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ABSTRACT

Re-election Threshold Contracts in Politics*

When politicians are provided with insufficient incentives by the democratic election mechanism, social welfare can be improved by threshold contracts. A threshold contract stipulates the performance level that a politician must reach in order to obtain the right to stand for re-election. 'Read my lips' turns into 'read my contract'. Politicians can offer the threshold contracts during their campaign. These threshold contracts do not violate the liberal principle of free and anonymous elections in democracies.

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Keywords: democracy, elections and threshold contract

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1 Introduction

Democracies are - and should be - built on the fundamental principles of free and anonymous elections. Consequently, future reelection is uncertain. For instance, highly competent challengers may emerge at the reelection stage, thus lowering politicians' reelection chances even if they have performed well in the past. Newly emerging issues during campaigns may also influence voting behavior. The randomness of a politician's reelection chances increases further when the benefits from the politician's efforts cannot be measured with sufficient precision, or when benefits are affected by external shocks. Consider a reform of the judiciary system as an example for the former, or a labor market reform as an example for the latter.[1]

Uncertainty in future reelections may not provide politicians with sufficient motivation to exert a socially desirable amount of effort, as good performance may not secure reelection. In this paper we show that adding a threshold contract to the election mechanism can increase social welfare without undermining the liberal principles of free and anonymous voting in democracies. A threshold contract stipulates the minimum performance level a politician must achieve in order to obtain the right to stand for reelection. Thus, it penalizes low effort more heavily than the reelection mechanism does and increases the marginal benefit of effort. The politician either reacts to such threshold contracts by increasing effort to enhance his reelection chances, or he does not find it worthwhile to meet the threshold and chooses zero effort. A suitable design of the threshold contract can obviate the latter possibility and welfare may be increased.

We consider a model in which an elected politician who is motivated by the prospect of holding office can exert effort on a public issue. The effort creates benefits for the public which are affected by noise, either due to measurement problems or to shocks. The

[1] The potential benefits in terms of reduction of unemployment rates can be thwarted by negative macroeconomic shocks, which may make it very difficult for voters to assess the effort exerted by the politician pursuing such reforms.

politician's reelection chances are determined by a mixture of backward- and forward-looking voting behavior. Hence, the reelection decision does not only depend on the effort exerted by the politician and consequently the reelection mechanism does not provide him with sufficient motivation to exert the socially optimal amount of effort. We allow a court to stipulate a threshold contract that the politician must accept upon election. This contract prescribes a level of benefits the politician must achieve in order to earn the right to stand for reelection. We show that optimally designed threshold contracts can increase social welfare.

Subsequently we extend the model and allow politicians to offer the threshold contracts themselves during their campaigns. We show that optimal contracts are offered provided the politicians have the same competence, which is measured by the marginal costs of exerting effort. If the politicians differ in competence, then a second-best contract is offered, and the politician with the higher competence will be elected.

Our paper is a new proposal to supplement the election mechanism in democracies by incentive contracts. While the literature (e.g. Gersbach (2002), Gersbach and Liessem (2000)) has introduced incentive contracts prescribing utility or monetary transfers after a politician has been reelected, the novel element in this paper is the idea of thresholds for reelection.[2] Such threshold contracts do not violate the fundamental liberal principles of free and anonymous elections in democracies, as voting behaviour is unrestricted. Moreover, all individuals are eligible as candidates except the incumbent operating under a threshold contract who may face a term limit if he does not meet the threshold. Term limits do not violate liberal principles in democracies.[3]

[2] While in our paper we combine threshold contracts for politicians with the democratic requirements of free and anonymous elections, there is a rapidly growing range of literature on incentive contracts for central bankers where democratic requirements play no role. This was initiated by Walsh (1995a), Walsh (1995b) and developed by Persson and Tabellini (1993), Lockwood (1997), Svensson (1997) and Jensen (1997).

[3] For comprehensive discussion of constitutional and unconditional term limits see Carey and Powell (2000), Dick and Lott (1993) and Petracca (1992). For dynamic models on the relative performance of term limits see Akemann and Kanczuk (1999).

Although incentive contracts for politicians are unconstitutional in modern democracies, there are historical parallels. In medieval Venice the doge (the former principal of Venice) was elected by the most influential families and the clergy. From 1192 onwards he had to swear an oath ("promissio ducale") when entering office which placed certain requirements on his administration of office. Most parts of the *promissio* had a constitutional purpose but other parts set specific requirements without constitutional aims. Examples of these sections are the duty to expand the fleet with funds of the doge and to fight against heretics.

There are various well-known situations where threshold contracts could have been applied in our days and age. When US President George Bush senior announced "read my lips: no new taxes", threshold contracts would not have allowed him to abandon his campaign promise and then stand for reelection. Another recent example materialized in the election campaign in Germany in 1998. Chancellor Schröder's campaign promise included a decrease in the unemployment level to 3.5 million by 2002. A threshold contract would have caused Schröder either to forgo such promises or to keep to them in order to stand for reelection as he did in 2002.

The paper is related to the literature about electoral accountability initiated by Barro (1973) and Ferejohn (1986) and extended by Persson, Roland, and Tabellini (1997) (see Persson and Tabellini (2000) for surveys). Politicians and voters are assumed to have divergent interests, and elections are a means by which voters can control a politician's misbehavior, since the possibility of reelection induces self-interested politicians to act on behalf of the electorate. Elections as a control device require backward-looking voting behavior. In our paper, voters are only partially backward-looking and also use forward-looking criteria to make their election decisions. When voters are both backward- and forward-looking, we show that threshold contracts can provide appropriate incentives.

The paper is organized as follows: In section 2 we outline the model. Section 3 presents the first-best solution. In section 4 we show how the reelection mechanism functions. In section 5 we add the threshold contract to the reelection mechanism and indicate the welfare implications. Section 6 gives an example of how the threshold contract works. Section 7 discusses what happens if the politicians themselves offer threshold contracts at the campaign stage. Section 8 presents our conclusions.

