Political media contests and confirmatory bias*

Adam Jacobsson
University of Stockholm
e-mail: aja@ne.su.se

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Abstract

This paper models a two-period media contest between two political candidates campaigning to win an election. Two main cases are examined. In the first case voters behave as unbiased Bayesian updaters when assessing political information. The second case considers voters suffering from confirmatory bias. In the first case I find that candidates spend equal amounts of their campaign funds in both periods in equilibrium. In the second case, candidates spend more in period one. A candidate with better media access (in period one) does, however, better if voters suffer from confirmatory bias than if they do not.

JEL codes: D72, D81, D83
Keywords; Election campaigns, voting behavior, confirmatory bias.

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1 Introduction

Large sums of money are spent on campaign expenditures in connection with elections worldwide.[1] This fact has attracted much research on how campaign spending affects vote shares. Jacobson (1978) pioneered this field by regressing campaign expenditures on vote shares in the 1972 and 1974 House and Senate elections in the US where he found a positive correlation. Later studies have confirmed this effect.[2] This research has primarily focused on how aggregate spending before an election has affected voter support. However, an election campaign is clearly a dynamic phenomenon. Kenny and McBurnett (1992) recognize this fact and study empirically how the timing of campaign spending affects voter support. They find that a candidate loses voter support if he waits extraordinarily long to spend his campaign resources. This paper will try to shed some light on why timing may be important in election campaigns. I will do so by focusing on how voters are affected by campaign information.

Psychologists have examined how individuals process information in general and one phenomenon, confirmatory bias, appears especially fruitful at explaining the Kenny and McBurnett results.[3] Confirmatory bias is the tendency of an individual to "...misread evidence as additional support for initial hypotheses"[4] In other words, the individual will treat information that goes against his current beliefs with suspicion and tend to misread the same in support of his beliefs. Rabin and Schrag (1999) model formally how individuals suffering from confirmatory bias systematically misperceive information in favor of old hypotheses which to a large extent has influenced this paper. Zaller (1992) describes how voters exhibit a partisan bias such that they tend to resist persuasive campaign messages that are inconsistent with their political predispositions. The phenomenon of partisan bias appears to be a special case of the more general phenomenon of confirmatory bias. It therefore seems lika a fruitful approach to model voter behavior in a model of confirmatory bias.

Applying confirmatory bias to voters would imply that once a voter has decided whom to vote for, it will be difficult to change his mind. Therefore it would make sense for political candidates to convince voters sooner rather than later.

[1] See for example Kenny and McBurnett (1994) for the case of the USA.

[2] Green and Krasno (1990) and Nagler and Leighley (1992) study the effects of aggregate campaign spending on elections in the USA while Palda and Palda (1998) do the same for France, and Pattie, Johnston, and Fieldhouse (1995) for the UK.

[3] See for example Lord, Ross, and Lepper (1979).

[4] Rabin (1998), p 26.

This paper will test this intuition formally by setting up a game-theoretic model analyzing the effect of timing of campaign resources on voter support. A representative voter forms his opinion on whom to vote for based on campaign information in the media from the two candidates during two periods before the election. The candidates decide how much of their campaign funds to spend each period where more funds are assumed to yield more voter support. I will examine two cases. In the first case the voter behaves as an unbiased Bayesian updater and in the second case he exhibits confirmatory bias. I show that as the degree of confirmatory bias increases, the larger is the share of campaign funds that both candidates spend in period one in equilibrium.

Elections often involve an incumbent and one (or many) challenger(s). The interaction between these candidates is often asymmetric in nature. Incumbents usually have access to larger campaign funds and have better media access which has given rise to a policy debate concerning for example campaign subsidies and/or limits to campaign spending. I examine whether the presence of confirmatory bias would increase the advantage of incumbency or not. I show that it does so with respect to asymmetric media access, but not with respect to asymmetric budgets.

The purpose of this model is to investigate how confirmatory bias may affect the timing of campaign spending. My aim is to isolate this effect and I therefore abstract from many other relevant factors. Such factors are for example; alternative use for campaign funds, fund raising issues[5], voters' tendency to forget, voters' age, sex, race, education, family income, etc.

The paper is organized as follows: Section 2 provides a benchmark model which describes the basic strategic interplay and how a representative voter receives campaign information under the assumption that he behaves as an unbiased Bayesian updater. Section 3 applies confirmatory bias to the model developed in section 2 assuming a symmetric setup. Section 4 analyzes the effect of confirmatory bias on an asymmetric setup with respect to the size of campaign budgets and media access. Section 5 has the conclusion.

2 A benchmark model

Consider an election where a representative voter chooses between candidates A and B. Assume that candidate A is the incumbent and that voting for A yields a payoff of one for sure. Candidate B is a challenger, not previously known to the voter. Voting for B yields a payoff of zero or $X > 0$. Candidate

[5] See Morton and Myerson (1992) for a model of the importance of timing with respect to fund raising.

B wants to convince the voter that voting for him will yield X and not zero while candidate A wants the voter to think the other way. Θ is the subjective probability that the voter assigns to voting for candidate B yielding a payoff of zero. Figure 1 illustrates the voter's choice:

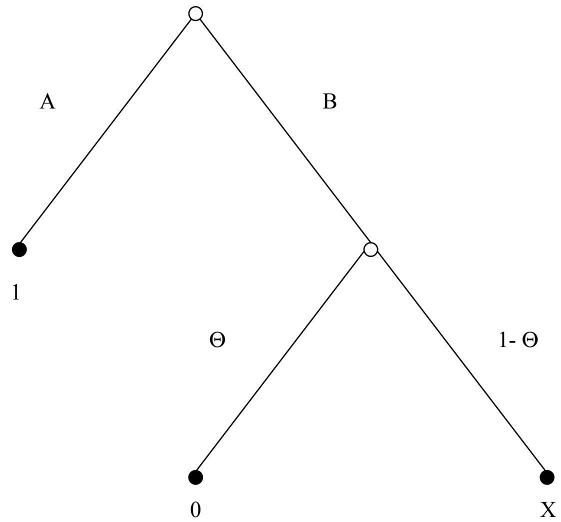

Figure 1. The voter's choice.

