# Essays on Incentives in Public and Private Institutions

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# Contents

# Preface

This doctoral dissertation is comprised of three chapters, two of which deal with problems in the field of Political Economy, while the last one is concerned with organizational economics. In particular, the first two chapters focus on the implications of commitment problems in the political sphere for (democratic) decision making. The last chapter studies the incentives of agents to acquire information in the presence of career concerns. The chapters are self contained and can be read independently.

Chapter 1 capitalizes on the idea that governments, through their policy choices, have the possibility to alter the incentives of their successors. We employ this mechanism to explain the widely observed prevalence of inefficient transfer instruments as e.g. tariffs or output subsidies. Why do governments find it preferable to transfer resources in an inefficient way, thereby distorting economic activity, if more efficient instruments (e.g. lump sum transfers) are available?

To answer this question we build a dynamic model of the interaction between special interest groups and a policy maker. The model builds on the key insight that inefficient transfer instruments lead to inefficiently high levels of production and capacity in an industry. As capacity is costly to adjust both policy makers and special interest groups have a higher incentive to sustain inefficient transfers as compared to efficient ones. This mechanism has profound effects on the outcome of the lobbying game.

Since the special interest group must compensate the policy maker for the aggravated distortions of inefficient transfers, the lump sum transfer is always more attractive if the players interact only once. This is one of the central results of the earlier literature on this topic which finds that, whenever efficient instruments are available, they will be employed. Following the logic outlined above, however, we demonstrate that this is not necessarily true given that the special interest group has a longer time horizon. The fact that future governments are more reluctant to cut back the transfer once overcapacities have been accumulated, reduces the expenses necessary to induce politicians in the future to sustain the subsidy. But does this not run counter to the interest of the policy maker who also cares about future contributions from the lobby group? The answer is affirmative only if the policy maker stays in office for sure. As soon as this is not the case he anticipates that (in expectation) part of the reduced contributions from the special interest group must be borne by his successors. We show that the policy maker can even extract a share of the special interest group's future gain today. It might therefore be strictly preferable for governments to grant inefficient transfers, thereby collecting part of the rents which otherwise would have been captured by their successors.

In a natural next step we extend the model to study competition between interest groups. We demonstrate that not only do inefficient transfers still exist under these circumstances, the probability of introducing them actually increases. It has long been noted in the literature that interest groups competing for a given pool of *efficient* transfers are caught in a miserable position. With competing lobby groups the policy maker is in a much better bargaining position since he can pit lobbies against each other. With solely efficient transfer instruments available, he can do so perfectly, as he is indifferent which interest group to grant favors to. Hence, this leaves the lobbies with no bargaining power and therefore, with no rents. This prisoners dilemma type of situation seems to be somewhat at odds with the sharply raising number of political action committees and interest groups in the US, as in theory each lobby loses nothing by unilaterally abandoning its influence activities. Therefore the theoretical result raises some concern about why lobbies manage to organize in the first place.

However, as soon as lobbies were able to obtain the inefficient transfer in the past the situation changes drastically. Ceteris paribus, the policy maker now wants to spread transfers evenly among special interest groups so as to minimize costly capacity adjustment. In the parlance of industrial organization the lobby groups now appear differentiated in the politician's eyes and are therefore able to capture some part of the rents. It is thus their desire to escape the very harsh consequences of competition in the future if no overcapacities have been accumulated so far, that makes the special interest groups even more eager to obtain the inefficient transfer, if they have to compete against each other.

In the second chapter we depart from the idea that a politician's concern is to influence future governments. Instead the main focus here is how a politician's actions in the past constrain his behavior later in his career. The mechanism which links past and present is the policy maker's concern about the electorate's perception of his competence. Revising one's policy positions is equivalent to admitting that one had wrong opinions in the past, which in turn signals a low level of competence.

We employ this logic in a model of electoral competition and post-electoral policy making to study the policy maker's incentive to keep or break his campaign promises. The model bridges the two prevalent modeling approaches which are used to investigate electoral competition so far. Whereas in models of pre-electoral politics candidates can commit to policies ex ante, the approach of post-election politics starts from the presumption that, once in office, politicians are unconstrained to pursue their own agenda. However, both approaches seem to be at odds with the empirical evidence.[1] This constitutes a severe problem as the question of the credibility of campaign promises is of central importance to understand both the selection of politicians and policy implementation. Given that campaign promises are at least partially binding they impact policy making after the elections. Anticipating this, candidates may distort their platforms in order to be able to uphold their reputation ex post which influences their attractiveness in the voter's eyes and hence, their chances to win the election.

In the model we develop, a tension exists between a policy maker's concern to maintain his reputation and the usage of new information which becomes available after the election. While deviating from one's own platform and adapting to new information increases the chance of successful policy making it depresses at the same time the politician's reputation. We establish that an equilibrium can be supported where agents distort their platform but where nevertheless a substantial amount of ex post available information is used. In this equilibrium unexpected or surprising platforms earn a higher reputation and are chosen inefficiently often.

Central to the investigation is the question which incentives govern the politician's policy implementation decision. In contrast to approaches that impose an exogenous cost accruing upon platform revision, we relate the propensity to break campaign promises to the environment in which the politician operates. We show that the degree of uncertainty about the candidate's competence, the amount of observability or the electorate's assessment capability of the appropriateness of a given policy measure, and the ex ante probability of a certain

[1] See chapter 2 for references.

policy to be optimal are driving determinants of the politician's ex post behavior. Moreover, the model is extended to provide a rationale for the optimality of ambiguous platforms and the widely observed behavior of politicians to renege on a subset of their campaign promises.

In the last chapter we stick to the assumption that agents are concerned about their reputation but leave the sphere of Political Economy and consider a rather general setting instead. In particular, we examine the consequences of additional information acquisition by experts, i.e. agents who are mainly concerned about the assessment of their ability to receive and process information. Typical examples for experts include fund managers whose task it is to identify profitable investment opportunities, analysts, judges or politicians.[2] In all those applications it seems reasonable to assume that agents can in principle acquire additional information.
In order to analyze this issue we build a multi period model where agents receive information in every period. Agent's desire to signal their competence leads to inefficiencies even if they obtain only one piece of information. In particular, those agents who receive noisy information should mainly follow the prior, while more competent types should condition more strongly on the information they receive. Hence, under efficient decision making, the behavior of good agents will be more variable. As incompetent types try to mimic good ones, they will therefore contradict the prior inefficiently often.
It turns out that more information on the agent's side does not unambiguously benefit the principal. Of course, more information improves the quality of decision making which benefits both the principal and the agent. However, in some situations the behavior of the agents is further distorted through more information acquisition. To understand this remember that the source of inefficiency lies in the fact that incompetent agent's posterior assessment of the true state of the world is more concentrated around the prior than the posterior of good types. If more information is accumulated this discrepancy becomes even more pronounced. Better type's information is true with a higher probability and for that reason more correlated over time which implies that good agents are likely to receive identical signals. The reverse logic holds for incompetent types who receive contradictory information more often. Hence from a first best perspective, good types should condition even more strongly on their information while the behavior of the unable types should not change by much. In their attempt to mimic their competent counterparts the behavior of bad agents can therefore be even more

[2]See chapter 3 for detailed references.

distorted.

In the model we derive sufficient conditions under which the above reasoning holds true. Moreover, we discuss possibilities how the principal can constrain information acquisition by the agents, in case he may be hurt by additional inefficiencies.

# Chapter 1

# Political Insulation and Lobbying

## 1.1 Introduction

One of the largest parts of government activity concerns redistribution across citizens. While part of the resources redistributed flow to large groups in the society such as the poor and can be justified on normative grounds, a large share is captured by small groups which have been able to organize powerful lobbies. In the last decades, a lot of work has been devoted to analyzing how lobbies can influence the political decision process and appropriate some resources at the expense of the general public.[1]

A far less investigated field is however which policy instruments are used in the political equilibrium to transfer resources to interest groups. A surprising observation is that apparently most of the instruments used in reality take an inefficient form. Examples abound: think of subsidies to agriculture in almost all countries of the world or of the wide use of tariffs and quotas which protect certain industries from competition. To be sure there could be reasons for such policies to be optimal, e.g. externalities or infant industry protection. However by now most scholars agree this is not the prime reason for such policies.[2] It is far from obvious how such inefficient transfers can survive in the political market. As forcefully argued by the so called Chicago School there are (at least) two arguments against inefficient redistribution devices. First, politicians who use them will simply be voted out of office and second, inefficient instruments will mobilize the rest of society since it has to bear the lion's share of the associated deadweight loss.[3] Hence, interest groups could obtain more resources by replacing inefficient instruments with efficient ones.

In this paper I propose a theory of inefficient redistribution which is based on dynamic considerations of the political actors. Specifically, interest groups do not only care about current transfers but also whether they will receive resources in the future. Therefore, it might be profitable for them to lobby for policies which are hard to reverse by succeeding governments. Political scientists have coined the term "insulation" for such policies[4] and I will argue that precisely the widely observed inefficient transfer instruments have the property

[1] See Grossman and Helpman (2001) for a comprehensive overview of the existing literature.

[2] See for example Gisser (1993).

[3] See for example, Stigler (1971), Becker (1983) and Wittman (1989) for work in the tradition of the Chicago School.

[4] See e.g. de Figueiredo (2002) and the references therein.

that they are insulated against future reversal. The starting observation is that almost all inefficient transfers we encounter in reality, be it a price or output subsidy or a tariff, lead to overproduction and thus overcapacities in an industry. In contrast, an efficient, e.g. lump sum transfer clearly has no distorting effect. Cutting back an inefficient transfer therefore leads to a reallocation of production factors in the economy which, albeit efficiency enhancing in the long run may lead to some cost in the short run. As an example, the production factor may have been partially specialized in the meantime or the market for the production factor may exhibit frictions such that its owner would suffer an income loss in case of reallocation. Hence a politician knows that if he is to introduce some inefficient transfer today, his successor will be more willing to sustain the policy. Thus insulation in the present model works through a change in the preferences of future governments.[5]

Is the effect outlined above really so strong that inefficient policies survive for that reason? Eventually, the income loss of a few members of society must be traded off against an overall welfare improvement. There is some evidence that politicians are willing to sacrifice welfare gains, especially in order to avoid rising unemployment. As an example some politicians in Britain supported ongoing subsidies to the (highly unprofitable) coal industry in order "to ease the pain that will be caused by the loss of 2,500 jobs". Similarly, Dominique Bussereau, the French minister for agriculture justified France's obstinate resistance to reform of the European Union's agricultural policy by noting that "tens of thousands of jobs would be at risk".[6] Since Bussereaus claim that ten thousands of jobs are at risk is probably an exaggeration, it is noteworthy that the number of job losses appears to be quite small in both examples.

Until now we have said nothing about who gains from political insulation. Clearly, for the argument to work, the present government must value the fact that the policy is sustained somehow. The mechanism by which this is achieved in the model is that interest groups anticipate that they will have to bribe future governments less for a transfer in case of political insulation. The additional rents which the interest group can thereby capture can be shared with the present ruler who may be able to extract even more resources from the lobby compared to the case of lump sum payments to the interest group. Hence the present

[5] This mechanism distinguishes this paper from Coate and Morris (1999) where insulation of a certain policy stems from the lobbies' higher willingness to pay for its maintenance once it is enacted.

[6] These examples are taken from the Economist: see "Bottomless pits", April 18th, 2002 and "European farm follies", December 8th, 2005.

government and the lobby collude at the expense of future rulers.

This paper contributes to an old dispute between the Chicago and the Virginia School[7] about how to interpret policies which seem to be inefficient at a first glance. While the proponents of the Chicago School (see the references above) argue that due to political competition seemingly inefficient policies can be given an efficiency rationale, the Virginia School posits that inefficient transfers can emerge since they can be better disguised. This argument was formalized by Coate and Morris (1995), who show that inefficient policies may prevail if voters are both uncertain about the politician's preferences and the welfare consequences of a certain policy. The drawback of this argument is that the policy under consideration must be welfare enhancing in at least some states of the world. However, if one takes agricultural subsidies in the European Union this is hardly the case: at least at the point where huge sums had to be expended in order to export agricultural overproduction it was obvious that the subsidies paid to farmers do not correct for some market failure.[8]

Another strand of the literature explains inefficient redistribution on grounds of an improved bargaining position of the politician vis-a-vis the lobbies. A commitment to inefficient transfer instruments on the politician's side might limit the amount of resources redistributed as in Rodrik (1986), Wilson (1990) and Becker and Mulligan (1998) or even help the politician to extract more bribes from the interest groups as in Drazen and Limao (2007). However, a somewhat arbitrary assumption in these papers is that the policy maker can commit to the transfer instruments but not to the level of redistribution.

At the heart of our theory is a commitment problem which is prevalent in the political arena.[9] Specifically the actions of future governments can not be constrained by explicit contract but only through institutions or today's policy choice. The latter mechanism is not new: it has first been explored by Persson and Svensson (1989) and Alesina and Tabellini (1990) in the context of public debt accumulation. Here the argument goes that a present conservative government might want to accumulate debt to be repaid tomorrow in order to constrain spending behavior of future (more left wing) governments.

We apply a similar mechanism to inefficient redistribution to lobby groups. The paper closest

[7]See, for example, Tullock (1983).

[8]This fact also invalidates autarchy arguments in favor of these subsidies.

[9]See Acemoglu and Robinson (2005) and Acemoglu (2003) for an extensive discussion and a wide array of applications of the commitment problem in politics.

to ours is Acemoglu and Robinson (2001). There, a politician can pay income subsidies which are targeted either to old or to all members of an industry. The targeted transfer is more efficient in their model since it gives no incentives for young agents to enter into the subsidized profession. However the non targeted subsidy program might still be preferred by the old members if the size of the industry is an asset in the political sphere. Acemoglu and Robinson (2001) assume that the industry gains power and effectively sets policy in all future periods if the number of agents working in that industry exceeds some threshold. Our paper departs from theirs in two important aspects. First the inefficient policy changes the preferences of future policy makers and not their identity.[10] Second, and more importantly, we explicitly model the determination of equilibrium policy by applying a menu auction lobbying game. This is attractive as interest groups usually try to influence policy makers but do not have political decision rights, and it helps us to identify the trade-offs a politician faces when he sets policy. This formulation also contributes to a better understanding of an unappealing property of menu auction lobbying games. The existing literature found that in the presence of multiple lobbies there is a strong tendency to efficient policies. This however benefits the politician only, since in the case of competing interest groups each lobby is held down to its reservation utility.[11] This prisoners dilemma type of situation seems to be somewhat at odds with the sharply raising number of political action committees and interest groups in the US, as in theory each lobby loses nothing by unilaterally abandoning its influence activities. Therefore the theoretical result raises some concern about why lobbies manage to organize in the first place. In response to these problems, Dixit, Grossman, and Helpman (1997) resort to the informal argument that interest groups obey to some agreed - upon "constitution" specifying that all organized groups are only allowed to lobby for inefficient transfers, in which case lobbies are able to expropriate some positive rent.

The extension of our model to the case of multiple lobbies reveals that in our dynamic setting, first, inefficient policies still can prevail, and second, lobbies earn positive rents. To obtain these results we do not need to assume some exogenously given coordination device, be it an explicit contract or a repeated game setting. It is also noteworthy that competition between interest groups can make the implemented policy even more inefficient.

[10] Other papers which examine the impact of a policy on the identity of future governments in different contexts are Milesi-Ferretti and Spolaore (1994), Besley and Coate (1998) and Aghion and Bolton (1990).

[11] See Grossman and Helpman (1994), Dixit (1996) and Dixit, Grossman, and Helpman (1997).

The paper is organized as follows. The next section lays out the model and discusses the basic assumptions. Subsequently we will analyze the simplest version of the model where only one interest group is active in the political arena. The forth section investigates the impact of multiple lobbies and the last section concludes.

## 1.2 The Model

In the first part of this section I present the structure of the model, while the following subsection is devoted to the discussion.

### *1.2.1 Description of the Model*

We consider a small open economy which is populated by a unit measure of individuals with different factor endowments.[12] All individuals have the same utility function defined over $n+1$ goods $(x_0, x_1, \ldots, x_n)$

$$u = x_0 + \sum_{i=1}^{n} u_i(x_i),$$

where $x_0$ serves as a numeraire good with price equal to one and the functions $u_i(\cdot)$ are increasing, strictly differentiable and concave. Assuming that the income of all individuals is high enough and the price for good $x_i$ equals $p_i$ the demand for good $i$ is given by the inverse of $u'(x_i)$ and is denoted by $d_i(p_i)$. For an individual endowed with income $m$ this gives rise to the indirect utility function $V_0 = m + S(\mathbf{p})$, where $\mathbf{p} = (p_1, p_2, \ldots, p_n)$ is the world market price vector the consumer faces and $S(\mathbf{p}) = \sum_{i=1}^{n} u_i(d_i(p_i)) - \sum_{i=1}^{n} p_i d_i(p_i)$ denotes consumer surplus.

It is assumed that the numeraire good $x_0$ is produced competitively by labor alone with a constant returns to scale technology. The input - output coefficient is set equal to one which implies that the labor market will clear at a wage of one. The nonnumeraire goods $x_i$ are produced by labor and a sector specific input with a constant returns to scale technology. The sector specific input is supplied inelastically and its reward is denoted by $\pi_i(p_i)$. It is assumed that the specific input can not be traded (one could think of human capital, for

[12] The model largely follows Grossman and Helpman (1994).

example).[13]

A fraction (mass) $1-\varphi$ of the population is only endowed with labor $z$ alone, while a fraction $\varphi_i$, $\sum_{i=1}^{n}\varphi_i \equiv \varphi$ additionally owns the sector specific input for good $i$. Hence the income of the owners of labor alone is given by one (the wage rate in the economy) while the owners of the sector specific input derive additional income of $\pi_i(p_i)$.

Some sectors $i \in L$ are organized as lobbies. Only organized sectors can try to bribe the politician in order to get a transfer, which can take two different forms: a lump sum transfer denoted by $e_i$ or an output subsidy $t_i$. Note that the output subsidy has no impact on prices in the economy, hence all consumers face world market prices. Total transfers $T(e,t) = \sum_{i=1}^{n}[e_i + t_i y_i(p_i+t_i)]$ are financed equally by all members of the economy where $y_i(p_i+t_i) = \pi_i'(p_i+t_i)$ denotes the equilibrium supply of good $i$. We denote by $T_i(e_i,t_i)$ the transfer to lobby $i$. It is assumed that the lobby maximizes the welfare of its members.

Redistributing money causes a welfare loss to the society which is expressed by $\phi(\sum_{i=1}^{n}[e_i + t_i y_i(p_i+t_i)])$, where $\phi(\cdot)$ is strictly increasing and convex with $\phi(0) = \phi'(0) = 0$.

Therefore the welfare of the workers consists of their consumer surplus minus the share of the transfer and the redistribution cost they have to bear and can be expressed as

$$\mathcal{W}_0 = (1-\varphi)\left[m + S(\mathbf{p}) - \sum_{i=1}^{n} T_i(e_i,t_i) - \phi\left(\sum_{i=1}^{n} T_i(e_i,t_i)\right)\right]. \tag{1.1}$$

Note that both transfers enter the welfare of workers only through the cost function $\phi(\cdot)$ and the share workers have to contribute to transfer expenditure but leave consumer surplus unaffected.

The welfare of the owners of the specific input gross of contributions (see below) to the politician in turn can be written as

$$\mathcal{W}_i = \pi_i(p_i+t_i) + \varphi_i\left[m + S(\mathbf{p}) - \sum_{i=1}^{n} T_i(e_i,t_i) - \phi\left(\sum_{i=1}^{n} T_i(e_i,t_i)\right)\right]. \tag{1.2}$$

Total welfare is simply given by the sum of the welfare levels of workers and the owners of the sector specific inputs

$$\mathcal{W} = \mathcal{W}_0 + \sum_{i=1}^{n}\mathcal{W}_i = m + S(\mathbf{p}) - \sum_{i=1}^{n} T_i(e_i,t_i) - \phi\left(\sum_{i=1}^{n} T_i(e_i,t_i)\right) + \sum_{i}^{n}\pi_i(p_i+t_i).$$

As is standard in the literature, the lobbying process is modeled as a menu auction, i.e.

[13] This so called specific factor model is often used in the theory of international trade. It goes back to Jones (1965), Mussa (1974), and Neary (1978).

for every policy vector $\mathbf{q} = (\{e_i\}_{i\in L}, \{t_i\}_{i\in L})$ each lobby offers a contribution $C_i(\mathbf{q})$. The policy $\mathbf{q}$ is set by a politician whose preferences are dependent on both aggregate welfare and contributions from the lobbies. We follow the literature in that both components enter linearly into the governments objective function such that

$$G = a\mathcal{W}(\mathbf{q}) + \sum_{i\in L} C_i(\mathbf{q}), \tag{1.3}$$

where $a \in \mathbb{R}_o^+$ is the weight the politician attaches to social welfare.

The model we consider has two periods, $\tau = 1, 2$. In every period, each lobby first offers a contribution schedule. After that the politician chooses a policy $\mathbf{q^1}$ which maximizes his utility given the contribution schedules. Then each sector decides on its production and therefore on the optimal amount of inputs employed. It is assumed that the industry represented by the lobby chooses the optimal amount of inputs in every period. At the end of the first period production takes place and payoffs are realized.

The second period is identical to the first one except that we assume that a new politician is in power who has the same objective function as his predecessor. Again the organized sectors lobby, followed by the implementation of the preferred policy by the politician. However if any sector chooses to adjust its production level we assume that every worker who changes job incurs a loss of $\vartheta$. After this adjustment has taken place firms produce and payoffs are realized. For simplicity we assume no discounting. The timing of the model is summarized in figure 1.

### *1.2.2 Discussion*

This subsection is devoted to the discussion of the model.

First of all we restricted the set of policy instruments available to the politician. The transfer $e$ can be seen as an efficient mean of redistribution while the price subsidy $t$ leads to distortions in the product market and is therefore less efficient. This structure is similar to Dixit, Grossman, and Helpman (1997) where the policy instruments are also exogenously given. What is really important in my model for the two means of redistribution is that first they can be ranked by how efficiently they transfer resources to the lobby, and second that the more inefficient instrument leads to an expansion of production. Since this is true for almost

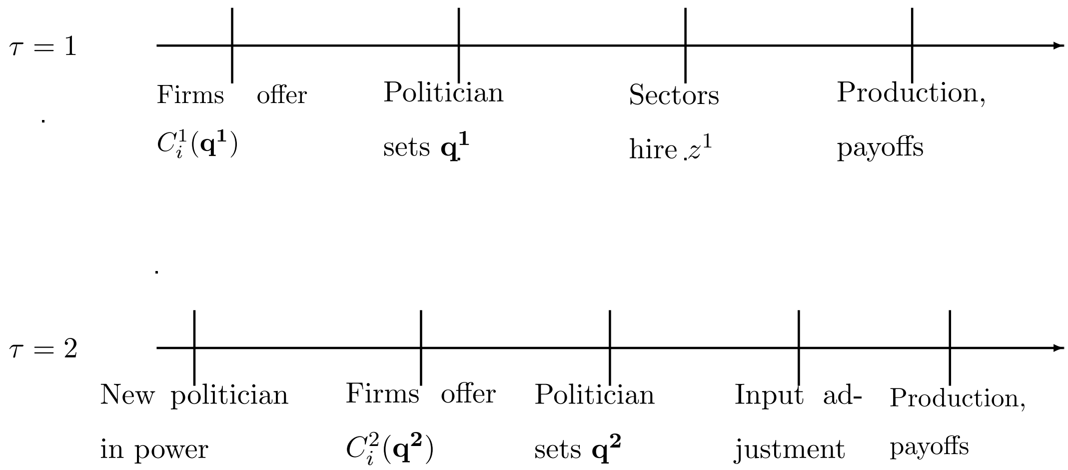


Figure 1.1: Timing

all observed inefficient transfers be it a cost or price subsidy or tariffs, changing the set of policy instruments would have no impact on the qualitative results.

The second point concerns the modeling of the lobbying process. For lobbying to be effective the politician must care sufficiently about contributions. This has been justified by assuming that the politician can either use the contributions for personal consumption or to finance his next electoral campaign.[14] Reelection concerns are also one interpretation of why social welfare enters into the objective function of the politician. Note that in my model the politician will be voted out of office or resign after the first period for sure. One possible justification, besides that the politician consumes the bribes, is that the incumbent is a member of a party which is in need of resources for the next campaign. It is often argued that one of the main roles of political parties is to discipline the leader and this would also explain why the incumbent still cares about social welfare.

As we will see later in the analysis, extracting more bribes from the interest groups today goes along with less bribes to be received in the future. In the model we assume that the politician acts purely myopically, i.e. his preferences are defined over present payments from the interest groups only. This assumption simplifies the analysis a lot but one might argue that his fellow party members will also care about bribes in the future. However, it seems

[14]See Grossman and Helpman (1996) for a model in which the reelection probability increases with the amount of resources spent in the campaign.

plausible to argue that at least a part of future bribes flow to a different party (almost any model of electoral competition has it that each competitor wins the election only with a certain probability). Besides, in the case where the present government is in power in the next period for sure *and* has a relatively high discount factor the argument of the paper goes through.

As mentioned above, the lobbying process itself is modeled as a menu auction. This approach goes back to Bernheim and Whinston (1986a,b).[15] The basic idea of this approach is that lobby groups tailor their contribution to the policy which is enacted by the politician. So implicitly it is assumed that the lobby group can commit to pay the politician according to the contribution schedule it has offered once the policy has been implemented. Besides this strong assumption, the menu auction approach to lobbying has the advantage that it is tractable, as it boils down to the politician maximizing a social welfare function in which the organized groups gain additional weight.

A further issue concerns the assumption that workers who change job in the second period lose some amount $\vartheta$. There are different interpretations possible. One could either assume that there is learning on the job and so a worker who is dismissed looses some part of his human capital. Another interpretation would be that $\vartheta$ simply measures the cost the worker has to incur to find a new job or that the worker stays unemployed for a short period and $\vartheta$ measures the difference between his wage and unemployment benefits.

Note that the only way to lose a job is to work in an organized sector and one might argue that workers have to be compensated for the risk they take. This would not allow us to fix the wage rate in the economy at one. However, as will become clear later on in the analysis, in equilibrium it never happens that workers are fired. That is also the reason why the labor market clearing conditions are neglected in the analysis.

I have assumed that the industry hires the efficient amount of labor in every period. This myopic behavior neglects possible dynamic considerations. It might be optimal for the industry to hire more than the efficient amount of labor in the first period to change the behavior of the politician later on. Although this might be in the interest of the industry as a whole it

[15] A very good overview about the theory of menu auctions and its application in the field of political economy can be found in Grossman and Helpman (2001). See also Bergemann and Valimaki (2003) for an analysis of dynamic common agency games.

is nevertheless not optimal for a single firm belonging to the industry for standard free-riding reasons. So implicit in this assumption is that the industry consists of many firms not able to coordinate on some statically suboptimal capacity. This lack of coordination ability can be justified in three ways: either a monitoring technology is missing or too costly or if contracts on capacity can be written, by private information held by each individual firm about its optimal capacity level. The information rents which have to be granted to all firms in this latter case can render contractual arrangements too costly. Third it could also be the case that capacity agreements are forbidden by the competition authorities.

