Media Systems and Voter Knowledge: An Agent-Based Model

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Abstract

Individual-level factors explaining voter knowledge have been well-established in behavioral political science research. However, their interactions with the national-level political and mass-mediated context have not. A primary reason for this is that because of their mutual interdependence, the causal mechanisms underlying voter knowledge, mass media reports and electoral competition are hard to disentangle with empirical data alone. One way to get around this is to formally model these types of contingencies and this paper does exactly that. It presents an agent-based model in which aggregate voter knowledge and electoral competition emerge as a function of media system characteristics. It shows that a set of simple behavioral rules implemented by voters, parties and media outlets generates interesting (and testable) predictions regarding (i) the mass-mediated underpinnings of aggregated voter knowledge, and (ii) the interactive underpinnings that explain individual voter knowledge.

Keywords: voter knowledge, party competition, incomplete information, media reporting, agent-based model
Individual-level factors explaining voter knowledge have been well-established in behavioral political science research. However, their interactions with the national-level political and mass-mediated context have not. A primary reason for this is that because of their mutual interdependence, the causal mechanisms underlying voter knowledge, mass media reports and electoral competition are hard to disentangle with empirical data alone.

One way to get around this is to formally model these types of contingencies and this paper does exactly that. It presents an agent-based model in which aggregate voter knowledge and electoral competition emerge as a function of media system characteristics. The model is motivated by the following observations. First, many voters depend for their (political) information on traditional mass media outlets.\footnote{Even in this day and age of new media most voters learn about politics from traditional mass media outlets. For example, a 2010 news consumption survey from the Pew Research Center for the People and the Press found that from the 70 minutes that Americans are busy with consuming (political) news, about 57 minutes is spent on traditional mass media like watching television, listening to the radio or reading a newspaper (see: \url{http://people-press.org/report/652/}.} Second, the quality of political content varies wildly across these outlets, which in turn affects what readers can learn from attending to that outlet.\footnote{For example, a typical write-up from the presidential campaign trail in the \textit{New York Times} will contain more information than a similar article in the \textit{New York Post}, and, all else equal, this will differentially affect political knowledge of the readers of both articles. That is, with varying degrees of success media outlets help voters overcome their rational ignorance (Downs 1957).} And third, this variation in quality is not exogenous as media outlets respond—some more than others—to reader demand. The model shows that a set of simple behavioral rules implemented by voters, parties and media outlets generates interesting (and testable) predictions regarding (i) the mass-mediated underpinnings of aggregated voter knowledge, and (ii) the interactive underpinnings that explain individual voter knowledge.

At the heart of the model are the (simplified) interactions between voters, parties and media outlets that occur over the course of several political campaigns, within the context of media systems. In particular, parties adjust their platforms in response to voter beliefs. Voters, in turn, adjust their beliefs about party platforms and inclinations to buy news in response to media content. And media outlets adjust the precision of their reporting.
in response to demand from voters or alignment with party platforms. In addition, these interactions are shaped by the media system in which they occur. Figure 1 displays these interactions graphically. The solid lines represent the endogenous supply and demand of information between mass media outlets, parties and citizens during electoral campaigns. The dotted lines denote how media systems at large shape these micro-level interactions over information across all actors during a political campaign. In other words, the dotted lines represent how the characteristics of media systems shape the ‘information environment’ that citizens find themselves in (Jerit, 2009; Kuklinski et al., 2001; Jerit, Barabas and Bolsen, 2006).

![Figure 1: A Model of Media Systems, Information and Political Competition](image)

**Note:**
I—parties change platforms, which affects media content
II—voters demand news, which affects quality of media content
III—quality of media content affects voter beliefs
IV—voter vote based on beliefs, which affects party platforms
V—changes in party platforms affect voter beliefs

The model generates a set of interesting results. For example, it finds that media competition is associated with a public that is better informed about politics (i.e., the Knowledge Hypothesis) but less representative party competition (i.e., the Representativeness Hypothesis).
sis). In addition, it predicts that more competitive media systems are associated with more alternations in government (the Alternations Hypothesis). It also finds that voters who are ideologically moderate tend to be more knowledgeable than voters at the ideological extremes, but only when the degree of media competition is low (i.e., the Ideology and Media Systems Hypothesis).

This paper proceeds as follows. In the next section I will briefly discuss findings on the economics of mass media content, and its effects on voter knowledge and political competition. I then discuss a set of seminal agent-based models that introduced the method to the study of electoral competition. After that, I present the model and the results it generates. I then briefly conclude.

**Voter Knowledge and Media Effects**

What explains a voter’s political knowledge? Answers to this question have varied considerably over time. Early behavioral work emphasizes voters’ individual characteristics such as their education, income and political interest. Yet the advent of more sophisticated multi-level modeling techniques in political science brought with it an interactive approach that models political knowledge as a function of both individual characteristics and the institutional environment. This interactive approach opens the door for understanding political

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3These studies tend to be rather pessimistic about the potential of the typical to learn about politics. For example, *The American Voter* (Campbell et al., 1960) argues that a majority of voters hold so-called ‘non-attitudes’ which are unconstrained by ideological content. Most voters do not care about issues—all that informs their vote is identification with the party they grew up with. More recent behavioral research is more optimistic about citizens’ potential to be knowledgeable voters, a position it supports with a range of arguments. Achen (1975), for example, argues that the measures used in *The American Voter* are flawed, systematically underestimating the cognitive capacities and knowledge levels of voters. Page and Shapiro (1992) finds that even though individual voters may not be all that politically knowledgeable the public at large is still capable of rationally responding to policy since individual-level noise tends to cancel out in the aggregate (for an opposite view see the heuristics and biases literature (e.g., Kahneman, Slovic and Tversky, 1982)). In addition, a sizable literature on ‘low-information rationality’ (e.g., Lupia, 1994) argues that voters may in fact not need all that much information to vote as if they are well-informed. Furthermore, the online model of candidate evaluations finds that much of what voters know is stored in affective summary judgments, which traditional memory-based knowledge items do not pick up on (Lodge, Steenbergen and Brau, 1995; Lodge and Stroh, 1989)
knowledge not just as a capability or cognitive trait (like the earlier behavioral studies did) but as a choice instead. That is, citizens may become better informed about politics if the institutional environment makes it less costly for them to do so. In a seminal study of party systems, electoral systems, legislative institutions and political knowledge, Gordon and Segura (1997) lay out this viewpoint. They reason that (1997, p. 126) “if the party system, the electoral system, and legislative institutions of a polity affect the availability, clarity and usefulness of political information, they will also account for some of the cross-national variance in any individual-level measure of sophistication.”

