

Biased News and Political Participation

Dimitri Kelly
UW Wisconsin-Madison
ddkelly@wisc.edu

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Abstract

Technological advances in media offer unprecedented access to news and information. The bulk of research focusing on media expansion has considered its effects with regards to the quantity of information available to society. Optimistically, increasing the availability of political information should enhance democratic responsiveness and representation, lessening inequalities in knowledge and participation across the socio-economic spectrum. Yet empirical studies of media expansion offer little support for this perspective. How can more plentiful information not provide participatory benefits? One reason is that nonpolitical entertainment alternatives have increased along with new information sources. With regards to politics, increasing media choice means that individuals so inclined can learn more, and politically uninterested others can take advantage of the opportunity to learn less. An important distinction exists however, between increasing the availability of political information and increasing its accessibility. Whereas the former is primarily a function of the quantity of information publicly available, the latter concerns its qualitative character. By focusing on the nature of information available, and in particular on the political biases that frequently define new media, this research attempts to answer the question: what effect does access to biased information have on political participation? To answer this, I examine the introduction of the Fox News Channel into U.S. media markets during the 2002 U.S. congressional elections. In contrast with previous null findings, I find that access to Fox News increased political participation rates. I argue that this result is driven by news bias functioning as a cognitive subsidy, reducing uncertainty, and thereby lowering the information costs constraining the decision to participate.

INTRODUCTION

Recent technological advances in media offer unprecedented access to news and information. The bulk of research focusing on media expansion has considered its effects with regards to the quantity of information available to society. Optimistically, increasing the availability of political information should enhance democratic representation, lessening socio-economic inequalities in knowledge and participation. Yet empirical studies of media expansion consistently offer little support for this perspective (e.g. Tichenor et al. 1970; Bimber 2001; Gentzkow 2006; George and Waldfogel 2006; 2008; Prior 2005; 2007).

How can more plentiful information not provide participatory benefits? One reason is that nonpolitical entertainment alternatives have increased along with new information sources. With regards to politics, increasing media choice means that individuals so inclined can learn more, and politically uninterested others can take advantage of the opportunity to learn less (Prior 2007). This helps to explain why studies examining the expansion of news media generally have so far failed to find increased levels of political knowledge or participation (e.g. Bimber 2001; Gentzkow 2006). For example, expanding access to the Internet represents a dramatic increase in the quantity of information available to society, yet it produced no net increase in political knowledge (Bimber 2001).

An important distinction exists however, between increasing the availability of political information and increasing its accessibility. Whereas the former is primarily a function of the quantity of information publicly available, the latter concerns its qualitative character. This research focuses on the nature of information available, and highlights the political biases that frequently define new media. What effect does access to biased information have on political participation? To answer this question, I examine how the introduction of the Fox News Channel (hereafter Fox News) into American media markets shaped voter participation in the 2002 U.S. congressional elections.

In contrast with previous null findings, I find that access to Fox News increased political participation rates. I argue that this result is driven by news bias functioning as a cognitive subsidy, reducing uncertainty, and thereby lowering the information costs constraining the decision to participate.

The paper proceeds as follows. Section 2 describes how information affects political participation, the pivotal role of the media environment, and the special case of biased information. Section 3 discusses empirical strategy, explains the focus on Fox News and

describes the data used in the empirical work. Section 4 examines the effects of access to Fox News on political participation. Section 5 concludes.

1 INFORMATION AND POLITICAL PARTICIPATION

Political participation requires information; at a minimum, information is needed to identify choices and their consequences. *Uncertainty* is defined generally as a lack of surety about present or future events. In politics uncertainty can manifest as ambiguity surrounding candidates' policy stances (e.g. Alvarez 1997; Franklin 1991), personal traits, competence, or more generally with regards to predictions about the likely impact of competing policy proposals (Jerit 2009). In this paper, I focus on a particular type of uncertainty, political choice uncertainty, which surrounds decision-making in the face of political alternatives. In this context, uncertainty can result either from political ignorance and indifference as well as from informed ambivalence. Following Burden (2003), I conceptualize uncertainty as "an amount or a degree rather than as a quality that is merely present or absent (p6)." In most cases, acquiring information can reduce uncertainty, but cannot eliminate it entirely. Few decisions in politics involve complete certainty. Political *information* is data about current political developments and actors. Crucially, to reduce uncertainty, information need not be correct; as Kuklinski et al. (2000) note, some people have both strong and incorrect beliefs about the political world. Indeed, from the perspective of a citizen observing politics, incorrect and correct information are often indistinguishable.

Political *knowledge* is defined as the range of factual information about politics stored in long-term memory (Delli Carpini and Keeter 1996). More generally, knowledge reflects an understanding of the basic relationships and actors operating in a given context (Downs 1957). Thus political knowledge might include cognizance of the organizational features of government, details about a proposed policy, or awareness of current political actors. Note the important distinction between uncertainty and knowledge. Uncertainty reflects how a person feels; knowledge is something a person has. While knowledge can be measured by the possession of verifiably correct information, measures of uncertainty would include the amount of information individuals believe they have and their level of confidence in decision-making.

From these definitions it is clear that information can reduce uncertainty without increasing knowledge, for example if the information is incorrect. Conversely, information can increase knowledge while failing to reduce uncertainty, for example information in the form of equally salient pros and cons surrounding an issue. Finally, information can increase knowledge and reduce uncertainty, for example one-sided information focused on the negatives effect of a proposed policy. In short, uncertainty is subjective, knowledge is not, and information can affect either or both¹.

In rational theories of political behavior, the cost of information is an important factor affecting the decision to participate (e.g. Aldrich 1993; Downs 1957; Riker and Ordeshook 1968; Matsusaka 1995). In behavioral political science, information occupies a central, though less explicit, role in political participation research. For example, education is positively associated with participation, a result largely mediated through education's positive effect on individuals' ability to process politically relevant information they encounter (e.g. Delli Carpini and Keeter 1996; Wolfinger and Rosenstone 1980; Verba, Schlozman, and Brady 1995).

Political actors desire information to reduce uncertainty. Rational choice theories of behavior depict information as valuable only insofar as it affects outcomes; thus, citizens continue to "invest" in information until marginal cost equals marginal return (Downs 1957). Voters tasked with deciding among candidates often rely on such low-cost heuristics as party identification in lieu of the more costly process of learning and evaluating candidates' issue positions (Campbell et al. 1960; Lupia 1994; Lupia and McCubbins 1998). The increased information costs required for voters to reach a decision are important factors explaining lower turnout rates in nonpartisan elections (Schaffner et al. 2001) and in elections below the presidential level that provide less free information about candidates and issues (Campbell 1960). In short, the cost of information is an important determinant in whether people participate in politics.