To conclude this section I will give a short justification for the function $\phi(\cdot)$ which measures some social cost of transferring money to the organized groups. The first reason is purely technical. In the absence of any redistribution costs the lobbies would extract money from the rest of the society until the marginal utility of income of the individuals exceeds one.[16] This however makes it impossible to measure the indirect utility of the individuals in monetary terms anymore, which in turn makes the aggregation of individual utility values and profits accruing from the specific production factor in a social welfare function more difficult. But there are also economic reasons to incorporate redistribution costs. Note that as the model stands we have assumed lump sum taxation. The function $\phi(\cdot)$ could measure the deadweight loss accruing to society in case distorting taxes must be resorted to. Alternatively, it could be interpreted as the administrative cost of collecting taxes and redistributing the revenue to interest groups. One could argue that catering too much to special interests decreases the reelection probability of the politician and therefore the value of his objective function.

## 1.3 Analysis with a Single Lobby

In this section we analyze the model in the presence of only one organized sector.[17] To save on notation we make the additional assumption that ownership is highly concentrated, so $\varphi_i = 0$.

[16] That means that the numeraire good is no longer consumed in equilibrium.

[17] In this section we shall drop the subscript $i$ to indicate variables which are related to the organized group and will simply write $e$, $t$ and $T(e,t)$ for $e_1$, $t_1$ and $T_1(e_1,t_1)$.

### 1.3.1 Preliminaries

Before we start the analysis in which one sector is organized let us take a look at the benchmark case in which no lobbying occurs. In this case the politician maximizes $\mathcal{W}$ over $e$ and $t$. Of course no transfers will be paid since by employing one of the two transfers social welfare is reduced by the positive cost of redistribution. Formally this can be seen by looking at the following derivatives[18]

$$\begin{aligned}\frac{\partial\mathcal{W}}{\partial e} &= -a\phi'(T(e,t)) \leq 0,\\ \frac{\partial\mathcal{W}}{\partial t} &= -aty'(p+t) - a\phi'(T(e,t))T'(e,t)\\ &= -aty'(p+t) - a\phi'(T(e,t))(y(p+t)+ty'(p+t)) \leq 0.\end{aligned}$$

Both expressions are obviously smaller than zero if $e$ or $t$ are positive. The second equation also reveals that the output subsidy is a less efficient transfer instrument compared to the lump sum payment. When $e$ is marginally increased by one unit the firm's profit rises by the same amount while increasing profits by one unit using the output subsidy costs more. Formally, $\mathrm{d}\pi(p+t) = y(p+t)\mathrm{d}t$, so the output subsidy must increase by $1/[y(p+t)]$ units in order to transfer one additional unit of profit to the firm. But society bears costs of $\mathrm{d}T = y(p+t)\mathrm{d}t + ty'(p+t)\mathrm{d}t$ which, after inserting the expression for $\mathrm{d}t$, yields $\mathrm{d}T = 1+\epsilon_{y,t}$, where $\epsilon_{y,t} > 0$ is the elasticity of supply with respect to the transfer. So part of the transfer is lost since the industry expands output. This effect is stronger the steeper the supply curve is, i.e. the stronger supply reacts to the output subsidy.

I now turn to the case where there exists one organized group which can pay a contribution $C(\mathbf{q})$ if the politician implements a policy $\mathbf{q}$. As shown by Bernheim and Whinston (1986b) an equilibrium of the menu auction game can be characterized as follows:

DEFINITION 1.1 $\{C^*(\mathbf{q}), \mathbf{q}^*\}$ *constitutes a Nash Equilibrium of the menu auction game if and only if the following conditions are satisfied:*
*1)* $\mathbf{q}^*$ *is feasible.*
*2)* $\mathbf{q}^* \in \arg\max_{\mathbf{q}} a\mathcal{W}(\mathbf{q}) + C^*(\mathbf{q})$
*3)* $\mathbf{q}^* \in \arg\max_{\mathbf{q}} \mathcal{W}_1(\mathbf{q}) + a\mathcal{W}(\mathbf{q})$
*4)* $\exists \mathbf{q}',\ \mathbf{q}' \in \arg\max_{\mathbf{q}} a\mathcal{W}(\mathbf{q}) + C^*(\mathbf{q})$, *such that* $C(\mathbf{q}') = 0$.

[18] See the appendix for the derivation.

The interpretation of the second condition is that the politician responds optimally to the contribution scheme. The third condition stipulates that the optimal policy maximizes joint welfare of the lobby group and the politician. This is not surprising as the lobby can transfer utility to the politician without further cost. It is the last point which may be more difficult to understand. It states that given the equilibrium contribution schedule the politician is just indifferent between choosing the equilibrium policy $\mathbf{q}^*$ and receiving $C^*(\mathbf{q})$ or choosing some other policy $\mathbf{q}'$ and collecting no contributions. The meaning of this condition becomes more apparent if we state it in the context of our model. Here $\mathbf{q}' = \mathbf{0}$ is the policy the government would choose in the absence of any lobbies and hence with no contributions. Then condition 4 says that the lobby induces the equilibrium policy $\mathbf{q}^*$ at minimum cost as the politician is just indifferent between taking the money and implementing the equilibrium policy or neglecting the contributions of the organized group and maximizing social welfare. In the analysis below, condition 3 will be used to determine the equilibrium policy vector while the last condition pins down the contribution levels of the lobbies.

So far the solution to the menu auction game still seems to be complicated since one has to maximize over a set of functions to find the lobby's optimal strategy. Fortunately one can simplify the problem considerably by focusing without loss of generality on a subset of feasible strategies for the interest group, namely so called truthful strategies. Assuming differentiability of the welfare and the contribution functions[19] note first that the second and third condition together imply *local truthfulness* in the sense that around the equilibrium point $\nabla C^*(\mathbf{q}) = \nabla \mathcal{W}_1(\mathbf{q})$. Bernheim and Whinston (1986b) show that one can go even a step further and restrict the lobby's strategy set to *globally truthful* contribution schedules without loss of generality. They show that each lobby's best response set contains a truthful strategy regardless of the strategies employed by other players. Furthermore, only truthful contribution schedules are immune to pre-play communication in the presence of multiple lobbies and are hence coalition proof. We will therefore restrict attention to these focal strategies in the analysis to come and assume that the contribution schedule of the lobby takes the truthful form

$$C_1^T(\mathbf{q}, b) = \max\{0, \mathcal{W}_1(\mathbf{q}) - b_1\},$$

[19]Grossman and Helpman (1994) argue that differentiability of the contribution function is reasonable since the equilibrium does not change too much if one of the players makes small mistakes.

where $b_1$ is some number chosen by the interest group and denotes the rent the lobby extracts from bribing the policy maker. Note that this simplifies the problem considerably since now one only has to solve for the optimal $b_1$ to find the equilibrium contribution. Hence the contribution function can be obtained by maximizing over a set of numbers and not over a set of functions anymore.

The restriction to globally truthful contribution also makes immediately clear that the equilibrium policy $\mathbf{q}^*$ maximizes the joint welfare of the politician and the lobby. Assuming an interior solution

$$\mathbf{q}^* \in \arg\max_q a\mathcal{W}(\mathbf{q}) + C_1(\mathbf{q}) = a\mathcal{W}(\mathbf{q}) + \mathcal{W}_1(\mathbf{q}) = a\mathcal{W}_0(\mathbf{q}) + (1+a)\mathcal{W}_1(\mathbf{q})$$

has to hold. So as already mentioned above the lobbying process leads the politician to maximize a social welfare function in which the lobby gains an additional weight of 1.

### *1.3.2 The Static Game*

We start the analysis with the simple case in which the game ends after the first period. As we have shown above the problem can be solved by maximizing a social welfare function in which the interest group has an increased weight. Specifically, this welfare function can be written as

$$\begin{aligned} G &= a\mathcal{W}_0(\mathbf{q}) + (1+a)\mathcal{W}_1(\mathbf{q}) \\ &= a[m + S(p(t)) - T(e,t) - \phi(T(e,t))] + (1+a)[\pi(p(t)+t) + e]. \end{aligned} \tag{1.4}$$

The maximization of this function yields the equilibrium policy, while the contribution function the lobby offers is obtained by employing the notion of a truthful strategy and choosing $b$ in a way such that the politician is exactly indifferent between a world where the interest group is active and one where it is not. In the following proposition we summarize the result of the static game:

PROPOSITION 1.1 *The equilibrium policy of the static game is given by* $t^* = 0$ *and* $e^*$ *implicitly defined by* $1 = a\phi'(e^*)$.
*The lobby offers the following contribution schedule:* $C^{T^*} = e - e^* + a\phi(e^*)$.

PROOF: See the appendix.

This result is reminiscent of Dixit, Grossman, and Helpman (1997) as the (more) inefficient transfer instrument is not used in equilibrium. To understand this result remember that the lobby and the politician maximize their joint welfare in equilibrium. Hence, the output subsidy is not used as it leads to a loss of resources. Turning to the contribution function, note that the lobby reimburses the politician exactly for the loss in social welfare it induces by influencing the policy choice. Evaluating $C^{T*}$ at the point $e^*$ immediately reveals that the policy maker gets exactly $a\phi(e^*)$ as a contribution and so is exactly indifferent between setting $e = 0$ (which is his default policy choice in the absence of a lobby group) and implementing $e^*$. Note therefore that the politician gains nothing if only one interest group is active, since he is precisely held down to his reservation utility and the lobby captures all the surplus which is generated by the lobbying process. This is a very important property of menu auctions, as we will see again later in the analysis. Each lobby's rent is determined by the amount the interest group adds to the *joint surplus* of the politician and the lobby by becoming active and bribing the policy maker. That $e^* - a\phi(e^*)$ corresponds to the added joint surplus can easily be seen. Without the lobby, the politician sets $\mathbf{q} = \mathbf{0}$ and the joint surplus is given by $a\mathcal{W}(e = 0, t = 0)$. With an active lobby the optimal policy increases joint welfare by $e^*$ as the lobby gets an additional weight of 1, but welfare is reduced by the redistribution cost $a\phi(e^*)$. The added joint surplus is of course larger if the politician cares less about society's well-being as measured by a decrease in the parameter $a$.

### *1.3.3 The Two Period Model*

*The Final Period*

As shown by Bergemann and Valimaki (2003), the same techniques as developed by Bernheim and Whinston (1986a,b) can be applied to solve dynamic menu auction games. The aim of this section is to show how the second period output subsidy $t^2$ depends on first period policy, especially on the subsidy $t^1$ granted in $\tau = 1$.

We proceed by backward induction and begin our analysis in the second period. Assume that the politician in period 1 has implemented a policy $\mathbf{q^1} = (t^1, e^1)$ which leads the organized industry to employ an amount $z^1(p+t^1)$ of labor.[20] When the second period politician has to decide about the policy $\mathbf{q^2}$, he now also takes into account that a price subsidy in period 2 which is different from $t^1$ leads to a welfare loss. This is due to the fact that the firm responds optimally to equilibrium prices and adjusts the amount of labor employed. Since all workers who have to change their job lose an amount $\vartheta$ of income, welfare in the second period is given by

$$\begin{aligned}\mathcal{W} &= \mathcal{W}_0 + \mathcal{W}_1 \\ &= m + S[\mathbf{p}] - T\left(e^2, t^2\right) - \delta\vartheta\left[z^1(p+t^1) - z^2(p+t^2)\right] - \phi\left[T(e^2,t^2)\right] + \pi\left[p(t^2)+t^2\right] + e^2.\end{aligned}$$

$\delta$ is a dummy variable taking the value 1 if $t^1 \geq t^2$ and $-1$ otherwise. It is obvious that the second period politician will never choose a policy which implements a higher price subsidy than the one already in place. In the following analysis we will assume that $t^1$ is large enough, postponing the exact characterization of $t^1$ until the period 1 lobbying game is examined. Hence, all values derived in this section are properly interpreted as maximum values given that the output subsidy in the first period was at least as large. Since the maximization problem is the same as in the static case, the policy maker will not use the efficient transfer $e^2$ in the absence of an organized lobby group. However, given that a positive price subsidy has been implemented in the first period, the politician has an incentive to at least partially sustain the policy. This can be seen by examining the first order condition of $\mathcal{W}$ with respect to $t^2$:

$$\frac{\partial \mathcal{W}}{\partial t^2} = a\left[-ty'(p+t^2) - \phi'[T(e,t)]\left[y(p+t^2) + ty'(p+t^2)\right] + \vartheta z'^2(p+t^2)\right] = 0.$$

Under the assumption that $\mathcal{W}$ is a concave function, the equation above has a unique solution $t_{-1} > 0$. It is important to note that this solution depends on the price subsidy in period one $t^1$ only insofar as $t_{-1}$ must be smaller than $t^1$. If this were not the case, the policy maker would *create* reallocation of workers instead of avoiding it. Formally, $\delta$ would turn negative and one would have to subtract $\vartheta z_2'(t_2)[p+t^2]$ in the first order condition above and the whole expression would be negative except at $t_{-1} = 0$. So $t_{-1}$ denotes the maximal value of the output subsidy in the second period under the assumption that the subsidy in the first period was at least as large.

[20]Remember that throughout the analysis, subscripts denote the lobby group while superscripts stand for the time period.

The solution $t_{-1}$ will obviously be larger the smaller $\phi'(\cdot)$ and $y'(p+t)$ are, i.e. the smaller the cost of transferring money to the lobby via the output subsidy.
As in the static case, when deciding over the policy the politician maximizes the following expression:

$$\begin{aligned} G^2 &= a\mathcal{W} + \mathcal{W}_1 \\ &= a\left[m + S[p(t^2)] - T(e^2,t^2) - \vartheta\left[z^1[p+t^1] - z^2[p+t^2]\right] - \phi[T(e^2,t^2)]\right] \\ &\quad +(1+a)\left[\pi[p+t^2] + e^2\right] \end{aligned}$$

ASSUMPTION 1.1 *$G^2$ is quasiconcave in $t^2$ and exhibits an interior maximum with respect to $e^2$.*

This assumption is necessary since $G^2$ depends on $t^2$ in two ways: first, increasing $t^2$ leads to a welfare loss lowering $G^2$ and this loss is the larger the larger $t^2$. On the positive side is that increasing $t^2$ saves reallocation costs. This positive effect depends on the labor demand function which normally is convex. Hence we subtract a convex function from a convex function and the assumption makes sure that the welfare loss dominates, leading to a well-behaved objective function. The interior solution with respect to $e^2$ is guaranteed if the redistribution cost function $\phi(\cdot)$ is not too convex and simplifies the analysis considerably.

We will now provide the solution to the lobbying game in the second period.

LEMMA 1.1 *Let $\widehat{t^2}$ be the solution to the following equation:*

$$-(1+a)\left(t^2 y'[p+t^2]\right) + a\vartheta z'(t^2) = 0.$$

*In the second period the politician will implement $\mathbf{q^{2*}} = (e^{2*}, t^{2*})$, where $t^{2*} = \min\{t^1, \widehat{t^2}\}$ and $e^{2*}$ solves $a\phi'[T(e^{2*}, t^{2*})] = 1$.*

PROOF: See the appendix.

The interpretation of this lemma is as follows. First, given that $e^2 > 0$ in equilibrium, the lobby will extract resources from the policy maker until its marginal benefit equals marginal redistribution cost. $t^2$ is characterized by a joint optimality condition of the politician and the interest group. Note that $\widehat{t^2}$ is the maximal sustainable output subsidy in the second period. The equilibrium transfer will be smaller than $\widehat{t^2}$ whenever the subsidy implemented in the first period is smaller. This is an important property of the model. When the lobby tries to increase the output subsidy in the first period it automatically increases the second period subsidy *by the same amount* (so $t^2$ as a function of $t^1$ is the identity function). From this reasoning, one can immediately deduce why no worker reallocation takes place in equilibrium.

*The First Period*

The above analysis was carried out under the assumption that the price subsidy implemented in the first period is positive. This must be the case in order for the equilibrium policy in the second period to entail a positive subsidy. We will now show that in the first period the interest group can decide between two options. First, by trying to receive the subsidy, which comes at a cost in the current period, since part of the transfer which must be paid is lost but increases the rent which can be captured in the second period. Or secondly, by lobbying solely for the efficient transfer, which has no effect on the future.
In order to determine the equilibrium policy of the game we therefore have to investigate first how the rent in the second period varies dependent on the price subsidy in the first period. We start with an important lemma.

LEMMA 1.2 *The optimal price subsidy in the first period $t^{1^*}$ is equal to $t^{2^*}$.*

The proof is obvious and therefore we will only give the intuition for the result. We have already established in the last section that the politician in the second period will never increase the level of the price subsidy, hence $t^{2^*} \leq t^{1^*}$. Now assume that the price subsidy in the first period strictly exceeds the one in the second, i.e. $t^{1^*} > \widehat{t^2}$. Then the interest group and the politician can improve on their joint welfare by reducing the price subsidy in the first period and using the efficient transfer instead. By doing this the rent of the lobby in the second period remains unchanged (since $t^{2^*}$ does not change) but the joint welfare in the first period increases as distortions on the product market are avoided.

We are now in the position to examine the rent the lobby receives in the second period depending on the subsidy in the first one. Again, the politician is exactly indifferent between receiving payments from the interest group and implementing his preferred policy and neglecting contributions altogether. Note that the default policy the politician chooses in absence of the lobby is given by $e^2 = 0$ and $t_{-1}$. Since it is a priori not clear whether $t_{-1}$ is smaller or larger than $t^{2*}$ one has to distinguish between two cases.

First consider the case where $t_{-1} > t^{2*}$. Since $t^{2*}$ and $e^{2*}$ are implemented in equilibrium the rent $b^2$ for the lobby is given by the following condition.[21]

$$a\mathcal{W}(t^{2*}) = a\mathcal{W}(t^{2*}, e^{2*}) + C^2(e^{2*}, t^{2*})$$

$$\Longleftrightarrow$$

$$a\mathcal{W}(t^{2*}) = a\mathcal{W}(t^{2*}, e^{2*}) + \pi(p + t^{2*}) + e^{2*} - b^2$$

Beside the redistribution cost, the welfare of the society is the same. Defining $\bar{T}$ as the equilibrium amount of transfers society has to pay with $a\phi'(\bar{T}) = 1$, we can write $b^2$ as follows:

$$b^2 = a\left[\phi(t^{2*}y(p + t^{2*})) - \phi(\bar{T})\right] + \pi(p + t^{2*}) + e^{2*} \tag{1.5}$$

Now it is important to remember that $t^2$ and $t^1$ vary exactly together in equilibrium as long as $t^1$ is smaller than $\widehat{t^2}$, the maximum output subsidy in the second period. Therefore, one could write $b^2$ as a function of $t^1$ as well by replacing $t^{2*}$ with $t^1$. In what follows it will be convenient to think of $b^2$ as directly controlled by the choice of the subsidy in the first period. One can immediately see that inducing a positive subsidy in the first period might be beneficial for the lobby since it does not have to compensate the policy maker for the full amount of redistribution costs anymore. However, note also that implementing the price subsidy causes a subtle cost for the lobby. Since the sum of transfers to the lobby is bounded by the redistribution cost function at $\bar{T}$, the amount of the lump sum transfer in period 1 shrinks whenever the output subsidy is positive, i.e. $e^{2*} = \bar{T} - t^{2*}y(p + t^{2*})$. In the following lemma we will show that this latter effect dominates whenever $t_{-1} > t^{2*}$.

LEMMA 1.3 *If $t_{-1} > t^{2*}$ the interest group will only lobby for the efficient transfer $e$.*

PROOF: See the appendix.

The intuition behind this result is that for $t_{-1} > t^{2*}$ it is necessary that the cost of redistribution is very low. Hence the cost saving in the second period from inducing the output subsidy

[21] Remember that given $t^{2*}$ it is optimal to have $t^{1*} = t^{2*}$. But that means that the politicians default policy is also $t^{1*}$ and *not* $t_{-1}$ anymore!

in the first period is rather low and the interest group prefers the efficient transfer.[22] Thus, the result makes clear that a politician who puts only little weight on welfare and caters a lot to interest groups (i.e. a politician with a small value of $a$) has an ambiguous effect on welfare: on the one hand total transfers increase but on the other hand, the more efficient transfer instrument is used.

Let us now turn to the second case where $t_{-1} < t^{2^*}$. Here, the contributions of the interest group make it optimal for the politician to increase the subsidy beyond his default policy. To examine the incentives of the lobby to receive such a transfer scheme, we again have to investigate how the rent in the second period depends on the subsidy in the first one. The rent of the lobby is calculated in the usual manner by compensating the politician exactly for the change in welfare induced by the lobbying process. Specifically, the rent $b^2$ can be obtained from the following equation:

$$a\mathcal{W}(t_{-1}) - a\vartheta[z^1(t^1) - z^2(t_{-1})] = a\mathcal{W}(t^{2^*}, e^{2^*}) + \pi(p + t^{2^*}) + e^{2^*} - b^2.$$

Note that no cost stemming from worker reallocation accrues in equilibrium since $t^{1^*} = t^{2^*}$. We can rewrite the above expression to obtain

$$b^2 = a[\mathcal{W}(t^{2^*}, e^{2^*}) - \mathcal{W}(t_{-1})] + a\vartheta[z^1(t^{2^*}) - z^2(t_{-1})] + \pi(p + t^{2^*}) + e^{2^*},$$

which after inserting $e^{2^*} = \bar{T} - t^{2^*}y(p + t^{2^*})$ can be rearranged to

$$\begin{aligned} b^2 \;\; = \;\; & (1 + a)\left[\pi(p + t^{2^*}) - t^{2^*}y(p + t^{2^*})\right] + a\left[t_{-1}y(p + t_{-1}) - \pi(p + t_{-1})\right] \\ & - a[\phi(\bar{T}) - \phi(t_{-1}y(p + t_{-1}))] + a\vartheta\left[z^1(t^{2^*}) - z^2(t_{-1})\right] + \bar{T} \end{aligned} \tag{1.6}$$

From the formula one can see two channels by which it might be beneficial for the lobby to induce a positive price subsidy in the first period. The second and the third term indicate that the interest group does not have to compensate the politician for the full welfare cost but only for the difference between the cost the politician would have been willing to incur in case of no active lobby group and the equilibrium cost. Hence, the interest group reimburses the policy maker just for the difference in redistribution cost and the difference in the deadweight

[22] This point can most easily be seen by looking at the extreme case where total transfers are bounded by $\bar{T}$ but no further redistribution costs accrue. In this case $b^2 = \pi(p + t^{2^*}) + e^{2^*} = \bar{T} - t^{2^*}y(p + t^{2^*}) + \pi(p + t^{2^*})$ and one can immediately see that setting $t^{2^*}$ equal to zero is optimal. The reason is that the lobby does not have to compensate the politician for any redistribution costs and therefore gets transfers for free.

loss which is associated with the inefficient transfer. The second channel, given by the last term, concerns worker reallocation. Since, in the absence of the lobby, the policy maker would tolerate some reallocation, the reservation utility of the politician goes down. This results in less compensation necessary to guarantee the politician's participation. This effect becomes stronger the further $t^1$ is expanded beyond $t_{-1}$.

However the first term in the above expression is an opposite force. Note that this term denotes the difference between what society has to pay for a given level of output subsidy and how much additional profit the output subsidy generates. Since the subsidy leads to an inefficient output expansion of the industry part of the resources spent is lost. This negative effect becomes stronger the higher the output subsidy is and will therefore limit the amount of inefficient redistribution.

After we have characterized the rent in the second period depending on the first period's implemented policy, we can now turn to the policy choice in the first period. If the interest group submits a truthful contribution schedule, it will not only take into account how a certain policy choice affects current profits but also its impact on future payoffs. Clearly, the efficient transfer $e$ does not influence future rents while the output subsidy does. Hence, the contribution schedule offered in the first period reflects both current and future profits:

$$C^1(e^1, t^1) = e^1 + \pi(p + t^1) + b^2(t^1) - b^1.$$

Again the chosen policy will be jointly optimal and maximizes

$$G^1(e^1, t^1) = a\mathcal{W}(e^1, t^1) + C^1(e^1, t^1) \tag{1.7}$$

over the two policy instruments $e^1$ and $t^1$.

The solution to this problem is summarized in the following proposition.

PROPOSITION 1.2 *Given that $t^{2^*} > t_{-1}$, the equilibrium subsidy $t^{1^*} = t^{2^*}$ is implicitly defined by the following equation:*

$$-2(1 + a)t^{1^*}y'(p + t^{1^*}) + a\vartheta z'(p + t^{1^*}) = 0.$$

*The lump sum transfer $e^{1^*}$ is given by $a\phi'[e^{1^*} + t^{1^*}y(p + t^{1^*})] = 1$.*

*The interest group offers the contribution schedule*

$$C^1(e^1, t^1) = e^1 + \pi(p + t^1) - a[\mathcal{W}(t^{1^*}, e^{1^*}) - \mathcal{W}(0, 0)] - \pi(p + t^{1^*}) - e^{1^*}.$$

PROOF: See the appendix.

As the labor demand function $z(p+t)$ is strictly increasing whenever $y'(\cdot) \neq 0$, the output subsidy will be positive in equilibrium. Therefore, we have established that the inefficient transfer is used despite the fact that an efficient redistribution device is available. The intuition for this result can be derived from our discussion of the rent $b^2$. It is shown in the appendix that if the interest group expands the output subsidy beyond $t_{-1}$ the marginal change in the rent is given by

$$\left.\frac{\partial b^2}{\partial t^1}\right|_{t^1 \geq t_{-1}} = -(1+a)t^1 y'(p+t^1) + a\vartheta z'(p+t^1).$$

The interest group thus faces two effects. The first effect is negative and measures the loss of resources the output subsidy entails. This loss accrues both to society (and is therefore weighted with $a$) and to the lobby which forgoes some amount of the transfer.[23]

But as mentioned above, a positive subsidy in the first period leads to overcapacities in the industry and makes the politician reluctant to cut back the transfer in the second period. In the case we consider where $t_{-1} < t^{2*}$, the parameters are such that the policy maker is nevertheless willing to tolerate some amount of worker reallocation in the absence of a lobby. However, this decreases his reservation utility and for this reason the interest group has to pay less compensation. Thus, as $t^1$ is increased beyond $t_{-1}$, the interest group gains exactly the additional welfare loss which would be inflicted on society if the lobby was absent in the second period.

The comparative statics of the equilibrium output subsidy are straightforwardly calculated. As one would expect, the subsidy is increasing in $\vartheta$, the welfare cost of worker reallocation. A more surprising effect is obtained when considering the parameter $a$. As the sign of $\frac{\partial t^{1*}}{\partial a}$ is the same as the derivative of the equilibrium condition for $t^{1*}$ stated in the proposition, we have

$$\text{sign}\left[\frac{\partial t^{1*}}{\partial a}\right] = \text{sign}\left[-2t^{1*}y'(p+t^{1*}) + \vartheta z'(p+t^{1*})\right] > 0.$$

[23] Remember that the total sum of transfers society has to pay for is fixed at $\bar{T}$. If the politician wants to transfer some fixed amount of money to the interest group by using the subsidy the deadweight loss associated with this transfer results in a higher payment for the society. That means that the interest group can extract only a smaller amount of the lump sum transfer. It is for this reason that the loss of resources is additionally weighted with 1.

