if politician 1 is of the dissonant type, he will always offer a contract $C_1(p^*_1 = p^0_1 = \frac{1}{2})$ given that candidate 2 offers a contract $C_2(p^*_2 < \frac{1}{2}, p^0_2 = \frac{1}{2})$.

To sum up, $C_i(p^*_1 = p^0_i = \frac{1}{2}) \forall i \in \{1, 2\}$ is the unique equilibrium under the election scheme $RES$. 

□

Proof of Proposition 3.5

In Proposition 3.4 we have shown that both politicians will offer $C_i(p^*_i = p^0_i = \frac{1}{2})$ if they believe that voters will use $RES$. Now we show that $RES$ is optimal for voters.

Proposition 3.3 in Appendix C.2 shows that the equilibrium price on the information market will be larger than $\frac{1}{2}$ if the incumbent chooses the socially optimal action, while it will be smaller than $\frac{1}{2}$ if the incumbent chooses the socially undesirable action. So $RES$ is optimal, as it induces the socially optimal action. Specifically, under $RES$ a politician (say $i = 2$) who offers a contract with a price
smaller than $\frac{1}{2}$ will never generate a higher utility than a politician who offers thresholds $p_1^1$ and $p_0^1$ equal to $\frac{1}{2}$. Thus in this case electing politician 1 can never be worse than electing politician 2. Finally, we note that under $RES$ a politician (say $i = 2$) who offers a contract with a threshold strictly larger than $\frac{1}{2}$ will never generate a higher utility than a politician who offers thresholds $p_1^1$ and $p_0^1$ equal to $\frac{1}{2}$. In this case, electing politician 1 can never be worse than electing politician 2. This completes the proof.

\[\square\]

**Proof of Proposition 3.6**

We start with dissonant politicians and look first at the case $s_1 = 1$ where the popular action is optimal from the voters’ point of view. The politician, however, would prefer the unpopular action. In the scenario with threshold contracts, the dissonant politician will undertake the socially optimal action if and only if

$$R + \delta R + \delta^2 R \geq R + G \iff \delta R (1 + \delta) \geq G.$$  \hfill (C.6)

Comparison with the condition when threshold contracts are absent shows that condition (C.6) is identical to condition (3.4). The reason is that threshold contracts have no impact in state $s_1 = 1$.

We next consider the case $s_1 = 0$. In this state, voters prefer the unpopular action, while the dissonant politician prefers the popular action. The dissonant politician will only undertake the socially optimal action if

$$R + \mu(\delta R + \delta^2 R) \geq R + G \iff \delta R \mu (1 + \delta) \geq G.$$  \hfill (C.7)

Comparison with the condition in the scenario without threshold incentive contracts shows that condition (3.5) is tighter than condition (C.7), i.e. the set of parameter values fulfilling (C.7) is larger than the corresponding set for condition (3.5). For instance, equation (C.7) is always fulfilled if $R$ is sufficiently high, which is not true in general under condition (3.5).

Next consider congruent politicians. In case $s_1 = 1$, a congruent politician will undertake the socially optimal action if

$$R + G + \delta R + \delta^2 R \geq R.$$  \hfill (C.8)
This condition is always fulfilled. In case \( s_1 = 0 \), a congruent politician will undertake the optimal action if

\[
R + G + \mu(\delta R + \delta^2 R) \geq R. \tag{C.9}
\]

Again, this condition is always fulfilled. Hence, in both states of the world, the politician will always pursue the policy optimal for the voters if he has offered a threshold contract with \( p_1^i = p_0^i = \frac{1}{2} \). As showed above in equation (3.7), this is not necessarily true for congruent politicians in the scenario without threshold contracts.

\[\square\]

**Proof of Proposition 3.7**

Suppose that \( G \) is sufficiently large relative to \( R \), such that congruent politicians will always act congruently and dissonant politicians will always act dissonantly, irrespective of the threshold contracts they have offered. In Appendix B we show that, for \( G \) sufficiently large relative to \( R \), the equilibrium price will be smaller than 1, even if politicians act in a socially optimal way. Thus, if both candidates offered contracts \( p_1^i = p_0^i = 1 \), neither of them would ever be able to fulfill their contract. This is an example of overpromising.

Suppose next that both candidates are of the congruent type. Then no candidate will deviate from a Nash equilibrium \( p_1^i = p_0^i = 1 \), as a deviating candidate would never be elected.

Next we show that the Nash equilibrium \( p_1^i = p_0^i = 1 \) is unique for certain parameters. Suppose both candidates offer threshold contracts with \( p_1^i = p_2^i < 1 \) and \( p_1^0 = p_0^2 < 1 \). Politicians face the trade-off between offering the largest thresholds that can be reached by acting congruently and deviating from this offer to higher values, thereby increasing election chances to 1. Deviation to higher threshold values is profitable if

\[
\frac{1}{2} \{z[R + G + \delta R + \delta^2 R] + (1 - z)[R + G + \mu(\delta R + \delta^2 R)]\} < (R + G)
\]

\[
\Leftrightarrow R\{[z + \mu(1 - z)](\delta + \delta^2) - 1\} < G. \tag{C.10}
\]

We see that this condition will always be fulfilled if \( G \) is sufficiently large relative to \( R \).\(^6\)

\[\square\]

\(^6\)There exist other constellations where overpromising occurs. Details are available on request.
C.2 Political Information Market

C.2.1 Assets

We assume that a political information market is organized during the first period after politicians have chosen their actions. There are $N$ potential investors. We assume that there are many investors in the market. However, compared to the total number of voters the quantity of investors is assumed to be sufficiently small for the influence of investors on the voting outcome to be negligible.

There are two assets, $D$ and $E$. If the politician is reelected after the second period, the owners of asset $D$ receive one monetary unit for a single unit of $D$. If the politician stands for reelection but is not reelected after the second period, the owners of asset $E$ receive one monetary unit for a single unit of $E$. This means that the settlement of the information market will occur at the beginning of period 3, when the result of the second reelection decision is known. If the politician is not able to run for second reelection, e.g. if he was already deselected at the first reelection or if he does not want to stand for reelection, then all transactions that have occurred will be neutralized, i.e. each investor will be paid back the money he has invested.

The information market works as follows: A bank or an issuer offers an equal amount of assets $D$ and $E$. On the secondary market, traders can buy assets $D$ or $E$. Trading in the secondary market results in price $p$ for one unit of asset $D$. As buying one unit of $D$ and one unit of $E$ pays one monetary unit with certainty, the price of asset $E$ must be $1 - p$, otherwise either traders or the issuer could make riskless profits. An equilibrium on the information market is a price $p^*$ such that traders demand an equal amount of assets $D$ and $E$.

It is useful to look more closely at the event tree associated with the assets. If, for example, an investor buys one unit of asset $D$ at price $p$, then the event tree and the payoffs for the information market are given as:

---

7It is sensible for only individuals to be allowed to trade in such information markets and for the trading volume per person to be limited so as to avoid large-scale manipulation attempts.
8We could allow for short-selling, but this is immaterial to our analysis.
9This is equivalent to an information market with only asset $D$ where traders can buy or sell $D$ and an equilibrium is obtained when supply equals demand.
In this chapter we specifically design information markets to allow for the design of reelection threshold contracts. If threshold contracts are offered, then the event tree and the payoffs for the information market have to be modified in the following way:
Finally, note that with probability $\mu$ there is complete information in period 1. Then the price in the information market will be either 1 or 0, depending on whether the politician undertook the socially optimal action or not.

### C.2.2 Investors

We assume that investors have log utility with

$$U_j(Y_j + W_j) = \ln(Y_j + W_j), \quad (C.11)$$

where $W_j$ is the investor’s wealth and $Y_j$ is gain or loss in the information market.\(^{10}\) Each investor $j$ obtains a signal $\sigma_j \in \{0; 1\}$ about the state of the world at the point in time when the politician in office discovers the state of the world.\(^{11}\) The probability that investor $j$ receives a correct signal, i.e. that $\sigma_j = s_1$, is given by $h_j \in (\frac{1}{2}, 1)$, where each investor $j$ knows his personal signal quality $h_j$. Our assumption $h_j > \frac{1}{2}$ implies that the signals are not completely uninformative.\(^{12}\) We assume that $h_j$ does not depend on the state that has occurred.\(^{13}\)

We first calculate the investors’ posterior probability estimations of the state after they have received their signals. We obtain

$$\text{Prob}(s_1 = 1|\sigma_j = 1) = \frac{zh_j}{zh_j + (1 - z)(1 - h_j)}, \quad (C.12)$$

$$\text{Prob}(s_1 = 1|\sigma_j = 0) = \frac{z(1 - h_j)}{(1 - z)h_j + (1 - h_j)z}, \quad (C.13)$$

$$\text{Prob}(s_1 = 0|\sigma_j = 1) = \frac{(1 - z)(1 - h_j)}{zh_j + (1 - z)(1 - h_j)}, \quad (C.14)$$

$$\text{Prob}(s_1 = 0|\sigma_j = 0) = \frac{(1 - z)h_j}{(1 - z)h_j + (1 - h_j)z}. \quad (C.15)$$

\(^{10}\)Note that we neglect utility from the action of the politician in the utility function of investors, as policy outcomes have no influence on the trading behavior of investors.\(^{11}\)There are several justifications why investors may be better informed than voters. It is fair to assume that investors spend time collecting information concerning the state of the world and thus have more knowledge than ordinary voters.\(^{12}\)We could also allow for poor signal qualities, i.e. $h_j \in (0, \frac{1}{2})$. As investor $j$ knows $h_j$, a value of $h_j$ near to 0 is as informative as a value near to 1. The lowest information gain is received by a signal which is correct with a probability of $\frac{1}{2}$. Nevertheless, we restrict the signal quality to $h_j \in (\frac{1}{2}, 1)$ in order to avoid additional case differentiations.\(^{13}\)The extension to state contingent values of $h_j$ does not change the qualitative results of our model.
C.2.3 Information from the Politician’s Choice

Investors may receive additional information about the state by observing the action of the incumbent. Recall that a politician of the congruent type will always behave congruently in equilibrium when threshold contracts are used. The behavior of a dissonant incumbent depends on the parameters \( R, G, \delta, \) and \( \mu, \) which are common knowledge among investors. Three cases may occur: First, the value of \( G \) may be sufficiently low relative to \( R. \) Then dissonant politicians will behave congruently. Second, the value of \( G \) is at an intermediate level, and dissonant politicians will behave congruently in the popular state \( s_1 = 1, \) while they will behave dissonantly in the unpopular state \( s_1 = 0. \) Third, the value of \( G \) may be rather high relative to the benefits from holding office. Then dissonant politicians will behave dissonantly in both states of the world. We summarize the three cases in the following table, where \( a^c_1 \) denotes the action of a congruent politician, while \( a^d_1 \) denotes the action of a dissonant politician.