Following this line of reasoning, variation in the quality of mass media reporting should affect the electorate’s political knowledge as well. After all, it is through the mass media that most citizens learn about politics. But for decades researchers have viewed the media as having little to no effect on political attitudes and behavior (e.g., Berelson, Lazarsfeld and McPhee, 1954; Klapper, 1960). Yet over time this behavioral “minimal effects” hypothesis has lost ground to the interactive “knowledge gap hypothesis” (Tichenor, Donohue and Olien, 1970) which posits that as “as the infusion of mass media information into a social system increases, higher socioeconomic status segments tend to acquire this information faster than lower socioeconomic-status population segments so that the gap in knowledge between the two tends to increase rather than decrease.” In recent years, new evidence has supported the knowledge gap hypothesis in the American context. For example, Jerit, Barabas and Bolsen (2006) find that volume of newspaper reporting moderates the impact of socioeconomic status in explaining political knowledge: increased volume of newspaper reporting is positively related with larger information differences between highly and poorly educated voters. De Vreese and Boomgaard (2006, p. 317) find that “exposure to news outlets with high levels of political content (such as public television news and broadsheet newspapers) contributes the most to knowledge gains and increases the propensity to turn out to vote.”

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4It is not just the volume of the news that matters but also the way the news is packaged. In a follow-up
Prior (2005) argues that such results can be explained by a process of selective exposure to either news or entertainment. He finds that “people who like news take advantage of abundant political information to become more knowledgeable” but that in contrast “people who prefer entertainment abandon the news and become less likely to learn about politics and go to the polls” (Prior, 2005, p.577). Prior thus conceives of political learning as a process of supply and demand of political information.

But if—as these studies show—voter knowledge increases with greater supply of useful political news, what exactly explains this supply? To answer this question, we need to understand what motivates media outlets in their reporting. Yet despite their importance to voter knowledge, much public opinion research in political science—both theoretical and empirical—has not systematically studied the mass media. That is, media reports often are taken to be the exogenous starting point for study. An assumption that is implicit to this approach is that mass media are “a conveyor belt that passively transports elite views—particularly the views of the most powerful elites—to the public (Baum and Potter, 2008, p.40). Yet this is only one possible model. One could also think of media outlets as producers of political news that respond to market incentives. Gentzkow and Shapiro (2008, p. 108) note: “For free markets to provide accurate information requires three things: that consumers want to hear the truth, that markets provide incentives to give consumers what they want, and that firms respond to these incentives. None of these is a given.” To put it another way, media outlets may enhance political knowledge if there is enough demand for good information and if its production is cheap enough. For example, Snyder Jr and Strömberg (2010) find that a poor fit between newspaper markets and political districts (i.e., less demand) reduces press coverage of politics in the United States. When employing study that employs “within-survey / within-subjects” comparisons under conditions of high and low media coverage, Barabas and Jerit (2009) show how in addition to volume, breadth and prominence of news media coverage increase policy-specific knowledge above and beyond common socioeconomic factors. Furthermore, Jerit (2009) shows that higher levels of expert commentary widens the knowledge gap across socioeconomic groups. By contrast, greater levels of contextual coverage diminish those differences.
this exogenous variation in fit they find very interesting effects of reduced political coverage. For instance, voters living in areas with less coverage of their U.S. House Representative are less likely to recall their Representatives name, and less able to describe and rate them. In short, if newspapers reduce their coverage of local representatives in response to market pressures, this may weaken mechanisms of political accountability.

On the theoretical side, work on the economics of media content studies the factors explaining the accuracy of media reports. In doing so it oftentimes relies on spatial models political competition (see e.g., Bernhardt, Krasa and Polborn, 2008; Chan and Suen, 2008; Mullainathan and Shleifer, 2005; Prat and Strömberg, 2011). Generally speaking, these models take media outlets to be either profit-maximizing or policy-motivated. In addition, consumers of news outlets are assumed to be either perfectly rational and only interested in factually accurate information, or their preferences are to hear or read news that is consistent with their (biased) priors—they are motivated reasoners. For example, Mullainathan and Shleifer (2005) find that competition among mass media outlets may lead to more biased reports (compared to a media monopoly) but only when consumers are heterogeneously biased. On the other hand, Gentzkow and Shapiro (2006) find that competition can lead to less bias but only in situations where consumers can easily observe the true state of the world ex post. With that in mind, the type of news (i.e., easy versus hard to verify) becomes an important determinant of media accuracy. In relation to electoral competition, Chan and Suen (2008) find that political parties are more likely to be responsive to the median voter when media outlets behave as ‘watchdogs’ rather than just passive transporters of information.

In sum, there is much work that is concerned with voter knowledge and political competi-

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5For seminal work on motivated reasoning in political science, see for example Lodge and Taber (2000); Taber and Lodge (2006)

6Meaning that some individuals want to hear the truth, whereas others want news to be tailored to their priors.

7In the set-up of Chan and Suen (2008) watchdogs are those media outlets that report to their audience about the ‘true state of the world’
tion as well as media effects on voter knowledge. However, there is not much work that links voters, mass media and politics all at the same time. A primary reason for this is that because of their mutual interdependence, the causal mechanisms underlying voter knowledge, mass media reports and electoral competition are hard to disentangle with empirical data alone. Yet as much as media firms compete for audience, they also struggle with political candidates to obtain information that they can then turn into news. Related to this is a point of criticism about the methods used in most theoretical work in political economy and the assumptions contained in the solutions to these models. Most theoretical work discussed in this section are classical game-theoretic models that can be solved analytically. However, these analytical solutions rely on strong assumptions about rationality and information of all actors involved and often lead to equilibrium-type predictions about political outcomes. Political reality, however, is mostly dynamic in nature and equilibrium is often difficult to find. This bring me to so-called computational or agent-based models of politics which I will discuss next.

