Media Systems and Voter Knowledge: A Theoretical Model and Empirical Evidence

A Dissertation Presented

by

Hendrik Jakob Martijn Schoonvelde

to

The Graduate School

in Partial Fulfillment of the Requirements

for the Degree of

Doctor of Philosophy

in

Political Science

Stony Brook University

May 2013

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Stony Brook University

The Graduate School

Hendrik Jakob Martijn Schoonvelde

We, the dissertation committee for the above candidate for the Doctor of Philosophy degree, hereby recommend acceptance of this dissertation.

Charles Taber – Dissertation Advisor
Professor, Department of Political Science

Martin Steinwand – Chairman of Defense
Assistant Professor, Department of Political Science

Oleg Smirnov
Associate Professor, Department of Political Science

Jennifer Jerit
Associate Professor, Department of Political Science
Florida State University

This dissertation is accepted by the Graduate School.

Charles Taber
Dean of the Graduate School

Abstract of the Dissertation

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2013

This dissertation presents and tests a theoretical model of electoral competition in the presence of mass media in which media effects on voter knowledge are endogenous to variation in media systems. To this end, I first explore empirically the connection between media systems and political knowledge of citizens across 22 countries. I find that media freedom has a positive effect on voter sophistication for electorates at large. Using cross-level interactions analysis, I also find that this effect is larger for better educated voters than for voters with less education. I then present a formal, agent-based model of electoral competition and voter knowledge across media systems. The model presents—to the best of my knowledge—the first attempt of modeling the endogenous interactions of voters, parties and media outlets in the context of varying media systems. As such, it generates novel hypotheses about the mediated underpinnings of the representativeness of electoral competition and citizens' political knowledge. The next chapter discusses the (admittedly mixed) empirical evidence for the hypotheses generated from the model.

To My Mother

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Chapter 1

Media Systems, Voter Knowledge and Electoral Systems

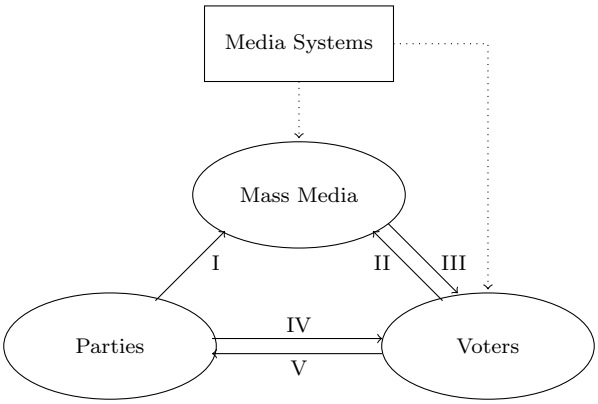
This is a dissertation about voter knowledge, electoral competition and the media systems that underpin them. It explores how characteristics of national media systems are linked to variation in voter knowledge. In particular, it analyzes how competitiveness of media systems as well as alignment between party systems and media systems are linked to what voters know about politics. In the process, it makes a number of assumptions. It first supposes that voter knowledge is of central importance to electoral competition in representative democracies. In fact, it conceives of voter knowledge as a necessary condition for accountable political competition considering voters need political information to meaningfully evaluate their representatives in the voting booth. In addition, it understands political knowledge as not just a function of certain individual characteristics of voters but of the supply of political information that is available from their institutional environment as well. As such, it takes an *interactive* approach to the study of voter knowledge, acknowledging the importance of both behavioral and institutional factors. Third, it assumes that media outlets constitute—

by definition almost—an important factor mediating between national electorates and their political representatives as—even in this day and age of new media—most voters learn about politics from traditional mass media outlets.[1] With varying degrees of success, these outlets help voters overcome the problem of *rational ignorance* (Downs 1957) by taking party platforms and repackage them into *news*. This dissertation thus finds political information disseminated by mass media to be located at the heart of electoral competition. Political information is what links parties and voters. It is the 'currency of democratic citizenship' (Kuklinski et al. 2003).

Figure 1.1 displays these viewpoints 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.

To examine the interactions in Figure 1.1, in Chapter 2 I will first explore the empirical connections between media systems and voter knowledge across 22 democracies with varying levels of media freedom and media competition (the dotted lines in Figure 1.1). The results of this exploratory analysis will inform an agent-based theoretical model (Chapter 3) of party competition and voter knowledge across randomly varying media systems. In essence, this model intends to capture what goes on at the solid lines in Figure 1.1. The model explores two outcome variables in particular: (i) voter knowledge (as a function of III and IV), and (ii) representativeness of party competition (as a function of I and II). In addition,

[1]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: `http://people-press.org/report/652/`.



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

Figure 1.1: A Model of Media Systems, Information and Political Competition

the model generates novel hypotheses with regards to voter information and the turnover rate of political parties (VI) as well as the cross-level interactions between individual voter characteristics and characteristics of the media systems at large in their effect on voter knowledge. All these hypotheses are the subject of empirical scrutiny in Chapter 4 using a different set of comparative data.

In the next section I will briefly survey the literature on voter knowledge taking into account the assumptions I have listed above. I will then turn to the theoretical and empirical contributions of this dissertation as well as a chapter-by-chapter outline.

1.1 Theoretical Background

Voter knowledge is a topic that touches on numerous fields in the social sciences. Of course it is rooted in public opinion studies in political science. But models of learning and information-processing from psychology and economics have contributed much to our understanding as well. Furthermore, the behavior of media outlets is at the core of media economics, whereas communication studies has produced seminal work on media systems (Hallin and Mancini 2004). In this section I will discuss (i) work in political science addressing media effects on voter knowledge, (ii) work on the economics of media content, and (iii) a seminal typology of media systems from communication studies. Furthermore, individual chapters will include brief reviews of the literature that are targeted more specifically to the topics at hand.

1.1.1 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. These 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.[2] 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 on-line 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).

The advent of more sophisticated multilevel 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 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 knowlede, 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." In a comparison of the twelve pre-1995 member states of the European Union (EU), these authors find that factors such as a the competitiveness of electoral systems as well the effective number of parties that make up party systems have significant positive effects on average political knowledge of citizens.

Following this line of reasoning, variation across mass media outlets should affect the elec-

[2]For an opposite view see the heuristics and biases literature (e.g., Kahneman, Slovic and Tversky 1982)

torate'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 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 Boomgaarden (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. Exposure to news outlets with less political content has either no effects or slightly positive effects, depending on the type of content. But it is not just the volume of the news that matters but also the way the news is packaged. In a follow-up 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. 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. This point of view resonates strongly with the idea of political knowledge as a choice rather than a cognitive trait.

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. 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 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 addition, congressmen who are less covered by the local press work less for their constituencies: they are less likely to stand witness before congressional hearings, to serve on constituency-oriented committee, and to vote against the party line. Finally, this congressional behavior affects policy. Federal spending is lower in areas where there is less press coverage of the local members of congress. 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 economic 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 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[3]. 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.[4] 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)

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

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

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.[5]

In sum, voter knowledge can be understood as a function of both individual-level characteristics and the media-institutional environment. With respect to the latter, theoretical and empirical research in the American context shows that—when it comes to political reporting—media outlets tend to respond to consumer demand for political news. In addition, theoretical work also shows that the accuracy of political news may affect electoral competition. In short, mass media outlets respond to demand side factors. To explore how supply side factors may affect mass media reporting, I will turn to comparative studies of media systems next.

1.1.2 Voter Knowledge Across Media Systems

Comparative political communication research as a field of study has flourished since the publication of *Comparing Media Systems: Three Models of Media and Politics* (Hallin and Mancini 2004) which presents a conceptual framework of media systems as varying on four principal dimensions: (i) structure of media markets, (ii) political parallelism, (iii) professionalization of journalism, and (iv) the role of the state. The structure of media markets is mostly concerned with the degree to which a country can be described as having a strongly developed mass circulation press with clear boundaries between sensationalist and quality press. Political parallelism refers to the "fact that media in some countries have distinct political orientations, while media in other countries do not." (Hallin and Mancini 2004, p.27). Professionalization of journalism concerns the development of journalism as a discipline with distinct professional norms and rules. Finally, the role of the state refers to the degree to

[5]In 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'

which the state interferes with a media system as an owner, a regulator or subsidizer.[6]

One can think of these dimensions as underpinning the behavior of individual media outlets in a country. Put differently, these dimensions may shape the costs and benefits for individual media outlets of supplying political information and thus voter knowledge. There is some evidence—both theoretical and empirical—for this point of view, most of which concerns the role of the state in media systems. For example, Besley and Prat (2006) find that more competition among media outlets makes it more difficult for government to capture these media, which makes government-induced media slant less likely. In other words, increased competition reduces bias resulting from capture by governments. This result is corroborated by some empirical findings. For instance, Leeson (2008) studies media freedom from government control and political knowledge in 13 central and eastern European countries. He finds that "falling from the highest level of media freedom in the sample to the lowest is associated with a 42 percent increase in political ignorance" (p.160). Djankov et al. (2003) find that private media ownership (in contrast to state owned media) is associated with improved social outcomes regarding citizens' health, wealth and life span. In a comparison of market-driven (United States) versus public sector (Finland and Denmark) systems, Curran et al. (2009) find that the latter devotes more attention to public affairs and international news, and fosters greater knowledge among citizens in these areas than the former.

To summarize, research on comparative media systems shows that voter knowledge changes with the degree to which the state interferes with the media system. Yet it remains unclear how exactly other dimensions underpinning media systems can be more or less conducive to voter learning. In particular, how are competitiveness of media systems as well as alignment between party systems and media systems ('political parallelism') are

[6]Hallin and Mancini explain that these dimensions co-vary with the political context. As such they recognize three types of media systems: the Polarized-Pluralist Model, the Corporatist Model and the Liberal Model.

linked to what voters know about politics? These are questions that I address—both theoretically and empirically—in this dissertation.

1.2 Contributions of this Dissertation

To advance our understanding electoral competition in the presence of mass media, this dissertation presents a theoretical model in which all media effects are endogenous to variation in media systems (see Figure 1.1). This viewpoint reflects Strömbäck (2008, p. 234) who notes: "What is thus required is a conceptualization of media influence that is sensitive to and recognizes the interactions and interdependencies of media systems, institutions and actors, political systems, culture, and sense making." This dissertation project aims to contribute to that goal and in the process contributes to the study of voter knowledge and electoral competition in the following ways:

- It links existing research on voter information and electoral competition to media systems research and as such, I believe, it advances our understanding of the "information environment" from which many individuals receive their political information. Instead of treating media reports as the exogenous starting point for the study of voter attitudes and behavior, this dissertation explores how variation in media systems may change media outlets' incentives to report about politics, and with it, political knowledge and electoral competition.

- Chapter 2 finds that media freedom has a positive effect on voter sophistication for electorates at large. Using cross-level interactions analysis, it also finds that this effect is larger for better educated voters than for voters with less education. These results extend the *interactive* approach to the study of voter knowledge (see, for example,

Jerit, Barabas and Bolsen 2006; Jerit 2009; Barabas and Jerit 2009) to a cross-national setting.

- The formal, agent-based model of electoral competition and voter knowledge across media systems that is presented in Chapter 3 represents—to the best of my knowledge—the first attempt of modeling the endogenous interactions of voters, parties and media outlets in the context varying media systems (but see Smirnov and Woodson 2011). As such, this model generates novel hypotheses about how electoral competition and voter knowledge may depend on competitiveness of the media system. In addition, it finds that the strength of stable individual characteristics such as self-reported ideology as a predictor of ideology is context-dependent as well. The empirical analyses in Chapter 4 provide some tentative evidence for the empirical implications of the model.

Although I am confident that this dissertation makes for an interesting and important contribution to the study of voter knowledge and electoral competition across media systems, I should also point to what this dissertation does not do. Most importantly, the empirical chapters in this dissertation do not contain measures of (i) actual media content, and (ii) voter exposure to this content. Instead I link variation in media systems directly to voter knowledge without these intervening variables. I have reasons for this that are both empirical and theoretical. Theoretically, this dissertation is more concerned with the ultimate causal connection between media systems and voter knowledge than proximal media effects (the dotted lines in Figure 1.1). With that in mind, I am using a measure of voter knowledge that I belief is highly relevant to party competition but that is abstract rather than issue-specific. This measure allows me to compare voter knowledge across a large number of countries and to explore interesting variation across media systems but cannot be plausibly linked to issue-specific voter knowledge and media content. The down side of this is of course that the

empirical evidence I present does not capture any of the intermediate interactions that are part of the model, but instead links input to output variables (i.e. variation in media systems to voter knowledge and representativeness of party competition). As such, the empirical evidence does not serve as a true test of the data-generating process in the model but instead as preliminary evidence that the hypotheses the model generates are plausible. With that in mind, I believe that an empirical strategy that allows me to include as many observations as possible (through an abstract but highly relevant measure of voter information) at the expense of the exact causal mechanism at the intermediate level, is warranted.[7]

1.3 Outline of this Dissertation

This section briefly outlines this dissertation on a chapter-by-chapter basis. To reiterate, this dissertation explores how cross-national variation in media systems may affect the information voters hold about their political representatives and with it, the degree of accountability of party competition. I do so using both empirical analysis as well as through a formal, agent-based model that I believe captures the most relevant aspects of media systems, following a seminal typology by Hallin and Mancini (2004).

Chapter 2 presents empirical evidence that voters who live in media systems that are more free from government interference are, on average, more knowledgeable about politics than voters in media systems that are less free, and the marginal effect of education is more pronounced in free media systems than it is less free media systems. These results are likely the result of increased supply of political information in free media systems, as evidenced by the strong positive correlation between media freedom and newspaper circulation. In free

[7]The "Advancing Understanding in News Information, Political Knowledge and Media Systems Research" project I will be working on at the University of Exeter (with Susan Banducci, Dan Stevens, Jennifer Jerit, Jason Barabas and William Pollock) revolves around constructing a dataset that actually goes into linking characteristics of media systems at large, intermediate media reports and individual voter data.

media systems, individual outlets are less likely to be 'captured' by the government leading to a more heterogeneous, competitive and less constrained information environment, which (i) positively affects the political knowledge of the electorate at large, yet (ii) it benefits well-educated voters more than less-educated voters. These findings help inform the assumptions underlying the agent-based model that is presented in Chapter 3. At the heart of this model are the (simplified) interactions between voters, parties and media outlets that occur over the course of several political campaigns. 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. 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 *Representativeness Hypothesis*[8]. In addition, it predicts that more competitive media systems are associated with more alternations in government*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. In addition, ideology becomes a better predictor of voter knowledge as media competition increases (i.e., the *Ideology and Media Systems Hypothesis*. These hypotheses are then tested in Chapter 4, which uses the CSES (2007) data set to explore the evidence for the empirical implications of the agent-based model in Chapter 3. The results are mixed. On the one hand, I find corroborating evidence for the main finding in Chapter 2 that media freedom is positively related to the political knowledge of the public at large (i.e., *Knowledge Hypothesis*). And although this particular finding was what informed

[8]see Chapter 3 for a discussion on the plausibility of these hypotheses

the model in the first place, I also find some evidence for the model-generated *Ideology and Media Systems Hypothesis*: at the individual level, ideology is becoming a worse predictor of voter knowledge as media systems are more free from government interference. On the other hand, I do not find any evidence for the *Representativeness Hypothesis*: media freedom does not relate to the accountability of political competition as measured in this chapter. Furthermore, it does not appear that the cross-level interaction effect between media freedom, ideology and voter knowledge is as clear-cut as predicted by the first part of the *Ideology and Media Systems Hypothesis*. Chapter 5 ties together the findings of the preceding chapters, as well their strengths and weaknesses and briefly concludes.

Chapter 2

Exploring Media Systems and Voter Knowledge

2.1 Introduction

Recent empirical work in the study of political sophistication has found that voters' knowledge of politics is not just a function of their individual characteristics but depends on the supply of information from their environment (the 'information environment') as well (Prior 2005; Jerit, Barabas and Bolsen 2006; Jerit 2009; Barabas and Jerit 2009; Hutchings 2003). A key finding from this literature is that different groups of citizens learn at different rates about politics depending on the information that is available to them from the media. Yet this literature leaves unaddressed the question of what exactly constitutes the information environment. This paper aims to fill this void. It first explains why characteristics of media systems—most freedom from government interference—compose an important ingredient of the information environment. It then studies if variation in government interference in the media sector impacts the political sophistication of electorates at large, as well as particular

groups of voters. To this end, it examines citizen knowledge across 22 countries using the first wave of the Comparative Study of Electoral Systems dataset and national-level data on the media from Freedom House's *Freedom the Press Report*. It finds that media freedom does in fact have a positive effect on political sophistication for electorates at large. Using cross-level interactions analysis, it also finds that this effect is larger for better educated individuals than for individuals with less education.

This chapter proceeds as follows. In the following subsection I present my hypotheses. Subsequently, I discuss the data, followed by the results of estimated statistical models. I finish with some concluding remarks.