The last expression is positive at the equilibrium value since the first (negative) term is weighted less while the second positive term is weighted more compared to the equilibrium condition. Thus ceteris paribus politicians who care more about social welfare will implement a higher output subsidy. The explanation for this phenomenon is simple: a higher value of $a$ means that the politician cares more about society's wellbeing relative to interest group profit. Hence, the policy maker is more willing to avoid reallocation cost and to tolerate less industry profits. We subsume the comparative statics of the single lobby model in the following corollary:

COROLLARY 1.1 *The implemented level of the price subsidy is increasing in reallocation cost* $\vartheta$ *and the politician's concern for social welfare* $a$.

To understand the condition for the equilibrium value of the subsidy, note that the interest group's willingness to pay[24] for it consists of two parts: the profit generated by it and the future rent which can be obtained. Hence, when the lobby decides whether to pay for the output subsidy, it takes into account the loss of resources entailed in the first period (which is again given by $(1+a)t^1y'(p+t^1)$). Adding up the first period loss and the change in the second period's rent yields the condition stated in the proposition.
Given the optimal value of the subsidy, the lump sum transfer $e^1$ is expanded until the marginal profit to the firm equals marginal redistribution cost. Once the equilibrium policy is fixed, the contribution schedule can easily be obtained by employing the notion of truthfulness and pushing the politician down to his reservation utility.

In summary, we have established that in a dynamic setting strategic considerations might lead interest groups to lobby for an inefficient transfer. The key in the model is that the preferences of succeeding politicians can be altered through an output subsidy. Specifically, compensation for the second period's policy maker can be lowered as sustaining the output subsidy avoids social costs through worker dismissal.

[24]Remember that we are still considering an equilibrium in truthful strategies so the contribution schedule offered just reflects willingness to pay.

## 1.4 Multiple Lobbies

One cumbersome property of the menu auction approach to lobbying is the fact that with two or more lobbies competition between organized groups gets extremely fierce. If one considers a model with inefficient transfer instruments only, the result that the benefits from lobbying activity go down is still intuitive. However if one allows for the availability of an efficient transfer the rents lobbies can appropriate are immediately driven down to zero. To see the point first note that in static settings only the most efficient redistribution device is employed. Since the politician must still get his reservation utility each interest group must design its contribution schedule in such a way that the policy maker is just indifferent between catering to this interest group or disregarding it altogether. Put differently each interest group must compensate the politician exactly for the joint welfare change of society and all other lobby groups induced by the policy change. So if only the efficient redistribution device is used, how does the utility of the politician change upon a new interest group entering the political arena? Since the well-being of the society as a whole is not affected by lump sum redistribution and the politician does not care which lobby gets the money, the utility of the politician is unaffected by the entry of a new lobby. That means that the policy maker does not lose anything if he disregards one lobby and caters instead to the other one(s), resulting in a very strong bargaining position. Hence the competition between interest groups is of a Bertrand type. By raising its contribution (i.e. lowering the rent) marginally over its rival each lobby can appropriate all the funds which are available. Consequently interest groups will raise their bids until their rent is zero.

This result raises two concerns: first only efficient redistribution takes place in equilibrium, which can hardly be reconciled with reality. Second, each interest group has nothing to gain from the lobbying process and would be as well off by unilaterally withdrawing its contributions. It is important to note that this prisoners dilemma type of situation does not occur if only inefficient transfer instruments are available. As inefficient redistribution causes welfare costs for which the politician must be compensated, each lobby is less aggressive leading to positive equilibrium rents. To save the plausibility of this type of model the extant literature resorted to the following argument:[25] since lobbies fare so poorly in equilibrium they will ex-ante agree on a constitution specifying that interest group are allowed to lobby

[25] See Dixit, Grossman, and Helpman (1997).

only for inefficient transfers. Since it is unclear whether such a contract is enforceable before a court the argument relies at least partially on a repeated game setting in the background. This being said, it seems to be worthwhile to investigate whether competition between lobbies has the same detrimental effect on interest group payoffs in our model.

Throughout we will stick to the same assumptions as in the monopolistic lobby case, except that we now allow for a second organized sector.[26] We will also assume that both industries are completely symmetric and are characterized by the same production technology.

### *1.4.1 The Static Game*

To illustrate the arguments outlined above we will start with the static case. The subscripts 1 and 2 denote the two lobbies.
In the presence of two lobbies which submit truthful contribution schedules the equilibrium policy is determined by the maximization of the following function:

$$G(e_1, e_2, t_1, t_2) = a\mathcal{W} + \mathcal{W}_1 + \mathcal{W}_2. \tag{1.8}$$

As in the setting with only one lobby only the efficient transfer will be used.

PROPOSITION 1.3 *In equilibrium $t_1^* = t_2^* = 0$. The efficient transfers $e_1^*$ and $e_2^*$ are set such that $a\phi'(e_1^* + e_2^*) = 1$.*

PROOF: See the appendix.

First note that the total amount of resources redistributed does not change compared to the single lobby case. Since the cost of redistribution depends on the *sum* of transfers the marginal payment to compensate the politician for the last unit of redistribution still equals marginal benefit of the lobby and is therefore equal to one. The second property of the equilibrium worth emphasizing is that although the total sum of transfers is fixed at $\bar{T}$ it is not clear how $\bar{T}$ is distributed among the groups. This indeterminacy is due to the fact that the policy maker is indifferent about the exact allocation of resources as long as only lump sum payments are used. This leads us directly to the investigation of the equilibrium rents

[26] Since two lobbies are sufficient to drive rents down to zero in the extant literature this assumption seems obvious. An extension to more than two lobbies has no impact on our core results (see section 4.2).

$b_i^*$, $i = 1, 2$.

As outlined before given $b_j^*$ the rent $b_i$ is determined such that the policy maker is indifferent between disregarding lobby $i$'s contribution and just dealing with lobby $j$, $j \neq i$, and taking both contributions into account and changing equilibrium policy accordingly. First of all we need to determine which policy would have been chosen in the absence of one lobby. Since only two industries are organized we can resort to the results of the previous section. Clearly, each lobby would get an amount of $\bar{T}$ of the efficient transfer. We denote the transfer to lobby $j$ in the absence of lobby $i$ with $\tilde{e}_j$. Formally the contribution schedule $C_1(e_1, b_1^*)$ of lobby 1 must satisfy the following requirement:

$$a\mathcal{W}(\tilde{e}_2) + C_2(\tilde{e}_2, b_2^*) = a\mathcal{W}(e_1^*, e_2^*) + C_2(e_2^*, b_2^*) + C_1(e_1^*, b_1^*).$$

The left hand side is the payoff of the politician with just lobby 2 active while at the right hand side both lobbies are active. Note first that the welfare of the society as a whole remains unchanged since the sum of transfers is not altered. Moreover as $\tilde{e}_2 = \bar{T}$ and $e_2^* = \bar{T} - e_1^*$ we can rewrite the above condition employing truthful strategies:

$$\bar{T} - b_2^* = \bar{T} - e_1^* - b_2^* + e_1^* - b_1^* \quad \Rightarrow b_1^* = 0.$$

The problem for lobby 2 is exactly the same so we can conclude that both interest groups derive no benefit from the lobbying process. Thus the static model replicates well known results from the extant literature. Both lobbies bid for transfers which are available in fixed total sum so competition drives their payoffs down to zero.

### *1.4.2 Analysis of the Dynamic Game*

Again we proceed by backward induction and first analyze the second period. Total welfare in the society is given by an expression analogous to the monopolistic case:

$$\mathcal{W} = \mathcal{W}_0(e_1^2, e_2^2, t_1^2, t_2^2) + \mathcal{W}_1(e_1^2, e_2^2, t_1^2, t_2^2) + \mathcal{W}_2(e_1^2, e_2^2, t_1^2, t_2^2) =$$

$$m + S[\mathbf{p}] - \sum_{i=1,2} T_i(e_i^2, t_i^2) - \sum_{i=1,2} \delta_i \vartheta [z_i^1(p + t_i^1) - z_i^2(p + t_i^2)] - \phi \left[ \sum_{i=1,2} T_i(e_i^2, t_i^2) \right] + \sum_{i=1,2} \{\pi_i[p(t_i^2) + t_i^2] + e_i^2\}.$$

$\delta_i$ is an indicator variable which takes on the value 1 if $t_i^1 > t_i^2$ (resulting in a compression of the amount of labor hired in industry $i$) and the value $-1$ otherwise. Some results of the single lobby case naturally carry over to the competitive case. Obviously the politician has no incentive to increase the output subsidy beyond the level stipulated in the first period. Second for the same reasons as in the monopolistic lobby case there will be no worker reallocation in equilibrium or, put differently, the subsidy implemented in the first period will not exceed the one in the second period.

As in the single lobby case we first investigate the maximal sustainable output subsidy in the second period, neglecting the equilibrium level until we analyze the first period of the game. For this we maximize the objective function of the politician

$$G^2(e_1^2, e_2^2, t_1^2, t_2^2) = a\mathcal{W}(e_1^2, e_2^2, t_1^2, t_2^2) + \mathcal{W}_1(e_1^2, e_2^2, t_1^2, t_2^2) + \mathcal{W}_2(e_1^2, e_2^2, t_1^2, t_2^2)$$

we respect to the policy instruments. The following lemma comprises the results.

LEMMA 1.4 *Let $\widehat{t_i}$ be defined by*

$$-(1+a)\widehat{t_i}y'(p+\widehat{t_i}) + a\vartheta z_i'(\widehat{t_i}) = 0, \quad i = 1, 2.$$

*Second period equilibrium policy is given by $\mathbf{q^{2}}^* = (t_i^{2^*}, e_i^{2^*})_{i=1,2}$ with $t_i^{2^*} = \min\{\widehat{t_i}, t_i^1\}$ where $t_i^1$ denotes the output subsidy for industry $i$ implemented in the first period.*
*The equilibrium lump sum transfers are determined by $a\phi'\left(\sum_{i=1,2} T_i(t_i^{2^*}, e_i^{2^*})\right) = 1$.*

PROOF: See the appendix.

The result is striking if one compares the condition for the maximal sustainable output subsidy with the single lobby case. The expressions are equal, meaning that the presence of an additional lobby does not alter the set of possible output subsidies which can be implemented by the interest groups. Again, once the level of output subsidies is fixed the amount of the efficient transfer to each lobby is obtained by equalizing marginal benefit with marginal redistribution cost.

However for the determination of the policy vector actually chosen by the politician one again has to look at the incentives to introduce the inefficient transfer in the first place. As we know already from the analysis of the single lobby case the crucial factor is how the second period equilibrium rent changes with $t_i^1$, the output subsidy implemented in the first period. To obtain this rent we first have to derive the default policy which is implemented in the absence of a lobby.[27] Of course if an interest group is not active it will not receive the

[27] The following analysis is conducted for lobby 1, the problem for lobby 2 is exactly the same.

efficient transfer. The level of the output subsidy instead is determined by the derivative of $G_{-1} = a\mathcal{W} + \mathcal{W}_2$ with respect to $t_1^2$. It can be shown (see the appendix) that

$$\frac{\partial G_{-1}}{\partial t_1^2} = -(1+a)t_1^2 y_1'(p+t_1^2) - y_1(p+t_1^2) + a\vartheta z_1'(t_1^2).$$

It is important to note that the maximizer of this derivative $t_{-1} \geq 0$ is always smaller compared to the monopolistic setting. Again we have to distinguish between two different cases as in the single lobby case. If $t_{-1} > t_1^{1*}$ there is no incentive for the interest group to obtain the output subsidy. In what follows we focus exclusively on the more interesting case where $t_{-1} < t_1^{1*}$.

Knowing the default policy of the politician it is by now straightforward albeit somewhat tedious to calculate the equilibrium rent of lobby 1.

LEMMA 1.5 *The equilibrium rent of lobby* 1 *in the second period* $b_1^{2*}$ *is given by*

$$b_1^{2*} = (1+a)\left[\pi(p+t_1^{2*}) - t_1^{2*} y(p+t_1^{2*})\right] + a[t_{-1}y(p+t_{-1}) - \pi(p+t_{-1})] + a\vartheta\left[z^1(t_1^{2*}) - z^2(t_{-1})\right].$$

PROOF: See the appendix.

The first term measures the welfare loss associated with an output subsidy of $t_1^{2*}$ which is weighted with $1+a$, the weight attached to industry profits by the politician. This is intuitive as the use of the output subsidy reduces the amount of additional profits which can be shifted to the lobby. Both other terms are positive and well known from the discussion of the equilibrium rent in the monopolistic lobby case. The first one displays how much of the output subsidy and thus loss of resources the politician would have been willing to tolerate in the absence of the interest group. The second one indicates the cost of worker reallocation society would have to bear if group one was not active.

It might be surprising that this expression is very similar to the monopolistic case. Comparing the formula above with equation (1.6) the first thing to note is that in the competitive case the interest group does not have to compensate the politician for any redistribution cost. This makes sense since in the monopolistic case the lobby had to reimburse the policy maker for the *additional* redistribution cost caused by active lobbying. Here however, if lobby 1 is not active all resources available for redistribution will flow to lobby 2 resulting in social cost of $a\phi(\bar{T})$ anyway. Besides this the expressions for second period rents are identical but note that $t_{-1}$ is smaller in the competitive case.

For the determination of equilibrium policy however the crucial factor is how $b_1^{2*}$ behaves as $t_1^1$ and therefore $t_1^{2*}$ changes. Assuming that $t_{-1} < t_1^{2*}$ the derivative of $b_1^{2*}$ with respect to $t_1^1$ is given by

$$\frac{\partial b_1^{2*}}{\partial t_1^1} = -(1+a)t_1^1 y_1'(p+t_1^1) + a\vartheta z_1'(t_1^1). \tag{1.9}$$

Note that this expression is exactly identical to the monopolistic case. We are now able to pin down the equilibrium policy vector.

Proposition 1.4 *The equilibrium output subsidies* $t_i^{1*}$, $i = 1, 2$ *are implicitly defined by*

$$-2(1+a)t_i^{1*} y_i'(p+t_i^{1*}) + a\vartheta z_i'(p+t_i^{1*}) = 0.$$

*The equilibrium lump sum transfers* $e_i^{1*}$, $i = 1, 2$ *are given by* $a\phi'\left(\sum_{i=1,2} T_i(e_i^{1*}, t_i^{1*})\right) = 1.$

Proof: See the appendix.

Hence competition between lobbies only affects the amount of the efficient transfer the interest groups can appropriate. The level of the output subsidy does not change. The intuition for this result is as follows. In the competitive case lobby 1 competes for transfers against lobby 2. But in the monopolistic case the interest group also takes into account that if it increases the output subsidy marginally, the amount of the efficient transfer it can appropriate goes down. One can therefore say that the lobby competes against itself. Furthermore equilibrium policy is characterized by a joint optimality condition and for the politician it makes no difference which lobby suffers from a reduction in available transfers. Hence the willingness to pay for the subsidy on the interest group's side and the willingness to give on the politician's side remain unchanged.

Since the equilibrium condition does not change compared to the monopolistic case the same interpretation and the same comparative statics apply. A more interesting point concerns the comparison of social welfare. First of all remember that in the monopolistic case a necessary condition for a positive output subsidy was that the second period policy maker was sufficiently reluctant to transfer resources inefficiently. We stipulated that if the costs of redistribution are too low it is optimal for the interest group to lobby for the efficient transfer only. Intuitively, as the lobby gets any transfer almost costlessly it does not pay to waste resources in the first period to influence the preferences for redistribution of the succeeding politician. This scenario happens in the competitive case only with a smaller probability. Here the presence of another lobby makes it more costly to obtain transfers since interest groups compete against each other. Hence more organized industries make the political equilibrium more inefficient since political insulation of policies becomes more attractive.

A second effect going in the same direction does not concern the probability that the output subsidy is used but the total amount of inefficient redistribution. Since equilibrium subsidies are the same for each lobby independently of the degree of competition, total waste in the economy increases as the number of organized industries goes up. It is also straightforward to see that if the number of active lobbies grows sufficiently large, all resources available for redistribution will be exhausted by subsidy payments. Hence if a society exhibits a growing number of organized special interests, lump sum transfers will no longer be observed in equilibrium.

We can therefore state that more competition among lobbies leads to a more and more inefficient political equilibrium.

## 1.5 Conclusion

The paper has developed a dynamic theory of inefficient redistribution to interest groups. It did so by considering a two period game where in each period interest groups have the possibility to bribe the politician in exchange for a favorable policy. As a main point we have shown that inefficient transfers can occur in equilibrium and that competition between interest groups is not effective in eliminating them but even makes things worse. The paper therefore contributes to our understanding of the lobbying process.

However we have treated some aspects of the game as a black box. First we have an incomplete understanding of which industries manage to get organized and how possible incentive problems within an interest group are overcome. Second politicians are hardly unitary actors but are members of organizations which constrain their behavior. To our knowledge a more explicit modeling of parties has not been embedded into the lobbying literature so far.[28] A

[28] The role of political parties in general is only poorly understood so far. See Caillaud and Tirole (1999), Caillaud and Tirole (2002) and Levy (2004b) for first steps in that direction.

model of the inner workings of parties would also help us to give a more solid microfoundation for the objective function generally assumed in the lobbying literature. For this point see also the discussion in the second section of this paper. Finally instead of assuming that both social welfare and received bribes increase the reelection probability one should incorporate the voting behavior explicitly into the model. Coate (2004a,b) goes along these lines and finds interesting results. More campaign spending does not automatically lead to better reelection prospects as voters anticipate that generous support of the campaign by interest groups must be paid back later in form of favorable policies. It is hence questionable whether more funds translate into higher reelection probabilities.

All of these topics seem to be worth future investigation.

## 1.6 Appendix

Derivation of $\frac{\partial \mathcal{W}}{\partial t}$

$$\frac{\partial \mathcal{W}}{\partial t} = a[-\frac{\partial T}{\partial t} + \frac{d\pi}{dt} - \frac{d\phi}{dT(e,t)}\frac{\partial T}{\partial t}].$$

Using $\pi'(\cdot) = y(\cdot)$ by Hotelling's lemma we obtain

$$a[-y(p+t) - ty'(p(t)+t) + y(p+t) - \phi'(T(e,t))T'(e,t)]$$

Hence we get the desired result:

$$\frac{\partial \mathcal{W}}{\partial t} = a[-ty'(p+t) - \phi'(T(e,t))T'(e,t)]$$

||

Proof of Proposition 1.1

The first order conditions can be written as

$$\begin{aligned} \frac{\partial G}{\partial e} &= 1 - a\phi'(T(e,t)) = 0 \\ \frac{\partial G}{\partial t} &= -aty'[p+t] + y[p+t] - a\phi'(T(e,t))(y[p+t] + ty'[p+t]) \end{aligned}$$

Making use of the fact that in an optimum $a\phi'(T(e,t)) = 1$ the second condition can be written as

$$-(1+a)ty'[p+t] < 0.$$

Hence $t^* = 0$ and $e^*$ is defined by the first condition. To derive the equilibrium rent of the lobby note that the politician must be just indifferent between paying $e^*$ to the lobby and getting the contribution or neglecting the interest group. Hence

$$\begin{aligned} a[\mathcal{W}(e=0)] &= a[\mathcal{W}(e^*)] + C^{T*} \\ &\Leftrightarrow \\ a[\mathcal{W}(e=0)] &= a[\mathcal{W}(e^*)] + \mathcal{W}_1(e^*,t) - b \\ &\Leftrightarrow \\ a[\mathcal{W}(e=0)] &= a[\mathcal{W}(e^*)] + e^* - b \\ &\Leftrightarrow \\ b^* &= e^* - a\phi(e^*) \end{aligned}$$

The contribution function stated in the proposition follows immediately. ||

Proof of Lemma 1.1

Maximization of $G^2$ leads to the following first order conditions:

$$\begin{aligned}\frac{\partial G^2}{\partial e^2} &= -a\phi'(T(e^2,t^2))+1=0\\ \frac{\partial G^2}{\partial t^2} &= a\{-t^2y'[p+t^2]+\vartheta z'^2(t^2)\\ &\quad -\phi'(T(e^2,t^2))[t^2y'[p+t^2]+y[p+t^2]]\}+y[p+t^2]=0\end{aligned}$$

Plugging in $a\phi'(T(e_2,t_2))=1$ in the second equation yields

$$-(1+a)\{t^2y'[p+t^2]\}+a\vartheta z'^2(t^2)=0 \tag{1.10}$$

||

Proof of Lemma 1.2

We plug in $e^{2*}=\bar{T}-t^{2*}y(p+t^{2*})$ in the formula for $b^2$ and form the derivative with respect to $t^{2*}$.

$$\begin{aligned}\frac{\partial b^2}{\partial t^{2*}} &= a\phi'(t^{2*}y(p+t^{2*}))\left[y(p+t^{2*})+ty'(p+t^{2*})\right]+y(p+t^{2*})-t^{2*}y'(p+t^{2*})-y(p+t^{2*})\\ &= a\phi'(t^{2*}y(p+t^{2*}))\left[y(p+t^{2*})+ty'(p+t^{2*})\right]-t^{2*}y'(p+t^{2*}).\end{aligned}$$

Now if $t_{-1}>t^{2*}$ it must be that $\frac{\partial \mathcal{W}}{\partial t}(t^{2*})>\frac{\partial G^2}{\partial t}(t^{2*})$ and hence

$$a\left[-t^{2*}y'(p+t^{2*})-\phi'[T(e,t)][y(p+t^{2*})+ty'(p+t^{2*})]+\vartheta z'^2(p+t^{2*})\right]>$$

$$-(1+a)\{t^{2*}y'[p+t^{2*}]\}+a\vartheta z'^2(t^{2*})$$

$$\Longleftrightarrow$$

$$t^{2*}y'(p+t^{2*})>a\phi'[T(e,t)][y(p+t^{2*})+ty'(p+t^{2*})].$$

Therefore $b^2$ is decreasing at $t^{2*}$ and so it is optimal for the lobby to decrease $t^2$. But since among all positive output subsidies $t^{2*}$ is optimal the best the interest group can do is to set $t^1=t^2=0$. ||

Proof of Proposition 1.2

First we have to derive $b^2$ for the case $t_{-1}<t^1$ which is given by

$$b^2=a[\mathcal{W}(t^{2*},e^{2*})-\mathcal{W}(t_{-1})]+a\vartheta[z^1(t^{2*})-z^2(t_{-1})]+\pi(p+t^{2*})+e^{2*}$$

$$\Longleftrightarrow$$

$$b^2 = a[-t^{2*}y(p+t^{2*}) + \pi(p+t^{2*}) + t_{-1}y(p+t_{-1}) - \pi(p+t_{-1})] - a[\phi(\bar{T}) - \phi(t_{-1}y(p+t_{-1}))]$$
$$+a\vartheta[z^1(t^{2*}) - z^2(t_{-1})] + \pi(p+t^{2*}) + e^{2*}.$$

Taking into account that $e^{2*} = \bar{T} - t^{2*}y(p+t^{2*})$ this reduces to

$$(1+a)[\pi(p+t^{2*}) - t^{2*}y(p+t^{2*})] + a[t_{-1}y(p+t_{-1}) - \pi(p+t_{-1})]$$
$$-a[\phi(\bar{T}) - \phi(t_{-1}y(p+t_{-1}))] + a\vartheta[z^1(t^{2*}) - z^2(t_{-1})] + \bar{T}.$$

We can now calculate the derivative of $b^2$ with respect to $t^{2*}$.

$$\left.\frac{\partial b^2}{\partial t^{2*}}\right|_{t^1 \geq t_{-1}} = \left.\frac{\partial b^2}{\partial t^1}\right|_{t^1 \geq t_{-1}} - (1+a)t^1 y'(p+t^1) + a\vartheta z'(p+t^1).$$

Since $t^{2*} = t^1$, $\frac{\partial b^2}{\partial t^1}$ is the same as $\frac{\partial b^2}{\partial t^1}$.