<table>
<thead>
<tr>
<th>Case</th>
<th>Condition</th>
<th>( a^c_1 ) if ( s_1 = 1 )</th>
<th>( a^c_1 ) if ( s_1 = 0 )</th>
<th>( a^d_1 ) if ( s_1 = 1 )</th>
<th>( a^d_1 ) if ( s_1 = 0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( G \leq \mu \delta R(1 + \delta) )</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>( \mu \delta R(1 + \delta) ) \n&lt; ( G ) \n\leq ( \delta R(1 + \delta) )</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>( \delta R(1 + \delta) &lt; G )</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Table C.1

In the following we use \( c \in \{1, 2, 3\} \) to denote the cases. In the next step we calculate the conditional probabilities \( \text{Prob}_c(s_1 = 1|a_1 = 1) \) and \( \text{Prob}_c(s_1 = 0|a_1 = 0) \) for an individual investor without private signals updating his beliefs in the signalling game with politicians choosing their action. For example, we obtain \( \text{Prob}_2(s_1 = 1|a_1 = 1) \) as \( \frac{z}{z + \frac{z}{z+2(1-z)}} = \frac{2z}{z+1} \) for \( c = 2. \) We summarize the conditional probabilities in the following table:
C.2.4 Private Signals and Information from Politicians

Finally, we calculate the conditional probabilities $Prob_c(s_1 = 1 | a_1 = 1)$ for $c \in \{1, 2, 3\}$ when voters have received their private signals $\sigma_j$ and draw inferences from the signalling games among politicians.

Case $c = 1$
Suppose $c = 1$. Then investors will learn the state with certainty by observing the action of the incumbent and can disregard their signals $\sigma_j$. We obtain

$$Prob_1(s_1 = 1 | \sigma_j = 1, a_1 = 1) = Prob_1(s_1 = 1 | \sigma_j = 0, a_1 = 1) = 1,$$

$$Prob_1(s_1 = 1 | \sigma_j = 1, a_1 = 0) = Prob_1(s_1 = 1 | \sigma_j = 0, a_1 = 0) = 0,$$

$$Prob_1(s_1 = 0 | \sigma_j = 1, a_1 = 0) = Prob_1(s_1 = 0 | \sigma_j = 0, a_1 = 0) = 1,$$

$$Prob_1(s_1 = 0 | \sigma_j = 1, a_1 = 1) = Prob_1(s_1 = 0 | \sigma_j = 0, a_1 = 1) = 0.$$

Case $c = 2$
In case 2, investors know with certainty that the true state of the world is $s_1 = 0$ when they observe $a_1 = 0$, i.e.

$$Prob_2(s_1 = 1 | \sigma_j = 1, a_1 = 0) = Prob_2(s_1 = 1 | \sigma_j = 0, a_1 = 0) = 0,$$

$$Prob_2(s_1 = 0 | \sigma_j = 1, a_1 = 0) = Prob_2(s_1 = 0 | \sigma_j = 0, a_1 = 0) = 1.$$
If investors observe $a_1 = 1$, then the signalling game reveals that the probability of $s_1 = 1$ after observing $a_1 = 1$ is equal to $\frac{2z}{z+1}$. Using the additional information from signal $\sigma_j$, investor $j$ forms the following a posteriori belief:\textsuperscript{14}

$$Prob_2(s_1 = 1|\sigma_j = 1, a_1 = 1) = \frac{\frac{2z}{z+1}h_j}{\frac{2z}{z+1}h_j + \frac{1-z}{z+1}(1-h_j)} = \frac{2zh_j}{2zh_j + (1-z)(1-h_j)}.$$ 

In a similar way we obtain

$$Prob_2(s_1 = 1|\sigma_j = 0, a_1 = 1) = \frac{2z(1-h_j)}{2z(1-h_j) + (1-z)h_j},$$

$$Prob_2(s_1 = 0|\sigma_j = 1, a_1 = 1) = \frac{(1-z)(1-h_j)}{2zh_j + (1-z)(1-h_j)},$$

$$Prob_2(s_1 = 0|\sigma_j = 0, a_1 = 1) = \frac{(1-z)h_j}{2z(1-h_j) + (1-z)h_j}.$$ 

Case $c = 3$

In case 3, the investors do not gain any information from the politician’s action, as there is complete pooling. All congruent politicians behave congruently, while all dissonant politicians behave dissonantly, and the probability for both types of politician equals $\frac{1}{2}$. Hence,

$$Prob_3(s_1 = 1|\sigma_j = 1, a_1 = 1) = Prob_3(s_1 = 1|\sigma_j = 1, a_1 = 0) = \frac{zh_j}{zh_j + (1-z)(1-h_j)},$$

$$Prob_3(s_1 = 1|\sigma_j = 0, a_1 = 1) = Prob_3(s_1 = 1|\sigma_j = 0, a_1 = 0) = \frac{z(1-h_j)}{(1-z)h_j + z(1-h_j)},$$

$$Prob_3(s_1 = 0|\sigma_j = 1, a_1 = 1) = Prob_3(s_1 = 0|\sigma_j = 1, a_1 = 0) = \frac{(1-z)(1-h_j)}{zh_j + (1-z)(1-h_j)},$$

$$Prob_3(s_1 = 0|\sigma_j = 0, a_1 = 1) = Prob_3(s_1 = 0|\sigma_j = 0, a_1 = 0) = \frac{(1-z)h_j}{(1-z)h_j + z(1-h_j)}.$$  

\textsuperscript{14}Alternatively, one could calculate the a posteriori belief of investor $j$ in the following way:

$$Prob_2(s_1 = 1|\sigma_j = 1, a_1 = 1) = \frac{2Prob(s_1 = 1|\sigma_j = 1)}{Prob(s_1 = 1|\sigma_j = 1) + 1} = \frac{2zh_j}{2zh_j + (1-z)(1-h_j)}.$$ 

Both methods lead to the same result.
APPENDIX C. APPENDIX TO CHAPTER 3

C.2.5 Price Formation Process

For ease of exposition, we assume that all investors are homogeneous concerning the quality of their signals \( \sigma_j \), i.e. we assume that \( h_j = h \ \forall j \).\(^{15}\) Thus, investors only differ as to whether they receive signal \( \sigma_j = 1 \) or \( \sigma_j = 0 \). When the number of investors is sufficiently large a fraction \( h \) of the investors will receive the correct signal, i.e. they receive \( \sigma_j = 1 \) if \( s_1 = 1 \) or \( \sigma_j = 0 \) if \( s_1 = 0 \), respectively.\(^{16}\) A fraction \( 1 - h \) will receive a misleading signal, i.e. they receive \( \sigma_j = 1 \) if \( s_1 = 0 \) or \( \sigma_j = 0 \) if \( s_1 = 1 \).

From Corollary C.2 in Appendix C.3 we know that the price in the information market will be a weighted average of the prices that would arise in the two subgroups of investors. This means that the price will be \( h \) times the price that would arise in a market where all investors receive a correct signal plus \((1-h)\) times the price in a market where investors only receive incorrect signals. Again, we go through all three cases.

**Case c = 1**

We start with case \( c = 1 \). In this scenario, the action of the incumbent will perfectly reveal the state of the world. Thus, we obtain

\[
p^{*1}_{1,1} = p^{*1}_{0,0} = 1 \quad (C.16)
\]

and

\[
p^{*1}_{1,0} = p^{*1}_{0,1} = 0, \quad (C.17)
\]

where \( p_{a_1,s_1}^{*} \) denotes the equilibrium price in case \( c \) given action \( a_1 \) and state \( s_1 \). The equilibrium price will equal one if the incumbent chooses the socially optimal action, while the price will be zero if the politician chooses the non-optimal action.

**Case c = 2**

In case 2, we obtain

\[
p^{*2}_{0,0} = 1 \quad (C.18)
\]

\(^{15}\)Further, we assume that investors are homogeneous concerning their wealth and their subjective confidence in their own signals. In Appendix C we will derive some general results for heterogeneous investors. Using the notation of Appendix C we assume \( W_j = W \ \forall j \) and \( b_j = b \ \forall j \) in this section. At the cost of additional notational complexity, the results can be extended to heterogeneous investors by using the formulas derived in Appendix C.3.

\(^{16}\)For a finite number of investors the variance of the fraction of investors receiving the correct signal is not zero. However, for a sufficiently large number of investors the variance becomes arbitrarily small. For instance, for \( N = 10000 \) the probability that the share of investors with a correct signal is in \([0.89, 0.91]\) for \( h = 0.9 \) is larger than 99.9%. 

APPENDIX C. APPENDIX TO CHAPTER 3

and

\[ p^2_{0,1} = 0, \tag{C.19} \]

which reflects the fact that the equilibrium price will be equal to zero or one upon observing \( a_1 = 0 \), as this action reveals the true state of the world with certainty.