This intuition is formally stated in the "calculus of voting", originally developed by Downs (1957) and extended by Riker and Ordeshook (1968) summarizes the "rewards," or

¹ Some may find it useful to think of the relationship between information and knowledge in terms of minimizing mean square error, whereas information is related to uncertainty in terms of minimizing variance. In the former, the correct answer is known, and information is useful because it reduces error, i.e. people with more information are more likely to know the correct answer. In the later, it is irrelevant what is objectively correct. Instead, what is important is whether people think they are correct; information is thus useful because it reduces uncertainty, i.e. people can be wrong, so long as they think they are right. This is certainty.

R , for voting as: $R = PB - C$. Where P is the probability that one's vote is decisive, B is the difference in utility between candidates, and C is the cost of voting² (Riker and Ordeshook 1968). Interpreting the calculus is straightforward; if R is positive, vote; if not, abstain. Holding all else constant, increasing the cost of information increases the cost of political decision-making. Empirically, the positive relationship between information and participation is well documented (e.g. Lassen 2005; Palfrey and Poole 1987; Delli Carpini and Keeter 1996; Wolfinger and Rosenstone 1980).

The calculus described above applies equally well to participation more generally. Adopting Aldrich's (1993) framing of the scenario, there are costs to participation, and presumably citizens who decide to abstain do not have to pay these costs. These costs include obtaining and processing information. For the voting decision, there are additional direct costs associated with registering and going to the polls (Wolfinger and Rosenstone 1980).

The decision to participate beyond voting entails additional direct costs, and more substantial information costs. Presumably a greater level of certainty about expected benefits is required to decide to incur the higher costs involved with donating money or volunteering one's time than is required for the voting decision, which is a relatively low-cost, low-benefit decision problem. Whether the above calculus applies to voting, attending a rally, displaying a campaign button, or any other means of actively taking part in the political process, information costs play an important role in the decision to participate or abstain.

While rational theories of participation are explicit about the role of information in political participation, observational studies in political science acknowledge its importance as well (e.g. Delli Carpini and Keeter 1996; Verba et al. 1995; Wolfinger and Rosenstone 1980). Normative concerns over the unequal distribution of political knowledge in America are often rooted in its contribution to systematic inequities in who participates in the political system and how effectively (Delli Carpini and Keeter 1996; Eveland and Scheufele 2000; Prior 2007). In socioeconomic status (SES) models of participation, the effects of education are mediated both through the provision of information directly and through the development of skills and motivations leading to effective acquisition of new information (Verba et al. 1995; Wolfinger and Rosenstone 1980). Indeed, the importance of public

² The D term is omitted for simplicity (c.f. Aldrich 1993).

information, and the role of campaign advertising in providing it, is cited in a rare defense of that frequent campaign villain: the negative ad (Freedman et al. 2004).

In sum, information matters for political participation. In addition to reducing uncertainty and clarifying choices, it demystifies the workings of the political world, increases feelings of efficacy and political interest, and fosters a sense of connectedness to the political process.

2.1 *The Media Environment*

The citizen is an information processor, but information is environmentally supplied, and individual choices are embedded within informational settings that systematically vary in time and space. (Huckfeldt and Sprague 1995, p292).

While existing research points towards a generally positive effect of political knowledge on participation, whether or not people become informed depends crucially on their information environment. In the influential opportunity-motivation-ability (OMA) learning framework, ability and motivation are individual qualities that can affect political knowledge levels, but their impact is conditional on the opportunities people have to access politically relevant information (Luskin 1990; Delli Carpini and Keeter 1996). Even the most motivated and able will remain ignorant of political affairs if no relevant information is available.

More recently, political knowledge research has focused on how technological changes have affected the constellation of media sources people routinely have access to. Altering the media environment alters the sources people turn to for political information, the frequency with which they consume media, and what they learn about politics from those sources. As the number of entertainment alternatives increases, substitution away from news programming exacerbates social inequities in the distribution of political knowledge (Prior 2005). While an early study found no discernible relationship between the presence or absence of television and voter turnout in Iowa during the 1952 Presidential election (Simon and Stern 1955) a more comprehensive longitudinal study found that expanding access to television between 1940 and 1972 contributed to decreasing voter turnout, a result attributed to people substituting away from more politically informative media (Gentzkow 2006). Today, people with cable television programming are less likely to view prime-time presidential TV appearances (Baum and Kernell 1999), watch televised

presidential debates (Baum and Kernell 1999; Hamilton 2005), or news programming in general (Prior 2007).

In focusing on the amount of information available and the costs of obtaining it these studies take an implicitly quantitative view of information. Studies adopting this perspective are often disappointed that increasing the amount of information available to people either fails to increase political knowledge and participation (Bimber 2001) or increases both only among already knowledgeable participants (Prior 2007; Tichenor et al. 1970).

While perhaps disappointing from a normative perspective, this result is not surprising. Though increasing the demand for information creates incentives to increase its supply, increasing the supply of information independent of demand does not imply demand will automatically increase. Simply put, there are a finite number of politically attentive people in society and news media face competition with other interests for people's attention. In addition, a narrow focus on the quantity of media coverage ignores content. Both the volume and character of information are important for understanding how media influence participation.

In sum, expanding the media environment increases the quantity of politically relevant information while simultaneously reducing its consumption among those less motivated to care about politics. When citizens opt out of politically relevant information sources in favor of other forms of entertainment, their incentives for participating are diminished because the loss of information results in increased costs. This study shifts focus away from the sheer quantity of information available and instead highlights qualitative distinctions in the type of information available.

Conceptually distinguishing between the quantity and the quality of information in a media environment depends on the research question. For example, George and Waldfogel (2006) found expanding availability of the *New York Times* decreases local newspaper readership. Consistent with a distraction effect of national media on local affairs, they found that as *Times* penetration increased, turnout in local elections among college-educated individuals decreased (George and Waldfogel 2008).

Qualitatively the *New York Times* differs from local newspapers in terms of its commitment to local versus national political coverage. However, a quantitative distinction could be made as well, either in terms of overall political coverage or in the amount of presidential news coverage specifically. A research program focused on either of these

distinctions might well hypothesize a positive effect of *Times* penetration on turnout in general or during presidential elections specifically. Predictions surrounding a given media expansion depend largely on how the researcher conceptualizes its contribution to existing media environments.

2.2 *The Special Case of Biased News*

There is an important distinction between adding entertainment alternatives to a news dominated media environment, and adding biased news to an already crowded media environment. The first allows people who prefer entertainment to substitute away from news, with a net effect of shrinking the news consuming public (Prior 2007). The second allows people to choose from a menu of political perspectives on the news, and entails primarily a reshuffling of the existing news audience (Morris 2007).

