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WHEN DO WAR CHESTS DETER?

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ABSTRACT

I present a repeated election model of campaign fund-raising and spending where the incumbent may use money not spent in one election for a future election, i.e. may create a war chest. I characterize the conditions where an incumbent creates a war chest for deterrence. The strongest incumbents do not create the largest war chests since they deter the challenger on their own. It is the weaker incumbents who must create the larger war chests to deter the challenger.

KEY WORDS • campaign finance • challenger entry • deterrence • incumbent strength • war chest

The incumbent's most effective electoral strategy is to discourage serious opposition. (Gary C. Jacobson, 1997: 43)

1. Introduction

Do war chests deter challengers? And if so, under what circumstances do they deter? An anecdote reveals one circumstance when war chests may deter.

After defeating Senator Jacob Javits in the Republican primary in 1980, Alfonse D'Amato won the general election with just 45 percent of the vote in a three-way election between the Democratic candidate Elizabeth Holtzman and Senator Javits (running as an independent). Holtzman, a member of the House of Representatives, received 44 percent of the vote, with Javits picking up the remaining 11 percent. The common wisdom was that Senator Javits cut into Holtzman's vote. Since she lost by merely 88,000

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votes, Holtzman planned to challenge D'Amato in 1986. D'Amato should have been one of the most vulnerable incumbents in the Senate in 1986: he was a first-term senator, it was a non-presidential election year, and the Democrats regained control of the Senate that year. But, once in the Senate, D'Amato raised over $4 million before the 1986 election season. Holtzman reconsidered her decision to run against D'Amato again. She 'decided against it in large part because of D'Amato's $4 million, says an aide to Holtzman' (Cobb, 1988: 16). Instead of Holtzman – a former House member – the Democrats nominated Mark Green, who was considered a much weaker candidate than Holtzman.

Numerous anecdotes and conventional wisdom state that war chests deter challengers. The usual extension to this wisdom is that the strongest incumbents raise the largest war chests. But the D'Amato example does not fit so neatly with this wisdom. D'Amato was not thought to be among the strongest incumbents but he had raised the most early money of any incumbent. Why would a relatively weak incumbent raise so much money?

Beyond anecdotes, studies that examine the systematic effect of war chests on challenger entry have found decidedly mixed results. Box-Steffensmeier (1996), Goidel and Gross (1994), Goldenberg et al. (1986), Hersch and McDougall (1994), and Hogan (2001) find that war chests deter high-quality challengers from entering (see also Sorauf, 1988). In contrast, Milyo (1998), Ansolabehere and Snyder (2000), Goodliffe (2001) and Squire (1989, 1991) argue that war chests do not deter high- (or low-) quality challengers from entering. Why have different studies come to different conclusions?

The major finding of this paper is that *some* incumbents successfully use war chests to deter potential challengers. Among those incumbents that deter high-quality challengers, the *weakest* incumbents raise the largest war chest (hence, D'Amato). The *strongest* incumbents do not need to create a war chest to ward off challengers. Thus, war chests do not get larger as incumbent strength increases; the relationship is not even monotonic. Consequently, it will be difficult to find a linear relationship between war chests and challenger entry, which may explain the mixed results in the empirical findings.

Because war chests are seen as an unfair advantage for incumbents, one suggested campaign finance reform is to eliminate war chests altogether – incumbents would not be allowed to carry money from one election cycle to the next. This paper addresses this proposed campaign finance reform, and campaign finance reform generally, by examining how incumbents are able to use money in elections.

I explore the circumstances when an incumbent may create a war chest to deter high-quality challengers from entering the next election. A war chest does have an opportunity cost, in that any money saved for the next election cannot be used to win the current election.[1] I present a model where the quality of the challenger and the strength of the incumbent are known. Incumbents exert great efforts to appear strong to potential challengers and potential challengers (and the press) constantly attempt to gauge the vulnerability (strength) of incumbents (Fenno, 1978, 1992; Herrnson, 2004; Jacobson, 2004; Mayhew, 1974). At the same time, incumbents are generally aware who their potential challengers are and their relative strength (Fowler and McClure, 1989; Kazee, 1980, 1983, 1994). Certainly, the strength of incumbents is not *completely* known and the quality of challengers is not *completely* known. But even if challenger quality is unknown, or the incumbent does not know who the potential challengers are, the incumbent knows that he wants to deter the highest quality challengers (he would prefer to deter *all* challengers). Empirically, this model may better fit situations where the incumbent's strength is well known, e.g. for long-time incumbents who have not had any recent major changes in their vulnerability (no redistricting or scandals).

There are other reasons to create a war chest. Sorauf (1988: 160) states that war chests may have dual purposes for incumbents: '[Incumbents] raise money early to discourage would-be challengers both by displaying their financial prowess and by setting a financial hurdle for any challenger. Even in short run terms, incumbents raise large sums as a form of catastrophe insurance against the sudden emergence of a strong and well-financed challenger . . .'. Furthermore, Sorauf (1988: 161) continues, 'The incumbent may also simply be saving for a future campaign for the present office'.[2] Ansolabehere and Snyder (2000) find that incumbents save money as an 'accident' or because they had helpful unexpected events (such as running against a weaker-than-expected challenger).[3] Milyo (2001: 122) presents data that suggest 'that incumbents build up a stock of savings in order to smooth their fund-raising efforts over time'. And Goodliffe (2004) presents and tests a model where war chests are created as precautionary savings. To capture the idea of accidents or savings, I later alter the model to allow challenger strength to be determined exogenously, rather than by the challenger herself.

1. Goodliffe (2001) criticizes Hersch and McDougall's (1994) assumption that using the war chest has zero opportunity cost. In the model that follows, the opportunity cost of using the war chest is explicitly incorporated.

2. Sorauf also notes that war chests can be used to build a nest egg for retirement (possible for those elected to the US House before 1980 who retired before 1992), to run for higher office, or for unfavorable circumstances after reapportionment.

3. Ansolabehere and Snyder also find that war chests are used for retirement (or consumption) and ambition (run for a higher office).

Previous theoretical models of war chests have also examined how and when war chests deter challengers. Dharmapala (2002) constructs a model of candidates, interest groups, and voters and finds that if fund-raising effectiveness is correlated with legislative effectiveness, then large early fund-raising deters challengers. Epstein and Zemsky (1995) develop a formal model of campaign fund-raising and show that although fund-raising can deter strong challengers in some situations, it is difficult to observe this empirically.[4] In their model, war chests are an instrument (exogenous to the model) used to test the comparative statics. Thus, war chests per se do not deter challengers but they may help the analyst determine whether preemptive fund-raising deters challengers.

The difficulty in testing either model is determining when fund-raising ends and spending begins. By examining more than one election cycle in the model, I am able to use the war chest – defined as money saved from one election for the next election – as a variable for comparison.

Further, the potential problem with Epstein and Zemsky's characterization is an incumbent's war chest may have something to do with incumbent strength and challenger quality of the previous election – variables Epstein and Zemsky want to explain. War chests are a conscious decision by incumbents *not* to spend money and, thus, should not be treated as an exogenous variable in any comparative statics test.

Previous models have examined only one decision of the incumbent: how much money to raise. But war chests are a result of (at least) two decisions: how much money to raise and how much money to spend (and thus, how much money to save). In the model I present, war chests are an endogenous result that occurs under specifically delineated circumstances. This is possible because the model covers more than one election and, thus, uncovers intra- and inter-election dynamics.[5]

The paper proceeds as follows. After first outlining the general model, I examine the case where there is only one election to characterize fund-raising and spending patterns. I then add a second election (repeat the game) to allow the incumbent to save money from one election to the next, i.e. create a war chest. Next, I add uncertainty to the model by having challenger entry determined randomly to see how this will affect the creation of war chests and spending. I conclude with a discussion of the empirical predictions of the model and some preliminary extensions.

