

## THE DURATION OF ADVERTISING EFFECTS IN THE 2000 PRESIDENTIAL CAMPAIGN

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### ABSTRACT

Recent studies of campaign advertising typically assess the response of voters to advertisements only from the last few weeks before the voter is interviewed. In so doing, they implicitly assume that the effects of advertisements decay over time. This paper attempts an explicit estimate of the rate of this decay for the Annenberg survey of voters in the 2000 election. Our results indicate that decay is fairly rapid. Even when the persuasive effect of ads on candidate preference is large, 50 to 75 percent of the effect dissipates within the first week and almost all is gone by the end of the second week. Along with other recent evidence, this tentative finding undermines the view that American voters are persuaded by information that accumulates during long campaigns and suggests instead the importance of tactical maneuvers by candidates to dominate the airwaves at the very end of campaigns.

Paper prepared for the 2008 American Political Science Association Annual Meeting. An earlier draft of the paper was presented at the 2007 Midwest meetings. Results may change with further analysis, so please check with an author before citing. We welcome comments. We thank Greg Huber for comments on an earlier draft of the paper and Greg Huber and Kevin Arceneaux for producing versions of data for us beyond their replication archive. Ken Goldstein provided helpful comments on a previous draft of this paper and also coordinated the collection of ads for the Wisconsin Advertising Project, from which we benefited greatly. Thanks to Paul Freedman for comments on a similar paper from the 2007 APSA that examined advertising effects in the 2006 Midterm elections.

Entering the last week of campaign 2000, George W. Bush was narrowly behind in the battleground states on which victory depended. The national media added to his problems by giving heavy coverage to discovery of his decades-old arrest for drunk driving. The effect of this and other news coverage was, according to Johnston, Hagan, and Jamieson's (2004) study of the election, a five-percentage point shift toward Al Gore at the end of the campaign in states in which neither candidate advertised. But in the battleground states, where advertising was a factor, the story was different. Bush outspent Gore by a large margin, gained four points despite the national tide, and thereby eked out his famously narrow victory.

This account is notable on two counts: The magnitude of the advertising effects, and the rapidity with which end-of-campaign advertising overcame the effects of months of prior advertising and campaigning. Our paper takes up both points. Based on data from the Annenberg National Election Study, we examine both the magnitude and the duration of the persuasive effects of campaign advertising. Consistent with the Johnston et al. account of Bush's late surge in battleground states, we find advertising effects that are both fairly large in magnitude and short-lived. As in some other studies, we also find that low to middle information voters are most susceptible to these persuasion effects.

In combination with other recent studies, our findings of short, sharp advertising effects must be taken seriously. Politicians may engage in endless campaigns, but advertising in the home stretch -- perhaps just the last week -- appears to have a disproportionate impact. Our findings suggest as well an electorate in which swing voters, especially those chronically inattentive to politics, are not persuaded by the

totality of campaign information, but decide on the basis of whatever messages they have encountered most recently.

#### **THEORETICAL BACKGROUND.**

The first major work to document the effect of political advertising in a national campaign is *Letting the Voter Decide*, a study of the 1988 Canadian general election by Johnston, Blais, Brady and Crete (1992). Its key analyses were based on candidate preference as reported in a rolling cross section survey during the campaign itself. To capture the effects of campaign communication, Johnston et al. measured the news and advertising to which citizens were exposed in the six days before their interview. Despite a relatively small sample – 47 daily samples averaging 77 voters each day – the study recovered evidence that both news and advertisements affected vote choice.

The fact that Johnston et al. measured campaign communication over a short period prior to each citizen's interview rather than over the whole campaign to the point of interview suggests that campaign effects decay over time rather than accumulate. But the authors make no systematic effort to estimate the amount of persistence and decay

In an inventive analysis based on the pre-election waves of NES studies, Daron Shaw (1999) estimated the rate at which effects of campaign events decay. He found that effects of some events, such as media gaffes, faded within a few days, but that others, notably convention bounces, tended to persist throughout the campaign. Shaw's is the first study of which we are aware to address the issue of persistence of campaign events and what he finds is provocative. However, he made no attempt to estimate decay rates for the most important form of campaign activity, paid advertising.

The Annenberg study of the 2000 election created the possibility for much more precise estimates of campaign communication. It features about 100,000 interviews, including 20,000 unique respondents during the traditional fall campaign. The latter figure is roughly equal to the total number of presidential voters interviewed by the Michigan-based National Election Studies in its entire history to that point.

Johnston, Hagan, and Jamieson (2004) were the first to exploit this powerful new body of evidence. As in the Canadian study, they tried to capture the effects of campaign communication to which people had been exposed in the week or two prior to an interview that took place during the campaign itself. Much more clearly than in the Canadian study, they found strong effects on campaign advertising on vote choice. But the authors made no systematic effort to estimate the persistence or decay of that effect.

A re-analysis of data from the 2000 Annenberg study by Huber and Arceneaux similarly detected large advertising effects on candidate preference during the campaign. Their principal refinement was to isolate the effects of advertising on people who lived in non-battleground states but were adjacent to battleground areas and received its political advertisements. This clever design allows them to estimate the effect of advertising independent of the other campaign effort -- the so-called ground campaign -- that usually accompanies it.<sup>1</sup> Huber and Arceneaux report that estimating the effect of advertising in battleground states alone would exaggerate its persuasive effect by 28 to 66 percent, but that advertisements have large effects in non-battleground states as well. Their estimates were based on a tally of advertisements over the four weeks prior to interview, a period which was determined by trial and error. So again there is a strong assumption that

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<sup>1</sup> For a complete critique of the endogeneity problems in the Johnston et al design, see Huber and Arceneaux (2007).

communication effects dissipate over time, perhaps in two weeks or so, but no systematic estimate of decay rates.

The clearest indication that the effects of advertising effects decay comes from a recent field experiment by Gerber, Gimpel, Green & Shaw (2007). The authors were permitted by a political candidate to assign different media markets in Texas to receive varying amounts of advertising in the warm-up phase of a gubernatorial campaign, namely, January of the election year. Researchers were further able to turn advertising on and off on pre-determined schedule, which increased opportunities to capture the possible decay of persuasion effects. Finally, Gerber et al. were able to interview 1,000 respondents per night for a period of about a month in order to assess the effect of their ad manipulations. Based on this powerful study design, Gerber et al. easily recovered clear evidence of important advertising effects –their weakest estimate suggests that 1,000 Gross Rating Points of advertising boosted a candidate’s vote share by 5.1%. More notably, they found that these effects lasted only about one day.

The decay effects uncovered by Gerber et al. are much more rapid than any previous scholar had assumed -- so much more rapid as to raise the question of how previous research has been able to find advertising effects with the longer lags it has used. The explanation, we suspect, is spuriousness: What an individual has been exposed to over the previous two weeks is a good proxy for what he or she has been exposed to in the day or two before an interview. But however this may be, the Gerber et al. study is strong evidence that studies of political campaigns must pay as much attention to the decay of persuasion effects as to the persuasion itself.