2.1.1 Hypotheses

In line with the institutional approach to voter learning in the aforementioned studies, the main argument of this chapter is that the institutional characteristics of media systems can be conducive to voter learning. A seminal paper in media economics (Besley and Prat 2006) finds that as the number of independent media outlets increases, *capture* of the media by the government is less likely to occur. That is, if a media market is becoming more diverse it becomes more difficult for political elites to constrain the supply of political information to voters. From this perspective, it makes sense to think of media freedom (as well as increased competition among media outlets) as conducive to voter information, simply because the 'information environment' is more heterogeneous and less constrained. This leads me to the first main hypothesis to be tested in this chapter:

Knowledge Hypothesis: Voters who live in media systems that are more free from government interference are, on average, more knowledgeable than voters in media systems that are less

free.

The Knowledge Hypothesis is in line with the findings in Leeson (2008). The current chapter improves on that study in at least three different ways. It first expands the sample of countries from 13 central and eastern European countries to over 20 countries on 5 different continents. Second, it uses a more satisfying measure of voter sophistication (to be discussed in the next section). And third, the multi-level modeling approach that I employ allows me to test cross-level interactions among types of voters and their institutional surroundings. The estimated multilevel models in this chapter include individual-level variables that have been named 'the usual suspects' (Prior 2005; Jerit, Barabas and Bolsen 2006; Jerit 2009; Barabas and Jerit 2009) of behavioral models of voter sophistication: education, income, etc. As noted, Jennifer Jerit and colleagues find a moderating effect of the information environment on the impact these factors have on knowledge. Extending their findings to a cross-national context, I expect that education and media freedom interact in their effect on voter knowledge: increased media freedom corresponds to more choice among media outlets, but individuals with more education are in a better position to learn from this increasingly diverse information environment than are voters who are less educated. This leads me to the second main hypothesis in this chapter:

Education Hypothesis: In a comparison of countries and voters, the marginal effect of education level on voter knowledge is larger in free media systems than it is in media systems that are less free.

The following section of this chapter discusses the data and the measurement of all variables in the models.

Data and Measurement

Data

Data for this research comes from a number of sources. Individual-level and country-level political data are from the first module of the Comparative Study of Electoral Systems (CSES), a cross-national research program among over fifty national election studies. Its first module contains data on elections in the period 1996–2001. Information on media freedom in those 22 countries is from Freedom House's annual Freedom of the Press Report. Freedom House is a U.S.-based non-governmental organization (NGO) that conducts and publishes research in the form of annual reports on democracy, political freedom and human rights. Political and media control variables are from UNESCO's Institute for Statistics, Golder (2005), and Baek (2009).

Dependent Variable: Voter Knowledge

Voter knowledge can be thought of and measured in many different ways, ranging from the abstract to the more concrete. Each measure comes with its own strength and weaknesses. For example, a more concrete measure would simply tally voters' ability to correctly answer a set political knowledge questions. Yet the problem with this type of measure in a cross-national context is that it is difficult to compare across countries. That is, what is considered concrete political information in country A is often different from concrete political information in country B. To be able to compare voter information across countries a more abstract measure is required that (i) applies to all counties involved, and (ii) is of central importance to voters in the electoral process. Gordon and Segura (1997) have developed a measure that has both these qualities. These authors think of voter information as the abil-

ity of voters to correctly locate parties' ideological preferences. After all, for voters to keep their representatives accountable it is necessary that they know their policy preferences and the better they are at this, the more information they must have. More concretely, Gordon and Segura measure voter knowledge as the average sum of the absolute distances between a respondent's placement of a polity's political parties on a one-dimensional ideological scale and their mean placements by all other respondents.[1]

This paper uses a similar approach, measuring knowledge as the absolute between an individual's perception of the largest party's ideological location to the mean perception of the electorate at large. That is, political knowledge is measured as $|L_{ij} - \bar{L}_j|$, where L_{ij} is individual i's perception of the ideological location L of party j and $\bar{L}_j$ is the perception of the electorate at large of the ideological position L of party j on a 10-point ideological scale.[2] This measure is constructed from CSES data (CSES 2003). To make the results more intuitive, the knowledge variable is inverted so that larger values of $|L_{ij} - \bar{L}_j|$ correspond to higher levels of knowledge. The variable is logged and re-coded so that fits a normal distribution and varies between 0 and 1.

Independent Variables

The main independent variable in this paper is Freedom House's annual media freedom measure. This is a substantive and continuous measure of press freedom that assigns scores to countries related to government interference in the media sector. This measure is a scale that varies between 0 (most free) and 100 (least free) and that is constructed from 23 items

[1] An important caveat is in place here in that his measure assumes that the mean of the distribution of perceived party locations is in fact that party's correct location. Gordon and Segura find voters' mean assessment to be strongly correlated with expert assessments by researchers in the field as well as the assessment of party members (Gordon and Segura 1997).

[2] To increase comparability across as many countries as possible, I only focus on voters' ability to locate the largest parties in their polity.

that are subdivided into three equally-weighted subcategories: legal environment, political environment and economic environment. The legal environment subcategory encompasses "an examination of both the laws and regulations that could influence media content and the governments inclination to use these laws and legal institutions to restrict the media's ability to operate."[3] In principle, this subcategory assess the extent to which the legal framework in a country guarantees freedom of expression, and the independence of the judiciary and media regulatory bodies. It consists of 8 individual items on which countries between 0 and 30 points (these points are scored by regional and professional experts employed by Freedom House). The political environment subcategory denotes the degree of political control over the content of the media (7 items, scores between 0 and 40 points). This subcategory assesses "the editorial independence of both state-owned and privately owned media; access to information and sources; official censorship and self-censorship; the vibrancy of the media and the diversity of news available within each country; the ability of both foreign and local reporters to cover the news freely and without harassment; and the intimidation of journalists by the state or other actors." The economic environment category (8 items, 0 to 30 points) includes "the structure of media ownership; transparency and concentration of ownership; the costs of establishing media as well as of production and distribution; the selective withholding of advertising or subsidies by the state or other actors; the impact of corruption and bribery on content; and the extent to which the economic situation in a country impacts the development and sustainability of the media." In other words, it measures the economic cost of establishing a media outlet in a country.

The scores on this Media Freedom variable have been inverted and re-scaled so that a 0 denotes the country in the sample with the most media interference (Belarus in 2001) and 1

[3]The citations in this section were taken from the Freedom House website (accessed May 2013) at `http://www.freedomhouse.org/report/freedom-press-2012/methodology`

denotes the country with the least media interference (Norway in 1997).

Furthermore, I control for a number of media system variables. A *Herfindahl Index* measures media market competitiveness (Hirschman 1964). Theoretically, a Herfindahl index ranges from 0 to 1 where 0 denotes a perfectly competitive industry and 1 denotes a monopoly. The index H is calculated as follows: $H = \sum_{i=1}^{N} s_i^2$ where s_i is the market share of firm i in the market, and N is the number of firms. The models in this paper include indices for both the television and the newspaper industries. Both indices were calculated using data from Djankov et al. (2003) on countries' five largest newspapers and television channels in terms of market share. *Public Broadcasting Percentage* measures audience share of public broadcasting channels as a percentage of total audience size of the five largest television stations (Baek 2009). *Newspaper Demand* is measured as the number of daily newspaper subscribers per capita in the population with daily newspapers referring to those publications appearing at least four times a week. This variable is from UNESCO's Institute for Statistics.

In addition to these media system variables, the models in this chapter also include a number of political control variables. *Political System* is a dummy variable that takes on 1 if a country in in the year of the election had a parliamentary system and 0 otherwise (i.e., presidential or mixed).[4] *Majoritarian* is a dummy variable that takes on 1 if a country in the year of the election had a majoritarian electoral system and 0 otherwise (i.e., proportional or mixed).This variable is taken from Golder (2005). *Compulsory Voting* is a dummy variable that takes on 1 if a country has compulsory voting laws and 0 otherwise. This variable is taken from CSES (2003) and its inclusion intends to capture the idea that in countries where voting is mandatory, this may affect voters willingness to learn about parties. *Party*

[4]The CSES data also include data on Belarus and Peru. Since both countries can be considered dictatorship they were dropped from consideration.

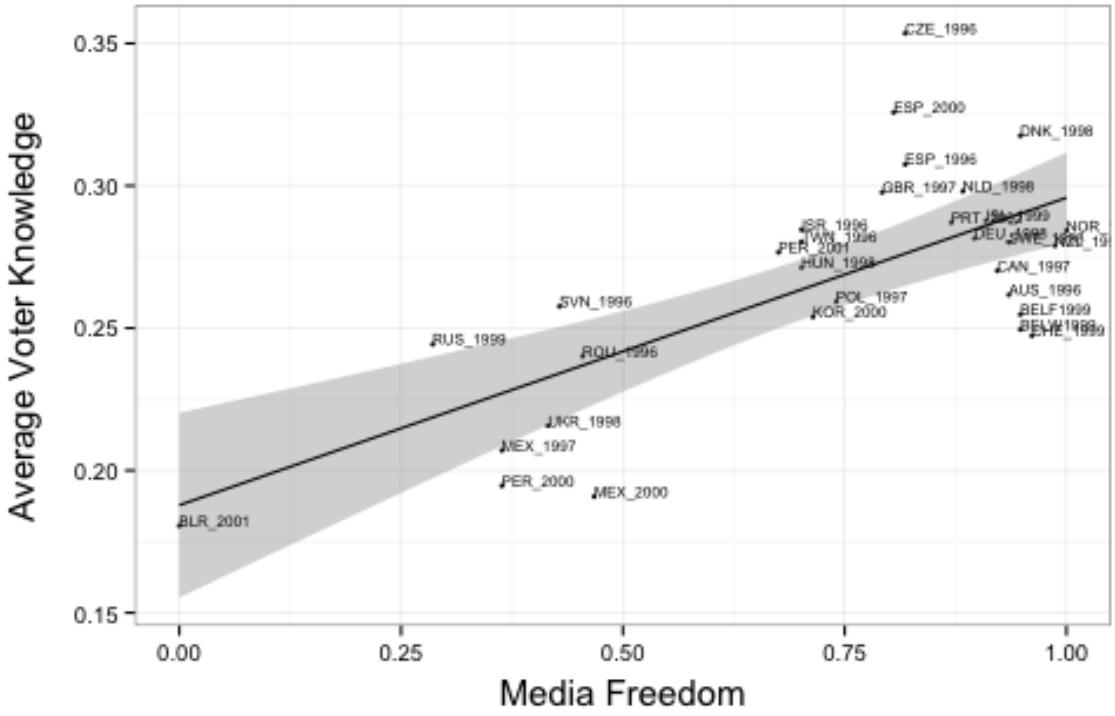
List is a dummy variable that takes on 1 if a country has party lists and 0 otherwise. This variable is taken from CSES (2003) and its inclusion intends to capture party strength. In electoral systems where parties are strong, individuals are expected to be more knowledgeable about parties' ideologies. *Effective Number of Legislative Parties* denotes a weighted count of the number of parties in each electoral system (Laakso and Taagepera 1979; Taagepera 1997). This variable is taken from Golder (2005) and intends to control for variation in the complexity of party systems.

Furthermore, I include a number of individual-level control variables. *Education* is measured on a scale from 1 (no education) to 8 (university undergraduate degree completed). *Income* is measured on a scale from 1 (lowest household income quintile) to 5 (highest household income quintile). *Age* is measured in years. *Union Membership* is a dummy variable that takes on 1 if a respondent is member of a union and 0 otherwise. To enhance ease of interpretation, all individual-level variables have been recoded to range from 0 to 1.

Analysis & Results

The statistical models I estimate in this chapter require much from the data. In order to extend the robustness of the statistical results to as many elections as possible, I estimated both a completely specified model (with controls for both political and media factors) on 28450 individuals in 23 elections, and nested models (with political controls alone) on 37077 individuals in 31 elections. Table 2.1 lists the elections that are under study in all of the estimated models.

Figure 2.1: Media Freedom and Voter Knowledge, Averaged Across Countries



2.1.2 Descriptive Statistics

Figure 2.1 pictures the raw, linear relationship between voter knowledge and media freedom, averaged across countries. This figure clearly displays the positive correlation between both variables: on average voters tend to be more knowledgeable about politics as a country's media system becomes more free.[5] Tables 2.2 and 2.3 displays the summary statistics for all variables in the model. Table 2.2 demonstrates that the Herfindahl index for the newspaper market does not vary all that much. That is, almost all countries in the data set are characterized by highly competitive newspaper markets. This may obscure a potential effect

[5]A graphical diagnostics analysis of both variables indicated the Mexico '97, '00 and the Czech Republic surveys had comparably large error terms, whereas the Mexico '00 survey appeared to be relatively influential as well. Exclusion of these surveys, however, did not substantively alter the pooled OLS relationship between nationally averaged voter knowledge and media freedom

Table 2.1: Elections Under Study

Country	Year	Model 1	Model 2	Model 3	Media Freedom Score
AUSTRALIA	1996	✓	✓	✓	0.94
BELGIUM-FLANDERS	1999	✓	✓	✓	0.95
BELGIUM-WALLONIA	1999	✓	✓	✓	0.95
BELARUS	2001		✓	✓	0.00
CANADA	1997	✓	✓	✓	0.92
CZECH REPUBLIC	1996	✓	✓	✓	0.82
DENMARK	1998	✓	✓	✓	0.95
GERMANY	1998	✓	✓	✓	0.90
GREAT BRITAIN	1997	✓	✓	✓	0.79
HUNGARY	1998	✓	✓	✓	0.70
ICELAND	1999		✓	✓	0.91
ISRAEL	1996		✓	✓	0.70
KOREA	2000		✓	✓	0.71
MEXICO	1997	✓	✓	✓	0.36
MEXICO	2000	✓	✓	✓	0.47
NETHERLANDS	1998	✓	✓	✓	0.88
NEW ZEALAND	1996	✓	✓	✓	0.99
NORWAY	1997	✓	✓	✓	1.00
PERU	2000		✓	✓	0.36
PERU	2001		✓	✓	0.67
POLAND	1997	✓	✓	✓	0.74
PORTUGAL	2002		✓	✓	0.87
ROMANIA	1996	✓	✓	✓	0.45
RUSSIA	1999	✓	✓	✓	0.29
SLOVENIA	1996	✓	✓	✓	0.43
SPAIN	1996	✓	✓	✓	0.82
SPAIN	2000	✓	✓	✓	0.81
SWEDEN	1998	✓	✓	✓	0.94
SWITZERLAND	1999	✓	✓	✓	0.96
TAIWAN	1996		✓	✓	0.70
UKRAINE	1998	✓	✓	✓	0.42

of market competitiveness on voter knowledge. Bivariate correlations among all variables are listed in Table 2.3. The correlation between between media freedom and per capita newspaper circulation is positive and high ($r = .58$). Thus an increase in media freedom is associated with a larger number of daily newspaper subscribers per capita.

Table 2.2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Political Knowledge	0.27	0.15	0	1	43635
Income	0.49	0.34	0	1	54103
Education	0.56	0.25	0	1	61546
Union Membership	0.26	0.44	0	1	52151
Age	0.35	0.19	0	1	59877
Parliamentary Dummy	0.46	0.5	0	1	62409
Compulsory Voting Dummy	0.28	0.45	0	1	62409
Party List Dummy	0.49	0.5	0	1	62409
Majoritarian Dummy	0.24	0.43	0	1	60735
Effective Number of Electoral Parties	4.44	2.07	2.12	9.73	57001
Media Freedom	0.75	0.24	0	1	60735
Newspaper Market Competitiveness	0.08	0.06	0	0.23	59104
Television Market Competitiveness	0.22	0.1	0.03	0.41	56801
Newspaper Circulation per Capita	0.21	0.13	0.02	0.59	59018
Public Broadcasting Pct.	0.47	0.27	0	0.96	58104

Table 2.3: Correlations

	VK	IN	ED	UN	Age	PD	CV	PL	MD	ENP	F	NC	TC	NN
VK														
IN	**0.08**													
ED	**0.08**	**0.37**												
UN	-0.01	**0.13**	**0.12**											
Age	-0.01	**-0.22**	**-0.26**	**-0.08**										
PD	**0.14**	-0.01	0.00	**0.04**	**0.02**									
CV	**-0.11**	**-0.03**	0.00	0.00	**-0.06**	**-0.14**								
PL	**0.07**	0.00	**-0.07**	**0.05**	**-0.01**	**0.15**	**0.15**							
MD	**0.02**	**0.04**	**0.13**	**-0.02**	**0.08**	**0.08**	**-0.20**	**-0.53**						
ENP	**-0.05**	**0.02**	**0.11**	**0.12**	**0.03**	**-0.16**	**0.21**	**0.22**	**-0.36**					
F	**0.15**	**0.03**	0.01	-0.01	**0.05**	**0.34**	**0.02**	**0.25**	**0.21**	**-0.20**				
NC	**0.03**	-0.01	0.00	**0.03**	**-0.02**	**0.18**	**-0.20**	**0.18**	**-0.08**	**0.11**	-0.01			
TC	**-0.02**	-0.01	**-0.08**	0.00	**-0.05**	**-0.24**	**-0.06**	**-0.05**	**-0.25**	**-0.06**	**-0.40**	0.00		
NN	**0.09**	0.00	**0.01**	**0.12**	**0.04**	**0.43**	**-0.21**	**0.12**	**0.20**	**-0.15**	**0.50**	**0.04**	**-0.13**	
PP	**0.09**	0.00	0.00	0.00	**0.09**	0.01	**-0.34**	**0.03**	**-0.04**	**0.22**	**0.12**	**0.12**	**0.27**	**0.30**

Note: Correlations with $p < 0.001$ are in bold font, VK = Voter Knowledge; IN = Income; ED = Education; UN = Union Membership; PD = Parliamentary Dummy; CV = Compulsory Voting Dummy; PL = Party List Dummy; MD = Majoritarian Dummy; ENP = Effective Number of Legislative Parties; F = Freedom of the Press Score; NC = Newspaper Market Competitiveness; TC = Television Market Competitiveness; NN = Newspaper Circulation; PP = Public Broadcasting Pct.