The production of news entails gathering and sorting information; by necessity this process prioritizes certain issues and perspectives at the expense of others. The dominant news paradigm elevates objectivity as the standard, leaving it up to individual citizens to translate information about current events into politically relevant considerations. Providing biased news coverage involves processing information about the political world in a particular manner, highlighting the decision-relevant aspects of an issue in a way that predisposes consumers to come to certain conclusions about the implications of current events and political actors' motivations or competence. In this sense, compared to information from an objective source, the cost of forming or updating political beliefs using information from a biased source is subsidized. Subsidizing the cost of information lowers the cost of being politically informed.

As a cognitive subsidy, the value of biased information varies across individuals according to their existing political predispositions and cognitive processing abilities. For a variety of reasons, people are more likely to accept biased information if they agree with the perspective it is slanted towards. Information that is consistent with an existing worldviews is easier to process and store (Axelrod 1973; Conover and Feldman 1984; Lodge and Hamill 1986; Zaller 1992). People tend to accept supportive information at face value, while subjecting dissonant information to a more critical evaluation (Lord et al. 1979; Taber and Lodge 2006). Because biased information is easier for some to process, the mobilizing effects of access may be stronger among partisans whose political beliefs are consistent with the direction of the bias. Substantively, this effect is likely to be compounded by partisans'

tendency to be disproportionately exposed to supportive information, whether unintentionally due to social, economic, or residential context (Lazarsfeld, Berelson, and Gaudet 1952; Sears and Freedman 1967), unconsciously via politically homogenous social networks (Huckfeldt and Sprague 1987), or through direct exposure resulting from motivated search (Stroud 2007; 2008; Iyengar and Hahn 2007; Iyengar et al. 2008). In short, congenial partisans are both more likely to accept the cognitive subsidy biased news sources represent and to be exposed to biased news sources in general.

In addition to partisan affiliation, the value of subsidized information is likely to vary with cognitive ability. For political sophisticates, the participatory benefits of biased news are likely to be negligible. Among individuals having already decided to become politically informed, decreasing the cost of information is unlikely to significantly increase levels of either information or participation. Instead, the benefits of lowering information costs should be greater among individuals whose ability to process new information effectively is limited either by low levels of education (Delli Carpini and Keeter 1996) or the lack of an existing store of political knowledge (Tichenor et al. 1970; Gilens 2001). Importantly, while congenial partisans seem most likely to benefit in general, among less knowledgeable individuals there are reasons to expect biased news to have positive participatory effects regardless of existing beliefs.

Less politically sophisticated people tend to have weaker political attachments, making them more susceptible to persuasion by the one-sided information flow that biased news represents, either directly through exposure (Zaller 1992) or indirectly through social networks (Katz and Lazarsfeld 1955; Katz 1957). In short, persuasion can motivate participation if it is successful enough to reduce uncertainty. This expectation should be moderated somewhat in the context of a biased news source as the individuals with the most to gain from subsidized information are also among the least likely to be exposed to political information in general (Zaller 1992; 1996).

In short, because decisions about whether to participate politically are sensitive to information costs, increasing the availability of biased news coverage may increase rates of political participation in general. In particular, participation rates may be higher among partisans congenial to the bias presented and the less educated, since for both the bias represents a more significant cognitive subsidy.

This prediction complements Verba, Scholzman, and Brady's (1995) resource model of political activism. Those authors focus on the resources that can be used to reduce the

costs of participation, which they categorize as time, money, and civic skills. In this case, access to a biased news source lowers the level of resources necessary to process the news and participate in politics by subsidizing information costs. From this perspective, biased news mobilizes, convincing people to participate, clearly identifying the sides of the debate, and letting viewers know where they should stand across political issues.

3 EMPIRICAL STRATEGY AND DATA

The empirical strategy of this paper relies on a counter-factual framework. The counter-factual framework borrows its logic and language from randomized experimental research. This approach is based on the belief that the most credible causal research designs rely on random assignment to overcome selection bias³. Identifying media effects under any circumstances is a historically difficult proposition; in the modern high-choice media environment it is more daunting still. Nonetheless, this research is concerned with identifying the causal effect of a biased news source; a lofty goal confounded by the fact that individuals select themselves into distinct news audiences for a variety of potential reasons.

In multivariate regression, the accuracy of estimation rests on the assumption that all relevant potential confounding variables are accounted for (Morgan and Winship 2007). However, in the context of a high choice media environment, this assumption is likely unrealistic. Consider for example, the reported relationship between holding misperceptions surrounding the rationale for the Iraq war and reliance on the Fox News Channel (Kull et al. 2003). In this study the researchers found that, controlling for a variety of demographic and political characteristics, regular viewers of the Fox News Channel were more likely to hold one or more misperceptions surrounding the decision to go to war.⁴ However, from this alone it is impossible to determine if viewing Fox News *causes* misperceptions because we cannot definitively rule out the possibility that some unmeasured characteristic simultaneously affects both Fox News viewership and propensity to hold these misperceptions. That is, unless we fully understand why some people choose Fox News over other news sources, we cannot rule out that the same factors

³ In the language of regression analysis, selection bias amounts to correlation between the regressor and the error term. For more technical expositions of both the counter-factual model and selection bias see Morgan and Winship (2007), or Angrist and Pishke (2009).

⁴ Misperceptions included were that clear evidence of Iraq-al Qaeda links have been found, WMD have been found, and world public opinion favored the Iraq war.

driving them towards Fox News are also predisposing them to hold certain attitudes. This fundamental problem bedevils research seeking causal inference, and is the primary reason that the controlled experiment has been exalted as the gold standard for making causal claims.

The ideal scenario for demonstrating the causal effect of a particular news source would be to randomly assign individuals into specific news audiences. Random assignment in this case would solve the selection problem because it would make news choice independent of news preference. In this ideal scenario, a difference of means test between the attitudes of individuals in each news audience would give the average causal effect.

In this paper I attempt to approximate this experimental ideal by taking advantage of the natural experiment provided by the introduction of *The Fox News Channel* (hereafter “Fox News”) into US media markets.

3.1 *Why Fox News?*

There are several reasons for focusing on Fox News. First, Fox News provides news coverage with a uniquely conservative perspective compared to other mainstream news providers. Research measuring the bias of various news programs using think tank citations found that Fox News is substantially to the right of both its cable competitors and the average U.S Congressperson (Groseclose and Milyo 2006). Importantly, the time frame of this study overlaps Groseclose and Milyo’s analysis; in their study, they track Fox News coverage from 1998-2003. A more recent study by the Pew Research Center’s Project for Excellence in Journalism of news coverage surrounding the 2008 presidential campaign found that Fox News offered substantially more favorable coverage to Republican candidate John McCain than to his Democratic rival Barack Obama (Pew 2008).