The only prior study to make systematic estimates of the rate of decay in the effects of

campaign communication is Hill, Lo, Vavreck, and Zaller (2007). This study, based on House, Senate and Gubernatorial campaigns in 2006, employed methods similar to those used in this paper and found evidence of rapid decay of the effects of political advertising. However, small samples and lack of high intensity races prevented them from reaching strong conclusions. Results of this study are described in a later section of this paper.

No major work of political science leads to a clear expectation that persuasion effects will persist or decay at any particular rate. However, given the above cited evidence that persuasion effects may be short-lived, existing literature does provide expectations about the pattern of decay.

Two general models of information processing have emerged in the literature on public opinion and may be used to generate these expectations. The models are the memory-based and on-line processing models (Zaller 1992, Lodge et al 1995). According to the memory-based model, individuals do not have fixed preferences. When asked to state a preference, they answer on the basis of information salient in memory. Persuasive communication affects that choice only as long as it remains salient in memory, which may be only a short time.

According to the on-line model, individuals develop relatively fixed and stable preferences based on the information they receive. This information is used to update long-term attitudes at the time it is received and then discarded. However, its effects on long-term attitudes persist.

Both models find support under particular circumstances. Individuals who are motivated to learn about a subject or knowledgeable about it tend to process information

by means of the on-line model, with the result that any attitude change that occurs will tend to persist. People who are less interested in a subject tend to process information by means of the memory-based model, with the result that any attitude change that occurs will tend to be short-lived.

These findings, developed mainly by psychologists and political psychologists, have clear implications for the present study: To the extent that advertising causes attitude change, the effect should decay more quickly for less informed citizens than for better informed ones.

A separate question is who should be more susceptible to persuasion in the first place. According to a series of studies (Converse, 1962; McGuire, 1968; and Zaller, 1992, 1996), more politically aware citizens tend to be more heavily exposed to persuasive communication, but also more resistant, often resulting in a pattern in which citizens falling in the middle range of political awareness are most likely to experience attitude change.

However, this non-monotonic pattern of attitude change is not expected in every situation. As communication becomes more intense, it becomes more likely to reach even the least aware citizens, who may then become most likely to experience attitude change. Thus the relationship between information and persuasion may be negative, non-monotonic, or even positive, depending on the intensity of the communication flow.

This theoretical machinery yields a reasonably clear set of expectations for the present study. For the fairly heavy and highly partisan communication flows that occur in contemporary elections, the most informed citizens should be the most resistant to persuasion. When the flow of communication is only moderately intense, as perhaps in

the more competitive House elections, the persuasive effects of advertising should be concentrated among moderately informed voters. For higher intensity races, particularly governor and presidential races, we should observe more persuasion among the least political aware segment of the electorate.

## **DATA**

The data for this study are from the roughly 15,000 respondents of the 2000 National Annenberg Election Study (NAES) who were interviewed between September 1 and Election Day, which is the period of the traditional fall campaign. Our analysis focuses on vote intention during the campaign itself rather than reported vote, as measured after Election Day. This focus creates more opportunities to observe the effect of advertising that varies in its intensity across time.

As noted earlier, prior research indicates that highly informed voters are more resistant to persuasion than middle-to-low information voters. Persistence of persuasion effects may also vary by political awareness, with persistence lower among the less informed. In view of these expectations, we shall analyze the effects of advertising separately for low, middle, and high information voters. Division of voters into three awareness groups is based on three sets of items in the NAES survey. The items are education, political knowledge, and interest in the campaign; the alpha reliability of our scale is .51.

To these survey data, we append data from the Wisconsin Advertising Project, which tracks political advertising on television throughout the campaign (also see Goldstein and

Freedman 2000).<sup>2</sup> Ads are measured in terms of Gross Ratings Points per one thousand respondents.

Figure 1 gives the basic contours of the advertising data. Panels A and B give the distribution of GRPs for respondents in the study. Thus, panel A indicates that about 80 percent of respondents in non-battleground states saw no advertising on the day of their interview, as against 20 percent of respondents in battleground states who saw no advertising on interview date. Of those who did see advertising, exposure rates varied up to .75 GRPs per thousand. These scores are the sum of the number of ads aired on a given interview date multiplied by the percentage of the population likely to have been exposed to the ad (divided by 1000). Note the GRP is a media market level measure and varies across individuals in our study only because they are interviewed on different days and live in different media markets. An individual's actual ad exposure could be higher or lower, depending on the amount of television an individual watched and when she watched, but GRP values are constant within the DMA/day. A GRP value on a given day of .75 (the maximum observed) for Bush ads indicates that the average person in the given market saw ads at the rate of 7.5 per day -- a very high number compared to the average value among those exposed to any ads at all, which was about 2.5 per day.<sup>3</sup> This value was about the same in both battleground and non-battleground states.<sup>4</sup>

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<sup>2</sup> For more information on WiscAds, please see [www.polisci.wisc.edu/tvadvertising](http://www.polisci.wisc.edu/tvadvertising). Greg Huber and Kevin Arceneaux generously provided these data to us.

<sup>3</sup> In these estimates, GRPS are defined as the frequency of ads aired multiplied by the percentage of the population exposed to the ads. This product is then divided by 1000 in the numbers reported above. To estimate the average person's advertising exposure in a given market on a given date, we divide the original GRP number by 100 because the second element of the product is a percentage of the population.

<sup>4</sup> Some respondents in non-battleground states saw ads because they lived in media markets that overlapped a state in which the candidates were running paid advertising. Huber and Arceneaux (2007) find that advertising effects were lower in non-battleground states, but our analysis does not. We are not

Panel C of Figure 1, which shows ad differentials between Gore and Bush, is especially important. This is because differences in the advertising rates between the two candidates are what drive advertising effects. Differentials in the battleground states range up to .5 GRPs per thousand, or a difference of five ads per day per average respondent. We note that such large differences do not persist over the whole campaign; rather, one candidate may have an advantage for a few days or weeks and then the other candidate may seize the advantage. Such alternations in the advertising advantage are, of course, useful in identifying the effects of advertising.