**Agent-Based Models of Political Competition**

Following a seminal paper by Kollman, Miller and Page (1992), computational models of political competition have seen their popularity rise in political science. Unsatisfied with some of the theoretical results of the post-Downsian spatial political competition literature, these authors develop a theory of party competition “as a complex and evolving system where key actors hold very incomplete and imperfect information” (Laver, 2005). KMP find that different behavioral search algorithms (which they initially titled random adaptive par-
ties, climbing adaptive parties and genetic adaptive parties but which have changed names several times since) systematically converge to positions that are centrist yet distinct. Interestingly enough, this occurs regardless of the exact spatial distribution of voter preferences, although more “rugged” or “less smooth” preferences slow down the process of convergence (Kollman, Miller and Page, 1998). An important extension to these seminal papers comes from De Marchi (1999). De Marchi also studies a two-party political system with either vote-seeking or policy-seeking parties, but other than KMP he lets go of the assumption of perfectly informed voters. In his model, voters are “information misers”, meaning that they try to minimize costly attention paid to politics. Voters do this retroactively by only focusing attention to specific policy issues in case they are unsatisfied with the last election outcome. When voters are satisfied with the last election, they will reduce the amount of attention they spend on politics. With these information constraints in place, De Marchi finds that voter attention and party victory cycles may occur in, findings that are mainly driven by how much parties are vote-seeking and the ‘intelligence’ of voters: “The frequency of both cycles depends on the parameter for ideological fervor of the candidates and voter sophistication (i.e., their mutation rate of attention). Ambitious incumbents result in lower frequency cycles than ideological incumbents. More responsive and aware voters, in turn, cause more party turnover, particularly when the incumbents are ideological (De Marchi, 1999, p. 411). In other words, in case candidates are only in search for votes and voters have good information, electoral cycles are less frequent. Laver (2005) has extended these earlier models to a setting of multiparty competition in a two-dimensional space. Laver finds that a so-called Predator strategy, a hill-climbing algorithm, is more successful at finding the higher voter density locations than other strategies he investigates. In line with earlier results, Predator parties do not position themselves at the exact location of the median voter but instead move around that core. More recent extensions have included valence issues, party birth, party death, and evolution of party strategies (Laver and Sergenti, 2011;
Laver and Schilperoord, 2007; Schreiber, 2013). In all these extensions, voters hold perfect information about the policy positions of all parties.

The Model

Before I lay out its specifics, I should first mention that this is a behavioral model. Actors in the model do not maximize an objective function but instead follow predetermined (‘trial-and-error’) behavioral rules to search through such a function. Implicit in this approach is that all actors have bounded knowledge and that they use this knowledge and this knowledge alone to inform their decision-making. With this in mind, the model is specified as follows.\(^9\)

There are two parties competing in elections with \(V\) sincere voters and \(N\) media outlets in \(T\) rounds. Each period \(t\) in the model denotes an election cycle consisting of a campaign plus an election between an incumbent and a challenger party. Each period begins with an incumbent and a challenger party campaigning for office. Both parties are office-motivated. They are represented by an ideal point \(I_p \in [0, 1]\) which is taken to be stable for parties within each round and can be thought of as their policy platform on a zero to one ideological space. After the election, the losing party changes its platform in response to its loss. It does so using an updating rule that requires just one piece of information: the ideological position of the winning party. That is, the losing party moves ideologically in the direction of the winning party. This strategy is a one-dimensional equivalent of the Predator strategy in the work of Michael Laver and colleagues (Laver, 2005; Laver and Schilperoord, 2007; Laver and Sergenti, 2011).\(^{10}\)

\(^9\)The model—which was programmed in R— can be found in the Appendix.

\(^{10}\)Of course, there are many decision rules possible for office-motivated parties competing in a one-dimensional issue space. For example, in a tournament of party competition in a two-dimensional issue space, Fowler and Laver (2008) explore the electoral effectiveness of as many as 29 decision rules. However, to keep things relatively simple this paper explores this Predator strategy as it (i) does not assume much information on the part of both parties, and (ii) makes intuitive sense.
\[ I_{p,t+1} = \begin{cases} 
\min(1, I_{p,t} + \delta) & \text{if } I_{\text{inc},t} > I_{p,t} \\
\max(0, I_{p,t} - \delta) & \text{if } I_{\text{inc},t} < I_{p,t} 
\end{cases} \] 

Both Equation 1 and Figure 2 represent this updating rule. The learning parameter \( \delta \) is fixed—but theoretically ranges between zero and the ideological distance between the two parties. It represents a party’s responsiveness to loss.

\[ \text{Figure 2: Updating Algorithm Parties} \]

Like incumbents, voters have ideal points on this scale, which are denoted with \( I_v \). All else equal, voters prefer parties for which the absolute distance between \( I_v \) and \( I_p \) is smallest, yet in each period voters’ payoff depend equally much on an exogenous policy shock, which is distributed \( U(0,1) \). This intends to reflect that implementation of policy is not just a function of the incumbent’s policy platform but also of factors that lie outside of the control of the incumbent (e.g., Ferejohn, 1986).\(^{11}\) At the same time, this policy shock represents the source of uncertainty that may motivate voters to seek out news reports from the media to learn more about party platforms. At the end of each period, a voter’s payoff is thus a function of a policy outcome \( s \) where \( s = \frac{1}{2} \times (I_p + a_t) \). The policy outcome is the average of the party’s ideology and the policy shock. After each period \( t \), voter \( v \) receives utility:

\[ U_{v,t} = -|I_v - s| - c_v \]  

where \( c \) is the cost of the news, which is a function of the quality of media reporting and

\(^{11}\)This linear loss function implies that voters are risk neutral (for a discussion, see Laver and Sergenti, 2011).
ideological distance to media outlets (more on this below).

Voters have incomplete information on $I_p$ since they observe policy outcome $s$, not ideology. Because of this incomplete information, voters hold beliefs over $I_p$, which are represented by a probability distribution $\pi(I_p)$ and are distributed $TN(\mu, \sigma^2, 0, 1)$. Voter beliefs about the challenger are distributed normally as well. Voters may decide to learn about both parties by buying news from the media. From this it follows that in each time period there are two groups of voters: news-buying voters and news-ignoring voters. Both groups of voters update their beliefs about the incumbent in response to information: news-ignoring voters learn from incumbent performance whereas news-buying voters directly learn about the policy platform of the incumbent through media content.\textsuperscript{12} News-buying voters also learn about the policy platform of the challenger, whereas news-ignoring voters do not since the challenger has not had a chance yet to implement policy.

Learning takes place as follows. From the perspective of news-ignoring voters, the information that is contained in performance can be represented by a draw from a truncated normal distribution $TN(s, \sigma^2_1, 0, 1)$ with mean equal to the policy outcome in the previous round and variance equal to 1. So not only is the signal noisy, it is potentially biased as well (with the degree of bias a function of the exogenous policy shock). News-buying voters on the other hand learn about ideology directly from media content, which is also represented as a truncated normal distribution $TN(I_p, \sigma^2_1, 0, 1)$ but with mean equal to the platform of the candidate and variance equal to the inverse of the quality of the news.\textsuperscript{13} In other words, the better the quality of the news, the more informative it is from the perspective of the news-buying voter. Voters update their beliefs using Bayes’ rule (Gerber and Green, \textsuperscript{12}This assumes that media outlets report the truth but with varying precision. Although media bias is of great interest to political scientists, economists and pundits alike, it has no place in the current model since biased news has \textit{a priori} informational value to news-buying voters. To study biased media outlets, I should assume that voters have a taste for news that confirms their priors.