4. It is difficult to observe deterrence empirically because their model has both pooling and separating equilibria under the same conditions.

5. Another difference is that Epstein and Zemsky divide incumbent strength into two categories – high and low. The model I present treats incumbent strength as a continuous variable. However, both models divide challenger quality into two categories, though I relax this later.

2. The Model

The model takes place in a single district. Different versions will examine strategies over one and two election cycles, with the latter in the presence of (un)certainty.

2.1 Agents and Preferences

There are two agents in the model: an incumbent and a high-quality challenger. There is a range of strength for incumbents: $I \in \mathcal{I}$, where $\mathcal{I}$ is bounded on $\mathbb{R}$. Let the incumbent's utility function (for one election) be given by:

$$U_{incumbent} = \begin{cases} b - C(r) & \text{if incumbent wins} \\ -C(r) & \text{else} \end{cases}$$

where b is the benefit of winning the election and $C(r)$ is the cost of raising money, r. When there are two election cycles, if the incumbent loses the first election, he receives 0 in the next election (i.e. does not run for office) and the game ends. Since the incumbent decides how much to raise and spend before the election, he maximizes his expected utility:

$$EU_{incumbent} = \Pr\{\text{winning}\} \cdot b - C(r)$$

I normalize the benefit of winning, b, by setting $b = 1$. The probability of winning will be given by the function $W(s, I)$, where s is the amount of money spent in the election and I is the incumbent strength. I assume that spending more money increases the incumbent's probability of winning (cf. Aldrich, 1980) but that there are diminishing returns to such spending.[6] Incumbent strength also affects the probability of winning: Stronger incumbents have a better chance of winning than weaker incumbents; stronger incumbents also get better returns on their spending than weaker incumbents.[7] Thus, for the purposes of this model, incumbent strength is operationalized as the ability to win votes and spend money effectively. This roughly corresponds to Stone et al.'s (2004) separation of incumbent quality into personal qualities (e.g. integrity) and strategic qualities (e.g. ability to raise money). In addition, the quality of challenger affects the probability of winning. Let $W^L(\cdot\,, \cdot)$ be the probability of winning an election when facing a low-quality challenger and $W^H(\cdot\,, \cdot)$ be defined similarly for a high-quality challenger. For any given spending, the probability of winning

6. In other words, $W_1(s, I) > 0$ and $W_{11}(s, I) < 0$. Further, I assume that $W(s, I) \in [0, 1]$ and $W(s, I)$ is twice continuously differentiable for $s \geq 0$. I also assume an Inada-type condition to obtain an interior solution: $W_1(s, I) \to 0$ as $s \to \infty$.

7. In other words, $W_2(s, I) > 0$ and $W_{12}(s, I) > 0$.

an election when facing a low-quality challenger is greater than the probability of winning an election when facing a high-quality challenger. Further, an incumbent facing a low-quality challenger receives higher returns to spending than an incumbent facing a high-quality challenger.[8]

Let $C(r)$ be the cost of raising money, where r is the amount of money raised. I assume that raising more money increases costs to the incumbent and that the marginal cost of raising money increases as the amount of money raised increases.[9] I also assume that an incumbent will always run for re-election, even against the highest quality challenger.[10] Holding constant incumbent strength and assuming complete information, from the previous assumptions, the money raised (and spent) against a high-quality challenger is lower than the money raised (and spent) against a low-quality challenger.[11] This somewhat counter-intuitive result does not take into account that most strong incumbents run against weaker challengers and have higher returns to spending. Note that the cost function does not depend on the strength of the incumbent or the quality of challenger running.[12] Figure 1 displays a sample cost function and sample win probability functions for an incumbent facing a high-quality or low-quality challenger. It also shows how much the incumbent would raise against a high or low-quality challenger in the form of vertical lines (r_H and r_L, respectively). The vertical lines indicate where the marginal cost equals the marginal benefit (probability of winning).

Figure 2 displays a sample win probability function for an incumbent facing a high-quality challenger. It also shows sample win functions for weak or strong incumbents. In addition, it shows how much the incumbent would raise (in the form of vertical lines) for two different strengths of incumbents (against a high-quality challenger).

8. In other words, $W^L(s, I) > W^H(s, I)$ for all s and I, and $W_1^L(s, I) > W_1^H(s, I)$ for all s and I. In addition, $W_2^L(s, I) > W_2^H(s, I)$ for all s and I.

9. Thus, $C_1(r) > 0$ and $C_{11}(r) > 0$. I assume that $C(r)$ is a twice continuously differentiable function. As in the win probability function, I assume Inada-type conditions: $C_1(r) \to 0$ as $r \to 0$. From the other assumptions, $C_{11}(r) \to \infty$ as $r \to \infty$. Finally, I assume that the curvature of the cost function is sufficiently high to develop some comparative statics that follow. The sufficient condition is that $C_{11}(r) > [C_1(r)]^2$. Given the other assumptions in this model, the condition is met by most convex functions (e.g. $C(r) = r^2$).

10. In other words, there exists some $\tilde{r}$ such that $W^j(\tilde{r}, I) > C(\tilde{r})$, for all I, for $j = L, H$.

11. That is, the r^H that solves $W_1^H(r^H, I) = C_1(r^H)$ is less than the r^L that solves $W_1^L(r^L, I) = C_1(r^L)$, for all I. This follows from the assumption that $W_1^L(s, I) > W_1^H(s, I)$ for all s and I.

12. One could assume that the cost and/or the marginal cost of raising money decreases as incumbent quality increases: $C_2(r, I) < 0$ and/or $C_{12}(r, I) < 0$. However, adding these assumptions does not qualitatively change the results and complicates the model.

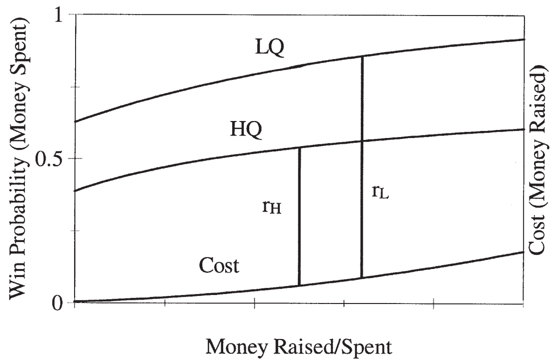

Figure 1. Win Functions for Challenger Qualities

The incumbent may not borrow money and is limited to spending the money on hand (either raised during this election cycle, or carried over from the previous election).[13]

To focus attention on the incumbent's decision, the high-quality challenger merely decides whether to enter the race or not. Like the incumbent's utility function, the high-quality challenger receives a benefit from winning and a cost of running. The probability of winning is the complement of the incumbent's probability of winning: $1 - W^H(r, I)$. Following Jacobson and Kernell (1983), higher-quality challengers have more to lose when running (often, they currently hold office, which they would lose by running).[14] Thus, the utility function for the high-quality challenger is:

$$EU_{HQ\ challenger} = \left[1 - W^H(r, I)\right]b - c^H$$

where b is the benefit of office (normalized to 1) and c^H is the high-quality challenger's cost of running for office.[15] From these assumptions, the high-quality challenger prefers to run against weaker incumbents. Among

13. In reality, incumbents may go into debt or, more importantly, have both cash-on-hand and debt, although the vast majority do not. However, allowing incumbent borrowing does not affect the logic of the following propositions.

14. There is a sizeable literature assessing challenger quality. See Squire (1995) for a survey. For this paper, I do not worry what constitutes a high-quality challenger; I merely assume that there is a difference between high- and low-quality challengers.