INSERT FIGURE 1 ABOUT HERE

Figure 2 turns to temporal variation in advertising over the three month period from September 1 to Election Day. Panel A shows the net advertising advantage of Bush and Gore in battleground and non-battleground states during the course of the fall campaign. The measure, which is denominated in GRPs per thousand, is formed by subtracting Gore advertising rates from Bush's. As can be seen, Bush out-advertises Gore at the beginning and at the ends of the campaign. The Republican's advantage at the end of the campaign was about .15 GRPs per thousand, or 1.5 ads per day on average. This figure, however, varies considerably by media market and state. In Florida, for example, Bush's advantage in the final days of the campaign was about 3 ads per day. By way of comparison, Panel B shows trends in vote intention. As can be seen, vote trends in Panel B line up quite well with trends in advertising advantage as shown in Panel A. This correspondence is roughly consistent with the Johnston et al. argument that Bush was

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sure which of several ways in which our analysis differs from theirs -- the most salient of which is taking account of persistence effects -- accounts for the difference in our findings. We have more work to do on this question. Meanwhile, our working assumption in this paper is that advertising effects are about the same in both battleground and non-battleground states.

able to gain advantage over Gore in the final week of the campaign as a result of the advertising advantage the Republican enjoyed at this stage. It is also roughly consistent with the view that voters make up their minds on the basis of ads they have seen most recently rather than ads seen over the course of the entire campaign.

INSERT FIGURE 2 ABOUT HERE

### **A FIRST LOOK AT THE DATA**

The easiest way to check for persistence or decay of advertising effects is to segment advertising into blocks based on how long it has been since the respondent was exposed to it. Accordingly, we segmented data from 30 days prior to the day the respondent was interviewed into six separate measures, each based on a five-day block of advertising. Thus, we have one measure of advertising during the previous five days, another for days 6 thru 10, and so forth. We examined the effects of these ad variables on the ordered measure of vote intention, on a seven-point measure of party identification, on self-described ideology, and on difference in the favorability ratings of Bush and Gore. Because advertising may affect willingness to offer an opinion as well as direction of opinion, we code non-response and don't know to neutral middle positions for purposes of this initial look at the data.

Results are shown in Table 1, with details of the analysis described in notes to the table. In marked contrast to the implicit assumption of most research that effects of advertising persist over periods up to 28 days, we find that only recent advertising has any clear effect. The tendency of advertising effects to decay over time is consistent over all four measures of partisan attitudes.

INSERT TABLE 1 ABOUT HERE

Studies of political advertising routinely control for party identification and ideology in testing for the effects of political advertising. Results in Table 1 suggest that this is inappropriate. Party and ideology are affected by advertising and may mediate its effect on vote choice. They should therefore not be controlled in testing for the effects of advertising.

These preliminary results indicate the need to take persistence and decay into account when modeling the effects of political advertising. We develop a model suited to this purpose in the next section.

Note that, in Table 1, we use Bush-Gore ad differentials as our measure of advertising. This implicitly specification assumes that Bush and Gore ads have roughly the same impact on voters; it further assumes that ad impact is a linear function of amount of advertising and independent of the amount of prior advertising. In preliminary analyses not reported in this paper, we found no basis for rejection of the null hypothesis of equal effects of each candidates' ads.<sup>5</sup> In the main results section of the paper, we empirically examine the second assumption.

### **A STATISTICAL MODEL**

Past scholarship has typically tested the effect of advertising over a fixed interval, such as the last few days or the last few weeks. In so doing, they have weighted all ads within their time window equally and given all ads outside the window an implicit weight of zero.

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<sup>5</sup> These tests did not, however, allow for decay. It is beyond our current modeling capability, and quite likely beyond the resolution of the data, to test a model of ad decay that allows each candidate's ads to have different effects.

It is unlikely that the effect of ads continues undiminished for a pre-fixed period and then abruptly ends. Our aim in this section is therefore to develop a model having a finer set of weights -- weights that will permit the persuasive impact of ads to decay at a rate that can be empirically estimated.

A standard approach to estimating such weights is the Koyck lag model (Koyck 1954). A type of time series model, the Koyck model estimates a single parameter, which we shall call delta ( $\delta$ ), to capture the rate of persistence or decay. (See Appendix for a discussion of alternative models.) Delta is expected to vary between 0 and 1.<sup>6</sup> The following equation gives the basic intuition for the Koyck model. It shows the effect of a string of prior advertisements on an attitude measured on day<sub>0</sub>, where each day's ads are designated Ad<sub>0</sub>, Ad<sub>1</sub> ... Ad<sub>n</sub>:

$$\text{Attitude}_0 = b_0 + b_1 [\delta^0 \times \text{Ad}_0 + \delta^1 \times \text{Ad}_1 + \delta^2 \times \text{Ad}_2 \dots \delta^n \times \text{Ad}_n] \quad \text{Eq. 1}$$

Each day's ad is weighted by  $\delta$  raised to a power that is incremented by one each day. So if, for example,  $\delta$  was equal to .8 and  $n$  was equal to four, then the weights for each day's ads would be  $.8^0$ ,  $.8^1$ ,  $.8^2$ ,  $.8^3$ , and  $.8^4$ , which would mean weights of 1, .8, .64, .51, and .41<sup>7</sup>. Thus, the above equation would become:

$$\text{Attitude}_0 = b_0 + b_1 [1 \times \text{Ad}_0 + .8 \times \text{Ad}_1 + .64 \times \text{Ad}_2 + .51 \times \text{Ad}_3 + .41 \times \text{Ad}_4]$$

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<sup>6</sup> Delta values above 1 would indicate that temporally remote ads matter more than recent ones. Such values might be obtained if citizens set their preferences on the basis of the earliest ads they saw. Though possible, this seems unlikely.

<sup>7</sup> Observe that .8 to the power of 4 is .4096.

As long as  $\delta$  remains between 0 and 1, the magnitude of the weight becomes progressively smaller with each passing day. The general form of the model is

$$Attitude_0 = b_0 + b_1 \sum_{t=0}^n \delta^t Ads_t \quad Eq. 2$$

In the discussion that follows, we shall refer to  $b_1$  as the “impact parameter” and  $\delta$  as the “persistence” parameter. Because our dependent variable, Vote Intention, takes three ordered values -- Bush, undecided, and Gore -- we estimate the Koyck lag model as an ordered logit. To ease interpretability of the results, we normalize the sum of the previous ads shown in the respondent’s DMA ( $m$ ) based upon the sum of the weights.<sup>8</sup> The structural model, including a set of control variables  $X$ , is:

$$Attitude_{0i} = b_0 + \frac{b_1 \sum_{t=0}^n \delta^t Ads_{tm}}{\sum_{t=0}^n \delta^t} + XB + e_i \quad Eq. 3$$

It is useful to understand exactly how the  $\delta$  parameter works. If  $\delta$  were estimated to be 1, the weights would be  $1^0, .1^1, .1^2, 1^3$ , and  $1^n$ , which would mean that all weights were 1 — that is, each day’s communication, whether early or late in the time window, gets

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<sup>8</sup> Specifically, we divide the sum of weighted ads by the sum of the weights; the effect is to standardize the variance of the weighted sum in a way that permits comparison of impact coefficients across different models.

exactly the same weight. A researcher who uses a simple sum of all advertising in a campaign is implicitly assuming total persistence and hence a  $\delta$  of 1 for the window of lagged advertising.