\textsuperscript{13}News-buying voters learn from media content alone and not from both media content and policy outcomes since media content represents a less noisy estimate of the same signal.
Assuming that news (either policy results or media reports) is represented by a draw $x \sim TN(\mu_0, \sigma^2_1, 0, 1)$, Bayes’ rule implies that voters’ posterior beliefs $\pi(I_p|x)$ are distributed $TN(\mu(x), \rho, 0, 1)$, where

$$
\mu(x) = \mu + (x - \mu) \frac{\sigma^2_0}{\sigma^2_0 + \sigma^2_1}
$$

(3)

$$
\rho = \frac{\sigma^2_0 \sigma^2_1}{\sigma^2_0 + \sigma^2_1}
$$

(4)

That is, voters beliefs after observing ‘news’ have mean $\mu(x)$. The strength of that belief is represented by $\rho$. The smaller $\rho$, the more ‘crystallized’ the belief is.

A voter’s decision to purchase news occurs through a simple form of reinforcement learning. That is, voters increase (decrease) their likelihood of buying news if doing so has benefited (cost) them in the past (De Marchi, 1999). This setup thus recognizes 4 groups of voters: (i) news-buying voters who performed beyond expectation, (ii) news-buying voters who performed short of expectation, (iii) news-ignoring voters who performed beyond expectation, and (iv) news-ignoring voters who performed short of expectation. Here I assume that voters initially have an idiosyncratic interest (denoted as a probability $q_v$) in buying news from the media. Voters update this probability—which is initially distributed uniformly across voters—dynamically over periods using the adaptive rules below (Fowler, 2006). For voters who bought news in round $t$, the probability of buying news in round $t + 1$ equals:

$$
q_{v,t+1} = \begin{cases} 
\min(1, q_{v,t} + \kappa) & \text{if } U_{v,t} > U_{v,t-1} \\
\max(0, q_{v,t} - \kappa) & \text{if } U_{v,t} \leq U_{v,t-1}
\end{cases}
$$

(5)

For news-ignoring voters in round $t$, the probability of buying news in round $t + 1$ equals:
The learning parameter $\kappa$ is fixed—but ranges between zero and one. It reflects voters’ responsiveness to new information.\(^{14}\)

There are $N$ media outlets. Just as voters and parties, media outlets have ideological ideal points $I_n$. These ideal points are fixed over time. In the model, media outlets are motivated by audience share as well as by benefits that follow from being ideologically close to the incumbent party. Both motivations are weighted by a parameter $\lambda$. This setup intends to reflect the degree of ‘political parallelism’ (Hallin and Mancini, 2004). That is, the larger $\lambda$, the more a news outlet is motivated by sales, and the smaller $\lambda$, the more a news outlet is motivated by being ideologically close to the incumbent party. In each period $t$, media outlet $n$ receives utility:

$$U_{n,t} = \lambda \times M - (1 - \lambda) \times |I_n - I_v|$$ (7)

where $M$ is the audience share of the outlet. Since their ideological ideal points are fixed, all that media outlets can vary is the quality of their reporting. An outlet’s decision with respect to the quality of its reporting is specified using an updating rule that requires just one bit of information: the quality of the news of the best-selling media outlet $c_{\text{max}}$. Media outlets vary $c$ dynamically over periods using the following behavioral rules:

$$c_{n,t+1} = \begin{cases} 
\min(1, c_{n,t} + \mu) & \text{if } c_{\text{max},t} > c_{n,t} \\
\max(1, c_{n,t} - \mu) & \text{if } c_{\text{max},t} < c_{n,t} 
\end{cases}$$ (8)

\(^{14}\)This decision rule implicitly assumes that voters do not interact with each other. All that matters to voters is their performance in round $t$ when compared to performance in round $t - 1$. Voter are thus a-social and myopic. For a model party competition, voter learning and media where voters are connected in a network, see work by Smirnov and Woodson.
Both Equation 8 and Figure 3 represent this updating rule.\textsuperscript{15} The updating rule is straightforward: the media outlet with the largest share of the audience it will not change the quality of its reporting. Media outlets that do not have the largest share of the audience will move the quality of their reporting in the direction of the largest media outlet. The learning parameter $\mu$ is fixed—but theoretically ranges between zero and one. It represents a media outlet’s responsiveness to small audience shares.

\begin{equation}
\begin{align*}
    c_{\text{max},t}^< &< c_{m,t}^< c_{\text{max},t}^> > c_{m,t}^> \\
    0 \ (\text{Low Quality}) &< c_{m,t+1}^< -\mu c_{m,t}^< +\mu c_{m,t+1}^> 1 \ (\text{High Quality})
\end{align*}
\end{equation}

Figure 3: Updating Rules Media Outlets

After the campaign is over elections take place. Voters vote for the incumbent or the challenger based on the information they have.\textsuperscript{16} After the elections, voters receive utility, update their willingness to buy news, and a new campaign period starts. The losing party updates its platform to compete in the campaign that starts in the next period. Table 1 displays the timing of the model. Together steps 1 through 7 represent one time (campaign) period.

Table 1: Timing of the Model

\begin{itemize}
    \item 1) Incumbent and challenger party campaign for office.
    \item 2) Exogenous policy shock.
    \item 3) Media outlets report on party platforms with quality $c_m$.
    \item 4) Voters decide to buy news reports.
    \item 5) Voters update beliefs about party platforms.
    \item 6) Elections take place. Losing party updates platform.
    \item 7) Voters update willingness to buy news. Return to step 1.
\end{itemize}

\textsuperscript{15}From the perspective of the voter, the cost of the media is simply the sum of the quality of the news and the ideological distance between the voter and the media outlet.

\textsuperscript{16}There is no abstention.
Results

There are many moving parts in the model as voter beliefs and news consumption, party platforms and media reporting are all endogenous factors. To be able to evaluate the results the model generates and to address internal validity considerations, I will start this discussion as simple as possible and proceed from there. Central to this discussion is a comparison of generated model results in scenarios where (i) voters are endowed with either complete or incomplete information, and (ii) access or no access to media outlets. The discussion will address two outcome variables in particular: i) the knowledge levels of voters as a function of exogenous variation in media systems (denoted by arrows III and IV in Figure 1), and (ii) the ‘representativeness’ of the evolved party systems (denoted by arrows V and VI in Figure 1). In addition, I will explore direct effects of mass media content on party behavior.

