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ELECTIONS AND THE MEDIA: THE SUPPLY SIDE

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Abstract

This paper examines the role of the media in modern elections. In particular, the media industry is included in a traditional spatial voting framework. Consumers are modeled as random utility maximizers, and predictions are obtained, including an incumbency/celebrity advantage, emphasis of news concerning front-runners and unknown candidates, higher levels of coverage of volatile issues, higher levels of horse-race coverage in heterogeneous electorates, and lower levels of issue coverage in competitive news markets. The paper also includes a brief, cursory look at media coverage of Perot's candidacies in 1992 and 1996, illustrating how the model can be used "out of the box."

Elections and the Media: The Supply Side*

John W. Patty[†]

Modern election campaigns are increasingly an enterprise of media management. The amounts of money being spent on advertising on television and in print by political candidates (and their supporters) has increased exponentially over the past 25 years. Media campaigns, especially those for high-profile offices, dedicate large amounts of time and energy to "massaging" the media. The reasoning is simple: voters dependon the mass media for large amounts of their information regarding political campaigns (see Popkin [35], Just, *et al.* [22], for example). While many political pundits (such as James Carville, for instance) and some political scientists have decried this relatively recent development as a isolating force, one which removes the candidates from the majority of voters and increases the power of an elite few (particularly journalists), the modern media is largely profit-driven (Gomery [17]). Thus, it is not clear that the media's incentives are not aligned with those of the voters.

In short, the phenomenon is sufficiently complicated to warrant formal analysis. This paper attempts to provide a framework in which the modern mass media's role in elections can be studied. We borrow the spatial theory of electoral competition and assume that a profit-maximizing media is the source of (at least a great deal of) voters' information about candidate's policy proposals. Voters desire this information for two reasons. First, voters obviously wish to avoid mistakes when voting (*i.e.* they wish to vote for the (viable) candidate who will implement the most preferred policy).[1] Second, and perhaps more importantly, we assume that voters are risk-averse. Therefore, they desire to know the policy which will be implemented with as high a degree of certainty as possible (ceteris paribus). This assumption can be thought of in the context of agents trying to plan their consumption and investment decisions in an optimal fashion and therefore desiring information regarding future tax rates and other legislation.

To summarize, the model generates the following predictions:

[1]This logic is far simpler in the case of two candidate elections, though the desire to avoid mistakes is present in elections with any number of candidates.

1. *A profit-maximizing media will offer greater coverage of celebrity and incumbent candidates.*

2. *Issues which are more costly to cover will be covered less.*

3. *Media outlets will devote more attention to front-runners than long-shot candidates.*

4. *Issues which are more important to voters will be covered to a greater degree.*

5. *Higher voter uncertainty regarding the policy to be implemented with respect to an issue implies that greater coverage of the issue.*

6. *New candidates will receive higher levels of coverage than well-known candidates.*

7. *Media monopolies will provide higher levels of issue coverage than competitive media markets.*

8. *When costs of coverage are convex, the issues covered by different media outlets will overlap more.*

These predictions offer several avenues along which the validity of the model can be tested (with existing data).

1   Motivation and (Brief) Literature Review

The media is often discussed by political scientists, but theoretical examinations of the media are few. The goal of this paper is to provide a framework for studying a profit-maximizing media in modern democracies. The results given here are far from exhaustive, and much work remains to be done in this area. We model an election in which candidates announce policy platforms as a location in some policy space, X. The media relay this information (imperfectly) to voters, who then vote for the candidate who offers the maximum expected utility. The winner of the election is decided by plurality rule. A central concern of this paper are the comparative statics of media coverage in equilibrium in this model.

As one might expect, the general literature on media involvement in elections is daunting. Recent treatments, including those by Endersby and Ognianova [14], Ognianova and Endersby [31], Just, *et al.* [22], and Zaller [40, 41] have emphasized various aspects of the media's role in modern democracy, including agenda setting and reducing both voter and candidate uncertainty. Until recently, however, the discussion of the media by political scientists has been decidedly informal. Ognianova and Endersby [31] provide a historical justification for objectivity (*i.e.* unbiasedness) in the modern media. Their discussion, however, is not a model. The same criticism can be leveled at recent work by Zaller [41]. Zaller's paper presents the beginnings of a formal model, but lacks predictive power insofar as the framework is too vague. In particular, Ognianova and Endersby as well as

Zaller embed behavioral assumptions in their work. While the assumptions are relatively appealing, no formal justification is given for their presence.[2] Similarly, the work of Just, *et al.* fails to provide a rigorous model of media participation in the electoral setting. Clear evidence of the media's agenda-setting power is presented, but the questions remain: why does the media have this control, and what factors influence its power to set the agenda in election campaigns.

Of course, the works cited above have yielded invaluable insights into this important area of political science. Nevertheless, little can be said in a general sense until there exists a theory of the media. This paper constitutes an attempt to answer this challenge by placing such a theory in the context of spatial voting models. These models have a long tradition in both economics and political science, beginning with the work of Hotelling [21] on spatial competition in economics. The political interpretation of Hotelling's work is largely due to Black [4] and Downs [13]. Since their work in the late 1950s, many researchers have extended and developed the field to a great extent.

One of the problems encountered in the study of spatial electoral competition is the generic lack of pure strategy Nash equilibria when the policy space is multidimensional (see Plott [34], for example). This problem can be overcome by imposing probabilistic behavior on the voters (see Coughlin [8], Coughlin and Nitzan [9], Hinich [20]). General uncertainty, concerning whether voters will abstain, for instance, can cause pure strategy equilibria to exist (see Ledyard [24]).

The true root of the problem, it turns out, is the assumption of a very severe information structure. Voters' preferences and behavior are known by the candidates, and voters know the positions chosen by candidates. This assumption is hardly realistic. Candidates *are* uncertain about voters' preferences and behavior, and voters are certainly less than completely informed as to the policies candidates will implement if elected. This paper proposes to take this reality into account explicitly by introducing a third actor into the traditional spatial model of voting: the media.

In reality, the media plays two roles: it transmits signals both to and from candidates, from and to the voters. This role is accomplished through polls, news stories, and advertisements. Here, however, we will discuss only one direction of this interaction: the transmission of information about candidates' policy proposals to the voters.

The innovation of this model is that the media is modelled as a profit-maximizing, apolitical agent. That is, media firms are simply concerned with selling their news good to as many people for as high a price as possible. They are assumed to be unconcerned with the electoral outcome. This assumption is not necessarily realistic, but it allows us to more clearly delineate the factors influencing coverage of modern elections, given the increasingly corporate nature of the modern media (See Gomery, [17]).

After setting up the framework, we study our model in a general fashion. We prove

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[2]That is, the assumptions are not derived from primitives, and the robustness of the authors' results to the relaxation of their assumptions is not examined in any detail.

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existence of equilibrium and then examine the comparative statics of such an equilibrium. We do not examine the policy outcomes or electoral results implied by the model, though implications concerning these follow immediately from the results presented here. We also do not construct an equilibrium for any particular model within our framework, though such a construction is possible (and relatively straight-forward, if tedious). The analysis provided here details the important features of *any* model satisfying the assumptions discussed below.

Finally the assumptions made in this paper are not necessary for many of the insights offered here to remain true. The model can be generalized in many important ways without changing the intuition presented here. Some of these generalizations are discussed in Section 6.

The paper is structured as follows: Section 2 outlines the basic formulation of the model. In Section 3 we define our equilibrium concepts and show existence. The model's predictions are outlined and discussed in Section 4 and the possibility of coordination effects in a dynamic version of the model. In Section 5 the Perot phenomenon is discussed briefly. Readers uninterested in the technical details of our framework can skim Sections 2 and 3 and concentrate on Section 4. Section 6 concludes and offers possible extensions of this work.