The voter will vote for A if $1 > (1 - \Theta)X$ and B otherwise. The beliefs of the voter are affected by gathering political information in the media during two periods. Assume that the only information the voter receives is messages sent by the two candidates which are broadcast in the media. Moreover, factors such as age, sex, family income, party affiliation etc affect voting decisions. However, for expositional clarity I only consider how the campaign spending by the candidates affect the voter.

The voter draws a representative sample of A- and B messages each period from the media. Based on the quantity of A- and B messages he forms a probability assessment, θ_t, that voting for B will yield a payoff of zero. In the mind of the voter, the messages make up a signal which has a correlation of θ_t to candidate B yielding zero. Candidates influence θ_t by buying messages, C_t^i, $i = \{A, B\}$, $t = \{1, 2\}$, in the media during two periods. The voter forms his probability assessment according to the following contest success function;

$$\theta_t = \frac{C_t^A}{C_t^A + C_t^B} \tag{1}$$

where θ_t is defined to equal 0.5 if $C_t^A + C_t^B = 0$. θ_t therefore corresponds to the relative success of candidate A's campaign in the mind of the voter in period t. The relative success of candidate B's campaign then equals $1 - \theta_t$. Thus, the more messages a candidate buys the more persuasive is his campaign. This specific functional form of the contest success function is chosen for its simplicity and wide use, for example in the rent-seeking literature.[6] Zaller uses the same functional form to define the probability that a voter will give a (pre- election) survey response in support of candidate A.[7]

Both candidates have a given endowment of campaign funds, ω^i , $i = \{A, B\}$, which is assumed to have no alternative use apart from buying messages. Assume also that the price of a message in either period for either candidate equals one. The process whereby the voter receives campaign information is illustrated in figure 2;

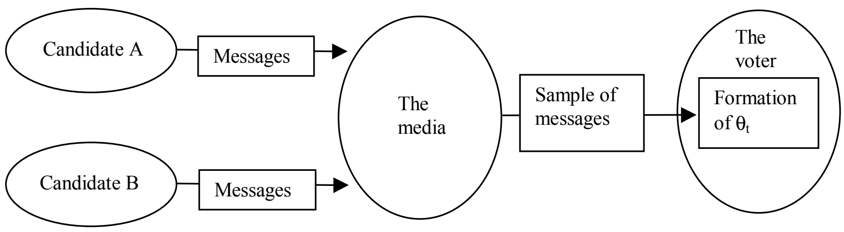

Figure 2. Information flow.

The voter thus receives two signals with correlations θ_1 and θ_2. These are then used by the voter, in accordance with standard Bayesian updating, to determine his final beliefs as represented by Θ. Formally (see appendix section A.1 for derivation);

$$\Theta = prob\,(B \text{ yields zero} \mid \theta_1, \theta_2) = \frac{\theta_1\theta_2}{\theta_1\theta_2 + (1-\theta_1)(1-\theta_2)} \tag{2}$$

Hence we have a game where the players, candidates A and B, want to maximize Θ (candidate A) and minimize Θ (candidate B). Note that Θ does not correspond to candidate A's vote share. This could be achieved by incorporating a distribution over voters' preferences on X into the model.

[6] See Hirschleifer (1989) and Skaperdas (1996) for a discussion about different contest success functions.

[7] Zaller defines C^A (C^B) as the number of considerations in favor of candidate A (B) in the mind of the voter. When the voter is to answer a survey, he then makes a random draw from the total number of considerations available in his mind which determines his response. Considerations are formed by persuasive messages in the environment of the voter where these messages sometimes are rejected as outlined above.

However, this would not alter the analysis as the candidates still want to optimize their timing of campaign spending. In order to keep the model as simple as possible I therefore refrain from using such a distribution.

Inserting equation 1 into equation 2 yields candidate A's maximization problem, given candidate B's campaign fund allocation:

$$\max_{\{C_1^A, C_2^A\}} \frac{\left(\frac{C_1^A}{C_1^A+C_1^B}\right)\left(\frac{C_2^A}{C_2^A+C_2^B}\right)}{\left(\frac{C_1^A}{C_1^A+C_1^B}\right)\left(\frac{C_2^A}{C_2^A+C_2^B}\right)+\left(1-\frac{C_1^A}{C_1^A+C_1^B}\right)\left(1-\frac{C_2^A}{C_2^A+C_2^B}\right)} \tag{3}$$

subject to $C_1^A + C_2^A = \omega^A$. By simplifying equation 3 we can set up the following Lagrangian:

$$\max_{\{C_1^A, C_2^A\}} \mathcal{L} = \frac{C_1^A C_2^A}{C_1^A C_2^A + C_1^B C_2^B} + \lambda(\omega^A - C_1^A - C_2^A) \tag{4}$$

Taking the first order conditions of equation 4 and assuming an interior solution:

$$\frac{\partial \mathcal{L}}{\partial C_1^A} = \frac{C_2^A C_1^B C_2^B}{(C_1^A C_2^A + C_1^B C_2^B)^2} - \lambda = 0, \tag{5}$$

$$\frac{\partial \mathcal{L}}{\partial C_2^A} = \frac{C_1^A C_1^B C_2^B}{(C_1^A C_2^A + C_1^B C_2^B)^2} - \lambda = 0 \text{ and} \tag{6}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = \omega^A - C_1^A - C_2^A = 0 \tag{7}$$

Dividing equation 5 by equation 6 yields:

$$\frac{C_2^A}{C_1^A} = 1 \Rightarrow C_2^A = C_1^A \tag{8}$$

Using equation 7 we derive the best response strategy for candidate A, given candidate B's strategy in the interval $C_t^B \in (0, 1)$:

$$C_1^{A*} = C_2^{A*} = \frac{\omega^A}{2} \tag{9}$$

By symmetry we also have:

$$C_1^{B*} = C_2^{B*} = \frac{\omega^B}{2} \tag{10}$$

Should, however, candidate B allocate all his funds in period one, $C_1^B = 1, C_2^B = 0$, or in period two, $C_1^B = 0, C_2^B = 1$, any interior allocation is optimal for candidate A; $C_1^{A*} \in (0,1)$. Thus we have a best response correspondence according to:

$$C_1^{A*} = \begin{cases} (0,1) & \text{if } C_1^B = 0 \\ \frac{\omega^A}{2} & \text{if } C_1^B \in (0,1) \\ (0,1) & \text{if } C_1^B = 1 \end{cases} \tag{11}$$