Having derived this the equilibrium policy is given by the maximization of

$$G(e^1, t^1) = a\mathcal{W}(e^1, t^1) + C^1(e^1, t^1) = a\mathcal{W}(e^1, t^1) + e^1 + \pi(p+t^1) + b^2(t^1) - b^1$$

The first order conditions are given by

$$\begin{aligned}
\frac{\partial G}{\partial e^1} &= -a\phi'(T(e^1, t^1)) + 1 = 0 \\
\frac{\partial G}{\partial t^1} &= -aty'[p+t^1] - a\phi'(T(e^1, t^1))(y[p+t^1] + ty'[p+t^1]) + y[p+t^1] \\
&\quad -(1+a)t^1 y'(p+t^1) + a\vartheta z'(p+t^1) = 0
\end{aligned}$$

Replacing the cost function $a\phi'(\cdot)$ with 1 we obtain

$$-2(1+a)ty'[p+t^1] + a\vartheta z'(p+t^1).$$

$\|$

PROOF OF LEMMA 1.3

The proof is almost identical to the single lobby case. Maximization of $G(e_1, e_2, t_1, t_2) = a\mathcal{W} + \mathcal{W}_1 + \mathcal{W}_2$ with respect to $e_1$, $e_2$, $t_1$ and $t_2$ yields the following first order conditions:

$$\begin{aligned}
\frac{\partial G}{\partial e_1} &= \frac{\partial G}{\partial e_2} = a\phi'\left(\sum_{i=1,2} T_i(e_i, t_i)\right) - 1 \overset{!}{=} 0 \\
\frac{\partial G}{\partial t_i} &= a\left\{-t_i y'[p+t_i] + -\phi'\left(\sum_{i=1,2} T_i(e_i, t_i)\right)[t_i y'[p+t_i] + y[p+t_i]]\right\} + y[p+t_i] \leq 0, \quad i = 1, 2.
\end{aligned}$$

Substituting for $a\phi'(\cdot)$ yields

$$-(1+a)t_i y'[p+t_i] < 0.$$

Hence $t_1 = t_2 = 0$. Plugging that into the first equation gives the equilibrium condition for $e_1$ and $e_2$. ||

PROOF OF LEMMA 1.4

From maximization of $G^2(e_1^2, e_2^2, t_1^2, t_2^2)$ we obtain the following first order conditions:

$$\frac{\partial G^2}{\partial e_i^2} = a\phi'\left(\sum_{i=1,2} T_i(e_i^2, t_i^2)\right) - 1 \stackrel{!}{=} 0$$

$$\frac{\partial G^2}{\partial t_i^2} = a\left\{-t_i^2 y'[p+t_i^2] + -\phi'\left(\sum_{i=1,2} T_i(e_i^2, t_i^2)\right)\left[t_i^2 y'[p+t_i^2] + y[p+t_i^2]\right] + \vartheta z_i'(t_i^2)\right\} + y[p+t_i^2] = 0,$$

$$i = 1, 2.$$

Plugging in for $a\phi'(\cdot)$ yields the condition stated in the lemma. ||

DERIVATION OF $\frac{\partial G_{-1}}{\partial t_1^2}$

$$\frac{\partial G_{-1}}{\partial t_1^2} = -a\left[t_1^2 y'(p+t_1^2) - \phi'\left(T_2(\tilde{e}_2^2, \tilde{t}_2^2) + t_1^2\right)\left[y_1(p+t_1^2) + t_1^2 y_1'(p+t_1^2)\right] + \vartheta z_1'(t_1^2)\right] \leq 0,$$

$$t_1^2 \geq 0, \quad t_1^2 \cdot \frac{\partial G_{-1}}{\partial t_1^2} = 0.$$

Since lobby 2 is active $a\phi'(\cdot) = 1$ in equilibrium. Plugging in yields

$$\frac{\partial G_{-1}}{\partial t_1^2} = -(1+a)t_1^2 y_1'(p+t_1^2) - y_1(p+t_1^2) + a\vartheta z_1'(t_1^2).$$

||

PROOF OF LEMMA 1.5

We will indicate the transfers to lobby 2 in the absence of lobby 1 with a tilde. $b_1^{2^*}$ is characterized by the following equation

$$a\mathcal{W}(\tilde{e}_2^2, \tilde{t}_2^2, t_{-1}) + C_2^2(\tilde{e}_2^2, \tilde{t}_2^2, b_2^{2^*}) \stackrel{!}{=} a\mathcal{W}(e_1^{2^*}, e_2^{2^*}, t_1^{2^*}, t_2^{2^*}) + C_2^2(e_2^{2^*}, t_2^{2^*}, b_2^{2^*}) + C_1^2(e_1^{2^*}, t_1^{2^*}, b_1^{2^*}).$$

Observe that since the condition for $t_i^{2^*}$ is the same in the competitive as in the monopolistic case $\tilde{t}_2^2 = t_i^{2^*}$. Hence we have that

$$C_2^2(e_2^{2^*}, t_2^{2^*}, b_2^{2^*}) - C_2^2(\tilde{e}_2^2, \tilde{t}_2^2, b_2^{2^*}) = e_2^{2^*} - \tilde{e}_2^2.$$

Furthermore as the total sum of transfers is unaffected by the entry of the second lobby redistribution costs remain unchanged. Thus

$$a\mathcal{W}(e_1^{2^*}, e_2^{2^*}, t_1^{2^*}, t_2^{2^*}) - a\mathcal{W}(\tilde{e}_2^2, \tilde{t}_2^2, t_{-1}) =$$

$$a\left[\pi_1(p + t_1^{2^*}) - t_1^{2^*}y_1(p + t_1^{2^*}) + t_{-1}y_1(p + t_{-1}) - \pi_1(p + t_{-1}) + \vartheta\left(z_1(t_1^{2^*}) - z_1(t_{-1})\right)\right]$$

Since $C_1^2(\cdot)$ is truthful we obtain

$$b_1^{2^*} = a\left[\pi_1(p + t_1^{2^*}) - t_1^{2^*}y_1(p + t_1^{2^*}) + t_{-1}y_1(p + t_{-1}) - \pi_1(p + t_{-1}) + \right.$$

$$\left.\vartheta\left(z_1(t_1^{2^*}) - z_1(t_{-1})\right)\right] + e_2^{2^*} - \tilde{e}_2^2 + e_1^{2^*} + \pi_1(p + t_1^{2^*}).$$

The derivation of $b_1^{2^*}$ as stated in the lemma is complete if one sets $\tilde{e}_2^2 = \bar{T} - t_2^{2^*}y_2(p + t_2^{2^*})$ and $e_1^{2^*} = \bar{T} - t_1^{2^*}y_1(p + t_1^{2^*}) - t_2^{2^*}y_2(p + t_2^{2^*}) - e_2^{2^*}$. Substituting gives

$$b_1^{2^*} = (1+a)\left[\pi(p + t_1^{2^*}) - t_1^{2^*}y(p + t_1^{2^*})\right] + a[t_{-1}y(p+t_{-1}) - \pi(p+t_{-1})] + a\vartheta\left[z^1(t_1^{2^*}) - z^2(t_{-1})\right].$$

‖

PROOF OF PROPOSITION 1.4

The procedure should be standard by now. The equilibrium policy maximizes

$$G^1 = a\mathcal{W}(e_1^1, e_2^1, t_1^1, t_2^1) + C_2^1(e_2^1, t_2^1, b_1^2) + C_1^1(e_1^1, t_1^1, b_1^1).$$

Taking into account that the marginal contribution just reflects marginal willingness to pay and considering the impact of a policy on *both* periods, i.e.

$$\frac{\partial C_i^1}{\partial t_i^1} = \frac{\partial \mathcal{W}_i}{\partial t_i^1} + \frac{\partial b_i^2}{\partial t_i^1}$$

yield the following first order conditions:

$$\begin{aligned}
\frac{\partial G^1}{\partial e_i^1} &= -a\phi'\left(\sum_{i=1,2} T_i(e_i^1, t_i^1)\right) + 1 = 0, \quad i = 1, 2. \\
\frac{\partial G^1}{\partial t_i^1} &= -a\phi'\left(\sum_{i=1,2} T_i(e_i^1, t_i^1)\right)[y_i(p + t_i^1) + t_i^1 y_i'(p + t_i^1)] \\
&\quad - a t_i^1 y_i'(p + t_i^1) + y_i(p + t_i^1) - (1 + a)t_i^1 y_i'(p + t_i^1) + a\vartheta z_i'(p + t_i^1) = 0, \quad i = 1, 2.
\end{aligned}$$

Plugging in $a\phi'(\cdot) = 1$ in the second condition immediately gives the equation stated in the proposition. Using the optimal values for the output subsidy in the first equation pins down $e_i^{1*}$.

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# Chapter 2

# Campaign Rhetoric and Policy Making under Career Concerns

## 2.1 Introduction

This chapter deals with the question when and to what extent promises made during an electoral campaign are binding for politicians. It was one of the central insights in the theory of political economy in the recent years that the political arena is plagued by commitment problems. Not only are governments short sighted and do not or only partially internalize the well being of their successors. It is also difficult to bind the hands of political actors by contracts, as once in office they generally have the power to defy the rulings of any enforcing institution (e.g. courts). A host of institutions can be interpreted as an attempt to limit power abuse ex post.[1]

Besides being bound by institutions, the concern about individual (or collective) reputation may act as a constraint on the behavior of political actors. In this paper we focus on the latter mechanism to explore to what degree campaign promises are binding. Although this question is of central importance in any theory of electoral competition, it has received scant attention so far. Persson and Tabellini (2000) (p. 483) summarize the two dominant approaches so far and also point to the unsatisfactory status quo.

> "It is thus somewhat schizophrenic to study either extreme: where promises have no meaning or where they are all that matters. To bridge the two models is an important challenge."

Two reasons can be brought forward for the relevance of this issue. First of all, if campaign promises bear some commitment value, candidates vieing for office will anticipate this and adapt their platforms accordingly. A better conception of the commitment implied by political platforms should therefore foster our understanding of electoral competition. Moreover, given that campaign promises are not pure cheap talk, they influence the policies implemented ex post. Hence, the degree of commitment not only impacts the electoral race but also policy choice.

As mentioned already, this project elaborates on the idea that reputational concerns may make promise keeping optimal. In particular, we focus on a situation where a politician is primarily concerned about the electorate's assessment of his competence. Competence, as

[1] A few seminal contributions are Persson, Roland, and Tabellini (1997), Aghion and Bolton (2003), Aghion, Alesina, and Trebbi (2004), and Messner and Polborn (2004).

defined here, manifests itself in the candidate's capability to identify the policy best suited for the needs of the voters. For example, one could think of the politician's ability to process and distill information in order to find appropriate solutions to political problems. Alternatively, the politician's competence could measure the quality of his advisers or future cabinet.

Our approach is fundamentally different from existing papers where the candidates prime reputational concern is to signal ideological congruence with the (median) voter. Indeed, we will neglect any ideological component throughout the analysis. We do so for several reasons. First, there is ample evidence that the electorate's assessment of a candidate's personal characteristics strongly influences their voting behavior. Markus (1982) finds that in the 1980 election, Carter's defeat against Reagan was not due to ideological differences but purely due to different assessments of personal characteristics such as competence. Peterson (2005) reports that voters in the US base their decision to the same extent on traits as on issues and also shows that voters try to infer traits from political platforms. Second, models that focus on ideology posit that the disciplining role of reputation stems from the fear that once a politician has reneged on his platform, his promises will no longer be believed in the future. The threat of being ousted from office in the future readily explains why promises are kept. However, these models have a hard time in explaining why promises are broken.[2] In particular, why do legislators often deviate on some issues but not on all, where the theory says that independent of the particular deviation at hand, voters should carry out the harshest punishment possible?[3] For example, Harrington (1992) and Ringquist and Dasse (2004) find that between 30% and 40% of campaign promises are broken. Also Budge and Hofferbert (1990), King and Laver (1993), and Poole and Rosenthal (1997) find that political platforms have a partially binding character. The model developed here has the appealing feature that it explains both promise keeping and breaking in a parsimonious framework.

But what exactly are the incentives which govern the politician's decision to keep or break his promises? In the model we will assume that before campaign promises are made and after the election the politician receives information about the optimal course of action. Breaking promises signals to the electorate that the political platform was based on poor information and is therefore a sign of incompetence. To avoid this, a politician can try to gamble or muddle through by sticking to his platform knowing that the implemented policy is likely to fail.

[2]For example, in Aragonès, Palfrey, and Postlewaite (2007) campaign promises are always honored.

[3]In section 5 we will discuss this point in more detail in a model with multiple policy dimensions.

Hence, a central tension exists between the desire to appear competent and the utilization of new information which is available after the election.

That this tension might lead to excessively stubborn behavior has also been recognized by the popular press. Douglas Waller complains in the Times[4] that since "economic conditions are constantly changing [...] assumptions and policy decision made in one year can be DOA by the next." For this reason he wishes "to see politicians be more flexible" and that they "did not keep the promises they make".

In the model we explore the implications of this trade-off on the politician's behavior both at the campaign stage and ex post, after the elections took place. We construct an equilibrium where given the candidate's platforms most of the information available ex post is used. Nevertheless in equilibrium promises will be broken. We furthermore establish that promise breaking signals low competence, so politicians benefit from the perception of having a firm standpoint. This paper therefore endogenizes the cost of breaking campaign promises instead of exogenously assuming it (as e.g. in Banks (1990)). Moreover, we provide a mechanism why politicians who do not change their minds are attributed a valence[5] advantage by the voters. By this, we contribute to a newly emerging literature. An example is Kartik and McAfee (2007) who explore the implications of the electorate's preference for candidates with "character" on electoral competition. We see our paper as complementary to theirs: while we do not model platform choice in as much detail, we investigate post-election behavior explicitly and derive the electorate's preference for candidates keeping their word endogenously.

Moreover the cost of breaking campaign promises need not be uniform across all issues. An advantage of our approach is that we can relate these cost to the environment in which the politician operates, e.g. the degree of uncertainty about his competence or the electorate's capability to assess the appropriateness of a certain policy. We can therefore make specific predictions under what circumstances campaign promises are more credible and which promises will be revised more often.

This chapter proceeds as follows. Following a short review of the related literature, we will present the model. After that the main properties of the equilibrium are derived, followed by an investigation of the voting behavior of the electorate. Section 4 considers extensions of

[4]See "Why some Campaign Promises Should be Broken" in the Times from September 10, 2001.

[5]In this literature the term 'valence' refers to traits or characteristics of the policy maker which influence the electorate's preferences over candidates.

the basic model. The chapter ends with a short conclusion.

### *2.1.1 Related Literature*

The theory developed here attempts to bridge the two dominant approaches to model the link between policy announcements before the election takes place and the actually implemented policy. Hotelling (1929) and Downs (1957) were the first to model electoral competition. They stand for one extreme approach which builds on the assumption that campaign promises are binding. A very much celebrated result of this strand of the literature is the famous median voter theorem which states that political platforms will collapse to the median voter's preferred position. On the other extreme is the literature on post-election politics which presumes that politicians are free to implement whatever policy serves their interests best. This approach, which was pioneered by Barro (1973) and Ferejohn (1986), points to the importance of selecting ideologically congruent politicians. In the so called citizen candidate models, Osborne and Slivinksi (1996) and Besley and Coate (1997) endogenize the pool of candidates running for office.

In an intermediate approach the cost of breaking campaign promises were (exogenously) assumed to be positive but not infinitely high. Banks (1990) studies the implications of this presumption. This work was extended by Callander and Wilkie (2007) who allow for differential cost of breaking campaign promises across candidates. The first idea how to provide a better microfoundation of the incentives politicians face ex post, was to invoke repeated game arguments. The papers by Alesina (1988), Alesina and Spear (1988), Duggan (2000) and Harrington (1993) illustrate how politicians concerned about their reputation achieve to communicate (at least partially) their policy intentions. While in these approaches voters are uncertain about the candidates' ideological leanings, Kartik and McAfee (2007) take a different route. Here politicians try to signal personal traits such as "character" which are valued by the electorate. As we are concerned about competence as a personal trait, our model is close in spirit to them.

We thereby extend a literature which studies electoral competition with vertically differentiated politicians. Bernhardt and Ingerman (1985), Ansolabehere and Snyder (2000), Aragones and Palfrey (2002), and Groseclose (2001) study models of electoral competition where one of the candidates has a valence advantage. In contrast to the approach pursued here, all these models start from the presumption that valence is observable to all voters or, alternatively, can be credibly communicated. Moreover, the candidates can signal their valence only in the campaign stage, while in our model, agents also strive to maintain their reputation after elected into office.

There are relatively few papers which view politicians as "experts" who are concerned about the electorate's assessment of their competence. Canes-Wrone, Herron, and Shotts (2001), Majumdar and Mukand (2004) and Fox (2007) are exceptions which in contrast to this paper focus on the implications of this assumption on policy implementation, but neglect the campaigning stage.

## 2.2 The Model

We consider a model with three players: the electorate and two politicians who compete against each other to win an election by specifying a policy platform $m \in \{a, b\}$.[6] We assume that the platform is non binding, i.e. after the election the successful candidate is free to implement either of two available policies $d \in \{a, b\}$.[7] Making promises to the voters comes at no cost, so the policy platforms are best thought of as pure cheap talk.

Which policy is best for the voters depends on the realization of a state of the world $x \in X = \{a, b\}$. The prior probability of state $a$ being true is denoted by $q \geq \frac{1}{2}$, i.e. the prior is leaning toward state $a$. If the policy implemented fits the state of the world it will yield a positive payoff $\omega = 1$ to the electorate with probability $\lambda$. The wrong policy in turn never generates any positive payoff, hence $\omega = 0$. Formally, we assume that

$$\text{Prob}(\omega = 1 | d = x) = \lambda \quad \text{and } \text{Prob}(\omega = 1 | d \neq x) = 0.$$

It is apparent that in absence of any information about the true state, all voters prefer policy $a$ over $b$, so we can think of policy measure $a$ as a standard course of action. Moreover, it is noteworthy that all members of the electorate share the same preferences, so we can think of the voters as a unitary actor in what follows.

[6] Given that the information structure is binary, it comes without loss of generality to restrict the message space of the politicians to two elements.

[7] Although most models take some interval to be the policy space, our binary specification is not unusual and might in some circumstances even be more plausible, e.g. one either supports or is against stem cell research. See Krasa and Polborn (2007).

Before the politicians specify their platform, they both receive a signal $s \in S = \{a, b\}$ about the true state of the world. The signals are assumed to be conditionally independent. How precise the information of the politician is, depends on his type denoted by $\theta \in \Theta = \{\underline{\theta}, \bar{\theta}\}$, $\bar{\theta} > \underline{\theta}$. The higher type occurs with ex ante probability $p = \frac{1}{2}$ and possesses better information. Specifically, we assume

$$\text{Prob}(s = x|\theta) = \theta, \quad x \in \{a, b\}.$$

Hence the type of the agent denotes his probability of receiving a correct signal. To simplify the exposition we will assume that the bad politician's signal does not contain any information and will set $\underline{\theta} = \frac{1}{2}$. Moreover we make the following assumption concerning the values of $\underline{\theta}$, $q$ and $\bar{\theta}$.

Assumption 2.1 $\bar{\theta} \geq q \geq \underline{\theta}$.

This assumption has the following important implication. If a good politician receives a signal in favor of state $b$ he considers state $b$ more likely to be true than state $a$, since the precision of his information source is high enough to more than offset the prior, which is leaned toward state $a$. The same is not true for the bad agent. Given that $\underline{\theta} \leq q$, the bad politician's information is so noisy that even after $s = b$ the chances to implement the appropriate policy are higher under $d = a$.

Importantly we assume that the politician's type is private information and only known to him. One could think of different information sources that the politician uses the quality of which is not observable to the public. Furthermore, the precision of the information is non verifiable and can therefore not be credibly communicated to the electorate. However, the politician can try to signal his type by the choice of his policy platform and the electorate can condition its voting behavior on the campaign promises made.

After one of the politicians is voted into office he receives a second signal. We assume that this second signal is perfect for both types of politicians, hence independent of competence both candidates learn the true state of the world after the elections. Immediately thereafter the politician in power has to decide over $d$.

Each policy maker is concerned about his reputation. Specifically, we assume that the utility $u_P$ of each candidate is given by the electorate's assessment of his type.

$$u_P = \mathbb{E}(\theta|m,d,\omega) = \text{Prob}(\bar{\theta}|m,d,\omega)\bar{\theta} + \text{Prob}(\underline{\theta}|m,d,\omega)\underline{\theta}, \tag{2.1}$$

where the voters use all of their information $I = (m, d, \omega)$ to compute the politician's expected type. Note that similar to the electorate we abstract from any ideological leanings of the policy makers, as they have no preferences for a specific policy per se.[8] Our "common value" approach where in principle all citizens share the same preferences, has a long standing tradition in the field of Political Economy. Condorcet (1785) was the first one to assess political institutions in the light of their capability to aggregate dispersed information such that the optimal policy for the citizenry could be found. This approach has been revived very recently. Feddersen and Pesendorfer (1996, 1997) put Condorcet's insights on a solid game theoretic basis and showed that this approach remains valid even if preference heterogeneity is introduced.[9] One possible rationale for this approach is that candidates fight primarily for the support of the so called swing voters, i.e. voters who do not have a strong ideological attachment to a certain party. Almost by definition, those voters care less about ideology but may be more concerned about other candidate characteristics. Indeed, Woyke (2005) describes the priority determining the voting behavior of swing voters as follows: "Dabei geht es weniger um detaillierte Problemlösungen, als darum, wem der Wähler die Lösungskompetenz zuschreibt."[10]

Moreover, in addition to the arguments already brought forward in the introduction, our modelling strategy is also supported by the data. Sigelman and Sigelman (1986) find that voters do support a politician even if his policy diverges from their bliss point, if they believe that this divergence is caused by superior information on the politician's side.

The preference configuration we use can be interpreted as a shortcut of a more general dynamic model, where the policy maker's future success, e.g. his reelection probability depends on the electorate's assessment of his valence. The voters do also assess the ability of the

[8]The same assumption is made in the Downsian model.

[9]Piketty (1999) offers a good overview over this branch of research. See also Canes-Wrone and Shotts (2007) for a paper strongly arguing in favor of the assumption that politicians can be viewed as experts holding superior information.

[10]"It is not about detailed solutions to problems but rather, who is attributed the competence to solve the problems."

loosing candidate by conditioning on his platform $m$ and their information about the appropriateness of the platform as revealed by the realization of $\omega$.[11] In what follows we make use of the fact that the expected type can be written as a linear function of the posterior probability of the politician to be competent, since

$$\mathbb{E}(\theta|m,d,\omega) = \underline{\theta} + \pi(m,d,\omega)(\bar{\theta} - \underline{\theta}),$$

where $\pi(m,d,\omega) := \text{Prob}(\bar{\theta}|m,d,\omega)$. Hence to save notation we will define the policy maker's preferences directly over $\pi(m,d,\omega)$.

The electorate's preferences are governed by their desire to elect a competent decision maker and the probability of a correct decision. Competence may be valued beyond its indirect impact on the appropriateness of the policy measure specified in the platform. For example, one could argue that during his term in office the winning candidate must (at least with some probability) handle problems unforeseen at the time the platforms were specified. If competence is correlated across issues, which is a natural assumption if we think of competence as also capturing the quality of the politician's advisers or cabinet, the electorate directly benefits from the selection of able types.

More specifically, we assume that given their information $I$ the voters select a voting strategy to maximize

$$u_E = \eta \text{Prob}(\bar{\theta}|I) + (1-\eta)\text{Prob}(d = x|I). \tag{2.2}$$

The timing of the game can be summarized as follows.

1. Each policy maker receives $s \in \{a,b\}$.
2. Platforms $m \in \{a,b\}$ are announced.
3. Election takes place.
4. Winning candidate learns true state of the world $x$.
5. Winning candidate chooses policy $d \in \{a,b\}$.
6. Realization of success or failure of the policy.

[11] There is evidence that some voters are indeed that sophisticated. See Butt (2006) for an illustration of the electorate's effort to assess the quality of the opposition.

7. Pay-offs are realized.

Each politician's strategy is given by functions $m : S \to \Delta(\{a, b\})$ and $d : S \times X \to \Delta(\{a, b\})$ where $\Delta(\{a, b\})$ denotes the set of probability distributions over the set $\{a, b\}$. The electorate's strategy is given by a voting function $v : \{a, b\} \times \{a, b\} \to [0, 1]$ where $v(\cdot, \cdot)$ gives the probability of voting in favor of candidate 1. In addition the voters use an updating function $B : \{a, b\} \times \{a, b\} \times \{0, 1\} \to [0, 1]$ which gives the posterior probability of facing a good agent given the voter's information $I$. From this they can also compute the probability of a correct policy to be implemented.

Throughout the paper we will focus on Perfect Bayesian Equilibria (PBE). In a PBE each policy maker's strategy must be optimal given the beliefs and the strategy of the other politician and the electorate. Moreover the beliefs are formed through Bayes' Rule whenever possible.

## 2.3 Analysis

Since the political platforms are non binding, the model outlined above is a cheap talk game. It is well known that these games are plagued by a multiplicity of equilibria. In what follows we will restrict attention to an equilibrium with the appealing property that given the platform choice of candidates the maximum amount of information, which is available after the election, is made use of. As we have assumed that politicians learn the true state of the world after the election this is tantamount to an equilibrium where (given the platform choice) the probability of the correct policy measure being implemented is highest. For this to happen, revising one's own previous political position must be least costly. This is the case if the good type always implements the ex post efficient policy.

### *2.3.1 Basic Structure and Results*

Even before the election takes place, the design of the political program may be governed by strategic incentives. In particular, it is tempting to think that the candidates will distort their electoral programs in order to win the election. This is not due to holding office is valuable per se[12], but may be due to the possibility to conceal a faulty political platform. Hence, gaining office may be valuable for pure reputational concerns. This will not be the case, however, since the electorate correctly anticipates the gambling decision and can therefore not be fooled.[13] Hence, in equilibrium the reputational payoffs adjust such that each candidate is indifferent between winning and loosing the election. This has the important implication that the agents will exclusively focus on maximizing their reputation. Equipped with this insight one can prove the following result.

PROPOSITION 2.1 *There exists an equilibrium with the following structure.*[14]

1. *A good politician will always announce $m = s$ and chooses $d = x$.*
2. *The bad politician sets*

$$m = \begin{cases} a & \text{if } s = a \\ a & \text{if } s = b \text{ with probability } 1 - \beta^\star \\ b & \text{if } s = b \text{ with probability } \beta^\star \end{cases}$$

*Moreover the bad politician will stick to his platform even after having learned that it is wrong with probability $\gamma_a^\star \in (0,1)$ if $m = a$ (and $x = b$) and $\gamma_b^\star \in (0,1)$ if $m = b$ (and $x = a$).*

PROOF: See the appendix.

Note that one can sustain an equilibrium where the good agent always behaves efficiently. If he does, however, bad agents will sometimes "gamble" in the sense that they adhere to their platform although there is no chance of success. To understand why this must be the case, consider the opposite. If the politicians were to behave in an ex post efficient manner, the reputation of the agent would be unaffected whether the policy is a success or not. Once the electorate knows whether the politician has received a correct or wrong signal (which it will

[12]Remember that we do not assume any rents from office.

[13]This effect is similar to Stein (1989) where a manager can boost short term profit at the expense of long run performance. Analogous to the reasoning here the manager cannot increase firm value in equilibrium because the market correctly anticipates the manager's behavior.

[14]The equilibrium outlined here comes closest to the equilibria which are commonly studied in the literature experts, see e.g. Levy (2004a) and Ottaviani and Sorensen (2006a,b).

if no agent gambles), the realization of $\omega$ carries no additional information. But as long as the political platform contains some information about the politician's signal, the agent will earn a higher reputation in case of a correct signal. Hence the payoff attainable by sticking to their platform would be higher, so agents would have no incentive anymore to revise the own political program.

In addition to gambling ex post, bad politicians will also distort their political platform. Reporting one's own signal truthfully implies that the reputation does not depend on the platform choice anymore, but only on the realization of $\omega$ and the fact whether the agent has revised his platform. But assumption 2.1 ensures that even after having received a signal in favor of state $b$ the bad agent considers state $a$ more likely to be true. Since his reputation increases if the platform specifies the correct policy, bad types shy away from the non standard policy $b$. Note, however, that the politician will not reveal his posterior either: as his information is too noisy, this would mean to choose an electoral program with the standard policy $a$ all the time. It is then easy to see, that $m = b$ would immediately reveal a good type, so bad agents, despite distorting the platform toward the standard policy, still behave too aggressive. The behavior of the agents in equilibrium and the resulting reputational payoffs are summarized in the next proposition.

Proposition 2.2 *In equilibrium the following relations hold.*

1. *Reputation:* $\pi(b, b, 1) > \pi(a, a, 1) > \pi(b, b, 0) = \pi(b, a, \omega) > \pi(a, a, 0) = \pi(a, b, \omega)$.
2. *Gambling:* $\gamma_a^\star > \gamma_b^\star$.

Proof: See the appendix.

Remember that $\pi(m, d, \omega)$ denotes the probability of facing a good type conditional on having observed platform $m$, decision $d$, and outcome $\omega$. As already indicated above, successful politicians earn a higher reputation compared to their unsuccessful counterparts. While a success reveals that the agent must have received the correct signal, a failure can be attributed to two things: either the politician was just unlucky but has chosen the right policy or his platform was incorrect, but he decided to gamble. Because only bad agents ignore ex post available information, it is the second possibility which drives down reputation. Note also that since a wrong policy never generates a success all agents must be indifferent between a failure and revising their platform. This implies, that the equilibrium has the reasonable feature that reneging on one's own campaign promises is a bad signal about competence. This is a direct consequence from the fact that adjustment of the own position reveals wrong ex ante information.

Hence, the model is insightful from a theoretical point of view as it provides a mechanism which endogenizes the cost of reneging one's own campaign promises. There are some recent papers which analyze electoral competition under the assumption that politicians can deviate from their previous announcement only at a cost. Banks (1990) and Callander and Wilkie (2007) consider settings where politicians with potentially different inclinations to lie bear a cost in case they renege on their initial political platform.