Second, of the three primary cable news channels, Fox News dominates primetime, with nearly double the viewership of CNN and MSNBC combined (Calderone 2009). The substantive significance of a Fox News effect is magnified by its popularity. Third, the natural experiment created by the timing of its introduction in local media markets provides a unique source of leverage for identifying and estimating causal effects.

Fox News debuted October 7, 1996 on a limited number of cable carriers. Advertising rates for cable channels depend on audience size, making the number of cable carriers offering a given channel an important factor in its profitability. Fox News had an especially aggressive strategy of expansion, offering cable companies \$10 or more per subscriber to

carry Fox News (Carter 1996). As a result, the number of people with cable access to Fox News increased rapidly. By 2000, Fox News was available to approximately 35 percent of the U.S. population (DellaVigna and Kaplan 2007); in 2002 this number was close to 50 percent⁵.

I focus on cable access because the fixed costs of laying cable gives local cable companies' natural monopolies. Local cable companies independently determine which channels to carry, creating substantial geographic variation in terms of access to particular channels. Decisions about whether to distribute a new channel are constrained in part by the number of channels available. Often, the decision to offer a new channel means eliminating an existing channel. For example, to make room for Fox News, Tele-Communications Inc. stopped carrying the Lifetime Channel, facing a public backlash among women's groups as a result (Carter 1996).

In sum, the rapid expansion of Fox News in the decade following its 1996 debut provides a natural experiment for the effects of media expansion. Because Fox News' coverage is to the right of its cable competitors (Groseclose and Milyo 2005), the introduction of Fox News into local media environments provides a unique source of biased political information. Della Vigna and Kaplan (2007) take advantage of this to estimate aggregate effects on Republican vote share in the 2000 U.S. presidential elections. Building on this design I estimate the effect of Fox News availability using individual level data on political participation.

3.2 *Data*

Data for this study are drawn from several sources: the 2002 American National Election Studies (NES), *The Television and Cable Factbook* (Factbook), and the 2000 U.S. Census Bureau.

The 2002 NES is a natural starting point because it contains a large, nationally representative survey and includes many demographic and political measures as well as respondents' detailed geographic location. The Factbook contains comprehensive

⁵ Though this project focuses exclusively on Fox News availability via cable, it should be noted that Fox News was also available via satellite. There are no controls available for access to Fox News via satellite; however, the substantive effect is respondents in the data mistakenly coded as not having access to Fox News who actually do. This type of measurement error introduces a bias against finding significant differences between groups (c.f. King et al. 1994).

information on TV, cable, and related industries. The relevant information for this project concerns the availability via cable of Fox News within specific geographic boundaries serviced by a single cable provider, data laboriously hand-coded from hard copies of the Factbook. Data on Fox News availability was merged onto the NES data by matching on census place identifiers. Data from the U.S. Census include 2000 turnout information⁶, racial makeup, income, and education levels at the county level.

It is important to be clear about what the following analysis is, and is not. It is not an analysis of the direct effect of exposure to a biased news source. Nor is it an analysis of the indirect effect of people in one's social network being exposed. Because the data do not include individual measures of exposure, these effects cannot be separated. Rather, what is estimated is the aggregate individual effect of introducing Fox News into a media environment. Keeping with the language of controlled experiments, this is analogous to an intent to treat (ITT) analysis. In clinical trials, randomization between control and treatment groups can be undone if the decision of individuals to follow through with the study is systematic. ITT analyses mitigate this by relying on initial treatment intent, rather than on treatment administered (see Lachin 2000).

While driven in part by necessity, the analysis presented here may be of more substantive interest in terms of understanding the real-world impact of biased news than one isolating either direct or indirect effects. That is, in the real world, the impact of news is not limited solely to its effect on those directly exposed, but includes various ripple effects as information is spread through social networks. By capturing the potential effect of treatment policy rather than any specific avenue of potential treatment effects, the ITT approach provides a pragmatic estimate of the total effect of changing the media environment.

4 ANALYSIS AND RESULTS

Fox News availability represents the treatment of causal interest; respondents with access to Fox News comprise the treatment group, while those without make up the control group. Given a random population sample, if Fox News availability were randomly assigned, a difference of means test would produce an unbiased average causal effect. However, while the NES is a random sample of the U.S. population, the availability of Fox

⁶ Special thanks to Sarah Niebler for sharing data on total turnout and Bush vote share.

News may not be randomly assigned. To correct for possible selection biases in Fox News availability and reduce the sensitivity of results to changes in model specification, I utilize propensity score matching to preprocess the data, followed by parametric estimation using the subsample of matched observations (c.f. Ho et al. 2007). Intuitively this strategy boils down to comparing participation rates for individuals in areas with access to Fox News with similar people in areas without Fox News.

4.1 *Selection*

That Fox News availability may not be randomly assigned is by itself not necessarily a problem. A problem would only arise in the event that variables affecting the likelihood of an individual receiving treatment also affect their propensity to participate in politics. In this case, failure to account for these factors violates the assumption of ignorability, confounding causal estimation.⁷

Fox News may well have focused their initial expansion efforts in areas based on expectations about viewership. If this was the case and Fox News was more available in areas with populations more naturally interested in political news, especially news with a conservative perspective, this could induce a spurious relationship between higher participation rates and Fox News availability. Being in an environment surrounded by people who are disproportionately interested in political coverage of this type may lead one to conclude mistakenly that it increased participation rates on average, even after controlling for individual characteristics. A similar effect could occur if Fox News was more available in areas with higher income and education levels, two other aggregate predictors of political participation (Huckfeldt 1990).

Party identification is another possible confounder as well. The 2002 elections were the first to take place after the September 11th, 2001 attacks on the World Trade Center. National security is generally thought of as an issue owned by the Republican Party (Petrocik et al. 2003). Because Republicans may be more sensitive to elite appeals based on national security, people in densely Republican areas may have participated at higher rates by virtue of having been exposed to more intense or more effective mobilization efforts. If this were the case, and Fox News was more likely to expand in heavily Republican areas

⁷ This is often referred to as omitted variable bias, see King et al. 1994.

based on expectations of greater demand for conservative news, this would also create a spurious association between political participation and Fox News availability.

Because the assignment of individuals into Fox News availability may not be purely random, I first investigate the nature of the selection process and estimate the availability of Fox News, focusing in particular on the contextual characteristics relating to political participation described above. While it is not plausible that Fox News availability is driven by individual level sample characteristics, some models include individual data as predictors as a means of assessing random imbalance in the survey sample.