Figure 3 illustrates candidate A's best reply correspondence:

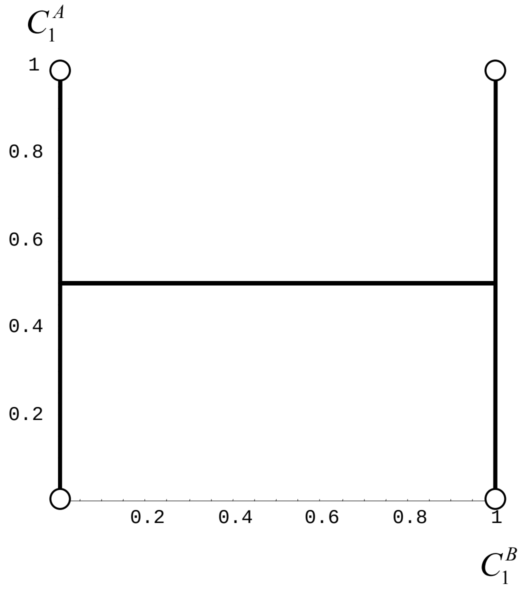

Figure 3. Candidate A's BR correspondence.

We need, however, only consider interior solutions since a Nash equilibrium with both candidates spending all of their budgets in periods one or two would mean that there would exist incentives for unilateral deviation. For example, if both candidates allocate all funds to period one, the resulting Θ would then be 0.5. Should candidate A, however, deviate and reallocate an arbitrarily small sum, ε, from period one to period two, he would win the period two media contest completely, that is, $\theta_2 = 1$. The resulting Θ would then be equal to one, that is, total victory for candidate A. By symmetry, the same argument applies to candidate B.

Assuming an interior solution, it is apparently optimal to keep a constant presence in the media arena. The intuition for this result is that since the marginal effect of another C_1^A is positive, but exhibits diminishing returns (see appendix, section A.2), and the two periods are treated equally by the voter, it is best to spread the campaign effort evenly. That is, since the prices for sending messages in both periods are equal, the only way to equalize marginal returns from campaign spending is to allocate half the budget each period. One might have suspected that the opponent's allocation of campaign resources would matter, but since it comes in symmetrically for both periods, it is always optimal to spend half the budget each period. This can be seen in the first term in equations 5 and 6 where the product of candidate B's period one and two spending, $C_1^B C_2^B$, enters symmetrically in both equations.

In this section it has been assumed that the voter takes all messages from the media at their face value. That is, the voter does not reinterpret them in any way, only weighs them together as to create a signal on which to base his decision. The next section looks at what happens when the voter processes the information more actively, that is, when he interprets the information based on his (possibly biased) state of mind.

3 Incorporating confirmatory bias

Psychology research has shown that people exhibit different kinds of judgement biases where confirmatory bias is one of them.[8] Confirmatory bias is usually presented in a context where an individual has to decide which state of the world is actually true, based on ambiguous information. In this model, however, there is no "true state of the world" since we do not know if voting for candidate B will yield a payoff of X or zero. Nor do we know the true probability distribution. A voter simply forms his subjective opinion based on information emanating from the two candidates. Thus we have not defined what is true or false but what matters is which candidate the voter *thinks* will yield the greatest payoff. Obviously, since voters have blank minds with respect to the new candidate B at the outset of period one, it would appear important for the candidates to inculcate a large support in the electorate in period one as this would bias people to interpret information favorably during the next period. I will examine this intuition formally.

Note that I use the term interpret information and not misinterpret information. This simply follows from the assumption that there is no right or wrong, only different assessments about the probability that candidate B's policy will yield a payoff of zero. A candidate A message, for example, could thus either be taken at face value, or, be interpreted, even though the sender of the same is never in doubt, as a message urging me to vote for candidate B.

A related psychological phenomenon, called anchoring, describes how people tend to anchor on possibly arbitrary values when they have to estimate an uncertain quantity and do not adjust their estimate sufficiently when more

[8] See Rabin (1998) for a survey.

information is available.[9] In this model this would mean that a voter would tend to anchor his final assessment of the probability that candidate B will yield zero on his assessment from period one. The voter would thus not fully take into consideration the information he gains in period two compared to an unbiased Bayesian updater as in the previous section. We will see later whether this holds true in the model or not.

The setup for this model is identical to the one presented in section 2 with the addition of the voter now suffering from confirmatory bias. The voter is assumed not to have an opinion, or prior, about candidate B at the outset of period one and all messages will be taken at face value. However, the voter's mind is no longer blank in period two since he by now has formed an opinion about the probability that candidate B's policy yields a payoff of zero. The voter is biased in favor of candidate A if he has received a period one signal with $\theta_1 > 0.5$ and biased the other way if $\theta_1 < 0.5$. He will now actively evaluate the messages he receives from the media and will be biased towards interpreting messages in favor of his opinion. This is close to Zaller's model where people tend to resist arguments against their political predispositions. However, while Zaller assumes that the voter's allegiances are predetermined exogenously, I allow his allegiences to be dynamically determined by the flow of political messages.

The probability that he will interpret a message from candidate A as a B message equals $q(1-\theta_1)$ while the probability of interpretation in the other direction equals $q\theta_1$. Thus, the more pro-candidate A the voter is (higher θ_1), the more likely he is to interpret B messages as A messages and the less likely to interpret information the other way. q represents the degree to which a voter actively interprets messages with $q \in [0,1]$ where $q = 0$ corresponds to a voter always accepting messages at their face value and $q = 1$ represents a voter who actively interprets all messages based on his frame of mind. A higher q thus increases the severity of confirmatory bias. For example, if a voter has a prior of $\theta_1 = 0.7$, the probability of interpreting a supportive A message as a B message equals $q(1-\theta_1) = 0.3q$ while interpreting a conflicting B message as an A message occurs with probability $q\theta_1 = 0.7q$ where the latter is strictly greater than the former. The difference will also be greater the larger is q.