Moreover, the model indicates that the cost of breaking promises is not uniform over policy dimensions, but can be traced back to fundamentals. How bad a platform revision is for reputation is the driving force of the gambling decision. The proposition states that agents who revise a standard political program suffer a sharper loss in reputation. To understand this property of the model, note that promise breaking is the less costly the more often good agents err on a specific platform. As competent candidates always adapt to new information, the electorate knows in this case that even upon observing a platform revision, the probability of facing a good type is still high. Hence, what makes breaking a standard platform so costly is the fact that good agents only rarely make a mistake upon choosing $m = a$.[15] This readily explains the higher gambling incentive in case the agent has chosen the standard platform.

How the cost of promise breaking and hence ex post behavior of the agents is influenced by the environment is presented in the following corollary.

corollary 2.1 *(Comparative Statics)*

1. $\gamma_a^\star$ *increases in* $q$ *while* $\gamma_b^\star$ *decreases in* $q$.

2. *Independently of platform choice, gambling decreases in* $\lambda$ *and increases in* $(\bar{\theta} - \underline{\theta})$.

Proof: See the appendix.

[15] As the prior is based in favor of state $a$ and good agents always choose $m = s$, the good agent is much more likely to choose the right platform upon $s = a$.

The first part of the corollary says that the gambling intensities move in different directions as policy measure $a$ becomes more likely to be optimal. Ceteris paribus, upon observing $(b, b, 0)$ the electorate understands that the higher is $q$ the more likely platform $b$ turned out to be the wrong one. Hence, to a larger extent a failure is attributed to a bad agent being wrong and gambling than to bad luck. This drives down the payoff from sticking to platform $b$ and therefore makes gambling less attractive. Exactly the reverse holds true for $m = a$ which explains the higher gambling incentive for $q$ rising.

Additionally the corollary states that politicians will use more ex post information if their performance can be monitored better. The lower is $\lambda$ the less information the electorate obtains regarding the appropriateness of the implemented policy. Confessing that the own political program is based on incorrect information clearly becomes less attractive under these circumstances. Higher gambling is therefore predicted in those policy areas which have long term consequences and in which the electorate lacks assessment capability. In both cases it is reasonable to assume that the electorate's signal is only loosely related to the optimality of the chosen policy. In the model this is represented by a lower value of $\lambda$.

The last part of the corollary states that higher type uncertainty as measured by the difference between a good and a bad type decreases ex post efficiency. To see why, assume that the information of the good agent becomes better. This depresses the reputation attached to breaking one's own political promises because this payoff depends on how often the good type receives a wrong signal relative to the bad type.[16] Accordingly, sticking to the own platform becomes more attractive. This logic might be especially pervasive in new or quickly changing political fields, where politicians do not have a well established track record and so uncertainty about their competence is highest. According to our theory especially these fields should be characterized by stubborn behavior.

[16] It may be illustrative to take a look at the extreme case where the good agent's signal becomes perfect, i.e. $\bar{\theta} = 1$. As the good agent's signal can never be wrong, revising one's own platform would immediately reveal the bad type, hence gambling will always occur.

### *2.3.2 The Voting Decision*

We have already shown that the politicians in the model simply strive to maximize their reputation and do not care about winning office. Nevertheless it is an interesting question which (if any) platform has an advantage in the electoral race. The answer to that question will crucially depend on the importance voters assign to the selection of able politicians relative to the likelihood of correct decision making.

We will start with the first dimension determining the voting decision, namely the electorate's assessment of the politician's type given the observed platform. In general, one can distinguish two competing forces. To see the point most clearly, assume first that all types of agents truthfully report their information during the campaign (so $\beta = 1$). As incompetent candidates only receive noise they obtain both signals and therefore select both platforms with equal probability. Good types, however, would choose the standard platform $m = a$ more often.[17] Thus, under truthful reporting the composition of agents choosing $m = a$ is better. However, we know already that through the desire to appear competent bad types distort their platform and shy away from $m = b$. It turns out that this countervailing effect is stronger.

LEMMA 2.1 *The electorate's assessment of the agent's type is higher after having observed* $m = b$.

PROOF: See the appendix.

Note that this lemma makes intuitive sense given that we have already seen that higher reputational payoffs can be earned with the non standard platform.

The lemma substantiates the feeling of a tension between competence and populism. Carrillo and Castanheira (2007) report several circumstances where parties adopting centrist platforms lost elections by a landslide mainly because the electorate's assessment of their valence deteriorated. They offer an explanation based on moral hazard problems. When selecting a non-centrist platform a politician handicaps himself since his program is inferior from an ideological point of view. To retain a chance of winning, the program must be superior in a

[17] This is a direct consequence from state $a$ being more likely and the good politicians receiving a signal correlated with the state.

second dimension, e.g. quality. Since the electorate can observe the program's quality with some probability, non centrist platforms are a signal of effort exertion.[18]

It is not straightforward to relate our theory to Carrillo and Castanheira (2007) as we do not consider an ideological policy space. What both theories have in common, however, is the fact that policy platforms contain information about some characteristic of the policy maker. In that sense, centrist platforms in Carrillo and Castanheira (2007) can be compared to the expected platform $m = a$ here since both contain unfavorable news; shirking in Carrillo and Castanheira (2007), lower competence here. If one is willing to accept this analogy, our theory which stresses an adverse selection effect can be regarded as complementary. Unexpected or "non centrist" platforms are adopted predominantly by more competent candidates. Our focus on reputational concerns allows us also to relax ex ante observability and therefore voter sophistication requirements. For the reputational mechanism to operate it is sufficient if the electorate can (at least with some probability) assess the appropriateness of a policy *after* implementation.

In its spirit our signaling mechanism is also closely related to Kartik and McAfee (2007) and it might be interesting to draw a comparison. In Kartik and McAfee (2007) politicians stick to their platform in order to signal "character" which for exogenous reasons is valued by the electorate.[19] The farer away an observed political program is from the median voter's position, the more likely the corresponding politician possesses character. Hence our model shares a central prediction with them: more extreme and unexpected policy announcements are made by candidates who have a valence advantage.

There is some evidence that lends support to our modeling strategy as it suggests that voters do value competence over other personal characteristics which may be incorporated in the term "character". Greene (2001) and Newman (2003), for example, report that the electorate's assessment of competence is more important for approval rates than integrity.

[18] This kind of handicapping can also work within a party. If the party's leadership has preferences different from the rank and file, then the rank and file's support for the leadership may also signal competence to the voters. See Caillaud and Tirole (1999, 2002) for an exposition of that idea.

[19] A politician with character here is bound to reveal his policy intentions truthfully, i.e. he bears an infinite cost of lying.

The second dimension voters may care about is the likelihood that a correct policy is implemented. The respective probabilities are given by

$$\begin{aligned}\text{Prob}(d = x|m = a) &= \lambda\left[1 - \frac{(1-p)(1-q)(1-\underline{\theta}\beta)\gamma_a}{\text{Prob}(m = a)}\right] \\ \text{Prob}(d = x|m = b) &= \lambda\left[1 - \frac{(1-p)q(1-\underline{\theta})\beta\gamma_b}{\text{Prob}(m = b)}\right]\end{aligned}$$

Both expressions have a straightforward interpretation and illustrate nicely the main forces at work. A prerequisite for a successful outcome conditional on $m$ is that the ex post correct decision is taken (the terms in squared brackets). This will always happen besides a bad agent (who occurs with probability $(1-p)$), who has chosen the wrong platform (which happens with probability $(1-q)(1-\underline{\theta}\beta)$ if $m = a$ and with probability $q(1-\underline{\theta})\beta$ if $m = b$ was selected) decides to gamble (respective probabilities $\gamma_a$ and $\gamma_b$).
The two expressions point to three main effects. First of all, there is the *composition effect* which we have already derived in the lemma above. As bad agents shy away from the unexpected platform the chance of facing a good candidate is higher under $m = b$, i.e. $(1-\underline{\theta})\beta < (1-\underline{\theta}\beta)$. Although the average type selecting the non standard platform is better, the likelihood that this platform was incorrectly adopted is larger. This is a simple consequence from the fact that state $a$ occurs with a higher probability (in general, $(1-q)(1-\underline{\theta}\beta) < q(1-\underline{\theta})\beta$ as we will see below). We call this effect the *error probability effect*. Lastly, even if a non standard program turns out to be wrong ex post, we cannot conclude that an inappropriate policy will be implemented. This is because we already know that politicians are more inclined to gamble given that they have selected $m = a$, what we will call the *gambling effect*.

Unfortunately it turns out that the interaction of these effects is highly complex, so it is not possible to analytically derive conditions which pin down the probabilities of correct decision making. Instead we resort to numerical simulations of the model. In all tables we fixed the values of $q$ and $g$ and varied the observability parameter $\lambda$. The difference between tables 1 and 2 is that $q$ increases from 0.6 (table 1) to 0.7 (table 2) while $\bar{\theta}$ is held constant at 0.8.

Before we turn to the success probabilities let me explain first the behavior of the endogenous variables $\beta$ and $\gamma_i$ dependent on parameter values. As one can directly see, $\beta$ decreases in both the observability parameter $\lambda$ and the prior $q$. This makes intuitive sense. As the bad agent is concerned about adopting the correct platform he will opt more often for $m = a$

**Table 1:** Numerical Simulations, $q = 0.6$, $\bar{\theta} = 0.8$

| | | **Comp. Effect** | | **Error Prob. Effect** | | **Gambling** | | **Sucess Prob.** | |
|---|---|---|---|---|---|---|---|---|---|
| $\lambda$ | $\beta$ | $\frac{1-\underline{\theta}\beta}{\text{Prob}(m=a)}$ | $\frac{(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\frac{(1-q)(1-\underline{\theta}\beta)}{\text{Prob}(m=a)}$ | $\frac{q(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\gamma_a$ | $\gamma_b$ | $\Pr(d=x\|m=a)$ | $\Pr(d=x\|m=b)$ |
| 0.2 | 0.875 | 0.501 | 0.498 | 0.200 | 0.299 | 0.621 | 0.511 | **0.175** | 0.169 |
| 0.3 | 0.876 | 0.502 | 0.497 | 0.201 | 0.298 | 0.606 | 0.488 | **0.264** | 0.256 |
| 0.5 | 0.865 | 0.503 | 0.496 | 0.201 | 0.297 | 0.562 | 0.429 | **0.443** | 0.436 |
| 0.7 | 0.857 | 0.505 | 0.493 | 0.202 | 0.296 | 0.482 | 0.333 | **0.632** | 0.631 |
| 0.8 | 0.853 | 0.506 | 0.492 | 0.202 | 0.295 | 0.409 | 0.261 | 0.734 | **0.738** |
| 0.9 | 0.851 | 0.506 | 0.491 | 0.203 | 0.295 | 0.281 | 0.158 | 0.849 | **0.858** |

**Table 2:** Numerical Simulations, $q = 0.7$, $\bar{\theta} = 0.8$

| | | **Comp. Effect** | | **Error Prob. Effect** | | **Gambling** | | **Sucess Prob.** | |
|---|---|---|---|---|---|---|---|---|---|
| $\lambda$ | $\beta$ | $\frac{1-\underline{\theta}\beta}{\text{Prob}(m=a)}$ | $\frac{(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\frac{(1-q)(1-\underline{\theta}\beta)}{\text{Prob}(m=a)}$ | $\frac{q(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\gamma_a$ | $\gamma_b$ | $\Pr(d=x\|m=a)$ | $\Pr(d=x\|m=b)$ |
| 0.2 | 0.751 | 0.502 | 0.497 | 0.151 | 0.348 | 0.661 | 0.434 | **0.180** | 0.170 |
| 0.3 | 0.745 | 0.503 | 0.495 | 0.151 | 0.347 | 0.650 | 0.405 | **0.271** | 0.257 |
| 0.5 | 0.733 | 0.505 | 0.491 | 0.151 | 0.344 | 0.617 | 0.346 | **0.453** | 0.440 |
| 0.7 | 0.720 | 0.508 | 0.487 | 0.152 | 0.340 | 0.552 | 0.254 | **0.641** | 0.639 |
| 0.8 | 0.714 | 0.509 | 0.485 | 0.153 | 0.339 | 0.488 | 0.191 | 0.740 | **0.748** |
| 0.9 | 0.710 | 0.510 | 0.483 | 0.152 | 0.338 | 0.362 | 0.110 | 0.850 | **0.867** |

if he assigns a higher probability to state $a$ being true. If monitoring becomes better ($\lambda$ goes up) this effect is amplified. Higher observability implies that the electorate attributes failures more strongly to a wrong policy choice instead of bad luck. Since the wrong policy is only implemented by bad candidates, preventing a failure becomes more important, hence $\beta$ declines. A very similar intuition applies to the gambling decision. With a low degree of monitoring, revising one's platform and thereby confessing a wrong platform choice is rather unattractive since the electorate cannot tell apart wrong policies from bad luck. Hence, gambling increases as observability deteriorates.

Comparing tables 1 and 2 one can see that the change in $q$ has nearly no effect on the composition of agents. The higher error probability given platform $b$ in table 2 can therefore almost fully be attributed to the smaller prior probability of state $b$ occurring. However, turning to the success probabilities, the higher probability of having selected $m = a$ correctly is almost completely offset by the change in the gambling intensities. To understand this effect, remember that able candidates always report their signal in the campaign stage. As $q$ increases, the likelihood that a good type has incorrectly adopted platform $a$, and therefore the probability that a good type revises this platform, goes down. But this, in turn, makes incompetent candidates much more hesitant to revise their former positions, since the cost in terms of reputation goes up (e.g. for $\lambda = 0.7$, $\gamma_a$ rises from 0.482 to 0.552 as $q$ increases from 0.6 to 0.7). The reverse effect holds true for $m = b$. Note that here the probability of correct decision making actually *increases* as $q$ goes up, i.e. the higher error probability is more than compensated by lower gambling.

Comparing success probabilities across platforms we can see that given $\lambda$ is high enough, candidates which have chosen the ex ante unexpected program will implement the appropriate policy more often. For low values of observability, gambling is pervasive across all platforms, so the error probability effect dominates. As monitoring improves, two effects contribute to the higher success probabilities. First, $\beta$ goes down, i.e. incompetent types choose better platforms. Second, the gambling incentive goes down, but it does so asymmetrically. While gambling is still rather common given $m = a$, it rapidly decreases under $m = b$ (e.g., if $q = 0.7$ and $\lambda = 0.9$ gambling is more than three times as likely under $m = a$ compared to $m = b$). As soon as $\lambda$ passes some threshold value, the gambling effect drives the success probability given $m = a$ below the one given $m = b$.

To examine the robustness of these results, we can compare these findings with tables 3 and

4 which can be found in the appendix. Here we leave $q$ constant at 0.6 and vary $\bar{\theta}$ from 0.7 in table 3 to 0.9 in table 4.[20] As one can see immediately, the qualitative results are very similar. Again the composition and the error probability effect stay almost constant as $\bar{\theta}$ increases. However, a higher spread between types has dramatic consequences for the gambling propensities. The better the good agent becomes the less likely he runs on a wrong platform, which makes incompetent candidates much more reluctant to utilize new information if it is in conflict with their platform. As a consequence the success probabilities across all platforms decline. Again, for low values of observability, a standard platform is conducive to correct decision making ex post, while the reverse is true for higher values of $\lambda$. We can summarize the consequences of the preceding discussion on the voting decision as follows.

Observation 2.1 *(Voting Decision)*

1. *Voters will always vote for a candidate with platform b (if there is any) if $\lambda$ is high enough.*

2. *If $\lambda$ is low* **and** *$\eta$ is low enough, a candidate with a standard platform (if there is any) wins the election.*

Remember that $\eta$ measures the importance of selecting an able politician. Candidates with $m = a$ are only preferred by the electorate if they implement the correct policy more often (i.e. $\lambda$ must be low enough) and the voters are sufficiently concerned about correct decision making (i.e. $\eta$ is low enough). In all other circumstances the electorate will vote for politicians with program $b$, since we have seen that running on platform $b$ contains favorable news about the agent's type. Given that both candidates specified the same program, the electorate is indifferent between them and votes for either of the two.

## 2.4 Extensions

In this section we will consider an alternative equilibrium structure and will extend the model to multiple policy dimensions.

[20]The qualitative results do not hinge on by how much $\bar{\theta}$ is increased.

### *2.4.1 Candidate Ambiguity*

It is well known and often complained about that candidates in an election refuse to make clear statements but deliberately choose ambiguous positions. This insight goes back at least to Downs (1957) who noticed that at the "critical issues" the candidate's incentive to "becloud their policies in a fog of ambiguity" is highest.

The model outlined here is a natural framework to study ambiguous platforms. Note that as ambiguity is best understood as a less than perfect correlation between platforms and implemented policies, all candidates in the equilibrium studied so far are to some extent ambiguous. In what follows we want to show that if the importance of correct decision making becomes sufficiently high, an even higher degree of ambiguity might be optimal for the citizens.

To see this, assume that policy platforms are completely unrelated to the politician's information. If that is the case the candidates bear no reputational cost if they adapt their platform to new information, nor do they benefit from sticking to their positions. This is true, since the electorate (knowing that platforms are pure "babbling") cannot draw any inference about competence from platform choice and subsequently implemented policies, as these choices do not depend on the agent's type.[21] It is therefore optimal for both candidates to make use of all ex post available information. Moreover, if the electorate believes that platforms are unrelated to information, it should not pay any attention to them. This, in turn, makes it (weakly) optimal for the candidates to "babble" when specifying their platforms. We can summarize the preceding discussion in the following proposition.

Proposition 2.3 *There exists an "babbling" equilibrium with the property of efficient decision making ex post which is optimal for the citizens as soon as correct decision making becomes important enough (i.e. for $\eta$ sufficiently low).*

The downside of this kind of equilibrium is that it makes both types of candidates indistinguishable ex ante. Hence, the less information is contained in the platforms, the worse selection of candidates will be.

The explanation for ambiguity we offer differs from existing approaches which emphasize the policy maker's endeavor to hide his true policy preferences from the electorate in order to

[21] Ex ante, platform choice does not depend on information while ex post both types of agents hold the same information.

increase his election probability.[22] In contrast to the theory outlined here, ambiguity there always harms voters and can therefore only be sustained in equilibrium if some degree of ambiguity is inevitable. Otherwise voters could (and had an incentive to) punish candidates by not electing them. We show instead that ambiguity can even be in the interest of the voters, if they care sufficiently about the implementation of the best policy measure. It may then well be optimal to exchange the screening of candidates for their higher propensity to utilize ex post available information.[23]

Coming back to the introductory quotation by Downs that candidates are especially prone to ambiguous platforms on the "critical" issues, we can speculate about the following rationale. It may well be an optimal social arrangement that political candidates are ambiguous in those dimensions where binding one's hands is expensive (e.g. where correct decision making is important, i.e. the "critical" ones), while they try to differentiate themselves by signaling their type in the remaining dimensions. This discussion already suggests the importance of a multidimensional specification of the model. This is, where we turn to next.

### *2.4.2 Multiple Policy Dimensions*

The main purpose of this section is to extend the model to multiple policy dimensions and to show that an equilibrium analogous to the one studied in the previous part of the paper still exists. Such an equilibrium has the interesting property that the candidates will renege on a *subset* of their campaign promises with positive probability. This is fully in line with the empirical evidence that has established that on average politicians break between 30% and 40% of their promises.[24]

However, previous models that employ a repeated game logic to show how politicians can be restrained, have a difficult time establishing partial promise breaking. In these models, politicians are disciplined through the threat from being never elected again once they renege on their platform. From the theory of optimal penal codes in repeated games (see Abreu (1988)) we know that citizens can achieve maximal deterrence by employing the harshest

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[22] See Alesina and Cukierman (1990) for an exposition of this idea.

[23] An explanation for ambiguity which also stresses the value of being unconstrained in decision making after the election, has also been offered by Glazer (1990) in a framework where candidates' platforms are binding.

[24] See Harrington (1992), Ringquist and Dasse (2004) , Budge and Hofferbert (1990), King and Laver (1993), and Poole and Rosenthal (1997).

possible punishment, once a deviation took place. This implies that every politician who has reneged on only one of his promises is permanently expelled from office.[25] This clearly renders selective promise breaking suboptimal. We should either observe promise keeping in all dimensions or defections across (almost) all political issues.

In contrast to this kind of mechanism, the theory outlined here naturally generates partial promise keeping when extended to multiple policy dimensions. we show in Appendix B, that an equilibrium exists where candidates' gambling decision is independent across policy dimensions, so that with strictly positive probability selective promise breaking will occur.

PROPOSITION 2.4 *In the multidimensional model it can be optimal for the agents to renege on a subset of their promises.*

PROOF: See Appendix B.

## 2.5 CONCLUSION

In this chapter we developed a model where the politician's main concern was the electorate's assessment of his competence. In contrast to the literature where agents are differentiated through different levels of valence which they can signal through platform choice, here candidates can influence the perception of their competence both before and after the elections. A central tension exists in the model between the agent's desire to uphold his reputation and adapting to new information. This set up enables us to study the incentives to keep or break campaign promises. We established that an equilibrium can be supported where agents distort their platform but where a substantial amount of ex post available information is utilized. In this equilibrium agents who choose unexpected platforms earn a higher reputation. For his reason those platforms are adopted inefficiently often.

We also examined which incentives govern the politician's policy implementation decision. In particular, we related the propensity to break campaign promises to the environment in which the politician operates, for example, the degree of uncertainty about a candidate's competence, the amount of observability or the electorate's assessment capability of the appropriateness of a given policy measure, and the ex ante probability of a certain policy to be

[25]See also Bernheim and Whinston (1990) who employ this logic to study collusion under multimarket contact.

optimal. Moreover, the model additionally gives a rationale for the optimality of ambiguous platforms and the widely observed behavior of politicians to renege on a subset of their campaign promises.

A natural next step would be to integrate an ideological dimension in a nontrivial way into the model. This would allow us to study the interaction of the politician's desire to appear competent with the temptation to follow his own most preferred agenda. Furthermore, it seems worthwhile to investigate multiple policy dimensions in more detail. Some issues we have only touched upon could then be analyzed more thoroughly. For example, it would be interesting to explore further on which issues candidates prefer to appear ambiguous. Moreover, there could be interesting interactions between the decision to revise one's platform across different dimensions, an issue we did not examine in the previous section.

## 2.6 Appendix

### 2.6.1 Appendix A: Proofs of Section 2.3

Proof of proposition 2.1

First of all we will define the reputational values attached to different outcomes $(m, d, \omega)$, given the equilibrium structure laid out in the text. To make the interpretation of the expressions clear we will not replace $\underline{\theta}$ and $p$ with $\frac{1}{2}$.

$$\pi(b,b,1) = \frac{p\bar{\theta}(1-q)\lambda}{p\bar{\theta}(1-q)\lambda + (1-p)[(1-q)\underline{\theta}\beta\lambda]}.$$

A good agent chooses $m = b$ if he receives a signal in favor of state $b$. He will stick to his announcement if it was correct, which happens with probability $\bar{\theta}(1-q)$. Given this, a success will realize with probability $\lambda$. Therefore, $p\bar{\theta}(1-q)\lambda$ is the probability of facing a good agent given the electorate observes $(b, b, 1)$. Analogously, $(1-p)[(1-q)\underline{\theta}\beta\lambda]$ denotes the probability that a bad agent generates realization $(b, b, 1)$. Notice that this expression does not depend on $\gamma_b$, since given that a policy proves to be successful, the electorate knows with certainty that the agent has not gambled.

The remaining probabilities can be interpreted in a completely analogous way.

$$\pi(b,b,0) = \frac{p\bar{\theta}(1-q)(1-\lambda)}{p\bar{\theta}(1-q)(1-\lambda) + (1-p)[(1-q)\underline{\theta}\beta(1-\lambda) + q(1-\underline{\theta})\beta\gamma_b]}.$$

If the voters observe a failure they attribute this in part to bad luck, as the agent might still have chosen the right policy (the probability of this is given by all terms which are multiplied by $(1-\lambda)$). However, a failure might also be due to a bad agent whose policy platform was wrong and who decided to gamble (the last term in the denominator).

$$\pi(b,a,\omega) = \frac{p(1-\bar{\theta})}{p(1-\bar{\theta}) + (1-p)(1-\underline{\theta})\beta(1-\gamma_b)}$$

It is important to observe that as soon as the agent revises his electoral platform, his reputation no longer depends on the realization of $\omega$. When changing his policy, the agent admits that he has received a wrong signal. In this case the realization of a success or failure does not contain any additional information about the agent's type anymore.

The same explanations given above hold also true for the reputation obtained under $m = a$.

$$\pi(a,a,1) = \frac{p\bar{\theta}q\lambda}{p\bar{\theta}q\lambda + (1-p)q(1-(1-\underline{\theta})\beta)\lambda},$$

$$\pi(a,a,0) = \frac{pq\bar{\theta}(1-\lambda)}{pq\bar{\theta}(1-\lambda)+(1-p)[q(1-\beta(1-\underline{\theta}))(1-\lambda)+(1-q)(1-\underline{\theta}\beta)\gamma_a]},$$

$$\pi(a,b,\omega) = \frac{p(1-\bar{\theta})}{p(1-\bar{\theta})+(1-p)(1-\underline{\theta}\beta)(1-\gamma_a)}.$$

Next, we will show that the strategies specified in the text constitute an equilibrium. We will start with the proof for the existence of $\gamma_a^\star$ and $\gamma_b^\star$.

The bad agent will gamble with a positive probability if he is exactly indifferent between revising and sticking to his platform, after having learned that his policy announcement was wrong. Sine he knows that gambling cannot produce a success the incentive constraint is given by

$$\pi(b,a,\omega) = \pi(b,b,0),$$

in case of $m = b$. Note that $\pi(b,a,\omega)$ is strictly increasing while $\pi(b,b,0)$ is strictly decreasing in $\gamma_b$. Setting $\gamma_b = 1$ cannot be an equilibrium as retracing one's platform would then reveal to be a good type. If $\gamma_b = 0$ , $\pi(b,b,0) = \frac{p\bar{\theta}}{p\bar{\theta}+(1-p)\underline{\theta}\beta}$ which is strictly larger than $\pi(b,a,\omega)$ under $\gamma_b = 0$. By the intermediate value theorem there must exist a $\gamma_b^\star \in (0,1)$, such that $\pi(b,a,\omega) = \pi(b,b,0)$.

Analogously we show the existence of $\gamma_a^\star$. The incentive constraint here is given by

$$\pi(a,b,\omega) = \pi(a,a,0).$$

By the same argument as above, $\gamma_a = 1$ cannot be an equilibrium. If $\gamma_a$ goes to zero, we obtain

$$\pi(a,a,0) = \frac{p\bar{\theta}}{p\bar{\theta}+(1-p)(1-\underline{\theta}\beta)} > \frac{p(1-\bar{\theta})}{p(1-\bar{\theta})+(1-p)(1-\underline{\theta}\beta)} = \pi(a,b,\omega).$$

Again by the intermediate value theorem the existence of $\gamma_a^\star \in (0,1)$ is guaranteed.

If the incentive constraints above are satisfied, both types of agents will find it optimal to stick to their policy platform given $m = b$ if it is correct as

$$\pi(b,a,\omega) < \lambda\pi(b,b,1) + (1-\lambda)\pi(b,b,0),$$

where the right hand side denotes the politician's expected reputation by sticking to his campaign promise. The same argument holds if $m = a$.