15. To concentrate on the incumbent's fund-raising, spending and saving decisions, the challenger does not raise or spend money. The win and cost functions can be thought of as reduced-form expressions of a game where both candidates raise and spend money.

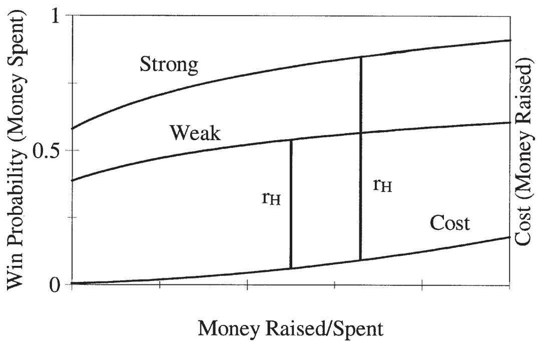

Figure 2. Win Functions for Incumbent Strengths

high-quality challengers, those with higher quality have greater c^H. This parameter will be important in characterizing the equilibria. The high-quality challenger can also choose not to enter the race, in which case she receives a payoff of zero.

There is also a low-quality challenger in the model, who runs against the incumbent if the high-quality challenger chooses to stay out.[16] The utility function for such a challenger is

$$EU_{LQ\ challenger} = \left[1 - W^L(r, I)\right]b - c^L$$

where c^L is zero or so low that the low-quality challenger will always enter if the high-quality challenger does not.

2.2 Decision Sequence and Information

The incumbent's probability of re-election is determined by how much he spends and whom he runs against. The incumbent has an opportunity to raise money and then an opportunity to spend that money (or less) in each election cycle. Since there is a second election, an incumbent can save money from the first election fund-raising to be spent in the second election, thus creating a war chest. The time-line is as follows. The incumbent decides how much money to raise for the first election. Next, a high-quality challenger (hereafter, the 'challenger') decides whether to enter the race against the incumbent. The incumbent then decides how much of the raised money

16. The decision by low-quality challengers to stay out of the race when a high-quality challenger runs can be thought of as a reduced-form of the primary election, which high-quality challengers usually win (Canon, 1990).

he will spend in this election. The election winner is probabilistically determined by incumbent spending and challenger quality. If he wins the election, the incumbent takes any money left over into the next election cycle, where once again, he decides how much money to raise for this election. Then the challenger again decides whether to enter the race, the incumbent decides how much money to spend in this second election cycle, and the election winner is again probabilistically determined by incumbent spending and challenger quality (see Figure 3).

The challenger's and incumbent's preferences as well as the decision sequence are common knowledge. In addition, both the incumbent and challenger know the incumbent's strength (I), and the challenger's cost of running (c^H). Thus, this model may be best applied to multi-term incumbents, who have not had any changes to their election profile (e.g. no recent redistricting).

Denoting the election with subscripts and the quality of first-election challenger the incumbent faced with superscripts, the incumbent's expected utility function over two election cycles is

$$-C(r_1) + W^j(s_1^j, I) + W^j(s_1^j, I)\left[-C(r_2^j) + W^k(s_2^j, I)\right]$$

where j is the challenger quality in the first election and k is the challenger quality in the second election. The second $W^j(s_1^j, I)$ denotes the probability of winning the first election and, thus, getting to the second election. In each election, if the high-quality challenger decides not to enter the race, a low-quality challenger will run against the incumbent. To summarize preferences:

$$EU_{HQ\ challenger} = \begin{cases} \left[1 - W^H(s, I)\right] - c^H & \text{enter against incumbent} \\ 0 & \text{not enter} \end{cases}$$

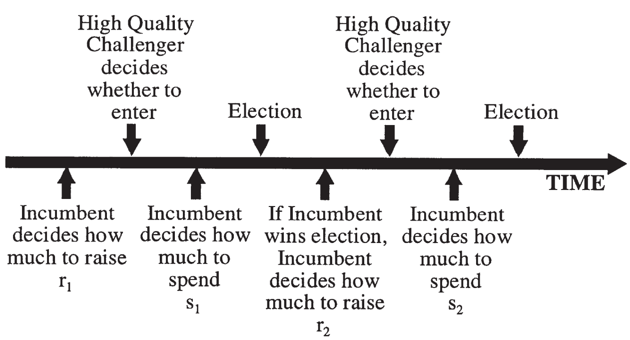

Figure 3. Two-election Decision Sequence Without Uncertainty

$$EU_{incumbent} = \begin{cases} -C(r_1) + W^H(s_1^H, I)\big[1 - C(r_2^H) + W^H(s_2^H, I)\big] & \text{enter both} \\ -C(r_1) + W^H(s_1^H, I)\big[1 - C(r_2^H) + W^L(s_2^H, I)\big] & \text{enter first} \\ -C(r_1) + W^L(s_1^L, I)\big[1 - C(r_2^L) + W^H(s_2^L, I)\big] & \text{enter second} \\ -C(r_1) + W^L(s_1^L, I)\big[1 - C(r_2^L) + W^L(s_2^L, I)\big] & \text{enter neither} \end{cases}$$

A quick comparison of the utility functions reveals that in the first election, the incumbent takes into account the benefits and costs of the second election, whereas the challenger concentrates only on the first election.[17] This is consistent with Milyo's (2001) argument that incumbents are utility-maximizers, looking ahead to future elections, and challengers are vote-maximizers, working just to win this election. Furthermore, the logic of the following proposition does not qualitatively change if the challenger takes into account the future benefits of being an incumbent should she win.[18]

2.3 Strategies and Equilibrium

The incumbent's *first-election fund-raising* strategy is a map:

$$\rho : \mathcal{I} \rightarrow \mathbb{R}_+$$

Thus, for any incumbent I, $\rho(I) = r_1$ is the amount of money raised in the first election.

The challenger's *first-election entrance* strategy is a map:

$$\alpha : \mathbb{R}_+ \times \mathcal{I} \rightarrow \{\text{enter, not enter}\}$$

Thus, for the challenger, $\alpha(r_1, I)$ denotes whether she enters the race, having observed the incumbent's fund-raising in the first election and knowing the incumbent's strength.

After the challenger has decided whether to enter, the incumbent decides how much to spend in the next election. In addition, he decides how much he will spend if he wins the election. The incumbent's *first-election spending* (*and second-election saving*) strategy is a map:

$$\sigma : \{\text{enter, not enter}\} \times \mathcal{I} \rightarrow \mathbb{R}_+^2$$

17. In the second election, there are no future elections, so both candidates only take into account the benefits and costs from the second election.

18. In Figure 5, the range where 'the HQ challenger enters first election only' moves right. In Proposition 2, the cutpoints, I_1 and I_2, increase. This is true whether the challenger becomes the incumbent only for the second election or if the game starts over with the (now former) challenger as the incumbent in the first election.

Thus, $\sigma(\{\text{action}\}, I) = (s_1^j, r_2^j)$ is the following double: the amount spent in the first election and the amount raised in the second election, given the *action* of the challenger in the first election and the incumbent's strength. If the (high-quality) challenger enters, $j = H$; if she does not (and the low-quality challenger enters), $j = L$. The amount that the incumbent can spend in the first election is contingent on the r_1 chosen initially and, thus, this constraint is implicit in σ.