If the incumbent undertakes \( a_1 = 1 \) in case \( c = 2 \), then we obtain

\[ p^2_{1,1} = 1 - \frac{(1 - z^2)h(1 - h)}{2zh + (1 - z)(1 - h)[2z(1 - h) + (1 - z)h]} \tag{C.20} \]

and

\[ p^2_{1,0} = \frac{2z(1 + z)h(1 - h)}{2zh + (1 - z)(1 - h)[2z(1 - h) + (1 - z)h]} \tag{C.21} \]

Case \( c = 3 \)

In case 3 we obtain

\[ p^3_{1,1} = 1 - \frac{(1 - z)h(1 - h)}{zh + (1 - z)(1 - h)[2z(1 - h) + (1 - z)h]}, \tag{C.22} \]

\[ p^3_{1,0} = \frac{zh(1 - h)}{zh + (1 - z)(1 - h)[2z(1 - h) + (1 - z)h]}, \tag{C.23} \]

\[ p^3_{0,0} = 1 - \frac{zh(1 - h)}{zh + (1 - z)(1 - h)[2z(1 - h) + (1 - z)h]}, \tag{C.24} \]

\[ p^3_{0,1} = \frac{1 - z)h(1 - h)}{zh + (1 - z)(1 - h)[2z(1 - h) + (1 - z)h]}. \tag{C.25} \]

We observe that \( p^3_{1,1} = 1 - p^3_{0,1} \) and \( p^3_{0,0} = 1 - p^3_{1,0} \). The next Proposition is the main result of Appendix B.

**Proposition 3.3 (detailed version)**

Suppose that \( h > \hat{h}(z) \) with

\[ \hat{h}(z) = \frac{1 + \sqrt{3z^2 + 1}}{2} \tag{C.26} \]

Then the equilibrium price in the information market fulfills the following conditions:

\[ p^c_{1,1} > \frac{1}{2} \quad \forall c, \]

\[ p^c_{0,0} > \frac{1}{2} \quad \forall c, \]

\[ p^c_{1,0} < \frac{1}{2} \quad \forall c, \]

and

\[ p^c_{0,1} < \frac{1}{2} \quad \forall c. \]
Proposition 3.3 shows that for \( h > \hat{h}(z) \) the equilibrium price in all circumstances will be larger than one-half if the incumbent behaves congruently, while the equilibrium price will be smaller than one-half if the politician behaves dissonantly. Note that \( \hat{h}(z) \) is increasing in \( z \) for \( z \in (\frac{1}{2}, 1) \) and that \( \hat{h}(z) \in (\frac{1}{2} + \sqrt{\frac{3}{44}}, 1) \) for \( z \in (\frac{1}{2}, 1) \). The intuition that \( \hat{h}(z) \) must be larger than \( \frac{1}{2} \) runs as follows: The signal must be sufficiently informative in order to detect dissonant behavior of a politician in the unpopular state \( s_1 = 0 \) in case \( c = 2 \), where \( \text{Prob}(s_1 = 0|a_1 = 1) \) is rather low. A formal derivation and explanation for condition (C.26) is given in the following proof of Proposition 3.3:

**Proof of Proposition 3.3**

First, it is obvious that \( p_1^{*1} > \frac{1}{2}, p_0^{*1} > \frac{1}{2}, p_1^{*1} < \frac{1}{2}, p_0^{*1} < \frac{1}{2}, p_0^{*2} > \frac{1}{2} \) and \( p_0^{*2} < \frac{1}{2} \) for any values of \( h \in (\frac{1}{2}, 1) \).

The condition \( p_1^{*2} > \frac{1}{2} \) is equivalent to

\[
\frac{(1 - z^2)h(1 - h)}{[2zh + (1 - z)(1 - h)][2z(1 - h) + (1 - z)h]} < \frac{1}{2}. \tag{C.27}
\]

After some manipulations we obtain the condition

\[
2z(1 - z) + h(1 - h)(11z^2 - 6z - 1) > 0. \tag{C.28}
\]

We note that \( h(1 - h) < \frac{1}{4} \) \( \forall h \in (\frac{1}{2}, 1) \) and that \( 2z(1 - z) > -\frac{1}{4}(11z^2 - 6z - 1) \) \( \forall z \in (\frac{1}{2}, 1) \). Thus, condition (C.28) is always fulfilled.

Next we examine \( p_1^{*2} < \frac{1}{2} \), which is equivalent to

\[
\frac{2z(1 + z)h(1 - h)}{[2zh + (1 - z)(1 - h)][2z(1 - h) + (1 - z)h]} < \frac{1}{2}. \tag{C.29}
\]

Rearranging terms yields

\[
h(1 - h) < \frac{2z(1 - z)}{-5z^2 + 10z - 1}. \tag{C.30}
\]

Solving for \( h \) leads to

\[
h > \frac{1 + \sqrt{\frac{3z^2 + 2z - 1}{-5z^2 + 10z - 1}}}{2}. \tag{C.31}
\]

The next condition \( p_1^{*3} > \frac{1}{2} \) is equivalent to

\[
\frac{(1 - z)h(1 - h)}{[zh + (1 - z)(1 - h)][z(1 - h) + (1 - z)h]} < \frac{1}{2}. \tag{C.32}
\]
This condition can be transformed to
\[ z(1 - z) + h(1 - h)(4z^2 - 2z - 1) > 0. \tag{C.33} \]

We note that \( h(1 - h) < \frac{1}{4} \forall h \in (\frac{1}{2}, 1) \) and that \( z(1 - z) > -\frac{1}{4}(4z^2 - 2z - 1) \forall z \in (\frac{1}{2}, 1) \). Thus, condition (C.33) is always fulfilled.

The condition \( p_{1,0}^3 < \frac{1}{2} \) is equivalent to
\[
\frac{zh(1 - h)}{[zh + (1 - z)(1 - h)][z(1 - h) + (1 - z)h]} < \frac{1}{2}, \tag{C.34}
\]

After some manipulations we obtain
\[ h(1 - h) < \frac{z(1 - z)}{-4z^2 + 6z - 1}, \tag{C.35} \]

which yields
\[ h > \frac{1 + \sqrt{\frac{2z - 1}{-4z^2 + 6z - 1}}}{2}. \tag{C.36} \]

Condition (C.36) is a weaker condition than condition (C.31) as the following inequality holds for all \( z \in (\frac{1}{2}, 1) \):
\[
\sqrt{\frac{2z - 1}{-4z^2 + 6z - 1}} < \sqrt{\frac{3z^2 + 2z - 1}{-5z^2 + 10z - 1}}. \tag{C.37}
\]

Hence, if \( h > 1 + \sqrt{\frac{3z^2 + 2z - 1}{-5z^2 + 10z - 1}} \), then condition (C.36) will always be fulfilled.

Next we investigate \( p_{0,0}^3 > \frac{1}{2} \), which leads to
\[
\frac{zh(1 - h)}{[zh + (1 - z)(1 - h)][z(1 - h) + (1 - z)h]} < \frac{1}{2}, \tag{C.38}
\]

This condition is the same as (C.34) and thus always fulfilled for \( h > 1 + \sqrt{\frac{3z^2 + 2z - 1}{-5z^2 + 10z - 1}} \).

Finally, we consider \( p_{0,1}^3 < \frac{1}{2} \), which yields
\[
\frac{(1 - z)h(1 - h)}{[zh + (1 - z)(1 - h)][z(1 - h) + (1 - z)h]} < \frac{1}{2}. \tag{C.39}
\]

This is identical to condition (C.32), which always holds as shown above. \( \square \)
C.2.6 Sophisticated Election Scheme

In this subsection we prove Proposition 3.8 by proving the following detailed version of Proposition 3.8:

**Proposition 3.8 (detailed version)**

Suppose that $h > \hat{h}$ with

$$\hat{h} = \frac{1 + \sqrt{\frac{z+1}{9z+1}}}{2} < \frac{1}{2} + \sqrt{\frac{3}{44}} \approx 0.761.$$  \hfill (C.40)

Then the equilibrium price in the information market fulfills the following conditions:

$$p_{1,1}^{c} > z \forall c,$$
$$p_{0,0}^{c} > 1 - z \forall c,$$
$$p_{0,1}^{c} < z \forall c$$

and

$$p_{0,1}^{c} < 1 - z \forall c.$$  

**Proof of Proposition 3.8**

The proof follows the same lines as the proof of Proposition 3.3. First, it is obvious that $p_{1,1}^{1} > z$, $p_{0,0}^{1} > 1 - z$, $p_{1,0}^{1} < z$, $p_{0,1}^{1} < 1 - z$, $p_{0,0}^{2} > 1 - z$ and $p_{0,1}^{2} < 1 - z$.

We explore the condition $p_{1,1}^{2} > z$, which is equivalent to

$$\frac{(1 - z^2)h(1 - h)}{[2zh + (1 - z)(1 - h)][2z(1 - h) + (1 - z)h]} < 1 - z.$$  \hfill (C.41)

After some manipulations we obtain

$$2(1 - z)^2 + h(1 - h)(-9z^2 + 16z - 7) > 0.$$  \hfill (C.42)

Using $h(1 - h) < \frac{1}{4} \forall h \in (\frac{1}{2}, 1)$ and $2(1 - z)^2 > \frac{1}{4}(9z^2 - 16z + 7) \forall z \in (\frac{1}{2}, 1)$ shows that condition (C.42) is fulfilled for all $z \in \{\frac{1}{2}, 1\}$.

Next we examine $p_{1,0}^{2} < z$, which yields

$$\frac{2(1 + z)h(1 - h)}{[2zh + (1 - z)(1 - h)][2z(1 - h) + (1 - z)h]} < 1.$$  \hfill (C.43)
Rearranging terms leads to
\[ h(1 - h) < \frac{2z(1 - z)}{-9z^2 + 8z + 1} = \frac{2z}{9z + 1}, \] (C.44)
which implies
\[ h > \frac{1 + \sqrt{\frac{z+1}{9z+1}}}{2}. \] (C.45)

Finally, conditions \( p_{1,1}^3 > z, p_{1,0}^3 < z, p_{0,0}^3 > 1 - z \) and \( p_{0,1}^3 < 1 - z \) all result in
\[
\frac{h(1 - h)}{[zh + (1 - z)(1 - h)](z(1 - h) + (1 - z)h)} < 1,
\] (C.46)
which is equivalent to
\[
h(1 - h) < \frac{1}{4}.
\] (C.47)
As \( h \geq \frac{1}{2} \) condition (C.47) is always fulfilled.

By comparing \( \hat{h} \) and \( \hat{\hat{h}} \) we obtain the following Corollary:

**Corollary C.1**
\( \hat{h} < \hat{\hat{h}} \) for all \( z \) with \( \frac{1}{2} < z < 1 \).

Hence, for all values \( z \in (\frac{1}{2}, 1) \) condition (C.40) is easier to fulfill than condition (C.26).\(^{17}\) As a consequence, \( SES \), which uses the results from Proposition 3.8, is applicable for signals with lower information content than \( RES \). Note that Corollary C.1 follows directly from comparing \( \hat{h} \) and \( \hat{\hat{h}} \). The claim \( \hat{h} < \hat{\hat{h}} \) can be transformed to \( 2z^2 + z > 1 \), which proves the Corollary.