Data & Measurement

The main dependent variables in the model are the representativeness of the evolved party system and voter knowledge. Representativeness $R$ at time $T$ is measured as $R = \sum_{n=1}^{N} |I_{p,T} - I_{mv}|$. That is, the representativeness of a party system that has evolved after $T$ time periods in the model equals the sum of the absolute distances between the platforms of all parties $N$ and the ideological location of the median voter. More representative party systems are thus represented by smaller values of $R$. Voter knowledge $VK$ is measured as the average distance of voter beliefs from actual party platforms averaged across all $T$ time periods in the model and across all $V$ voters: $VK = \frac{1}{TV} \sum_{t=1}^{T} \sum_{v=1}^{V} \frac{1}{2}(|\pi(I_{1}) - I_{1}| + |\pi(I_{2}) - I_{2}|)$. As such, smaller values of $VK$ represent higher levels of knowledge. In the discussion that follows, the $VK$ will be recoded so that larger scores denote higher levels of knowledge as this makes more intuitive sense. In addition to the main dependent variables, I measure the average quality ($AQ$) of the media reporting: $AQ = \frac{1}{TN} \sum_{t=1}^{T} \sum_{n=1}^{N} c_{N}$, and the average share of
news-buying voters $NBV = \frac{1}{T} \frac{1}{V} \sum_{t=1}^{T} \sum_{n=1}^{V} B(1, q_v)$, where $B(1, q_v)$ is the result of a single Bernoulli trial with probability of success equal to $q_v$, a voter’s inclination to buy news.

In addition to these variables, I explore how endogenous voter knowledge may affect party turnover (Alternations) in office (simply measured as the number of elections in which the incumbent loses as a percentage of the total number of elections).

Observations for all variables are collected from Monte Carlo simulations wherein the number of media outlets $N$ as well as $\lambda$ are randomly varied. Table 2 contains the starting values and distributions for all parameters in the Monte Carlo simulations.
Voters With Complete Information

To start things simple, I will first investigate a scenario with completely informed voters. At this point, media outlets play no role because voters have no interest in paying for news as they can locate party platforms with no error already.\textsuperscript{17} When it comes to political competition among two office-motivated parties on a one-dimensional issue space, the benchmark result in political science is of course the median voter theorem (Downs, 1957). It posits that under these conditions, over time both parties will converge on the location of the median voter. This is a very strong theoretical prediction and it follows from comparably strong informational assumptions. The most obvious is of course complete information: parties know the exact distribution of voter ideal points, voters know the platforms of candidates and vote sincerely for their most-preferred platform (that is, the party that is closest to them ideologically).

Yet the current model shows that even if parties are initially unknowing of the location of the median voter a decision rule as simple ‘if an election is lost, move by increment $\delta$ in the direction of the winning party’ will generate results that closely resemble the median voter theorem. Central to this observation is the information that is contained in election results. That is, losing parties know that winning parties must be located closer to the median voter and will adjust their platform in that direction in response to losses in the voting booth. This can be observed from the time-series in Figure 4 which displays a single run of the model consisting of 100 time periods with completely informed voters. It shows that in this particular run, over time, parties converge on a platform that is located near the median voter.\textsuperscript{18} Figure 5 shows the distribution of absolute total distance between the median voter

\textsuperscript{17}Of course one could think of access to media reports as a consumption good, beneficial in and of itself (see for example Hamilton (2003)) but that would be a different model. For current purposes, all that matters is the informational value of reporting.

\textsuperscript{18}It should be noted that the decision rule is deterministic so that the moment parties have converged on identical platforms, they won’t change platforms again, even though they are not located at the ideal point of the median voter.
Note: The bold horizontal line denotes the location of the median voter. As time progresses both parties move ideologically towards the location of the median voter.

Figure 4: A Single Model Run With Complete Information Voters

and the platforms of both parties across 1000 runs of the model (see Table 2 for parameter settings). The smaller this value, the greater the ‘representativeness’ of the evolved party positions (e.g., Golder and Stramski, 2010; Laver and Sergenti, 2011). Related to this is the degree of political accountability: the greater the degree of representativeness, the more accountable parties are to the wishes of the median voter. Figure 5 shows that—most of the time—the specified party decision rule generates party configurations that are highly representative of the median voter as the median value of the representativeness distribution is as small as .02. This median representativeness will serve as a benchmark when evaluating the representativeness of evolved party systems when voters can learn from media content and media systems vary randomly.\footnote{This foray into a complete information scenario provides some evidence for the internal validity of the model: as is to be expected under such a scenario, party behavior is much in line with the median voter theorem, a central finding in the political science literature.}

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Note: The figure displays the ‘representativeness’ of the evolved configuration of party platforms across 1000 model runs with voters with complete information. The median of the distribution equals .02 (denoted by the dashed line), and the mean equals .01.

Figure 5: 1000 Model Runs With Complete Information Voters

Voters With Incomplete Information

The next step is to introduce incompletely informed voters (see e.g., De Marchi, 2003; Bendor, Diermeier and Ting, 2003; Jackson, 2003). Rather than being able to locate party platforms with certainty voters know hold beliefs about these platforms. To reiterate, initial beliefs are taken to follow a truncated (between 0 and 1) normal distribution $\text{TN}(I_p, 1, 0, 1)$, with mean equal to the party platform and standard deviation 1. That is, as a group voters are uncertain but initially unbiased. With these beliefs in place, there are two possible scenarios: one in which voters do not update their beliefs in response to information, and one in which they do. In the first (rather unrealistic) scenario, parties will again converge to identical platforms. Yet this platform is meaningless in the sense that it is not constrained by voter beliefs.\textsuperscript{20} That is, by coincidence one party will be perceived to be located closer to the

\textsuperscript{20}For an adaptive office-seeking party voter beliefs represent information with regards to voter preferences and thus the location of the median voter. With that in mind, one cannot think of parties that are not
median voter and will win all subsequent elections. The second party will respond—to no avail—by iteratively moving its platform in the direction of the winning party. In short, the specified party decision rule—in fact, all party decision rules that one could think of—becomes meaningless when the electorate consists of voters who are (i) wrong in their beliefs, and (ii) unresponsive to information to the contrary.

The more interesting scenario occurs when voters learn over time. In the model voters can learn either through the news media or through observing policy outcomes.\textsuperscript{21} I will first discuss the latter scenario. As noted before, news-ignoring voters only learn about the platform of the incumbent, not the challenger. Again parties will converge to identical platforms as this is hardwired in their specified decision-making process, but the location of convergence is much less responsive to the location of the median voter when compared with the complete information scenario. That is, the representativeness of the evolved configuration of party platforms is much lower in the incomplete information condition than it is in the complete information scenario. This can be seen in Figure 6 which displays the distribution of absolute total distance between the median voter and the platforms of both parties across 1000 runs of the model (see Table 2 for parameter settings).