The challenger's *second-election entrance* strategy is a map:

$$\beta : \mathbb{R}_+ \times \mathcal{I} \to \{\text{enter, not enter}\}$$

Thus, for the challenger, $\beta(r_1 - s_1 + r_2; I)$ is the probability that the challenger enters the race, having observed the incumbent's fund-raising and spending in the first election, fund-raising in the second election, and given the incumbent's strength.[19]

After the challenger has decided whether to enter, the incumbent decides how much to spend in the last election. The incumbent's *second-election spending* strategy is a map:

$$\tau : \{\text{enter, not enter}\} \times \mathcal{I} \to \mathbb{R}_+$$

where $\tau(\{\text{action}\}, I) = s_2^j$ is the amount spent in the second (and last) election given the *action* of the challenger in the second election and given that j entered in the first election. The incumbent's spending strategy is trivially derived: Because $W_1(s, I) > 0$, the incumbent will spend all that he has in the last election: $s_2^j = r_1 - s_1^j + r_2^j$. Thus, I only concentrate on the strategy pairs $\{(\rho^*, \sigma^*), (\alpha^*, \beta^*)\}$.

Since there is perfect information, an appropriate equilibrium concept for this game is *subgame perfect equilibrium*. Loosely, incumbents and challengers maximize their expected payoffs at every point in time and players cannot make threats without credibility.

3. Results

I first characterize the equilibria for a one-election game. The challenger may choose whether to enter. I then add the second election. Finally, I alter the first election so that challenger entry is determined randomly.

19. The high-quality challengers in the first and second elections can be thought of as the same challenger in each election (unless she wins the first election, in which case, the game ends) or two different high-quality challengers with the same c^H.

3.1 One-election Cycle

As a preliminary step (and to see how the model works generally), I will first examine incumbent and challenger behavior if there were only one election. In Figure 3, the game would end after the first election. Since there is only one election, there is no reason for the incumbent to save money for future elections. Thus, first-election spending will equal first-election fund-raising ($s = r$). Although the challenger's utility function does not change, the incumbent's is simpler:

$$EU_{incumbent} = \begin{cases} -C(r) + W^H(s, I) & \text{enter} \\ -C(r) + W^L(s, I) & \text{not enter} \end{cases}$$

The strategies are also simpler: I need only concentrate on the strategy pair (ρ^*, α^*).

Since the marginal benefit of spending money increases as incumbent strength increases, *if incumbents could not affect challenger quality*, stronger incumbents would raise and spend more money.[20] This means that strong incumbents may be able to deter challengers through their fund-raising behavior.

The high-quality challenger will run against an incumbent if

$$c^H < 1 - W^H(s, I)$$

If it is not too costly, the incumbent's task is to make the high-quality challenger indifferent between entering the race or not, in which case the challenger does not enter.

PROPOSITION 1: *[One election] The unique subgame perfect equilibrium* (ρ^*, α^*) *is*

$$\begin{aligned} \rho^*(I) &= \hat{r}(I) && \text{for all } I \geq I_3 \\ \rho^*(I) &= \dot{r}(I) && \text{for all } I \in [I_1, I_3) \\ \rho^*(I) &= \check{r}(I) && \text{for all } I < I_1 \\ \alpha^*(r, I) &= \text{not enter} && r \geq \dot{r}(I) \\ \alpha^*(r, I) &= \text{enter} && r < \dot{r}(I) \end{aligned}$$

20. This proof is available on request from the author or at URL: http://fhss.byu.edu/polsci/Goodliffe/papers. With an additional sufficient (but not necessary) assumption ($W_2(s, I) \gg W_{12}(s, I)$), one can also show that war chests increase as incumbent strength increases, if incumbents could not affect challenger quality.

where $\dot{r}(I)$ is the amount raised by incumbent I where the high-quality challenger is indifferent between entering the race or not, $\check{r}(I)$ is the amount raised by incumbent I knowing that the high-quality challenger will enter, and $\hat{r}(I)$ is the amount raised by incumbent I knowing that the high-quality challenger will not enter. Further, $\hat{r}(I)$ and $\check{r}(I)$ increase in incumbent strength, but $\dot{r}(I)$ decreases in incumbent strength.

I postpone the proof until the two-election game. A graphical illustration of the one-election equilibrium is in Figure 4. In this model, there are three regions of behavior: the lower region, which has the weakest incumbents; the middle region, which has 'mid-strength' incumbents; and the upper region, which has the strongest incumbents. The cut-points (I_1, I_3) divide these regions (I_2 is omitted to facilitate comparison to the two-election model). Incumbents weaker than I_1 will face the high-quality challenger; incumbents stronger than (or equal to) I_1 will not face the high-quality challenger. Because there is one election, incumbents spend all that they raise. Mid-strength incumbents raise enough money to make the high-quality challenger indifferent between entering or not (and the challenger does not enter). In this middle region, incumbents must raise extra money to keep the challenger out. Within this region, weaker incumbents must raise more than

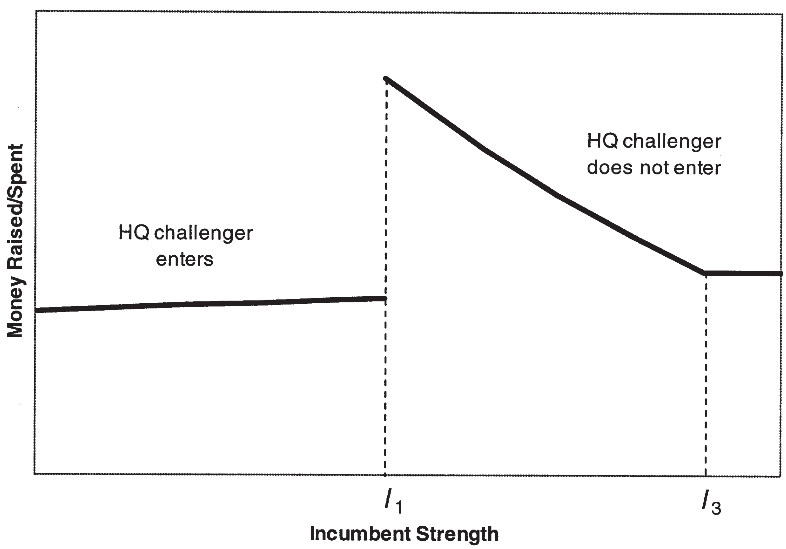

Figure 4. Equilibrium for One Election

stronger incumbents. Below I_1, it becomes too costly for incumbents to raise extra money to keep the high-quality challenger from entering and these weak incumbents (in the lower region) raise and spend money with the expectation that the high-quality challenger will enter. Above I_3, incumbents do not need to do anything special to keep the high-quality challenger from entering.

The break points (I_1, I_3) between the regions depend on the cost to the high-quality challenger (c^H). As this cost decreases, the break point increases (to the point where it would eliminate the relatively flat region for the strongest incumbents). It is also possible that one (or two) of the regions would disappear if the cost of running for the high-quality challenger were high or low enough.

Although this is not the full model, there are some interesting features of the equilibrium. Given that the challenger knows the incumbent's strength, it would appear that extra fund-raising keeps out high-quality challengers. Since the relationship is not monotonic, it would make empirical testing complex.

3.2 Two-election Cycles

The results for the two-election model extend the one-election model. The incumbent acts similarly in the second election as he does in the one-election model. But in the first election, the incumbent may save money for the second election.