### C.3 General Price Formation Process

In this Appendix we determine a general formula for an information market with heterogeneous agents. Suppose, without loss of generality, that politician 1 has been elected after offering a contract \( C_1(p_{1,1}, p_{0,0}) \), that the politician undertakes \( \alpha_1 = 1 \), and hence that \( p_{1,1}^1 \) applies.

\(^{17}\) For \( z = \frac{1}{2} \) equation (C.26) would be identical to condition (C.40).
For a price $p < p_1^*$, no investor will have a strict incentive to buy assets, as he will be paid back $p_1^*$. Suppose $p \geq p_1^*$. An investor $j$ with signal $\sigma_j$ has to weigh up the state of his information and the information the market price will reveal. One way of modeling the information aggregation process is as follows:

$$Prob_j(RE|p) = b_j \cdot Prob_j(RE) + (1 - b_j) \cdot p,$$

where $Prob_j(RE|p)$ is the probability assessment of investor $j$ that the incumbent will be reelected, taking into account the information inferred from the market price. The term $Prob_j(RE)$ is given as the individual reelection probability estimation of an investor and depends on his signal $\sigma_j$, the signal quality $h_j$, the action $a_1$, and the case $c$. If, e.g., $c = 3$, $a_1 = 1$, and $\sigma_j = 1$, then

$$Prob_j(RE) = \frac{zh_j}{zh_j + (1-z)(1-h_j)},$$

where we assume that $z$ and $h_j$ are known to investor $j$. The weight $b_j$ (with $0 < b_j \leq 1$) describes self-assessed confidence, i.e., the subjective confidence of an investor in his estimation $Prob_j(RE)$ relative to the market belief expressed by the price $p$. The information aggregation formula (C.48) is flexible. It captures the case $b_j = 1$ when investors rely only on their own signal, which would occur if they can only submit a quantity (and not an entire demand/supply schedule depending on the price) to the market. For small values of $b_j$, investors rely mainly on the information aggregated by the market.

Given price $p$ and signal $Prob_j(RE)$, an investor $j$ maximizes

$$\max_{d_j} \quad EU_j = Prob_j(RE|p) \cdot \ln(W_j + d_j(1 - p)) + (1 - Prob_j(RE|p)) \cdot \ln(W_j - d_jp),$$

where $d_j$ is the demand. If $d_j$ is positive, investor $j$ will want to buy $d_j$ units of asset $D$. If $d_j$ is negative, investor $j$ will want to buy $d_j$ units of asset $E$. The solution of the investor’s problem yields

$$d_j^* = \frac{W_j \cdot b_j \cdot Prob_j(RE) + (1 - b_j)p - p}{p(1 - p)} \Leftrightarrow d_j^* = \frac{W_j \cdot b_j \cdot Prob_j(RE) - p \cdot b_j}{p(1 - p)},$$

We thus obtain

---

18 Note that investors learn nothing from the threshold contract offers of the candidates because in equilibrium both types of politicians will offer the same contract, as we will show later.

19 For a statistical foundation, see Morris (1983) and Rosenblueth (1992). Wolfers and Zitzewitz (2006) have independently proposed a similar procedure.

20 Note that it can never be rational to set $b_j = 0 \ \forall j$ as the price would contain no information contradicting the assumption of investors to rely only on the information inferred from the market price. This is the information paradox addressed by Grossman and Stiglitz (1980).
Proposition C.1
There is a unique equilibrium in the information market given by
\[ p^* = \sum_{j=1}^{N} \text{Prob}_j(\text{RE}) \frac{W_j b_j}{\sum_{k=1}^{N} W_k b_k}. \] (C.51)

Proof of Proposition C.1
Equilibrium in the information market requires that condition \( \sum_{j=1}^{N} d_j^* = 0 \) be fulfilled, which implies \( \sum_{j=1}^{N} W_j b_j \text{Prob}_j(\text{RE}) - p \sum_{j=1}^{N} W_j b_j = 0 \). The assertion follows from that.

The market price is a wealth- and confidence-weighted average belief on the part of investors. We note that the market price is equal to the simple average belief of investors if traders are homogeneous with respect to wealth and confidence in their own belief. If confidence levels are homogeneous, the market price is a wealth-weighted average belief on the part of traders. We summarize both cases in the following Corollary:

Corollary C.2
(i) Suppose \( W_j = W \ \forall j \) and \( b_j = b \ \forall j \). Then \( p^* = \frac{1}{N} \sum_{j=1}^{N} \text{Prob}_j(\text{RE}) \).

(ii) Suppose \( b_j = b \ \forall j \). Then \( p^* = \sum_{j=1}^{N} \text{Prob}_j(\text{RE}) \frac{W_j}{\sum_{k=1}^{N} W_k} \).

C.4 Welfare Gains

Here we provide an example of the welfare gains that can be achieved with the triple mechanism. Suppose that, at a time when this institution is introduced, it is only known that \( \delta \) is equal to 1 and that \( \mu \) is uniformly distributed in \([0, \frac{1}{2}]\). Since only the proportion of \( R \) and \( G \) is important for our analysis, we write \( G = \alpha R \) with \( 0 \leq \alpha < \infty \). In the following, we calculate the values of \( \mu \) that enable congruent behavior by the incumbent. We use \( \text{eo} \) to denote the case with elections
only and \( tm \) to denote the scenario with the triple mechanism. From condition (3.6) we conclude that, in the case of elections alone, a congruent politician will only behave congruently in state \( s_1 = 1 \) if
\[
\alpha R + 3R \geq R.
\]
This condition is equivalent to \( \alpha \geq -2 \). In the same way we obtain the other conditions summarized in the following table:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Congruent Politician</th>
<th>Dissonant Politician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elections Only</td>
<td>( \alpha \geq -2 )</td>
<td>( \alpha \leq 2 )</td>
</tr>
<tr>
<td></td>
<td>( \mu \geq \frac{1 - \alpha}{3} )</td>
<td>( \mu \geq \frac{1 + \alpha}{3} )</td>
</tr>
<tr>
<td>Triple Mechanism</td>
<td>( \alpha \geq -2 )</td>
<td>( \alpha \leq 2 )</td>
</tr>
<tr>
<td></td>
<td>( \mu \geq -\frac{\alpha}{2} )</td>
<td>( \mu \geq \frac{\alpha}{2} )</td>
</tr>
</tbody>
</table>

Table C.3

Note that congruent politicians will always behave congruently in the scenario with the triple mechanism, as conditions \( \alpha \geq -2 \) and \( \mu \geq -\frac{\alpha}{2} \) are always fulfilled. Furthermore, if \( \alpha \geq 1 \) congruent politicians will always behave congruently in the scenario with elections only. Finally, it is apparent that a dissonant politician will never act congruently for \( \alpha > 2 \), which clearly derives from Corollary 3.1 and Proposition 3.6. In the next stage, we calculate expected utilities, starting with the triple mechanism scenario:

\[
EU^{tm} = \frac{1}{2} + \frac{1}{2} \begin{cases} 
\frac{1}{2} 2d\mu & \text{if } \alpha \leq 2 \\
\int_{0}^{1/2} 2d\mu & \text{if } \alpha > 2 
\end{cases} + \frac{1}{2} (1 - z) \begin{cases} 
\frac{3}{2} 2d\mu & \text{if } \alpha \leq 1 \\
\int_{1/2}^{1} 2d\mu & \text{if } \alpha > 1 
\end{cases}
\]

The reasoning for the above expression is as follows: A politician is of the congruent type with probability \( \frac{1}{2} \). He always behaves congruently and thus generates a voter utility of 1. The probability that a politician is of the dissonant type and that state \( s_1 = 1 \) occurs is given by \( \frac{1}{2}z \). In this case, the politician generates a utility of 1 for all feasible values of \( \mu \), as long as \( \alpha \) is not larger than 2. Finally, the probability
that a politician is of the dissonant type and that state \( s_1 = 0 \) occurs is given by \( \frac{1}{2}(1 - z) \). In this case, the politician generates a utility of 1 for all values of \( \mu \) with \( \mu \geq \frac{\alpha}{2} \), as long as \( \alpha \) is not larger than 1.\(^{21}\) The calculation in the scenario with elections alone is similar and yields

\[
E_{\text{eo}} = \frac{1}{2}z + \frac{1}{2}(1 - z) \begin{cases} 
\int_{\frac{1}{2}}^{\frac{1}{2}} 2d\mu & \text{if } \alpha \leq 1 \\
\int_{0}^{\frac{1}{2}} 2d\mu & \text{if } \alpha > 1 
\end{cases}
\]

\[
+ \frac{1}{2}z \begin{cases} 
\int_{\frac{1}{2}}^{\frac{1}{2}} 2d\mu & \text{if } \alpha \leq 2 \\
\int_{\frac{1}{2}}^{\frac{1}{2}} z + \frac{1}{2}(1 - z) & \text{if } \alpha > 2 
\end{cases}
\]

These expressions can be simplified to

\[
E_{\text{tm}} = \begin{cases} 
\frac{1}{2} + \frac{1}{2} \alpha(1 - z) & \text{if } \alpha \leq 1 \\
\frac{1}{2} + \frac{1}{2} z & \text{if } 1 < \alpha \leq 2 \\
\frac{1}{2} & \text{if } \alpha > 2
\end{cases}
\]  

\[(C.52)\]

and

\[
E_{\text{eo}} = \begin{cases} 
z + \frac{1}{3}(1 - z) & \text{if } \alpha \leq \frac{1}{2} \\
z + (1 - z)(1 + 2\alpha) & \text{if } \frac{1}{2} < \alpha \leq 1 \\
\frac{1}{2} + \frac{1}{2} z & \text{if } 1 < \alpha \leq 2 \\
\frac{1}{2} & \text{if } \alpha > 2
\end{cases}
\]  

\[(C.53)\]

We illustrate the relationships by calculating the utilities for four different values of \( \alpha \). We choose one value of \( \alpha \) that is smaller than 1, one value larger than 1, and \( \alpha \) equal to 1. These values correspond to the cases where, for the politician, utility \( G \) is lower/higher than or equal to utility \( R \). Furthermore, we add the special case \( \alpha = 0 \), where the politician has no private benefits \( G \). The expected utilities in these four cases are summarized in the following table:

\[^{21}\text{Note that we have assumed that } \mu \text{ is uniformly distributed in } [0, \frac{1}{2}].\]
Note that in all cases we have $EU^{tm} \geq EU^{eo}$. Further, we see that $EU^{tm}$ is strictly larger than $EU^{eo}$ if $z < 1$ and $\alpha < 1$. The difference between $EU^{tm}$ and $EU^{eo}$ depends on $z$ for $0 < \alpha < 1$. The last row in the table shows the relative welfare gains ($\Delta_{EU}$). $\Delta_{EU}$ is maximum for $\alpha = 0$. The example illustrates the following insights:

(i) Threshold contracts have the highest effect in the case $\alpha = 0$, i.e. if the politicians are only motivated by benefits $R$ acquired from holding office. Note that threshold contracts may reduce the reelection chances of the incumbent. Thus, threshold contracts will be more effective if politicians are mainly interested in getting reelected, which is expressed in a low value of $\alpha$.