2 The Model

We consider a simple political agency problem. The voters and the politician are assumed to be risk-neutral. There are two periods. In the first period, the incumbent has to exert effort e on a task T, which for example could be the reform of the judiciary system. The effort e on task T creates benefits B for the public in the first period.[4] For simplicity, we assume

$$B = e. \tag{1}$$

The voters cannot observe B directly; instead, they receive a noisy signal about the benefits. This refers to a situation where the benefits of political actions are not easily measurable. For example, if the politician works on the reform of the judiciary system, the benefits are widespread and cannot be identified in simple quantitative terms. We assume the benefit signal to be given as

$$b = B + \epsilon = e + \epsilon. \tag{2}$$

Factor ϵ is a random variable with the support $[-a, a]$ distributed with the density function $f(\epsilon)$. We assume $E(\epsilon)$ to be zero. Hence, the benefit signal b is distributed with the density function $f(b) = f(e + \epsilon)$ on $[e - a, e + a]$.

[4] Additional benefits may also materialize in the second period, but this has no bearing on our main results.

The expected utility for the public is denoted by U^P. Upon observing b, U^P is given as

$$U^P = E(B \mid b). \tag{3}$$

E is the expectation of the benefits, evaluated after b has been observed. Given our assumption $b = B + \epsilon$ and thus $E(B \mid b) = b$, U^P is simply given as

$$U^P = b. \tag{4}$$

An alternative interpretation of our model would be that the public does not perceive a signal about their benefits, but that the benefits themselves are affected by an external shock. This would describe, for example, a situation in which a politician exerts effort on a labor market reform, but the benefits of the effort are affected by macroeconomic shocks. In this case, b stands for the benefits for the public. While our results are also valid for this alternative interpretation, we focus on the first interpretation.

We assume that the reelection chances of the politician depend on his performance in the first term. More particularly, we assume that his reelection probability can be expressed by a continuous probability function $p(b)$ that is known by the politician at the beginning of the first period. $p(b)$ is the probability that the politician will be reelected if the benefit signal b is realized. The reelection probability is assumed to be monotonically increasing in b with support $[\underline{b}, \bar{b}]$. For $b < \underline{b}$ the reelection probability is assumed to be zero, for $b > \bar{b}$ the reelection probability is one.

A continuous reelection probability $p(b)$ represents a mixture of backward- and forward-looking voting. While we work with a given stochastic reelection scheme throughout the paper, it is important that the reelection probability $p(b)$ can be justified as the voters' best response to the politician's choice of effort in an extended version of our model. Three variants of how $p(b)$ can be endogenized are introduced at the end of this section.

The utility of the politician is given by

$$U^A(b,e) = W_1 + q\{e \mid p(b)\}W_2 - C(e). \tag{5}$$

W_1 denotes the utility of the office in period 1, W_2 the discounted utility of the office in period 2 and $C(e)$ the cost of exerting the effort. For tractability, the cost $C(e)$ of the politician is assumed to be given as follows:

$$C(e) = ce^2. \tag{6}$$

The factor c can be interpreted in two ways. Either it measures the politician's disinclination to provide the effort e, or it could be interpreted as the competence of the politician, with small c meaning high competence, i.e., achieving a certain benefit level does not require much expense of effort from the politician. The utility from holding office may include monetary benefits, such as a fixed wage, and non-monetary benefits, such as prestige or the desire for a statesman-like image. The function $q\{e \mid p(b)\}$ denotes the politician's expected reelection probability if he exerts the effort level e and the reelection scheme $p(b)$ holds. For simplicity of exposition, we denote the expected reelection probability $q\{e \mid p(b)\}$ as $q(e)$. Then the overall expected utility of office in period 2 is given by $q(e)W_2$. The utility W_1 from holding office in the first period is independent of the effort choice. Accordingly, it will be neglected in the subsequent analysis. The remaining utility takes the form

$$U^A(b,e) = q(e)W_2 - C(e). \tag{7}$$

Given the politician's utility, the participation constraint (PC) that the politician wants to stand for reelection amounts to

$$q(e)W_2 - C(e) \geq 0. \tag{8}$$

The politician chooses an effort level that maximizes his utility. Thus, the incentive constraint (IC) is given as

$$e = \arg\max_e \{q(e)W_2 - C(e)\}. \tag{9}$$

In order to break ties, we assume that a politician who is indifferent between actions will choose those that yield the highest utility for the voters.

The overall game is summarized as follows:

Stage 1:

Based on his expected reelection chances $q(e)$, the politician exerts his effort on task T.

Stage 2:

The benefit from the politician's activity is realized. The public observes the benefit signal b and makes its reelection decision.

The important assumption of our model regarding $p(b)$ is that voters do not use an ex ante optimal cutoff rule when they decide on the reelection of an incumbent, as has been a prominent theme in the theory of political accountability developed by Barro (1973), Ferejohn (1986) and Persson, Roland, and Tabellini (1997).

Our assumption can be justified empirically, as a wealth of research has shown how voter opinion can shift over time (see, for example, the comprehensive study by Lupia and McCubbins (1998)). Our assumption can be justified theoretically by considering more extended games that make it possible to endogenize the probability function $p(b)$ in particular ways. We discuss three possibilities.

First, a continuous reelection rule $p(b)$ can be derived as an equilibrium strategy in an infinitely repeated version of our game when the cost parameters of future challengers are subject to noise.[5]

Second, consider again a repeated version of our game, but suppose that voters behave reciprocally towards the incumbent (see Hahn (2004)) and there is a two-term limit.

[5] By using the methods developed in Banks and Sundaram (1998) the statement is straightforward to prove if the cost parameters of candidates are observable when they compete for office and if the future cost of efforts of a politician is a decreasing function of current efforts. Then, keeping an incumbent if his costs are not larger than that of a challenger is part of an equilibrium and produces a continuous reelection rule. The details are available upon request.

If there is uncertainty about the competence of future candidates and thus about the costs of reciprocally rewarding good behavior, reelection schemes can take the form of a continuous probability function $p(b)$.

Third, an ex ante inefficient cutoff rule has been derived by Banks and Sundaram (1998). They study the optimal retention rule when agents have two-period lives and work for a longer-lived principal. When there is only moral hazard (as in our model) every agent carries out the action that maximizes the agent's one-period utility in equilibrium. This principal cannot credibly provide the incentive for agents to work hard in the first period. For an infinitely repeated version of our model with the features of Banks and Sundaram (1998) this would imply that the politician would choose minimal effort in the first term[6] and the reelection chances are independent of the performance signal. In such a set-up, threshold contracts would yield the highest welfare gains for the public.

To sum up, while we work here with the reduced game introduced above and allow for arbitrary probability functions $p(b)$, particular forms of $p(b)$ can be endogenized as an equilibrium response in more extended versions of our game.