Other than in the complete information condition (see Figure 5) when there is incomplete information parties are much less capable of settling at or near the location of the median voter. The median representativeness $R$ is .26 which is about one forth of the total policy space and much larger than the median of .02 in the complete information condition. The reason for this is simply that, from the perspective of the parties, tailoring to the preferences of the median voter that dynamically changes as the campaign progresses is simply a more difficult problem to solve. That is, from the perspective of parties, the electoral landscape is more ‘rugged’ than compared to the complete information scenario (De Marchi, 1999, 2003, affected by voter beliefs as being adaptive.\textsuperscript{21} Of course there are many more possible sources that one could think of but that are beyond the scope of this paper.
Note: The figure displays the ‘representativeness’ of the evolved configuration of party platforms across 1000 model runs with voters with incomplete information and no access to media outlets. The median of the distribution (which is denoted by the dashed line) equals .26, and the mean equals .33.

Figure 6: 1000 Model Runs With Incomplete Information Voters and No Media

In addition, voters receive noisy signals of party platforms as these signals are correlated with random policy shocks. As a result, voters will settle on beliefs that are crystallized but oftentimes wrong (as displayed in Figure 7). Since parties are constrained these beliefs, the evolved party configuration may diverge from the median voter.

All of this goes to show that the median voter could benefit from having media outlets report about party platforms. After all, when the median voter has better information, the evolved party system generally is more representative of the preferences of the median voter. In the next section I will discuss how different types of media systems may differentially affect the knowledge of electorate’s at large and the accountability of party competition.
Note: The figure displays average political knowledge of the electorate across 1000 model runs with voters with incomplete information and no access to media. The median of the distribution (which is denoted by the dashed line) equals .51, and the mean equals .49

Figure 7: 1000 Model Runs No Media

Voters With Incomplete Information and Access to Media Outlets

There are $N$ media outlets. Just like voters and parties, media outlets have ideological ideal points $I_n$. In the model, media outlets are motivated by audience share as well as by benefits that follow from being ideologically close to the incumbent party and these motivations are weighted by $\lambda$ (Hallin and Mancini, 2004). In addition, the number of media outlets is varied randomly (between 1 and 10 outlets on 1001 voters) to isolate the effect of the degree of competition in media systems on outcome variables. The discussion in this section will address two outcome variables in particular: (i) the representativeness of the evolved party systems, and (ii) the knowledge levels of voters, both as a function of exogenous variation in media systems. But first, I will first discuss descriptive statistics of the model results and some considerations regarding internal validity.
Descriptive Statistics and Internal Validity

Tables 3 lists the correlations and for the most relevant output variables in the model. At face value, most correlations make intuitive sense. For example, when voter knowledge increases, parties tend to settle at ideological platforms that are closer to the ideal point of the median voter ($\rho = -.07$).\(^{22}\) The reason is that as voters become more knowledgeable, they can better hold their parties accountable. Voter knowledge is also positively related with the number of media outlets ($\rho = .53$), the average quality of reporting ($\rho = .56$) and the share of the electorate that buys media reports ($\rho = .38$).

Table 3: Correlations

<table>
<thead>
<tr>
<th></th>
<th>VK</th>
<th>R</th>
<th>$\lambda$</th>
<th>N</th>
<th>AQ</th>
<th>NBV</th>
<th>MV</th>
<th>Alt</th>
</tr>
</thead>
<tbody>
<tr>
<td>VK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>-0.07*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda$</td>
<td>-0.04</td>
<td>-0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>0.53***</td>
<td>0.19***</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQ</td>
<td>0.56***</td>
<td>-0.11***</td>
<td>-0.03</td>
<td>0.23***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NBV</td>
<td>0.38***</td>
<td>-0.22***</td>
<td>-0.01</td>
<td>0.08*</td>
<td>0.78***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV</td>
<td>0.04</td>
<td>0.03</td>
<td>-0.04</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt</td>
<td>0.20***</td>
<td>0.64***</td>
<td>0.01</td>
<td>0.32***</td>
<td>-0.01</td>
<td>-0.17***</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

Note: VK = Voter Knowledge; $R =$ Representativeness; $AQ =$ Average Quality of News Content; NBV = Percentage of News-Buying Voters; $MV =$ Location of the Median Voter; $Alt =$ Number of Alternations in Office

Table 3 also shows that as the number of media outlets increases, the average quality of the news increases with it. That is, the model predicts that as competition among media outlets intensifies this is related to higher quality of reporting.\(^{23}\) In contrast to their number, the motivations (profit versus party) of media outlets does not seem to matter all that much. Audience-motivated media outlets are no better at attracting consumers ($\rho = -.01$) than are party-motivated media outlets and do not differ in the average quality of their reporting either ($\rho = -.03$). In addition, the degree of political-parallelism is only modestly related

\(^{22}\)Voter knowledge has been recoded so that higher scores denote increasing levels of average knowledge.

\(^{23}\)This may relate to the decreased average ideological distance between voters and media outlets as the number of media outlets increases. This in turn decreases the cost of information for voters which allows the media outlets to increase the quality of their content at no extra cost.
to either average voter knowledge ($\rho = -0.04$) or the representativeness of party competition ($\rho = -0.03$).

Table 4: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>VK</td>
<td>0.83</td>
<td>0.09</td>
<td>0</td>
<td>1</td>
<td>1000</td>
</tr>
<tr>
<td>R</td>
<td>0.19</td>
<td>0.12</td>
<td>0</td>
<td>0.55</td>
<td>1000</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>0.51</td>
<td>0.29</td>
<td>0</td>
<td>1</td>
<td>1000</td>
</tr>
<tr>
<td>N</td>
<td>5.61</td>
<td>2.91</td>
<td>1</td>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>AQ</td>
<td>0.63</td>
<td>0.18</td>
<td>0.01</td>
<td>0.99</td>
<td>1000</td>
</tr>
<tr>
<td>NBV</td>
<td>0.38</td>
<td>0.03</td>
<td>0.33</td>
<td>0.5</td>
<td>1000</td>
</tr>
<tr>
<td>MV</td>
<td>0.5</td>
<td>0.02</td>
<td>0.45</td>
<td>0.55</td>
<td>1000</td>
</tr>
<tr>
<td>Alternations</td>
<td>18.09</td>
<td>9.13</td>
<td>0</td>
<td>39</td>
<td>1000</td>
</tr>
</tbody>
</table>

Note: $VK =$ Voter Knowledge; $R =$ Representativeness; $AQ =$ Average Quality of News Content; $NBV =$ Percentage of News-Buying Voters; $MV =$ Location of the Median Voter; $Alt =$ Number of Alternations in Office