2.1.3 Diagnostics

A citizen's political knowledge can be modeled as a function of both individual- and country-level covariates using many types of statistical models, each making its own assumptions about the data-generating process. For example, a pooled OLS model takes all (individual-level) observations to be drawn from the same general population. That is, an OLS model implicitly assumes that there is no country-level component to individual-level errors. Yet when I estimate the country-level intraclass correlation coefficient ($\rho = .065$) significant and considerable unobserved heterogeneity is revealed, which strongly indicates that the individual observations are clustered within countries.[6] This implies that a random intercept model is to be preferred over a pooled OLS regression model since there is significant variation across countries and under such conditions complete pooling leads to biased standard errors and incorrect hypothesis tests (Rabe-Hesketh and Skrondal 2008). More substantively, these diagnostics also indicate that there is interesting cross-national variation in voter knowledge to explore.

2.1.4 Results

The Knowledge Hypothesis holds that individuals who live in media systems that are more free from government interference are, on average, more knowledgeable about politics than individuals in media systems that are less free. The random-intercept model for political knowledge of voter i in country j that is employed to test this hypothesis is written out as

[6]The intraclass correlation coefficient ρ is calculated as follows: $\rho = \frac{\psi}{\psi+\theta}$, where ψ equals the country-level error variance and θ the individual-level error variance. It can be thought of in two ways: the degree of country-level unobserved heterogeneity or the degree of within-country dependence. It is the proportion of the total variance in voter knowledge that can be attributed to between-cluster variance or unobserved heterogeneity. A likelihood ratio test compared a random intercept model to a pooled model ($H_0 : \psi = 0; H_A : \psi > 0$). The highly significant test statistic ($\chi^2(df = 1) = 2417.89, p = .000$) indicates the presence of significant unobserved heterogeneity.

follows:

$$\text{Voter Knowledge}_{ij} = \beta_{0j} + \beta_{1j} \times \text{Education} + \sum \beta \times \text{Controls (Individual-Level)} + \epsilon_{ij}$$

$$\beta_{0j} = \gamma 00 + \gamma_{01} \times \text{Media Freedom} + \sum \gamma \times \text{Controls (Country-Level)} + \zeta_{0j}$$

Thus the intercept β_{0j} is allowed to vary across countries as a function of country-level covariates. Technically, random-effects estimators are a weighted average of the between-country estimates and the within-country estimates (and thus incorporate information from both). To test the *Knowledge Hypothesis* I have estimated two random intercept models (see Table 2.4). Model 1 is a fully specified model (with both political and media controls) on individuals in 23 elections, whereas Model 2 is a nested model (with political controls alone) on individuals in 31 elections. The estimated effect for media freedom is significant, in the hypothesized direction, and of similar size in both models: all else equal, voters are about 10 percentage points ($\gamma_{01} = .10$ in Model 1 and $\gamma_{01} = .09$ in Model 2) more knowledgeable when media are most free (Norway in 1997) than when media are least free (Belarus in 2001). This difference corresponds to more than half a standard deviation in political knowledge.

At the individual level both income and education positively affect political knowledge: better educated individuals with a larger income tend to be more knowledgeable about politics than their less-earning, less-educated counterparts ($\beta = .02$ and $\beta = .04$ respectively). This expected effect of the 'usual suspects' of behavioral studies support the validity of the voter knowledge measure employed in this study. Furthermore, union member are slightly less knowledgeable about politics than non-members ($\beta = -.01$), whereas the most senior citizens are slightly less informed than those who just turned 18 ($\beta = -.01$). With regards to political institutions, the model demonstrates that citizens in parliamentary democracies

tend to be better informed than citizens in mixed or presidential democracies. This finding is possibly explained by the important role that parties have in parliamentary democracies. After all, in such democracies the executive needs majority support from the legislature to remain in power. Compulsory voting laws negatively impact voter sophistication ($\gamma = -0.03$). The model also suggests that an increase in newspaper circulation is marginally associated with less political knowledge within the electorate at large ($\gamma = -0.01$). However, because of the sizable positive correlation between newspaper circulation and media freedom ($\rho = .50$) and newspaper circulation and government type ($\rho = .43$). I am not too confident that this estimate captures a substantively meaningful effect. Furthermore, as television markets become more competitive, this has a positive and sizable effect on the political knowledge of the electorate at large ($\gamma = .11$). In contrast, the competitiveness of newspaper markets does not seem to have any effect on voter knowledge, but this is possibly explained by the lack of variability of newspaper markets in the data set (see Table 2.2).

All in all, the results from the random-intercept model strongly support the *Knowledge Hypothesis*: media freedom and political knowledge of the electorate at large are positively related to each other. Yet by aggregating across electorates interesting variation may have been obscured. For example, political and media institutions may differentially affect knowledge across different groups of individuals. This idea is in line with the work of Jennifer Jerit and colleagues (Jerit, Barabas and Bolsen 2006; Jerit 2009; Barabas and Jerit 2009) who find that volume as well as type of newspaper reporting moderates the (widely-established) impact of socioeconomic status in explaining political information: with an increase in volume of newspaper reporting also comes an increase in information between highly and poorly educated citizens. An extension of these findings to a cross-national setting is summarized in the *Education Hypothesis* which posits that in a comparison of countries and citizens, the marginal effect of education level on political knowledge is larger in free media systems

than it is in media systems that are less free from government interference. To investigate evidence for the *Education Hypothesis*, I have estimated a random coefficient model in which the slope parameter for the within-country variation of the education variable[7] is modeled as a function of media freedom (Gelman and Hill 2007; Rabe-Hesketh and Skrondal 2008).[8] The random-intercept, random-coefficient model for political knowledge of individual i in country j that is employed to test this hypothesis is written out as follows:

$$\begin{aligned}
\text{Voter Knowledge}_{ij} &= \beta_{0j} + \beta_{1j} \times \text{Education}_{ij} + \sum \beta \times \text{Level-1 Controls} + \epsilon_{ij} \\
\beta_{0j} &= \gamma 00 + \gamma_{01} \times \text{Media Freedom}_j + \sum \gamma \times \text{Controls} + \zeta_{0j} \\
\beta_{1j} &= \gamma 10 + \gamma_{11} \times \text{Media Freedom}_j + \zeta_{1j}
\end{aligned}$$

This model allows both the intercept β_{0j} and the slope for education β_{1j} to vary across countries as a function of country-level covariates and media freedom respectively. The model results are presented in Table 2.5. The first thing to notice is that the income ($\beta = 0.02$), the compulsory voting ($\gamma = 0.02$) and the parliamentary dummies ($\gamma = -0.04$) are similar to their estimates in the random intercept model, and that the majoritarian dummy ($\gamma = -0.02$) now is marginally significant. Yet in contrast to the random intercept model, the estimate for the effect of education on political knowledge ($\gamma_{10} = .01$), rather than denoting a marginal effect, now denotes a specific conditional effect of education. More precisely, it denotes the effect of education on political knowledge for individuals living in Belarus. Across all countries j, the conditional effects of education on political knowledge

[7] To purge the education variable from between-election variation, I simply subtracted election-means from individual education scores.

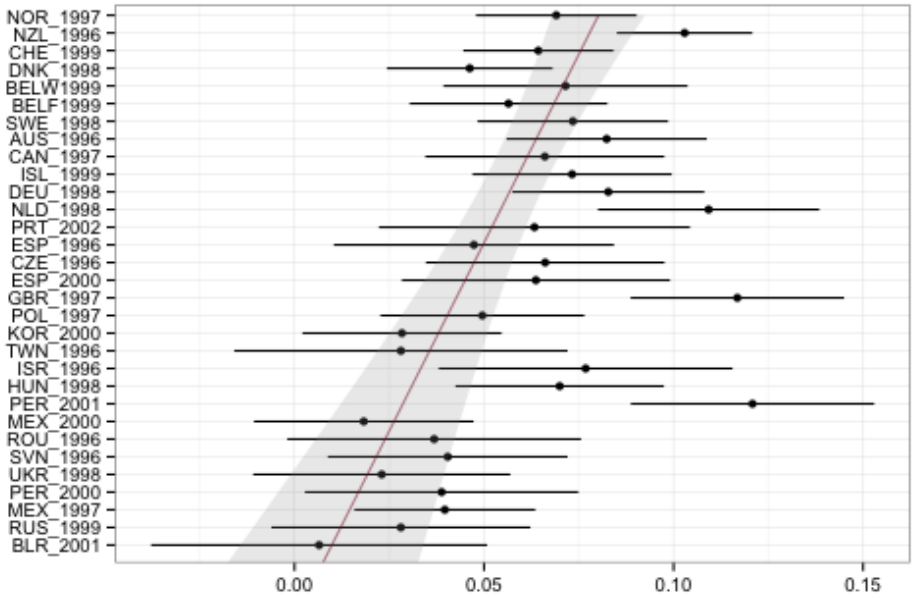
[8] A likelihood ratio test ($\chi^2(df = 3) = 106.39, p = .000$) comparing the random intercept model to the random coefficient model found that the latter provides a significantly better fit.

(i.e., β_{1j}) are estimated as the sum of fixed components (the fixed effects of education and media freedom) as well as the estimated random effect of education. More generally and in contrast to random intercept models or pooled OLS models, the varying coefficient for education denotes conditional effects rather than a marginal effect.

Figure 2.2 displays these estimated conditional effects (and their 95% confidence intervals) for all countries, sorted from lowest media freedom (Belarus in 2001) to highest media freedom (Norway in 2007). Although the conditional effects do not neatly line up in order, they do follow a clear pattern: as media freedom increases, so does the effect of education on political knowledge. Further evidence for this comes from the displayed least squares regression line ($\beta = .07$, se $= .02$, $p < .00$) of the conditional effects of education on media freedom. The plot paints an interesting picture of varying conditional effects in which education ranges from having no effect on political knowledge (e.g., Belarus, Russia, Mexico and Taiwan) to having significant positive effects. To illustrate, in New Zealand a university-educated individual is about 11 percentage points more knowledgeable about political than a counterpart with only primary school. And in Norway and Switzerland education alone moves an individual about half a standard deviation up the political knowledge distribution. To further visualize the interactive *Education Hypothesis*, I have separately estimated the conditional effect of education on voter knowledge in less free media systems (for which the media freedom variable $\leq .5$) and more free media systems (for whom the media freedom variable $> .5$). The results of these estimations are displayed in Figure 2.3. This figure first shows that voters in countries with unrestricted media are predicted to be politically more knowledgeable than their counterparts in countries where the media are less free, regardless of their education level.[9] In addition, it demonstrates that the marginal effect of education

[9]To distinguish between the types of countries I created a dummy variable that took on value 1 if that country scored higher than the mean on the media freedom variable and zero otherwise

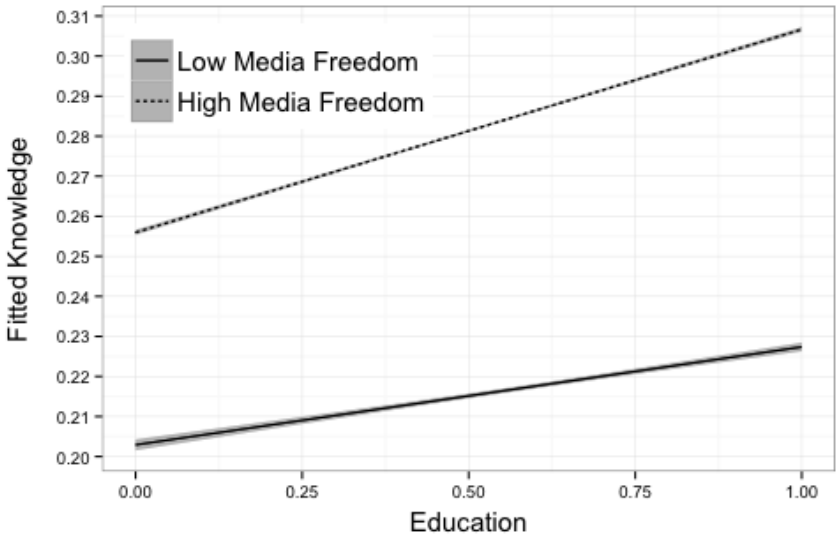
Figure 2.2: Conditional Effects of Education Across Elections and Countries



Note: Each dot represents the estimated conditional effect of education for individual countries (with the black lines representing their 95% confidence intervals). The countries are sorted from lowest media freedom (Belarus 2001) to highest media freedom (Norway 1997). The red line denotes the least squares regression line of the conditional effects on the media freedom variable (its 95% confidence interval is shown in gray). The figure shows that, all else equal, mass media become more free from government interference, education has a stronger effect on political knowledge.

on voter sophistication is larger for voters in free media systems than for their counterparts in less free media systems. That is, the predicted marginal effect of education is much larger for voters in free media systems than it is for voters in relatively unfree media systems, as evidenced by the steeper slope for these voters. This finding lends strong support for the *Education Hypothesis*: all else equal, education is a more informative predictor of political knowledge when media are free than when media are less free.

Figure 2.3: Education and Voter Knowledge in Countries that are Low and High in Media Freedom



Note: The lines denote fitted political knowledge for individual voters with different levels of education within countries that are high ($> .5$) and low ($\leq .5$) in media freedom. The shading denotes 95% confidence intervals around those predicted values. Confidence intervals are small because they are estimated at the level of the individual.

2.2 Conclusion

The statistical models estimated in this chapter find evidence for the Knowledge Hypothesis as well as the Education Hypothesis: voters who live in media systems that are more free from government interference are, on average, more knowledgeable about politics than voters in media systems that are less free, and the marginal effect of education is more pronounced in free media systems than it is less free media systems. These results are likely the result of increased supply of political information in free media systems, as evidenced by the strong positive correlation between media freedom and newspaper circulation (see Table 2.3). In free media systems, individual outlets are less likely to be 'captured' by the government leading to a more heterogeneous and less constrained information environment, which (i) positively

affects the political knowledge of the electorate at large, yet (ii) it benefits well-educated voters more than less-educated voters.

These findings illustrate the larger point of this chapter: voter knowledge is not just a function of individual characteristics but of the institutional environment as well. That is, individual characteristics like education, income and political interest interact with the institutional environment in explaining voter knowledge. In the American context, these type contingencies have been studied extensively by Jennifer Jerit and Jason Barabas and colleagues (Jerit, Barabas and Bolsen 2006; Jerit 2009; Barabas and Jerit 2009). This chapter has extended their findings to a cross-national setting.

This chapter thus provides empirical evidence that media systems at large can have differential effects on separate groups of voters. That is, it gives a better sense of the dotted lines in Figure 1.1. In the next chapter, I will present a theoretical model of the microfoundations at the actor-level that, I believe, can serve as an explanation for these patterns.