PROPOSITION 2: *[Two elections, no uncertainty] The unique subgame perfect equilibrium* $\{(\rho^*, \sigma^*), (\alpha^*, \beta^*)\}$ *is:*

$$
\begin{aligned}
\rho^*(I) &= \hat{r}(I) && \text{for all } I \geq I_3\\
\rho^*(I) &= \ddot{r}(I) && \text{for all } I \in [I_2, I_3)\\
\rho^*(I) &= \dot{r}(I) && \text{for all } I \in [I_1, I_2)\\
\rho^*(I) &= \check{r}(I) && \text{for all } I < I_1\\
\alpha^*(r, I) &= \text{not enter} && r \geq \ddot{r}(I)\\
\alpha^*(r, I) &= \text{enter} && r < \ddot{r}(I)\\
\sigma^*(\text{not enter}, I) &= (\hat{s}_1^L(I), \hat{r}_2^L(I)) && \text{for all } I \geq I_3\\
\sigma^*(\text{enter}, I) &= (\hat{s}_1^H(I), \hat{r}_2^H(I)) && \text{for all } I \geq I_3\\
\sigma^*(\text{not enter}, I) &= (\ddot{s}_1^L(I), \ddot{r}_2^L(I)) && \text{for all } I \in [I_2, I_3)\\
\sigma^*(\text{enter}, I) &= (\ddot{s}_1^H(I), \ddot{r}_2^H(I)) && \text{for all } I \in [I_2, I_3)\\
\sigma^*(\text{not enter}, I) &= (\dot{s}_1^L(I), \dot{r}_2^L(I)) && \text{for all } I \in [I_1, I_2)\\
\sigma^*(\text{enter}, I) &= (\dot{s}_1^H(I), \dot{r}_2^H(I)) && \text{for all } I \in [I_1, I_2)\\
\sigma^*(\text{not enter}, I) &= (\check{s}_1^L(I), \check{r}_2^L(I)) && \text{for all } I < I_1\\
\sigma^*(\text{enter}, I) &= (\check{s}_1^H(I), \check{r}_2^H(I)) && \text{for all } I < I_1\\
\beta^*(r_1 - s_1 + r_2; I) &= \text{not enter} && r_1 - s_1 + r_2 \geq r_1 - \dot{s}_1 + r_2(I)\\
\beta^*(r_1 - s_1 + r_2; I) &= \text{enter} && r_1 - s_1 + r_2 < r_1 - \dot{s}_1 + r_2(I)
\end{aligned}
$$

where $(\ddot{r}(I), \ddot{s}_1^j(I), \ddot{r}_2^j(I))$ *are the amounts raised and spent by incumbent I, where the high-quality challenger is indifferent between entering the race or not in either election;* $(\dot{r}(I), \dot{s}_1^j(I), \dot{r}_2^j(I))$ *are the amounts raised and spent by incumbent I, where the high-quality challenger is indifferent between entering the race or not in the second election only;* $(\check{r}(I), \check{s}_1^j(I), \check{r}_2^j(I))$ *are the amounts raised and spent by incumbent I knowing that the high-quality challenger will enter; and* $(\hat{r}(I), \hat{s}_1^j(I), \hat{r}_2^j(I))$ *are the amounts raised and spent by incumbent I knowing that the high-quality challenger will not enter.*

In this model, there are four regions of behavior: the lowest region, which has the weakest incumbents; the lower-middle region, which has lower-strength incumbents; the upper-middle region, which has mid-strength incumbents; and the upper region, which has the strongest incumbents. The cut points (I_1, I_2, I_3) divide these regions. I solve the game through backwards induction.[21]

21. The full proof is available on request from the author or at URL: http://fhss.byu.edu/polsci/Goodliffe/papers.

Step 1: second-election challenger entry. As previously mentioned, incumbents spend all the money they raise in the second election. The challenger enters if the money held by the incumbent (raised in the second election and saved from the first election) makes the probability of winning against that incumbent lower than the cost of running (i.e. if $c^H < 1 - W^H(r_1 - s_1 + r_2, I)$). In equilibrium, the high-quality challenger strictly prefers to run against incumbents in the lowest region; is indifferent between entering or not against incumbents in the two middle regions (and chooses not to enter); and strictly prefers not entering against incumbents in the upper region.

Step 2: first-election spending, second-election fund-raising. At this point, the incumbent knows who he is running against in the first election and how much money he has raised for that election. He must decide how much to spend in the first election (and, thus, how much to save for the next election) and how much to raise in the second election should he win the first. The incumbent can either save and raise enough to deter the challenger in the second election or not. Some incumbents have to raise (and/or save) extra money to deter the challenger in the second election. For the weakest incumbents, this is too costly and they spend and raise money expecting the challenger to enter. The strongest incumbents do not have to raise or save extra money to deter the challenger and they spend and raise money expecting the challenger not to enter. Lower- and mid-strength incumbents save and raise extra money to deter the challenger.

Step 3: first-election challenger entry. The challenger enters if the money raised (and to be spent) by the incumbent makes the probability of winning against that incumbent lower than the cost of running (i.e. if $c^H < 1 - W^H(s_1, I)$). In equilibrium, the challenger strictly prefers to run against incumbents in the lower two regions; is indifferent between entering or not against incumbents in the upper-middle region; and strictly prefers not to run against incumbents in the upper region.

Step 4: first-election fund-raising. The incumbent can either save and raise enough to deter the challenger in the first election or not. Some incumbents have to raise extra money to deter the challenger in the first election. For the weakest incumbents, this is too costly and they raise money expecting the challenger to enter. The strongest incumbents do not have to raise extra money to deter the challenger and they raise money expecting the challenger not to enter. Mid-strength incumbents need to raise extra money to deter the challenger (in both elections). Lower-strength incumbents find it too costly to deter the challenger in the first election but raise extra money to deter the challenger in the second election.

A graphical illustration of the two-election equilibrium is in Figure 5. Incumbents weaker than I_1 will face the high-quality challenger in both elections; incumbents stronger than (or equal to) I_1 will not face the high-quality

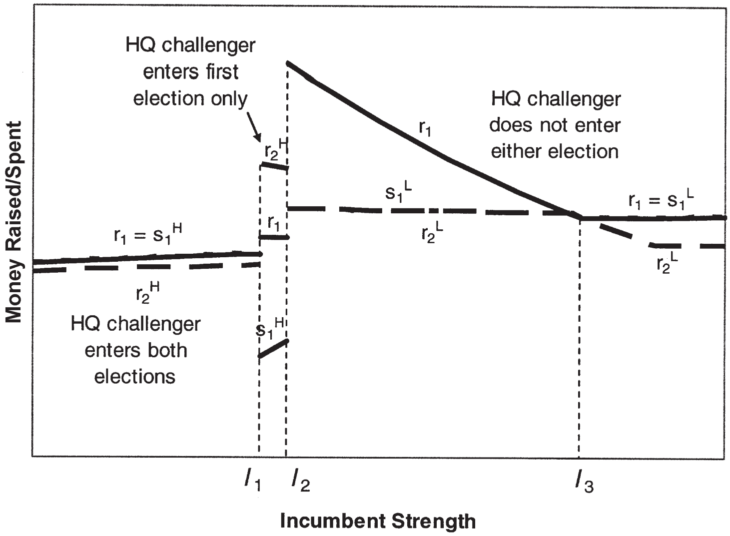

Figure 5. Equilibrium for Two Elections, No Uncertainty

challenger in the second election; incumbents stronger than (or equal to) I_2 will not face the high-quality challenger in either election. Above I_3, incumbents do not need to do anything special to keep the high-quality challenger from entering in either election. The interesting regions are between I_1 and I_2 (lower middle), and I_2 and I_3 (upper middle). First examine the upper-middle region. These mid-strength incumbents raise enough money to make the high-quality challenger indifferent between entering or not (and the challenger does not enter) in both elections. In this upper-middle region, incumbents must raise extra money to keep the challenger out. Within this region, weaker incumbents must raise more than stronger incumbents to deter the high-quality challenger. But having deterred the high-quality challenger, the mid-strength incumbent does not spend all of the money raised against the low-quality challenger he runs against – he saves some of it for the next election, thereby creating a war chest. (The vertical distance between r_1 and s_1^L constitutes the war chest.) The mid-strength incumbent then raises enough money in the second election combined with the war chest to deter the high-quality challenger, which is equal to the amount raised in the first election ($r_1 - s_1^L + r_2^L = r_1$, which implies $s_1^L = r_2^L$).[22]

22. If challenger quality (the cost of running) changed across elections, then the amount raised would change across elections as well.