If the voter reinterprets a message he thereby decides that the message is an argument for the other candidate and the message enters the relative success function (equation 1) accordingly. Reinterpreting a message thus means that the voter finds the argument in the message not convincing, wrong or plain silly with the consequence that he perceives it as an argument

[9] Rabin (1998), p 29.

for voting for the other candidate. The flow of information and the voter's assessment of the same can be illustrated by figure 4 below:

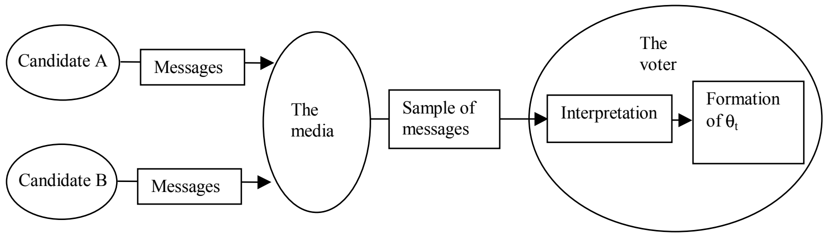

Figure 4. Information flow with confirmatory bias.

Given the period one signal, the final number of messages the voter perceives as supporting candidate A in period two will then be a share (depending on the size of the media sample which we can assume to be one) of all A messages sent minus the number of A messages that are interpreted in support of candidate B plus the number of B messages that are interpreted to support candidate A. The same argument applies for the number of B messages. Formally:

$$\text{Number of perceived } A \text{ messages} = C_2^A - q\left(1-\theta_1\right)C_2^A + q\theta_1 C_2^B$$

$$\text{Number of perceived } B \text{ messages} = C_2^B - q\theta_1 C_2^B + q\left(1-\theta_1\right)C_2^A$$

Given the number of perceived A- and B messages in period two, the perceived correlation of the period two signal can be simplified to[10]:

$$\theta_2' = \theta_2 + q(\theta_1 - \theta_2) \tag{12}$$

where we can see that candidate A will gain from confirmatory bias as long as $\theta_1 > \theta_2$ for $q > 0$. This implies that it is important to do relatively better in period one than in period two. Hence, if $\theta_1 > \theta_2$, then candidate A will gain from confirmatory bias since $q(\theta_1 - \theta_2) > 0$. Confirmatory bias thus reinforces the first impression of the voter.

We see that the voter exhibits confirmatory bias in the sense that he is more prone to interpret conflicting messages as supportive as opposed to the opposite. However, equation 12 also tells us that the voter perceives smaller deviations from his prior than the unbiased voter of section 2 which indicates

[10]See appendix section A.3.

behavior associated with anchoring. We can see this by computing the difference in perceived signal correlation firstly for an unbiased Bayesian updater voter and secondly for one who suffers from confirmatory bias. The unbiased Bayesian updater voter accepts messages at their face value and does not engage in any reinterpretation so the difference simply equals $\theta_1 - \theta_2$. The difference for the voter who reinterprets messages equals $\theta_1 - \theta_2' = \theta_1 - \theta_2 - q(\theta_1 - \theta_2)$. We note that the first two terms on the right hand side equal the difference in the unbiased Bayesian updater case while the third term represents the effect of confirmatory bias. Further, the third term carries the opposite sign to the sum of the first two terms and is, for $0 > q > 1$, also smaller than the same. Therefore, the absolute difference in perceived signal correlation between the two periods is smaller for a voter suffering from confirmatory bias than for one who is not. Hence, the model links confirmatory bias to anchoring since voters not only have a net tendency to interpret conflicting information as supportive but also tend to make insufficient adjustments from their initial assessment in any direction.

We can see from equation 12 that if the degree of confirmatory bias is very strong, $q = 1$, then, $\theta_2' = \theta_1$. This means that only the signal in period one is relevant as all messages are subject to reinterpretation. Should there, however, be no reinterpretation of information, that is, $q = 0$, then the voter acts as an unbiased Bayesian updater and perceives the signal correlation in period two, θ_2', as θ_2. That is, he weighs both signals equally. Let us for now assume that there exists some confirmatory bias within the electorate, thus $q \in (0, 1)$. The subjective probability that a voter will hold that candidate B's policy will yield a payoff of zero is then:

$$\Theta = \frac{\theta_1[\theta_2 + q(\theta_1 - \theta_2)]}{\theta_1[\theta_2 + q(\theta_1 - \theta_2)] + (1 - \theta_1)(1 - [\theta_2 + q(\theta_1 - \theta_2)])} \tag{13}$$

This corresponds to equation 2 with the added feature of reinterpretation of information. Note also that setting $q = 0$ will reduce equation 13 to equation 2. As before, candidate A wants to maximize Θ subject to its budget constraint while candidate B wishes to minimize the same. Inserting the budget equation and taking the first order condition of equation 13 yields a best response correspondence which in the open interval $C_t^B \in (0, 1)$ (as opposed to the case with an unbiased Bayesian voter) is a function of candidate B's strategy. Unfortunately, this expression is too lengthy for a convenient analytical representation. However, figure 5 plots candidate A's best response correspondence for $\omega_A = \omega_B = 1$ and $q = 0.4$.

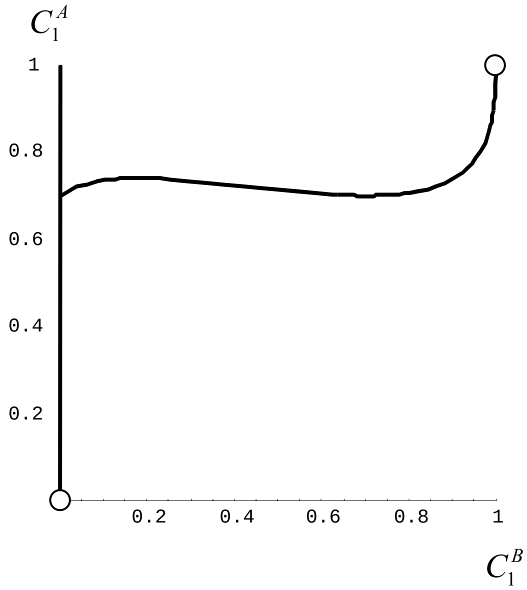

Figure 5. Candidate A's BR correspondence.