Table 2.4: Voter Knowledge: Random Intercept Models

	Model 1 Coef./Std. err.	Model 2 Coef./Std. err.
Individual-level variables		
Income	0.02***	0.02***
	0.00	0.00
Education	0.04***	0.04***
	0.00	0.00
Union Membership	-0.01***	-
	0.00	-
Age	-0.01*	-
	0.00	-
Country-level variables		
Media Freedom	0.10***	0.09***
	0.03	0.02
Parliamentary Dummy	0.04***	0.02**
	0.01	0.01
Compulsory Voting Dummy	-0.03***	-0.03***
	0.01	0.01
Party List Dummy	0.01	0.01
	0.01	0.01
Majoritarian Dummy	-0.01	-0.01
	0.01	0.01
Effective Number of Parties	-.00	-
	0.00	-
Newspaper Market Competitiveness	-0.03	-
	0.06	-
Television Market Competitiveness	0.11**	-
	0.04	-
Newspaper Circulation per Capita	-0.01*	-
	0.04	-
Public Broadcasting Pct.	0.02	-
	0.01	-
Constant	0.13***	0.15***
	0.04	0.01
$\sqrt{\psi}$	.02	0.02
	0.00	0.00
$\sqrt{\theta}$	0.14	0.14
	0.00	0.00
ρ	0.02	0.02
	-	-
AIC	-31815.3	-40297.3
n/N	23 / 28450	31/37077

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-sided

Table 2.5: Random Intercept, Random Coefficient Model With Cross-Level Interactions

	Model 3 Coef./Std. err.
Individual-level variables	
Income	0.02***
	0.00
Education	0.01
	0.03
Country-level variables	
Media Freedom	0.07***
	0.02
Parliamentary Dummy	0.02**
	0.01
Compulsory Voting Dummy	-0.04***
	0.01
Party List Dummy	0.01
	0.01
Majoritarian Dummy	-0.02*
	0.01
Cross-Level Interaction Terms	
Education X Media Freedom	0.04
	0.03
Constant	0.24***
	0.01
$\sqrt{\theta}$	0.14
	0.00
$\sqrt{\psi}_{intercept}$	0.02
	0.00
$\sqrt{\psi}_{slope}$	0.04
	0.01
$Cov(\zeta_{0j}, \zeta_{1j})$	-0.64
	.13
AIC	-40451.3
n / N	31 / 37077

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-sided

Chapter 3

An Agent-Based Model of Electoral Competition with Media Outlets

3.1 Introduction

This chapter presents an agent-based model of media systems, party competition and voter knowledge. At the heart of this model are the (simplified) interactions between voters, parties and media outlets that occur over the course of several political campaigns, withing 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. 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*). 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*). Table 3.1 lists these hypotheses.

Table 3.1: Hypotheses Generated From the Model

Knowledge Hypothesis: In a comparison of countries, as national media systems become more competitive, on average, the electorate at large becomes better informed.
Representativeness Hypothesis: In a comparison of countries, as national media systems become more competitive, political competition becomes less representative of the electorate at large.
Alternations Hypothesis: In a comparison of countries, as national media systems become more competitive, on average, alternations in government are more likely to occur.
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.

The next section first discusses findings in the literature on the economics of mass media content, 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.

3.1.1 Mass Media and Political Competition

Many voters depend for their (political) information on traditional mass media outlets but it is no secret that the quality of political content varies wildly across these outlets. For example, a typical write-up from the presidential campaign trail in the *New York Times* will contain more information than a similar article in the *New York Post*, and, all else equal, this will differentially affect political knowledge of the readers of both articles. In other words, with varying degrees of success, media outlets help voters overcome their rational ignorance (Downs 1957) by taking party platforms and repackaging them into news. The economic determinants for the accuracy of media reports has been a major topic in media economics (Prat and Strömberg 2011). In doing so it oftentimes resorts to 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 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[1]. 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.[2] 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. Bernhardt, Krasa and Polborn (2008) develop a model to study under what conditions media bias may lead to electoral mistakes. In their model, there only exists negative information

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

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

about the valence of two candidates. Profit-motivated media outlets may either decide to report this information or remain silent. Consumers are assumed to be motivated reasoners: left-wing consumers obtain utility from negative news about a right-wing candidate, whereas right-wing consumers derive utility from negative news about the left-wing candidate. Not surprisingly—given that these preferences are hard-wired into their model—the authors establish that if there are enough left- and right-leaning ideological consumers relative to politically centrist consumers, profit-driven media are biased in equilibrium and, under certain conditions, this may lead to the 'wrong' candidate being voted in office.[3]

Investigating supply-side factors of slant, Besley and Prat (2006) find that more competition among media outlets makes it more difficult for government to capture these media, which makes government-induced media slant less likely. In other words, increased competition reduces bias resulting from capture by governments. Baron (2006) finds that ideologically motivated journalists are a primary determinant of media bias, but only if media owners give discretion to these journalists in exchange for lower wages. Bovitz, Druckman and Lupia (2002) present a model in which the internal decision-making structure of policy-motivated media firms is a critical determinant of their ability to shape the political discourse to their own ideological purposes.

Most work on the economics of media firms presents theoretical models, but only a few papers actually investigate the empirical implications of these models. Using an elaborate index of media slant that compares the use of partisan language in newspapers with that of Democratic and Republican members of Congress combined with zip code-level circulation data, Gentzkow and Shapiro (2010) examined what factors drive media slant. They find that: "Consumer demand responds strongly to the fit between a newspapers slant and the ideology of potential readers, implying an economic incentive for newspapers to tailor their slant to the

[3]The wrong candidate being the candidate who is not preferred by the median voter.

ideological predispositions of consumers. By contrast, we find much less evidence for a role of newspapers owners in determining slant. While slant is somewhat correlated across co-owned papers, this effect is driven by the geographic clustering of ownership groups (p. 64). In other words, in their data bias is driven by consumer demand more so than by the ideological leanings of newspaper owners. The authors find that about 20 percent in the variation in newspaper slant in their sample is explained by consumer demand. In an empirical test of their reputation model of media firms, Gentzkow and Shapiro (2006) find some evidence for their hypothesis that ex post feedback and competition mitigate observed media bias. For instance, they find no evidence for overall favoritism toward New York football teams in New York Times sports editors betting predictions, which provides some support for their ex post feedback hypothesis. Gentzkow and Shapiro also find that, in the run-up to the 2000 Presidential elections between Bush and Gore, biased reporting—as measured by the difference in total speaking time given to both candidates by each news channel—is reduced in more competitive media markets. Studying media firms in nine Muslim countries in the Middle East, Gentzkow and Shapiro (2004, p.2) show that: "News consumers tend to gravitate towards sources with a perspective similar to their own. Consumers who report that religion is an important part of their lives exhibit less pro-American attitudes. These consumers are also less likely to report watching CNN, and more likely to report watching Al Jazeera."

As noted, both theoretical and empirical work on the economics of news is mostly concerned with the foundations of bias and has found in the specific motivations of the media (profit versus policy) and the preferences of news consumers (truth versus confirmation) its assumptions of choice. But although empirical work has revolved more often than not about politics, actual political competition is notably absent in these models.[4] Yet as much

[4]Bernhardt, Krasa and Polborn (2008) and Chan and Suen (2008) serve as notable exceptions.

as media firms compete for audience, they also struggle with political candidates to obtain information that they can then turn into news. An implicit and untested assumption in the work on the economics of the media is that the public platforms of all political candidates are stable over time, which is reflected in the recurrent assumption that media firms hold perfect information about the state of the world. But that information comes from political candidates who may even have an incentive to misrepresent the signal they send if they expect this to benefit them in the polls. The political state of the world should thus be made endogenous to a model of political competition with media. A point of criticism that is somewhat related revolves around 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 the previous sections 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 lead to static equilibrium predictions about political outcomes. Political reality, however, is mostly dynamic in nature and equilibrium is often difficult to find. As a result, recent years have seen the rise of so-called computational and agent-based models (ABM), which I will discuss next.

3.1.2 Computational Models of Political Competition

Over the past two decades, computational models of political competition have seen a steady increase in popularity, following a seminal paper by Kollman, Miller and Page (1992). 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). As noted by Kollman, Miller and Page (1992, p. 929) : "We develop a model

of two-party spatial elections that departs from the standard model in three respects: parties information about voters preferences is limited to polls; parties can be either office-seeking or ideological; and parties are not perfect optimizers, that is, they are modeled as boundedly rational adaptive actors. We employ computer search algorithms to model the adaptive behavior of parties and show that three distinct search algorithms lead to similar results. Our findings suggest that convergence in spatial voting models is robust to variations in the intelligence of parties. We also find that an adaptive party in a complex issue space may not be able to defeat a well-positioned incumbent." KMP find that different behavioral search algorithms (which they initially titled random adaptive parties, 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 ideologicalDe 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 Hunter 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, Hunter 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). In all these extensions, voters hold perfect information about the policy positions of all parties.

3.1.3 Conclusion

In sum, media economics finds in competition among media outlets an important determinant of media accuracy but the direction of its effect depends on voter tastes. At the same time, political competition—or the relationship between party systems and media systems—is notably absent in these theoretical models. The model I present in the next section intends to fill this void, making the relationships between parties, media outlets and voters all endogenous to each other as well as the media system at large.

3.2 The Model

This section presents an agent-based model voter knowledge, competitive media and party competition that intends to generate hypotheses linking media system characteristics, political competition and voter information. To begin with, I should 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. With this in mind, the model is specified as follows.[5]

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).[6]

$$I_{p,t+1} = \begin{cases} \min(1, I_{p,t} + \delta) & \text{if} \quad I_{inc,t} > I_{p,t} \\ \max(1, I_{p,t} - \delta) & \text{if} \quad I_{inc,t} < I_{p,t} \end{cases} \tag{3.1}$$

Both Equation 3.1 and Figure 3.1 represent this updating rule. The learning parameter δ is fixed—but theoretically ranges between zero and the ideological distance between the two parties. It represents a party's responsiveness to loss.

[5]The model—which was programmed in R— can be found in the Appendix.

[6]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 chapter explores this Predator strategy as it (i) does not assume much information on the part of both parties, and (ii) makes intuitive sense.

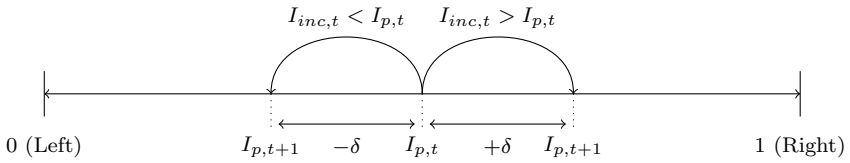


Figure 3.1: Updating Algorithm Parties

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).[7] 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:

$$U_{v,t} = -|I_v - s| - c_v \tag{3.2}$$

where c is the cost of the news, which is a function of the quality of media reporting and 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 denoted by the 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 par-

[7]This linear loss function implies that voters are *risk neutral* (for a discussion, see Laver and Sergenti 2011).

ties 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 alone whereas news-buying voters directly learn about the policy platform of the incumbent through media content.[8] 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 $TN(s, \sigma_1^2, 0, 1)$ with mean equal to the policy outcome in the previous round and variance equal to 1 (which is the maximum feasible variance). 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 $TN(I_p, \sigma_1^2, 0, 1)$ but with mean equal to the platform of the candidate and variance equal to the inverse of the quality of the news.[9] 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 1999). More generally, assuming that news (either policy results or media reports) is represented by a draw $x \sim TN(\mu_0, \sigma_1^2, 0, 1)$, Bayes' rule implies that voters' posterior beliefs $\pi(I_p|x)$ are distributed $TN(\mu(x), \rho, 0, 1)$, where

[8]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 *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.

[9]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.

$$\mu(x) = \mu + (x - \mu)\frac{\sigma_0^2}{\sigma_0^2 + \sigma_1^2} \tag{3.3}$$

$$\rho = \frac{\sigma_0^2 \sigma_1^2}{\sigma_0^2 + \sigma_1^2}, \tag{3.4}$$

That is, voters beliefs after observing 'news' have mean $\mu(x)$. The strength of that belief is represented by ρ. The smaller ρ, 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. 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:

$$q_{v,t+1} = \begin{cases} \min(1, q_{v,t} + \kappa) & \text{if} \quad U_{v,t} > U_{v,t-1} \\ \min(0, q_{v,t} - \kappa) & \text{if} \quad U_{v,t} \leq U_{v,t-1} \end{cases} \tag{3.5}$$

For news-ignoring voters in round t, the probability of buying news in round $t+1$ equals:

$$q_{v,t+1} = \begin{cases} \max(0, q_{v,t} - \kappa) & \text{if} \quad U_{v,t} > U_{v,t-1} \\ \min(1, q_{v,t} + \kappa) & \text{if} \quad U_{v,t} \leq U_{v,t-1} \end{cases} \tag{3.6}$$

The learning parameter κ is fixed—but ranges between zero and one. It reflects voters'

responsiveness to new information.[10]

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 λ. This setup intends to reflect the degree of 'political parallelism' (Hallin and Mancini 2004). That is, the larger λ, the more a news outlet is motivated by sales, and the smaller λ, the more a news outlet is motivated by being ideologically close to the incumbent party. In each period t, media outlet n receives utility:

$$U_{n,t} = \lambda \times M - (1 - \lambda) \times |I_n - I_v| \tag{3.7}$$

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 two pieces of information: the quality of the news of the best-selling media outlet c_{max} and its utility. Media outlets vary c dynamically over periods using the following behavioral rules:

$$c_{n,t+1} = \begin{cases} \max(1, c_{n,t} + \mu) & \text{if} \quad c_{max,t} > c_{n,t} \\ \max(1, c_{n,t} - \mu) & \text{if} \quad c_{max,t} < c_{n,t} \end{cases} \tag{3.8}$$

Both Equation 3.8 and Figure 3.2 represent this updating rule.[11] The updating rule is straightforward: the media outlet with the largest share of the audience will not change the

[10]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.

[11]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.

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 μ is fixed—but theoretically ranges between zero and one. It represents' a media outlet's responsiveness to small audience shares.

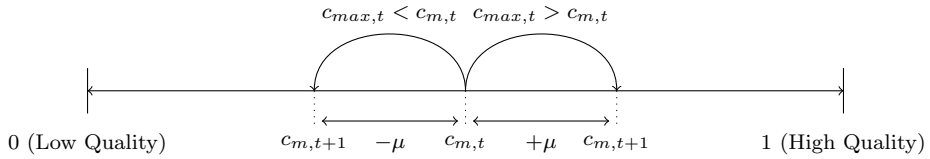


Figure 3.2: Updating Rules Media Outlets

After the campaign is over elections take place. Voters vote for the incumbent or the challenger based on the information they have.[12] 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 3.2 displays the timing of the model. Together steps 1 through 7 represent one time (campaign) period.

Table 3.2: Timing of the Model

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

[12]There is no abstention.

3.3 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 1.1), and (ii) the 'representativeness' of the evolved party systems (denoted by arrows IV and V in Figure 1.1). In addition, I will explore direct effects of mass media content on party behavior.

3.3.1 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: $VK = \frac{1}{T}\frac{1}{V}\sum_{t=1}^{T}\sum_{v=1}^{V}\frac{1}{2}(|\pi(I_1) - I_1| + |\pi(I_2) - I_2|)$. 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

Table 3.3: Simulation Parameters Incomplete Information with Media

Parameter	Description	Default Value
	Monte Carlo Parameters	
R	Number of Monte Carlo Runs	1000
λ	Parallelism Parameter	$\sim U(0,1)$
N	Number of Media Outlets	Integer $\sim U(1,10)$
	Individual Time Period Parameters	
V	Number of Voters	1001
P	Number of Parties	2
T	Number of Time Periods	100
a	Policy Shock	$\sim TN(I_{inc},1,0,1)$
I_p	Party Ideology	$\sim U(0,1)$
I_v	Voter Ideology	$\sim TN(.5,1,0,1)$
I_n	Media Outlet Ideology	$\sim TN(.5,1,0,1)$
ϵ	Voter Learning Parameter	.01
γ	Media Learning Parameter	.01
δ	Party Learning Parameter	.01
C	Initial Quality of Reporting	$\sim U(0,1)$
Q	Pr(Voter Purchases News)	$\sim U(0,1)$

the average quality (AQ) of the media reporting: $AQ = \frac{1}{T}\frac{1}{N}\sum_{t=1}^{T}\sum_{n=1}^{N} c_N$, 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 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 λ are randomly varied. Table 3.3 contains the starting values and distributions for all parameters in the Monte Carlo simulations.

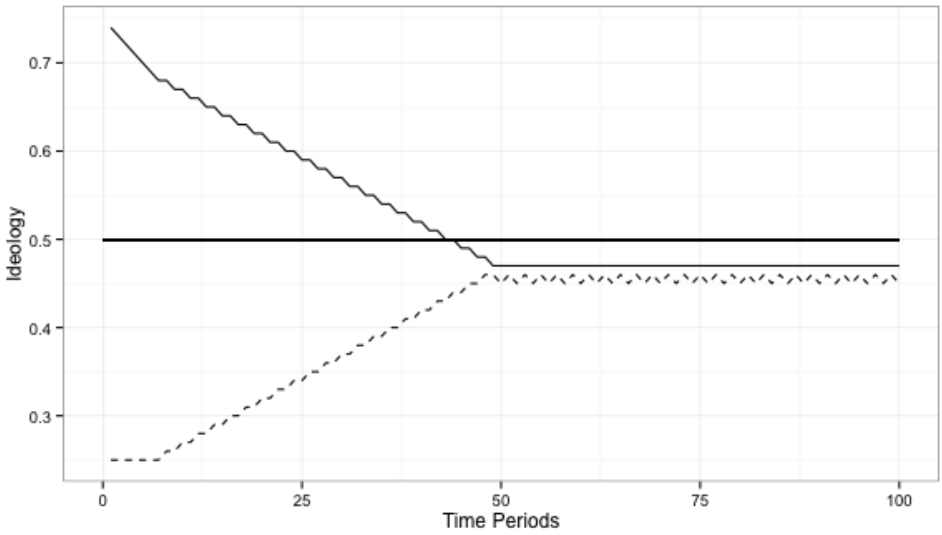
3.3.2 Voters With Complete Information

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.[13] 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 δ 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 3.3 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.[14] Figure 3.4 shows the distribution of absolute total distance between the

[13] 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.