(ii) If $\alpha$ is at least equal to 1, i.e. if politicians are at least as motivated by $G$ as by $R$, then there is no effect from threshold contracts. This is due to the fact that in state $s_1 = 0$ congruent politicians always behave congruently, while dissonant candidates always behave dissonantly. The conditions for congruent behavior in state $s_1 = 1$ are the same in the scenarios with or without threshold contracts.

If $\alpha$ is at least equal to 2, then congruent politicians will always behave congruently, while dissonant candidates will always behave dissonantly. Thus, the expected utility is equal to $\frac{1}{2}$. 

<table>
<thead>
<tr>
<th></th>
<th>$\alpha = 3$</th>
<th>$\alpha = 1$</th>
<th>$\alpha = 0.1$</th>
<th>$\alpha = 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$EU^{eo}$</td>
<td>$\frac{1}{2}$</td>
<td>$\frac{1 + z}{2}$</td>
<td>$\frac{1 + 2z}{3}$</td>
<td>$\frac{1 + 2z}{3}$</td>
</tr>
<tr>
<td>$EU^{tm}$</td>
<td>$\frac{1}{2}$</td>
<td>$\frac{1 + z}{2}$</td>
<td>$\frac{19 + z}{20}$</td>
<td>1</td>
</tr>
<tr>
<td>$EU^{tm} - EU^{eo}$</td>
<td>0</td>
<td>0</td>
<td>$\frac{37(1 - z)}{60}$</td>
<td>$\frac{2(1 - z)}{3}$</td>
</tr>
<tr>
<td>$\Delta_{EU} = \frac{EU^{tm} - EU^{eo}}{EU^{eo}}$</td>
<td>0</td>
<td>0</td>
<td>$\frac{37(1 - z)}{20 + 40z}$</td>
<td>$\frac{2(1 - z)}{1 + 2z}$</td>
</tr>
</tbody>
</table>
(iii) Finally, for a given value of $\alpha$ we discover that $\Delta_{EU}$ is (weakly) increasing when $z$ decreases. Thus, the higher the probability of the unpopular state $s_1 = 0$, the larger is the effect of threshold contracts.
Appendix D

Appendix to Chapter 4

D.1 Proofs

Proof of Proposition 4.1
Voters maximize their utility subject to the incumbent still wanting to enter into the contract. If the incumbent does not enter into the contract and will neither receive a pension nor be reelected after completion of his current term, then he would maximize $ke - ce^2$, which yields $e = \frac{k}{2c}$. In this case his utility equals $\frac{k^2}{4c}$.

If $W_2 = \bar{W}_2$ and the incumbent wants to stay in office, the problem of the public is given by

$$\max U^v = b \quad \text{(D.1)}$$

$$s.t. \delta W_2 + ke - ce^2 \geq \frac{k^2}{4c} \quad \text{(D.2)}$$

As $\frac{\partial b}{\partial e} > 0$, condition (D.2) will hold with equality, which yields

$$e_{1/2} = \frac{k}{2c} \pm \sqrt{\frac{\delta W_2}{c}} \quad \text{(D.3)}$$

Hence voters will demand the highest possible amount of effort

$$e^{fix,FB}_R = \frac{k}{2c} + \sqrt{\frac{\delta W_2}{c}} \quad \text{(D.4)}$$

The proof in the case where the incumbent does not want to run for reelection is analogous and is therefore omitted here. \qed
Proof of Proposition 4.2
The incumbent has the following utility function:
\[ U_{NR}^{\text{fix}} = ke - ce^2 + \delta m. \]  
(D.5)
The first-order condition
\[ \frac{\partial U_{NR}^{\text{fix}}}{\partial e} = k - 2ce = 0 \]
implies \( e_{NR}^{\text{fix}} = \frac{k}{2c} \). According to our assumptions, we have \( \frac{k}{2c} \leq \bar{e} \), so the solution is feasible. Note that the incumbent will never choose \( e = 0 \), as his utility would be equal to \( \delta m \), which is smaller than \( U_{NR}^{\text{fix}}(\frac{k}{2c}) = \frac{k^2}{4c} + \delta m \).

\[ \square \]

Proof of Proposition 4.3
The incumbent has the following utility function:
\[ U_R^{\text{fix}} = ke - ce^2 + \delta [r_1 W^2 + (1 - r_1) m]. \]  
(D.6)
The first-order condition amounts to
\[ \frac{\partial U_R^{\text{fix}}}{\partial e} = k - 2ce + \delta \frac{\partial r_1}{\partial e} W^2 - \delta \frac{\partial r_1}{\partial e} m = 0. \]  
(D.7)
Using \( \frac{\partial r_1}{\partial e} = \phi \), we obtain
\[ k - 2ce + \delta \phi (W^2 - m) = 0 \]  
(D.8)
which yields \( e_R^{\text{fix}} = \frac{k + \delta \phi (W^2 - m)}{2c} \). Note that \( e_R^{\text{fix}} > 0 \) since \( W^2 \geq m \). Furthermore, we have \( U_R^{\text{fix}}(\frac{k + \delta \phi (W^2 - m)}{2c}) = \frac{(k + \delta \phi (W^2 - m))^2}{4c} + \delta m > \delta m = U_R^{\text{fix}}(0) \). Thus the politician will always prefer \( e_R^{\text{fix}} \) over \( e = 0 \). Finally, according to our assumptions we have \( e_R^{\text{fix}} \leq \bar{e} \).

\[ \square \]

Proof of Corollary 4.1
We have \( e_{NR}^{\text{fix}} = \frac{k}{2c} < \frac{k}{2c} + \sqrt{\frac{\delta m}{c}} = e_{NR}^{\text{fix}, FB} \) in the case where the politician is not running for reelection.

In the case where the politician is running for reelection, we have to show that \( e_R^{\text{fix}, FB} > e_R^{\text{fix}} \). This condition is equivalent to
\[ \frac{k}{2c} + \sqrt{\frac{\delta W^2}{c}} > \frac{k + \delta \phi (W^2 - m)}{2c} \]  
(D.9)
APPENDIX D. APPENDIX TO CHAPTER 4

160

By using $\phi = \frac{1}{\bar{e}}$, condition (D.9) can be transformed into $4\bar{e}^2 \bar{W}_2 > \delta(\bar{W}_2 - \bar{m})^2$. Using our assumption $\bar{e} \geq \frac{k}{2c} + \sqrt{\frac{\delta \bar{W}_2}{c}}$, the condition becomes

$$\frac{k^2}{\delta c} \bar{W}_2 + 4\frac{k}{\delta} \sqrt{\frac{\delta \bar{W}_2}{c}} \bar{W}_2 + 2\bar{W}_2 \bar{m} + 3\bar{W}_2^2 - \bar{m}^2 > 0,$$

which is fulfilled since $\bar{W}_2 \geq \bar{m}$.

Proof of Proposition 4.4

Part (i):
The necessary condition for an equilibrium in the information market is that the number of investors with

$$(1 - q)[\bar{s}(1 - p)(z Pr_j(RE|\beta_j) + (1 - z)p) - \bar{s}p(1 - z Pr_j(RE|\beta_j) - (1 - z)p)] > 0$$

be equal to the number of investors with

$$(1 - q)[\bar{s}(1 - p)(z Pr_j(RE|\beta_j) + (1 - z)p) - \bar{s}p(1 - z Pr_j(RE|\beta_j) - (1 - z)p)] < 0.$$

This condition will be fulfilled if the investor who obtains the median signal $\beta^m_j$ is indifferent as to buying assets $D$ or $E$ and thus if

$$(1 - q)[(1 - p)(z Pr_j(RE|\beta^m_j) + (1 - z)p) - \bar{s}p(1 - z Pr_j(RE|\beta^m_j) - (1 - z)p)] = 0$$

Inserting $\frac{\phi}{k} \beta^m_j$ for $Pr_j(RE|\beta^m_j)$ and solving for $p^*$ yields equation (4.18).

Part (ii):
The expected value for $\beta^m_j$ is equal to $E[\beta]$ as the signals $\beta_j$ are assumed to be distributed symmetrically around $E[\beta]$. Further, we know that $E[\beta] = b = k\bar{e}$. Thus we obtain the expected value for the equilibrium price by inserting $k\bar{e}$ for $\beta^m_j$ in equation (4.18). Moreover, we use $\frac{1}{\bar{e}}$ for $\phi$ and obtain equation (4.19).