I define Fox News availability as Fox_{ik} , which equals one if individual i in county k lives in an area where all cable systems in 2002 offer Fox News in either a basic or expanded cable package, and zero if no cable system offers Fox News. What few individuals (< 20) in areas with multiple cable providers were dropped if one provider offered Fox News and the other did not. Using political and demographic variables drawn from the above discussion of potential confounders, I estimate the logit regression model:

The political variables of interest for individual i in county k are: county level turnout in the 2000 presidential election, $\text{Turnout}_{k,2000}$, measured as votes cast over total population, and $\text{Bush}_{k,2000}$, the proportion of votes received by George W. Bush in 2000. County level data from the 2000 Census for median income and percent of the population with at least a bachelor's degree are $\text{Income}_{k,2000}$ and $\text{Degree}_{k,2000}$ respectively. To control for the mobilizing effect of increased electoral competition, $x_{i,2002}^{\text{open}}$ and $\text{Contact}_{i,2002}$ are dichotomous indicators for whether individual i lives in a district with an open seat in the 2002 congressional elections and whether individual i was contacted by any political organization about the elections.

To assess random imbalance in the sample $\Gamma_{i,2002}$ is a vector of individual level variables related to political participation: strength of partisanship⁸, gender, age, and education. All models utilize NES provided weights to correct for individual sampling

⁸ Partisanship is measured by an ordinal scale from zero (nonpartisan identifiers) to three (strong partisan identifiers).

probabilities and bias due to unit non-response. Because some individuals i live in the same county k , standard errors are clustered at the county level⁹. Table 1 presents results¹⁰.

[TABLE 1 ABOUT HERE]

Column one presents results from a model using only county level predictors. While Fox News availability is significantly related to turnout in 2000, the association is negative. Holding all other variables at their mean, moving from the lowest level of turnout in the data (0.16) to the highest (0.59) reduces the predicted probability of Fox News availability from 0.68 to 0.26. Median income is also significantly related to Fox availability, but is similarly negative. Moving upwards through the full range of median income reduces the predicted probability of Fox News availability from 0.74 to 0.12, holding all other variables at their mean¹¹. Substantively these together suggest that Fox News availability was not more likely in areas where people were more highly participatory in general or more financially well off on average.

There is, however, a significant positive association between Fox News availability and the percent of the population with at least a college degree. In the least educated county the predicted probability of Fox News availability is 0.24 compared to the most educated, 0.82¹². The coefficient for Bush vote share in 2000, while positive, is statistically insignificant.

Column two of Table 1 estimates Fox News availability using only individual level variables. As stated above, this model is primarily useful only for assessing balance in the sample between individuals with Fox News and those without. That is, are people in the data with access to Fox News comparable to those without? While stronger partisans are on average more likely to have access to Fox News, because increased partisan attachment is a potential result of biased news, its appropriateness as a control is debatable. Other

⁹ Clustering in the data is minimal and results do not change using unclustered standard errors.

¹⁰ An alternative approach would be a series of means tests for areas with and without Fox News. Table A in the appendix presents this information.

¹¹ The negative relationship between income and Fox News may be due to the nature of cable expansion. In general, advertisers pay more for audiences with disposable income. In more wealthy areas, the payoff in terms of higher advertising rates should increase competition among content providers, making it comparatively easier to expand into less wealthy markets.

¹² Aggregate education levels are thankfully highly correlated with income levels. In additional model specifications withholding each in turn the statistical significance of the remaining variable is eliminated altogether.

important predictors of political participation: age, education, electoral competitiveness and mobilization, are insignificant.

It is not the case that Fox News is disproportionately available to older, more educated individuals in the sample, nor are they more likely to be in electorally competitive districts or to be mobilized by political elites. Income, as in the county-level model, is significant but negative. Note also that using only individual data explains very little of the variation in Fox News availability, indeed the model as a whole fails to achieve statistical significance.

The combined model in column three of Table 1 includes all individual and county level predictors. The results are largely unchanged when both sets of variables are included. The overall picture that emerges from Table 1 is encouraging. Among sample respondents, it does not appear that Fox News availability is positively related to factors encouraging political participation. If anything, Fox News availability is greater among those less likely to participate in politics in general.

To correct for what differences do exist between individuals with and without access to Fox News, I preprocess the data using matching methods and then apply a parametric regression model for causal inference. The accuracy of causal inference models depend on the assumption of ignorability, or no omitted variable bias. Often this assumption is untestable, and debates over endogenous selection mechanisms end in stalemate. Using matching to preprocess the data breaks the connection between the treatment variable and the background covariates (Ho et al. 2007). Ideally, after matching, the only difference in the data between people with and without access to Fox News is whether they have access to Fox News.

While matching each treated case to an identical control case on all covariates would be ideal, a technique known as exact matching, the data cannot support this. Instead, I utilize an alternative approach that matches on a single variable, the propensity score. The propensity score is defined as the probability that an individual receives treatment—in this case, the probability that an individual has access to Fox News via cable. Matching treatment and control cases on their propensity scores, in expectation, balances the groups on all observed and unobserved covariates (Rosenbaum and Rubin 1983). As in all observational studies individuals' true propensity scores are unobserved; I estimate propensity scores for respondents using the logit model for Fox News availability presented

in column three of Table 1. I use the software Psmatch2 to implement nearest-neighbor matching, with replacement, and a 1% caliper¹³ (Leuven and Sianesi 2003).

[FIGURE 1 ABOUT HERE]

The goal of matching is to balance treatment and control groups to ensure comparability. The unmatched data contained 484 control cases (respondents without access to Fox News), and 451 treated cases (respondents with access). The matched data consist of 192 control cases to 282 treated cases¹⁴. Figure 1 presents a rough assessment of balance by plotting the distribution of estimated propensity scores for treatment and control groups. While this is not a formal balance test, the distributions appear reasonably comparable with substantial overlap.

[TABLE 2 ABOUT HERE]

Table 2 presents a more formal balance test, comparing mean differences and standardized biases for treatment and control groups after matching¹⁵. The standardized bias is a common measure of assessing covariate balance¹⁶ (c.f. Rosenbaum and Rubin 1985).

Looking at the percent bias reduction in column three, the matched data appear to be better balanced along all observable variables. Remaining standardized biases range from 0 to 9.2, with most either close to or below 5. Table B in the Appendix replicates the selection models from Table 1 using only matched data; no coefficients are statistically significant. Having established the similarity of the people in my sample with access to Fox News compared to those without, I turn now to estimating the effects of Fox News availability on political participation.

4.2 *Political Participation*

¹³ The use of a caliper constrains matches between treatment and control cases to those within a specified difference in treatment probabilities, in this case a difference of less than a one percentage point.