As candidate B's problem is symmetric, we can see from figure 5 that we can restrict attention to interior solutions when solving for the Nash equilibrium. Assuming symmetry we can simplify the first order condition and solve for C_1^{A*} (see appendix section A.4 for derivation):

$$C_1^{A*} = C_1^{B*} = \frac{\omega\left(1+q\right)}{2} \tag{14}$$

Both candidates allocate half of their funds to period one plus a fraction $\frac{\omega q}{2}$. The more the electorate suffers from confirmatory bias (higher q) the more campaign funds are allocated to period one. Figure 6 illustrates the effect of different degrees of confirmatory bias on the equilibrium strategies (only interior parts of the correspondences are plotted):

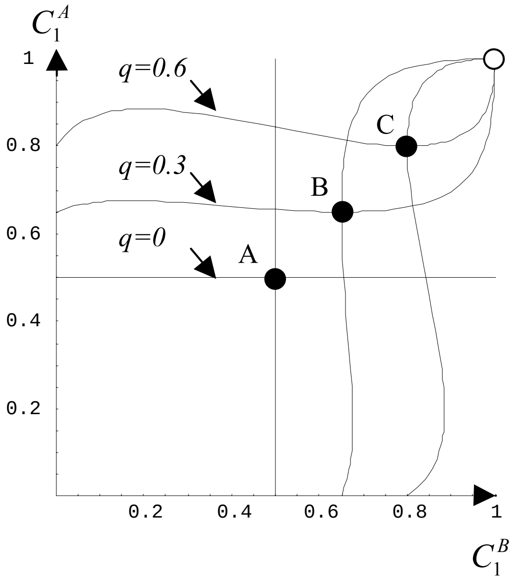

Figure 6. Different degrees of q.

Points A through C represent the equilibria for increasing degrees of confirmatory bias. Note that in this symmetric case, both candidates allocate the same quantity in period one whereby $\theta_1 = \theta_2 = 0.5$. Hence, there is no effect from confirmatory bias in the mind of the voter (see equation 12) since he receives the same correlation in both periods. However, it is the *potential* for this effect that pushes both candidates to allocate more funds in period one.

Thus the intuition that candidates focus on period one if voters suffer from confirmatory bias appears to be correct. Before looking at the effect from confirmatory bias on a game where I allow for asymmetric budgets and media access, I will briefly comment on some of the similarities and differences between this model and the one of Rabin and Schrag (1999).

In the model of Rabin and Schrag a person forms beliefs about which state of the world is true, A or B, based on independently and identically distributed signals. These signals are correlated to the true state of the world to a certain degree which is given exogenously. Starting with a prior, agents then update their beliefs based on the signals they receive. However, if an agent is biased, that is, he thinks that either A or B is more likely than the other, he may misinterpret a signal which conflicts with his beliefs as being supportive. For example, an agent thinks that state A is true with probability 0.7. He is thus biased in favor of state A and if he receives a B-signal, which goes against his beliefs, he will misinterpret this as an A-signal with probability q. q thus reflects the severity of confirmatory bias of the agent. The probability of misinterpreting a conflicting signal as supportive is thus constant and does not depend on the strength of the individual's beliefs.

My model has many similarities with the Rabin and Schrag model but differs from the same on three main points. Firstly, as opposed to the exogenously given correlation in the Rabin and Schrag model, the correlation of the signals in the model of this paper is endogenous and determined by the relative campaigning efforts of the two candidates. Secondly, in my model, the probability that a representative voter reinterprets (misperceives in Rabin and Schrag terms) conflicting information as supportive is a function of his strength of beliefs. Thirdly, the Rabin and Schrag model allows biased agents only to misinterpret conflicting information while I allow agents to reinterpret also supportive information assuming that the probability of interpreting conflicting information as supportive is strictly greater than the probability of interpreting supportive information as conflicting. Thus, the voter has a net propensity to interpret conflicting information as supportive.

Should I, however, assume that voters only reinterpret conflicting messages, as in the Rabin and Schrag model, then the above anchoring effect would only work in one direction. For example, a voter who is biased in favor of candidate A, that is $\theta_1 > 0.5$, would tend to overestimate the signal correlation in period two, while a voter biased in the other direction would tend to underestimate the same (remember that a high signal correlation means high support for candidate A).

Matthew Rabin has raised the important issue of whether it is correct to apply Bayesian updating to modelling voter behavior.[11] One may question whether the messages from the candidates can be regarded as information or not? One interpretation would be to consider the messages as really containing information helping the voter to make an informed decision. Another is to assume that the voter behaves as if it was information. Much of political messages is about projecting positive images of candidates, that is, about packaging and not so much about policy contents.[12] I suggest that if this is the case, the voter still forms his opinion in such a way that the methodological framework of Bayesian updating can be applied. Even though the voter may not fully comprehend the real policy content and its implicaitons, he will vote for the candidate he thinks will yield the most utility. This assessment is then to a large extent dependent on how the candidates have been able to present themselves in the media.

[11] The discussion in this paragraph is inspired by a question raised by Matthew Rabin.
[12] See Biocca 1991, p 11.

4 Asymmetries

Elections between incumbents and challengers are asymmetric in nature. There are usually two main advantages to incumbency; better access to financial resources and easier access to the media.[13] Incumbents generally have access to larger financial resources and can more easily raise more campaign funds than challengers. Obviously, this will empower incumbents to launch more persuasive media campaigns and it has been debated how policy measures, such as spending limits and/or campaign subsidies, could level the playing field.[14] The advantage of incumbency with respect to media access comes from journalists' need of exciting stories from candidates of proven newsworthiness. An incumbent is not only a candidate for re-election, he is also an official in charge of public affairs and therefore a source of news. A challenger, on the other hand, will have to prove his newsworthiness by showing that he is a serious candidate, which will take some time. In this paper we can obviously model the first advantage by giving the incumbent a larger budget. The second advantage can be analyzed by setting a lower price for the incumbent to send messages in period one, reflecting media's greater interest in him. Period two prices are again equal between the incumbent and the challenger reflecting the increased interest in the challenger.

How will then confirmatory bias affect the advantage of incumbency? I analyze this by comparing the case with confirmatory bias to the one without. We first look at the case with asymmetric budgets and go on to asymmetric media access.