Now consider incumbents in the lower-middle region (lower-strength incumbents). In this (relatively small) region, the incumbents do not raise enough money to deter the challenger in the first election. But even though they run against the high-quality challenger in the first election, they save some money – a war chest – for the next election. (The vertical distance between r_1 and s_1^H constitutes the war chest.) Combining the war chest with the money raised in the second election, the incumbent has enough cash on hand to deter the high-quality challenger in the second election. Similar to the upper-middle region, within the lower-middle region, weaker incumbents save more money than stronger incumbents. Comparing the strongest lower strength incumbent to the weakest middle strength incumbent, the weakest middle strength incumbent has a larger war chest. Below I_1, it becomes too costly for incumbents to raise extra money to keep the high-quality challenger from entering in either election and these weak incumbents (in the lowest region) raise and spend money with the expectation that the high-quality challenger will enter in both elections.

The fund-raising behavior of incumbents in the two-election model is similar to the fund-raising behavior of incumbents in the one-election model. But there is a big difference in the spending (and saving) behavior of the mid-strength incumbents in the two models. In this model, the weakest incumbents and the strongest incumbents do not create a war chest, only lower- and mid-strength incumbents create a war chest. The weakest and strongest incumbents raise (and spend) more money in the first election than the second election since they are maximizing utility for two elections in the first election and one election in the second election.

As before, the break points (I_1, I_2, I_3) between the regions depend on the cost to the high-quality challenger (c^H). As this cost decreases, the break points increase to the point where it would eliminate the relatively flat region for the strongest incumbents. As this cost increases, the break points decrease to the point where there would no longer be a relatively flat region for the weakest incumbents. It is also possible that two or three of the regions would disappear if the cost of running for the high-quality challenger were high or low enough. Similarly, if the benefit of winning (or the cost of losing) increased for the incumbent, the break points would also decrease (move left).

Comparing the one-election and two-election models – which use the same cost of running – adding a second election allows the incumbent more potential utility. Consequently, incumbents in the second election raise more relative to incumbents in the first election. In addition, the break points move down, relative to the one-election model.

There are some interesting features to this model. Similar to the one-election model, fund-raising is not monotonic in incumbent strength or challenger quality. In addition, war chests are not monotonic in incumbent strength or challenger quality. However, whenever there is a war chest, the high-quality challenger does not enter. The non-monotonic relationships make empirical testing complex.

3.3 Two Election Cycles with Uncertainty

In this section, I alter the two-election model so that the challenger in the first election is chosen randomly.[23] This will enable me to examine the interaction between deterrence and savings (or insurance) reasons for war chests. The time-line is as follows. The incumbent decides how much money to raise for the first election. Next, instead of the high-quality challenger deciding whether to enter, a high- or low-quality challenger is selected (randomly) to run against the incumbent. The incumbent then decides how much of the raised money he will spend in this election. If he wins the election, he takes any money left over – i.e. the war chest – into the next election cycle, where once again, he decides how much money to raise for the last election. Then the challenger decides whether to enter the race or not and, finally, the incumbent decides how much money to spend in this second election cycle.

The information is the same as the previous model except that the probability of challenger entry in the first election is determined exogenously rather than endogenously generated (by the challenger).

I denote the probability that a high- (low-) quality challenger runs against the incumbent as η $[1-\eta]$, where $0 \leq \eta \leq 1$. Denoting the election with subscripts and the quality of challenger the incumbent faced in the first election with superscripts, the incumbent's expected utility function over two election cycles is

$$-C(r_1) + \eta\left\{W^H(s_1^H, I)\left[1 - C(r_2^H) + W^k(s_2^H, I)\right]\right\}$$
$$+ (1-\eta)\left\{W^L(s_1^L, I)\left[1 - C(r_2^L) + W^k(s_2^L, I)\right]\right\}$$

where k is the quality of challenger in the second election. In the second election, if the high-quality challenger decides not to enter the race, a low-quality challenger will run against the incumbent.

Some modification of the strategies is also necessary. Because the challenger that enters the first election is determined randomly, the incumbent makes three decisions before the high-quality challenger chooses whether to enter in the second election cycle: how much to raise and spend in the first election; and how much to raise in the second election. Thus, for any incumbent of strength I, $\rho(I) = (r_1, s_1^L, r_2^L, s_1^H, r_2^H)$, where r_1 equals the

23. If the challenger is chosen randomly in the second election (and not the first), the results are qualitatively similar to the one-election model.

amount of money raised in the first election, s_1^L equals the amount of money spent in the first election if the incumbent faces a low-quality challenger, r_2^L equals the amount of money raised in the second election if the incumbent faces a low-quality challenger in the first election (given the incumbent wins the first election), s_1^H equals the amount of money spent in the first election if the incumbent faces a high-quality challenger, and r_2^H equals the amount of money raised in the second election if the incumbent faces a high-quality challenger in the first election (given the incumbent wins the first election).

Similar to the previous model, $\alpha(r_1 - s_1 + r_2; I)$ is the probability that the challenger enters the race, having observed the incumbent's fund-raising and spending in the first election, and fund-raising in the second election. As before, the incumbent will spend all that he has in the last election. Thus, I only concentrate on the strategy pair (ρ^*, α^*).

The results for the two-election model with uncertainty are qualitatively similar to the one- and two-election models without uncertainty.

Proposition 3: *[Two elections, uncertainty] The unique subgame perfect equilibrium* (ρ^*, α^*) *is:*

$$\rho^*(I) = (\hat{r}_1(I), \hat{s}_1^L(I), \hat{r}_2^L(I), \hat{s}_1^H(I), \hat{r}_2^H(I)) \quad \textit{for all } I \geq I_3$$

$$\rho^*(I) = (\dot{r}_1(I), \dot{s}_1^L(I), \dot{r}_2^L(I), \dot{s}_1^H(I), \dot{r}_2^H(I)) \quad \textit{for all } I \in [I_1, I_3)$$

$$\rho^*(I) = (\check{r}_1(I), \check{s}_1^L(I), \check{r}_2^L(I), \check{s}_1^H(I), \check{r}_2^H(I)) \quad \textit{for all } I < I_1$$

$$\alpha^*(r_1 - s_1 + r_2; I) = \text{not enter} \qquad r_1 - s_1 + r_2 \geq r_1 - \dot{s}_1 + r_2(I)$$

$$\alpha^*(r_1 - s_1 + r_2; I) = \text{enter} \qquad r_1 - s_1 + r_2 < r_1 - \dot{s}_1 + r_2(I)$$

where $(\dot{r}_1(I), \dot{s}_1^L(I), \dot{r}_2^L(I), \dot{s}_1^H(I), \dot{r}_2^H(I))$ *are the amounts raised and spent by incumbent I where the high-quality challenger is indifferent between entering the race or not,* $(\check{r}_1(I), \check{s}_1^L(I), \check{r}_2^L(I), \check{s}_1^H(I), \check{r}_2^H(I))$ *are the amounts raised and spent by incumbent I knowing that the high-quality challenger will enter, and* $(\hat{r}_1(I), \hat{s}_1^L(I), \hat{r}_2^L(I), \hat{s}_1^H(I), \hat{r}_2^H(I))$ *are the amounts raised and spent by incumbent I knowing that the high-quality challenger will not enter.*

The proof is similar to the previous model. As in the one-election model, there are three regions of behavior: the lower region, which has the weakest incumbents; the middle region, which has 'mid-strength' incumbents; and the upper region, which has the strongest incumbents. The cut-points (I_1, I_3) divide these regions. A graphical illustration of the two-election with uncertainty equilibrium is in Figure 6. The illustration shows the results if a