A result that is less intuitive is that as the number of media outlets goes up, this tends to decrease $R$, the representativeness of the evolved party system ($\rho = 0.19$). In part because increased competition among media outlets is positively related to voter knowledge, one would expect that increased competition among media outlets would lead to more accountable political competition. However, it should be kept in mind that the party strategy employs not just voter ideology but voters’ beliefs about the location of both parties. That is, parties tailor to the voter with the ‘median belief’ rather than the median voter. Additional analysis does in fact show that as the number of media outlets increases, parties locate themselves nearer to the voter with the median belief ($\rho = -0.27$).\textsuperscript{24}

Furthermore, $VK$ ($\rho = 0.20$), $N$ ($\rho = 0.32$) and $R$ ($\rho = 0.64$) are positively related to the number of alternations in office. In addition, Table 4 displays summary statistics for all

\textsuperscript{24}I should note that the exact causal mechanism of why increased media competition is related to decreased representativeness of party competition remains unclear at this point. It might be the case that because of the higher quality reporting and the larger percentage of news-reading individuals in competitive media systems, voters tend to crystallize their beliefs more quickly. However, these crystallized beliefs are wrong and as a result the Predator strategy becomes meaningless (much like in the ‘no media’ scenario discussed earlier), and parties arbitrarily settle in a location that is further from the median voter. However, this story is post hoc and speculative. The fact that all the intermediate variables are endogenous to each other makes it difficult to parse out the exact causal mechanism.
variables in the model.

**Implications of the Model: Simulation Results**

Figure 8 displays the evolved party configuration of party platforms across all types of media systems. It shows that the presence of media in itself does not affect the accountability of party competition. Across media systems, the representativeness of evolved party configurations is only slightly smaller (median = .17, mean = .19) than in the scenario with no media (Figure 6). However, the standard deviation of the distribution across runs of the model is much smaller than in the no media scenario. This implies that the presence of media outlets *per se* does not have an effect on the average representativeness of party systems, but that party systems are less likely to be excessively unrepresentative of the median voter in the

---

**Note:** The figure displays the ‘representativeness’ of the evolved configuration of party platforms across 1000 model runs with voters with incomplete information and access to media. The median of the distribution (which is denoted by the dashed line) equals .17, and the mean equals .19.

Figure 8: 1000 Model Runs With Incomplete Information Voters With Access To Media

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\(^{25}\) See Table 2 for the starting values and distributions for all parameters in the Monte Carlo simulation.
presence of media. The presence of competitive media outlets can thus be thought of as a necessary but not a sufficient condition for accountable political competition. For political competition to be accountable to the median voter, what is needed is that voter beliefs about party platforms are (i) correct\textsuperscript{26}, or (ii) close to the truth and responsive to political news. From this viewpoint, responsive party competition can be thought of as a function of the presence of mass media outlets in combination with certain individual voter characteristics present in the electorate.

Figure 9 displays voter knowledge across political systems.\textsuperscript{27} In contrast with the no media scenario (see Figure 7) voters on average are much better informed about party platforms and there is much less variation in voter knowledge. Across media systems the electorate at large thus benefits from having access to media outlets in keeping informed about policy platforms and keeping their representatives accountable.

Table 5 present the results of simple OLS regression models of voter knowledge, the representativeness of party competition and alternations in power on the number of media outlets ($N$) and the motivation of media outlets ($\lambda$). It shows that, across media systems, as the number of media outlets goes up, average voter knowledge increases but the representativeness of media systems decreases.\textsuperscript{28} In addition, media competition has a sizable effect on party competition, such that, all else equal, as the number of media outlets goes up, incumbent parties are more likely to get voted out of office.

$\lambda$ negatively affects voter knowledge such that, all else equal, as media systems are inhabited by profit-motivated outlets this negatively affects the political knowledge of the electorate at large.\textsuperscript{29} However, this effect is only marginally significant and too small in

\textsuperscript{26}See the results in section \textit{Voters With Complete Information.}

\textsuperscript{27}Voter knowledge is coded such that perfect knowledge receives a score of 1 and the knowledge level of the least knowledgeable voter receives a score of 0.

\textsuperscript{28}The regression of $VK$ is estimated with much more error than the regression of $R$ though. This implies that media competition is a better predictor of voter knowledge than of the accountability of party competition.

\textsuperscript{29}Separate analysis showed that increased media competition is associated with smaller variation knowledge
Note: The figure displays average political knowledge of the electorate across 1000 model runs with voters with incomplete information and access to media. The median of the distribution (which is denoted by the dashed line) equals .84, and the mean equals .82.

Figure 9: 1000 Model Runs With Media

size to be of substantive importance. In addition, \( \lambda \) has no independent effects on neither representativeness nor the competitiveness of party competition.

Up to this point, I have aggregated model results across media systems. In contrast, Figures 10 and 11 display the OLS regression estimates on voter knowledge of media competition across levels of media motivation and the effect of media motivation across levels of media competition respectively.\(^{30}\) Figure 10 shows that increased media competition is associated with higher levels of aggregated voter knowledge regardless of whether media are motivated by audience share or policy distance from the incumbent. The estimated effects are sizable across the board with small standard errors. Media competition thus has a clear positive effect on voter knowledge of electorates at large, a finding to which I will return in

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\(^{30}\)The lines denote the 95% confidence intervals for the parameter estimates.
Table 5: Voter Knowledge, Representativeness of Electoral Competition and Alternations in Office Across Media Systems

<table>
<thead>
<tr>
<th></th>
<th>Average Knowledge</th>
<th>Representativeness</th>
<th>Number of Alternations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS (1)</td>
<td>OLS (2)</td>
<td>OLS (3)</td>
</tr>
<tr>
<td>N</td>
<td>0.170*** (0.009)</td>
<td>0.082*** (0.013)</td>
<td>10.159*** (0.941)</td>
</tr>
<tr>
<td>Lambda</td>
<td>−0.019** (0.009)</td>
<td>−0.014 (0.013)</td>
<td>0.061 (0.951)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.743*** (0.007)</td>
<td>0.149*** (0.010)</td>
<td>12.354*** (0.756)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>R²</td>
<td>0.283</td>
<td>0.039</td>
<td>0.105</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.282</td>
<td>0.037</td>
<td>0.103</td>
</tr>
<tr>
<td>Residual Std. Error</td>
<td>0.079</td>
<td>0.119</td>
<td>8.647</td>
</tr>
<tr>
<td>F statistic (df = 2; 997)</td>
<td>196.733***</td>
<td>20.224***</td>
<td>58.320***</td>
</tr>
</tbody>
</table>

*** p < 0.01, ** p < 0.05, * p < 0.1

discussion of the hypotheses generated from the model.