Proof of Proposition 4.5

The incumbent has the following utility function:

$$U_{NR}^{flex} = ke - ce^2 + \delta m_{E}(e).$$
The first-order condition $\frac{\partial U^\text{flex}_{NR}}{\partial e} = k - 2ce + \delta \lambda = 0$ implies $e^\text{flex}_{NR} = \frac{k + \delta \lambda}{2c}$. According to our assumptions, $e^\text{flex}_{NR} \leq \bar{e}$, so the solution is feasible for the incumbent.

\[ \square \]

**Proof of Proposition 4.6**

The incumbent maximizes

$$U^\text{flex}_R = ke - ce^2 + \delta [r_1(e) W_2 + (1 - r_1(e)) m^E(e)]. \quad (D.12)$$

We insert $m^0 + \lambda e$ for $m^E(e)$ and $\phi e$ for $r_1(e)$ and obtain the following first-order condition:

$$\frac{\partial U^\text{flex}_R}{\partial e} = k - 2ce + \delta \phi(W_2 - m^0) + \delta \lambda - 2\delta \phi \lambda e = 0. \quad (D.13)$$

Solving for $e$ yields $e^\text{flex}_R = \frac{k + \delta \lambda + \delta \phi(W_2 - m^0)}{2c + 2\delta \phi \lambda}$. According to our assumptions, $e^\text{flex}_R \leq \bar{e}$, so the solution is feasible for the incumbent.

\[ \square \]

**Proof of Proposition 4.8**

For $m^0 = 0$ we obtain $e^\text{flex,}\hspace{0.1em}m^0=0}_R = \frac{k + \delta \lambda + \delta \phi W_2}{2c + 2\delta \phi \lambda}$ when the incumbent runs for re-election. We prove $e^\text{flex,}\hspace{0.1em}m^0=0}_R \geq e^\text{fix}_R$ by contradiction. Suppose $e^\text{flex,}\hspace{0.1em}m^0=0}_R < e^\text{fix}_R$, which implies

$$k + \delta \lambda + \delta \phi W_2 < \frac{k + \delta \phi (W_2 - m)}{2c}. \quad (D.14)$$

By using $\lambda = \phi \bar{m}$, this condition can be simplified to

$$W_2 > \bar{m} + \frac{2c - k\phi}{\delta \phi^2}. \quad (D.15)$$

By inserting $W_2 > \bar{m} + \frac{2c - k\phi}{\delta \phi^2}$ into $e^\text{flex,}\hspace{0.1em}m^0=0}_R$, we obtain

$$e^\text{flex,}\hspace{0.1em}m^0=0}_R = \frac{k + \delta \lambda + \delta \phi W_2}{2c + 2\delta \phi \lambda} > \frac{k + \delta \lambda + \delta \phi(m + \frac{2c - k\phi}{\delta \phi^2})}{2c + 2\delta \phi \lambda}. \quad (D.16)$$

Furthermore, we can show that

$$\frac{k + \delta \lambda + \delta \phi(m + \frac{2c - k\phi}{\delta \phi^2})}{2c + 2\delta \phi \lambda} = \frac{1}{\phi} = \bar{e}. \quad (D.17)$$
Thus we have $e_{R}^{\text{flex},m^0=0} > \tau$ which is a contradiction as the effort choice under flexible pensions would be too large to be feasible. Hence $e_{R}^{\text{flex},m^0=0} \geq e_{R}^{\text{fix}}$.

\[\square\]

**Proof of Proposition 4.9**

For $m^0 = m$ we obtain $e_{R}^{\text{flex},m^0=m} = \frac{k + \delta \lambda + \delta \phi(W_2 - m)}{2c + 2\delta \phi \lambda}$ in the case where the incumbent runs for reelection. The level of effort under flexible pensions will be smaller than the level of effort under fixed pensions if $e_{R}^{\text{flex},m^0=m} < e_{R}^{\text{fix}}$. This condition

$$\frac{k + \delta \lambda + \delta \phi(W_2 - m)}{2c + 2\delta \phi \lambda} < \frac{k + \delta \phi(W_2 - m)}{2c}$$  (D.18)

can be simplified to

$$W_2 > m + \frac{c - k \phi}{\delta \phi^2}$$  (D.19)

We next show that the effort under flexible pensions may be indeed lower than under fixed pensions. This is the case if the set of parameters \{c, k, \delta, \tau, m, W_2\} simultaneously fulfills condition (D.19) and the condition

$$e_{R}^{\text{flex},m^0=m} = \frac{k + \delta \lambda + \delta \phi(W_2 - m)}{2c + 2\delta \phi \lambda} \leq \tau.$$  (D.20)

Let us choose

$$W_2 = m + \frac{c - k \phi}{\delta \phi^2} + \epsilon$$  (D.21)

for some $\epsilon > 0$. Then the second condition translates into

$$\frac{k + \delta \phi(m + \frac{c - k \phi}{\delta \phi^2} + \epsilon - m) + \delta \lambda}{2c + 2\delta \phi \lambda} \leq \tau,$$  (D.22)

which (by inserting $\frac{1}{\phi}$ for $\phi$ and $\frac{m}{\phi}$ for $\lambda$) can be transformed into

$$\frac{c}{\delta \tau^2} + m \geq \epsilon.$$  (D.23)

Equation (D.23) will be fulfilled for small values of $\epsilon$. Thus we have shown that the effort under flexible pensions may be lower than under fixed pensions.

\[\square\]
Proof of Proposition 4.10
We calculate \( m^{\text{crit}} \) such that \( e^{\text{flex}}_R = e^{\text{fix}}_R \). This condition
\[
\frac{k + \delta \lambda + \delta \phi (W_2 - m^0)}{2c + 2\delta \phi \lambda} = \frac{k + \delta \phi (W_2 - \bar{m})}{2c}
\] (D.24)
can be simplified to
\[
m^0 = \bar{m} - \frac{k \lambda + \delta \phi \lambda (W_2 - \bar{m})}{c} + \frac{\lambda}{\phi}.
\] (D.25)
By inserting \( \bar{m} \) for \( \frac{\lambda}{\phi} \), we obtain the critical value \( m^{\text{crit}} \). It is obvious that \( m^{\text{crit}} > 0 \), as we have shown in Proposition 4.8 that for \( m^0 = 0 \) flexible pensions are always weakly welfare-increasing.

\[ \square \]

D.2 Corner Solutions

In this section of Appendix D we prove that our assumption
\[
\bar{e} \geq \frac{k}{2c} + \sqrt{\frac{\delta W_2}{c}} = e^{\text{fix}, FB}_R
\]
is sufficient to ensure interior solutions in all cases by showing that under this assumption all interior solutions are smaller than the physical constraint \( \bar{e} \).

The highest possible effort choices with interior solutions are given by

- Fixed pensions: \( e^{\text{fix}, FB}_R = \frac{k}{2c} + \sqrt{\frac{\delta W_2}{c}} \).
- Flexible pensions with \( m^0 = 0 \): \( e^{\text{flex}, m^0=0}_R = \frac{k + \delta \phi + \delta \phi \lambda W_2}{2c + 2\delta \phi \lambda} \).

As our assumption is equivalent to \( \bar{e} \geq e^{\text{fix}, FB}_R \), it remains to be shown that \( \bar{e} \geq e^{\text{fix}, FB}_R \) implies \( \bar{e} \geq e^{\text{flex}, m^0=0}_R \). By using \( \phi = \frac{1}{\bar{e}} \) and \( \lambda = \frac{\bar{m}}{\bar{e}} \), the condition \( \bar{e} \geq e^{\text{flex}, m^0=0}_R \) can be transformed into
\[
\bar{e} \geq \frac{k + \sqrt{k^2 + 8\delta \phi (W_2 - \bar{m})}}{4c}.
\]
It is straightforward to verify that \( \frac{k}{2c} + \sqrt{\frac{\delta W^2}{c}} \) is larger than \( \frac{k+\sqrt{k^2+8c\delta(W^2-m)}}{4c} \). Thus \( \varpi \geq \frac{k}{2c} + \sqrt{\frac{\delta W^2}{c}} \) implies \( \varpi \geq \frac{k+\sqrt{k^2+8c\delta(W^2-m)}}{4c} \), which proves our claim.
Appendix E

Appendix to Chapter 5

E.1 Proofs

Proof of Proposition 5.1
Part (i) is obvious. Next, the problem of politician $R$ in his second term is given by
\[
\max_{e_{R2}} \{ \gamma (e_{R2} + a_R) - c_l e_{R2}^2 \},
\]
which yields $e_{R2} = \frac{\gamma}{2c_l}$. For politician $R$ in his first term, the problem is given by
\[
\max_{e_{R2}} \{ \mathbb{E}[\gamma (e_{R2} + a_R)] - c_h e_{R2}^2 \}.
\]
The solution is $e_{R2} = \frac{\gamma}{2c_h}$. This yields the second part. Finally, note for part (iii) that the expected utility from the public project for a second-term office-holder $R$ is given by \(\gamma \left( \frac{\gamma}{2c_l} + a_R \right) - c_l \left( \frac{\gamma}{2c_l} \right)^2 = \frac{\gamma^2}{4c_l} + \gamma a_R\), while the corresponding utility for an office-holder $R$ in his first term is \(\gamma \left( \frac{\gamma}{2c_h} \right) - c_h \left( \frac{\gamma}{2c_h} \right)^2 = \frac{\gamma^2}{4c_h}\).

\[\Box\]

Proof of Fact 5.2
We consider the reelection decision of the median voter $i = \frac{1}{2}$. It is optimal for him to reelect $R$ if this implies that his utility in $t = 2$ is higher. Formally, this is stated as
\[
\gamma \left( \frac{\gamma}{2c_l} + (a_R + e_{R1} - \hat{e}_1) \right) + \varepsilon_R f \Delta - (\mu_R - \frac{1}{2})^2 \geq \gamma \frac{\gamma}{2c_h} - (\mu_L - \frac{1}{2})^2,
\]

165
where we have applied that upon observing \( g_1 \), the median voter expects the ability level of \( R \) to be \( \hat{\mu} - \hat{e}_1 = a_R + e_{R1} - \hat{e}_1 \). Using our assumption \( \mu_L = 1 - \mu_R \), we obtain
\[
a_R \geq -\epsilon_R \frac{f\Delta}{\gamma} - e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l}.
\]
(E.1)

Condition (E.1) states that \( R \) is reelected if his ability level is equal or above the critical level \( -\epsilon_R \frac{f\Delta}{\gamma} - e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} \). Now let us look at \( R \)'s decision about \( \epsilon_R \):

- For \( a_R \geq -e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} \), \( R \) is reelected even with \( \epsilon_R = 0 \). As \( a_R \) is uniformly distributed on \([ -A; A]\), the probability for \( a_R > -e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} \) is given by \( p^0 (e_{R1}, \hat{e}_1) = \frac{1}{2} + \frac{1}{2A} (e_{R1} - \hat{e}_1 - \frac{\gamma (c_l - c_h)}{2c_h c_l}) \).