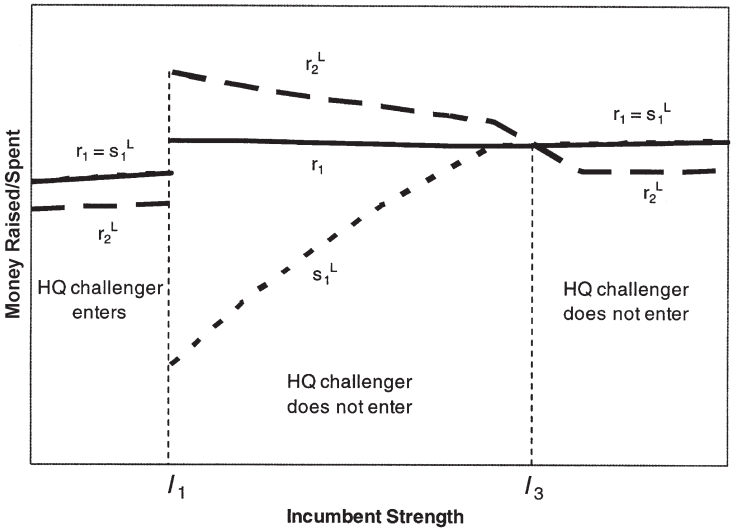

Figure 6. Equilibrium for Two Elections with Uncertainty

low-quality challenger runs in the first election (where $\eta = 0.5$) but a similar illustration is found if a high-quality challenger runs. Incumbents weaker than I_1 will face the high-quality challenger in the second election; incumbents stronger than (or equal to) I_1 will not face the high-quality challenger in the second election.

Looking at fund-raising behavior in the second election, the broken line of r_2^L is similar to the fund-raising line in a one-election race: the strongest incumbents ($I \geq I_3$) raise (and spend funds) expecting the high-quality challenger to stay out of the race. Mid-strength incumbents ($I \in [I_1, I_3)$) raise enough funds (augmented by funds saved from the previous election) to deter the high-quality challenger from entering. It is too expensive for weaker incumbents ($I < I_1$) to raise enough funds to deter, so they behave anticipating high-quality challenger entry. Looking at behavior in the first election, weaker incumbents raise funds not knowing whether they will face a high-quality challenger in the first election but knowing if they win that election, they will face a high-quality challenger in the second election. Within this lower region, stronger incumbents raise and spend more. Mid-strength incumbents raise funds not knowing whether they will face a high-quality challenger in the first election but knowing if they win that election, they will face a low-quality challenger in the second election. Because they cannot deter the high-quality challenger in the first election and will have to raise a lot of funds to deter the high-quality challenger in the second election, the weaker incumbents in the middle region save more money from the first election for the second election. As in the model without uncertainty, the war chest (which is equal to $r_1 - s_1$) is larger for weaker incumbents than stronger incumbents. In addition, these mid-strength incumbents will also form a (smaller) war chest if they run against a high-quality challenger in the first election. The strongest incumbents do not form such a war chest because they do not need to raise excess funds to deter high-quality challengers.

As before, the break points (I_1, I_3) between the regions depend on the cost of the high-quality challenger (c^H). As this cost decreases, the break points increase to the point where it would eliminate the relatively flat region for the strongest incumbents. As this cost increases, the break points decrease to the point where it would eliminate the relatively flat region for the weakest incumbents. It is also possible that two of the regions would disappear if the cost of running for the high-quality challenger were high or low enough.

Although the absolute values and slopes are different, this model has the same qualitative properties as the two-election model without uncertainty. Namely, fund-raising, spending, and war chests are not monotonic in incumbent strength or challenger quality. Thus, empirical testing is difficult, especially when aggregating across districts, as discussed later.

4. Discussion

4.1 Empirical Predictions

In all three models, the most interesting behavior occurs for medium-strength incumbents. The weakest incumbents (in the lowest region) know that they cannot credibly deter high-quality challengers and raise and spend money expecting them to enter (when the challenger is not determined randomly). If the weakest incumbents have somehow defeated the high-quality challengers in the first election (having spent all of their money), they are again made weaker by drawing another high-quality challenger in the second election. The strongest incumbents (in the upper region) know they can deter high-quality challengers without working as hard as medium-strength incumbents and raise and spend money knowing such challengers will not enter. But medium-strength incumbents have to raise extra money to deter the challenger.

The high-quality challenger stays out of the (first) election if the medium-strength incumbent has raised a lot of money. Since that incumbent then runs against a low-quality challenger, he does not need to spend all of the money he has raised and a war chest is left over for the next election. Thus, a large war chest is created as a joint result of the excessive money raised to deter the high-quality challenger in the first election *and* the fact that the high-quality challenger did not run against the incumbent in the first election. In the second election, medium-strength incumbents have war chests to draw on to defeat their low-quality challengers. Thus, they do not need to raise as much money for the second election.

These equilibria have interesting implications. Incumbents in the lower and upper regions raise no war chest. Among the incumbents in the middle region, the stronger the incumbent is, the *smaller* the war chest will be. Thus, contingent on creating a war chest, stronger incumbents create (weakly) smaller war chests. The situation is more complicated for the model with no uncertainty, where there are two separate regions where incumbents raise war chests.

These models can be tested empirically several ways. In making empirical predictions, however, note that this model – like most game-theoretic models – simplifies by including some factors and excluding others. Thus, the model yields predictions *ceteris paribus*.[24]

One more qualification needs to be made about empirical tests. It is possible that one district has a (relatively) strong high-quality challenger and another district has a (relatively) weak high-quality challenger, in which case these districts may not have one (or two) of the three regions described in the previous equilibria. It is also possible that one district would have more uncertainty than another district, which also affects the results. However, all of the equilibria have the same general form (although they may differ in their cut points). Thus, if one assumes that all districts have strong high-quality challengers, then one can make general predictions about the empirical patterns to be observed across districts.

The first empirical prediction is that large war chests appear to deter high-quality challengers from entering.[25] However, this prediction has already been tested by several studies and the results are mixed. Goodliffe (2001) argues that the reason the empirical results differ is omitted variables. Even when the incumbent does not raise a war chest, no high-quality challenger enters against a very strong incumbent. To test the prediction that war chests deter high-quality challengers, one would first need to determine

24. See Morton (1999) for an exposition of empirically testing formal models. In Morton's terminology, I assume that the model is a 'partial data generating process'.

25. Actually, it is the combination of fund-raising, spending, saving, and incumbent strength that deters high-quality challengers from running. As it is difficult to decide exactly when to measure incumbent fund-raising, a war chest (the money saved from the previous election) is the most easily measured variable of the model's predictions.

the strength of the incumbent, as well as the strength of the high(est) quality potential challenger.[26]

The second empirical prediction of the model is that conditional on creating a war chest, stronger incumbents create (weakly) smaller war chests.

The third empirical prediction is that if there is uncertainty, an incumbent who faced a high-quality challenger in the previous election creates a smaller war chest (or no war chest at all) than the same-strength incumbent who faced a low-quality challenger. Extending the model (intuitively) to a range of challenger qualities, the higher the quality of challenger in the previous election is, the smaller the war chest for the current election will be. This prediction is confirmed by Ansolabehere and Snyder (2000) and Goodliffe (2004).

The fourth empirical prediction is that since low-quality challengers only enter when high-quality challengers choose not to, the two types of challenger entry will be negatively correlated. This prediction was tested in Goodliffe (2001) and confirmed.

Thus, this model squares with previous empirical tests and offers a preliminary explanation why war chests appear to deter in some circumstances but not others. In short, war chests are not a blanket deterrent, they are a conditional deterrent.