3 First-Best Solution

We first describe the first-best solution. We assume that the public has perfect information about the politician's effort. Furthermore, the public can impose the exertion of a certain effort level on the politician by designing a contract that heavily penalizes any deviation from a prescribed effort level. If the politician selects the prescribed effort, his remuneration is equal to the benefits W_2 he would receive in the second term.

To determine the first-best solution the public has to maximize its utility subject to the

[6]Note that the remuneration and the benefits of the office are fixed and thus incentives can only be provided by reelection decisions.

politician's participation constraint.[7] The participation constraint must be honored by the public, otherwise the politician would resign and leave office.

The perfect information assumption yields

$$U^P = B. \tag{10}$$

Hence, the voters' problem is given by

$$\max\{U^P = e\}, \tag{11}$$

$$\begin{aligned} s.t. \quad W_2 - C(e) &\geq 0, \\ e &\geq 0. \end{aligned}$$

From $W_2 = ce^2$ we immediately obtain

Proposition 1

The first-best effort level is given by

$$e^{FB} = \sqrt{\frac{W_2}{c}}. \tag{12}$$

This is the maximum effort level the public can implement. Higher effort levels would not satisfy the participation constraint, and the politician would not accept the contract.[8]

4 The Reelection Mechanism

4.1 Effort Levels

In this section we explore the equilibria of the game if only the reelection mechanism is at work. Since $p(b)$ is given, an equilibrium is simply the optimal effort choice of the

[7] We do not include the utility of the politician in social welfare because we consider elections in a large population.

[8] Note that the first-best solution can also be implemented if the public could commit to a reelection scheme at the beginning of the first term and effort is perfectly observable (see Ferejohn (1986)). We exclude the idea that voters can precommit to a reelection rule; hence voting behavior must be sequentially rational.

politician. The politician chooses his effort according to the incentive constraint (IC) as

$$e = \arg\max_{e}\{q(e)W_2 - ce^2\}.$$

The expected reelection probability $q(e)$ is given by

$$q(e) = \int_{e-a}^{e+a} p(b)f(b-e)db = \int_{-a}^{+a} p(e+\epsilon)f(\epsilon)d\epsilon. \tag{13}$$

Note that $p(b)$ is zero for $b < \underline{b}$ and reelection is certain for $b \geq \bar{b}$. Therefore the expected reelection probability $q(e)$ has different forms for the cases $e - a < \underline{b}$, $e - a > \underline{b}$, etc., which we will address when necessary. We thus obtain

Proposition 2

Under the reelection scheme $p(b)$ only three types of solutions can occur:

(i) $e = 0$ *(lower corner solution),*

(ii) $e = \bar{b} + a$ *(upper corner solution)*

(iii) $e^{int} = \frac{\partial q(e)}{\partial e}\frac{W_2}{2c}$ *(interior solutions).*

The proof is given in the appendix.

Among the possible solutions, the politician selects the one that maximizes his utility. Let e^* be the solution of the politician's maximization problem, i.e., the global maximum

$$e^* = \arg\max\{U^A(e)\}.$$

4.2 Efficiency Considerations

In the following, we discuss the efficiency or inefficiency of the various solutions. Obviously the lower corner solution is the worst in terms of welfare. We next consider the upper corner solution.

4.2.1 The Upper Corner Solution

If the politician chooses the upper corner solution, the first-best solution is implemented provided that $\bar{b} = e^{FB} - a$. Since $W_2 = C(e^{FB}) = ce^{FB^2}$, the first-best solution requires a reelection probability of one, otherwise the PC would be violated.

If $\bar{b} \neq e^{FB} - a$ then first-best cannot be obtained. Either the politician can secure his reelection with an effort smaller than e^{FB} (in the case where $\bar{b} < e^{FB} - a$) or his reelection probability is smaller than one if he exerts the socially desirable amount of effort and thus his PC is violated (in the case where $\bar{b} > e^{FB} - a$).

We next give the conditions that lead to the upper corner solution. Let e^j, $j = 1...k$ denote any effort level of the interior or lower corner solutions. Then the politician chooses the upper corner solution, provided

$$W_2 - c(\bar{b} + a)^2 \geq \int_{e^j - a}^{e^j + a} p(b) f(b - e) db W_2 - c\left(e^j\right)^2 \geq 0 \quad \text{for all } j$$

and thus if

$$\left(1 - \int_{e^j - a}^{e^j + a} p(b) f(b - e) db\right) W_2 \geq c(\bar{b} + a)^2 - c\left(e^j\right)^2 \geq 0 \quad \text{for all } j.$$

So, for the politician to adopt the upper corner solution, the loss through higher costs has to be outweighed by the gain in the expected reelection probability. The costs of exerting the effort $e = \bar{b} + a$ increase in a (the bounds of the density function of the noise) and $\bar{b}$. The gain in expected reelection probability is high if $p(b)$ has a high gradient.[9]

4.2.2 The Interior Solution

As interior solutions imply $q(e) < 1$, they cannot lead to the first-best effort level. We briefly examine the characteristics of the interior solution. To do this, we write the

[9]Moreover, one can show that the gain is high, and thus the corner solution is more likely to be adopted, when the benefit signal has a small variance.

effort e^{int} as

$$e^{int} = \frac{\partial \int_{-a}^{a} p(e+\epsilon) f(\epsilon) d\epsilon}{\partial e} \frac{W_2}{2c}.$$

Using the rules for differentiation of parameter integrals,[10] this can be written as

$$e^{int} = \int_{-a}^{a} \frac{\partial p(e+\epsilon)}{\partial e} f(\epsilon) d\epsilon \frac{W_2}{2c}. \tag{14}$$

Throughout the paper we assume that equation (14) has a finite number of solutions. The implicit equation (14) exhibits intuitive comparative statics if we assume in addition that the interior solution is unique. A sufficient condition for a unique interior solution is, for instance, that $q(e)W_2 - ce^2$ is concave on $[0, \infty)$ and that $\frac{\partial q(e)}{\partial e}|_{e=0} > 0$. In this case, e^{int} increases the higher the gradient of the reelection scheme and the lower the variance of the benefit signal is.[11] Additionally, the effort level in the interior solution depends in an intuitive way on the benefits of holding office and on the costs of exerting effort.