- If \( -e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} > a_R \geq -e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} - \frac{f\Delta}{\gamma} \), then it is optimal to choose \( \epsilon_R = 1 \), which prevents the office-holder from being dismissed. The probability of \( a_R \) being within this interval is given by \( \frac{f\Delta}{2A\gamma} \).

- For \( a_R < -e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} - \frac{f\Delta}{\gamma} \), the ability of \( R \) is too low for him to become reelected and he will choose \( \epsilon_R = 0 \) to avoid losses from output-shift policies.

Finally, we obtain the expected ability level of \( R \), conditional on the fact that he is reelected, as the arithmetical average of \( -e_{R1} + \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} - \frac{f\Delta}{\gamma} \) and \( A \), which is given by \( \tilde{a}_R (e_{R1}, \hat{e}_1) = \frac{A + e_{R1} - \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l} - \frac{f\Delta}{\gamma}}{2} \).

\[\square\]

**Proof of Proposition 5.2**

Together with equations (5.4), (5.5), and (5.6), the maximization problem (5.7) yields the following first-order condition:
\[
\gamma - 2c_h e_{R1} + \frac{1}{2A} \left( b + \frac{\gamma^2}{4c_l} + \frac{\gamma (A - \frac{f\Delta}{\gamma} + e_{R1} - \hat{e}_1 + \frac{\gamma (c_l - c_h)}{2c_h c_l})}{2} \right)
\]
\[-\frac{\gamma}{2} \left( \frac{e_{R1} - \hat{e}_1 - \frac{\gamma (c_l - c_h)}{2c_h c_l}}{2A} + 1 + \frac{f\Delta}{2A\gamma} \right) - \frac{1}{2A} \left( \frac{\gamma^2}{2c_h} - (\mu_R - \mu_L)^2 \right) = 0.
\]

In equilibrium, \( \hat{e}_1 = e_{R1} \) will hold, so the equilibrium effort is given by
\[
e^{*}_{R1} = \frac{1}{2c_h} \left\{ \gamma + \frac{1}{2A} [b - \frac{\gamma^2}{4c_l} - f\Delta + (\mu_R - \mu_L)^2] \right\}.
\]
We obtain part (ii) - (iv) by using the fact that $\hat{e}_1 = e_{R1}$ will hold in equilibrium.

\[ \square \]

Proof of Fact 5.3
Under a socially optimal reelection rule, voters should reelect $R$ if the expected utility from the public project in period 2 is not smaller when $R$ remains in office than under $L$ as new office-holder. This gives the following necessary condition:

\[
\gamma \left( \frac{\gamma}{2c_l} + a_R \right) \geq \gamma \left( \frac{\gamma}{2c_h} + a_L \right). \tag{E.2}
\]

The expected ability $a_L$ is zero. Thus, $R$ should be reelected if and only if

\[
a_R \geq \frac{\gamma(c_l - c_h)}{2c_h c_l}. \tag{E.3}
\]

The average of $A$ and $\frac{\gamma(c_l - c_h)}{2c_h c_l}$ gives $a^*_R = \frac{A}{2} - \frac{\gamma(c_l - c_h)}{4c_h c_l}$ as the optimal average ability level of a reelected candidate.

\[ \square \]

Proof of Fact 5.4
The derivation of (5.13), (5.14), and (5.15) is similar to the derivation of (5.4), (5.5), and (5.6). With $s_R > \frac{1}{2}$, incumbent $R$ is reelected only if all voters $i \geq 1 - s_R$ prefer to vote for him, as he needs at least $s_R$ votes. This leads to the condition

\[
\gamma \left( e^V_{R2} + (a_R + e^V_{R1} - \hat{e}_1^V) \right) + \epsilon_R f \Delta - (\mu_R - (1 - s_R))^2 \geq \gamma e^V_{L2} - (\mu_L - (1 - s_R))^2.
\]

Using $\mu_L = 1 - \mu_R$, this can be rewritten as

\[
a_R \geq -\epsilon_R f \frac{\Delta}{\gamma} - e^V_{R1} + \hat{e}_1^V + \frac{1}{\gamma} (2\mu_R - 1)(2s_R - 1) + \frac{\gamma(c_l - c_h)}{2c_h c_l}. \tag{E.4}
\]

The right-hand side of this inequality gives the minimum ability $R$ must have to be reelected. This minimum ability is increasing in $s_R$. With condition (E.4), it is straightforward to show that (5.4), (5.5), and (5.6) generalize to (5.13), (5.14), and (5.15).

\[ \square \]
Proof of Proposition 5.3
The problem of the incumbent is the same as in Proposition 5.2, except that we have to use equations (5.13), (5.14), and (5.15) instead of (5.4), (5.5), and (5.6). The first-order condition of the maximization problem (5.7) is given by
\[ \gamma - 2c_he_{R1} + \frac{1}{2A} \left( b + \frac{\gamma^2}{4c_l} + \frac{\gamma A + (2\mu_R - 1)(2s_R - 1) - f\Delta + \gamma e_1 - \gamma e_{R1} - \frac{\gamma^2(c_h - c_l)}{2c_h c_l}}{2} \right) \]
\[ - \frac{\gamma}{2} \left( \frac{1}{2} + \frac{1}{2A} (e_{R1} - \hat{e}_1 - \frac{1}{\gamma} (2\mu_R - 1)(2s_R - 1) + \frac{f\Delta}{\gamma} + \frac{\gamma(c_h - c_l)}{2c_h c_l}) \right) \]
\[ - \frac{1}{2A} \left( \frac{\gamma^2}{2c_h} - (\mu_R - \mu_L)^2 \right) = 0. \]
In equilibrium, \( \hat{e}_1 = e_{R1} \) must hold. Hence, the equilibrium effort \( e^*_{R1} \) is given as
\[ e^*_{R1} = \frac{1}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} + (2\mu_R - 1)(2s_R - 1) - f\Delta + (\mu_R - \mu_L)^2 \right] \right\}. \]

Proof of Fact 5.5
We insert equations (5.16), (5.17), and (5.18) into the maximization problem (5.19), and use the fact that \( a^*_L = 0 \). This yields the following first-order condition:
\[ \frac{(2\mu_R - 1)\gamma}{2A c_h} - \frac{(2\mu_R - 1)}{A \gamma} \left( \frac{A \gamma + (2\mu_R - 1)(2s_R - 1) - f\Delta - \frac{\gamma^2(c_h - c_l)}{4c_h c_l} + \frac{\gamma^2(c_h - c_l)}{2c_h c_l}}{2} \right) \]
\[ + (2\mu_R - 1) \left( \frac{1}{2} - \frac{(2\mu_R - 1)(2s_R - 1) - f\Delta}{2A \gamma} + \frac{\gamma(c_h - c_l)}{4A c_h c_l} \right) = 0. \]
Solving for \( s_R \) yields \( s^* = \frac{1}{2} + \frac{f\Delta}{2(2\mu_R - 1)} + \frac{\gamma^2}{4c_h(2\mu_R - 1)} \). Finally, the second derivative with respect to \( s_R \) is negative, which proves that \( s^* \) maximizes equation (5.19).

Proof of Proposition 5.4
First, the reelection probability of an incumbent offering \( s^* \) is larger than \( \frac{f\Delta}{2A \gamma} \), as \( p^0(e^*_{R1}, e^*_{R1}) > 0 \) according to our assumption \( 2\mu_R - 1 < A \gamma \). As \( b \) is sufficiently
large, the incumbent will not exert lower effort and thereby will lose his reelection chances. If a candidate deviates from $s^*$ to a higher or a lower vote-share threshold, he will not be elected, as the median voter is better off with a candidate offering $s^*$. Hence, deviation is not profitable. Uniqueness of $s^*$ follows in the same way.

If $k$ chooses $s_k \neq s^*$, then $k'$ certainly wins the election by choosing $s_{k'} = s^*$.

The second point is obvious. For part (iii), we observe that any other vote-share threshold reduces the expected utility from public projects, as citizens are homogeneous regarding $P$. Due to the symmetry of ideal points of candidates and voters, aggregate utility from the ideological project does not depend on whether the left- or right-wing candidate is elected. Thus, the optimal vote-share, from the perspective of the median voter, is ex ante optimal.

\[ \square \]

**Proof of Proposition 5.5**

By inserting the values from equation (5.8) and (5.9), we obtain

\[
E[e^*_R] = \frac{1}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} - f\Delta + (\mu_R - \mu_L)^2 \right] \right\} + \frac{\gamma}{2c_l} \left( \frac{1}{2} + \frac{\gamma(c_h - c_l)}{4Ac_h c_l} + \frac{f\Delta}{2A\gamma} \right) + \frac{\gamma}{2c_h} \left( 1 - \frac{1}{2} - \frac{\gamma(c_h - c_l)}{4Ac_h c_l} - \frac{f\Delta}{2A\gamma} \right).
\]

(E.5)

By inserting the values from equation (5.16) and (5.17), we obtain

\[
E[e^*_V] = \frac{1}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} - f\Delta + (\mu_R - \mu_L)^2 + (2\mu_R - 1)(2s_R - 1) \right] \right\} + \frac{\gamma}{2c_l} \left( \frac{1}{2} + \frac{\gamma(c_h - c_l)}{4Ac_h c_l} - \frac{(2\mu_R - 1)(2s_R - 1)}{2A\gamma} \right) + \frac{\gamma}{2c_h} \left( 1 - \frac{1}{2} - \frac{\gamma(c_h - c_l)}{4Ac_h c_l} + \frac{(2\mu_R - 1)(2s_R - 1)}{2A\gamma} - \frac{f\Delta}{2A\gamma} \right).
\]

(E.6)

Subtracting equation (E.5) from (E.6) yields, after some straightforward algebra

\[
E[e^*_V] - E[e^*_R] = \frac{(2\mu_R - 1)(2s_R - 1)}{4Ac_h c_l} (2c_l - c_h).
\]