If, on the other hand,  $\delta$  were estimated to be 0, it would mean that only communication from the most recent period -- that is, the period just before the respondent is interviewed -- has any effect at all. This is because  $0^0, .0^1, .0^2, 0^3$ , and  $0^n$  is equal to 1, 0, 0...0. The finding from Gerber et al. that only the previous day's advertising has much effect is an implicit claim that advertising effects persist for only a single day and that  $\delta$  is close to zero.

Values of  $\delta$  between 0 and 1 would represent intermediate rates of persistence. Figure 3 shows hypothetical persistence rates graphically for a period of 40 days. Looking at the top panel, we see that if  $\delta$  were estimated as .95, it would mean that communication effects persist for a fairly long period of time (solid line at top). A communication from one day earlier ( $.95^1=.95$ ) would have roughly the same effect as a communication from 5 periods earlier ( $.95^5=.77$ ). But if  $\delta$  were estimated as .45 (lowest dotted line), effects from the most recent period would dwarf the effects from five periods earlier.

INSERT FIGURE 3 ABOUT HERE

The lower panel of Figure 3 shows the same persistence rates in terms of cumulative effects. When  $\delta$  is .9, about half of the total effect of communication over the 40 previous time periods is due to communication from the most recent seven periods, i.e., the previous week. When  $\delta$  is .45, essentially all of the effect of communication over the previous 40 days is due to communication within just the most recent three days.

## RESULTS

One difficulty in estimating effects of lagged advertising is that citizens are exposed to similar net ad flows over the course of the campaign: Someone who more ads favoring a given candidate in one time period will tend to see about the same balance in the adjacent time period. However, this temporal covariation breaks down over longer periods of time, as shown by correlations among measures of Bush-Gore ad differentials in five-day ad blocks:

INSERT TABLE 2 ABOUT HERE

In light of these correlations and the rate of decay suggested by Table 1, we have estimated advertising effects over a period of four weeks. This period is long enough to achieve substantial variation in individual-level exposure rates but not too long as to be implausible.<sup>9</sup>

We present estimates of the persistence parameter,  $\delta$ , and the impact parameter,  $b_1$ , over a period of 28 days in Table 3, along with their standard errors and t-statistics. For  $\delta$  we also include a one-tailed p-value (at  $\alpha = .05$ ) for the chance that  $\delta$  is below 1.0, or total persistence. Results include controls for exogenous predictors gender, race, age, education, income, an indicator for whether income was missing, and state indicators for Texas, Tennessee, Arkansas, and Kansas (the home states of nominees in 1996 and 2000).

For the sample as a whole, the estimate of the persistence parameter is .88, a value that is below 1.0 at  $p < .02$ . A persistence parameter of .88 indicates that the half-life of the effect of political advertising is about one week ( $.88^6 = .46$ ). It can also be calculated

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<sup>9</sup> Experimentation showed that the precision but not the magnitude of estimates was reduced by examining a smaller time window.

that, for a persistence parameter of .88 and a consistent flow of communication, about 61 percent of the effect that registers at any point will be due to advertising from the last seven days.

Table 3 also provides estimates for respondents in the bottom, middle, and top thirds of our measure of political awareness. The results are consistent with theoretical expectations. The highly aware are most resistant to persuasion, as indicated by the impact parameter of .55, but to the extent they are persuaded, the effect tends to persist for a long time, as indicated by the persistence parameter of .99, which implies nearly total lack of decay. For the least informed, the impact parameter is larger, with a value of 1.11, but the persistence parameter is .79. The value of  $\delta$  indicates that the half-life for the effect of communication is about three days ( $.79^3 = .49$ ); it can also be calculated that, for a consistent flow of advertising, about 81 percent of the effect that registers with low information people at any point will be due to communication from the last seven days.

Note that the standard errors for the estimates of  $\delta$  within the three information subgroups are larger than for the whole sample -- so much so that even the much lower persistence effects that we find are barely distinguishable from 1.0. It is natural to want to look at differences in persistence within smaller subgroups, but whenever we make the subgroups much smaller than they are in this table, results become unstable or even nonsensical, as in an analysis that suggests (with very wide confidence bands) that the most temporally distant ads have a large negative (or boomerang) effect.

Despite the difficulty of subgroup analysis, we were particularly keen to test whether persistence and decay are constant over the course of the campaign. Our suspicion was that, as the campaign progressed, respondents would pay more attention and then begin to

assimilate communication over a longer period of time. Results were consistent with this suspicion. Focusing on low and middle awareness respondents -- the groups affected by advertising in the first place -- we found that  $\delta$  is .84 over the first 33 days of the campaign and .90 over the last 32 days.<sup>10</sup> The two estimates are not statistically different from one another, but we suspect nonetheless that the difference is real. In the early part of the campaign, the effects from advertising decay more quickly than they do in the latter part of the campaign for those who are most effected.

### A CLOSER LOOK AT PERSUASION EFFECTS

Because the total effects of advertising depend on a combination of the initial impact and persistence over time, persuasion effects are time dependent. Figure 4 illustrates this dependency. Recall that impact coefficients ( $b_1$ ) in our model capture the effects of a stream of prior communication at the time of a respondent's interview; Figure 4 shows how these effects decay over time. Let us focus on the low information respondents. From Table 3, their impact coefficient is 1.11; this value is shown on the graph at day<sub>0</sub>, which is the day of the respondent's interview. The  $\delta$  estimate for low information people is .79; this means that the effects of advertising decay at the rate of .79 per day. Hence, the amount of communication effect that remains on day<sub>1</sub> is  $1.11 \times .79 = .88$ ; the amount that remains on day<sub>2</sub> is  $1.11 \times .79^2 = .69$ , and so forth. By day<sub>28</sub>, the communication effect that survives from day<sub>0</sub> is almost nil ( $1.11 \times .79^{28} = .0015$ ). These values -- each representing the amount of advertising impact that survives on the given day -- are plotted along the X-axis.

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<sup>10</sup> The impact coefficients were 1.4 and 1.24; the p-values that the persistence coefficients were below 1.0 were .02 and .08.

The three trend lines in Figure 4 show how persuasion effects decay for low, middle, and high information respondents. The overall pattern is one in which high information respondents are hardest to persuade, but once persuaded tend to stick with their new views. The less aware are easier to persuade, but they lapse back to their old views fairly quickly.

INSERT FIGURE 4 ABOUT HERE

Since, in our study, voting occurs immediately upon conclusion of advertising, the effects that exist at day<sub>0</sub> — including larger effects for the less informed — may seem more politically relevant than the effects that remain 28 days after advertising ceases. But persistence and decay still matter greatly. Indeed, they explain Bush’s critical surge in battleground states in the last week of the 2000 election.