5 Reelection Threshold Contracts

In this section, we investigate whether the introduction of a threshold contract leads to a superior solution. We assume that there is an independent institution, for example a court, that has the same utility function as the voters and the right to design and to execute the threshold contract. The design of the threshold contract and its execution is given as follows: The court announces a threshold value denoted by $\hat{b}$ at the beginning of the first period. If the benefit signal realized at the end of the first period is lower than $\hat{b}$, the politician is not allowed to stand for reelection. If the benefit signal realized

[10] Note that e and ϵ are the two independent variables and $b = e + \epsilon$.

[11] One can further show that the variance of the benefit signal influences the outcome as follows: the higher the variance of the benefit signal, i.e. the lower $f(b-e)$, the less impact the design of the reelection mechanism has. If the variance is very high then it is irrelevant whether $p(b)$ has a high gradient, as the expected reelection probability remains approximately the same.

is equal to or higher than $\hat{b}$, the politician is allowed to stand for reelection. Then the democratic election process with free and anonymous voting takes place. Thus, a hierarchy of threshold contracts and elections is formed. First, the decision is taken as to whether the politician has the right to stand for reelection, then voting takes place.

The overall game is summarized as follows:

Stage 1:

A court dictates a threshold value $\hat{b}$ that the politician must reach if he wants to stand for reelection. The required value is known to the politician. Voters have a stochastic reelection scheme $p(b)$.

Stage 2:

The politician exerts his effort on task T.

Stage 3:

The benefit from the politician's activity is realized. The public and the court observe the benefit signal b. If $b < \hat{b}$, the politician has to leave office. If $b \geq \hat{b}$ the politician is allowed to stand for reelection and reelection takes place.

When the threshold contract is at work and the court announces $\hat{b}$, the expected reelection probability for a given effort changes to

$$q(e, \hat{b}) = \int_{e-a}^{e+a} p(b) f(b - e) db - \int_{e-a}^{\hat{b}} p(b) f(b - e) db. \tag{15}$$

The last term measures the decline of the expected reelection probability due to the threshold contract. If $e - a < \hat{b}$, then $q(e, \hat{b}) < q(e)$, because the expected reelection probability for some signals is now zero. In this case, the expected reelection probability can be directly written as

$$q(e, \hat{b}) = \int_{\hat{b}}^{e+a} p(b) f(b - e) db. \tag{16}$$

The utility for the politician with a threshold contract is denoted by $U^A(e, \hat{b})$ and is given by

$$U^A(e, \hat{b}) = q(e, \hat{b})W_2 - ce^2.$$

We now explore the consequences of the threshold contract. First, we examine how effort levels under the IC are affected by threshold contracts. In the next step, we derive the optimal threshold contract. Then we characterize the conditions in which the threshold contract strictly improves welfare.

Proposition 3

For an appropriate choice of $\hat{b}$ the threshold contract weakly increases the effort levels chosen under the incentive constraint.

The proof is given in the appendix.

The proposition indicates that the threshold contract increases the upper corner solution and the interior solutions, provided an adequate threshold value is stipulated. In the upper corner solution, the effort level is raised by choosing a threshold value $\hat{b} > \bar{b}$. In this case, the effort level which ensures reelection is given by $e = \hat{b} + a$. For the interior solutions, the effort level can be increased by choosing a threshold value $\hat{b} = e^{int} - a + \xi$ with ξ sufficiently small. In this case, the cutoff of the reelection probability in the presence of threshold contracts increases marginal reelection chances and thus the marginal utility from exerting effort. This is the main effect thresholds to reelection should achieve.

Note that this does not imply that the chosen effort increases for an arbitrary threshold value $\hat{b}$. For instance if $\hat{b}$ is very high, the politician would choose the lower corner solution, since he would suffer very high cost if he wants to have a chance to get reelected.

We now examine what threshold value $\hat{b}$ should be required by the court in order to obtain a second-best solution. We denote the possible corner and interior solutions under the threshold contract by $e^j(\hat{b})$, $j = 1, ..., k$. Let $e^*(\hat{b})$ be the solution of the politician's maximization problem, i.e., the global maximum

$$e^*(\hat{b}) = \arg\max\{U^A(e^j(\hat{b}), \hat{b})\}. \quad (17)$$

Note that $e^*(-a)$ is equal to the effort level e^* chosen when only the reelection mechanism regulates the situation. We state

Proposition 4

The court chooses the threshold value $\hat{b}^*$ as

$$\hat{b}^* = \arg\max\{e^*(\hat{b})\} \quad s.t. \quad U^A(e^*(\hat{b}^*), \hat{b}^*) \geq 0.$$

The proof is given in the appendix.

In the next two propositions, we establish sufficient conditions for the threshold contract to strictly improve welfare.

Proposition 5

(i) If $U^A(e^*(-a)) = 0$, then $e^*(\hat{b}^*) = e^*(-a)$;

(ii) If $U^A(e^*(-a)) > 0$ and $e^*(-a) = e^{int}(-a)$, then $e^*(\hat{b}^*) > e^*(-a)$.

The proof is given in the appendix.

Proposition 6

Suppose $U^A(e^*(-a)) > 0$. Then

(a) $e^*(\hat{b}^*) > e^*(-a)$ if $e^*(-a) = 0$ and $p(a)f(a) - \int_{-a+\xi}^{a} p(\epsilon)f'(\epsilon)d\epsilon \geq 0$;

(b) $e^*(\hat{b}^*) > e^*(-a)$ if $e^*(-a) = \bar{b} + a$ and $p(a)f(a)W_2 - \int_{-a+\xi}^{a} p(\bar{b} + a + \epsilon)f'(\epsilon)d\epsilon W_2 - 2c(\bar{b} + a) \geq 0$.

The proof is given in the appendix.

In the proofs we show that the threshold contract strictly improves social welfare if $U^A(e^*(-a)) > 0$ and $e^*(-a)$ is an interior solution. Given certain conditions, the threshold contract also improves social welfare if $e^*(-a)$ is one of the corner solutions and $U^A(e^*(-a)) > 0$. The reasoning is as follows: We first show that $U^A(e^*(-a)) > 0$ is a necessary condition for the PC to be satisfied in a solution $e^*(\hat{b}) > e^*(-a)$. We continue by showing that it is always possible to set a threshold value $\hat{b}$ for which $q(e^*(-a), \hat{b}) < q(e^*(-a), -a)$ and the politician does not provide the effort $e^*(\hat{b}) < e^*(-a)$. Then, as we recall from proposition 3, the effort in the interior solution is increased due to the increasing marginal utility. Thus, if $e^*(-a) = e^{int}(-a)$, social welfare is strictly improved for $U^A(e^*(-a)) > 0$. Regarding the corner solutions, the effort can only be increased via the threshold contract if the marginal gain in reelection chances outweighs the marginal increase in costs. Note that a negative impact of threshold contracts can always be avoided by setting $\hat{b} = -a$.