2   The Model

This section outlines our basic assumptions. As alluded to above, this paper offers a *general* framework in which the media may be studied. Many of the assumptions made in this paper are unnecessary for the results to hold.

2.1   Notation and Preliminaries

We will denote the set of probability distributions over some set Y by $\Delta(Y)$. Given a measure μ a random variable z, and any function Y, the expectation of $Y(z)$ when z is distributed according to μ is denoted $\mathbf{E}_\mu[Y]$. Given a set B, the indicator function with respect to B (*i.e.* the function taking value 1 on B and 0 otherwise) is denoted $\mathbf{1}[\mathbf{x} \in \mathbf{B}]$.

2.2   The Game Form

An election is modeled as a single-shot normal form game. There are three classes of players: candidates, firms, and voters. We assume the set of candidates, $\mathcal{K}$, has cardinality $K \geq 2$, the set of firms, $\mathcal{M}$, has cardinality $M > 0$, and the set of voters, $\mathcal{N}$, has cardinality $N > 0$. Each class of players moves simultaneously, with the candidates moving first, the firms moving second, and the voters moving last. A timeline of the game

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is shown in Figure 1. Regardless of class, the payoff function for player i is denoted u_i. Candidates each choose a position in the policy space, X, which is a compact rectangle in $\mathbf{R}^L$.[3] Candidate k's choice is denoted x_k, and the set of all K choices is denoted x.[4] These positions are observed perfectly by the media, but not at all by the voters. The media firms each produce one news good, characterized by a vector $a_m \in Q$, where $Q \subseteq \mathbf{R}_+^{KL+1}$. We assume that Q is compact and convex.[5] Finally, voters observe the vector of goods offered and choose either one or zero of these to consume. Given their decisions, voters then update their prior beliefs as to the candidates' proposals and vote strategically.

2.3 News Goods

Firms offer news goods which, in effect, can reduce voters' uncertainty about the policies the candidates will implement if elected. One can think of a news good as an observation of the candidates' positions drawn from some distribution, G. Each firm m chooses a distribution G_m from which this point is drawn. Risk-aversion implies that voters have preferences over $\{G_1, \ldots, G_M\}$. Thus, we model each voter as choosing her most preferred G_m.[6] Technically, then, the firms are offering lotteries to the consumers. Each good is actually KL lotteries, corresponding to a lottery for each candidate's position on each issue. Given a firm m we will denote the probability measure of the random variable $\gamma_{m,k,l}$ representing the observation of the position of candidate k on issue l by $g_{m,k,l}$. The probability measure of the random variable $\gamma_m \in X^K$ (in this case a KL dimensional vector) representing the positions of all candidates on all issues offered by firm m will then be denoted by g_m.[7] We will refer to each $g_{m,k,l}$ as a *component lottery* of g_m. Our first assumption is that the realizations of the component lotteries are independent.

Assumption 1 (Independence) Given any firm m and g_m, let z_k^l denote the component corresponding to candidate k and issue l in z, a realization of γ_m. Then

$$g(z) = \prod_{k,l \in \mathcal{K} \times \{1,\ldots,L\}} g_{m,k,l}(z_k^l). \tag{2.1}$$

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[3]The assumption of rectangles is made for simplicty. All that is needed is for X to be compact and convex.

[4]We assume, for simplicity, that the candidates will implement their announced position if elected, but this is not at all necessary for the purposes of this analysis.

[5]This assumption is simply for convenience. In general it is possible to "compactify" Q by eliminating those choices which are strictly dominated (*i.e.* they lead to negative profits).

[6]Note that voters choose distributions, not realizations. A voter only observes the realization of the draw from the G_m she chose once she has made her choice. To assume otherwise makes the problem trivial, as voters would have no reason to buy any of the goods (this is, in a sense, equivalent to consumers who read their news at the newsstand and then leave without purchasing the news good(s) consumed). A possibly interesting modification would be to assume voters observe the realizations (*i.e.* read the headlines, perhaps) for free, but must purchase a good in order to find out the G_m which generated that good's realization.

[7]We do not deal with the realization of $q_{m,k,l}$ in this paper, as we are uninterested in the electoral outcomes.

That is, the component lotteries, for any news good with distribution g_m, are independent. We also assume that these goods are unbiased in a special sense.

Assumption 2 (Unbiased Coverage) Given a candidate k and an issue l,

$$\mathbf{E}_{g_m}[z^l|k] = \mathbf{E}_{g_{m,k,l}}[z] = x_k^l. \tag{2.2}$$

Assumption 2 implies that news coverage is unbiased in a particular way. In essence, we are restricting ourselves to examining media firms which do not misrepresent the candidates in a particular, systematic fashion.[8]

2.4 Firms

Firms are modelled as offering samples from distributions with differing variances. Low variance distributions may be thought of as representing high quality news. As discussed above, a news good is modelled as a sample from a multivariate normal distribution, $g_m(y)$, where $y \sim N(x, \Lambda_m)$, with

$$\Lambda_m = \begin{bmatrix} s_{m,1,1}^2 & \cdots & & & 0 \\ \cdots & \ddots & & 0 & \\ & & s_{m,k,l}^2 & & \\ & 0 & & \ddots & \cdots \\ 0 & & & \cdots & s_{m,K,L}^2 \end{bmatrix},$$

where $s_{m,k,l}^2$ is the variance of the sampling distribution offered by firm l over the realization of y^l conditional on victory by candidate k. Thus, the sampling distribution has a diagonal variance-covariance matrix. Technically, one can think of a news good as a bundle of KL independent lotteries. We will denote the set of all the firms' choices by Λ. Finally, firms may charge a price for their good, $p_m \geq 0$. This price is implemented as a transfer of utility from consumers to the firm, as we will model consumers as having preferences which are quasi-linear in money.[9] We will denote the feasible action space of firm m by Q, and define Q^M to be the space of all possible actions profiles chosen by the M firms. It follows from our assumptions regarding Q and $M < \infty$ that Q^M is compact and convex.

2.5 Voters

Voters are characterized by their type, which determines their preferences over the enacted policy, $y \in X$, money, media goods, and candidates. Define a voter's type, t_i, as

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[8] We do not completely restrict the media from being biased, however, as firms could skew distributions in a manner which preserves the expected value of g. Under the assumptions of this model, though, voters are indifferent (and their behavior invariant) to such "manipulation".

[9] The assumption of quasi-linearity is not essential, but separability of preferences over policy outcomes and those over money is probably necessary.

the following real-valued vector:

$$t_i = \left\{ \alpha_i^1, \dots, \alpha_i^L, \beta_i, \omega_i^1, \dots, \omega_i^L, \eta_i^1, \dots, \eta_i^M, \varepsilon_i^1, \dots, \varepsilon_i^K \right\},$$

and assume that t is distributed according to some probability measure $\theta : \mathbf{R}^{2L+M+K+1} \to \mathbf{R}$. We restrict t_i in the following ways:

- $\alpha_i^l \geq 0$ for all i, for all l,

- $\beta_i \geq 0$ for all i, and

- $\omega_i = \left\{ \omega_i^1, \dots, \omega_i^L \right\} \in X$ for all i.