¹⁴ Matching with replacement allows multiple treatment cases to be matched to a single control cases, no control case was matched to more than five treated cases

¹⁵ Table 1 is replicated using only matched data as Table 2A in the Appendix.

¹⁶
$$B = \frac{|\bar{X}_T - \bar{X}_C|}{\sqrt{(S_T^2 + S_C^2)2}}$$

The variable for political participation, $d_{i,k,2002}^{Participate}$, equals one if individual i in county k engages in at least one of five self-reported forms of political participation¹⁷, and zero if they engage in none of them. I estimate a linear probability model¹⁸:

$$d_{i,k,2002}^{Participate} = \delta + \beta_1 v_{i,k,2000}^{FOX} + \beta_f \Gamma_{i,k,2000}^{Individual} + \beta_j \Gamma_{k,2000}^{County} + \varepsilon_k$$

The independent variable of interest is Fox News availability, $v_{i,k,2000}^{FOX}$, coded as before. The vector of individual level controls: partisanship, gender, age, education, income, electoral mobilization and competitiveness is $\Gamma_{i,k,2000}^{Individual}$, while the vector of county level controls: turnout in 2000, Bush vote share in 2000, median income in 2000, and percentage with at least a bachelor's degree is $\Gamma_{k,2000}^{County}$. As before all estimations utilize NES sampling weights to correct for non-response biases, standard errors are clustered at the county level.¹⁹ Table 3 presents results.²⁰

[TABLE 3 ABOUT HERE]

Unconditionally, the average treatment effect of access to Fox News increases the probability an individual will engage in at least one participatory act other than voting by 0.094. For perspective, consider that moving through the full range of education in the data increases the probability of participation by 0.187. Note that applying an unconditional linear probability model to the matched data is equivalent to a difference of means test between treatment and control groups. While the effect size remains relatively constant, the standard error shrinks as additional controls are added. This makes sense; while the control variables are uncorrelated with Fox News availability, they contain explanatory power for participation. Including them in the model therefore reduces the residual variance, which in turn lowers the standard error of the regression estimates (c.f. Angrist

¹⁷ The various forms of participation include: attempts to influence others votes, displaying a campaign button, attending a campaign event, volunteering for a campaign, and donating money.

¹⁸ Results do not change using either a logit or probit specification. An alternative approach would be to create an ordinal index and estimate using either ordinal logit or probit. Results are consistent using either of these specifications as well.

¹⁹ Significance does not change if standard errors are unclustered.

²⁰ Coefficient estimates for control variables are presented in Table C in the Appendix.

and Pischke 2009). This is an indication both of the robustness of the effect as well as further evidence that the matched data are well balanced.

To explore how the effects of access to Fox News varies for people with differing cognitive processing abilities, column four presents the results of a model including an interaction term between Fox News availability and respondent's level of education. Education in this case represents a proxy for cognitive ability. The interaction is negative and statistically significant. Substantively, this indicates that the participatory benefits of access to Fox News are stronger among respondents with less education. The predicted probability that an individual with the lowest level of education will engage in at least one participatory act increases from 0.11, in areas without Fox News, to 0.26 in areas with Fox News. This result is consistent with the expectation that the value of bias as a cognitive subsidy is greater for those with limited information processing ability.

Finally, the model in column 5 examines the varying effect of access to Fox News across respondents' political attitudes. To do this, I include an interaction between Fox News availability and a dummy variable for Republican partisan identification. The interaction is not significant and negative. Substantively this implies that the effect on participation of having access to Fox News was no different for Republicans than for Democrats and Independents. Contrary to theoretical expectations, this would seem to indicate that bias motivates congenial and opposing partisans equally. I explore this unexpected result further in the conclusion.

5 CONCLUSIONS

Does biased information change political behavior? The principle finding presented here is that it does. People with access to Fox News were more likely to actively participate during the 2002 U.S. Congressional elections than people without access. A significant corollary finding is that the positive participatory effects appear to be stronger for less educated individuals. Contrary to expectations, the effects of access did not vary for those whose political attitudes were assumed to be more consistent with the direction of bias.

Overall, the findings presented here are consistent with the larger theoretical perspective outlined in this paper. Namely, that biased news sources represent cognitive subsidies for processing political information. Because political participation depends

crucially on information about the actors and events involved, the cognitive subsidy provided by bias has a positive effect on the decision to participate.

It is important to highlight again that this project does not show that *exposure* to bias increased participation levels. While that is a logical inference, the direct effect of exposure is not identified in the present study. What is captured in the analyses presented here is the total effect of introducing an easily accessible source of biased information into an individual's media environment, what I termed an aggregate individual effect. This implicitly includes exposure, but also the indirect effects resulting from biased information transmitted via social networks.

While 'media bias' has historically been the villain of the right, the rise of Fox News has turned frequent denunciations of media bias one of few truly bipartisan pastimes (e.g. Brock 2004; Goldberg 2001). Implicit in these accusations is the assumption that biased news is harmful, a perversion of the natural and correct role of the press in a democracy. The belief that the appropriate role of the press is to provide objective reporting enjoys considerable support.

It should be noted however, that the norm of journalistic objectivity is a historically recent phenomena, arising more due to the system of economic incentives created by the industrial revolution than to changing public perceptions about the normatively appropriate role of the press in society (Baldasty 1992). During the 19th century, newspapers attempting to be politically neutral were roundly condemned from all sides as being either servile or lacking in principle. Explicit partisanship was viewed as a crucial aspect defining journalism's proper public mission in American democracy, with partisan newspapers seen as both platforms from which to entice voter support for the party and as a vehicle to mobilize party supporters to vote in elections (Kaplan 2002).

The newfound rise and popularity of biased news providers has caused some considerable consternation; leading some to predict dire consequences as a result of citizens' ability to sequester themselves in reinforcing and isolated "knowledge enclaves" (Jamison and Capella 2008), exposed only to information of their choosing (i.e. Sunstein 2002 "Daily Me). While claims about the influence of biased news sources have mostly relied on untested theoretical predictions, emerging research points to a few normatively conflicting results. On the one hand, biased information may inspire political discussion (Stroud 2007), helping combat pervasive political apathy. On the other hand there is evidence that

reliance on biased news sources can result in systematic misperceptions about the nature of the political world (Kull et al. 2003).

Scholars have historically decried the morsalizing approach many citizens take to politics (Lane 1962; Converse 1964), with some of the blame placed on news providers (Iyengar 1991). Biased news by definition involves putting events in context. That is, events may not be put into the same context across biased providers, but across all they are put into *some* context. This relieves the citizen of the cognitive task of connecting the dots between events and their decision-relevant political implications. As a result, bias combats political apathy by subsidizing the costs of attending to and participating in the political process; and participation is good.