In the following, we describe situations where threshold contracts lead to significant welfare improvement. Without further specifications of the reelection probability $p(b)$ and the density function $f(b)$ this can only be carried out in a very general way. For a specific example see section 6.

Social welfare is maximal if the first-best effort level can be reached. This is possible if the threshold value can be set as $\hat{b} = e^{FB} - a \geq \bar{b}$ and the politician chooses the upper corner solution. Generally, there are two ways in which the threshold contract can increase social welfare in connection with the upper corner solution. Firstly, it can increase the effort in the upper corner solution when $e^{FB} - a > \bar{b}$ is satisfied. Secondly, it could induce a switch from one of the interior solutions to the upper corner solution. To illustrate the latter case, suppose there is an interior solution $e^1(-a)$ and the upper corner solution is $e^2(-a)$. Suppose further that $U^A(e^1(-a)) > U^A(e^2(-a))$, but the utility difference is small. Then there is a possibility that the threshold contract will change utility in such a way that $U^A(e^2(\hat{b})) > U^A(e^1(\hat{b}))$. Accordingly, the politician will choose the upper corner solution.

Regarding the interior solutions, social welfare can always be strictly improved. Note that the threshold contract can increase the effort level in the interior solution in two ways: First, as we have seen in proposition 3, the effort can be continuously increased; second, the threshold contract can induce a switch from one interior solution to another, following the same logic as above.

In the next section, we give an example illustrating how threshold contracts work.

6 Example

We illustrate the functioning of the dual mechanism of elections and threshold contracts with a simple example. We assume that $a = 0$ and thus the politician's effort is perfectly observable by the public, i.e. $b = e$.

As before, the first-best solution is given by

$$e = \sqrt{\frac{W_2}{c}}.$$

Further, we assume the reelection mechanism $p(b)$ is given as

$$p(b) = \begin{cases} 0 & \text{for } \; b \leq \underline{b}, \\ \gamma + \phi b & \text{for } \; \underline{b} \leq b \leq \bar{b}, \\ 1 & \text{for } \; b \geq \bar{b}, \end{cases}$$

with $\bar{b} \leq e^{FB}$ and $\underline{b} \geq 0$ and $\gamma + \phi\bar{b} = 1$.

As the politician's effort and benefits are perfectly observable, we have $q(e) = p(b)$.

According to the incentive constraint of the politician, three solutions are possible:

(i) $e = 0$ (lower corner solution),

(ii) $e = \bar{b}$ (upper corner solution),

(iii) $e^{int} = \phi\frac{W_2}{2c}$ if $\phi\frac{W_2}{2c} \leq \bar{b}$ (interior solution).

Note that for the interior solution we have

$$\frac{\partial^2 U^A}{\partial e^2} = -2c < 0,$$

and hence e^{int} is indeed a maximum. The upper corner solution $e = \bar{b}$ is only chosen for $\frac{\phi W_2}{2c} \geq \bar{b}$.[12] Furthermore, the lower corner solution $e = 0$ is chosen if the PC is not satisfied for any effort level greater than $e = 0$. In all other cases, the politician chooses e^{int}. Obviously, the probability that $\frac{\phi W_2}{2c} \geq \bar{b}$ and that the politician will provide an effort $\bar{b}$ increases with ϕ.

We now introduce the threshold contract.

A court announces a threshold value $\hat{b}$, which the politician must achieve in order to obtain the right to stand for reelection. Then the politician's reelection probability becomes

$$q(e, \hat{b}) = \begin{cases} 0 & \text{for } \; b \leq \max[\underline{b}, \hat{b}], \\ \gamma + \phi b & \text{for } \; \max[\underline{b}, \hat{b}] \leq b \leq \bar{b}, \\ 1 & \text{for } \; b \geq \max[\bar{b}, \hat{b}]. \end{cases}$$

The politician chooses his effort according to the modified incentive constraint, which now amounts to

$$e = \arg\max\{q(e, \hat{b})W_2 - ce^2\}.$$

The possible solutions, i.e. the possible utility maxima, are given as

(i) $e = 0$ (lower corner solution),

(ii) $e = \max\{\bar{b}, \hat{b}\}$ (upper corner solution),

(iii) $e^{int}(\hat{b}) = \max\{\phi\frac{W_2}{2c}, \hat{b}\}$ if $\phi\frac{W_2}{2c} \leq \bar{b}$ (interior solution).

We use $e^*(\hat{b})$ to denote the global utility maximum and hence the effort that the politician chooses under the threshold contract.

[12] The politician does not exert an effort level higher than $\bar{b}$ because $q(e) = 1$ for all $b \geq \bar{b}$. Thus, reelection is ensured given an effort $\bar{b}$.

In order to derive the optimal threshold value $\hat{b}^*$, we must ensure that $\hat{b}^*$ maximizes the chosen effort under the IC and that the PC is satisfied.

Thus, the optimal value $\hat{b}^*$ is chosen as $\hat{b}^* = \arg\max\{e^*(\hat{b})\} \quad s.t. \quad U^A(e^*(\hat{b}^*), \hat{b}^*) \geq 0$. Clearly, $\hat{b}^* = e^{FB}$ is the solution. The politician will not choose an effort level lower than e^{FB} as this would prevent his reelection. The participation constraint is satisfied because $U^A(e^{FB}, e^{FB}) = 0$. According to our tie-breaking rule, the politician chooses e^{FB} and not $e = 0$.

In this example, the threshold contract always leads to the first-best solution. Thus, it is welfare-improving if the politician chooses the interior solution under the reelection mechanism, or if $\bar{b} < e^{FB}$ and the politician chooses the upper corner solution under the reelection mechanism. Note that the assumption $\bar{b} \leq e^{FB}$ is necessary because otherwise the reelection probability under the first-best effort level is less than one and the PC would not be satisfied. In this case, the optimal threshold value would satisfy $U^A(e^*(\hat{b}^*), \hat{b}^*) = 0$ and would be second-best.