Assumption 3a (Common Knowledge of Preferences)[10] all i, $\alpha_i = \left\{ \alpha_i^1, \dots, \alpha_i^L \right\}$, β_i, and ω_i are common knowledge amongst all of the players. In particular, u_i is common knowledge for all $i \in \mathcal{K} \cup \mathcal{M} \cup \mathcal{N}$. This is a misstatement. What we mean is that the policy preferences of voters, the profit functions of firms, and the office-seeking nature of politicians is commonly known. As we describe in Section 2.6, the voters' preferences over firms and candidates are private information.

By common knowledge of the prior and preferences, voters also possess a common prior, ϕ, denoting the vector of probabilities,

$$\phi = \left\{ \phi_1, \dots, \phi_K \right\},$$

where $\sum_{k=1}^{K} \phi_k = 1$ and ϕ_k is the probability candidate k will win the election, *given that each voter votes strategically, given the common prior f*.[11] The diagonality of Σ is equivalent to assuming that, conditional on the winning candidate, voters treat the realization of the enacted policy position on some issue j, y^j as being independent of the realization of $y^{j'}$, for any issue $j' \neq j$.[12]

We assume that voters' priors, f, over the policy which will be enacted following the election, y, are correct. That is,

Assumption 4 Let f denote voters' prior beliefs, and k denote a candidate. Then,

$$\mathbf{E}_f \left[y \mid k \right] = x_k,$$

or, the expectation of y, conditional on candidate k's victory, is equal to the policy announced by candidate k.[13]

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[11] enacted policy is treated as a random variable by the voters. The assumption of normality is simply for convenience. Any well-behaved distribution will suffice for the results presented here.

[12] This is a strong assumption, made only for clarity of presentation. It is not, however, necessary for the results presented here.

[13] This assumption is not necessary for the results of this paper to hold. It is, however, necessary for the algebra to remain simple and intuitive.

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For simplicity, these beliefs are assumed to be represented by a multivariate normal distribution.

Assumption 5 Voters prior beliefs over y are represented by a mutually held and commonly known multivariate normal distribution with mean x and variance Σ, where Σ is a $KL \times KL$ diagonal matrix with diagonal entries

$$\sigma^2_{k,l},$$

corresponding to the variance of voters' beliefs with respect to the policy candidate k will enact if elected.

We assume that voters are Bayesians, insofar as the apply Bayes' rule in all cases in which it applies.[14]

Assumption 6 Voters apply Bayes' rule correctly, using any information contained in the news good to form posterior beliefs regarding the policy position each candidate would implement if elected.

Voters choose one news good to consume (or abstain, modelled here as consuming the 0th news good) and update their beliefs according to Bayes' rule.[15] They then vote for the candidate who offers the highest expected utility conditional on victory. Voters, upon consuming news good m, are assumed to possess preferences represented by

$$u\left(y, m; \alpha_i, \beta_i, \omega_i\right) = \alpha \cdot \left(\omega - y\right)^2 - \beta p_m, \tag{2.3}$$

where $\cdot$ denotes the usual dot product, $\alpha \geq 0$, $\beta \geq 0$, $\omega \in X$, y is the enacted policy position, and p_m is the cost paid for the news good. Equation 2.3 then leads to the following expected utility, conditional on consumption of news good m and voting for candidate k:

$$U\left(m, k; \alpha_i, \beta_i, \omega_i\right) = -\int_X \left[\alpha_i \cdot \left(\omega_i - z\right)^2\right] h_i\left(z; m, k\right) dz - \beta_i p_m, \tag{2.4}$$

where $h\left(z; m, k\right)$ denotes the posterior beliefs of a voter, given consumption of good m and voting for candidate k. Then we define expected utility of consumption of good m as

$$U_i(m) = \max_{k \in \mathcal{K}} U\left(m, k; \alpha_i, \beta_i, \omega_i\right). \tag{2.5}$$

By the assumption that y has the same expected value under both the sampling distribution and the prior, the expected value of z with respect to the posterior beliefs is equal to

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[14]We will see that it applies at all times in our model, by assumption. We do not allow beliefs or news goods to assign zero probability to *any* feasible event. Allowing such beliefs and news goods would simply create more equilibria.

[15]Note that we have no problem applying Bayes' rule since there are no zero probability events.

the true positions as well. Therefore, voters are in essence choosing the variance of their posterior distribution, h_i. It is well known that, under Bayesian updating, the variance of the posterior is no greater than the variance of the prior. In particular, the posterior beliefs are normal, with mean x and variance Σ', where Σ' is a KL diagonal matrix with diagonal elements equal to

$$\frac{\sigma_{k,l}^2 s_{m,k,l}^2}{\sigma_{k,l}^2 + s_{m,k,l}^2}.$$

Thus, given updating according to Bayes' rule, the change in variance, given s_m^2, is a KL diagonal matrix with diagonal elements equal to

$$\frac{\sigma_{k,l}^2 s_{m,k,l}^2}{\sigma_{k,l}^2 + s_{m,k,l}^2} - \sigma_{k,l}^2 = -\frac{\left(\sigma_{k,l}^2\right)^2}{\sigma_{k,l}^2 + s_{m,k,l}^2}. \tag{2.6}$$

By the assumption that the (conditional) mean of y with respect to the posterior is equal to the (conditional) mean of y with respect to the prior, a reduction of variance is equivalent to a reduction in mean-preserving spread. Since voters are risk-averse (by the strict concavity of $\alpha \cdot (\omega_i - y)^2$ with respect to y), this reduction in mean-preserving spread implies an increase in expected utility (see Rothschild and Stiglitz, [36]). Notice also that the increase in utility is decreasing in the variance of the sampling distribution, s^2. Thus, lower variance is, ceteris paribus, preferred by consumers.[16] This derivation also confirms the general fact that, in situation where there are no zero probability events, the variance of a posterior distribution is a continuous function of the parameters of the sampling distribution. Notice that, since utility is separable with respect to issues, utility is also separable with respect to the variances of component lotteries of g_m. These facts makes the analyis of the comparative statics in equilibrium relatively simple.

2.6   The Formal Model of Demand

There are essentially two mainstream models of consumer demand in a framework such as this. The first is the complete information case, where consumers (voters) simply choose the firm which maximizes equation 4.1. The second model assumes that consumers are characterized by a type which encompasses firm-specific utility shocks that are privately known to the consumer. This framework is the random utility maximization (RUM) model (see McFadden, [26], for example). Either case can be included in our framework. In this paper, however, we will assume a special case of the RUM model, the linear random utility maximization model (LRUM).[17] A companion paper (Patty, [33]) discusses the complete information case (*i.e.* when voters best-respond with probability 1) in some detail.

The LRUM model is used here for two reasons. The first is the obvious tractability it brings to the problem. The second is its prominent position in both the applied and

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[16]This of course is strict preference so long as $\alpha_l > 0$ for all l.

[17]For a thorough treatment of LRUM models in consumer choice, see Anderson, *et al.* [1].

theoretical literature on product choice. To be formal, the LRUM model assumes that each consumer possesses a type, t_i, which is represented by a real-valued vector. This vector, in our application, includes $\alpha_i, \beta_i, \omega_i$, and $\eta_i = \{\eta_{i,1}, \ldots, \eta_{i,M}\}$, which represent voter i's firm-specific utility shocks. Then equation 4.1 is extended so that the utility derived by consumer i from consumption of good m is

$$V(m) = U(m) + \eta_{i,j}. \tag{2.7}$$

We assume that the marginal distribution of $\eta_{i,j}$ is i.i.d. across j and i. Further, denoting the marginal distribution of η_i by $\theta(\eta)$, we assume that the marginal distribution θ_j exists for each j, that θ_j is continuously differentiable, and that $\mathbf{E}(\eta_j) = 0$, for all m.