[14] It should be noted that the decision rule is deterministic so that the moment parties have converged on

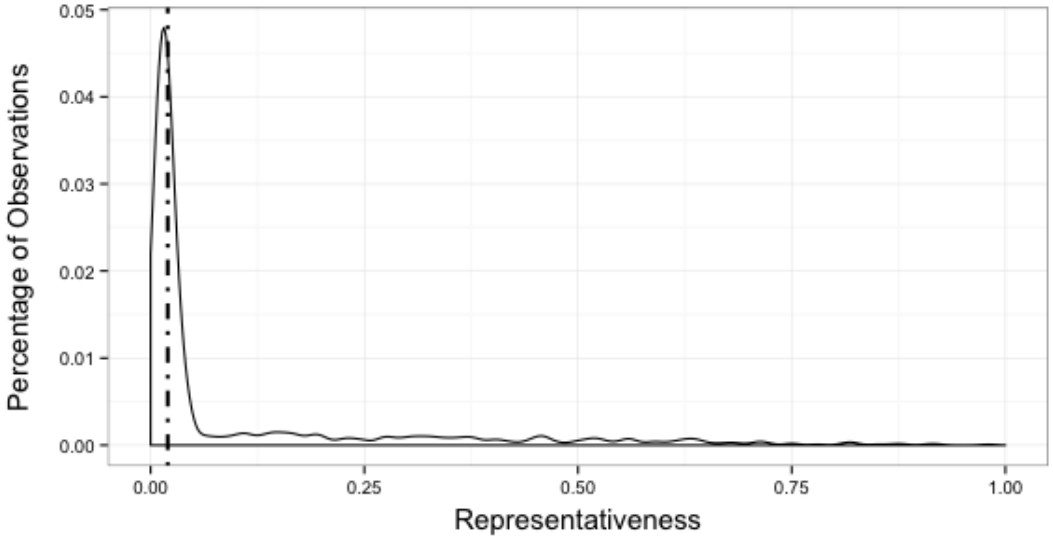


Note: The bold horizontal line denotes the location of the median voter. As time progresses both parties move ideologically towards the location of the median voter.

Figure 3.3: A Single Model Run With Complete Information Voters

median voter and the platforms of both parties across 1000 runs of the model (see Table 3.3 for parameter settings). This is a measure how well the evolved configurations of party platforms represent the ideal point of the median voter. 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 3.4 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

identical platforms, they won't change platforms again, even though they are not located at the ideal point of the median voter.



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 3.4: 1000 Model Runs With Complete Information Voters

voters can learn from media content and media systems vary randomly.[15]

3.3.3 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 $TN(I_p, 1, 0, 1)$, 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:

[15]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.

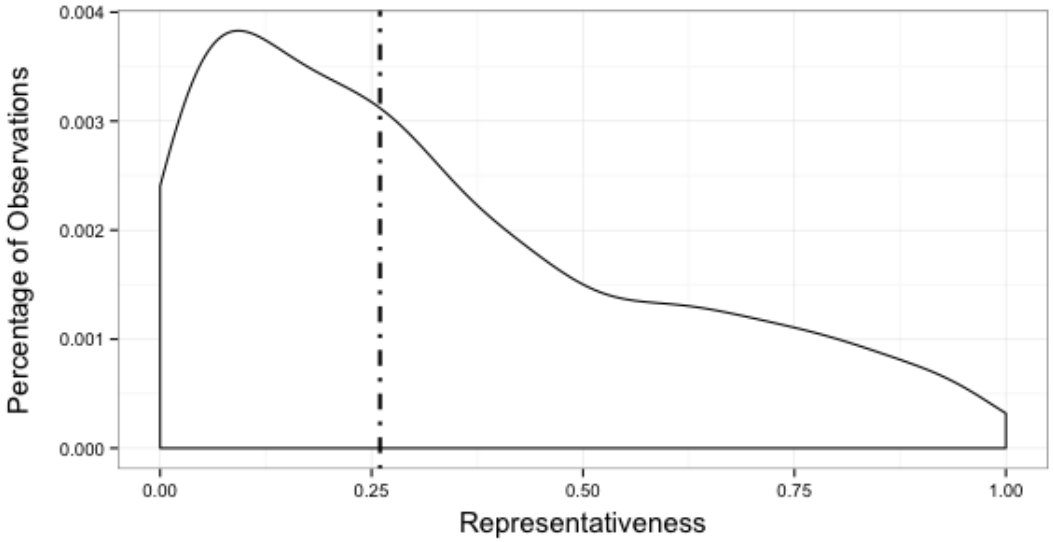
one in which voters do not update their beliefs in response to information, and one in which they do. In the first (rather unrealistic) scenario, parties will again converge to identical platforms. Yet this platform is meaningless in the sense that it is not constrained by voter beliefs.[16] That is, by coincidence one party will be perceived to be located closer to the 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.[17] 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 3.5 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 3.3 for parameter settings). Other than in the complete information condition (see Figure 3.4) when there is incomplete information parties are much less capable of settling

[16]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 affected by voter beliefs as being adaptive.

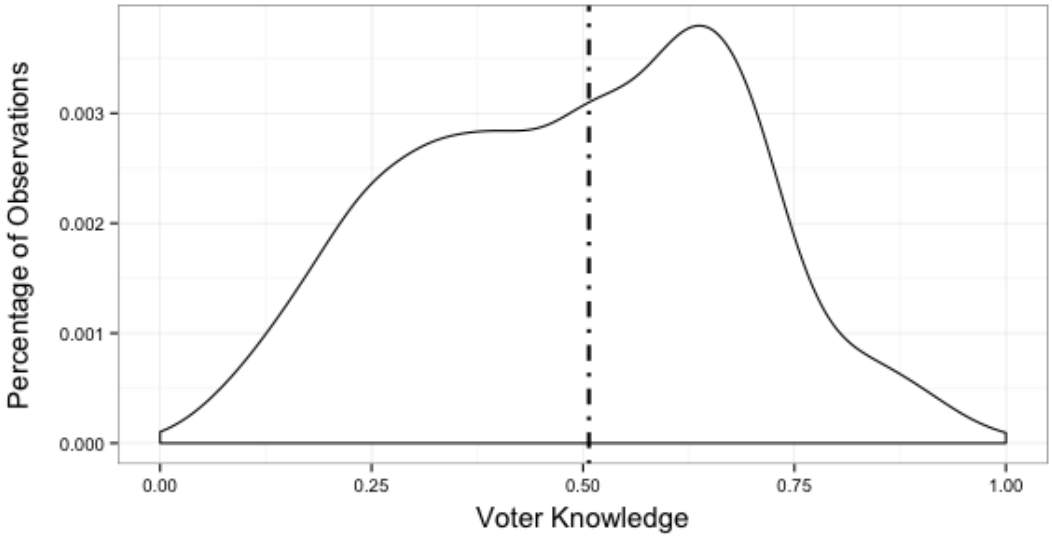
[17]Of course there are many more possible sources that one could think of but that are beyond the scope of this paper.



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 3.5: 1000 Model Runs With Incomplete Information Voters and No Media

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, 2005; Kollman, Miller and Page 1998, 1992). 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 3.6). Since parties are constrained these beliefs, the evolved party configuration may diverge from the median voter.



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 3.6: 1000 Model Runs No Media

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.

3.3.4 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 λ (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 3.4 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 ($\rho = -.07$).[18] The reason is that 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 3.4 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.[19] 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

[18]Voter knowledge has been recoded so that higher scores denote increasing levels of average knowledge.

[19]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.

Table 3.4: Correlations

	VK	R	λ	N	AQ	NBV	MV	Alt
VK								
R	-0.07*							
λ	-0.04	-0.03						
N	0.53***	0.19***	0.03					
AQ	0.56***	-0.11***	-0.03	0.23***				
NBV	0.38***	-0.22***	-0.01	0.08*	0.78***			
MV	0.04	0.03	-0.04	0.01	0.02	0.03		
Alt	0.20***	0.64***	0.01	0.32***	-0.01	-0.17***	0.01	

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

either ($\rho = -.03$). In addition, the degree of political-parallelism is only modestly related to either average voter knowledge ($\rho = -.04$) or the representativeness of party competition ($\rho = -.03$).

Table 3.5: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
VK	0.83	0.09	0	1	1000
R	0.19	0.12	0	0.55	1000
λ	0.51	0.29	0	1	1000
N	5.61	2.91	1	10	1000
AQ	0.63	0.18	0.01	0.99	1000
NBV	0.38	0.03	0.33	0.5	1000
MV	0.5	0.02	0.45	0.55	1000
Alternations	18.09	9.13	0	39	1000

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 ($\rho = .19$). 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 po-

litical 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 ($\rho = -.27$).[20]

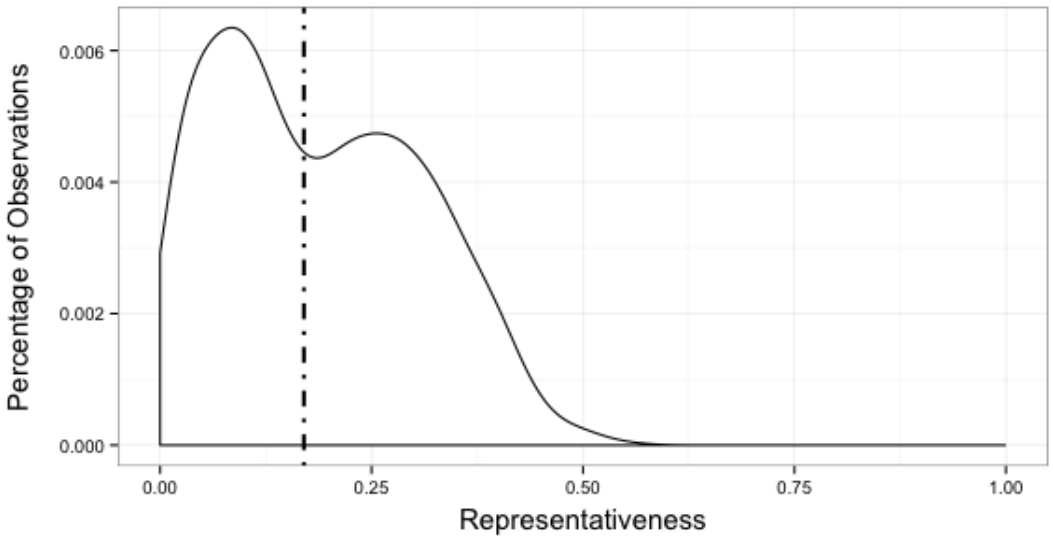
Furthermore, VK ($\rho = .20$), N ($\rho = .32$) and R ($\rho = .64$) are positively related to the number of alternations in office. In addition, Table 3.5 displays summary statistics for all variables in the model.

Implications of the Model: Simulation Results

Figure 3.7 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 3.5).[21] 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 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.

[20] 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.

[21] See Table 3.3 for the starting values and distributions for all parameters in the Monte Carlo simulation.



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 3.7: 1000 Model Runs With Incomplete Information Voters and No Media

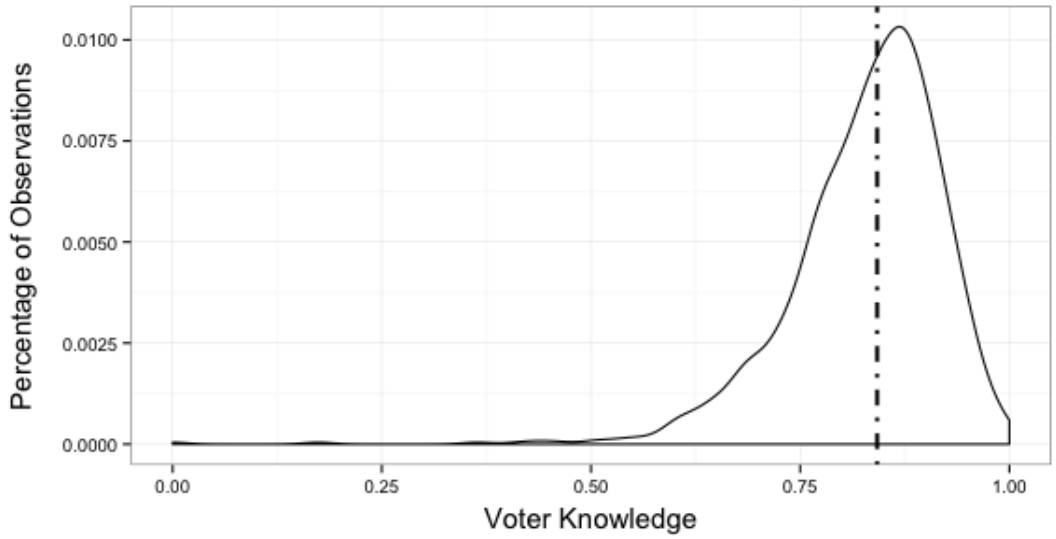
For political competition to be accountable to the median voter, what is needed is that voter beliefs about party platforms are (i) correct[22], or (ii) close to the truth and responsive to political news. From this viewpoint, responsive party competition can be thought of as a function of the presence of mass media outlets in combination with certain individual voter characteristics present in the electorate.

Figure 3.8 displays voter knowledge across political systems.[23] In contrast with the no media scenario (see Figure 3.6) 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

[22]See the results in section *Voters With Complete Information*.

[23]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.

platforms and keeping their representatives accountable.



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 3.8: 1000 Model Runs With Media

Table 3.6 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 (λ). 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.[24] 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.

λ negatively affects voter knowledge such that, all else equal, as media systems are

[24]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.

Table 3.6: Voter Knowledge, Representativeness of Electoral Competition and Alternations in Office Across Media Systems

	Average Knowledge	Representativeness	Number of Alternations
	OLS	*OLS*	*OLS*
	(1)	(2)	(3)
N	0.170^{***}	0.082^{***}	10.159^{***}
	(0.009)	(0.013)	(0.941)
Lambda	-0.019^{**}	-0.014	0.061
	(0.009)	(0.013)	(0.951)
Constant	0.743^{***}	0.149^{***}	12.354^{***}
	(0.007)	(0.010)	(0.756)
Observations	1,000	1,000	1,000
R^2	0.283	0.039	0.105
Adjusted R^2	0.282	0.037	0.103
Residual Std. Error (df = 997)	0.079	0.119	8.647
F statistic (df = 2; 997)	196.733^{***}	20.224^{***}	58.320^{***}

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

inhabited by profit-motivated outlets this negatively affects the political knowledge of the electorate at large.[25] However, this effect is only marginally significant and too small in size to be of substantive importance. In addition, λ has no independent effects on either representativeness or the competitiveness of party competition.

Up to this point, I have aggregated model results across media systems. In contrast, Figures 3.9 and 3.10 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.[26] Figure 3.9 shows that increased media competition is associated with higher levels of aggregated voter knowledge regardless of whether media are

[25]Separate analysis showed that increased media competition is associated with smaller variation knowledge as well. This implies that not only does media competition have a positive effect on average voter knowledge, it also tends to decrease the Knowledge Gap (Tichenor, Donohue and Olien 1970) between better and lesser informed groups of citizens.

[26]The lines denote the 95% confidence intervals for the parameter estimates.

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 the 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 λ in Table 3.6 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.