In particular, the results presented here show that biased news may disproportionately increase participation rates among the less educated. Consider that an entire sub-field has developed around the “knowledge-gap hypothesis,” which states that increasing the flow of information into society widens rather than narrows political knowledge differences across socioeconomic strata (Tichenor et al. 1970). If this tendency is mitigated by the political character of the information, and the results presented here suggest that it is, the introduction of biased news sources has the potential to diminish existing inequities in who participates. Certainly this is a large claim that cannot be made based on this study alone, but given both the normative stakes and the results presented here this question is one that deserves further investigation.

Perhaps the most curious result is a null result, that between partisanship and Fox News. The theory of biased news as cognitive subsidy rests on the supported assumption that information consistent with existing beliefs is easier to process (Axelrod 1973; Conover and Feldman 1984; Lodge and Hamill 1986; Zaller 1992). A systematic study of news bias looking at Fox News from 1998-2003, found Fox News to be far to the right of the political spectrum (Groseclose and Milyo 2005). Why then wouldn’t Fox News have a greater effect on Republicans?

A possible explanation is that Fox News had a mobilizing effect across party lines, via alternative mechanisms. If Fox News were initially perceived as unbiased, or rather had a reputation for unbiasedness, there is no reason to expect that Democrats would avoid it or that Republicans would seek it out. In another chapter of the larger dissertation project, I examine the degree of political selective exposure over time and find that in 2002 self-

identified democrats made up approximately 40 percent of the Fox News Channel's audience²¹.

The theory of bias as cognitive subsidy outlined above does not offer an explanation for why conservative news would stimulate participation among more liberal individuals. However, the well-supported "third person effect" in communication holds that individuals exposed to persuasive messages in the mass media believe they will have a greater effect on others than on themselves (Davidson 1983). Additionally, perceptions of media bias are heightened when the medium is seen as having the potential to reach a mass audience (Gunther and Liebhart 2006). Thus, Democrats exposed to Fox News may recognize its bias, reject it, but nonetheless be motivated to participate as a means of counteracting the perceived persuasive effect bias on others. This is highly speculative of course, and further research to understand the mechanisms behind the mobilizing effect of biased news should be a priority.

Finally, it is also worth pointing out that typically political participation is treated as an unequivocal normative good. But what about participation motivated by misinformation or selective knowledge? This project offers no answer to this question; in some sense it further muddies the waters. The results presented here both highlight a positive effect of biased news, increased participation, but by assuming that bias systematically distorts the information presented to consumers, I implicitly assume that this increase is driven by incorrect or incomplete information. Bias may increase participation, but at what price? That the effects of slanted information appear to be strongest among the less educated raises the uncomfortable prospect that the price may come in the form of political demagoguery, persuasion, and manipulation.

²¹ Data from 2002 Pew Biennial Media Consumption Survey.

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Table 1: Fox News Availability

Dep Var: Fox Availability Via Cable in 2002

	Predictor Level		
	County	Individual	Combined
Partisan Strength		0.209** (0.098)	0.199* (0.103)
Male		0.028 (0.186)	0.060 (0.184)
Age		-0.001 (0.006)	0.002 (0.005)
Education		0.039 (0.067)	0.036 (0.069)
Income		-0.112** (0.053)	-0.098* (0.053)
Contact		-0.009 (0.208)	0.004 (0.201)
Open		0.200 (0.490)	0.252 (0.502)
2000 Turnout	-4.079** (1.953)		-4.016** (1.979)
2000 Bush	0.785 (1.048)		0.608 (1.103)
Median Income	-0.000** (0.000)		-0.000* (0.000)
Percent College	8.027* (4.424)		8.462* (4.563)
Constant	1.688* (0.978)	-0.199 (0.504)	1.310 (1.071)
Observations	830	773	772
Wald X^2	8.68*	8.46	17.45*
Pseudo R ²	0.039	0.0141	0.0489

Robust standard errors in parentheses

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

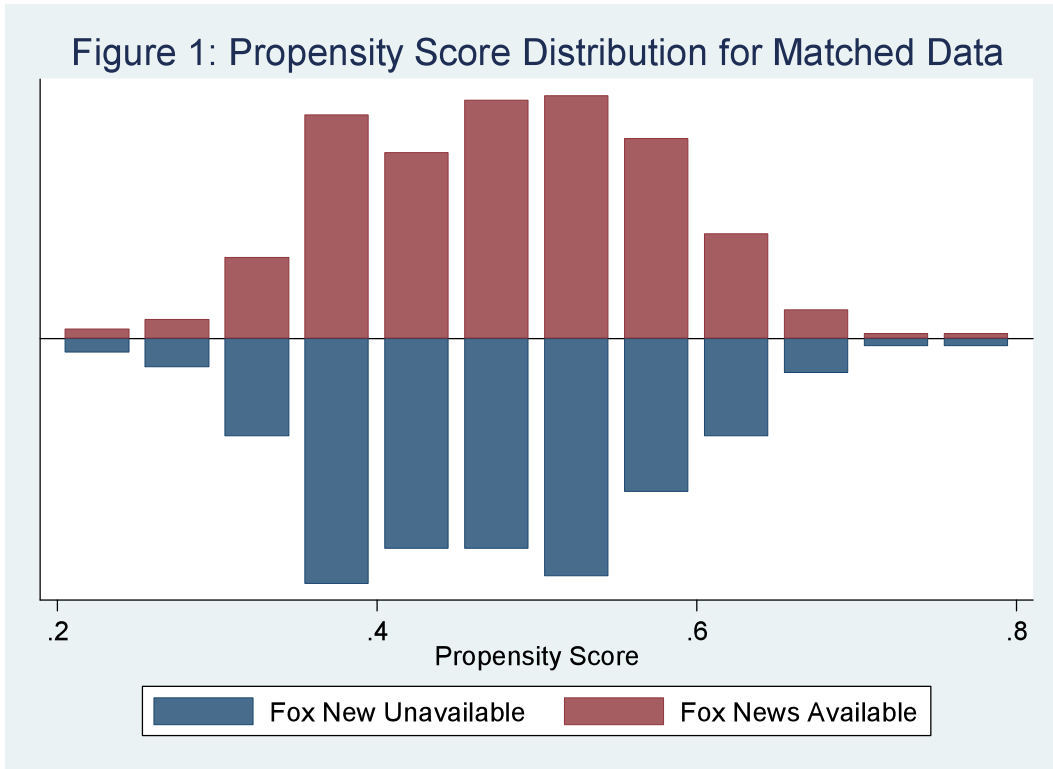


Table 2: Propensity Score Balance for Matched Data

	Mean		Std Bias %	% Bias Reduced
	Fox News	No Fox News		
Partisan Strength	1.93	2.01	-8.1	-1.6
Male	0.47	0.47	0	100
Age	50.34	49.99	2.2	63
Education	4.55	4.64	-5.3	52.3
Income	4.10	4.30	-9.2	57.4
Contact	0.52	0.52	-1.4	42.3
Open	0.11	0.09	5.8	20.3
2000 Turnout	0.38	0.38	7.4	74.1
2000 Bush	0.49	0.50	-7.7	53.3
Median Income	42.65	43.04	-3.5	84.8
Percent College	0.16	0.16	-1.5	82.3