Next we will focus on the existence of $\beta^\star$. To determine the bad agent's incentives to manipulate his platform one has to consider the following incentive constraint which must hold in case the agent has received $s = b$:

$$(1-q)\underline{\theta}[\lambda\pi(b,b,1) + (1-\lambda)\pi(b,b,0)] + q(1-\underline{\theta})\pi(b,a,\omega) =$$
$$q(1-\underline{\theta})[\lambda\pi(a,a,1) + (1-\lambda)\pi(a,a,0)] + (1-q)\underline{\theta}\pi(a,b,\omega).$$

The left hand side denotes the expected utility of the agent if he decides to follow his signal. Given that $s = b$ state $b$ will realize with probability $\text{Prob}(x = b|s = b) = \frac{(1-q)\underline{\theta}}{(1-q)\underline{\theta}+q(1-\underline{\theta})}$. In that case the agent will stick to his platform and receives either the payoff attached to a success $\pi(b,b,1)$ with probability $\lambda$ or the reputation associated with a failure. With probability $\text{Prob}(x = a|s = b) = \frac{(1-\underline{\theta})q}{(1-q)\underline{\theta}+q(1-\underline{\theta})}$ the signal was wrong and the agent receives $\pi(b,a,\omega)$. The right hand side of the equation in turn is the expected payoff under policy $a$. We will prove the existence of $\beta^\star$ by using the intermediate value theorem again. For this note first that all reputational payoffs associated with action $b$ are decreasing in $\beta$ while the reverse is true for the payoffs under $m = a$. Moreover, both sides are continuous functions of $\beta$.

It is straightforward to see that $\beta = 0$ can never be an equilibrium, since then $m = b$ would only be chosen by the more competent agent, hence the left hand side would exceed the right hand side. Consider now the case of $\beta = 1$. Then $\pi(b,b,1) = \pi(a,a,1)$. For the incentive constraint to be satisfied, $\pi(b,a,\omega)$ must be larger than $\pi(a,b,\omega)$ since the payoff in case of a successful policy accrues with a smaller probability if $d = b$. For this to be true, $\gamma_a < \gamma_b$ must hold. But straightforward calculations reveal that under $\gamma_a < \gamma_b$ we obtain that $\pi(b,b,0) > \pi(a,a,0)$ holds, a contradiction given the equilibrium condition for the $\gamma_i$. Hence given equilibrium values $\gamma_i^\star$, the right hand side exceeds the left hand side for $\beta = 1$. Hence, the constraint must be satisfied for some intermediate value $\beta^\star \in (0,1)$.

Lastly, note that given that the agent is indifferent between choosing $m = a$ or $m = b$ after he has received a signal in favor of state $b$, he will strictly prefer $m = a$ after $s = a$. One can also directly see that given indifference of the bad type, a good type with superior information will always find it optimal to follow his signal. ||

Proof of proposition 2.2

The fact that $\pi(b,b,1) > \pi(a,a,1)$ follows directly from the fact that $\beta^\star < 1$.

In equilibrium the incentive constraint for the $\gamma_i$ must be satisfied. Setting $\pi(a,b,\omega) = \pi(a,a,0)$ and $\pi(b,a,\omega) = \pi(b,b,0)$ one can solve for the equilibrium values of $\gamma_i$ as a function of $\beta$. One obtains

$$\gamma_a = \frac{q(1-\lambda)(2\bar{\theta}-1)}{(1-q)(1-\bar{\theta})+q(1-\lambda)\bar{\theta}},$$

$$\gamma_b = \frac{(1-\lambda)(1-q)(\bar{\theta}-\underline{\theta})}{(1-\underline{\theta})[(1-\bar{\theta})q+\bar{\theta}(1-\lambda)(1-q)]}.$$

Note that both $\gamma_a$ and $\gamma_b$ do not depend on $\beta$. It is now easy to see that $\gamma_a \geq \gamma_b$ as

$$\gamma_a - \gamma_b = (\bar{\theta}-\underline{\theta})(1-\bar{\theta})(2q-1) \geq 0.$$

Substituting the equilibrium values back in the expressions for $\pi(a,b,\omega)$ and $\pi(b,a,\omega)$ respectively yields

$$\pi(a,b,\omega) = \frac{(1-q)(1-\bar{\theta})+q(1-\lambda)\bar{\theta}}{(1-q)(1-\bar{\theta})+q(1-\lambda)\bar{\theta}+(1-q)(1-\underline{\theta}\beta)+q(1-\lambda)(1-\beta(1-\underline{\theta}))},$$

$$\pi(b,a,\omega) = \frac{q(1-\bar{\theta})+(1-q)(1-\lambda)\bar{\theta}}{q(1-\bar{\theta})+(1-q)(1-\lambda)\bar{\theta}+\beta[(1-\underline{\theta})q+(1-q)(1-\lambda)\underline{\theta}]}.$$

We will now show that there exists an upper bound $\widehat{\beta} = 2[q(1-\bar{\theta})+(1-q)\bar{\theta}]$, such that for all parameter constellations the equilibrium value of $\beta$ is weakly smaller than $\widehat{\beta}$. In the next step it will be proven that given this upper bound the equilibrium reputational payoffs satisfy the relations stated in the proposition.

Tedious calculations show that the equilibrium value of $\beta$ is decreasing in $\lambda$. Intuitively, as monitoring becomes better, making the correct decision becomes more important for the agent. Hence, more likely he will switch away from $m = b$. To derive the upper bound on $\beta$ it is therefore sufficient to consider the case $\lambda = 0$. Under this circumstances, and plugging in the upper bound of $\beta$, we arrive at the following payoffs:

$$\pi(a,a,1) = \frac{\bar{\theta}}{\bar{\theta}(1+q)+(1-q)(1-\bar{\theta})}, \quad \pi(a,b,\omega) = \frac{1}{2},$$

$$\pi(b,b,1) = \frac{\bar{\theta}}{2\bar{\theta}(1-q)+q}, \quad \pi(b,a,\omega) = \frac{1}{2}.$$

Consider now the equilibrium condition for $\beta$. We know that in general the left hand side is decreasing in $\beta$ while the right hand side increases. Hence, if at $\widehat{\beta}$ the left hand side is smaller than the right hand side, we have established that $\widehat{\beta}$ indeed is an upper bound. Plugging in $\widehat{\beta}$ in the equilibrium condition for $\beta$ we obtain

$$\lambda\left[\frac{\bar{\theta}}{2\bar{\theta}(1-q)+q} - \frac{\bar{\theta}}{\bar{\theta}(1+q)+(1-q)(1-\bar{\theta})}\right] \leq \frac{1}{2}\lambda(1-2q)$$

Multiplying out gives

$$\frac{1}{2}\bar{\theta}(1-2q) \leq (1-2q)\left(\frac{1}{2}\bar{\theta}(q^2+(1-q)^2\right) + (1-q)q\left(\bar{\theta}^2+\frac{1}{4}\right)$$

$$\Longleftrightarrow$$

$$\left(\bar{\theta}-\frac{1}{2}\right)^2 \geq 0,$$

which is always satisfied.

$\pi(a,b,\omega) < \pi(b,a,\omega)$ follows directly as the difference $\pi(a,b,\omega) - \pi(b,a,\omega)$ decreases in $\lambda$ and both expressions are equal at $\widehat{\beta}$ for $\lambda = 0$. ‖

Proof of Lemma 2.1

If the sole information of the electorate is given by the political platform, the voters assign the following probabilities to the agent being good:

$$\text{Prob}(\bar{\theta}|m=a) = \frac{q\bar{\theta}+(1-q)(1-\bar{\theta})}{[q\bar{\theta}+(1-q)(1-\bar{\theta})]+[q(1-\beta(1-\underline{\theta}))+(1-q)(1-\beta\underline{\theta})]},$$

$$\text{Prob}(\bar{\theta}|m=b) = \frac{(1-q)\bar{\theta}+q(1-\bar{\theta})}{[(1-q)\bar{\theta}+q(1-\bar{\theta})]+\beta[(1-q)\underline{\theta}+q(1-\underline{\theta})]}.$$

The expected type conditional on having announced $m = b$ is better if the likelihood ratio of $\text{Prob}(\bar{\theta}|m = a)$ is smaller than the likelihood ratio of $\text{Prob}(\bar{\theta}|m = b)$, i.e.

$$\frac{q\bar{\theta}+(1-q)(1-\bar{\theta})}{q(1-\beta(1-\underline{\theta}))+(1-q)(1-\beta\underline{\theta})} < \frac{(1-q)\bar{\theta}+q(1-\bar{\theta})}{\beta[(1-q)\underline{\theta}+q(1-\underline{\theta})]}.$$

Solving this equation for $\beta$ we obtain that

$$\text{Prob}(\bar{\theta}|m=a) < \text{Prob}(\bar{\theta}|m=b) \Longleftrightarrow \beta \leq 2[q(1-\bar{\theta})+(1-q)\bar{\theta}].$$

From the proof of proposition 2.2, we know that this is always satisfied. ‖

### *2.6.2 Appendix B: Outline of the Multidimensional Model*

We extend the model to two dimensions $j = 1, 2$. Both dimensions are identical to the one dimensional model, i.e. there are for each dimension respectively, two possible states $x_j \in \{a_j, b_j\}$, two possible signals $s_j \in \{a_j, b_j\}$, two possible platform announcements $m_j = \{a_j, b_j\}$, two possible decisions $d_j \in \{a_j, b_j\}$ and the outcomes $\omega_j \in \{0, 1\}$. We assume furthermore that $\lambda_j := \lambda$, $j = 1, 2$ denotes the probability of success ($\omega_j = 1$) given $d_j = x_j$. We take the realizations of $\omega_j$ to be independent variables.

We look for the existence of an equilibrium where good agents set $m = (m_1, m_2) = (s_1, s_2)$ and $d = (d_1, d_2) = (x_1, x_2)$. The bad agent will choose $m_j = a_j$ whenever $s_j = a_j$ and also with probability $(1-\beta_j)$ if $s_j = b_j$, $j = 1, 2$. Hence, if $s_j = b_j$ bad types will set $m_j = b_j$ with probability $\beta_j \in (0, 1)$. Ex post bad agents will gamble with probability $\gamma_a^j$ and $\gamma_b^j$, $j = 1, 2$ respectively. Importantly, we assume that $\beta_1$ and $\beta_2$ and also the choices of the $\gamma_m^j$, $j = 1, 2$ are set independently from each other. This implies that after having learned that $m_1 \neq x_1$ and $m_2 \neq x_2$ the agent will break his promises partially, e.g. in the first dimension only but not in the second one with probability $(1 - \gamma_m^1)\gamma_m^2 > 0$.

In what comes we will focus on the case where $m_1 = m_2 = b$, all other instances can be derived analogously.[26] First we derive the respective reputational payoffs $\pi((m, d, \omega)_1, (m, d, \omega)_2)$ if $(m_j, d_j, \omega_j) := (m, d, \omega)_j$, $j = 1, 2$ is observed.[27]

$$\pi((b,a,\omega)_1,(b,b,1)_2) = \frac{q(1-q)\bar{\theta}\lambda(1-\bar{\theta})}{q(1-q)\bar{\theta}\lambda(1-\bar{\theta}) + q(1-q)\underline{\theta}\beta_2\lambda(1-\underline{\theta})\beta_2(1-\gamma_b^1)}$$

$$\pi((b,a,\omega)_1,(b,a,\omega)_2) = \frac{(1-\bar{\theta})^2}{(1-\bar{\theta})^2 + (1-\underline{\theta})^2\beta_1\beta_2(1-\gamma_b^1)(1-\gamma_b^2)}$$

$$\pi((b,a,\omega)_1,(b,b,0)_2) = \frac{q(1-q)\bar{\theta}(1-\lambda)(1-\bar{\theta})}{q(1-q)\bar{\theta}(1-\lambda)(1-\bar{\theta}) + q(1-\underline{\theta})\beta_1(1-\gamma_b^1)[(1-q)\underline{\theta}\beta_2(1-\lambda) + q(1-\underline{\theta})\beta_2\gamma_b^2]}$$

$$\pi((b,b,0)_1,(b,b,1)_2) = \frac{(1-q)^2\bar{\theta}^2\lambda(1-\lambda)}{(1-q)^2\bar{\theta}^2\lambda(1-\lambda) + (1-q)\underline{\theta}\beta_2\lambda[(1-q)\underline{\theta}\beta_1(1-\lambda) + q(1-\underline{\theta})\beta_1\gamma_b^1]}$$

[26]Note that $m_1 = m_2 = b$ will be played by the bad agent with strictly positive probability, since otherwise this platform configuration would immediately reveal a good type.

[27]We will only derive those needed for the proof.

$$\pi((b,b,0)_1,(b,b,0)_2) = \frac{(1-q)^2\bar{\theta}^2(1-\lambda)^2}{(1-q)^2\bar{\theta}^2(1-\lambda)^2 + \left\{ \begin{array}{l} (1-q)^2\underline{\theta}^2\beta_1\beta_2(1-\lambda)^2 + (1-q)\underline{\theta}\beta_1(1-\lambda)q(1-\underline{\theta})\beta_2\gamma_b^2 \\ +q(1-\underline{\theta})\beta_1\gamma_b^1(1-q)\underline{\theta}\beta_2(1-\lambda) + q^2(1-\underline{\theta})^2\beta_1\beta_2\gamma_b^1\gamma_b^2 \end{array} \right\}}$$

It is clearly suboptimal to set one or both of the $\gamma_b^j$ equal to one, as in this case a platform configuration would exist that is revised by good types only. Hence, in this case a reduction of $\gamma_b^j$ would increase the agent's utility. Next, we will show that $\gamma_b^j = 0$ cannot be optimal either as then an increase in $\gamma_b^j$ would be optimal for the agent. We will then stress continuity and use the intermediate value theorem to argue that some intermediate values of the $\gamma_b^j$, $j = 1, 2$ constitute an equilibrium.

The incentives to gamble arise only if the agent learned that he has specified an incorrect platform. We have to distinguish between the case, where only one dimension is false and the situation with two wrong specifications.

1. Consider first $m_1 \neq x_1$ and $m_2 = x_2$.

We will show that for all $\gamma_2^b$ the value of $\gamma_1^b$ must be larger than zero. Assume the opposite were true. Then the reputational payoff from changing the platform (in the first dimension) must exceed the payoff obtained through gambling, i.e.

$$\lambda\pi((b,a,\omega)_1,(b,b,1)_2)+(1-\lambda)\pi((b,a,\omega)_1,(b,b,0)_2) \geq \lambda\pi((b,b,0)_1,(b,b,1)_2)+(1-\lambda)\pi((b,b,0)_1,(b,b,0)_2).$$

However, if $\gamma_b^1 = 0$ was an equilibrium, the electorate would correctly anticipate the behavior of the bad agent and we would obtain the following reputational payoffs.

$$\pi((b,b,0)_1,(b,b,1)_2) = \frac{\bar{\theta}^2}{\bar{\theta}^2 + \underline{\theta}^2\beta_1\beta_2},$$

$$\pi((b,b,0)_1,(b,b,0)_2) = \frac{\bar{\theta}^2(1-q)(1-\lambda)}{\bar{\theta}^2(1-q)(1-\lambda) + \underline{\theta}\beta_1\beta_2[(1-q)(1-\lambda)\underline{\theta} + q(1-\underline{\theta})\gamma_b^2]}.$$

These payoffs are larger than the values on the left hand side as

$$\pi((b,a,\omega)_1,(b,b,1)_2) = \frac{\bar{\theta}(1-\bar{\theta})}{\bar{\theta}(1-\bar{\theta}) + \underline{\theta}(1-\underline{\theta})\beta_1\beta_2} < \frac{\bar{\theta}^2}{\bar{\theta}^2 + \underline{\theta}^2\beta_1\beta_2}$$

and

$$\begin{aligned} \pi((b,a,\omega)_1,(b,b,0)_2) &= \frac{\bar{\theta}(1-\bar{\theta})(1-q)(1-\lambda)}{\bar{\theta}(1-\bar{\theta})(1-q)(1-\lambda) + (1-\underline{\theta})\beta_1\beta_2[(1-q)(1-\lambda)\underline{\theta} + q(1-\underline{\theta})\gamma_b^2]} \\ &< \frac{\bar{\theta}^2(1-q)(1-\lambda)}{\bar{\theta}^2(1-q)(1-\lambda) + \underline{\theta}\beta_1\beta_2[(1-q)(1-\lambda)\underline{\theta} + q(1-\underline{\theta})\gamma_b^2]} \\ &= \pi((b,b,0)_1,(b,b,0)_2). \end{aligned}$$

Hence the optimality condition for $\gamma_b^1 = 0$ cannot be satisfied. Note however that all terms on the left hand side increase in $\gamma_b^1$ while all terms on the right hand side decrease in $\gamma_b^1$. We can therefore find an intermediate value of $\gamma_b^1$ which exactly solves the condition. Given this value of $\gamma_b^1$ the bad agent is exactly indifferent between gambling and revising, hence this value is part of an equilibrium.

2. Take now the case of $m_1 \neq x_1$ and $m_2 \neq x_2$. For $\gamma_b^1 = 0$ to be optimal it must be true that

$$\pi((b,a,\omega)_1,(b,b,0)_2) \geq \pi((b,b,0)_1,(b,b,0)_2)$$

if the agent does not revise his platform in the second dimension or

$$\pi((b,a,\omega)_1,(b,a,\omega)_2) \geq \pi((b,b,0)_1,(b,a,\omega)_2)$$

if he does. We know already from case 1 that

$$\pi((b,a,\omega)_1,(b,b,0)_2) < \pi((b,b,0)_1,(b,b,0)_2).$$

Given that $\gamma_b^1 = 0$ we can derive

$$\pi((b,b,0)_1,(b,a,\omega)_2) = \frac{\bar{\theta}(1-\bar{\theta})}{\bar{\theta}(1-\bar{\theta}+(1-\gamma_b^2)(1-\underline{\theta})\underline{\theta}\beta_1\beta_2},$$

which is obviously larger than $\pi((b,a,\omega)_1,(b,a,\omega)_2)$ under $\gamma_b^1 = 0$, so $\gamma_b^1 = 0$ cannot be an equilibrium outcome under $m_1 \neq x_1$ and $m_2 \neq x_2$ either.

Note however that both $\pi((b,a,\omega)_1,(b,b,1)_2)$ and $\pi((b,a,\omega)_1,(b,a,\omega)_2)$ are increasing in $\gamma_b^1$ while both $\pi((b,b,0)_1,(b,b,0)_2)$ and $\pi((b,b,0)_1,(b,a,\omega)_2)$ are decreasing in $\gamma_b^1$. Hence, by the intermediate value theorem there exists $\gamma_b^1$ which solves the equations above with equality and therefore constitutes an equilibrium. Since we derived this for arbitrary $\gamma_b^2$ the same argument can be made for the gambling decision in the other dimension. ‖

**Table 3:** Numerical Simulations, $q = 0.6$, $\bar{\theta} = 0.7$

| | | Comp. Effect | | Error Prob. Effect | | Gambling | | Sucess Prob. | |
|---|---|---|---|---|---|---|---|---|---|
| $\lambda$ | $\beta$ | $\frac{1-\underline{\theta}\beta}{\text{Prob}(m=a)}$ | $\frac{(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\frac{(1-q)(1-\underline{\theta}\beta)}{\text{Prob}(m=a)}$ | $\frac{q(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\gamma_a$ | $\gamma_b$ | $\Pr(d=x \mid m=a)$ | $\Pr(d=x \mid m=b)$ |
| 0.2 | 0.918 | 0.500 | 0.499 | 0.200 | 0.300 | 0.421 | 0.317 | **0.183** | 0.181 |
| 0.3 | 0.917 | 0.501 | 0.499 | 0.200 | 0.299 | 0.406 | 0.298 | **0.276** | 0.273 |
| 0.5 | 0.914 | 0.501 | 0.498 | 0.201 | 0.299 | 0.364 | 0.250 | **0.464** | 0.462 |
| 0.7 | 0.912 | 0.502 | 0.498 | 0.201 | 0.299 | 0.293 | 0.182 | 0.659 | **0.662** |
| 0.8 | 0.911 | 0.502 | 0.498 | 0.201 | 0.299 | 0.235 | 0.136 | 0.762 | **0.768** |
| 0.9 | 0.911 | 0.502 | 0.498 | 0.201 | 0.299 | 0.148 | 0.077 | 0.873 | **0.879** |

**Table 4:** Numerical Simulations, $q = 0.6$, $\bar{\theta} = 0.9$

| | | Comp. Effect | | Error Prob. Effect | | Gambling | | Sucess Prob. | |
|---|---|---|---|---|---|---|---|---|---|
| $\lambda$ | $\beta$ | $\frac{1-\underline{\theta}\beta}{\text{Prob}(m=a)}$ | $\frac{(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\frac{(1-q)(1-\underline{\theta}\beta)}{\text{Prob}(m=a)}$ | $\frac{q(1-\underline{\theta})\beta}{\text{Prob}(m=b)}$ | $\gamma_a$ | $\gamma_b$ | $\Pr(d=x \mid m=a)$ | $\Pr(d=x \mid m=b)$ |
| 0.2 | 0.830 | 0.502 | 0.497 | 0.201 | 0.298 | 0.814 | 0.736 | **0.167** | 0.156 |
| 0.3 | 0.823 | 0.504 | 0.495 | 0.201 | 0.297 | 0.803 | 0.718 | **0.251** | 0.236 |
| 0.5 | 0.808 | 0.507 | 0.490 | 0.203 | 0.294 | 0.774 | 0.667 | **0.422** | 0.401 |
| 0.7 | 0.789 | 0.511 | 0.484 | 0.204 | 0.290 | 0.713 | 0.517 | **0.598** | 0.583 |
| 0.8 | 0.775 | 0.514 | 0.480 | 0.205 | 0.288 | 0.649 | 0.485 | **0.693** | 0.688 |
| 0.9 | 0.761 | 0.516 | 0.475 | 0.207 | 0.285 | 0.511 | 0.333 | 0.805 | **0.814** |

# Chapter 3

# Information Acquisition by Experts

## 3.1 Introduction

In many situations of economic relevance a principal has to either delegate a decision to an agent or rely on information the agent transmits, since the principal lacks sufficient information or expertise to perform the task independently. Examples include such diverse settings as delegated portfolio management or advisers of a political decision maker (as in Morris (2001)). If the agent's information can be verified full information disclosure can often be sustained as an equilibrium outcome (see e.g. Bolton and Dewatripont (2005) on disclosure of private certifiable information.). The same holds true if the principal can design a mechanism to elicit information.

If these condition are not satisfied, however, inefficiencies might arise due to divergence of preferences as in standard cheap talk games[1] or due to the agent's desire to appear well informed. These situations have been analyzed in so called expert games: here an agent (the expert) is hired in order to make a decision on behalf of the principal.[2] He bases his decision on his private information whose accuracy is determined by his type. In contrast to a classical cheap talk game the agent does not care about the decision per se, but only about the decision's impact on the principal's assessment of his type. These kind of preferences can be rationalized by means of future reemployment considerations, for example. In the examples mentioned above such incentives arguably play an important role: politicians or their advisers care about reelection which is partially determined by the electorate's assessment of their ability.[3] The same is probably true for other state officials.[4] As a further example, the behavior of fund managers is driven by such career concerns, a point empirically confirmed by Chevalier and Ellison (1999) and theoretically elaborated by Dasgupta and Prat (2005, 2006).

This paper examines the consequences of information acquisition by experts. To analyze this, we extend an expert model to two periods where in each period the agent acquires additional

[1]The first paper analyzing the outcome in cheap talk games is Crawford and Sobel (1982). A more recent reference is Battaglini (2002); Krishna and Morgan (2007) gives a very comprehensive overview.

[2]It could also be that the agent is just supposed to making a recommendation to the principal who then makes the decision. In the framework of this paper this distinction is immaterial.

[3]See for example Ottaviani and Sorensen (2001) or Majumdar and Mukand (2004).

[4]Levy (2005) builds a model of the incentives of judges where the behavior of the judges in driven by such career concerns.

information. The agent can act at different points in time and the principal can observe the timing decision of the agent. There are a lot of situations where this setting seems realistic: fund managers can decide whether to invest early or late in certain stocks, for example. The set up allows us to shed light on questions like: Do agents have an incentive to accumulate information? If so, which agents? Does the principal necessarily benefit from better informed agents? Or might there be an incentive for the principal to restrict information acquisition and force agents to act early?

It turns out that more information on the agent's side does not unambiguously benefit the principal. Of course, more information improves the quality of decision making which benefits both the principal and the agent. However, in some situations the behavior of the agents is further distorted through more information acquisition. If the agent has gathered more than one signal an additional effect comes into play which is best understood if one considers efficient decision making first. Efficiency dictates that the agent chooses those actions, which from an ex ante point of view are less likely to be optimal, only if his information in favor of these actions is sufficiently strong. In case this is not true, which will happen especially if the expert has received contradictory information, he should opt for a "standard" action. However, since the better the agent the more correlated is his information over time, predominantly bad experts will end up with conflicting signals.[5] Hence, under efficient decision making, the standard actions carry a reputational discount as they are selected mainly by unable experts. In equilibrium this effect might lead to inefficiencies as some agents will be tempted to choose the reputationally more valuable action even if their own information is not precise enough. As we will illustrate in the model, this wedge between different actions only emerges if agents have accumulated more than one piece of information. Therefore it might be beneficial for the principal to restrict the agents and force them to make their decision early.[6]

The paper can thus also be seen as a contribution to the literature on optimal delegation. Here the principal does not restrict *which* actions are available to the agent (as for example in Alonso and Matouschek (2007)), but at *which point in time* the agent is supposed to act. There is also a completely different rationale behind the principal's desire to restrict the

[5] The better the agent the higher the probability that the signal is correct. Hence better agents are more likely to receive identical signals, as in case of contradictory signals at least one signal must have been wrong.

[6] One way to achieve this may be work overload of the agents. See section 4 for a more detailed discussion.

agents. The reason does not lie in an imperfect alignment of preferences which induces the agents to choose the wrong action from the principal's point of view. In fact the principal and the agent share the same objective as the agents want to choose the correct action. Restricting the agents may nevertheless be valuable, since the accumulation of more information might aggravate distortions due to strategic behavior. In the framework of an expert game, this paper is the first one which shows that the principal might indeed be hurt by agents holding better information.

#### *3.1.1 Related Literature*

The paper is related to several strands of the literature a few of which have been mentioned already. There is a link to the literature on optimal delegation and, obviously, on cheap talk. As the agent cares about the principal's assessment of his ability, this paper fits into the literature on career concerns, which has been pioneered by Holmström (1999) and generalized by Dewatripont, Jewitt, and Tirole (1999a,b). There an agent's ability increases expected output and the agent exerts unobservable effort to improve some performance measure. Here, in contrast, the agent's type determines the precision of the information she receives. This information is private but the principal can observe the action chosen by the agent.