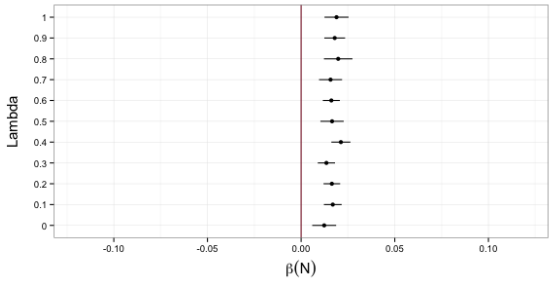


Figure 3.9: Voter Knowledge as a Function of Number of Media Outlets

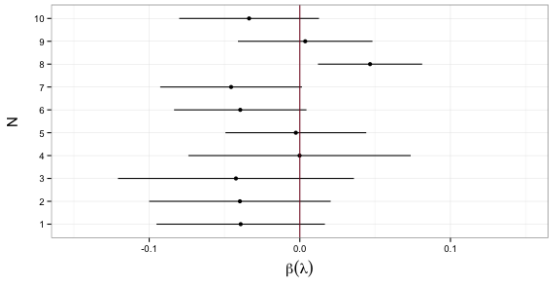


Figure 3.10: Voter Knowledge as a Function of Media Motivation

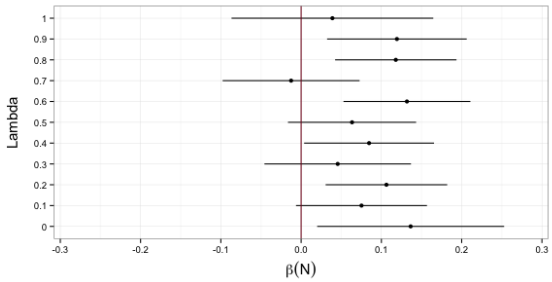


Figure 3.11: Representativeness as a Function of Number of Media Outlets

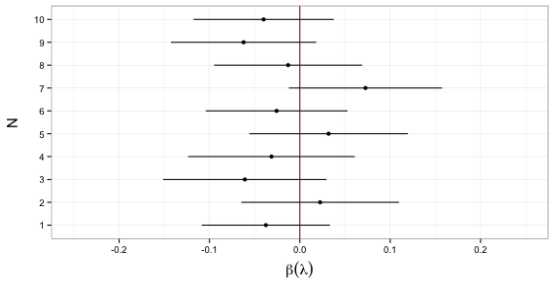
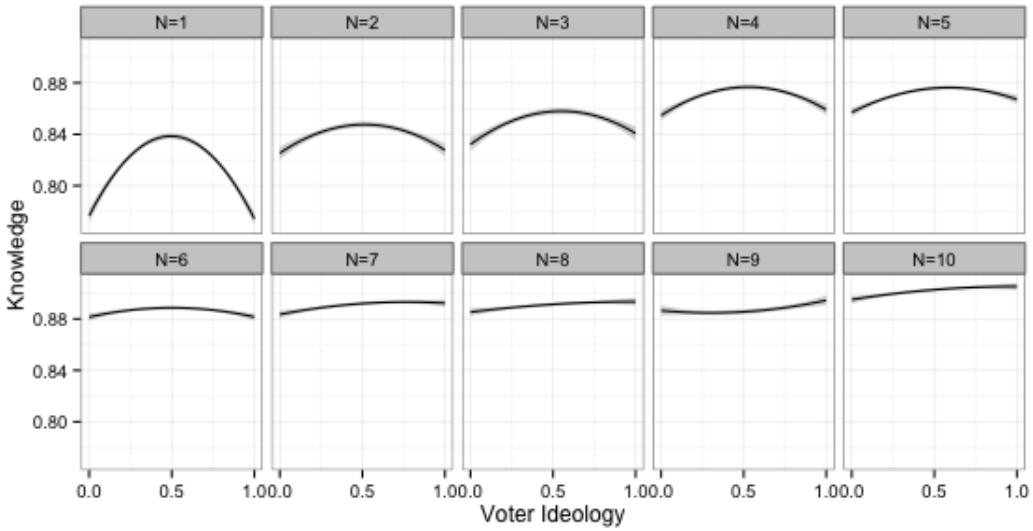


Figure 3.12: Representativeness as a Function of Media Motivation

Figures 3.11 and 3.12 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 3.11 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 3.12 clearly shows that the model produces no independent effects of media motivation regardless of the degree of competition among outlets.



Note: The figure displays political knowledge for individual voters across different ideological ideal points, in increasingly competitive media systems. 1 denotes perfect knowledge.

Figure 3.13: Ideology and Voter Knowledge

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 3.13 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 moderate voters when media competition is low.[27] In addition, Figure 3.13 also shows that ideology becomes a weaker predictor of voter knowledge as media competition increases.

3.4 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 belief are convincing enough to serve as hypotheses generated from the model. Some of these hypotheses will be tested empirically in the next chapter.

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 3.9). 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.

[27] Remember that media outlets' ideal points are distributed TN(.5,1,0,1)

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 3.11). 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 3.6). 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 3.13). In addition, ideology becomes a better predictor of voter knowledge as media competition increases (see Figure 3.13). 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.

3.5 Conclusion

This chapter presented an agent-based model of media systems, political competition and voter knowledge. The model has both it strengths and it 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.[28] 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 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 λ parameter and as a result there was no effect of media motivation on

[28]The American case with conservative FOX News and liberal MSNBC serves as a prime example here.

any of the outcome variables (see Figures 3.10 and 3.12).

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 is in line with the *interactive* approach that work in public opinion and voter knowledge has taken in recent years.

In the next chapter I explore evidence for both the *Knowledge Hypothesis*, the *Representativeness Hypothesis* and the *Ideology and Media Systems Hypothesis* using the most recent wave of the CSES dataset (CSES 2007). Testing the *Alternations Hypothesis* empirically requires time-series or time-series cross-sectional data and is left for later work.

Chapter 4

Empirically Testing the Agent-Based Model

4.1 Introduction

The last chapter introduced an agent-based model of media systems, party competition and voter knowledge. In this chapter, I present empirical results that serve as an empirical test of the implications of the model with regards to the connections competitiveness of media systems and political knowledge of electorates at large as well as the representativeness of political competition. To this end, I explore the second wave of the Comparative Study of Electoral Systems data set CSES (2007).

I should emphasize that it is hard to think of the analysis constitute a real 'test' of the model. The reason is, as noted in Chapter 3, that the behaviors of the actors in the model are endogenous to each other which makes it difficult to pin down the data-generating process for the outcome variables. In other words, even though all actors in the model are endowed with straightforward behavioral decision-making rules, their interplay is complex and difficult

to track causally. In essence, the macro-level results the model generates 'emerge' from predetermined behavioral responses but it is unclear how exactly and why they emerge.[1] So even though the model generates macro-level predictions about the linkages between media systems and aggregated voter knowledge and electoral competition and empirical results that corroborate these connections are of course good news for the external validity of the model, they are best seen as a test of *outcome validity* and not of *conceptual validity* (Carley 1996). As such, corroborating empirical results are a *necessary* condition for confidence in the overall validity of the model, but not a *sufficient* condition because these results are silent with regards to the causal mechanisms by which they were generated. As such, the empirical results presented in this chapter should not be considered as having the final say on the quality of the model.

This chapter proceeds as follows. In the following subsection I briefly list the hypotheses that were derived in the previous chapter. Subsequently, I discuss the data, followed by the analysis of the empirical predictions. I finish with some concluding remarks.

4.1.1 Hypotheses

In this section, I will briefly list the the hypotheses that I will bring to the data. As noted in Chapter 3, 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 3.9). 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.

[1] Though one could make the argument that the emergence of macro-level patterns from micro-level behavioral rules is an explanation in and of itself (see e.g., Epstein 1999).

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 3.11). 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.

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 3.13). In addition, ideology becomes a better predictor of voter knowledge as media competition increases (see Figure 3.13). 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

4.2 Data and Measurement

Data

Data for this research comes from a number of sources. Individual-level and country-level political data are from the second module of the Comparative Study of Electoral Systems (CSES), a cross-national research program among over fifty national election studies (CSES

2007). The second module contains data on elections in the period 2001–2006. The models in this chapter are estimated with data from 27,596 individuals in 26 countries. Information on media freedom in those 26 countries is from Freedom House's annual Freedom of the Press Report. Freedom House is a U.S.-based non-governmental organization (NGO) that conducts and publishes research in the form of annual reports on democracy, political freedom and human rights. Political and media control variables are from UNESCO's Institute for Statistics, World Press Trends, the World Bank and Bormann and Golder (2013).

Table 4.1: Elections Under Study

Country	Year	Analysis	Media Freedom Score
ALBANIA	2005	✓	0.40
AUSTRALIA	2004	✓	0.84
BULGARIA	2001	✓	0.68
BRAZIL	2002	✓	0.56
CANADA	2004	✓	0.85
CHILE	2005	✓	0.73
CZECH REPUBLIC	2002	✓	0.77
GERMANY	2002	✓	0.88
DENMARK	2001	✓	0.96
FRANCE	2002	✓	0.85
GREAT BRITAIN	2005	✓	0.82
HUNGARY	2002	✓	0.77
IRELAND	2002	✓	0.86
ICELAND	2003	✓	1.00
ITALY	2006	✓	0.68
MEXICO	2003	✓	0.59
NETHERLANDS	2002	✓	0.88
NORWAY	2001	✓	0.96
NEW ZEALAND	2002	✓	0.97
POLAND	2001	✓	0.84
ROMANIA	2004	✓	0.44
SPAIN	2004	✓	0.78
SWEDEN	2002	✓	0.97
SWITZERLAND	2003	✓	0.96
USA	2004	✓	0.85

Dependent Variable: Voter Knowledge

Voter knowledge is measured identically to Chapter 2 as the absolute distance between an individual voter's perception of the largest party's ideological location to the mean perception of the electorate at large.[2] That is, individual voter knowledge is measured as $|L_{ij} - \bar{L}_j|$, where L_{ij} is voter i's perception of the ideological location L of party j and $\bar{L}_j$ is the perception of the electorate at large of the ideological position L of party j on a 10-point ideological scale.[3] This measure is constructed from CSES data (CSES 2007). To enhance interpretability of the results, the knowledge variable is inverted so that larger values of $|L_{ij} - \bar{L}_j|$ correspond to higher levels of knowledge. The variable is re-coded so that it varies between 0 and 1.

Dependent Variable: Representativeness

Representativeness R is measured as $R = |I_{p1} - I_{mv}| + |I_{p2} - I_{mv}|$. That is, the representativeness of a party system equals the sum of the absolute distances between the platforms of the two largest parties in the polity (I_{p1},I_{p2}) and the ideological location of the mean voter (I_{mv}). More representative party systems are thus represented by smaller values of R. Empirically, I_{p1} and I_{p2} are parties' positions on a 10-point left-right scale in the expert judgment of the CSES collaborators, whereas I_{mv} is measured simply as the national mean of respondents' self-reported ideological self-placement.[4] As such, this measured variable is identical to the representativeness variable that was generated from the theoretical model.

[2]Chapter 2 discusses the strengths and weaknesses of this approach.

[3]To increase comparability across as many countries as possible, I only focus on voters' ability to locate the largest parties in their polity.

[4]The exact wording of the item is as follows: "*In politics people sometimes talk of left and right. Where would you place yourself on a scale from 0 to 10 where 0 means the left and 10 means the right?*" CSES collaborators are local political scientists who worked with the CSES working group to integrate domestic election studies and institutional variables into the CSES data set at large. They were simply asked to place all parties in their polity on the same 10-point ideological scale.

Independent Variables

The first main independent variable in this paper is Freedom House's annual media freedom measure. This is a substantive and continuous measure of press freedom that assigns scores to countries related to government interference in the media sector.[5] Theoretically, the scale varies between 0 (most free) and 100 (least free) but usually Freedom House categorizes media systems as Free (0-30), Party Free (31-60) and Not Free (61-100). Scores are based three equally-weighted categories: legal environment, political environment and economic environment. The legal environment category encompasses "an examination of both the laws and regulations that could influence media content and the governments inclination to use these laws and legal institutions to restrict the media's ability to operate." The political environment category denotes the degree of political control over the content of the media, and the economic environment category includes for example the ownership structure of the media. Scores have been inverted and re-scaled so that a 0 denotes the country in the sample with the most media interference and 1 denotes the country with the least media interference.

Furthermore, I control for a number of media system, political system and individual-level variables. A Herfindahl Index measures *Newspaper Competitiveness* (Hirschman 1964). Theoretically, a Herfindahl index ranges from 0 to 1 where 0 denotes a perfectly competitive

[5]Without a doubt, the Freedom House measure does capture media competition alone. More than anything, it is a *substantive* measure—as opposed to an institutional measure—of a set of societal factors that together allow media outlets to do their work free from government interference. With that in mind, one could argue that it measures the extent to which a media system allows for competition among media outlets although I acknowledge this could be considered somewhat of a stretch. Ideally, I would have used a indicator of just media competition that is available in as many countries as possible. To this end, I include controls for *Newspaper Circulation* and *Newspaper Competition*, the latter measured using a Herfindahl index of newspaper audiences. Yet both variables only party capture competitiveness of a media system (which is, after all, what I am after): *Newspaper Circulation* is a simple measure of newspaper supply, whereas *Newspaper Competition* indicates the relative sizes of the five largest newspapers. However, competitiveness, is not just about audience sizes but about ownership structure, financial position and relationship to the government as well.

industry and 1 denotes a monopoly. The index H is calculated as follows: $H = \sum_{i=1}^{N} s_i^2$ where s_i is the market share of firm i in the market, and N is the number of firms. The models in this chapter include an index for just the newspaper industries, which was calculated using data from the World Press Trends Reports on countries' five largest newspapers.[6]. *Newspaper Circulation* is measured as the circulation of daily newspaper per 1000 inhabitants in the year of election.[7] This variable is from the World Bank. *Political System* is a dummy variable that takes on a 1 if a country in the year of the election had a parliamentary system and 0 otherwise (i.e., presidential or mixed). This variable is taken from Bormann and Golder (2013). *Majoritarian* is a dummy variable that takes on 1 if a country in the year of the election had a majoritarian electoral system and 0 otherwise (i.e., proportional or mixed).This variable is also taken from Bormann and Golder (2013). *Compulsory Voting* is a dummy variable that takes on 1 if a country has compulsory voting laws and 0 otherwise. This variable is taken from CSES (2007) and its inclusion intends to capture the idea that in countries where voting is mandatory, this may affect voters willingness to learn about parties. *Effective Number of Legislative Parties* denotes a weighted count of the number of parties in each electoral system (Laakso and Taagepera 1979; Taagepera 1997). This variable is taken from Bormann and Golder (2013) and intends to control for variation in the complexity of party systems. *Education* is measured on a scale from 1 (no education) to 8 (university undergraduate degree completed). *Income* is measured on a scale from 1 (lowest household income quintile) to 5 (highest household income quintile). *Age* is measured in years. All individual-level variables are taken from CSES (2007). To enhance ease of interpretation, all individual-level variables have been recoded to range from 0 to 1.

[6] `http://www.wan-ifra.org/microsites/world-press-trends`

[7] Daily newspapers refers to those publications that appear at least four times a week

4.3 Results

In this section, I will discuss evidence for *Knowledge Hypothesis*, *Representativeness Hypothesis* and the *Ideology and Media Systems Hypothesis* respectively. The discussion of the evidence for the *Knowledge Hypothesis* will be brief since it is this hypothesis that informed the model in Chapter 3 in the first place. In contrast, I will place more emphasis on the *Representativeness Hypothesis* and the *Ideology and Media Systems Hypothesis* since these are novel empirical implications that were derived from the model.

Table 4.2: Correlations at the Elections Level

	VK	R	I	Inc	Edu	Age	PD	MD	CV	ENP	F	NC
VK												
R	0.14											
I	-0.41*	-0.76***										
Inc	-0.17	-0.32	0.46**									
Edu	0.09	0.00	0.20	0.28								
Age	0.37*	-0.18	-0.05	-0.01	0.21							
PD	0.23	-0.06	-0.19	0.09	0.16	0.53***						
MD	0.00	-0.03	0.06	0.05	0.36*	0.29	0.11					
CV	-0.53***	0.17	-0.22	-0.07	-0.30	-0.40*	-0.03	0.02				
ENP	0.01	0.21	-0.21	0.11	-0.17	-0.26	0.08	-0.35*	0.40*			
F	0.60***	0.16	-0.27	-0.07	0.11	0.42**	0.27	0.13	-0.16	0.18		
NC	0.51**	0.05	-0.01	0.18	0.23	0.36	0.25	-0.08	-0.37*	0.09	0.65***	
H	0.34	0.28	-0.31	-0.16	-0.21	-0.11	-0.11	-0.22	-0.10	0.03	0.17	0.33

Note: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$, VK = Voter Knowledge; I = Ideology; Inc = Income; Edu = Education; R = Representativeness; PD = Parliamentary Dummy; PD = Majoritarian Dummy; CV = Compulsory Voting; ENP = Effective Number of Parties; F = Media Freedom; NC = Newspaper Circulation; H = Newspaper Herfindahl.

4.3.1 Descriptive Statistics

Tables 4.2, 4.3 and 4.4 contain correlations and summary statistics for all the variables.[8] More than anything else in Table 4.2, the high correlation ($\rho = .65$) between *Media Freedom*

[8]I have included correlation tables for variation at both the individual level and the level of elections since both types of variation are relevant when it comes to the interpretation of multilevel-model results later.

and *Newspaper Circulation* stands out. Furthermore, it appears that *Media Freedom* and *Media Competition* correlate modestly as well ($\rho = .17$). This provides some evidence for *Media Freedom* as an encompassing measure of media competition. Furthermore, media freedom and voter knowledge at the election level are positively related. Table 4.3 shows that at the individual level as well, education and income are positively linked with voter knowledge.[9]

Table 4.3: Correlations at the Individual Level

	VK	I	Inc	Edu
VK				
I	-0.08***			
Inc	0.07***	0.04***		
Edu	0.12***	-0.01**	0.38***	
Age	0.02***	0.03***	-0.19***	-0.24***

Note: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$, VK = Voter Knowledge; I = Ideology; Inc = Income; Ed = Education.

Table 4.4 shows the descriptive statistics of the variables at both the individual level and the election level. Since many observations were missing for both the *Newspaper Circulation* (8 out of 39) and *Newspaper Competitiveness* (15 out of 39) variables, I used multiple imputation on these variables in the analysis that follows next, not just to increase the statistical power of the statistical tests but to avoid potentially biased results as well (Little and Rubin 1987).