One example of such a model is when θ has an extreme-value distribution, which implies that the probability voter i consumes news good m is given by

$$\rho_i(m) = \frac{e^{\lambda U_i(m)}}{\sum_{j=0}^{M} e^{\lambda U_i(j)}}, \tag{2.8}$$

where $U(0)$ is defined by simply inserting the common prior as h in equation 4.1.

In general, any θ satisfying our conditions will yield a $\rho_i(\cdot)$ which is continuous and monotonically increasing in $U_i(m)$.

2.7 The Formal Model of Voting

We are modelling the voters as playing an agent-normal form game. That is, we assume that the voters first choose media goods according to the LRUM model outlined above. Then, the voters vote strategically according to their updated beliefs after observing a further realization of their type.[18] Therefore, if we define, for each candidate k,

$$U(k) = -\int_X \sum_{l=1}^{L} (\omega_i^l - z^l)^2 h_i(z|k)dz,$$

then we can define

$$V(k) = U(k) + \epsilon_{i,k}$$

as the perturbed utility for candidate k, where $\epsilon_i = \{\epsilon_{i,1}, \ldots, \epsilon_{i,K}\}$ is a vector of components of voter i's type which is observed only after consumption of the news good.[19]

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[18]This is not a necessary assumption - we could assume that the voters completely observe their types prior to the game, but the analysis would have to take this into account. For instance, a voter might have a utility shock for a candidate who is covered only in one news outlet. If the voter observed the shock prior to the election, she would simply be more likely to consume that news good. Since we have assumed that these shocks are well-behaved, such a modification to the model would not change the results in any substantive fashion.

[19]Regardless, we assume that the realization of ϵ_i takes place prior to the game, so that the value ϵ_i is independent of the news consumption decision.

Then, analogous to the discussion of demand, above, we can define a possibly mixed strategy resulting when voter i chooses to vote for the candidate with the highest perturbed utility,

$$\nu_i\left(U(1),\dots,U(K)\right): \mathbf{R}^K \to \Delta(K).$$

This is simply a generalized version of probabilistic voting (see Coughlin, [8], Coughlin and Nitzan [9], Hinich [20], for examples). A model similar to this is examined by McKelvey and Patty [27] in a recent paper.

We assume that the marginal distribution of these candidate-specific shocks exists and satisfies the same requirements as placed on the marginal distribution of the firm-specific shocks in Section 2.6. This implies that ν is continuous. Since we are not concerned with the electoral outcomes *per se*, we include this section merely for completeness (it is necessary for the equilibrium existence proof in Section 3).

2.8   Firms Revisited

We now are in a position to define the payoff (profit) function of firms in our model. Profits, of course, are simply revenues minus costs. We assume that marginal costs of production are zero.[20] Expected demand is simply the sum, over i, of $\rho_i(m)$. It is well-known that $\rho_i(m)$ is continuous in both Λ and x under the assumptions of section 2.6, since u_i is continuous in all of its arguments and ρ_i is everywhere continuous in u_i. Therefore, expected consumer demand for good m,

$$D_m\left(\Lambda_m, p_m; \Lambda_{-m}, p_{-m}, x\right) = \sum_{i=1}^{N} \rho_i(m), \tag{2.9}$$

is continuous in Λ and x as well, for all m. On this note, then, we can define the payoff (profit) function of firm m as

$$\pi_m\left(\Lambda_m, p; \Lambda_{-m}, p_{-m}, x\right) = p_m D_m\left(\Lambda_m, p_m; \Lambda_{-m}, p_{-m}, x\right) - C_m\left(\Lambda_m\right), \tag{2.10}$$

where

$$C_m\left(\Lambda_m\right) = \sum_{k=1}^{K}\sum_{l=1}^{L} c_{m,k,l}\left(s_{m,k,l}^2\right). \tag{2.11}$$

We assume throughout this paper that $c_{m,k,l}$ is continuously differentiable everywhere for all m,k,l. In addition, we usually assume (unless noted otherwise) that $c_{m,k,l}$ is strictly convex for all m,k,l. Therefore, C_m is continuous in Λ and x for all m, and since D_m and C_m are both continuous for all m, π_m is continuous in Λ and x for all m.

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[20]This could be generalized without any trouble. The results are largely invariant to such a modification.

2.9 Probability of Winning the Election

As stated above, we assume that candidates are seeking to maximize probability of winning the election. It follows immediately (by the same logic as above) that this probability is continuous in Λ and x (because Bayesian updating is continuous whenever it is well-defined, and u is continuous in all of its arguments) since ν is continuous in Λ and x. The event of a victory is governed by a Bernoulli sample[21] with $\nu_i, i \in N$ as the probabilities. The probability that a Bernoulli sample will exceed a given threshold is a continuous function of the probabilities of the Bernoulli processes of which it is composed. Therefore, the probability of victory is a continuous function of Λ and x.

2.10 A Few Technical Remarks

Note that the continuity of payoffs above does not rely on the assumption of a *linear* random utility maximization framework. One might have utility shocked in any "continuous" fashion and obtain continuity of payoffs. We also do not need for the shocks to be identically distributed across options or voters. The independence assumption (across voters, at least) is more vital for these results to remain true, however. A generalization of the model in this direction might be interesting because any dynamic version of this model should allow for temporal correlation between the shocks.

3 Equilibrium Existence

This brief section contains one proposition. Proposition 3.1 states the existence of at least one pure-strategy Nash equilibrium in the media market of any electoral game within our framework. Note that we can do this because of the sequential nature of the game - firms essentially treat the candidates' announcements as given in any Nash equilibrium. In addition, firms are assumed to be indifferent to x. The purpose of this section is simply to validate the remainder of the analysis in this paper, in which we do equilibrium analysis without ever constructing any equilibria to an electoral game.[22]

Proposition 3.1 *Let Γ be a game satisfying the assumptions of Section 2. Then Γ possesses at least one pure strategy Nash equilibrium in the media market.*

Proof: Any game γ will be characterized by each firm m's payoff function being continuous in $(\Lambda \times \mathbf{R})^M$ and quasi-concave in Λ_m and p_m.

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[21] A Poisson sample is a sample of Bernoulli variables with differing probabilities.

[22] The reason we choose not to construct equilibria is simple: there are many possible models one could use, but the analysis presented here applies to a generic subset of such models. Thus, it seems much simpler and more useful to carry out such an analysis than to present special cases within the general framework.

Continuity follows by assumption. Consumer utility is continuous in $(\Lambda \times \mathbf{R})^M$, and the distribution function of η_i is assumed to be continuous. Therefore, the expectation of demand is continuous in $(\Lambda \times \mathbf{R})^M$. Quasi-concavity of demand in Λ_m and p_m follows by the following facts: 1) utility is strictly convex in quality, and 2) utility is monotonically decreasing in price. Finally, costs are assumed to be strictly concave in quality and independent of price. Thus, quasi-concavity follows by the fact that a positive linear combination of a concave and quasi-concave functions is quasi-concave.

Standard arguments due to Glicksberg imply the existence of a pure strategy Nash equilibrium. ∎

As an aside, note that we have not proven (and it is not generally true) that there exists an equilibrium involving the candidates using pure strategies. The next part of this section sets up how one would construct a Nash equilibrium of the media market in a model within our framework.