The literature on experts started with a famous paper by Scharfstein and Stein (1990) who analyzed sequential decision making by multiple experts.[7] This allows them to study incentives to herd on previous agent's actions. The herding result depends crucially on the agent's objective function: Effinger and Polborn (2001) show that anti-herding can be an equilibrium outcome if the agents care sufficiently about their relative reputation.

The issue of the timing of decision making has not received attention in the literature on experts, but was analyzed in the context of statistical herding models. Statistical herding occurs whenever an agent disregards his own signal because the actions of her predecessors at least partially reveal their information. If this information is stronger than the agent's own information it is optimal to follow the predecessors independently of one's own signals. See Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) for early contributions in this realm. Following these papers there are a few contributions where agents can endoge-

[7]See Ottaviani and Sorensen (2000) for a generalization.

nously determine when to act but can not influence the amount of information they receive. Gul and Russell (1995) establish that endogenous sequencing leads to delay and a clustering of agent's decision. As actions are public and reveal (part of) the private information agents delay their actions in order learn other agent's private information. As soon as the first agent has moved (this will be the agent with the most extreme signal realization) others follow immediately (clustering of actions). In Zhang (1997) the model is extended to two dimensional uncertainty: not only are the signal realizations private information but also the accuracy of the information. The equilibrium of this model also exhibits initial delay; once the first agent (here the one with the most precise signal) has moved, again all others follow immediately.
While we share with these papers the focus on the timing of decision making, I will only consider settings with a single agent who has to make only one decision, so herding is not an issue. Moreover, in contrast to the statistical herding literature agents in this chapter care about their reputation. In what follows I will give a short overview over the reputational expert literature, which can be divided into two parts depending whether the agent knows his own type or not.
The problem if the agent is ignorant about his own type and receives only one signal, has been extensively studied in Ottaviani and Sorensen (2006a,b). They show that quite generally agents distort their behavior in order to signal competence. Prat (2005) shows that the problem of inefficient signalling can be alleviated if the principal can only observe whether the agent has chosen the correct action or not, but not which action in particular.
If the agent knows his type new distortions can arise as shown for example by Trueman (1994), Prendergast and Stole (1996) Avery and Chevalier (1999), and Levy (2004a). Good agents, knowing their type will find it optimal to follow their signal more often and contradict the prior. As the bad agent has an incentive to appear well informed, he will try to mimic the behavior of good agents. Hence, it will be optimal for him to contradict the prior even if his information is not precise enough to outweigh the prior.
The only paper in this literature which allows for an endogenous information structure is Levy (2004a). Here the agent can resort to an external consultant and gather additional information. She shows that the agent has an incentive to ignore or even excessively contradict the consultant in order to gain reputation. The result is thus complementary to ours as it too studies the behavioral distortions arising if more information about the optimal course of action is available. However, there are two important differences which make the mechanism

at work quite distinct from the one at work in our model. First, the quality of additional information is independent of the expert and second, the consultant's recommendation is publicly observable. By contradicting the consultant, the agent can signal that his information is superior.

The paper is organized as follows. In the next section I present the model. The next two parts of the chapter present the analysis when agents have to move in the first or second period respectively. Section 5 concludes. All proofs are relegated to the appendix.

## 3.2 The Model

I consider a model with two time periods $t = 1, 2$ and two players, an agent A and an evaluator E. In every period the agent can choose an action $d_t \in \{a, b\}$ which I assume to be irreversible.

Which action is best depends on the realization of a state of the world $x \in \{a, b\}$. The prior probability of $x = a$ being the true state of the world is denoted by $q \geq \frac{1}{2}$. In addition, the agent receives a signal $s_t \in \{a, b\}$ about $x$ in every period immediately before she can make the decision. The precision of the signal depends on the agents type $\theta \in \Theta := \{\underline{\theta}, 1\}$, $\underline{\theta} \in [\frac{1}{2}, 1]$ in the following way:

$$\text{Prob}(s_t = a | x = a, \theta) = \text{Prob}(s_t = b | x = b, \theta) = \theta.$$

Hence, we assume that the agent's type denotes the probability with which a correct signal is obtained. The quality of the signal therefore increases in the agent's type with the case of $\underline{\theta} = \frac{1}{2}$ corresponding to the situation where the bad agent receives pure noise. Note that the good type $\theta = 1$ gets a perfect signal in every period.[8] I assume that conditional on the true state $x$ the signals are drawn independently in every period. The true state is revealed to all players after the agent has made his decision.

Importantly, I assume that the agent's type is only known to her. The prior probability of $\theta = 1$ is given by $p$.

[8]For the model to be interesting it is important that the information of the good type is sufficiently precise. In particular, it must be optimal for the principal to follow the agent's advice if he knew that the agent was good. As long as this is satisfied, the exact precision of the good agent's information does not qualitatively affect the equilibrium.

An important ingredient of the model is that the agent's payoff $u_A$ depends positively on the evaluators assessment of his type.[9] I assume that the agent's payoff is given by her expected type conditional on all information the evaluator has. The evaluator observes the decision of the agent, the point in time when the decision was made and the true state of the world.

$$u_A = \mathbb{E}(\theta | d_1, d_2, x, p).$$

The evaluator is a passive player whose only task it is to assess the quality of the agent.[10] Throughout the paper I will consider Perfect Bayesian Equilibria (PBE). In such an equilibrium the agent's strategy must be optimal given the evaluator's beliefs. The evaluator forms beliefs according to Bayes' Rule using all of his information whenever this is possible. More formally the agents strategy consists of functions $d_1(s_1|\theta) : \{a, b\} \to \Delta(\{a, b\})$ and $d_2(s_1, s_2|\theta) : \{a, b\}^2 \to \Delta(\{a, b\})$.[11] The evaluator uses an updating function $\mu(d_1, d_2, x, p)$ : $\{a, b\} \times \{a, b\} \times \{a, b\} \times [0, 1] \to [0, 1]$ which denotes the posterior probability of facing a good agent. Using the updating function the evaluator can compute $\mathbb{E}(\theta|d_1, d_2, x, p) = \mu(d_1, d_2, x, p) + (1 - \mu(d_1, d_2, x, p))\underline{\theta}$.

In what comes I will restrict attention to informative equilibria where the agent conditions his actions on his information.[12]. Moreover I will ignore all "mirror" equilibria which take some equilibrium and just flip every action from $a$ to $b$ and vice versa. [13]

The timing of the game is as follows:

1. The agent learns his type $\theta$.
2. The agent receives signal $s_1$ and chooses $d_1$.
3. The agent receives $s_2$ and chooses $d_2$.
4. Evaluator observes $d_1$, $d_2$ and $x$ and updates about agent's type.

[9]This can be, e.g. due to reemployment or promotion decisions the evaluator has to make in the future.

[10]This is common in the literature on career concerns. One could interpret the evaluator as consisting of possible future employers of the agent, who, after having observed the agent's performance, are willing to offer a wage equal to the experts expected reputation for his services.

[11]Given some set $A$, $\Delta(A)$ denotes the set of all probability distributions over $A$.

[12]As common in all cheap talk games there also exists an "babbling" equilibrium in which the agent's decisions does not convey any information about his type and the evaluators belief is independent of any of the agent's actions

[13]This is standard, see e.g. Levy (2004a)

5. Payoffs realized.

## 3.3 Analysis with a Single Period

As a benchmark case and in order to gain some intuition into the workings of the model, consider first a situation where the agent has to make his decision in $t = 1$.[14] To this end define $\overline{V}_1^i := \mathbb{E}(\theta|d_1 = i, x = i)$, $i = a, b$ as the reputational payoff for the agent if he chooses $d = i$ in the first period and $x = i$. Analogously we define $\underline{V}_1^i = \mathbb{E}(\theta|d_1 = i, x \neq i)$, $i = a, b$ as the agent's reputation if he chooses the wrong action. As there is no incentive for the good type $\theta = 1$ to contradict his signal, we have $\underline{V}_1^i = \underline{\theta}$.

Assume first that the bad agent decides to follow his signal as well. Note that if the evaluator correctly anticipates the behavior of the agent this implies $\overline{V}_1^a = \overline{V}_1^b$ as

$$\begin{aligned}\overline{V}_1^a &= \mathbb{E}(\theta|d_1 = a, x = a) = \text{Prob}(\theta = 1|d = a, x = a) \cdot 1 + \text{Prob}(\theta = \underline{\theta}|d = a, x = a) \cdot \underline{\theta} \\ &= \frac{qp}{qp + q(1-p)\underline{\theta}} \cdot 1 + \frac{q(1-p)\underline{\theta}}{qp + q(1-p)\underline{\theta}} \cdot \underline{\theta} = \frac{p + (1-p)\underline{\theta}^2}{p + (1-p)\underline{\theta}},\end{aligned}$$

and

$$\begin{aligned}\overline{V}_1^b &= \mathbb{E}(\theta|d_1 = b, x = b) = \text{Prob}(\theta = 1|d = b, x = b) \cdot 1 + \text{Prob}(\theta = \underline{\theta}|d = b, x = b) \cdot \underline{\theta} \\ &= \frac{(1-q)p}{(1-q)p + (1-q)(1-p)\underline{\theta}} \cdot 1 + \frac{(1-q)(1-p)\underline{\theta}}{(1-q)p + (1-q)(1-p)\underline{\theta}} \cdot \underline{\theta} = \frac{p + (1-p)\underline{\theta}^2}{p + (1-p)\underline{\theta}}.\end{aligned}$$

As the agent's payoff depends only on making the correct decision the bad agent has always an incentive to follow his signal if $s_1 = a$. Formally we see that given $s_1 = a$ the agent prefers $d_1 = a$ over $d_1 = b$ as

$$\text{Prob}(x = a|s_1 = a, \underline{\theta})\overline{V}_1^a + \text{Prob}(x = b|s_1 = a, \underline{\theta})\underline{V}_1^a \geq \text{Prob}(x = b|s_1 = a, \underline{\theta})\overline{V}_1^b + \text{Prob}(x = a|s_1 = a, \underline{\theta})\underline{V}_1^b,$$

because $\text{Prob}(x = a|s_1 = a, \underline{\theta}) \geq q \geq \frac{1}{2}$.

Following $s_1 = b$ in turn is only optimal if

$$\text{Prob}(x = b|s_1 = b, \underline{\theta})\overline{V}_1^b + \text{Prob}(x = a|s_1 = b, \underline{\theta})\underline{V}_1^b \geq \text{Prob}(x = a|s_1 = b, \underline{\theta})\overline{V}_1^a + \text{Prob}(x = b|s_1 = b, \underline{\theta})\underline{V}_1^a.$$

[14] The results in this section can in a slightly different form already be found in Trueman (1994) and in Avery and Chevalier (1999).

Note that this condition is only satisfied if Prob$(x = b|s_1 = b, \underline{\theta}) \geq$ Prob$(x = a|s_1 = b, \underline{\theta})$, i.e. only if $\underline{\theta} \geq q$.[15] The intuition for this is straightforward. If $\underline{\theta}$ is sufficiently small then a signal in favor of state $b$ does not outweigh the prior, i.e. even after having observed $s_1 = b$ the bad agent considers state $a$ more likely to be true. Since her utility depends only on making the correct decision, bad agents have an incentive to contradict their signal. If the prior probability of state $a$ being true is high enough, this effect may be so strong that the bad agent does not choose $d_1 = b$ anymore. Note that in this case observing $d = b$ and $x = a$ is an out of equilibrium event. In what follows I assume that the evaluator holds the belief that he faces a bad agent for sure whenever he observes the inappropriate decision. The equilibrium of the game can be summarized as follows:

PROPOSITION 3.1 *In equilibrium the good type will always follow his signal. The behavior of the bad type depends on the parameters.*

1. *If $\underline{\theta} \geq q$ the bad agent will also follow his signal.*
2. *Let $\beta_1 = Prob(d = b|s_1 = b)$. If $p \leq \frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}$ the bad agent will choose $d_1 = a$ whenever $s_1 = a$ and $d_1 = b$ with probability $\widehat{\beta}_1$ if $s_1 = b$ where $\widehat{\beta}_1$ is the unique solution to*
$$\frac{p + (1-p)\underline{\theta}\widehat{\beta}_1}{1-(1-p)(1-\underline{\theta})\widehat{\beta}_1} = \frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}.$$
3. *If $p > \frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}$ the bad agent will always choose $d_1 = a$.*

PROOF: See the appendix.

Part one of the proposition asserts that the bad agent will always follow his signal if it is efficient to do so. The last part stipulates that the bad agent will abstain from $d_1 = b$ if, even after having observed a signal in favor of state $b$, she still puts sufficiently large probability on state $a$ being true. In this case the likelihood ratio $\frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}$ on the right hand side becomes sufficiently small. This will hold true whenever the difference between $q$ and $\underline{\theta}$ is large, i.e. if either there is a strong prior in favor of state $a$ and/or the information of the bad agent is very noisy. In intermediate cases (part 2 of the proposition) the bad agent randomizes between both actions given she received signal $b$. To understand the equilibrium condition

[15] This implies that agents will always follow their signal if $q = \frac{1}{2}$. Notice that this is also efficient.

note that one can write the left hand side as

$$\frac{p + (1-p)\underline{\theta}\widehat{\beta}_1}{p + (1-p)[\underline{\theta} + (1-\underline{\theta})(1-\widehat{\beta}_1)]}$$

which exactly gives the probability that $d = b$ will be chosen conditional on $x = b$ relative to the probability of $d = a$ conditional on $x = a$. This expression is a measure of the relative reputational payoffs attached to the different actions. If $\widehat{\beta}_1$ declines, the bad agent switches away from action $b$ and hence, the expected type upon observing $d = a$ decreases. As a direct consequence the reputation earned upon having selected $d = a$ correctly decreases as well, and so does the left hand side of the equilibrium condition. When will it be optimal to shy away from the unexpected action $b$? Only when the right hand side of the equilibrium condition goes down as well, hence, if state $a$ is ex ante more likely and if the information quality of the agent deteriorates (i.e. $\underline{\theta}$ declines).

We can therefore conclude that the randomization decision trades off two effects: on the one hand, as the bad agent chooses $d = b$ less often, a higher reputation can be gained by correctly selecting action $b$ compared to action $a$. On the other hand however, given that the information of the bad type is not precise enough to outweigh the prior, $d = b$ is correct with a smaller probability. It is clear then that the randomization probability decreases if the latter effect becomes larger, i.e. if the prior rises or $\underline{\theta}$ decreases.

Note that the agent behaves inefficiently in this intermediate case. Although his information suggests state $a$ being the most probable, the agent chooses $d_1 = b$ with some probability.

## 3.4 Second Period Decision Making

I now turn to the analysis when the agent must make his decision in the second period. Define $\overline{V}_2^i$ ($\underline{V}_2^i$) analogously as the reputation of the agent after having correctly (incorrectly) chosen action $i$ in the second period.

The behavior of the good type is not affected. She will still choose the action prescribed by her signals. The bad agent in contrast can now end up with three different posteriors. Either she has received two identical signals ($s_1 = s_2 = a$ or $s_1 = s_2 = b$) or two contradictory signals ($s_1 \neq s_2$).[16] In the first case the agent believes with a higher probability that the signals indicate the true state of the world compared to a situation where she received only one

[16] Notice that the good agent never receives two different signals.

signal. In the latter case the signals exactly offset each other and the agent puts probability $q$ on state $a$ being true. The following figure illustrates the different posterior assessments of the agent dependent whether she received only one signal (as in the previous section) or two signals.

As one moves from the left to the right, state $b$ is considered to be more likely. The lower

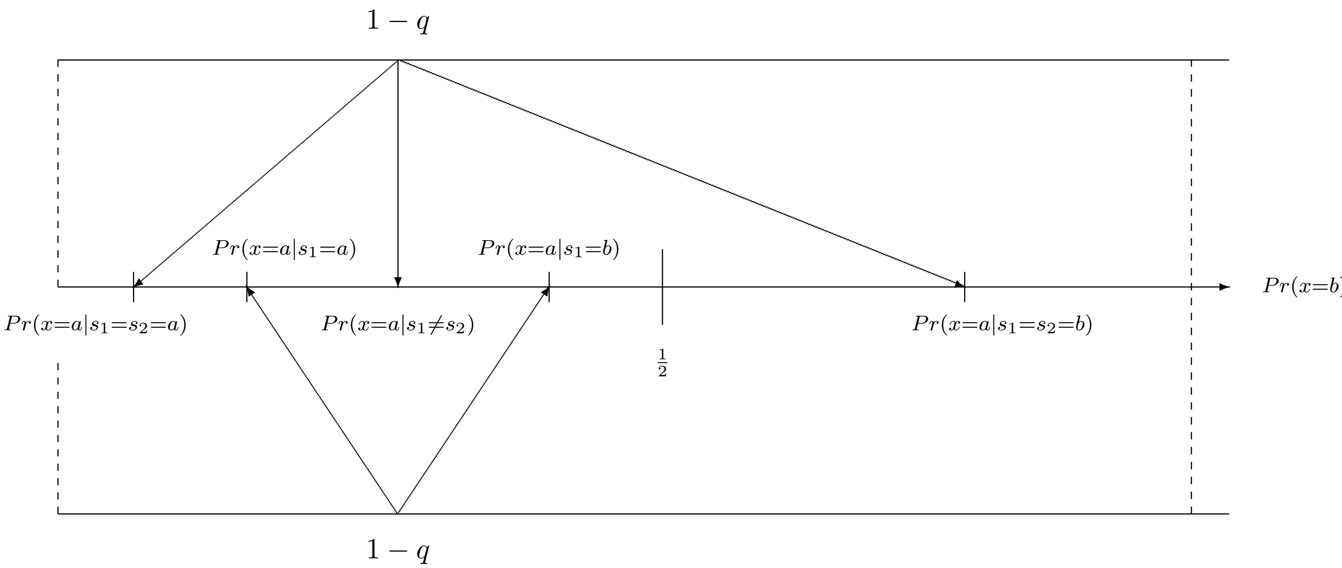


Figure 3.1: Posteriors of the bad agent

half of the figure illustrates how the bad agent's assessment of state $b$ being true changes conditional on the signal she receives. Starting from the prior $1-q$ the agent puts even less probability on state $b$ being true if he obtains $s_1 = a$. In the figure we implicitly assumed that $\underline{\theta} < q$ so even after having observed a signal in favor of $b$ the bad agent assigns a probability smaller than $\frac{1}{2}$ of state $b$ being true.

The upper side of the figure illustrates the agent's posterior if he has received two signals. In case of two conflicting signals the posterior equals the prior. Identical signals, however, pull the posterior more strongly to the indicated state. In the figure the bad agent's signal is good enough, such that two signals in favor of state $b$ more than offset the prior.

It turns out that it is of crucial importance which decision is made given the two signals are not equal, as this influences the reputation which is attached to an agent successfully choosing action $a$ or $b$ (still assuming that the evaluator correctly anticipates the behavior of the agents.). In particular, the action which is chosen after $s_1 \neq s_2$ carries a lower reputational value. As contradictory signals are only received by bad agents, the action chosen after $s_1 \neq s_2$ is made by a bad agent with a higher probability. This already indicates that it cannot be an equilibrium outcome that $d_2(s_1 \neq s_2) = b$, since in this case $d = b$ would carry a reputational discount and would be correct with smaller probability compared to $d = a$. This intuition can be formally confirmed.

Lemma 3.1 *If $s_1 \neq s_2$ the bad agent will play $d_2 = a$ with strictly positive probability.*

Proof: See the appendix.

How large this probability is in equilibrium depends on $q$. Assume that $d_2(s_1 \neq s_2) = a$ with probability one. In this case the decision $d_2 = a$ carries a reputational discount while $d_2 = b$ gives a higher reputation to the agent. Choosing $d_2 = b$ correctly is a better signal about the agent's type since the evaluator knows that the agent must have received two correct signals. In contrast, upon observing that decision $a$ was selected correctly, the evaluator can only infer that the agent has received at least one correct signal. The former is much more probable for good relative to bad agents, hence $\overline{V}_2^b > \overline{V}_2^a$ (see the appendix for a formal proof). However, for this to be an equilibrium outcome, an agent with two conflicting signals must find it optimal to select action $a$. He will do so if

$$q\overline{V}_2^a + (1-q)\underline{\theta} \geq (1-q)\overline{V}_2^b + q\underline{\theta}.$$

Given the wedge between $\overline{V}_2^b$ and $\overline{V}_2^a$ this condition is satisfied only if $q$ is larger than some threshold value $\widehat{q}$.[17]

**Case 1:** $q \geq \widehat{q}$ Assume first that this is the case. It is clear that if $d_2(s_1 \neq s_2) = a$ is optimal than $d_2(s_1 = s_2 = a) = a$ will be optimal as well. But similar to the the one period case the bad agent has an incentive to contradict his signals in case of $s_1 = s_2 = b$ if his information is sufficiently bad. Formally, it holds true that

$$\begin{aligned} \text{Prob}(x = b|s_1 = s_2 = b, \underline{\theta})\overline{V}_2^b \quad &+ \quad \text{Prob}(x = a|s_1 = s_2 = b, \underline{\theta})\underline{\theta} \\ &< \\ \text{Prob}(x = b|s_1 = s_2 = b, \underline{\theta})\underline{\theta} \quad &+ \quad \text{Prob}(x = a|s_1 = s_2 = b, \underline{\theta})\overline{V}_2^a. \end{aligned}$$

[17] As $\overline{V}_2^a$ is always larger than $\underline{\theta}$ the existence of $q$ is guaranteed.

given that $\underline{\theta}$ is low enough.[18] The structure of the equilibrium will resemble the one in the one period case as the agent will contradict signals in favor of $b$ with at least some probability. The equilibrium is summarized in the following proposition where I assume again that E believes to face a bad agent with probability one in case of an inappropriate decision.

PROPOSITION 3.2 *Suppose* $q \geq \widehat{q}$ *and define* $\kappa := \frac{p+(1-p)\underline{\theta}^2}{p+(1-p)\underline{\theta}(2-\underline{\theta})}$. *In equilibrium the good agent will always follow his signal.*

1. *The bad agent always chooses* $d_2 = a$ *if* $p > \frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2}$.
2. *Suppose* $p \leq \frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2} \leq \kappa$. *Then the bad agent will set* $d_2 = a$ *if either* $s_1 = s_2 = a$ *or* $s_1 \neq s_2$. *If* $s_1 = s_2 = b$ *the agent chooses* $d = b$ *with probability* $\widehat{\beta}_2 > \widehat{\beta}_1$ *implicitly defined by*
$$\frac{p + (1-p)\underline{\theta}^2\widehat{\beta}_2}{1-(1-p)(1-\underline{\theta})^2\widehat{\beta}_2} = \frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2}.$$
3. *Suppose* $\frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2} > \kappa$. *Then the bad agent follows his signal whenever* $s_1 = s_2$ *and chooses* $d_2 = a$ *in case of* $s_1 \neq s_2$.

PROOF: See the appendix.

The intuition for this equilibrium is similar to proposition 3.1. Note first that the likelihood ratio $\frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2}$ again measures how probable it is that state $b$ is true relative to state $a$, given that two signals in favor of $b$ have been observed.

The bad agent will again disregard his signal and always choose $d_2 = a$ if the evidence in favor of state $b$ is weak. This happens for large values of $q$ and small values of $\underline{\theta}$. If the information of the agent becomes better she will randomize between decision $a$ and $b$ if she receives two signals in favor of state $b$. The equilibrium condition again equates the likelihood ratio of both states being true with the relative reputational payoffs attached to the different actions. Only if the posterior probability of state $b$ is sufficiently high the agent follows his information.

It is important to note that conditional on $s_1 = s_2 = b$ the agent chooses $d_2 = b$ more often

[18] In the extreme case where $\underline{\theta} = \frac{1}{2}$ the agent does not receive any information and so the posterior equals the prior. We know then from the definition of $q$ that the bad type will not find it optimal to follow his signals if $s_1 = s_2 = b$.

if he has to decide in the second period compared to the decision in the first period. There are two reasons for this. First, given $s_1 = s_2$ the evidence in favor of state $b$ being true is now stronger. However there is a second effect which makes the agent more aggressive. As already noted above, the fact that $d_2 = b$ is chosen only with two confirmatory signals while for $d_2 = a$ at least one signal in favor of state $a$ must have been received, leads to a reputational "premium" of decision $b$ relative to decision $a$ even if the agent does not randomize.

Hence letting the agent decide in the second period may lead to strategic distortions in the behavior of the agents. An interesting fact is that this distortion can more than offset the benefits of better information which can be accumulated.

Proposition 3.3 *If $\underline{\theta}$ is low enough (and smaller than $q$) the probability of a wrong decision is higher if the agent acts in the second period only.*

It should be rather obvious that $\underline{\theta} < q$ is necessary for inefficient decision making to increase. If the agent does not randomize in any of the two equilibria under consideration, decision making will be better in the second period as more information is utilized.

However, if the bad agent randomizes, additional distortions can arise. As an illustration consider a parameter constellation such that the agent randomizes between $a$ and $b$ if he has obtained one, respectively two signals in favor of state $b$. We know from the proposition that $\widehat{\beta}_2 > \widehat{\beta}_1$. Consider now the limit case where $\underline{\theta} = \frac{1}{2}$. In this case the bad agent receives only noise while the information quality of the good agent does not improve through a second perfect signal either. The probability of a correct decision declines strictly when a second signal is acquired, as the bad agent should efficiently choose $d = a$ regardless of his information (remember that $q \geq \widehat{q} > \frac{1}{2}$). As $\underline{\theta}$ rises the decision made by the bad agent improves since $d_2 = b$ if and only if the agent has received two signals in favor of it. Hence the evidence of state $b$ being true becomes stronger. For $\underline{\theta}$ high enough this effect of better information offsets the stronger inclination to choose $d = b$ if agents acquire two signals.

Hence, if the evaluator or a principal is interested in correct decision making he may benefit from forcing the agent to act early and forgo useful information. An interesting question is how the principal can achieve this. One possible way might be work overload of the agents which prevents them from gathering additional information. The role of work overload in mitigating agency problems has been already identified in previous work. In Aghion and

Tirole (1997) work overload on the principal's side serves as a commitment device not to interfere with the agent's decisions. Although not optimal ex post, this commitment gives better incentives to the agents ex ante. Laux (2001) focuses on a different mechanism. He notes that bundling several tasks and allocating them to a single agent might reduce agency cost stemming from limited liability. The rationale for overload offered here is quite different. In contrast to Aghion and Tirole (1997), here it may be optimal to overburden the *agent*, not his principal in order to achieve better decision making. Moreover, in Aghion and Tirole (1997) the *probability* that the agent makes a valuable decision increases in the principal's work load, but the decision per se remains the same. Here it is that work overload has a direct impact on which decision the agent makes.

**Case 2:** $q < \widehat{q}$ In the analysis above the "inferior" action $d = a$ was sustainable as in the case of $s_1 \neq s_2$ the agent was compensated for the lower reputation with a higher success probability. However, if $q$ is sufficiently close to $\frac{1}{2}$, playing $d_2(s_1 \neq s_2) = a$ with probability one is no longer optimal as the reputational wedge between the different actions is too large to be offset by the different success probabilities. Formally,

$$q\overline{V}_2^a + (1-q)\underline{\theta} \geq (1-q)\overline{V}_2^b + q\underline{\theta}$$

is violated for small values of $q$. Hence in the only equilibrium the agent will now randomize between both actions if she has received two contradictory signals. As the agent is now indifferent between both actions after having received no information, she will strictly prefer to follow her signal in case of $s_1 = s_2$. The equilibrium is formally described in the following proposition.