4.1 Rich versus poor candidates

In the case of an unbiased Bayesian updater voter equations 9 and 10 tell us that both candidates will allocate half their campaign funds each period. A smaller ω^B, for example, will simply shift the interior section of candidate B's best response correspondence to the left and have no effect on candidate A's correspondence. Candidate B will of course not be able to launch a campaign of the same persuasiveness as before and loses voter support. This is illustrated in figure 7 below:

[13] On the advantage of better financial resources see for example Green and Krasno (1990), Jacobson (1978), Krasno, Green and Cowden (1994) and for media access Graber (1980).

[14] See for example Kenny and McBurnett (1994).

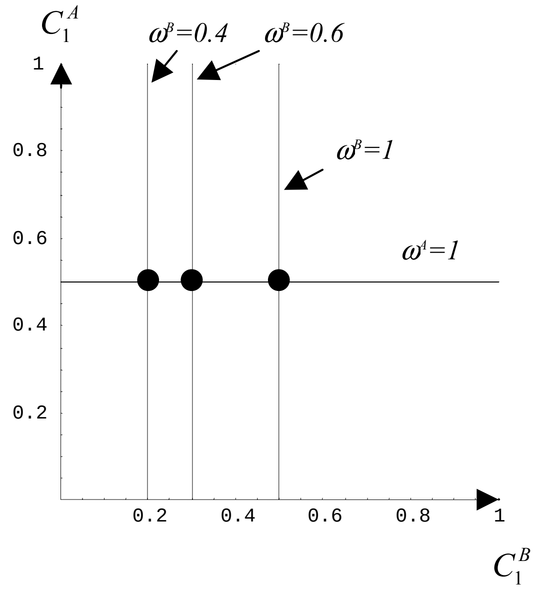

Figure 7. Asymmetric budgets, $q = 0$.

Would the advantage of candidate A be stronger or weaker if we assume that voters suffer from confirmatory bias? As we no longer can assume symmetry, the derivation of the equilibrium becomes rather complex (see appendix section A.5), but it turns out that the asymmetric equilibria can be represented by:

$$C_1^{A*} = \frac{\omega^A (1+q)}{2} \tag{15}$$

and

$$C_1^{B*} = \frac{\omega^B (1+q)}{2} \tag{16}$$

Both candidates will allocate a given share $(\frac{(1+q)}{2})$ of their budget in period one. The equilibrium allocation of campaign funds in period one is therefore independent of the size of the other candidate's budget. This is illustrated in the graph below (for $q = 0.4$) where point A corresponds to the symmetric case ($\omega^A = \omega^B = 1$) and points B and C represent the equilibria for smaller ω^Bs:

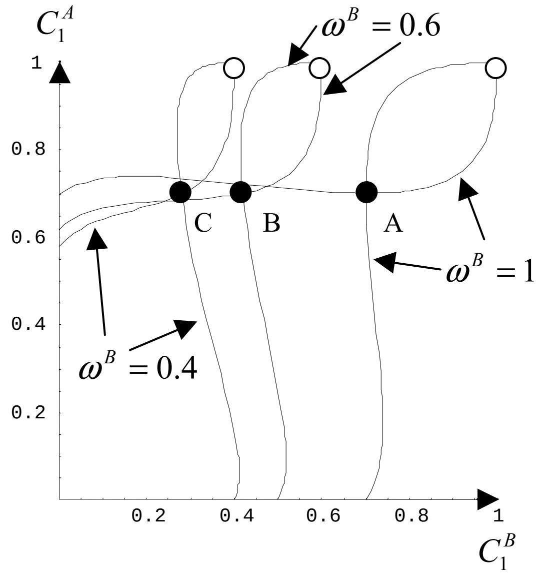

Figure 8. Asymmetric budgets, $q = 0.4$.

Candidate B's funds are distributed in the same proportions as before, that is, if candidate B should receive a dollar less he would deduct $\frac{\delta C_1^{B*}}{\delta \omega^B} = \frac{1+q}{2}$ in period one and $\frac{1-q}{2}$ in period two. Candidate A maintains his equilibrium allocation. This implies that $\theta_1$and θ_2 increase by equal amounts[15] as ω^B drops, that is, the increase in persuasiveness is spread equally over the two periods. Thus, from equation 12 we see that there will be no extra effect from confirmatory bias as the value of $q(\theta_1 - \theta_2)$ is constant and equal to zero. Neither rich- nor poor candidates derive any extra benefits from the presence of confirmatory bias.

4.2 Media access

Firstly we look at how differential prices affect the case with unbiased Bayesian voters, then the case with voters suffering from confirmatory bias.

By incorporating prices into the maximization problem of section 2 (see equation 3) we can derive the following equilibrium strategies;

$$C_t^{i*} = \frac{\omega^i}{2p_t^i} \tag{17}$$

[15]Remember that $\theta_2 = \frac{C_2^A}{C_2^A + C_2^B}$ and $\theta_1 = \frac{C_1^A}{C_1^A + C_1^B}$. Inserting the equlibrium allocations yields: $\theta_2 = \frac{\frac{\omega^A(1+q)}{2}}{\frac{\omega^A(1+q)}{2}^A + \frac{\omega^B(1+q)}{2}} = \frac{\omega^A}{\omega^A + \omega^B}$ and $\theta_1 = \frac{\frac{\omega^A(1-q)}{2}}{\frac{\omega^A(1-q)}{2}^A + \frac{\omega^B(1-q)}{2}} = \frac{\omega^A}{\omega^A + \omega^B}$. Thus decreasing ω^B will have the same effect on θ_1 and θ_2.