3.1 Equilibrium: the generic case

Here we discuss how to find a Nash equilibrium for the media market in a generic model within our framework. In particular, one can work through the model in a backwards fashion, treating the candidates' announcements as given.[23] We also treat the consumer behavior as given, as it is determined by our assumption of the LRUM model of demand.[24] A firm m is faced with payoff function π_m and $m - 1$ competitors. We assume that the payoff functions are commonly known by the firms. Then a Nash equilibrium is characterized by a vector of strategies

$$a^* = (\Lambda_1^*, p_1^*, \dots, \Lambda_M^*, p_M^*),$$

where, given a policy announcement x, for all m and all Λ_m, p_m :

$$\pi_m(a^*) \geq \pi_m(\Lambda_m, p_m, a_{-m}^*). \tag{3.1}$$

---

[23]This is especially true since we assume that the announcements do not affect the payoffs of firms, though this method of constructing a Nash equilibrium will work even in cases where this restriction is relaxed.

[24]If one wished to construct the equilibrium strategies for candidates, it would simply be a little more algebra of the same flavor as that presented here, since the LRUM model is used for the vote choice as well.

That is, assuming an interior solution, we must find a solution to the following system of equations, for all m and all triplets m, k, l:

$$\frac{\partial \pi_m}{\partial s_{m,k,l}^2} = \frac{\partial D_m}{\partial s_{m,k,l}^2} - \frac{\partial c_{m,k,l}}{\partial s_{m,k,l}^2} = 0,$$

$$\frac{\partial \pi_m}{\partial p_m} = D_m + p_m \frac{\partial D_m}{\partial p_m} = 0,$$

$$\frac{\partial^2 \pi_m}{\partial \left(s_{m,k,l}^2\right)^2} = \frac{\partial^2 D_m}{\partial \left(s_{m,k,l}^2\right)^2} - \frac{\partial^2 c_{m,k,l}}{\partial \left(s_{m,k,l}^2\right)^2} < 0,$$

$$\frac{\partial^2 \pi_m}{\partial \left(p_m\right)^2} = 2\frac{\partial D_m}{\partial p_m} + p_m \frac{\partial^2 D_m}{\partial \left(p_m\right)^2} < 0.$$

This system contains $2\left(MKL + M\right)$ equations, which is one of the main reasons we do not present any constructed equilibria in this paper. Even a simple case, with 2 candidates, 1 issue, and 2 firms involves 12 such equations (which is not many, until ones takes into account the relative paucity of the model under consideration). Proposition 3.1 guarantees the existence of a solution to this system of equations. In fact, we can guarantee that such a solution will be an interior solution as well so long as

$$\lim_{\Lambda_m \to 0} \nabla_{\Lambda_m} C_m\left(\Lambda_m\right) = 0$$

and

$$\lim_{\Lambda_m \to 0} \nabla_{\Lambda_m} D_m\left(\Lambda_m, \Lambda_{-m}\right) > 0 \tag{3.2}$$

for all m, since, for any m, $C_m\left(\mathbf{0}\right)$ is assumed to be zero and $D_m\left(\mathbf{0}\right) \geq 0$. In addition, since π_m is a continuous function of its parameters and the feasible set is a continuous, compact-valued correspondence from the parameter space to $\left(Q \times \mathbf{R}_+\right)^M$, Berge's maximum theorem ensures that the set of equilibria will be an upper-hemicontinuous correspondence from the parameter space to $\left(Q \times \mathbf{R}_+\right)^M$.

Now we will discuss the predictions of the model, having guaranteed existence of at least one equilibrium in any example of our model.

4   Equilibrium Analysis and Predictions

We examine three types of forces within the model: cost-driven, preference-driven, and belief-driven. Our results, to set the stage for this section, are simple: incumbent candidates and celebrities enjoy an advantage in media coverage, implying an advantage in elections. Similarly, efficient campaigns enjoy an advantage in media coverage, implying an advantage for major political parties in elections. Reputation, in general, confers several advantages in media coverage, leading to stability in the number of political parties and the candidates running for major office. Also, volatile issues and those which are

salient with voters receive more coverage than issues which are perceived as unlikely to change or which most voters are indifferent towards. Similarly, heterogeneity of preferences and beliefs in the electorate leads to less coverage of issues (and more coverage of horse-race stories). Finally, a larger media industry may imply less intensive competition on quality: *i.e.* the variance of the sampling distributions offered by firms in a larger media industry may be greater than the variance of the sampling distributions offered by a monopolist.[25]

First, we outline the comparative statics of demand. Then we examine the predictions generated by the model. First we look at predictions based on the costs faced by firms. These include a incumbency/celebrity advantage, the political party advantage, and emphasis of horse-race and personality stories at the expense of complicated policy issues. Following this, the equilibrium effects of changes in voters' preferences are discussed. In particular, these include emphasis of main-stream issues and emphasis of issues which concern policy-oriented consumers (*i.e.* those with a lower marginal utility of money, and thus more willing to spend it). Then we examine the equilibrium effects of different beliefs. Examples include the emphasis of horse-race issues, stability in the number of viable political contenders in any given race, emphasis of volatile issues (issues which are considered likely to change or about which voters are uncertain), and an advantage for candidates with good public reputations. Finally, we present some comparative results regarding the size and organization of the media industry.

The next part of this section discusses consumer demand, the analysis of which is central to many of the model's predictions.

4.1 Comparative Statics of Demand

This section examines the comparative statics of consumer utility. It follows immediately that the comparative statics of consumer utility carry over into consumer demand directly, as Section 2.6 showed that, for all models satisfying our assumptions,

$$\frac{\partial \rho_i}{\partial U_i} \geq 0.$$

First we decompose the posterior beliefs, as they represent a compound lottery. That is, the voters face a lottery over which candidate will win, which is followed by a lottery over what policy the winning candidate will implement. Thus, we decompose h in the following way. Let W denote a random variable taking on any value in $\{1, \ldots, K\}$, with the subjective probability that $W = k$ being defined by ϕ_k, above. Thus, W denotes the winner of the election. Then, conditional on $W = k$, the policy outcome, y, is viewed as being drawn from a distribution with density function $h(y \mid k)$. This is simply the conditional distribution of y given candidate k wins.[26]

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[25]This result is similar to that obtained in Patty [32].

[26]Therefore, the assumption of independence across issues, mentioned above, is equivalent to assuming that the variance-covariance matrix of $h(y \mid k)$ is diagonal for all k.

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Finally, we will write ϕ_i^* for the vector of voter i's subjective probabilities that each candidate will win, given that voter i will vote according to the LRUM hypothesis.[27] Given this decomposition, we can express equation 2.5 as

$$
\begin{aligned}
U_i(m) &= -\int_X \sum_{l=1}^L \alpha_i^l \sum_{j=1}^K \phi_j^* \left[\left(\omega_i^l - z^l \right)^2 h_i(z|j;m) \right] dz - \beta_i p_m, \\
&= -\sum_{l=1}^L \alpha_i^l \sum_{j=1}^K \phi_j^* \int_X \left[\left(\omega_i^l - z^l \right)^2 h_i(z|j;m) \right] dz - \beta_i p_m, \\
&= -\sum_{l=1}^L \alpha_i^l \left[\left(\omega_i^l \right)^2 - \sum_{j=1}^K \left[\phi_j^* \left(\omega_i^l + x_j^l \right) x_j^l - V\left(z^l \right) \right] \right] - \beta_i p_m, \quad (4.1)
\end{aligned}
$$

where $V\left(z^l | j \right)$ is the variance of z^l conditional on victory by candidate j. Given consumption of news good m, this is equal to

$$
\frac{\sigma_{j,l}^2 s_{m,j,l}^2}{\sigma_{j,l}^2 + s_{m,j,l}^2}. \quad (4.2)
$$

Thus, as mentioned earlier, a firm m can increase the utility for its good by decreasing the variance of the sampling distribution represented by the news good. The substitution of x_j^l in the third step follows from our assumption that the conditional expected values of the enacted policy are equal to the true policy announcements under both the prior and sampling distributions.