7 Campaigning with Incentive Contracts

In this section, we examine what occurs when politicians can offer the threshold value $\hat{b}$ themselves during a campaign. We assume that there is a campaign stage before the first period in which two political candidates, denoted by i, j, offer threshold contracts with values $\hat{b}_i$, $\hat{b}_j$ to the public that become effective upon election.

The costs of exerting effort (or of the competencies) of politicians i, j are denoted by c_i, c_j and are assumed to be known to the voters. The offered threshold values $\hat{b}_i$, $\hat{b}_j$ are associated with effort levels $e_i^*(\hat{b}_i)$, $e_j^*(\hat{b}_j)$ that politicians i, j would exert in office. Due to our complete information assumption, the voters can derive these effort levels by observing $\hat{b}_i$, $\hat{b}_j$.[13] The independent court would require threshold values $\hat{b}_i^*$, $\hat{b}_j^*$ from

[13] Note that the choice of effort and also the first-best effort levels depend on the competency of the

the politicians in order to allow them to stand for reelection. They are associated with efforts $e_i^*(\hat{b}_i^*)$, $e_j^*(\hat{b}_j^*)$.

The voters observe the threshold offers and cast their votes. We assume that each politician is elected with a probability of 1/2, if $e_i^*(\hat{b}_i) = e_j^*(\hat{b}_j)$ and $c_i = c_j$. If $c_i > c_j$ and $e_i^*(\hat{b}_i) = e_j^*(\hat{b}_j)$ we assume as a tie-breaking rule that politician j is elected with probability 1.[14] If $e_i^*(\hat{b}_i) > e_j^*(\hat{b}_j)$ then politician i is elected with probability 1.

The structure of the game is summarized as follows:

Stage 1:

Two politicians denoted by i, j with competencies c_i, c_j offer threshold contracts with values $\hat{b}_i$, $\hat{b}_j$ to the public.

Stage 2:

The voters observe the threshold offers and make their election decisions.

Stage 3:

The elected politician exerts his effort on task T.

Stage 4:

The benefit from the politician's activity is realized. The public observes the benefit signal b. If $b < \hat{b}_i$, $\hat{b}_j$ respectively, the politician leaves office and does not stand for reelection. If $b \geq \hat{b}_i$, $\hat{b}_j$ respectively, the politician stands for reelection.

We now look for the sub-game perfect equilibria of the campaigning game.

politician.

[14]This tie-breaking rule is not crucial; it allows us to avoid the ϵ-framework in characterizing the equilibria.

Proposition 7

(i) If $c_i = c_j$, there exists a unique equilibrium in which both politicians offer the threshold values $\hat{b}_i^* = \hat{b}_j^*$.

(ii) If $c_i > c_j$, there exists a unique equilibrium in which politician i offers the threshold value $\hat{b}_i^*$ and politician j offers the threshold value $\hat{b}_j^o$ with

$$\hat{b}_j^o = \arg\max_{\hat{b}_j} U^A(e_j^*(\hat{b}_j), \hat{b}_j, c_j) \quad s.t.\ e_j^*(\hat{b}_j^o) \geq e_i^*(\hat{b}_i^*).$$

The proof is given in the appendix.

In the proof we have shown that the politicians offer the optimal threshold contracts on condition that they are equally competent. However, if the politicians have different competencies, inefficiencies in the determination of threshold contracts will occur. If politician j has a higher competency than politician i, he will offer at least a threshold value $\hat{b}_j$ that yields $e_j^*(\hat{b}_j) = e_i^*(\hat{b}_i^*)$. Thus, he will be elected with certainty. The more competent politician obtains a rent that depends on the degree of his superiority.

8 Conclusion

Our analysis suggests that thresholds to reelection could be a viable supplementary mechanism for improving democratic procedures. There are, of course, a variety of practical issues involved in using incentive contracts in politics, as discussed in Gersbach (2002) and in Gersbach and Liessem (2000) for monetary or utility transfers. Moreover, one might ask whether a threshold contract, such as the one proposed in this paper, might lead to a decrease in the effort a politician would have exerted in an issue emerging after completion of the contract. Voters, however, can punish such behavior by not reelecting the politician. Also, one could introduce a clause which would lead to the cancellation or renegotiation of the contract in the event of extraordinary circumstances such as a war. Overall, the threshold contracts suggested in this paper promise efficiency gains and we see no obvious practical considerations that would be detrimental to its actual use in politics.

The literature has identified a number of further inefficiencies in the political system (see e.g. the surveys and contributions of Mueller (1989), Drazen (2000), Dixit (1995), Buchanan and Tullock (1965), Stiglitz (1989), Persson and Tabellini (1990) and Persson and Tabellini (2000)). Deliberating on how the dual mechanism of threshold contracts and elections might be applied to these kinds of inefficiencies would be a useful extension. Moreover, our model has been kept simple to introduce the basic idea. It remains to be examined how threshold contracts affect outcomes in more complicated political-economic models.

Appendix

Proof of proposition 2:

According to the IC, the politician chooses the effort level that maximizes his utility under the reelection scheme $p(b)$.

First, we observe $U^A(e) < U^A(\bar{b} + a)$ for all $e > \bar{b} + a$. An effort level $e = \bar{b} + a$ guarantees reelection, because the benefit signal $\bar{b}$ is reached with certainty. Clearly, a politician will only provide the minimum effort level that will ensure his reelection. Any additional effort would only incur costs with no benefits. Therefore, we can restrict the problem to

$$\max_{e}\{U^A(e)\}; \quad e \in [0; \bar{b} + a].$$

Either there is a corner solution, i.e., $e = 0$ or $e = \bar{b} + a$, or there are interior solutions. In the interior solutions, the politician chooses his effort level according to the IC. The first-order condition implies[15]

$$\frac{\partial q(e)}{\partial e} W_2 - 2ce = 0,$$

and the politician exerts the effort[16]

$$e^{int} = \frac{\partial q(e)}{\partial e} \frac{W_2}{2c}.$$

■

[15] We assume that the second-order condition is fulfilled.

[16] Note that multiple interior solutions as local maxima can exist without further assumptions regarding $q(e)$.

Proof of proposition 3:

First, we rewrite the politician's maximization problem under the hierarchy of threshold contracts and elections as

$$\max_e \{U^A(e, \hat{b})\}; \quad e \in [0; \max[\bar{b} + a, \hat{b} + a]]$$

As we have seen, there are three possibilities. The lower corner solution remains the same with $e = 0$, but the upper corner solution becomes

$$e = \hat{b} + a$$

for $\hat{b} > \bar{b}$. Hence, the effort level in the upper corner solution is higher with a threshold contract, or remains the same in the case where $\hat{b} \leq \bar{b}$.