To see how, we must return to the Koyck model in Equation 3 and work through its basic algebra, some of which we glossed over in initial presentation of the model. For purposes of this exercise, let us assume that we have three time periods, and that the net ad values (in GRPs) for these three periods are:

$$3, 2, 1$$

These values might represent a three-day ad flow which gives the Democratic candidate an advantage of +3 GRPs on the most recent day, +2 on the next most recent day, and +1 on the most distant day. Note that the average of these values is a +2 net advantage to the Democratic candidate. Each of the GRP values must now be weighted by our persistence parameter,  $\delta$ , raised to the power of the ad’s time period. The weights for the three periods are thus

$$\delta^0, \delta^1, \delta^2$$

Our “ad variable” is sum of the weighted ad values, as follows:

$$\delta^0 \times 3 + \delta^1 \times 2 + \delta^2 \times 1$$

Suppose now that  $\delta=1$ , meaning no decay. Then our ad variable is

$$1^0 \times 3 + 1^1 \times 2 + 1^2 \times 1 = 6$$

The sum of these weights is  $1^0 + 1^1 + 1^2 = 3$ . From Equation 3, we divide the ad variable by the sum of the weights to standardize across  $\delta$ , getting  $6/3 = 2$ . Thus, the ad variable — the variable to which the impact coefficient will apply — is the average of the GRP values of ads to which individuals have been exposed and still remembers at the time of interview (which, in this example, is all ads).

Now let’s go to the other extreme by choosing  $\delta=0$  -- that is, total decay after the first time period. Our ad variable is then

$$\begin{aligned} &0^0 \times 3 + 0^1 \times 2 + 0^2 \times 1 \\ &= 1 \times 3 + 0 \times 2 + 0 \times 1 \\ &= 3 \end{aligned}$$

The sum of the weights is  $1 + 0 + 0 = 1$ . So when we divide by the sum of the weights, we get an ad variable  $= 3/1 = 3$ . Thus, for the case of total decay, the ad variable reflects the GRP of ads in the recent period only. But, as in the previous example, this value is a weighted average of the ads to which the individuals has been exposed and remembers -- which, in this case, is only ads from the most recent period.

Finally, let us do an intermediate case in which  $\delta=.5$ . Our ad variable is then

$$\begin{aligned} &.5^0 \times 3 + .5^1 \times 2 + .5^2 \times 1 \\ &= 1 \times 3 + .5 \times 2 + .25 \times 1 \\ &= 4.25 \end{aligned}$$

The sum of the weights is  $1 + .5 + .25 = 1.75$ . When we divide by the sum of the weights, we get an ad variable  $= 4.25/1.75 = 2.43$ . This ad value is based on all three days, but is most affected by the most recent period, whose GRP value was 3. As in the previous examples, this ad value is the average of the ad GRP values to which individuals have been exposed, weighted by the amount still remembered. This weighted average of the ad flow is the value to which the impact coefficient applies.

The key idea here is that, even when individuals have all been exposed to the same stream of ads, the particular ads that affect their opinion will depend on how long individuals remember the information, as indexed by  $\delta$ , the persistence parameter. The effect of those ads, whether all ads or mainly the most recent ads, can be large or small, depending on  $b_1$ , the impact parameter. The  $b_1$  coefficient captures the effect of a one unit-change in the average net value of remembered ads.

Let's now return to the estimates in Table 3, which show that high information voters have  $\delta$  close to 1 and an impact parameter equal to 0.55, and that less informed voters have  $\delta$  equal to .79 and an impact parameter of 1.11. Although the two impact parameters apply, as we have just seen, to quite different ad flows, they do still accurately summarize the persuasive effects of the stream of communication at the endpoint of the period, as shown in Figure 4. Thus, one may say that ads have twice as much impact on low information voters as high information voters; but one must immediately add that the ads that matter for low information voters are ads they saw fairly recently, whereas the ads that affect high information voters are an average of ads over a long period. Put differently, the average of ads over just a few days has twice the impact on the

preferences of the least informed as the average of ads over 30 days on the preferences of the most informed.

Whether voters respond to all ads or mainly the most recent ads can have great political importance — and it did in the 2000 election. As we saw in Figure 1, Gore ran more advertising than Bush during the final month of the campaign, but Bush ran many more ads than Gore at the very end. If voters had made up their minds on the basis of all advertising during the last 28 days — if, that is,  $\delta$  had been near 1.0 — Gore would have gotten the full benefit of his advertising advantage from one, two, and three weeks before Election Day. However, the fact that  $\delta$  was lower — around .88 for all respondents in the NAES sample — meant that much of the effect of earlier ads had decayed by Election Day, and that many voters were voting on the basis of ads in the last week, when Bush was spending much more than Gore. Our estimate, based on the ad values in Figure 1 and the coefficients in Table 3, is that Bush won about 3.5 percent more votes in battleground states than he would have won if voters had been responding on Election Day to the entire previous month of ads.<sup>11</sup> The effect of decay was most pronounced for the least aware. Their combination of moderate openness to persuasion, lack of memory for any but the most recent ads, and Bush's large advantage in recent ads yielded a vote gain to Bush of about six percentage points. Gains on Election Day to Bush among the moderately aware and highly aware were about three percentage points and zero, respectively. The reason for complete lack of impact among the highly aware is that Gore's small advertising advantage during the first three weeks of the period persisted through the final days of the campaign to offset Bush's last week surge.

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<sup>11</sup> Baseline for the estimates is a population assumed to be 40 percent for Bush, 40 percent for Gore, and 20 percent undecided.

The ad flows that drove Bush's late surge are as follows: In the six campaign days in November, the average person saw 5.1 Bush ads and 3.6 Gore ads, for a differential of about 1.5 ads per day. (The actual number of ads broadcast in battleground states was much greater, but GRP measures the number of ads seen by the average person.) Bush's advantage was somewhat larger in Florida, about two ads per day. That an advertising difference of this magnitude could move the vote three or so percentage points in key states at the end of a long campaign seems noteworthy. It also tends to corroborate the Johnston et al. argument on the importance of Gore's cash shortfall at the end of the race.

Yet our findings do not imply that candidates should save all of their advertising until the final week. The optimal strategy is probably some mix of early advertising to win over high information voters with long memories and last-week advertising to win over the less informed. Johnston et al. provide suggestive evidence on this point. Bush's early advertisements on social security stressed complex arguments, like the efficiency gains of investing retirement funds in the stock market, which might have appealed more to high information voters, whereas his later ads focused on Gore's personal lack of trustworthiness to handle social security, which might have appealed to less sophisticated voters (Johnston et al., p. 158).