Equation 4.1 makes some comparative statics possible immediately. First, notice that the absolute value of the marginal utility of variance on an issue l is

$$
\frac{\partial U}{\partial \sum_{j=1}^K V(z_j^l)} = -\alpha_i^l. \quad (4.3)
$$

Voters derive more utility from low variance news on issues they care about. Similarly, the absolute value of the marginal utility of variance with respect to the policies of a candidate is

$$
\frac{\partial U}{\partial \sum_{l=1}^L V(z_k^l)} = -\phi_i^*. \quad (4.4)
$$

Hence, voters derive more utility from low variance news on front-runners. Finally, note the role of the prior. The partial derivative of equation 4.1 with respect to $s_{m,k,l}^2$ is

$$
\frac{\partial U}{\partial s_{m,k,l}^2} = -\frac{\alpha_i^l \phi_k^* \left(\sigma_{j,l}^2 \right)^2}{\left(\sigma_{j,l}^2 + s_{m,j,l}^2 \right)^2}. \quad (4.5)
$$

---

[27]In large electorates, this vector can be treated as equal to ϕ, since the probability of one vote deciding the election is very small.

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Thus, we see that high levels of initial subjective uncertainty lead to higher marginal utilities for information, so long as the issue is salient and the candidate considered viable.

For the remainder of the analysis, we make the simplifying assumption that prices are fixed, with $p_m > 0$ for all firms. This can be justified empirically, as price changes are relatively infrequent in the mass media market and most competition is carried out in terms of quality. Now we are ready to discuss the predictions of the model in detail.

4.2 Cost-Driven Effects

The first prediction we make is that an increase in firm m's marginal cost of covering candidate k's position on issue l will increase the variance of firm m's coverage of candidate k's position on issue l. The predictions of this section follow from the second order conditions for equilibrium, namely that

$$\frac{\partial^2 D_m}{\partial \left(s^2_{m,k,l}\right)^2} < \frac{\partial^2 c_{m,k,l}}{\partial \left(s^2_{m,k,l}\right)^2}. \tag{4.6}$$

Prediction 1 *It is in candidate's interests to reduce the marginal costs media firms face when covering that candidate's position.*

Major political parties offer advantages to candidates since the party is able to take advantage of economies of scale in the dissemination of information about the candidate and his or her position - thus reducing the marginal cost of covering that candidate (and all candidates in the party) [28].

The second prediction is that, ceteris paribus, candidates whose positions are less expensive to cover will receive more coverage. This follows by the same logic as above, across all issues. One might think of people who have been in the news, who are experienced with the media, *etc.,* as being less expensive to cover (less background research is necessary, the news may be carried in other parts of the news good (such as the entertainment section, the sports page), *etc.*).

Prediction 2 *Celebrity and incumbent candidates will receive more coverage and enjoy an electoral advantage.*

Our third prediction is that, ceteris paribus, more expensive issues will receive less coverage. This follows from the same logic as both of the previous predictions. The implication of this is clear: complex issues will receive less attention due to the high cost of understanding and explaining them to the public (not to mention the fact that, in reality, candidates may not communicate their positions on such issues).

---

[28]This logic has not gone without notice in the literature, of course. Nevertheless, this is the first formal model of which the author is aware which contains such a prediction as a result of equilibrium analysis.

Prediction 3 *Issues which are more costly to cover will receive less coverage.*

The cost-driven effects within the model point in the same direction, obviously. The media cuts those corners which are most expensive to retain. It is in the candidate's interests to reduce these costs (with respect to the candidate's own positions, at least) since more coverage of a candidate increases his or her probability of winning the election.

4.3 Preference-Driven Effects

Voters' preferences are another factor in determining news coverage in equilibrium. In particular, we find that voters' preferences are represented in the equilibrium level of news coverage so long as these preferences are sufficiently homogenous. The predictions of this section and the next follow from the fact that

$$
\begin{aligned}
\frac{\partial D_m}{\partial s_{m,k,l}^2} &= \sum_{i=1}^{N} \frac{\partial \rho_i}{\partial U_i} \frac{\partial U_i}{\partial s_{m,k,l}^2}, \\
&= -\sum_{i=1}^{N} \frac{\partial \rho_i}{\partial U_i} \frac{\alpha_i^l \phi_k^* \left(\sigma_{j,l}^2\right)^2}{\left(\sigma_{j,l}^2 + s_{m,j,l}^2\right)^2},
\end{aligned}
\tag{4.7}
$$

The fourth prediction we make is that an increase in the saliency of an issue (α_i^l increases, for some i) implies (weakly) lower variance coverage of that issue. This prediction follows equations 4.6 and 4.7, and the fact that

$$
\frac{\partial c_m}{\partial s_{m,k,l}^2}
$$

is continuous in $s_{m,k,l}^2$ for all m, k, l. This then implies that any candidate who was receiving coverage on the issue before the increase in saliency of issue l will receive more coverage after the increase in saliency.

Prediction 4 *Increases in the saliency of an issue imply higher levels of coverage of that issue.*

A related prediction made by the model is that issues which are salient with larger groups of voters will receive more coverage than those which are salient with smaller proportions of the electorate. The logic of this prediction is clear: it represents a shock just like that discussed in Prediction 4.

Prediction 5 *Issues which concern larger groups of voters will receive higher levels of coverage.*

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The sixth prediction of the model concerns the relative coverage of horse-race stories.[29] Generically, every voter cares about which candidate wins.[30] Also, consider models where L is large. It may be the case that no single issue is salient for a very large subset of the electorate (not likely, but possible). In such a case, for example, the media will devote higher levels of coverage to horse-race stories relative to issue coverage than in more homgenous populations, ceteris paribus.

Prediction 6 *More heterogeneous electorates will receive more horse-race coverage, relative to the level of issue coverage.*

4.4 Belief-Driven Effects

The final group of predictions are comparative statics generated by changes in the prior beliefs of the voters. In particular, we find that our model predicts that issues which are perceived as unlikely to change will be covered less, that voters priors are very often self-fulfilling, and that new candidates are more likely to receive coverage.

Enacted policy positions on certain issues may be perceived as more or less susceptible to change by a voter. Issues which are more likely to change are represented by more diffuse priors, whereas priors approaching degeneracy indicate issues which are perceived by the voter as fixed, regardless what the candidate says. Since the marginal benefit of sampling is less with "tight" priors (*i.e.* the posterior variance is closer to the prior variance, given some sampling distribution), the model predicts that issues characterized by such priors will be covered less in equilibrium. Formally, equation 4.7 implies that a decrease in the variance of voters prior beliefs with respect to some pair k, l implies that the marginal revenue of coverage of candidate k's position on issue l decreases as well. Thus we obtain Prediction 7.

Prediction 7 *Issues regarding which the voters are more certain prior to the election will receive less news coverage than other issues.*

Voters' priors regarding candidates' probabilities of victory will influence news coverage greatly. Candidates which are viewed as unlikely to win the election do not affect the voters' utilities very much. Therefore, they will be covered less in equilibrium than front-runners. Formally, Prediction 8 follows directly from examination of equation 4.7.

Prediction 8 *Candidates who, prior to the campaign, are perceived by the electorate as more likely to win the election will receive more coverage than other candidates.*

---

[29]The reader may object that horse-race coverage is not explicitly modelled here. The objection, while true, is not particularly troubling. One can simply add another dimension to Q for coverage of the probabilities of victory, and allow voters to update ϕ_i with the information contained in this dimension of the news good. The results remain unchanged. The assumption implicitly made in Prediction 6 is that coverage of horse-race stories is relatively inexpensive.