4.2 Extensions

4.2.1 Challenger quality. It is useful to consider the circumstance in which there is a range of challenger quality, rather than merely two categories. Instead of two win probability functions for the incumbent (one for each possible challenger), there would be a range of win probability functions. Assume that the highest quality challenger that prefers to enter does enter and lesser quality challengers do not (or, alternatively, they lose in the primary to the highest quality challenger entering).[27] The intuition of this model would continue to hold – incumbents would still have the incentive to deter this highest quality challenger from entering, and would act accordingly. Thus, instead of being driven by the strength of a high-quality challenger, the model would be driven by the strength of the *highest* quality (potential) challenger in the district.

26. This is difficult to do except through case studies of specific districts. Whereas publications such as *Congressional Quarterly* keep tabs on challengers who have entered election races, very few follow the decisions of potential challengers. See Kazee (1994) for an example of a collection of case studies of districts. Maisel and Stone's Candidate Emergence Study (e.g. Stone and Maisel, 2003) is one step toward gathering this information.

27. Canon (1990) notes that high-quality challengers 'push' low-quality challengers from the electoral process, either by winning the primary election or by deterring low-quality challengers from entering.

To get a better idea of the intuition, suppose that there are three qualities of challengers: high, medium, and low (with costs of running c^H, c^M, and c^L, respectively). The medium-quality challenger will only enter if the high-quality challenger does not and the low-quality challenger will only enter if both the high- and medium-quality challengers do not. The difficulty is specifying the preferences of the medium-quality challenger. Recall that the expected utility of the high-quality challenger is

$$EU_{HQ\,challenger} = \begin{cases} [1 - W^H(s, I)] - c^H & \text{enter against incumbent} \\ 0 & \text{not enter.} \end{cases}$$

Since the low-quality challenger will enter against any incumbent, the reduced form expression of the challenger's expected utility would be

$$EU_{LQ\,challenger} = \begin{cases} [1 - W^L(s, I)] - c^L & \text{enter against incumbent} \\ 0 & \text{not enter} \end{cases}$$

where c^L is close to zero and $1 - W^L(s, I) > 0$. By assumption, $c^L < 1 - W^L(s, I)$. Thus, the low-quality challenger always prefers to enter if the high-quality challenger does not. A reasonable expression for the medium-strength challenger would be

$$EU_{MQ\,challenger} = \begin{cases} [1 - W^M(s, I)] - c^M & \text{enter against incumbent} \\ 0 & \text{not enter} \end{cases}$$

where $c^M \in (c^L, c^H)$. Since $W^H(s, I) < W^M(s, I) < W^L(s, I)$ for any given s and I, an incumbent may have an incentive to attempt to deter both high- and medium-quality challengers. But doing so would be more costly – only the strongest incumbents could do it. If the intuition of the model holds, then these strongest incumbents would run against low-quality challengers and may or may not have a war chest. Medium-strength incumbents would deter high-, but not medium-quality challengers. They would have medium-size war chests. And weak incumbents could deter no one – they would run against high-quality challengers and create no war chests.

Even with this generalization, it is difficult to make a monotonic empirical prediction on fund-raising, spending, and saving behavior. With a range of challenger qualities, strong incumbents will run against the lowest-quality challengers and may or may not have war chests. Weak incumbents will run against the highest-quality challengers and will not have war chests. Medium-strength incumbents will run against medium-strength challengers and will have war chests. Conditional on being a medium-strength incumbent, stronger incumbents have smaller war chests. Thus, war chests will deter under limited circumstances. Since empirical tests generally include incumbents of all strengths, combining medium-strength incumbents (who create war chests and deter high-quality challengers) with strong incumbents (who do not create war chests and still do not draw high-quality challengers) will make it difficult to observe the deterrent capabilities of war chests. This is especially the case when challenger entry is determined as much by accident as by strategy.

If challenger quality (cost of running) were initially unknown, it would not change the results significantly. Because the challenger does not have an opportunity to demonstrate her strength, the incumbent would have to act on his beliefs about the distribution of challengers. The incumbent would (roughly) act as if he were trying to deter (if possible) the average challenger. If the challenger happened to be stronger than average, then the challenger would not be deterred. If the challenger were weaker than average, then she would continue to be deterred. This would make the model something between the two-election model without uncertainty and the two-election model with uncertainty.

4.2.2 Multiple elections. Extending the model to include more than two elections would yield similar results to the models above. (As previously noted, there are many similarities between the one- and two-election models.) The weakest incumbents would not try to deter high-quality challengers and would run against them. The strongest incumbents would scare away high-quality challengers without doing anything special. And mid-range incumbents would raise extra money each election cycle to deter the challenger but would not need to spend it when the challenger was deterred. If there were no uncertainty about the challenger, then there would be a set of incumbents who would initially run against high-quality challengers but if they managed to defeat them, eventually save enough to deter the high-quality challengers (the lower-middle region). This fits with the empirical finding that young incumbents often have their most difficult elections early in their careers.

4.2.3 No war chests allowed. One proposed campaign finance reform is to eliminate war chests for incumbents: Incumbents would not be allowed to carry over funds from one election to the next election. (Such a proposal was passed in the state of Missouri and the US Senate [Corrado et al., 1997: 353; Donovan 1993].) The effect this would have on incumbent behavior is to move from the two-election model to repeating the one-election model. The incumbents in the two-election model who are barely able to deter the high-quality challenger by raising excessive funds and then saving a portion of those funds for the next election would now find it too costly to deter the high-quality challenger. Thus, eliminating war chests would increase the likelihood of defeat for these lower-strength incumbents. If incumbent strength (here defined as ability to use money effectively and get votes) is positively related to incumbent 'quality', then such a reform may be helpful.

But the reform would also require those incumbents who are able to deter challengers through extra fund-raising to spend even more time fund-raising than they do under the current campaign finance system. (In Figure 5, r_2 would be more like r_1.) Presumably, requiring incumbents to spend more time raising money to achieve the same result is a negative change. Thus, the net result of eliminating war chests depends on the relative benefit of increasing overall incumbent strength (since weaker incumbents would lose more often) with increasing the incumbent's time raising money.

4.2.4 Adding the supply side. This model is essentially a demand-side model: It assumes that incumbents can obtain funds to use in a campaign (at a cost) but it does not specify from where those funds come. The essential logic of the model would not change, however, if contributors are added to the model. If contributors want to support either a winning candidate (following a legislative strategy) or a candidate who is in electoral trouble (an electoral strategy), then they will contribute more to those incumbents that have a chance of winning or those incumbents that are in unsafe seats. Funds would thus follow the stronger incumbents and, in particular, the incumbents who are raising extra funds (for deterrence reasons), which is the general result of the models. Similarly, adding campaign consultants would not alter the model as consultants would like to work on winning campaigns (strong incumbents) and those incumbents from whom they can extract more fees (marginal incumbents).

Another supply-side consideration that is excluded from the model is that some incumbents raise funds more easily, and thus, the cost function is not uniform across incumbents. For example, party leaders, committee chairs, and ranking members generally raise funds more easily than others. This will not change the model results qualitatively. Decreasing the absolute or marginal cost of raising funds has the same effect on incumbent behavior as increasing incumbent strength in the model. Thus, incumbents who find it easier to raise funds should be classified as stronger incumbents.

4.2.5 Incumbent strength. Although incumbent strength is generally known, there are times where incumbent strength changes (e.g. after redistricting or a scandal) or is not as well known (e.g. first-term incumbents). In such circumstances, incumbents may use their fund-raising, spending and saving behavior to demonstrate strength to potential challengers. Thus, they could serve as signals to others. This is logically the next step to take this model but beyond the scope of this paper. I examine the case where incumbent strength is not known in Goodliffe (2003). Making incumbent strength unknown reduces the non-monotonic features of this model. Thus, this model of this paper applies best to incumbents about whom much is known: long-term incumbents or incumbents under careful scrutiny.

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