#### **COMPARISON WITH OTHER STUDIES**

It is illuminating to compare the patterns of persistence and decay found in this paper with those reported in previous studies. Recall that Gerber et al found that the effects of advertising in an early stage of a Texas gubernatorial race — a January ad blitz ahead of a November election — decayed after just one day. This implies a  $\delta$  near zero. In another prior study, Hill, Lo, Vavreck, and Zaller (2007) estimated the impact and decay

of the effects of political advertising in a set of 2006 Midwestern House, Senate, and Gubernatorial races. The samples in this study were much smaller and the ad volumes were lower than in the present one, but some races had large differentials in favor of one of the candidates, due usually to an incumbent-dominated race. Delta values in these campaigns were found to be higher than in the Gerber et al. study but lower than in the present one. Table 4 summarizes estimates of  $\delta$  values from all studies.

INSERT TABLE 4 ABOUT HERE

The pattern in these  $\delta$  values would seem to be that the effects of advertising persist longer in higher intensity races than in lower intensity ones. This pattern, along with the tendency of effects to persist longer for more aware voters, suggests that persistence of the effects of advertising and perhaps other political communication is highly variable, ranging from very low to very high. The determinant of variation may be the extent of citizen engagement, as indexed by individual-level or aggregate-level variables or most likely both.

A similar pattern may exist for the persuasive impact of communication, with highest values registering in lower or middle intensity races and among less aware or middle aware respondents. Corroboration of this speculation must await a finer-grained analysis than can be undertaken here.

## CONCLUSION

In an important paper, Gelman and King (1993) argue that lengthy campaigns may have a cumulative education effect, enabling voters to soak up information and make better decisions (for their own values) as campaigns progress. That argument finds mixed support in our study and the studies reviewed in the previous section. The good

news is that some voters are capable of long-term learning; the bad news is that the conditions necessary to produce such learning may not be common. In the House races examined by Hill, Lo, Vavreck, and Zaller (2007), the half-life of communication effects was about two to three-days. For voters in our study of a presidential election, the half-life was notably longer — perhaps a week — still short of the length of an entire campaign, but more in keeping with the period of time over which candidates think about electioneering and ad strategy. Only the most politically aware voters exhibited a clear capability for long-term effects from ads, a finding that is consistent with other work showing that the most aware voters are most stable in their vote preferences both within and between presidential campaigns (Zaller, 2004). Again, this echoes the reality electioneering for candidates – they seem to understand that the voters who are likely to be influenced in the closing days of the campaign are those without long-term allegiances.

Prospects for advertising effects in political campaigns, both for the presidency and for lower-level offices, may therefore seem bleak overall. Yet it is too soon to reach any such conclusion. On one hand, some scholars have found evidence of durable campaign effects (Popkin, 1992; Holbrook, 1996; Shaw, 1999; Stevenson and Vavreck, 2000; Gilens, Vavreck, and Cohen 2007). On the other hand, political advertisements, particularly in sub-presidential races, are often dull, repetitive, and even moronic.<sup>12</sup> Hence, in their discussion of the rapid decay found in the Texas study, Gerber, Gimpel, Green, and Shaw comment that progress in the understanding the effects of political advertising ...

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<sup>12</sup> Vavreck (2001) reports that in the 1998 midterm election advertisements for House, Senate, and Governor's 73 percent of candidates mentioned the name of the state in which they were running while only 33 percent mentioned their partisan affiliation.

. . . requires assessment of a range of different ads' effects in different political contexts. Do the dynamics of opinion change look different when, instead of offering evocative imagery, an advertisement campaign reveals new information? Would, for example, a negative campaign ad that leveled a specific charge about an opponent's malfeasance in office produce an enduring shift in opinion? (p. 26)

We concur. Before reaching bleak conclusions about the political memories of voters for political advertisements or other campaign communication, one must establish that the communication conveys information worth remembering. Unlike Gerber et al, we have not accounted for the content of the advertisements under investigation and this likely influences their level of effectiveness. Perhaps it is an indication of healthy democracy that many voters forgot as rapidly as they seem to do. We cannot know whether forgetting is a good or a bad thing until we understand, even generally, the content of the information.

We therefore conclude that the agenda for research in this field should be to determine whether some kinds of political communication are more durably persuasive than others and, if so, the qualities of the more effective ads. Brader (2005) recently suggested that attack advertising encourages voters to seek out and use newly acquired information, and Geer (2006) suggests that attack advertising provides more information than promotional ads. We do not predict that such studies will entirely vindicate the political memories of voters, but it is too early to count them out.

Still taking an optimistic view of our results, we point out that campaign ads whose effects are fleeting cannot easily accumulate over time into massive advantage, thereby creating a natural ceiling on the amount of persuasion that can occur. In this way, the very short-term memories of voters may insulate them to some extent from efforts to buy

elections outright. Candidates can make up some ground with advertising -- enough to win a close election -- but perhaps not enough to manufacture victory out of nothing. Political fundamentals, whatever they might be, are therefore likely to remain important and perhaps even dominant.

Even political advertisements with fleeting effects, however, may still last long enough to sway important elections. The large size and short duration of effects found in this paper are quite consistent with the claim of Johnston, Hagan, and Jamieson (2004) that Bush won the 2000 election in part because Gore ran short of money in the last week. Yet if, as we have also shown, advertising can have fairly durable effects on high information voters, candidates cannot save all of their advertising until the final week. They must strike the right balance of early advertising to win over voters with long memories and later advertising to win over voters who are more present-minded. Hence, whether good or bad for democracy, campaign strategies matter.

## APPENDIX

The Koyck lag model used in the main analysis of the paper embodies a particular structure of decay: A fixed proportion of the effect of the message decays each day. This pattern of decay, called geometric decay, is illustrated in the body of the paper. But several other patterns of decay are possible. One is a negative exponential decay, as described by the function:

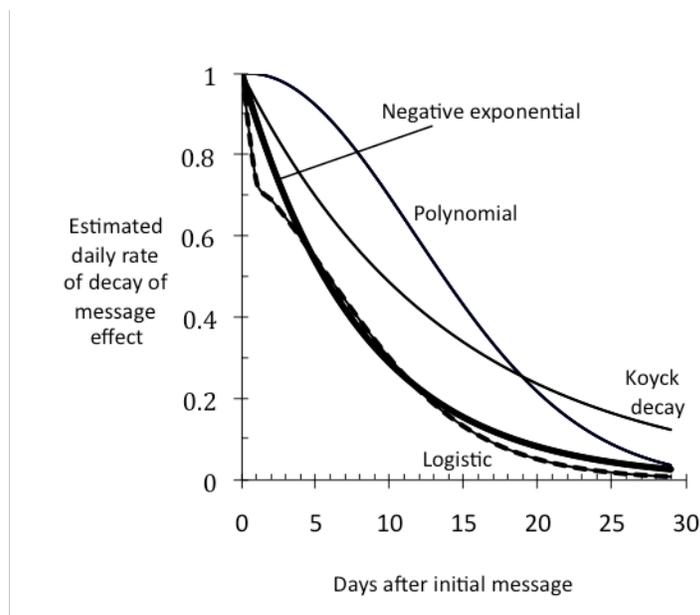
$$\text{Decay} = \exp(-b_1 * \text{time})$$

This function generates a pattern similar to the right tail of a normal curve. Another pattern is the cumulative logistic function, which follows the well-known S shape. Though plausible, this function requires two parameters, which leads, in our data, to imprecise estimates. A fourth, more agnostic approach is use of polynomial terms to fit the pattern of decay, as follows:

$$\text{Decay} = b_1 * \text{time} + b_2 * \text{time}^2$$

This function also has the disadvantage of requiring two parameters.