Regarding the interior solutions, the politician chooses his effort level according to the new incentive constraint as

$$e = \arg\max\{q(e, \hat{b})W_2 - ce^2\},$$

which yields the following effort level in the first order condition

$$e^{int}(\hat{b}) = \frac{\partial q(e, \hat{b})}{\partial e} \frac{W_2}{2c}.$$

This can be written as

$$e^{int}(\hat{b}) = \left[\frac{\partial q(e)}{\partial e} - \frac{\partial \left[\int_{e-a}^{\hat{b}} p(b) f(b-e) db \right]}{\partial e} \right] \frac{W_2}{2c}.$$

Without a threshold contract the interior solutions were

$$e^{int} = \frac{\partial q(e)}{\partial e} \frac{W_2}{2c}.$$

The term

$$\frac{\partial \left[\int_{e-a}^{\hat{b}} p(b) f(b-e) db \right]}{\partial e}$$

can be written as

$$\frac{\partial}{\partial e}\int_{-a}^{\hat{b}-e} p(e+\epsilon)f(\epsilon)d\epsilon \ ,$$

which yields

$$\int_{-a}^{\hat{b}-e} \frac{\partial p(e+\epsilon)}{\partial e} f(\epsilon)d\epsilon - p(\hat{b})f(\hat{b}-e).$$

Suppose we start from a particular solution e^{int} where no threshold contract is present. If we set $\hat{b} = e^{int} - a + \xi$ for some $\xi > 0$, for $e = e^{int}$ the expression amounts to

$$\int_{-a}^{-a+\xi} \frac{\partial p(e+\epsilon)}{\partial e}|_{e=e^{int}} f(\epsilon)d\epsilon - p(e^{int} - a + \xi)f(-a+\xi).$$

For sufficiently small ξ the expression is negative since the integral term becomes arbitrarily small. Hence, with $e = e^{int}$ and an appropriate choice of $\hat{b}$ we have

$$e^{int} < \frac{\partial q(e^{int}, \hat{b})}{\partial e}\frac{W_2}{2c} \ ,$$

which implies that there exists a solution $e^{int}(\hat{b}) > e^{int}$ for every solution e^{int} we start from.[17]

■

Proof of proposition 4:

The optimal threshold value $\hat{b}^*$ should be chosen to maximize the effort level e and thus maximize the benefits for the public.

$e^*(\hat{b})$ is the effort level that the politician chooses subject to the threshold value $\hat{b}$. Hence, $e^*(\hat{b})$ must be maximized over $\hat{b}$. The participation constraint $U^A(e^*(\hat{b}^*), \hat{b}^*) \geq 0$ has to be satisfied, otherwise the politician would not seek reelection.

■

[17]The latter follows from the fact that $\frac{\partial q(e,\hat{b})}{\partial e}$ is continuous and $\frac{\partial q(e,\hat{b})}{\partial e}|_{e=\bar{b}+a} = 0$.

Proof of proposition 5:

Proof of (i)

Suppose $U^A(e^*(-a)) = 0$. $e^*(-a)$ maximizes the utility under the reelection mechanism alone and thus

$$U^A(e^*(-a)) \geq U^A(e) \quad \forall e,$$

and because of our tie-breaking rule

$$U^A(e^*(-a)) > U^A(e) \quad \text{for } e > e^*(-a).$$

Then, if $e^*(\hat{b}) > e^*(-a)$, the PC would be violated and the optimal threshold value is set as $\hat{b}^* = -a$.

Proof of (ii)

Since costs and $q(e, \hat{b})$ are continuous in e and $\hat{b}$ respectively, there exist $\delta > 0$ and $\xi > 0$ small enough that $U^A(e^*(-a) + \delta, -a + \xi) \geq 0$. Thus, in principle it is possible to satisfy the PC if effort and threshold value are marginally increased.

We proceed in two stages. First, we show that for $U^A(e^*(-a)) > 0$ there always exist threshold values $\hat{b}$ with $q(e^*(-a), \hat{b}) < q(e^*(-a), -a)$ for which the politician does not choose a solution lower than $e^*(-a)$. Then we show that the effort in the interior solution can always be increased when $U^A(e^*(-a)) > 0$.

We first show that for $U^A(e^*(-a)) > 0$, there are always threshold values $\hat{b}$ for which the politician does not choose an effort level $e < e^*(-a)$ under the threshold contract.

The solution $e^*(-a)$ satisfies $U^A(e^*(-a)) \geq U^A(e)$ for all e and thus

$$\int_{e^*(-a)-a}^{e^*(-a)+a} p(b) f(b-e) db W_2 - c(e^*(-a))^2 \geq \int_{e-a}^{e+a} p(b) f(b-e) db W_2 - ce^2 \quad \text{for } e^*(-a) \neq e.$$

Then, for the threshold value $\hat{b} = e^*(-a) - a$ and for $e < e^*(-a)$:

$$\int_{e^*(-a)-a}^{e^*(-a)+a} p(b) f(b-e) db W_2 - c(e^*(-a))^2 > \int_{e^*(-a)-a}^{e+a} p(b) f(b-e) db W_2 - ce^2,$$

because the introduction of a threshold contract diminishes expected reelection probability and thus the utility for a given effort level.

Thus, threshold values $\hat{b} = e^*(-a) - a + \xi$ with sufficiently small ξ exist, such that for $e < e^*(-a)$

$$\int_{e^*(-a)-a+\xi}^{e^*(-a)+a} p(b)f(b-e)dbW_2 - c(e^*(-a))^2 \geq \int_{e^*(-a)-a+\xi}^{e+a} p(b)f(b-e)dbW_2 - ce^2.$$

Accordingly, there exist threshold values with $q(e^*(-a), \hat{b}) < q(e^*(-a))$ for which the politician does not choose an effort level lower than $e^*(-a)$.

Suppose $e^*(-a) = e^{int}(-a)$. For sufficiently small ξ, the politician will choose the interior solution in the vicinity of $e^*(-a)$. Then, the effort is increased for a threshold value $\hat{b} = e^*(-a) - a + \xi$ by using the construction from proposition 3.

■

Proof of proposition 6:

We first show (a).