Proposition 3.4 *Suppose $q < \widehat{q}$. Both agents will follow their signal if $s_1 = s_2$. In case of contradictory signals the agent chooses $d = b$ with probability $\widehat{\beta}_3$, where $\widehat{\beta}_3 < \frac{1}{2}$ is implicitly defined by the unique solution to*

$$\frac{p + (1-p)\underline{\theta}(1 - (1-\underline{\theta})(1-2\widehat{\beta}_3))}{p + (1-p)\underline{\theta}(1 + (1-\underline{\theta})(1-2\widehat{\beta}_3))} = \frac{1-q}{q}.$$

Proof: See the appendix.

If ex ante both states of the world are considered to be almost equally likely, there does not exist an "inferior" action anymore which is chosen without new information. Still as long as

$q \geq \frac{1}{2}$ , action $a$ will carry a lower reputational value than action $b$.[19] This is only possible if the bad agent chooses $d_2 = a$ with higher probability, hence $\widehat{\beta}_3 < \frac{1}{2}$.

Next, we will examine the consequences of additional information on the principal's well being, in particular, on the probability of a wrongful decision. It turns out that the principal always benefits from better information if the prior on the two states is balanced enough (i.e. $q \leq \widehat{q}$).

Proposition 3.5 *Consider the case of $q < \widehat{q}$. Then under second period decision making the probability of success is always higher.*

Proof: See the appendix.

If the agents postpone their decision they will make better informed decisions which benefits the principal directly. Additionally, if $q < \widehat{q}$ the distortions arising from strategic behavior are also smaller. Two forces drive this result. Given that the agent must decide in the first period, she holds weaker information in favor of state $b$ when selecting $d = b$. In the second period the agent has either acquired two contradictory signals or two signals in favor of state $b$ but the randomization probability is such that on average, the evidence in favor of $x = b$ is stronger. Additionally, as shown in the appendix the agent chooses the inefficient action $b$ with strictly lower probability.

## 3.5 Conclusion

This paper examined the consequences of information acquisition in an expert setting, where an agent (the expert) who is primarily concerned with his reputation, has to make a recommendation to a principal. It was shown that while better informed agents make correct recommendations more often, more information also has a potential downside. As bad agents try to mimic good ones, their behavior suffers from excessive "experimentation", i.e. they select ex ante less likely actions to often from an efficiency point of view. This distortion can be aggravated if agents hold better information, since an additional reputational wedge is driven

[19] Again the agent must be compensated for the lower success probability if he chooses $d_2(s_1 \neq s_2) = b$ with a higher reputation in case of success.

between different actions. This additional wedge can hurt the principal if he is concerned with correct decision making. But a different dimension of interest might be the selection of agents. If the principal's primary focus is on selecting able agents and sorting out bad ones, another rationale for restricting agent's access to information arises. Superior competence can be better assessed if the error probability of bad agents increases. So especially in the beginning of their career, when arguably selection is more important than correct decision making, agent's might be overburdened with work.[20] More generally speaking, one could think of the organizational structure as a whole being designed such that career concerns of agents are optimally exploited. Koch and Peyrache (2005) is a very interesting first step in that direction.

Although this paper attempted to advance our understanding of expert models by considering a rather obvious extension, a host of further extensions are still unexplored. To name a few, the role of multiple experts is still poorly understood in that setting. As shown by Dewatripont and Tirole (1999), forcing agents to advocate a certain standpoint increases effort. In a pure cheap talk setting, Krishna and Morgan (2001) explore the role of consulting multiple agents. Under certain conditions, if the agents are not too strongly biased in opposite directions, this can improve on information transmission.

To make full use of multiple experts, it might be necessary to augment reputational incentives with explicit incentive schemes. Zwiebel (1995) already noted that relative reputational concerns are of major interest.[21] However, those relative concerns can also be created with contracts specifying some form of relative performance evaluation. Hopefully those issues will be examined in more detail in the near future.

[20] The issue of selection in expert settings has received little attention so far. A notable exception is Prat (2005).

[21] See Effinger and Polborn (2001).

## 3.6 Appendix

Proof of proposition 3.1

Part one of the proposition is already shown in the text. For the other parts, first define the reputational values of choosing $d = a$ and $d = b$ if a bad agent sets $d(s_1 = b) = b$ with probability $\beta_1$ and plays $d = a$ otherwise.

$$\overline{V}_1^a(\beta_1) = \text{Prob}(\theta = 1|d = a, x = a) \cdot 1 + \text{Prob}(\theta = \underline{\theta}|d = a, x = a) \cdot \underline{\theta} = \frac{p}{p + (1-p)(\underline{\theta} + (1-\underline{\theta})(1-\beta_1))} \cdot 1 + \frac{(1-p)(\underline{\theta} + (1-\underline{\theta})(1-\beta_1))}{p + (1-p)(\underline{\theta} + (1-\underline{\theta})(1-\beta_1))} \cdot \underline{\theta}$$

$$\overline{V}_1^b(\beta_1) = \text{Prob}(\theta = 1|d = b, x = b) \cdot 1 + \text{Prob}(\theta = \underline{\theta}|d = b, x = b) \cdot \underline{\theta} = \frac{p}{p + (1-p)\underline{\theta}\beta_1} \cdot 1 + \frac{(1-p)\underline{\theta}\beta_1}{p + (1-p)\underline{\theta}\beta_1} \cdot \underline{\theta}$$

To understand this expression note that good types (which occur with probability $p$) always implement the correct policy. Bad agents, in turn, choose action $a$ correctly if they receive the correct signal (which happens with probability $\underline{\theta}$) and if they obtain a wrong signal but decide to contradict it (which happens with probability $(1-\underline{\theta})(1-\beta_1)$).

If the agent randomizes between both actions the following equality must hold

$$\text{Prob}(x = a|s_1 = b, \underline{\theta})\overline{V}_1^a(\beta_1) + \text{Prob}(x = b|s_1 = b, \underline{\theta}) \cdot \underline{\theta} = \text{Prob}(x = b|s_1 = b, \underline{\theta}) \cdot \overline{V}_1^b(\beta_1) + \text{Prob}(x = a|s_1 = b, \underline{\theta}) \cdot \underline{\theta},$$

which is true if

$$q(1-\underline{\theta})\left[\overline{V}_1^a(\beta_1) - \underline{\theta}\right] = (1-q)\underline{\theta}\left[\overline{V}_1^b(\beta_1) - \underline{\theta}\right]$$

$$\Longleftrightarrow$$

$$q(1-\underline{\theta})\left[\frac{p(1-\underline{\theta})}{p + (1-p)(\underline{\theta} + (1-\underline{\theta})(1-\beta_1))}\right] = (1-q)\underline{\theta}\left[\frac{p(1-\underline{\theta})}{p + (1-p)\underline{\theta}\beta_1}\right]$$

$$\Longleftrightarrow$$

$$\frac{p + (1-p)\underline{\theta}\beta_1}{p + (1-p)(\underline{\theta} + (1-\underline{\theta})(1-\beta_1))} = \frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}$$

$$\Longleftrightarrow$$

$$\frac{p + (1-p)\underline{\theta}\beta_1}{1 - (1-p)(1-\underline{\theta})\beta_1} = \frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}.$$

The right hand side is smaller than one if $\underline{\theta} < q$. The left hand side is equal to $p$ if $\beta_1 = 0$ and goes to one as $\beta_1 \to 1$. Moreover, the left hand side is monotonically increasing in $\beta_1$.

Hence by the intermediate value theorem, if $\frac{(1-q)\theta}{q(1-\underline{\theta})} \in [p,1]$ there exist a unique $\beta_1 \in [0,1]$ which solves the condition in proposition 3.1.

If $\frac{(1-q)\theta}{q(1-\underline{\theta})} < p$ then it can be easily seen that the payoff from choosing $d = a$ always exceeds the payoff from $d = b$. ||

PROOF THAT $\overline{V}_2^b > \overline{V}_2^a$ IF $d_2(s_1 \neq s_2) = a$

$$\overline{V}_2^a = \frac{p + (1-p)\underline{\theta}(\underline{\theta}^2 + 2\underline{\theta}(1-\underline{\theta}))}{p + (1-p)(\underline{\theta}^2 + 2\underline{\theta}(1-\underline{\theta}))} = \frac{\mathbb{E}(\theta^3) + (1-p)2\underline{\theta}^2(1-\underline{\theta})}{\mathbb{E}(\theta^2) + (1-p)2\underline{\theta}(1-\underline{\theta})}.$$

$$\overline{V}_2^b = \frac{p + (1-p)\underline{\theta}^3}{p + (1-p)\underline{\theta}^2} = \frac{\mathbb{E}(\theta^3)}{\mathbb{E}(\theta^2)}.$$

The good type will again always choose action $a$ if this is appropriate. Bad agents will do so if they receive the correct signal twice (which occurs with probability $\underline{\theta}^2$) or in case of contradictory signals (which happens with probability $2\underline{\theta}(1-\underline{\theta})$). $\overline{V}_2^b > \overline{V}_2^a$ if

$$\mathbb{E}(\theta^3)\cdot\mathbb{E}(\theta^2) + \mathbb{E}(\theta^3)(1-p)2\underline{\theta}(1-\underline{\theta}) > \mathbb{E}(\theta^3)\cdot\mathbb{E}(\theta^2) + \mathbb{E}(\theta^2)(1-p)2\underline{\theta}^2(1-\underline{\theta})$$

$$\Longleftrightarrow$$

$$\underline{\theta}\mathbb{E}(\theta^2) < \mathbb{E}(\theta^3),$$

which is always satisfied. ||

PROOF OF LEMMA 3.1

We have just shown that the action which is chosen only with two confirmatory signals bears a higher reputation in case of success. Assume this action would be $a$, i.e. $d_2(s_1 \neq s_2) = b$. This would imply $\overline{V}_2^b < \overline{V}_2^a$. In case of two contradictory signals, the bad agent must have an incentive to choose $b$. But

$$(1-q)\overline{V}_2^b + q\underline{\theta} \geq q\overline{V}_2^a + (1-q)\underline{\theta}$$

can only be satisfied if $\overline{V}_2^b > \overline{V}_2^a$, a contradiction. ||

PROOF OF PROPOSITION 3.2

Let $q \geq \widehat{q}$ which implies $d(s_1 \neq s_2) = a$. Define $\beta_2 = \text{Prob}(d_2 = b | s_1 = s_2 = b, \underline{\theta})$.

$$\begin{aligned}\overline{V}_2^b(\beta_2) &= \text{Prob}(\theta = 1 | d_2 = b, x = b)\cdot 1 + \text{Prob}(\theta = \underline{\theta} | d_2 = b, x = b)\cdot\underline{\theta} = \\ &= \frac{p}{p + (1-p)\underline{\theta}^2\beta_2}\cdot 1 + \frac{(1-p)\underline{\theta}^2\beta_2}{p + (1-p)\underline{\theta}^2\beta_2}\cdot\underline{\theta}.\end{aligned}$$

$$\overline{V}_2^a(\beta_2) = \text{Prob}(\theta = 1|d_2 = a, x = a) \cdot 1 + \text{Prob}(\theta = \underline{\theta}|d_2 = a, x = a) \cdot \underline{\theta} =$$

$$\frac{p}{p + (1-p)[\underline{\theta}^2 + 2\underline{\theta}(1-\underline{\theta}) + (1-\beta_2)(1-\underline{\theta})^2]} \cdot 1 + \frac{(1-p)[\underline{\theta}^2 + 2\underline{\theta}(1-\underline{\theta}) + (1-\beta_2)(1-\underline{\theta})^2]}{p + (1-p)[\underline{\theta}^2 + 2\underline{\theta}(1-\underline{\theta}) + (1-\beta_2)(1-\underline{\theta})^2]} \cdot \underline{\theta}.$$

To understand these expressions note that the denominator of $\overline{V}_2^a$ gives the probability that action $a$ is chosen correctly in equilibrium. The good type will always choose correctly, while the bad type sets $d_2 = a$ if either he receives two signals in favor of $a$ (this happens with probability $\underline{\theta}^2$) or two mixed signals (probability $2\underline{\theta}(1-\underline{\theta})$). She will also choose $d = a$ with probability $1 - \beta_2$ if she receives two signals in favor of state $b$ (probability $(1-\underline{\theta})^2$). The other expressions can be interpreted analogously.

For randomization to be an equilibrium outcome we must have

$$\text{Prob}(x = a|s_1 = s_2 = b, \underline{\theta})\overline{V}_2^a(\beta_2) + \text{Prob}(x = b|s_1 = s_2 = b, \underline{\theta}) \cdot \underline{\theta} =$$

$$\text{Prob}(x = b|s_1 = s_2 = b, \underline{\theta}) \cdot \overline{V}_2^b(\beta_2) + \text{Prob}(x = a|s_1 = s_2 = b, \underline{\theta}) \cdot \underline{\theta},$$

$$\Longleftrightarrow$$

$$q(1-\underline{\theta})^2 \left[\overline{V}_2^a(\beta_2) - \underline{\theta}\right] = (1-q)\underline{\theta}^2 \left[\overline{V}_2^b(\beta_2) - \underline{\theta}\right]$$

$$\Longleftrightarrow$$

$$q(1-\underline{\theta})^2 \left[\frac{p(1-\underline{\theta})}{p + (1-p)[\underline{\theta}^2 + 2\underline{\theta}(1-\underline{\theta}) + (1-\beta_2)(1-\underline{\theta})^2]}\right] = (1-q)\underline{\theta}^2 \left[\frac{p(1-\underline{\theta})}{p + (1-p)\underline{\theta}^2\beta_2}\right]$$

$$\Longleftrightarrow$$

$$\frac{p + (1-p)\underline{\theta}^2\beta_2}{p + (1-p)[\beta_2(2\underline{\theta} - \underline{\theta}^2) + (1-\beta_2)]} = \frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2}$$

$$\Longleftrightarrow$$

$$\frac{p + (1-p)\underline{\theta}^2\beta_2}{p + (1-p)[1 - \beta_2(1-\underline{\theta})^2]} = \frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2},$$

which is the condition stated in the proposition which implicitly defines the randomization probability (existence can be shown completely analogous to proposition 3.1).

Note that the left hand side is monotonically increasing in $\beta_2$ and takes on values between $p$ for $\beta_2 = 0$ and $\frac{p+(1-p)\underline{\theta}^2}{p+(1-p)\underline{\theta}(2-\underline{\theta})} := \kappa$ for $\beta_2 = 1$. If the right hand side is larger than $\kappa$, $\beta_2 = 1$ is optimal, i.e. the agent always follows his signal. If the right hand side falls short of $p$ the agent will optimally set $\beta_2 = 0$. This proves the optimality of the strategy stated in the proposition.

What remains to be shown is that $\beta_2 > \beta_1$. As $\frac{(1-q)\underline{\theta}^2}{q(1-\underline{\theta})^2} \geq \frac{(1-q)\underline{\theta}}{q(1-\underline{\theta})}$ it is sufficient to show that

$$\forall \beta : \frac{p + (1-p)\underline{\theta}^2 \beta}{p + (1-p)[1 - \beta(1-\underline{\theta})^2]} \leq \frac{p + (1-p)\underline{\theta}\beta}{1 - (1-p)(1-\underline{\theta})\beta}.$$

Figure 2 illustrates this.

We have already seen that for $\beta = 0$ both terms are equal to $p$. Note that one can write the

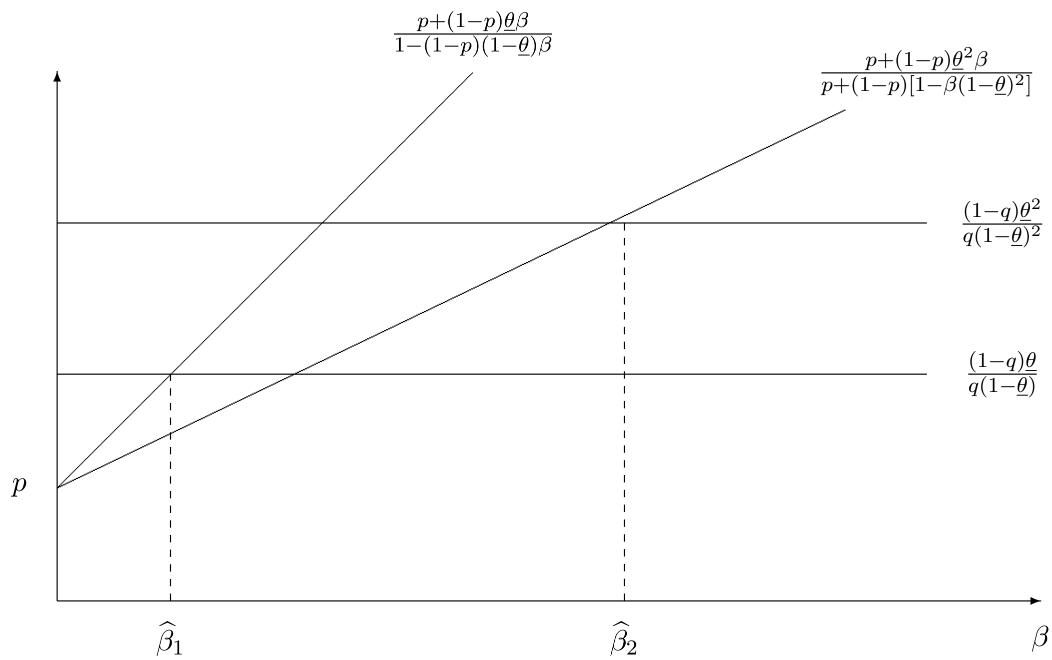


Figure 3.2: Illustration of the equilibrium

term on the left hand side also as

$$\frac{p + (1-p)\underline{\theta}^2 \beta}{1 - (1-p)\beta(1-\underline{\theta})^2}.$$

As the numerator is smaller and the denominator is larger compared to the respective terms on the right hand side it is now obvious to see that the condition is satisfied, hence $\beta_2 > \beta_1$. ||

Proof of proposition 3.3

The probability of a wrong decision in the first period is given by

$$q[(1-\underline{\theta})\beta_1] + (1-q)[(1-\underline{\theta}) + \underline{\theta}(1-\beta_1)] = q[(1-\underline{\theta})\beta_1] + (1-q)[1 - \underline{\theta}\beta_1].$$

Whenever the true state is $a$ then the wrong decision is only made if the agent receives an incorrect signal (which happens with probability $1-\underline{\theta}$) and chooses action $b$ (which happens with probability $\beta_1$). If $x = b$ the agent chooses $d_1 = a$ if she obtained the wrong signal (which happens with probability $(1-\underline{\theta})$), but also with probability $(1-\beta_1)$ if she received the correct signal.

In an completely analogous way we derive the probability of a wrong decision in the second period as

$$q[(1-\underline{\theta})^2\beta_2] + (1-q)[1-\beta_2\underline{\theta}^2].$$

Therefore, the probability of a mistake in the second period exceeds the one in the first period if

$$q(1-\underline{\theta})[\beta_1 - (1-\underline{\theta})\beta_2] < (1-q)\underline{\theta}[\beta_1 - \beta_2\underline{\theta}].$$

From proposition 3.1 and 3.2 we can derive $\beta_1(q) = \frac{(1-q)\underline{\theta}-pq(1-\underline{\theta})}{\underline{\theta}(1-\underline{\theta})(1-p)}$ and $\beta_2(q) = \frac{(1-q)\underline{\theta}^2-pq(1-\underline{\theta})^2}{\underline{\theta}^2(1-\underline{\theta})^2(1-p)}$. Inserting , one obtains

$$q\frac{pq(2\underline{\theta}-1)(1-\underline{\theta})}{\underline{\theta}^2(1-p} > (1-q)\frac{(1-q)(2\underline{\theta}-1)\underline{\theta}}{(1-\underline{\theta})^2(1-p)},$$

which is satisfied whenever

$$\frac{q^2}{\underline{\theta}^2}p(1-\underline{\theta}) > \frac{(1-q)^2}{(1-\underline{\theta})^2}\underline{\theta}.$$

One can directly see that $\underline{\theta} < q$ is necessary for this condition to be satisfied. If $\underline{\theta}$ approaches $\frac{1}{2}$ the condition becomes $q^2p > (1-q)^2$ which is satisfied if $p$ and $q$ are large enough. ||

PROOF OF PROPOSITION 3.4

Suppose $q \leq \widehat{q}$ and define $\beta_3 := \text{Prob}(d = b|s_1 \neq s_2)$. The reputational payoffs of the different actions are given by[22]

$$\begin{aligned}
\overline{V}_2^a(\beta_3) &= \text{Prob}(\theta = 1|d_2 = a, x = a)\cdot 1 + \text{Prob}(\theta = \underline{\theta}|d_2 = a, x = a)\cdot\underline{\theta} = \\
&= \frac{p}{p+(1-p)[\underline{\theta}^2+(1-\beta_3)2\underline{\theta}(1-\underline{\theta})]}\cdot 1 + \frac{(1-p)[\underline{\theta}^2+(1-\beta_3)2\underline{\theta}(1-\underline{\theta})]}{p+(1-p)[\underline{\theta}^2+(1-\beta_3)2\underline{\theta}(1-\underline{\theta})]}\cdot\underline{\theta} \\
&= \frac{p+(1-p)[\underline{\theta}+\underline{\theta}(1-\underline{\theta})(1-2\beta_3)]\underline{\theta}}{p+(1-p)[\underline{\theta}+\underline{\theta}(1-\underline{\theta})(1-2\beta_3)]}
\end{aligned}$$

$$\begin{aligned}
\overline{V}_2^b(\beta_3) &= \text{Prob}(\theta = 1|d_2 = b, x = b)\cdot 1 + \text{Prob}(\theta = \underline{\theta}|d_2 = b, x = b)\cdot\underline{\theta} = \\
&= \frac{p}{p+(1-p)[\underline{\theta}^2+\beta_3 2\underline{\theta}(1-\underline{\theta})]}\cdot 1 + \frac{(1-p)[\underline{\theta}^2+\beta_3 2\underline{\theta}(1-\underline{\theta})]}{p+(1-p)[\underline{\theta}^2+\beta_3 2\underline{\theta}(1-\underline{\theta})]}\cdot\underline{\theta} \\
&= \frac{p+(1-p)[\underline{\theta}-\underline{\theta}(1-\underline{\theta})(1-2\beta_3)]\underline{\theta}}{p+(1-p)[\underline{\theta}-\underline{\theta}(1-\underline{\theta})(1-2\beta_3)]}
\end{aligned}$$

[22]Notice that we make use of the fact that if the agent randomizes in case of mixed signals she will have an incentive to follow her signals if $s_1 = s_2$.

Indifference implies that

$$q\overline{V}_2^a(\beta_3) + (1-q)\underline{\theta} = (1-q)\overline{V}_2^b(\beta_3) + q\underline{\theta}$$

$$\iff$$

$$q[\overline{V}_2^a(\beta_3) - \underline{\theta}] = (1-q)[\overline{V}_2^b(\beta_3) - \underline{\theta}]$$

$$\iff$$

$$q\left[\frac{p(1-\underline{\theta})}{p+(1-p)[\underline{\theta}+\underline{\theta}(1-\underline{\theta})(1-2\beta_3)]}\right] = (1-q)\left[\frac{p(1-\underline{\theta})}{p+(1-p)[\underline{\theta}-\underline{\theta}(1-\underline{\theta})(1-2\beta_3)]}\right],$$

from which the proposition follows immediately. ||

<u>Proof of proposition 3.5</u>

The probability of a mistake in the second period can be written as

$$(1-\underline{\theta})^2 + 2\underline{\theta}(1-\underline{\theta})[\beta_3(q)q + (1-\beta_3(q))(1-q)],$$

where from proposition 3.4 we obtain $\beta_3(q) = \frac{1}{2} - \frac{(2q-1)\mathbb{E}(\theta)}{2(1-p)(1-\underline{\theta})\underline{\theta}}$. The first term denotes the probability of receiving two wrong signals, while the second term gives the probability of getting two contradictory signals and choosing the wrong action.

Consider first the case where the bad agent does not randomize in the first period, i.e. $\underline{\theta} \geq q$. The error probability in the first period is then simply given by $1-\underline{\theta}$. If the error probability in the second period was higher it must be true that

$$1-\underline{\theta} < (1-\underline{\theta})^2 + 2\underline{\theta}(1-\underline{\theta})[\beta_3(q)q + (1-\beta_3(q))(1-q)]$$

$$\iff$$

$$\frac{1}{2} < [\beta_3(q)q + (1-\beta_3(q))(1-q)]$$

$$\iff$$

$$-\frac{(2q-1)q\mathbb{E}(\theta)}{2(1-p)(1-\underline{\theta})\underline{\theta}} + \frac{(2q-1)(1-q)\mathbb{E}(\theta)}{2(1-p)(1-\underline{\theta})\underline{\theta}} > 0,$$

which can never be the case given that $(1-q) < q$.

Let us now turn to the case where the agent randomizes in the first period. We now obtain the following expression for the error probability in the first period:

$$q(1-\underline{\theta})\beta_1(q) + (1-q)[(1-\underline{\theta}) + \underline{\theta}(1-\beta_1(q))] = (1-\underline{\theta}) - (\underline{\theta}-q)(1-\beta_1(q)).$$

When the agent receives a wrong signal if the true state is $a$, she chooses the wrong action with probability $\beta_1(q)$, while she will always make the wrong decision upon receiving the wrong signal in state $b$. Additionally, if the state is $b$ the bad agent wrongly contradicts a correct signal with probability $(1-\beta_1(q))$.

Inserting $\beta_1(q) = \frac{(1-q)\underline{\theta}-pq(1-\underline{\theta})}{\underline{\theta}(1-\underline{\theta})(1-p)}$, one obtains

$$(1-\underline{\theta}) - (q-\underline{\theta})^2 \frac{\mathbb{E}(\theta)}{\underline{\theta}(1-\underline{\theta})(1-p)}$$

as expression for the error probability in period 1.

The likelihood of a wrongful decision is lower in period 1 if

$$(1-\underline{\theta}) - (q-\underline{\theta})^2 \frac{\mathbb{E}(\theta)}{\underline{\theta}(1-\underline{\theta})(1-p)} \leq 2\underline{\theta}(1-\underline{\theta}) \left[\frac{1}{2} - \frac{(2q-1)^2\mathbb{E}(\theta)}{2(1-p)(1-\underline{\theta})\underline{\theta}}\right]$$

$$\Longleftrightarrow$$

$$(1-\underline{\theta})^2 \leq [(q-\underline{\theta})^2 - (2q-1)^2] \frac{\mathbb{E}(\theta)}{\underline{\theta}(1-\underline{\theta})(1-p)},$$

which can never be satisfied since $(q-\underline{\theta})^2 < (2q-1)^2$, so the right hand side is always smaller than zero. ||

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## Eidesstattliche Versicherung

Ich versichere hiermit eidesstattlich, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sowie mir gegebene Anregungen sind als solche kenntlich gemacht.

Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

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