As it turns out, all four functional forms yield substantively similar and statistically indistinguishable patterns of decay, as shown below for the full sample. The models are the same as in column 1 of Table 3, except that the functional form has been varied. We used the Koyck model for the paper because it works best for purposes of exposition.



**Table 1. Effects of lagged advertisements on political variables**

|   | Vote<br>intention | 7-pt<br>Party<br>self-ID | 5-pt<br>Ideology<br>self-ID | Bush/<br>Gore<br>favorability |
|---|-------------------|--------------------------|-----------------------------|-------------------------------|
| Ads on days 1-5 <sup>a</sup><br>mean = .017;sd=.12) | .53<br>(.20)      | .31<br>(.19)             | .40<br>(.18)                | 13.63<br>(5.38)               |
| Ads on days 6-10                                    | .24<br>(.29)      | .27<br>(.27)             | .22<br>(.26)                | 7.86<br>(7.82)                |
| Ads on days 11-15                                   | .11<br>(.29)      | -.03<br>(.27)            | .09<br>(.26)                | 1.58<br>(7.82)                |
| Ads on days 16-20                                   | .13<br>(.27)      | .17<br>(.25)             | .13<br>(.24)                | 3.26<br>(7.20)                |
| Ads on days 21-25                                   | .18<br>(.26)      | .06<br>(.24)             | -.38<br>(.24)               | 4.05<br>(7.05)                |
| Ads on days 26-30                                   | -.29<br>(.23)     | -.29<br>(.21)            | .08<br>(.20)                | -3.95<br>(6.11)               |
| Female<br>(0-1)                                     | -.37<br>(.03)     | -.32<br>(.03)            | -.27<br>(.03)               | -12.1<br>(.91)                |
| White<br>(0-1)                                      | 1.06<br>(.05)     | 1.14<br>(.04)            | .22<br>(.04)                | 29.06<br>(1.24)               |
| Age<br>(in years)                                   | .00<br>(.00)      | -.01<br>(.00)            | .01<br>(.00)                | -.06<br>(.03)                 |
| Income<br>(range 1 - 9)                             | .07<br>(.01)      | .09<br>(.01)             | .05<br>(.01)                | 2.04<br>(.26)                 |
| Education<br>(range 1-9)                            | -.05<br>(.01)     | .00<br>(.01)             | -.06<br>(.01)               | -.83<br>(.22)                 |
| 1996 state vote<br>(% Rep - % Dem)                  | .02<br>(.12)      | .01<br>(.11)             | .02<br>(.10)                | .55<br>(3.11)                 |

*Note:* Estimates include all subjects from September 1 to Election Day. N's average about 13,000, depending on non-response. First three models are estimated as ordered logits and the fourth as an OLS. Intercepts and cutpoints suppressed. Models also include state dummies for Kansas, Arkansas, Texas, and Tennessee.

<sup>a</sup> Ads are measured as average daily Bush-Gore difference in GRPs per thousand.

**Table 2. Correlations among Five-day Ad Periods, 2000**

|            | Days 1-5 | Days 6-10 | Days 11-15 | Days 16-20 | Days 21-25 |
|------------|----------|-----------|------------|------------|------------|
| Days 6-10  | .72      |           |            |            |            |
| Days 11-15 | .46      | .72       |            |            |            |
| Days 16-20 | .26      | .42       | .65        |            |            |
| Days 21-25 | .16      | .24       | .39        | .64        |            |
| Days 26-30 | .13      | .11       | .16        | .38        | .60        |

*Note:* Cell entries are correlations among Bush-Gore ad differentials. Ad variables are the same five-day blocks as in Table 1.

**Table 3. Impact and persistence of political advertising**

|  | Full<br>Sample | Political awareness |               |              |
|--|----------------|---------------------|---------------|--------------|
|  |                | Low                 | Middle        | High         |
| Impact   | 1.04<br>(.21)  | 1.11<br>(.30)       | 1.52<br>(.38) | .55<br>(.41) |
| Persistence  | .88<br>(.05)   | .79<br>(.12)        | .92<br>(.05)  | .99<br>(.14) |
| P-value that persistence<br>coefficient is less than 1.0 | .02            | .04                 | .07           | .47          |
| N  | 13,943         | 4,548               | 4,644         | 4,751        |

Note: Dependent variable is vote intention for Bush, Gore, or undecided, as measured in surveys from September 1 to Election Day. Coefficients show the impact and persistence of advertising, based on model described in text. The full model contains the same control variables as in Table 1.

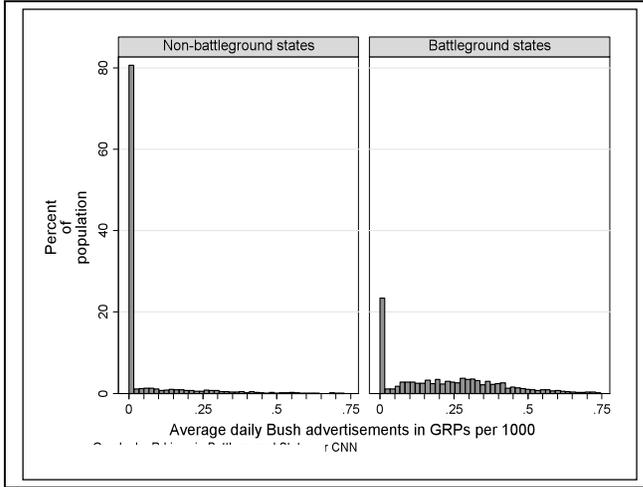
**Table 4. Decay Rates from Gerber et al (2008), Hill et al (2007; 2008)**

| <u>Race/Period</u>                     | <u>Decay Parameter</u> |
|--|------------------------|
| Texas Governor (warm-up to election)   | ~0                     |
| 2006 Midwest House <sup>13</sup>       | .49                    |
| 2006 Midwest Governor                  | .65                    |
| 2006 Midwest Senate                    | .72                    |
| 2000 Presidential (September)          | .84                    |
| 2000 Presidential (October/November)   | .90                    |
| 2000 Presidential (High Information)   | .99                    |
| 2000 Presidential (Middle Information) | .92                    |
| 2000 Presidential (Low Information)    | .79                    |