[30]This is generically, because a voter may have identical priors for each candidate. Otherwise, however, the victorious candidate's identity is of concern to any voter.

Prediction 8 can probably be extended in a dynamic generalization of this model: in many cases voters' prior beliefs regarding candidate's likelihood of victories will be self-fulfilling. On the other side of the coin, however, "new" candidates will usually receive more coverage than known candidates, ceteris paribus, since voters' priors regarding the positions such candidates would impose if elected probably possess higher variance than priors' over the positions more established candidates would enact.

Prediction 9 *New candidates will receive relatively more attention.*

Of course, Prediction 9 is difficult to test, since rarely is a new candidate viewed as likely to win the election. Exceptions may include races for open seats and primaries involving no incumbents. Prediction 9 is discussed a bit further in relation to the Perot phenomenon in 1992. It is the author's belief that the belief-driven forces in the model are interesting for a reason aside from the predictions they generate. As alluded to above regarding Prediction 8, these forces have clear implications for a dynamic version of this model. Such an extension of the model seems to be a fruiful area for further research.

4.5   The Optimal Size of the Media

In an earlier paper (Patty [32]), Patty claims that a media monopoly may provide better news coverage than a perfectly competitive media market. This claim follows from the assumption that the monopolist may offer more than one news good and implicitly price discriminate. Thus, Patty's result does not necessarily follow in the model presented here, since we restrict any news outlet to provision of one news good, but the model does say something about the relative coverage of issues in large versus small media industries. As the industry becomes larger, the absolute value of marginal revenue of $s_{m,k,l}^2$ decreases (since there are more choices for consumers, and hence more "errors" by them as well) for all m, k, l. To see this, replicate the market (*i.e.* for each firm add one firm offering the same product, including abstention). In such a replication, under the assumption of i.i.d. disturbances across firms, each firm's market share is cut in half (stolen by the replicant). Furthermore,

$$\sum_{j=0}^{M}\sum_{i=1}^{N}\rho_i\left(j\right) = M \Rightarrow \sum_{j=0}^{M}\sum_{i=1}^{N}\frac{\partial\rho_i\left(j\right)}{\partial U_i} = 0. \tag{4.8}$$

Let $D_m\left(M\right)$ indicates the demand for firm m's good when there are M firms in the industry, and let $D_m(2M)$ denote the same firm's demand in the replcated market. Then

$$\frac{\partial D_m\left(2M\right)}{\partial s_{m,k,l}^2} - \frac{\partial D_m}{\partial s_{m,k,l}^2} = \sum_{i=1}^{N}\frac{\partial\rho_i\left(m\right)}{\partial U_i}\frac{\alpha_i^l\phi_k^*\left(\sigma_{j,l}^2\right)^2}{\left(\sigma_{j,l}^2 + s_{m,j,l}^2\right)^2} - \sum_{i=1}^{N}\frac{\partial\rho_i\left(2M\right)}{\partial U_i}\frac{\alpha_i^l\phi_k^*\left(\sigma_{j,l}^2\right)^2}{\left(\sigma_{j,l}^2 + s_{m,j,l}^2\right)^2},$$

$$= \sum_{i=1}^{N}\left[\left(\frac{\partial\rho_i\left(M\right)}{\partial U_i} - \frac{\partial\rho_i\left(2M\right)}{\partial U_i}\right)\frac{\alpha_i^l\phi_k^*\left(\sigma_{j,l}^2\right)^2}{\left(\sigma_{j,l}^2 + s_{m,j,l}^2\right)^2}\right],$$

$$< 0.$$

The last inequality follows from 4.8. Therefore, in general, the responsiveness of demand to changes in quality falls as the market size is increased. Cost functions remain unchanged, however, so by equation 4.6 it is clear that the variance of offered sampling distributions will increase as the number of firms increases.[31] Therefore, so long as we are assuming that prices are fixed, we obtain Prediction 10.

Prediction 10 *More competitive news markets will be characterized by lower levels of issue coverage.*

This result does *not* say that, in general, the addition of one firm will decrease the quality of products offered. Thus, in a sense, we obtain a result similar to that contained in Patty [32], but the result in that paper actually assumed that the monopolist could choose the prices charged for her goods.

4.6 Coordination and Convergence

The final prediction of the model is broken into two parts and concerns coordination of media firms and convergence of coverage, in a particular sense. As noted by many authors, the presence of wire services such as AP and Reuters possibly leads to a greater homogeneity of news goods across firms. Our model predicts this phenomenon, it turns out, so long as the cost function is convex.[32]

Prediction 11a *If the costs faced by media firms are convex in the quality of coverage, media firms will find it optimal to coordinate quality efforts, leading to sharing of information and a convergence, across firms, of the issues and candidates covered well.*

Prediction 11a follows immediately from convex cost functions and the LRUM model of consumer demand. In essence, it hurts firms less to give away their information than to gather everything on their own. Prediction 11b simply states the obvious: in media markets where coordination of news firms occurs, the quality of news offered to readers will be higher.

Prediction 11b *Assume media firms coordinate quality efforts. Then the quality of offered goods should be strictly higher.*

Any dynamic version of this model would benefit from a Stackelberg dynamic: one in which certain firms (the New York Times, USA Today, the Big 3 networks, CNN, for example) declare their qualities first, allowing high-valuation consumers to obtain news earlier and second-tier news outlets to steal their coverage. The advantage gained

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[31]This may not hold if firms can compete on price as well, since the marginal change in demand as a function of price will decrease as well when the industry size increases.

[32]Actually, this finding really only requires convexity in the applicable regions.

by leader firms is obvious: they can channel the "news" into areas in which they have a comparative advantage (with respect to their cost functions) as well as second-order price discriminate, since high-valuation consumers will reveal their type by choosing goods from the leader firms.

4.7 A few remarks

The reader may or may not be unhappy with the relatively untechnical presentation of the model's results. It is the author's opinion that the proofs of these results are not very illuminating - simply because the model is so simple. Generalizations of the game form, including a dynamic version of the game, are in order before such a technical paper would be of much interest to the more technically inclined reader. This paper is motivated by a desire to actually begin studying a phenomenon, the mass media in elections. There obviously remains *much* to be done, but hopefully the reader feels that the predictions listed above lead this line of inquiry in the right direction: towards falsifiable models and empirical tests.

5   Perot?

Now for a brief discussion of the U.S. Presidential candidacies of H. Ross Perot in 1992 and 1996. Perot's candidacy in 1992 has been the subject of much work by Alvarez, Just *et al.*, and many others. This model predicts several of the salient features of the coverage of Perot's candidacies in both 1992 and 1996. For example, Perot received a flurry of attention when he first announced he might run in 1992. This flurry was short-lived, probably due to the fact that few voters when polled actually thought he would win, *even though he was in the lead in many polls*. Our model predicts that coverage of Perot's candidacy should fall in this case, and it did. Indeed, it was this drop-off of attention which caused Perot to purchase his famous 30 minute advertisements. Another characteristic of Perot's campaigns was his intense desire to control the media's access to him and his campaign. Such control effectively increased the marginal cost faced by the media when attempting to cover Perot's positions on the issues. Thus, the model predicts that coverage of Perot would be lower than that of Clinton, for example, whose campaign centered around cozy relations with the press corps. Finally, in 1996 Perot faced an additional challenge: he was no longer a new face. In addition, he kept himself in the news with his very public opposition to NAFTA. Thus, voters were relatively sure of where Perot stood on the issues (at least those he would discuss), and assigned him little chance of winning the election in 1996, meaning the model predicts lower coverage of his campaign in 1996 than in 1992. This is indeed the case.