4.3.2 Evidence for the Knowledge Hypothesis

The *Knowledge Hypothesis* posits that in a comparison of countries, as national media systems become more competitive, on average, the electorate at large becomes better informed. Stated in empirical terms, this implies that as national media systems are more free

[9]With so many observations at the individual level, the significance levels are not so informative. What matters more is the size of the correlation.

Table 4.4: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Voter Knowledge	0.8	0.17	0	1	48007
Representativeness	0.27	0.16	0	1	59079
Ideology	0.52	0.26	0	1	50475
Income	0.48	0.34	0	1	49199
Education	0.58	0.26	0	1	63694
Age	0.35	0.2	0	1	61887
Parliamentary	0.44	0.5	0	1	60982
Majoritarian	.10	.30	0	1	61887
Compulsory Voting	.20	.40	0	1	64256
ENP	3.85	1.57	1.55	8.47	62178
Media Freedom	0.75	0.23	0	1	63060
Newspaper Circulation	0.37	0.28	0	1	47287
Newspaper Herfindahl	.16	.06	.10	.42	40827

from government interference, on average, the public at large is better able to ideologically locate the biggest party in their polity. To investigate this empirical prediction, I estimated a random intercept model of voter knowledge on individual-level and institutional variables, the results of which are presented in Table 4.5.[10]

The highly significant, positive estimate for media freedom ($\beta = .12$) shows that in countries where media systems are more free from government interference, on average, the public at large is better informed about politics, which is in line with the findings from Chapter 2 and provides some tentative evidence for the *Knowledge Hypothesis*. In substantive terms, the size of the parameter estimate is remarkable: it suggests that the effect of *Media Freedom* is about twice as large as the effect of *Education* ($\beta = .12$ vs. $\beta = .06$). The positive and significant OLS regression estimate for media freedom in Table 4.6 confirms this result. In

[10]A short note on Diagnostics: To have a better feel for the structure of the data, I estimated the country-level intraclass correlation coefficient ($\rho = .16$) which revealed significant and considerable unobserved heterogeneity. This indicates that the individual observations are clustered within countries. As noted in Chapter 2, in the presence of significant heterogeneity a random intercept model is to be preferred over a pooled OLS regression model since there is significant variation across countries and under such conditions complete pooling leads to biased standard errors and incorrect hypothesis tests (Rabe-Hesketh and Skrondal 2008) With that in mind, the statistical models that test *Knowledge Hypothesis* thus employ a multilevel-model structure.

Table 4.5: Random Intercept Model

	Random Intercept Coef./Std. err.
Individual-level variables	
Income	0.03***
	(0.00)
Education	0.06***
	(0.00)
Age	0.00
	(0.00)
Country-level variables	
Parliamentary Dummy	0.01
	(0.01)
Majoritarian Dummy	-.03
	.02
Compulsory Voting	-0.08***
	(0.02)
ENP	-.00
	.00
Media Freedom	0.12***
	(0.04)
Newspaper Circulation	-0.00
	(0.01)
Newspaper Competitiveness	.01
	.03
(Intercept)	0.68***
	(0.04)
$\sqrt{\psi}$	.04
	.01
$\sqrt{\theta}$	.15
	.00
ρ	.07
	.02
n/N	36 / 38305

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

contrast, I find no evidence that *Newspaper Circulation* and *Newspaper Competition* significantly affect *Voter Knowledge*. With regards to *Newspaper Circulation* this is potentially explained by its large correlation with *Media Freedom* ($\rho = .65$, see Table 4.2): both variables probably pick up identical variance in *Voter Knowledge*. The insignificant parameter estimate for *Newspaper Competition* in essence qualifies the *Knowledge Hypothesis*. It implies that, when it comes to media competition and voter knowledge, it is not the relative size of the largest media outlets that matters.[11]

Confirming the findings from Chapter 2, at the individual level both income and education positively affect voter knowledge: better educated voters with a larger income tend to be more knowledgeable about politics than their less-earning, less-educated counterparts.[12] If anything, these intuitive findings should enhance confidence in this measure of voter knowledge.

4.3.3 Evidence for the Representativeness Hypothesis

The *Representativeness Hypothesis* posits that in a comparison of countries, as national media systems become more competitive, political competition becomes less representative of the electorate at large.[13] Empirically, this would imply that in countries where media systems are more free from government interference, on average, parties are located further away from the mean voter. To investigate this empirical prediction I ran a simple OLS regression of

[11] It's also possible that this Herfindahl index is just a very noisy measure of media competition.

[12] I have also estimated a random-coefficient model where the estimated effect of education on voter knowledge is modeled to vary randomly across elections, much like the random coefficient model from Chapter 2. But although education and voter knowledge are positively correlated at both the individual level and the election level (see Tables 4.5 and 4.6), the random coefficient model estimates the effect of education on voter knowledge to be negative for most elections in the data set. At this point, I do not have a good answer for why this is the case. Although the differential effect of education on voter knowledge across media systems is not an outcome that is generated from the model and thus unrelated to its discussion here, I wanted, for reasons of transparency, to share this peculiar statistical result.

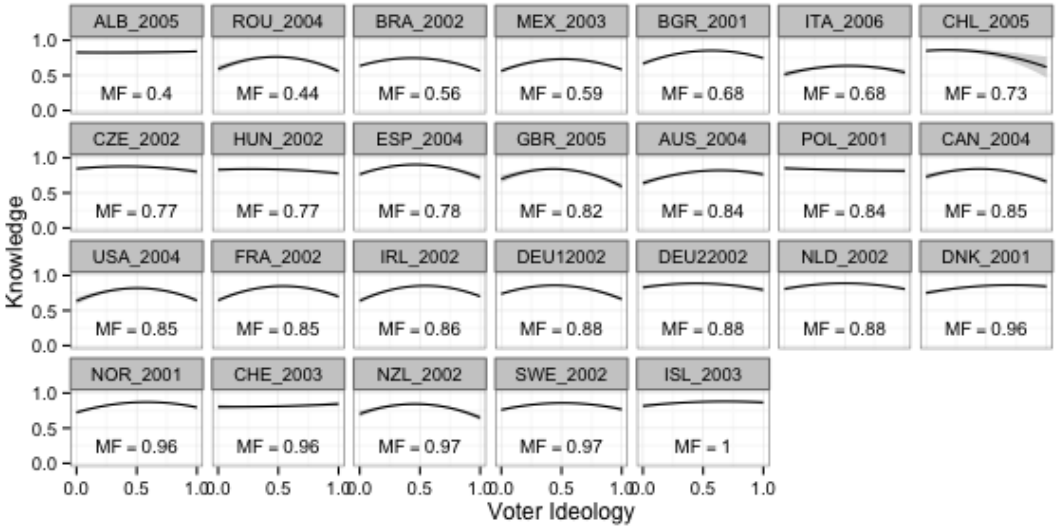
[13] See Chapter 3 for a discussion of the tentative nature of this hypothesis.

Table 4.6: OLS Models of Voter Knowledge and Representativeness

	Dependent variable:	
	Representativeness	VoterKnowledge
	OLS	*OLS*
	(1)	(2)
Parliamentary	−0.075	0.016
	(0.079)	(0.025)
Media Freedom	0.383	0.166**
	(0.363)	(0.070)
Compulsory Voting	0.111	−0.087**
	(0.101)	(0.032)
Newspaper Circulation	−0.021	−0.009
	(0.238)	(0.066)
Constant	0.005	0.680***
	(0.239)	(0.041)
Observations	27	28
R^2	0.130	0.511
Adjusted R^2	−0.028	0.426
Residual Std. Error	0.197 (df = 22)	0.061 (df = 23)
F statistic	0.822 (df = 4; 22)	6.002*** (df = 4; 23)

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

representativeness on media freedom (see Table 4.6). Contrary to the *Representativeness Hypothesis*, I find no evidence that media freedom has any effect (let alone a negative effect) on representativeness. In fact, none of the institutional-level predictors seems to significantly affect the representativeness variable. This can mean one of two things. Either these variables really do not have any effect on representativeness and the *Representativeness Hypothesis* is flat-out wrong, or this is simply a poor measure of representativeness of party systems. At this point both explanations are observationally equivalent, and the way forward lies in further study of the model predictions and the literature on representation, starting with Achen (1978).



Note: The figure displays estimated knowledge for individual voters across different ideological ideal points in increasingly competitive media systems (denoted by MF). Higher scores denote increasing levels of knowledge with one denoting perfect knowledge.

Figure 4.1: Voter Knowledge and Ideology Across Countries

4.3.4 Evidence for the Ideology and Media Systems Hypothesis

The model not only generated election-level predictions, but individual-level predictions as well. Most importantly, the *Ideology and Media Systems Hypothesis* states that 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. Empirically, this would imply that ideologically moderate voters are better capable at locating the biggest party in their polity but only when media are less free from government interference. In addition, it entails that in a simple (quadratic) regression of voter knowledge on ideology, voter knowledge is estimated with more error as media systems become more competitive.

As a test of the first part of the hypothesis, Figure 4.1 displays predicted voter knowledge

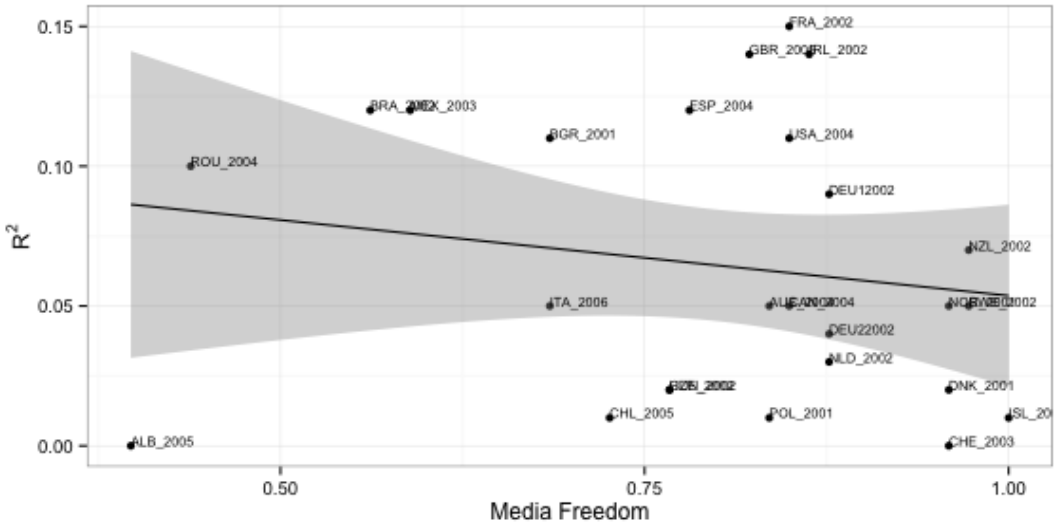
of a quadratic regression of voter knowledge on ideology across elections [14] If the *Ideology and Media Systems Hypothesis* were right we should observe that, going from least free media systems to most free media systems (that is, from Albania, 2005 to Iceland, 2003), the shape of the regression line should change from a quadratic relationship to a linear relationship. The estimated effects, however, are somewhat inconclusive in that there is no unambiguous transformation in the predicted pattern of voter knowledge across media systems.[15] For example, moderate citizens in New Zealand (2002) are clearly better informed about politics than are citizens at the ideological extremes even though their media system is free from government interference. Furthermore, there is no differential effect of moderate ideology on voter knowledge in Hungary (2002) despite a relatively high level of government interference in that country. That being said, Figure 4.1 does show an interesting interaction between voter ideology and media freedom in their effect on voter knowledge. In some media systems, the relationship between ideology and voter knowledge is a linear one, whereas in others it is quadratic with moderate citizens being relatively-well-informed. So even though this interactive effect is not as clear-cut as the first part of the *Ideology and Media Systems Hypothesis* this variation is worth exploring more.[16]

As a test of the second part of the hypothesis, Figure 4.2 displays a scatter plot of the estimated R^2 of a quadratic regression of voter knowledge on ideology across levels of media freedom. If the *Ideology and Media Systems Hypothesis* were right we should observe that,

[14] That is: $VK = \beta_0 + \beta_1 I + \beta_2 I^2 + \epsilon_i$, where VK = Voter Knowledge and I = Ideology.

[15] A more systematic approach to tackling this question would be to employ a cross-level interaction model where the individual-level Ideology and Ideology^2 variables both interact with the election-level media freedom variable to explore whether the random coefficient of the Ideology^2 variable decreases with higher degrees of media freedom. However, eye-balling the results from Figure 4.1 deems such an approach superfluous.

[16] One confounding explanation is that media freedom is correlated with the effective number of parties (Laakso and Taagepera 1979) such that voter knowledge is a function of the complexity of the party systems and not of media freedom. Another possibility—at the individual level—is that ideology is correlated with other voter-level characteristics like interest in politics or party membership. These rivaling hypotheses can be tested empirically, but that project is for later.



Note: The scatter plot displays a scatter plot of the estimated R^2 of a quadratic regression of voter knowledge on ideology across levels of media freedom. It shows that in media systems that are more free from government interference, ideology becomes a worse predictor of political knowledge.

Figure 4.2: The Predictive Value of Ideology on Voter Knowledge Across Countries

going from least free media systems to most free media systems (that is, from Albania, 2005 to Iceland, 2003), ideology becomes a worse predictor of voter knowledge. This is in fact what happens as evidenced by the fitted line in the Figure. This fitted line denotes the least squares regression line across the observed R^2 in all elections.[17] It shows that as government interference in the media sector decreases, individual ideology becomes a worse predictor of individual voter knowledge. Even though this regression itself is estimated with a lot of error, this is an interesting finding nonetheless and a finding that is in line with the *Ideology and Media Systems Hypothesis*.[18]

[17]Technically it is the line that maximizes the R^2 across the estimates of R^2 for all elections. It probably doesn't get more meta than that.

[18]I should note, however, that the theoretical argument for the *Ideology and Media Systems Hypothesis* is that with increased media competition, moderate voters are less likely to have the advantage of having a media outlet located near them in the ideological space. Yet empirically, there of course exist alternative explanations for this relationship. This is the down side of having a noisy and multifaceted measure of media

4.4 Discussion

In this chapter I have used the CSES (2007) data set to explore the evidence for the empirical implications of the agent-based model in Chapter 3. Without a doubt, the results are mixed. On the one hand, I find corroborating evidence for the main finding in Chapter 2 that media freedom is positively related to the political knowledge of the public at large. This lends some empirical support for the *Knowledge Hypothesis*. However, I also find some evidence that qualifies this hypothesis as, when it comes to media competition, it is not the relative size (in terms of audience share) of the largest newspaper outlets that matters (as evidenced by the insignificant parameter estimate for *Media Competition* in Table 4.5). In other words, the empirical results suggest that the *Knowledge Hypothesis* is perhaps not specific enough. In the agent-based model it was easy to affect competitiveness of a media system by randomly varying the number of media outlets while keeping all else constant. Yet empirically it is unclear what it is about media competition that matters (among other factors, for example, owner ship structure, ties between government and mass media or simply the number of media outlets).[19] This of course brings me back my earlier discussion (see the Introduction to this Chapter) of how difficult it is to empirically test abstract agent-based models.

That being said, I do find some evidence for the model-generated *Ideology and Media Systems Hypothesis*: at the individual level, ideology becomes a worse predictor of voter knowledge as media systems are more free from government interference (see Figure 4.2). With regards to the causal mechanism for this finding, it's possible that in media systems that are more free from government interference there is simply more information from ideologically like-minded outlets available to citizens (since *Media Freedom* and *Newspaper*

competition.

[19] I am dealing with an *observational equivalence* problem here since it might be that (i) media competition doesn't affect voter knowledge, or (ii) I simply haven't captured that aspect of media competition that matters.

Circulation are positively correlated). As a result, citizens from across the ideological spectrum are all equally met in their informational needs and thus the effect of ideology on voter knowledge weakens. However, the cross-level interaction that this causal story implies is not exactly borne out by the data. Figure 4.1 shows that in some countries with high *Media Freedom* ideology still is a relevant predictor of voter knowledge.

Chapter 5

Conclusion

The objective of this dissertation has been to explore how characteristics of national media systems are linked to variation in voter knowledge, both theoretically and empirically. In this concluding chapter I will first briefly list the contributions this dissertation has made. I will then finish with some concluding remarks.