When breaking down the effect of media motivation or political parallelism (as summarized by the aggregated OLS estimate for $\lambda$ in Table 5 across levels of media competition) it becomes obvious that it has no unambiguous, independent effect on voter knowledge regardless across levels of media competition. As such, the model does not generate clear predictions regarding the relationship between these two variables.

Figure 10: Voter Knowledge as a Function of Number of Media Outlets

Figure 11: Voter Knowledge as a Function of Media Motivation
Figures 12 and 13 display OLS parameter estimates for the effect of media competition (across levels of media motivation) and media motivation (across levels of media competition) on representativeness, respectively. Figure 12 provides tentative evidence that media competition is associated with party competition that is less representative of the median voter (higher $R$), although this result is not wholly unambiguous as not all estimates are significantly different from zero. Figure 13 clearly shows that the model produces no independent effects of media motivation regardless of the degree of competition among outlets.

Finally, the model generates—in addition to institutional-level results—interactive results as well since individual voters are characterized by their ideological ideal points. Figure 14 displays a second-order polynomial regression line of voter ideology on voter knowledge in scenarios with different degrees of media competition. First of, it shows that voters who are ideologically moderate tend to be more knowledgeable than voters at the ideological extremes, but only when the degree of media competition is low. As the degree of media competition increases, this effect of ideological moderation disappears. The reason for this finding lies with how the cost of media content is modeled. Because part of this cost stems from the ideological distance between a voter’s ideal point and that of the nearest media outlet, ideologically moderate voters are, on average, more likely to feel ideologically close to a newspaper. This implies in turn that the cost of media content is lowest for ideologically

\[ \text{Figure 12: Representativeness as a Function of Number of Media Outlets} \]

\[ \text{Figure 13: Representativeness as a Function of Media Motivation} \]
Note: The figure displays political knowledge for individual voters across different ideological ideal points, in increasingly competitive media systems. 1 denotes perfect knowledge.

Figure 14: Ideology and Voter Knowledge

moderate voters when media competition is low.\textsuperscript{31} In addition, Figure 14 also shows that ideology becomes a weaker predictor of voter knowledge as media competition increases.

**Hypotheses Generated From the Model**

As noted before, there are many moving parts in the model as voter beliefs and news consumption, party platforms and media reporting are all endogenous to each other. This is a mixed blessing. On the plus side of things is that the model generates many possible results. Yet on the down side not all of these results are equally convincing because—with all these endogenous relationships occurring at the same time—the exact data-generating process remains elusive at times. In this section, I briefly list the results that I believe are convincing enough to serve as hypotheses generated from the model.\textsuperscript{32}

\textsuperscript{31}Remember that media outlets’ ideal points are distributed $\operatorname{TN}(.5,1,0,1)$

\textsuperscript{32}Some of these hypotheses are under empirical scrutiny in a companion paper.
Increased media competition is associated with higher levels of aggregated voter knowledge regardless of whether media are motivated by audience share or policy distance from the incumbent (see Figure 10). This implies the following hypothesis:

**Knowledge Hypothesis:** In a comparison of countries, as national media systems become more competitive, on average, the electorate at large becomes better informed.

The model provides tentative evidence that media competition is associated with party competition that is less representative of the median voter (higher $R$) (see Figure 12). Therefore I cautiously posit the following hypothesis:

**Representativeness Hypothesis:** In a comparison of countries, as national media systems become more competitive, political competition becomes less representative of the electorate at large.

The model finds that, as the number of media outlets goes up, incumbent parties are more likely to get voted out of office (see Table 5). This implies the following hypothesis:

**Alternations Hypothesis:** In a comparison of countries, as national media systems become more competitive, on average, alternations in government are more likely to occur.

Voters who are ideologically moderate tend to be more knowledgeable than voters at the ideological extremes, but only when the degree of media competition is low (see Figure 14). In addition, ideology becomes a better predictor of voter knowledge as media competition increases (see Figure 14). This implies the following two-part hypothesis:
Ideology and Media Systems Hypothesis: In a comparison of countries and individuals, as national media systems are less competitive, (i) ideologically moderate voters are, on average, better informed than voters at the ideological extremes. and (ii) ideology becomes a weaker predictor of voter knowledge.

Conclusion

This paper presented an agent-based model of media systems, political competition and voter knowledge. The model has both its strengths and its weaknesses. To begin with the latter, I should start by emphasizing that, without a doubt, the behavioral assumptions make this model very abstract. For example, voters have no stable individual characteristics but their ideology. In reality of course, citizens are all but homogeneous and behavioral research has shown time and again that stable individual-level characteristics other than ideology are important when it comes to explaining citizens’ political behavior and attitudes. Furthermore, all that links the behavior of the actors in the model is quality of information. At the same time, media bias does not exist. Again, this is a simplification from what we observe in the real world where voters, parties and media outlets are linked in more ways than just through supply and demand for information about party platforms and media bias surely does exist. In addition, the behaviors of the actors in the model are endogenous to each other which at times makes it difficult to pin down the data-generating process for some of the outcome variables. For example, it is unclear what exactly explains the Representativeness Hypothesis. Why exactly would an increase in media competition lead to an increase in aggregated voter knowledge but a decrease in the representativeness of party competition? All else equal, a positive correlation between voter knowledge and representativeness seems more intuitive since that would imply that, on average, high information electorates are

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33The American case with conservative FOX News and liberal MSNBC serves as a prime example here.
better able to keep their representatives in check. As a last point of criticism on the model, I should mention it has not captured media motivations very well (or ‘political parallelism’ (Hallin and Mancini, 2004)). That is, the behavioral rule I specified was not at all sensitive to variation in the $\lambda$ parameter and as a result there was no effect of media motivation on any of the outcome variables (see Figures 11 and 13).

That being said, I also believe that the model could serve a contribution to the study of media effects and voter knowledge. To begin with, it generates testable predictions about the interrelationship between media systems knowledge, party behavior and the characteristics of electoral competition building from a set of intuitive assumptions about the behavior of actors involved. Some hypotheses, like the Knowledge Hypothesis, are somewhat unsurprising and refer to what the model was set out to explain in the first place. Other hypotheses such as the Ideology and Media Systems Hypothesis and the Alternations Hypothesis are novel and generated from the model. The Ideology and Media Systems Hypothesis in particular is a model-based hypothesis that makes an interesting and testable claim about the interrelationship between political knowledge of individual citizens and the characteristics of the media systems they find themselves in. As such, it provides theoretical backing of the interactive approach that work in public opinion and voter knowledge has taken in recent years (Jerit, Barabas and Bolsen, 2006; Jerit, 2009; Barabas and Jerit, 2009).
References