Of course, this is one example - rife with problems, to be sure - but it is illustrative of the predictive power of the model. Further work in developing tests of the model will obviously help shed more light on the model's validity, and is planned for the near future.

6 Conclusions and Extensions

The model outlined in this paper is an attempt at constructing a formal framework in which to study the modern media. We have been forced to place some severe assumptions on the model at times, though most of these, such as the assumption that priors and sampling distributions are represented by normal distributions, the restriction to quasi-linear preferences, the assumption of a common, correct prior for each voter, and the assumption that firms must offer unbiased news coverage, are not necessary for the results outlined here to hold. A major weakness of the model is its inability to predict where the voters' priors come from and the lack of analysis of electoral outcomes. The first of these is a weakness of many game-theoretic models, of course, and electoral outcomes are not the concern of this paper. Nevertheless, both of these concerns will hopefully be addressed in future work.

The point of this paper was to show that the media should be modelled explicitly in the political science literature. In particular, the assumption of a profit-maximizing media does not jibe with the assumption that the media is either some monolithic juggernaut, imposing its will on the electorate, or that it provides "perfect" information to voters. Essentially, the model provides an institutional framework within which the beginnings of Downs' rationally ignorant voters may be found. In addition, the model provides a starting point for more specific models of the media, unlike Zaller [41]. Finally, the model is capable of being tested empirically, making specific, comparative statics predictions without many restrictions. In short, the model is falsifiable, unlike most, if not all, of the previous theoretical literature concerning the role of the media in elections.

References

[1] Anderson, S. P., A. de Palma, and J.-F. Thisse. 1992. *Discrete Choice Theory of Product Differentiation*. Cambridge: MIT Press.

[2] Aliprantis, C. D. and K. C. Border. 1994. *Infinite Dimensional Analysis: A Hitchhiker's Guide*. New York: Springer-Verlag.

[3] Ansolabehere, S. and S. Iyengar. 1995. *Going Negative*. New York: Free Press.

[4] Black, D. 1958. *The Theory of Committees and Elections*. Cambridge: Cambridge University Press.

[5] Border, K. C. 1985. *Fixed Point Theorems with Applications to Economics and Game Theory*. New York: Cambridge University Press.

[6] Buck, R. C. 1978. *Advanced Calculus*. New Tork: McGraw-Hill.

[7] Casella, G. and R. L. Berger. 1990. *Statistical Inference*. Belmont, California: Duxbury Press.

[8] Coughlin, P. J. 1992. *Probabilistic Voting Theory*. Cambridge: Cambridge University Press.

[9] Coughlin, P.J. and S. Nitzan. 1981. "Electoral Outcomes with Probabilistic Voting and Nash Social Welfare Maxima." *Journal of Public Economics* 15: 113-122.

[10] Dalton, Beck, and Huckfeldt. 1998. "Partisan Cues and the Media: Information Flowsin the 1992 Presidential Election." *American Political Science Review* 92:111-126.

[11] Dasgupta, P. and E. Maskin. 1986. "The Existence of Equilibrium in Discontinuous Economic Games, I: Theory." *Review of Economic Studies* 53:1–26.

[12] Dasgupta, P. and E. Maskin. 1986. "The Existence of Equilibrium in Discontinuous Economic Games, II: Applications." *Review of Economic Studies* 53:27–42.

[13] Downs, A. 1957. *An Economic Theory of Democracy*. New York: HarperCollins.

[14] Endersby, J. W., and E. Ognianova. 1997. "A Spatial Model of Ideology and Political Communication." *Harvard International Journal of Press/Politics* ??:23–39.

[15] Fudenberg, D., and J. Tirole. 1988. "Perfect Bayesian and Sequential Equilibria." *Journal of Economic Theory*.

[16] Fudenberg, D., and J. Tirole. 1996. *Game Theory*. Cambridge: MIT Press.

[17] Gomery, D. 1998. "Media Ownership." In Alexander, A., J. Owers, and R. Carveth, *eds.. Media Economics: Theory and Practice*, 2nd Ed., Mahwah, New Jersey: Lawrence Erlbaum.

[18] Halmos, P. R. 1974. *Measure Theory*. New York: Springer-Verlag.

[19] Harsanyi, J. 1967-68. "Games with Incomplete Information Played by Bayesian Players." *Management Science* 14: 159-182, 320-334, 486-502.

[20] Hinich, M. 1977. "Equilibrium in Spatial Voting: The Median Voter Result is an Artifact." *Journal of Economic Theory* 4:144-153.

[21] Hotelling, H. 1929. "Stability in Competition." *Economic Journal* 39:41–57.

[22] Just, M. R., A. N. Crigler, D. E. Alger, T. E. Cook, M. Kern, and D. M. West. 1996. *Crosstalk*, Chicago: University of Chicago Press.

[23] Laffont, J.-J. 1995. *The Economics of Uncertainty and Information*, Cambridge: MIT Press.

[24] Ledyard, J. 1984. "The Pure Theory of Large Two-Candidate Elections." *Public Choice* 44: 7-41.

[25] Mas-Colell, A., M. D. Whinston, and J. R. Green. 1995. *Microeconomic Theory*, New York: Oxford University Press.

[26] McFadden, D. 1976. "Quantal Choice Analysis: A Survey." *Annals of Economic and Social Measurement* 5:363-390.

[27] McKelvey, R. D. and J. W. Patty. 1998. "Quantal Response Voting," *mimeo*, California Institute of Technology.

[28] Mertens, J. F. and S. Zamir. 1985. "Formulation of Bayesian Analysis for Games with Incomplete Information." *International Journal of Game Theory* 10:619-632.

[29] Milgrom P. and R. Weber. 1986. "Distributional Strategies for Games with Incomplete Information." *Mathematics of Operations Research* 10:619-631.

[30] Myerson, R. B. 1991. *Game Theory*. Cambridge: Harvard University Press.

[31] Ognianova, E. and J. W. Endersby. 1996. "Objectivity Revisited: A Spatial Model of Political Ideology and Mass Communication," *Journalism and Mass Communication Monographs* 159:1–32.

[32] Patty, J. W. 1997. "The Optimal Size of the Media." Paper presented at the 1998 Annual Meetings of the Public Choice Society.

[33] Patty, J. W. 1998. "The Demand for Political Information," *mimeo*. California Institute of Technology.

[34] Plott, C. 1967. "A Notion of Equilibrium and Its Possibility Under Majority Rule." *American Economic Review* 57:787-806.

[35] Popkin, S. L. 1991. *The Reasoning Voter*. Chicago: University of Chicago Press.

[36] Rothschild, M. and J. E. Stiglitz. 1970. "Increasing Risk: I. A Definition." *Journal of Economic Theory* 2:225–43.

[37] Savage, L. J. 1972. *The Foundations of Statistics*. New York: Dover.

[38] Simon, L. K. and W. R. Zame. 1990. "Discontinuous Games and Endogenous Sharing Rules." *Econometrica* 58:861–872.

[39] Smithies, A. 1941. "Optimum Location in Spatial Competition." *Journal of Political Economy* 49:423–39.

[40] Zaller, J. R. 1992. *The Nature and Origins of Mass Opinion*. Cambridge: Cambridge University Press.

[41] Zaller, J. R. 1997. "The Political Economy of Election News." *manuscript*, University of California, Los Angeles.