5.1 Findings

Chapter 2 presents empirical evidence that voters who live in media systems that are more free from government interference are, on average, more knowledgeable about politics than voters in media systems that are less free, and the marginal effect of education is more pronounced in free media systems than it is less free media systems. These results are likely the result of increased supply of political information in free media systems, as evidenced by the strong positive correlation between media freedom and newspaper circulation. In free media systems, individual outlets are less likely to be 'captured' by the government leading to a more heterogeneous, competitive and less constrained information environment,

which (i) positively affects the political knowledge of the electorate at large, yet (ii) it benefits well-educated voters more than less-educated voters. Chapter 3 took these empirical connections to construct an agent-based model that aimed to capture micro-dynamics between the electorate, media outlets and parties across varying media systems. This model generated a set of interesting results. For example, it found that media competition is associated with a public that is better informed about politics (i.e., the *Knowledge Hypothesis* but less representative party competition *Representativeness Hypothesis*[1]. In addition, it predicted that more competitive media systems are associated with more alternations in government*Alternations Hypothesis*. It also found 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. In addition, ideology becomes a better predictor of voter knowledge as media competition increases (i.e., the *Ideology and Media Systems Hypothesis*. These hypotheses were then tested in Chapter 4, which used the CSES (2007) data set to explore the evidence for the empirical implications of the agent-based model in Chapter 3. The results were mixed. On the one hand, I found corroborating evidence for the main finding in Chapter 2 that media freedom is positively related to the political knowledge of the public at large (i.e., *Knowledge Hypothesis*). And although this particular finding was what informed the model in the first place, I also found some evidence for the model-generated *Ideology and Media Systems Hypothesis*: at the individual level, ideology becomes a worse predictor as media systems are more free from government interference. On the other hand, I do not find any evidence for the *Representativeness Hypothesis*: media freedom does not relate to the accountability of political competition as measured in this chapter. Furthermore, it does not appear that the cross-level interaction effect between media freedom, ideology and voter knowledge is as clear-cut as predicted by the *Ideology and*

[1]see Chapter 3 for a discussion on the plausibility of these hypotheses

Media Systems Hypothesis.

5.2 Concluding Remarks

This dissertation presented a formal model of electoral competition and voter knowledge in the presence of variation in media, as well as empirical evidence for that model. The results have been mixed, which, I believe, has much to do with the fact that 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. As a result, the model generates many possible results, some of which are not all that convincing because the exact data-generating process remains elusive. That being said, I also believe that linking formal theory and empirical evidence could make for an important contribution to the study of media effects and voter knowledge. For example, the model I presented 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. As such, I hope the approach I took in this dissertation helps to bridge the empirical study on media effects with theoretical work on spatial models of electoral competition (with incomplete information) and the economics of media, which, in principal, all struggle with the same underlying question: how does information flow in a political system with candidates, voters and competitive media?

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Appendix A: R Code for the Agent-Based Model

```
#Martijn Schoonvelde, 2013

#hjms$ open -n /Applications/R.app/
rm(list=ls(all=TRUE))
ptm <- proc.time()
library(msm)
library(foreign)

update <- function(x,y,z){
x[,3] <- x[,3] + (y - x[,3])*x[,4] / (x[,4] + (1 - x[,12]) +.01)
x[,5]  <- x[,5] + (z - x[,5])*x[,6] / (x[,6] + (1 - x[,12]) + .01)
x[x[,4] <= .01,4] <- .01
x[x[,6] <= .01,6] <- .01
x[x[,4] > .01,4]  <- x[x[,4] > .01,4]*(1 - x[x[,4] > .01,12]) / (x[x[,4] > .01,4] + (1 - x[x
    [,4] > .01,12])) +.01
x[x[,6] > .01,6]  <- x[x[,6] > .01,6]*(1 - x[x[,6] > .01,12]) / (x[x[,6] > .01,6] + (1 - x[x
    [,6] > .01,12])) +.01
return(x)
}

update1 <- function(x,y,z){
x[,3] <- x[,3] + (y - x[,3])*x[,4] / (x[,4] + ((1 - x[,12]) + x[,15]) +.01)
x[,5]  <- x[,5] + (z - x[,5])*x[,6] / (x[,6] +((1 - x[,12]) + x[,15]) +.01)
x[x[,4] <= .01,4] <- .01
```

```
x[x[,6] <= .01,6] <- .01
x[x[,4] > .01,4]  <- x[x[,4] > .01,4]*(1 - x[x[,4] > .01,12]) / (x[x[,4] > .01,4] + (1 - x[x
    [,4] > .01,12])) +.01
x[x[,6] > .01,6]  <- x[x[,6] > .01,6]*(1 - x[x[,6] > .01,12]) / (x[x[,6] > .01,6] + (1 - x[x
    [,6] > .01,12])) +.01
return(x)
}

#MONTE CARLO SIMULATION PARAMETERS
R <- 10000                          #Number of Monte Carlo runs
mc_data <- array(0, dim <- c(R,19))                 #Monte Carlo Data set
yhat <- array(0, dim <- c(R,1001))
#MODEL PARAMETERS
V <- 1001                          #number of voters
T <- 100                           #election periods
kappa <- .01                                        #voter learning parameter
mu <-  .01                                          #media learning parameter
delta <- .01                                        #party learning parameter
P <- 2                                              #incumbent and challenger party

party <- array(0,dim <- c(P,5))                     #PARTY VARIABLES
# 1 ideology
# 2 ideology t-1
# 3 vote share t
# 4 vote share t-1
# 5 vote share t-2
voter <- array(0, dim <- c(V,15))                   #VOTER VARIABLES
# 1 interest in news (propensity)
# 2 decision to buy news
# 3 mu Party 1
# 4 sigma^2 Party 1
# 5 mu Party 2
# 6 sigma^2 Party 2
# 7 electoral choice
# 8 media choice
# 9 ideology
# 10 U(t)
```

```
# 11 U(t-1)
data <- array(0,dim <- c(T,14))                          #DATA

#q <- array(0, dim <- c(R*T,7))

pb <- txtProgressBar(min = 0, max = R, style = 3)

for (r in 1:R){                              #Monte Carlo loop
Sys.sleep(0.1)
setTxtProgressBar(pb, r)
N <- (1 + as.integer(runif(1,0,10)))                  #number of media outlets (min 1, max 10)
lambda <- round(runif(1), 1)                            #utility parameter media

media <- array(0, dim <- c(N,9))                         #MEDIA VARIABLES
media1 <- array(0,dim <- c(T,N*2))
# 1 quality at time t
# 2 quality at time (t-1)
# 3 media audience share at time t
# 4 media audience share at time (t-1)
# 5 media ideology
# 6 U(t)
# 7 U(t-1)
# 8 U(t-2)
# 9 media ideology (t-1)

voter[1:V,1] <- runif(V)                                 #propensity to consume news
voter[1:V,3] <- rtnorm(V,.5,1,0,1)                       #initial mu Party 1
voter[1:V,4] <- 1                                        #initial sigma^2 Party 1
voter[1:V,5] <- rtnorm(V,.5,1,0,1)                       #initial mu Party 2
voter[1:V,6] <- 1                                        #initial sigma^2 Party 2
voter[1:V,9] <- rtnorm(V,.5,1,0,1)                       #distribution of ideology
voter[1:V,10:11] <- runif(V*2)                           #initial utility at t and (t-1)

party[1,1:2] <- round(runif(2,0,median(voter[,9])), 2)
party[2,1:2] <- round(runif(2,median(voter[,9]),1), 2)
gov <- 1                                                 #set Party 1 to be in government

```

```
media[1:N,1:4] <- round(runif(N*4), 2)                #initial news quality and audience
    share
media[,5] <- round(rtnorm(N,.5,1,0,1), 2)            #media ideology
#media[,5] <- round(runif(N),2)

                                                      #voter locate nearest media outlet
voter[,15] <- Vectorize(function(r) min(abs(voter[r,9] - media[,5])))(seq(nrow(voter)))

for (t in 1:T) {                    #Time Loop
data[t,1] <- t                                        #Time Counter
a <- round(runif(1),  2)
voter[,2] <- rbinom(V,1,voter[,1])
x <- ((a+party[1,1])/2)
y <- ((a+party[2,1])/2)
w <- party[1,1]
z <- party[2,1]
p <- ((a+party[gov,1])/2)
                                                      #voters choose to consume news based
                                                          on propensity to do so; choose
                                                          outlet closest to them
                                                          ideologically
voter[,8]  <- Vectorize(function(r) which.min(abs(voter[r,9] - media[,5])))(seq(nrow(voter))
    )
voter[,12] <- Vectorize(function(r) media[voter[r,8],1])(seq(nrow(voter)))
voter[voter[,2]==0,8] <- 0
voter <- update1(voter,w,z)

if (gov==1) {                                          #news-ignoring voters only learn
    about incumbent through policy outcomes
  voter[voter[,2]==0,3] <- voter[voter[,2]==0,3] + (x - voter[voter[,2]==0,3])*(voter[voter
      [,2]==0,4] / (voter[voter[,2]==0,4] + 1))
  voter[voter[,2]==0,4] <- voter[voter[,2]==0,4] / (voter[voter[,2]==0,4] + 1)
  voter[voter[,2]==0,5] <- voter[voter[,2]==0,5]
  voter[voter[,2]==0,6] <- voter[voter[,2]==0,6]
}

if (gov==2) {
```

```
voter[voter[,2]==0,3] <- voter[voter[,2]==0,3]
voter[voter[,2]==0,4] <- voter[voter[,2]==0,4]
voter[voter[,2]==0,5] <- voter[voter[,2]==0,5] + (y - voter[voter[,2]==0,5])*(voter[voter
    [,2]==0,6] / (voter[voter[,2]==0,6] + 1))
voter[voter[,2]==0,6] <- voter[voter[,2]==0,6] / (voter[voter[,2]==0,6] + 1)
}

voter[voter[,3] > 1,3] <- 1
voter[voter[,5] > 1,5] <- 1
voter[voter[,3] < 0,3] <- 0
voter[voter[,5] < 0,3] <- 0
                                                    #voters vote sincerely based on the
                                                        information they have
voter[,13] <- abs(rtnorm(V,voter[,3],voter[,4],0,1) - voter[,9])
voter[,14] <- abs(rtnorm(V,voter[,5],voter[,6],0,1) - voter[,9])
voter[voter[,13] <= voter[,14],7] <- 1
voter[voter[,13] > voter[,14],7] <- 2
                                                    #voters obtain utility and update
                                                        interest in news
voter[voter[,2]==0,10] <-  - abs(voter[voter[,2]==0,9] - p)
voter[voter[,2]==1,10] <-  - abs(voter[voter[,2]==1,9] - p) - (1 - voter[voter[,2]==1,12])
voter[voter[,2]==0 & voter[,10] <= voter[,11],1] <-  voter[voter[,2]==0 & voter[,10] <=
    voter[,11],1] + kappa
voter[voter[,2]==0 & voter[,10] > voter[,11],1]  <-  voter[voter[,2]==0 & voter[,10] > voter
    [,11],1] - kappa
voter[voter[,2]==1 & voter[,10] > voter[,11],1]  <-  voter[voter[,2]==1 & voter[,10] > voter
    [,11],1] + kappa
voter[voter[,2]==1 & voter[,10] <= voter[,11],1] <-  voter[voter[,2]==1 & voter[,10] <=
    voter[,11],1] - kappa
voter[voter[,1] > 1,1] <- 1
voter[voter[,1] < 0,1] <- 0
voter[,] <- round(voter[,], 2)

                                                   #votes are counted and party with most
                                                        votes wins election
party[1,3] <- round(sum(voter[1:V,7]==1)/V, 2)
party[2,3] <- round(sum(voter[1:V,7]==2)/V, 2)
```

```
gov <- which.max(party[,3])
                                                    #media update quality of reporting
                                                        using predator strategy
media[,3] <- Vectorize(function(r) sum((voter[1:V,8]==r)/V))(seq(nrow(media)))
media[,6] <- round(lambda*(media[,3]) - (1 - lambda)*abs(media[,5] - party[gov,1]), 2)
max.audience <- which.max(media[,3])
max.utility  <- which.max(media[,6])

for (n in 1:N) {
if (max.utility != n & media[n,2] > media[max.utility,2]) {media[n,1] = media[n,2] - mu}
if (max.utility != n & media[n,2] < media[max.utility,2]) {media[n,1] = media[n,2] + mu}
else {media[n,1] = media[n,2]}
}

media[media[,1] < .01,1] <- .01
media[media[,1] > .99,1] <- .99

                                                  #losing candidates update platform
                                                      using predator strategy
if (party[-gov,1] < party[gov,1]) {party[-gov,1] <-  party[-gov,2] + delta}
if (party[-gov,1] >= party[gov,1]) {party[-gov,1] <-  party[-gov,2] - delta}
if (party[-gov,1] < 0) {party[-gov,1] <- 0}
if (party[-gov,1] > 1) {party[-gov,1] <- 1}

data[t,2] <- gov                                     #government party
data[t,3] <- party[1,1]                              #ideology party 1
data[t,4] <- party[2,1]                              #ideology party 2
data[t,5] <- party[gov,3]                            #government vote share
data[t,6] <- mean(media[,1])                         #mean quality of reporting
data[t,7] <- sum(voter[,2]==1)/V                     #share of informed voters
data[t,8] <- mean(abs(voter[,3] - party[1,2]))       #avg know party 1
data[t,9] <- mean(abs(voter[,5] - party[2,2]))       #avg know party 2
data[t,10] <- sd(voter[,3] - party[1,2])             #variation in knowledge party 1
data[t,11] <- sd(voter[,5] - party[2,2])             #variation in knowledge party 2

alt <- array(0,dim=c(T,2))                           #calculating no of alternations
alt[,1]=data[,2]
```

```
for (i in 2:T) {
if (alt[i,1]!=alt[i-1,1]) alt[i,2]=1
}
data[t,12] <- sum(alt[,2])                          #number of alternations

voter[1:V,11] <- voter[1:V,10]                      #voters reset utility
media[1:N,4] <- media[1:N,3]                        #media reset audience share, quality
     of reporting and utility
media[1:N,8] <- media[1:N,2]
media[1:N,2] <- media[1:N,1]
media[1:N,7] <- media[1:N,6]
party[1:P,4] <- party[1:P,3]                        #parties reset vote shares and
    ideology
party[1:P,5] <- party[1:P,2]
party[1:P,2] <- party[1:P,1]
a = x = y = w = z = p = 0
media1[t,1:N] <- media[,4]
media1[t,(N+1):(2*N)] <- media[,5]
}                          #Close Time Loop
data[,1:7] <- round(data[,1:7], 2)

mc_data[r,1] <- N                                   #number of media outlets
mc_data[r,2] <- lambda                              #profit versus policy-driven media
mc_data[r,3] <- mean(data[1:T,6])                   #mean quality of reporting
mc_data[r,4] <- data[T,3]                           #ideology party 1
mc_data[r,5] <- data[T,4]                           #ideology party 2
mc_data[r,6] <- abs(data[T,3] - median(voter[,9]))  #ideological distance party 1 from
    median voter
mc_data[r,7] <- abs(data[T,4] - median(voter[,9]))  #ideological distance party 2 from
    median voter
mc_data[r,8] <- median(voter[,9])                   #median voter
mc_data[r,9] <-  mean(data[,7])                     #share of informed voters
mc_data[r,10] <- mean(data[,8])                     #average knowledge voters party 1
mc_data[r,11] <- mean(data[,9])                     #average knowledge voters party 2
mc_data[r,12] <- mean(voter[,15])                   #average distance to media outlet
mc_data[r,13] <- mean(data[,10])                    #variation in knowledge party 1
mc_data[r,14] <- mean(data[,11])                    #variation in knowledge party 2
```

```
mc_data[r,15] <- data[T,12]                                    #number of alternations in power
mc_data[r,16] <- abs(data[1,3] - data[T,3])                    #range party 1
mc_data[r,17] <- abs(data[1,4] - data[T,4])                    #range party 2
                                                               #correlation between voter ideology
                                                                   and voter knowledge
#mc_data[r,18] <- cor(voter[voter[,9]<= .5,9],(abs(voter[voter[,9]<= .5,3] - party[1,2]) +
    abs(voter[voter[,9]<= .5,5] - party[2,2])))
#mc_data[r,19] <- cor(voter[voter[,9] > .5,9],(abs(voter[voter[,9] > .5,3] - party[1,2]) +
    abs(voter[voter[,9] > .5,5] - party[2,2])))
                                                               #predicted voter knowledge, across
                                                                   ideology and N
VK <- as.data.frame(abs(voter[,3] - party[1,2]) + abs(voter[,5] - party[2,2]))
ID <- as.data.frame(voter[,9])
predict <- cbind(VK,ID)
names(predict) <- c("VK","ID")
new <- data.frame(x = seq(0, 1, 0.001))
yhat[r,] <- as.matrix(predict(lm(predict$VK ~ predict$ID), new, se.fit = FALSE))

party[,] = 0
voter[,] = 0
media[,] = 0
data[,]  = 0
}                          #Close Monte Carlo Loop

#mc_data[,1:9] <- round(mc_data[,1:9], 2)
#mc_data[,16:19] <- round(mc_data[,16:19], 2)
#mc_data <- as.data.frame(mc_data)
#save(mc_data, file = "/Users/hjms/Documents/StonyBrook/Dissertation/Model/Data/Media1.Rdata
    ")
#write.dta(mc_data,"/Users/hjms/Documents/StonyBrook/Dissertation/Model/Data/Media1.dta")
close(pb)
proc.time() - ptm
```