Standardized bias is the difference between sample means as a percentage of the square root of the mean sample variances for treated and control groups (c.f. Rosenbaum and Rubin 1985)

Table 3: Political Participation - Matched Data

	Models				
Fox News Availability	0.094*	0.091*	0.095**	0.370**	0.145**
	(0.053)	(0.048)	(0.046)	(0.145)	(0.068)
Fox News * Education	-	-	-	-0.066**	-
				(0.037)	-
Fox News * Republican	-	-	-	-	-0.112
				-	(0.105)
Individual Controls	-	X	X	X	X
County Controls	-	-	X	X	X
Constant	0.311***	0.242*	0.498**	0.712***	0.563**
	(0.036)	(0.128)	(0.237)	(0.251)	(0.222)
Observations	474	474	474	474	474
R ²	0.009	0.096	0.106	0.106	0.112

Robust standard errors in
parentheses

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

APPENDIX**Table A: Difference in Means - Unmatched Data**

	Fox New=0	Fox News=1	Difference
Partisan Strength	1.809 (0.0610)	1.975 (0.0591)	-0.166* (0.085)
Male	0.478 (0.0320)	0.478 (0.0335)	0.001 (0.046)
Age	44.27 (1.075)	44.42 (1.113)	-0.154 (1.548)
Education	4.079 (0.0976)	4.005 (0.104)	0.074 (0.143)
Income	4.219 (0.129)	3.821 (0.140)	0.397** (0.190)
Contact	0.516 (0.0320)	0.525 (0.0332)	-0.009 (0.046)
Open	0.107 (0.0221)	0.132 (0.0239)	-0.025 (0.033)
2000 Turnout	0.384 (0.00463)	0.361 (0.00547)	0.024*** (0.007)
2000 Bush	0.493 (0.00788)	0.504 (0.00902)	-0.011 (0.012)
Median Income	44,035 (700.6)	41,265 (724.1)	2,769*** (1,007.5)
Percent College	0.158 (0.00360)	0.156 (0.00326)	0.002 (0.005)
N	484	451	

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

Table B: Fox News Availability - Matched Data

Dep Var: Fox Availability Via Cable in 2002

	Predictor Level		
	County	Individual	Combined
Partisan Strength		0.173 (0.130)	0.152 (0.130)
Male		-0.021 (0.239)	-0.029 (0.232)
Age		0.000 (0.008)	0.001 (0.008)
Education		0.033 (0.092)	0.010 (0.089)
Income		-0.091 (0.069)	-0.089 (0.067)
Contact		0.043 (0.261)	0.029 (0.258)
Open		0.197 (0.539)	0.217 (0.520)
2000 Turnout	-0.200 (2.643)		-0.455 (2.580)
2000 Bush	-0.554 (1.499)		-0.626 (1.504)
Median Income	-0.000 (0.000)		-0.000 (0.000)
Percent College	4.766 (6.022)		5.139 (5.912)
Constant	1.045 (1.167)	0.226 (0.654)	0.977 (1.268)
Observations	474	474	474
Wald X^2	1.39	3.53	5.78
Pseudo R^2	0.008	0.009	0.017

Robust standard errors in parentheses

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

Table C: Difference in Means - Matched Data

	Fox New=0	Fox News=1	Difference
Partisan Strength	1.859 (0.0925)	1.983 (0.0701)	-0.124 (0.116)
Male	0.480 (0.0466)	0.467 (0.0377)	0.013 (0.060)
Age	43.80 (1.579)	44.12 (1.241)	-0.315 (2.008)
Education	4.168 (0.139)	4.108 (0.114)	0.060 (0.180)
Income	4.247 (0.187)	3.942 (0.162)	0.305 (0.247)
Contact	0.518 (0.0465)	0.530 (0.0377)	-0.012 (0.060)
Open	0.109 (0.0311)	0.132 (0.0288)	-0.023 (0.042)
2000 Turnout	0.375 (0.00640)	0.375 (0.00596)	0.000 (0.009)
2000 Bush	0.502 (0.0114)	0.490 (0.00831)	0.011 (0.014)
Median Income	43.26 (1.026)	42.14 (0.861)	1.114 (1.339)
Percent College	0.157 (0.00487)	0.158 (0.00385)	-0.002 (0.006)
N	192	282	

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

Table D: Political Participation – Matched Data

	Models				
	Unconditional	Individual	Full	Education	Partisan
Fox News Available	0.094* (0.053)	0.091* (0.048)	0.095* (0.046)	-0.066** (0.032)	0.145* (0.068)
Fox * Education				0.370** (0.145)	
Fox * Republican					-0.112 (0.105)
Partisan Strength		0.045 (0.031)	0.050 (0.030)	0.048 (0.031)	0.052* (0.031)
Rep					0.014 (0.076)
Male		-0.012 (0.047)	-0.011 (0.051)	-0.004 (0.046)	-0.009 (0.046)
Age		0.004** (0.002)	0.003** (0.002)	0.003** (0.002)	0.003** (0.002)
Education		0.032 (0.021)	0.031 (0.019)	0.070*** (0.025)	0.032 (0.022)
Income		0.024 (0.015)	0.022 (0.014)	0.024* (0.015)	0.024* (0.014)
Contact		0.140*** (0.053)	0.136*** (0.052)	0.134** (0.053)	0.132** (0.053)
Open		0.144** (0.072)	0.116 (0.096)	0.113 (0.069)	0.107 (0.074)
Population Total			-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
2000 Turnout			0.505 (0.387)	0.544 (0.38)	0.529 (0.389)
2000 Bush			0.012 (0.241)	0.069 (0.225)	0.074 (0.231)
Median Income			0.003 (0.004)	0.000 (0.000)	0.000 (0.000)
Percent College			-0.175 (0.838)	-0.386 (0.836)	-0.221 (0.809)
Constant	0.311*** (0.036)	-0.242* (0.128)	-0.498** (0.237)	-0.712*** (0.252)	-0.563** (0.222)
Observations	474	474	474	474	474
Pseudo R ²	0.009	0.096	0.106	0.117	0.112

Robust standard errors in parentheses

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