This gives part (i). Part (ii) and part (iii) follow directly from equation 5.23. \[ \square \]
Proof of Fact 5.6
We use the fact that the expected ability of a new left-wing office-holder in period 2 is equal to zero and insert the values from (5.8), (5.9) and (5.10) into equation (5.24). After some straightforward transformations, we obtain:

\[
E[a_R(e^*_{R1}, e^*_{R1})] = \frac{A}{4} \left( \gamma (c_h - c_l) + \frac{f \Delta}{2A\gamma} \right)^2 - A \left( \frac{f^2 \Delta^2}{16A^2\gamma^2} \gamma (c_h - c_l)^2 + \frac{f \Delta (c_h - c_l)}{16A^2\gamma^2} \right)
\]

Then we insert the values from (5.16), (5.17) and (5.18) into \(E[a_V(e^*_{V1}, e^*_{V1})]\) and obtain

\[
E[a_V(e^*_{V1}, e^*_{V1})] = A \left( \frac{f^2 \Delta^2}{16A^2\gamma^2} \gamma (c_h - c_l)^2 + \frac{f \Delta (c_h - c_l)}{16A^2\gamma^2} \right) - \frac{(2\mu_R - 1)(2s_R - 1)}{4A\gamma^2} c_h c_l (c_h - c_l)
\]

as the expected ability of the incumbent in the second period with vote-share contracts, given that the elected politician chooses \(e^*_{V1}\) in the first period. From equation (E.7) and (E.8), we immediately obtain the following result:

\[
E[a_V(e^*_{V1}, e^*_{V1})] - E[a_R(e^*_{R1}, e^*_{R1})] = \frac{(2\mu_R - 1)(2s_R - 1)}{4A\gamma^2} \left( \gamma^2 (c_h - c_l) + 2f \Delta - (2\mu_R - 1)(2s_R - 1) \right).
\]

\(\square\)

Proof of Proposition 5.6
We insert \(s^*_R\) from Fact 5.5 into equation (5.25). Hereby, we have to distinguish two separate cases: The case where \(\frac{1}{2} < s^*_R < 1\) and the case where \(s^*_R = 1\).

First, in the case where \(s^*_R < 1\), we insert \(\frac{1}{2} + \frac{f \Delta}{2(2\mu_R - 1)} + \frac{\gamma^2}{4c_h(2\mu_R - 1)}\) for \(s^*_R\) into equation (5.25) and obtain:

\[
E[a_R(e^*_{R1}, e^*_{R1}), s^*] - E[a_R(e^*_{R1}, e^*_{R1})] = \left( \frac{f \Delta}{4A\gamma^2} + \frac{1}{8A}\right) \gamma^2 (2c_h - 3c_l) + \frac{f \Delta}{2c_h c_l} + f \Delta
\]

(E.9)
APPENDIX E. APPENDIX TO CHAPTER 5

Second, in the case where $s_R^* = 1$, we insert $s_R^* = 1$ into equation (5.25) and obtain:

$$
E[a_R^V(e_{R1}^*, e_{R1}^*)] - E[a_R(e_{R1}^*, e_{R1}^*)] = \frac{2\mu_R - 1}{4A\gamma^2} \left( \frac{\gamma^2(c^h - c_l)}{c_h c_l} + 2f\Delta - (2\mu_R - 1) \right)
$$

(E.10)

Furthermore, note that we know from Fact 5.5 that in the case $s_R^* = 1$ the following inequality has to hold:

$$(2\mu_R - 1) \leq f\Delta + \frac{\gamma^2}{2c_h} \quad \text{(E.11)}$$

If we use (E.11) to replace the last term of equation (E.10), we obtain

$$
E[a_R^V(e_{R1}^*, e_{R1}^*)] - E[a_R(e_{R1}^*, e_{R1}^*)] \geq \frac{2\mu_R - 1}{4A\gamma^2} \cdot \left( \frac{\gamma^2(2c_h - 3c_l)}{2c_h c_l} + f\Delta \right)
$$

(E.12)

The results of equation (E.9) and (E.12) together imply Proposition 5.6.

\[\square\]

Proof of Theorem 5.1

Part (i): Suppose, without loss of generality, that candidate $R$ is elected in the first election. Applying vote-share contracts will be welfare-enhancing if and only if the welfare, under vote-share contracts and with a vote-share threshold $s_R^*$ minus the welfare in the case under elections alone, is positive. This gives the following condition:

$$
\left\{ \gamma e_{R1}^* + \left( p^0V(e_{R1}^*, e_{R1}^*) + p^1V(e_{R1}^*, e_{R1}^*) \right) \cdot \left( \gamma \tilde{a}_R^V(e_{R1}^*, e_{R1}^*) + \gamma e_{R2}^* \right) \\
+ \left( 1 - p^0V(e_{R1}^*, e_{R1}^*) - p^1V(e_{R1}^*, e_{R1}^*) \right) \cdot \left( \gamma a_L^V + \gamma e_{L2}^* \right) \right\} \\
- \left\{ \gamma e_{R1}^* + \left( p^0(e_{R1}^*, e_{R1}^*) + p^1(e_{R1}^*, e_{R1}^*) \right) \cdot \left( \gamma \tilde{a}_R(e_{R1}^*, e_{R1}^*) + \gamma e_{R2}^* \right) \\
+ \left( 1 - p^0(e_{R1}^*, e_{R1}^*) - p^1(e_{R1}^*, e_{R1}^*) \right) \cdot \left( \gamma a_L + \gamma e_{L2}^* \right) \right\} > 0
$$

By inserting $e_{R2}^* = e_{R2} = \frac{\gamma}{2c_h}, e_{L2}^* = e_{L2} = \frac{\gamma}{2c_h}, a_L^V = a_L = 0$ and the values for $e_{R1}^*, p^0(e_{R1}^*, e_{R1}^*), p^1(e_{R1}^*, e_{R1}^*), \tilde{a}_R(e_{R1}^*, e_{R1}^*), e_{R1}^*, p^0V(e_{R1}^*, e_{R1}^*), p^1V(e_{R1}^*, e_{R1}^*)$ and
\( \tilde{a}^{V}_{R}(e^{V}_{R1}, e^{V}_{R1}) \) from Propositions 5.2 and 5.3, we obtain the following expression:

\[
\frac{\gamma}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} + (2\mu_R - 1)(2s^*_R - 1) - f\Delta + (\mu_R - \mu_L)^2 \right] \right\} \\
+ \left[ \frac{1}{2} + \frac{\gamma(c_h - c_l)}{4Ac_h c_l} - \frac{(2\mu_R - 1)(2s^*_R - 1)}{2A\gamma} \right] \\
\cdot \left[ \gamma \left( \frac{A}{2} + \frac{(2\mu_R - 1)(2s^*_R - 1)}{2\gamma} - \frac{f\Delta}{2\gamma} - \frac{\gamma(c_h - c_l)}{4c_h c_l} \right) + \frac{\gamma^2}{2c_l} \right] \\
\leq \left[ \frac{1}{2} + \frac{\gamma(c_h - c_l)}{4Ac_h c_l} + \frac{f\Delta}{2A\gamma} \right] \\
\cdot \left[ \gamma \left( \frac{A}{2} - \frac{f\Delta}{2\gamma} - \frac{\gamma(c_h - c_l)}{4c_h c_l} \right) + \frac{\gamma^2}{2c_h} \right] \\
- \left[ \frac{1}{2} + \frac{f\Delta}{2A\gamma} \right] \\
\leq \frac{\gamma^2}{2c_h} \left\{ \gamma + \frac{1}{2A} \left[ b - \frac{\gamma^2}{4c_l} - f\Delta + (\mu_R - \mu_L)^2 \right] \right\} \\
- \left[ \frac{1}{2} - \frac{\gamma(c_h - c_l)}{4Ac_h c_l} - \frac{f\Delta}{2A\gamma} \right] \cdot \frac{\gamma^2}{2c_h} > 0
\]

After some tedious calculation\(^1\), we obtain the following expression:

\[
\frac{\gamma^2}{c_h} + 2f\Delta - (2\mu_R - 1)(2s^*_R - 1) > 0 \quad (E.13)
\]

In the next step, we insert \( s^*_R \) from Fact 5.5 into condition (E.13), and show that condition (E.13) is always fulfilled, which proves the welfare-enhancing effect of vote-share contracts with vote-share threshold \( s^*_R \). We have to analyze two separate cases: First, the case where \( \frac{1}{2} < s^*_R < 1 \), and second, the case where \( s^*_R = 1 \).

If \( s^*_R < 1 \), we insert \( \frac{1}{2} + \frac{f\Delta}{2(2\mu_R - 1)} + \frac{\gamma^2}{4c_h(2\mu_R - 1)} \) for \( s^*_R \) in condition (E.13) and obtain

\[
\frac{\gamma^2}{2c_h} + f\Delta > 0. \quad (E.14)
\]

This condition is always fulfilled.

In the case where \( s^*_R = 1 \), we insert \( s^*_R = 1 \) in condition (E.13) and obtain

\[
\frac{\gamma^2}{c_h} + 2f\Delta - (2\mu_R - 1) > 0. \quad (E.15)
\]

Furthermore, we use the fact that for \( s^*_R = 1 \), the following inequality will be fulfilled:

\[
\frac{1}{2} + \frac{f\Delta}{2(2\mu_R - 1)} + \frac{\gamma^2}{4c_h(2\mu_R - 1)} \geq 1 \quad (E.16)
\]

\(^1\)In our calculations, we use the fact that \( s^*_R > \frac{1}{2} \), which allows us to divide by \( 2s^*_R - 1 \).
Inequality (E.16) can be transformed to

\[ 2f \Delta + \frac{\gamma^2}{c_h} \geq 2(2\mu_R - 1) \]  

(E.17)

and, by inserting this inequality into condition (E.15), we immediately see that condition (E.15) is always fulfilled.

Part (ii): The second part of the Theorem follows directly from condition (E.14), where the term \( f\Delta + \frac{\gamma^2}{2c_h} \) represents the gains that accrue from the introduction of vote-share contracts.
Bibliography


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