$t = \{1, 2\}$, $i = \{A, B\}$, where p_t^i is the price of sending a message in period t for candidate i. Decreasing the price for candidate A to send a message in period one simply shifts the interior part of his best response correspondence up while leaving the one of candidate B unaffected. Figure 9 illustrates this effect:

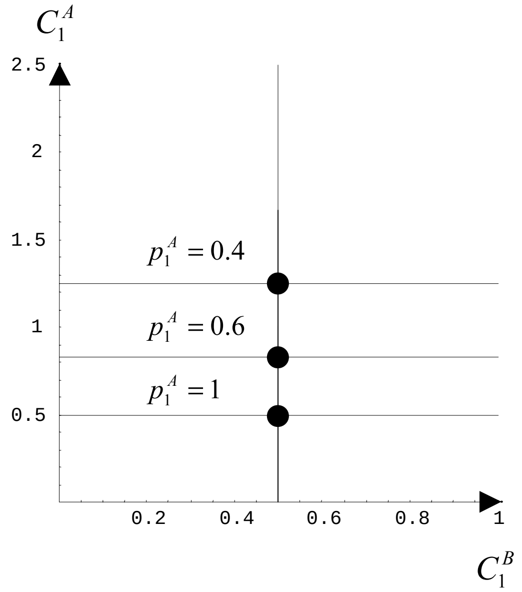

Figure 9. Asymmetric prices, $q = 0$.

If voters suffer from confirmatory bias, the effect will be somehow different. Relaxing the assumption of equal prices unfortunately makes the problem of deriving analytical expressions for the equilibria very complicated so I have to rely on graphical representation. Plotting the interior parts of the best response correspondences for different levels of p_1^A (for $q = 0.6$) we see that the smaller is p_1^A the more is spent by candidate A in equilibrium in the first period and the less by candidate B:

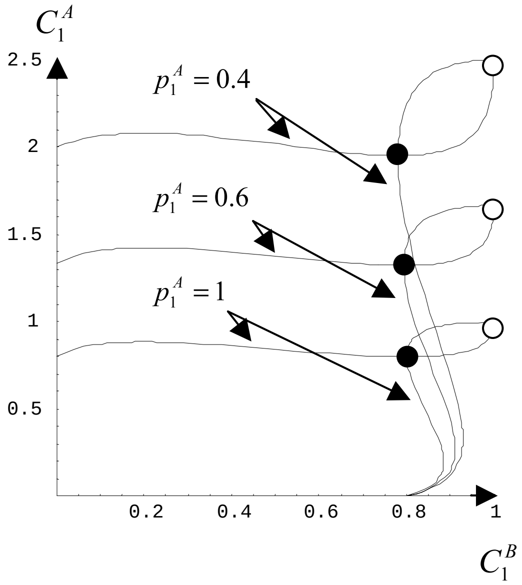

Figure 10. Asymmetric prices, $q = 0.6$.

Candidate A will not only be able to send more messages as the average price of sending a message is lower, but will also allocate a larger share of his funds to period one as this is relatively cheap. This means that the persuasiveness of candidate A's period one campaign will increase more than that of period two[16]. Comparing with the unbiased Bayesian updater case, candidate A will, ceteris paribus, gain more voter support from a given price difference with voters suffering from confirmatory bias. Confirmatory bias would thus increase the advantage of better media access! From a policy point of view, confirmatory bias would thus strengthen the case for public support to challengers in election campaigns.

5 Conclusion

The aim of this paper was to shed some light on the findings of Kenny and McBurnett (1992) that candidates waiting very long to spend their campaign funds are punished in terms of voter support. The psychological phenomenon of confirmatory bias appeared to provide an intuitive explanation and my model could also show this formally. The greater the severity of confirmatory bias the more of available funds are allocated by the candidates to period one campaigning. When allowing for asymmetric budgets and media

[16]This can be verified by measuring the co-ordinates of the equilibria in the diagram and then using these values in the expressions for θ_1 and θ_2.

access, two results emerged. Firstly, the candidate with the largest budget (usually the incumbent) derives the same amount of voter support from an electorate exhibiting confirmatory bias as from one who does not. Secondly, the candidate with better media access in period one (usually the incumbent) does better if the electorate exhibits confirmatory bias than if it does not. Thus, if incumbents, rich *or* poor, enjoy this media privilege, they gain from confirmatory bias. This finding strengthens the case for public support for challengers in elections.

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Appendix

A.1 Derivation of equation 2

In the mind of the voter, two, and only two, things can happen if he votes for candidate B.

1) $C =$ voting for candidate B yields a payoff of zero.

2) $D =$ voting for candidate B yields a payoff of X.

The voter can each period receive either of two signals:

1) $a =$ indicates C with correlation θ_t

2) $b =$ indicates D with correlation $1 - \theta_t$

The model is designed such that the voter will receive signal a if $\theta_t > 0.5$ and b if $\theta_t < 0.5$. This is equivalent to the voter always receiving signal a with correlation $\theta_t \in [0, 1]$ (which is assumed in the text).

The voter forms his prior probability assessment about C based on the period one signal. Thus; $P(C) = \theta_1$

In period two he receives signal a with correlation θ_2. Hence; $P(a \mid C) = \theta_2$. The voter's updated probability assessment of C can be represented according to Bayes theorem[17];

$$P(C \mid a) = \frac{P(C)\, P(a \mid C)}{P(a)} = \frac{\theta_1 \theta_2}{P(a)} \tag{18}$$

where

$$\begin{aligned} P(a) &= P(a \cap C) + P(a \cap D) = \\ &= P(C)\, P(a \mid C) + (1 - P(C))\,(1 - P(a \mid C)) = \\ &= \theta_1 \theta_2 + (1 - \theta_1)(1 - \theta_2) \end{aligned}$$

Inserting this into equation 18 yields;

$$P(C \mid a) = \frac{\theta_1 \theta_2}{\theta_1 \theta_2 + (1 - \theta_1)(1 - \theta_2)}$$

Which corresponds to equation 2.

A.2 Second order conditions in the benchmark case

If the second derivatives are negative, then we have diminishing returns from campaign spending in each period. Taking the second order conditions of Θ:

[17] See for example Ramanathan (1993), p21.

$$\frac{\delta^2\left(\frac{C_1^A C_2^A}{C_1^A C_2^A + C_1^B C_2^B}\right)}{\delta\left(C_1^A\right)^2} = (-)\frac{2\left(C_2^A\right)^2 C_1^B C_2^B}{\left(C_1^A C_2^A + C_1^B C_2^B\right)^3} < 0 \tag{19}$$

$$\frac{\delta^2\left(\frac{C_1^A C_2^A}{C_1^A C_2^A + C_1^B C_2^B}\right)}{\delta\left(C_2^A\right)^2} = (-)\frac{2\left(C_1^A\right)^2 C_1^B C_2^B}{\left(C_1^A C_2^A + C_1^B C_2^B\right)^3} < 0 \tag{20}$$

Where we see that we have, indeed, diminishing returns. Diminishing returns and independence from party B's expected allocation yields the result in equation 11.