Suppose $e^*(-a) = 0$. Then the effort can be increased if there exists $\hat{b} = -a + \xi$, with $\xi > 0$ and ξ sufficiently small, and an effort level $\delta > 0$ such that

$$U^A(0, -a+\xi) \leq U^A(\delta, -a+\xi).$$

The condition can be rewritten as

$$\int_{-a+\xi}^{a} p(b)f(b)dbW_2 \leq \int_{-a+\xi}^{\delta+a} p(b)f(b-\delta)dbW_2 - c\delta^2.$$

Thus, we obtain

$$\int_{a}^{\delta+a} p(b)f(b-\delta)dbW_2 + \int_{-a+\xi}^{a} p(b)[f(b-\delta) - f(b)]dbW_2 - c\delta^2 \geq 0.$$

This is equivalent to

$$\int_{a-\delta}^{a} p(\delta+\epsilon)f(\epsilon)d\epsilon W_2 + \int_{-a+\xi-\delta}^{a-\delta} p(\delta+\epsilon)[f(\epsilon) - f(\epsilon+\delta)]d\epsilon W_2 - c\delta^2 \geq 0.$$

By taking the derivatives at $\delta = 0$ we obtain a sufficient condition as

$$p(a)f(a) - \int_{-a+\xi}^{a} p(\epsilon)f'(\epsilon)d\epsilon \geq 0.$$

Next we prove (b).

Suppose $e^*(-a) = \bar{b} + a$. Then, the effort can be increased if for threshold values $\hat{b} = e^*(-a) - a + \xi$, $\xi > 0$ and an effort level $e^*(\hat{b}) = e^*(-a) + \delta$, $\delta > 0$

$$U^A(\bar{b} + a, e^*(-a) - a + \xi) \leq U^A(\bar{b} + a + \delta, e^*(-a) - a + \xi).$$

The condition can be rewritten as

$$\int_{\bar{b}+\xi}^{\bar{b}+2a} p(b)f(b-(\bar{b}+a))dbW_2 - c(\bar{b}+a)^2 \leq \int_{\bar{b}+\xi}^{\bar{b}+\delta+2a} p(b)f(b-(\bar{b}+a+\delta))dbW_2 - c(\bar{b}+a+\delta)^2.$$

Thus we obtain

$$\int_{\bar{b}+2a}^{\bar{b}+\delta+2a} p(b)f(b-(\bar{b}+a+\delta))dbW_2 + \int_{\bar{b}+\xi}^{\bar{b}+2a} p(b)[f(b-(\bar{b}+a+\delta)) - f(b-(\bar{b}+a))]dbW_2$$
$$-c(\bar{b}+a+\delta)^2 + c(\bar{b}+a)^2 \geq 0.$$

This is equivalent to

$$\int_{a-\delta}^{a} p(\bar{b}+a+\delta+\epsilon)f(\epsilon)d\epsilon W_2 + \int_{\bar{b}+\xi-(\bar{b}+a+\delta)}^{\bar{b}+2a-(\bar{b}+a+\delta)} p(\bar{b}+a+\delta+\epsilon)[f(\epsilon) - f(\epsilon+\delta)]d\epsilon W_2$$
$$-c(\bar{b}+a+\delta)^2 + c(\bar{b}+a)^2 \geq 0.$$

By taking derivatives at $\delta = 0$, a sufficient condition is

$$p(a)f(a)W_2 - \int_{\xi-a}^{a} p(\bar{b}+a+\epsilon)f'(\epsilon)d\epsilon W_2 - 2c(\bar{b}+a) \geq 0.$$

■

Proof of proposition 7:

First, note that

$$U^A(e_i^*(\hat{b}_i^*), \hat{b}_i^*, c_i), U^A(e_j^*(\hat{b}_j^*), \hat{b}_j^*, c_j) \geq 0$$

as the PC is satisfied if the politicians offer the threshold values $\hat{b}_i^*$, $\hat{b}_j^*$.

(i) Suppose $c_i = c_j$.

Threshold value offers $\hat{b}_i^* = \hat{b}_j^*$ are an equilibrium, because a downward deviation by a politician would yield a zero election probability for him.

Threshold value offers $\hat{b}_i = \hat{b}_j < \hat{b}_i^* = \hat{b}_j^*$ and $\hat{b}_i = \hat{b}_j > \hat{b}_i^* = \hat{b}_j^*$ cannot be an equilibrium. They would induce efforts $e_i^*(\hat{b}_i) = e_j^*(\hat{b}_j) < e_i^*(\hat{b}_i^*) = e_j^*(\hat{b}_j^*)$ as $e_i^*(\hat{b}_i^*) = e_j^*(\hat{b}_j^*)$ is the highest effort level that can be implemented under the PC. A deviation by politician i to a threshold value corresponding to an infinitesimally higher effort would yield an election probability of one and thus a higher utility for politician i.

Finally, threshold value offers $\hat{b}_i < \hat{b}_j \leq \hat{b}_j^*$ cannot be an equilibrium either, because politician i could raise his expected utility by choosing a value $\hat{b}_i = \hat{b}_j$ that would provide him with a positive election probability.

(ii) Suppose $c_i > c_j$.

We show that threshold value offers $\hat{b}_i^*$ with a corresponding effort level $e_i^*(\hat{b}_i^*)$ and $\hat{b}_j^o$ with

$$\hat{b}_j^o = \arg\max_{\hat{b}_j} U^A(e_j^*(\hat{b}_j), \hat{b}_j, c_j) \quad s.t.\ e_j^*(\hat{b}_j^o) \geq e_i^*(\hat{b}_i^*)$$

are an equilibrium. First note that $U^A(e_j^*(\hat{b}_j^o), \hat{b}_j^o, c_j) \geq 0$ since by choosing $\hat{b}_j^o = \hat{b}_j^*$ $U^A(e_j^*(\hat{b}_j^*), \hat{b}_j^*, c_j) \geq 0$. Politician j will not be elected if he deviates to a threshold value corresponding to $e_j^*(\hat{b}_j) < e_i^*(\hat{b}_i^*)$. Thus he chooses the threshold value that maximizes his utility under the constraint $e_j^*(\hat{b}_j) \geq e_i^*(\hat{b}_i^*)$. Politician i will not deviate either, since he cannot offer a higher utility for voters by selecting other thresholds.

The rest of the proof follows the lines of the proof of (i) and is therefore omitted here.

■

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