A.3 Derivation of equation 12

We want an expression for the ratio of perceived period two messages where the number or perceived A messages equals $C_2^A - q(1-\theta_1)C_2^A + q\theta_1 C_2^B$ and the number of perceived B messages equals $C_2^B - q\theta_1 C_2^B + q(1-\theta_1)C_2^A$.
Setting up the ratio:

$$\theta_2' = \frac{C_2^A - q(1-\theta_1)C_2^A + q\theta_1 C_2^B}{C_2^A - q(1-\theta_1)C_2^A + q\theta_1 C_2^B + C_2^B - q\theta_1 C_2^B + q(1-\theta_1)C_2^A}$$

where the denominator consists of the sum of perceived messages which, regardless of reinterpretation, equals the sum of sent messages:

$$\theta_2' = \frac{C_2^A - q(1-\theta_1)C_2^A + q\theta_1 C_2^B}{C_2^A + C_2^B}$$

Using the fact that $\theta_2 = \frac{C_2^A}{C_2^A + C_2^B}$ and that $1 - \theta_2 = \frac{C_2^B}{C_2^A + C_2^B}$ and rewriting yields:

$$\theta_2' = \theta_2 - q(1-\theta_1)\theta_2 + q\theta_1(1-\theta_2)$$

which can be simplified to:

$$\theta_2' = \theta_2 + q(\theta_1 - \theta_2)$$

A.4 Derivation of equation 14

Candidate A's problem is:

$$\underset{C_1^A, C_2^A}{max}\ \Theta = \frac{\theta_1\left[\theta_2 + q(\theta_1 - \theta_2)\right]}{\theta_1\left[\theta_2 + q(\theta_1 - \theta_2)\right] + (1 - \theta_1)\left(1 - \left[\theta_2 + q(\theta_1 - \theta_2)\right]\right)} \tag{21}$$

such that $C_1^A + C_2^A = \omega^A$.

Inserting the contest success functions and using both candidates' budget constraints to substitute for C_2^A and C_2^B in equation 21 , setting $\omega^A = \omega^B = \omega$, and simplifying yields;

$$max\ \Theta = \frac{C_1^A\left(\left(C_1^A\right)^2 + (q-1)C_1^B\omega + C_1^A\left(C_1^B - (1+q)\omega\right)\right)}{\left(C_1^A\right)^3 + C_1^A C_1^B\left(C_1^B + 2(q-1)\omega\right) + \left(C_1^A\right)^2\left(C_1^B - (1+q)\omega\right) + \left(C_1^B\right)^2\left(C_1^B - (1+q)\omega\right)}$$

Taking the first order condition:

$$\frac{\partial\Theta}{\partial C_1^A} = \frac{\left(\left(C_1^A\right)^2 + (q-1)C_1^B\omega + C_1^A\left(C_1^B - (1+q)\omega\right)\right) + C_1^A\left(2C_1^A + C_1^B - (1+q)\omega\right)}{\left(C_1^A\right)^3 + C_1^A C_1^B\left(C_1^B + 2(q-1)\omega\right) + \left(C_1^A\right)^2\left(C_1^B - (1+q)\omega\right) + \left(C_1^B\right)^2\left(C_1^B - (1+q)\omega\right)} -$$

$$\frac{C_1^A\left[\left(C_1^A\right)^2 + (q-1)C_1^B\omega + C_1^A\left(C_1^B - (1+q)\omega\right)\right]\left[3\left(C_1^A\right)^2 + C_1^B\left(C_1^B + 2(q-1)\omega\right) + 2C_1^A\left(C_1^B - (1+q)\omega\right)\right]}{\left[\left(C_1^A\right)^3 + C_1^A C_1^B\left(C_1^B + 2(q-1)\omega\right) + \left(C_1^A\right)^2\left(C_1^B - (1+q)\omega\right) + \left(C_1^B\right)^2\left(C_1^B - (1+q)\omega\right)\right]^2}$$

and then assuming symmetry, that is, $C_1^A = C_1^B$, setting the expression equal to zero and solving for C_1^A yields after some algebraic manipulation;

$$C_1^{A*} = C_1^{B*} = \frac{\omega\,(1+q)}{2}$$

A.5 Derivation of equations 15 and 16

Candidate A's problem is the same as in section A.4 except for the fact that we no longer assume that $\omega^A = \omega^B$. Simplifying equation 21 then yields:

$$\underset{C_1^A, C_2^A}{max}\ \Theta = \frac{C_1^A\left(C_1^A + (1-q)C_1^B)(C_1^A - \omega_A) + qC_1^A\left(C_1^B - \omega_B\right)\right)}{(((C_1^A)^2 + q(C_1^B)^2 + C_1^A C_1^B(1-q))(C_1^A - \omega_A) + (qC_1^A\left(C_1^A - C_1^B\right) + C_1^B(C_1^A + C_1^B))(C_1^B - \omega_B)))}$$

As before I take the first order condition. Setting this derivative equal to zero and solving for C_1^{A*}analytically as in section A.4 would be extremely difficult. Instead, based on the graphical representation of the equlibria, we substitute C_1^B for our best guess, that is $\frac{\omega_B(1+q)}{2}$, in the equation of the first derivative and simplify:

$\frac{\delta\Theta}{\delta C_1^A} = \frac{1}{16}\left(1+q\right)(-2C_1^A + \left(1+q\right)\omega_A)\omega_B^2(4(1-3q)\left(C_1^A\right)^2 - (2q\omega_A + (1-q)\omega_B)(-4C_1^A + (-1+q^2)\omega_B))$

Setting this expression equal to zero and solving for C_1^{A*}yields:

$C_1^{A*} = \frac{\omega^A(1+q)}{2}$

Solving for C_1^{B*}assuming that $C_1^{A*} = \frac{\omega^A(1+q)}{2}$ yields by symmetry:

$C_1^{B*} = \frac{\omega^B(1+q)}{2}$

Thus, the guess must be correct, and we have a fixed point.