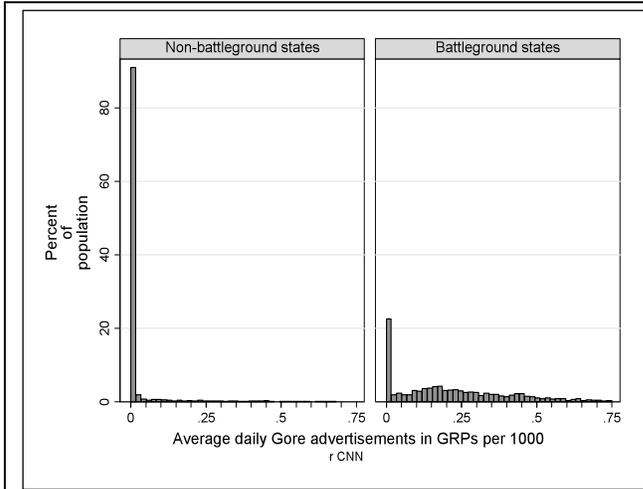
<sup>13</sup> Estimates of  $\delta$  for House and Senate campaigns were found to be less than 1 at  $P < .01$ ; however, the estimate for gubernatorial races was not statistically significantly different from 1.

**Figure 1. Basic contours of advertising data**

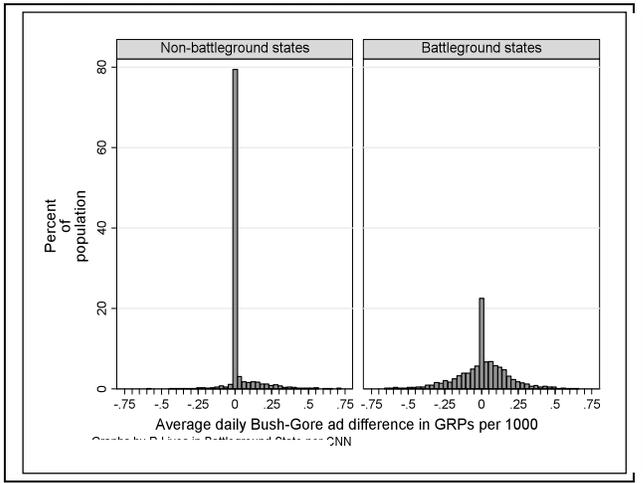
**A. Bush ad volume**



**B. Gore ad volume**

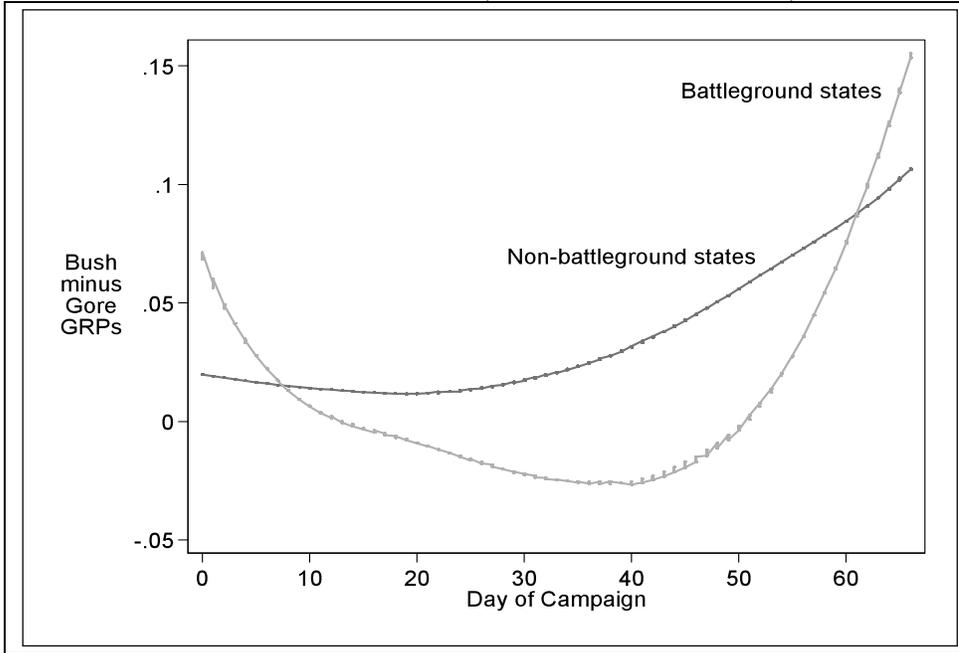


**C. Bush-Gore ad differential**

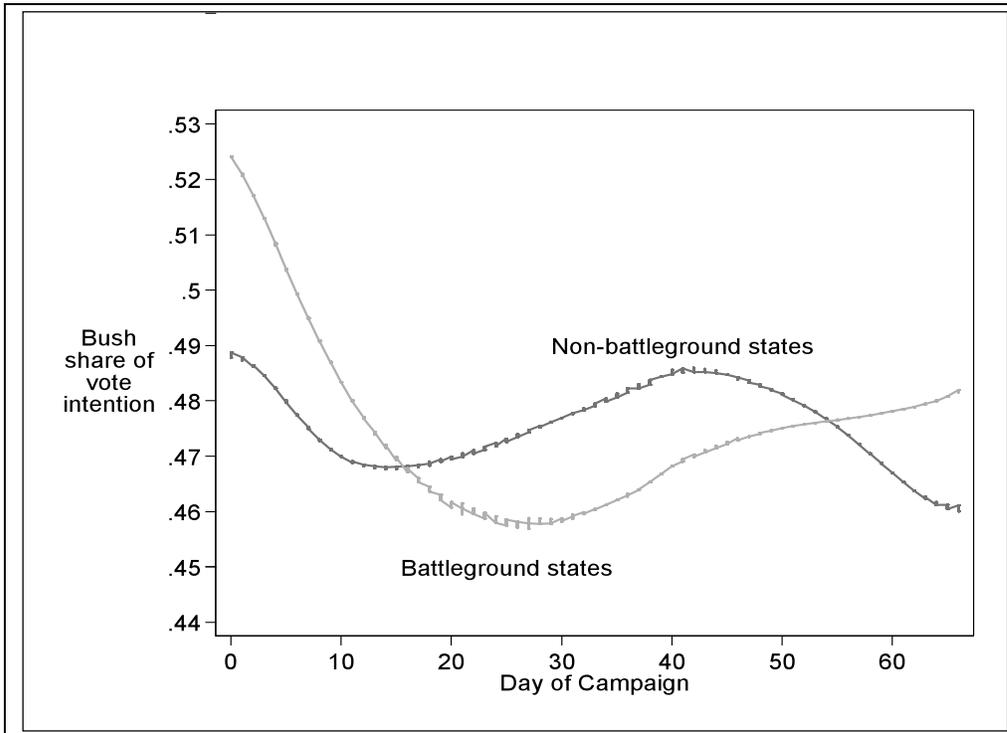


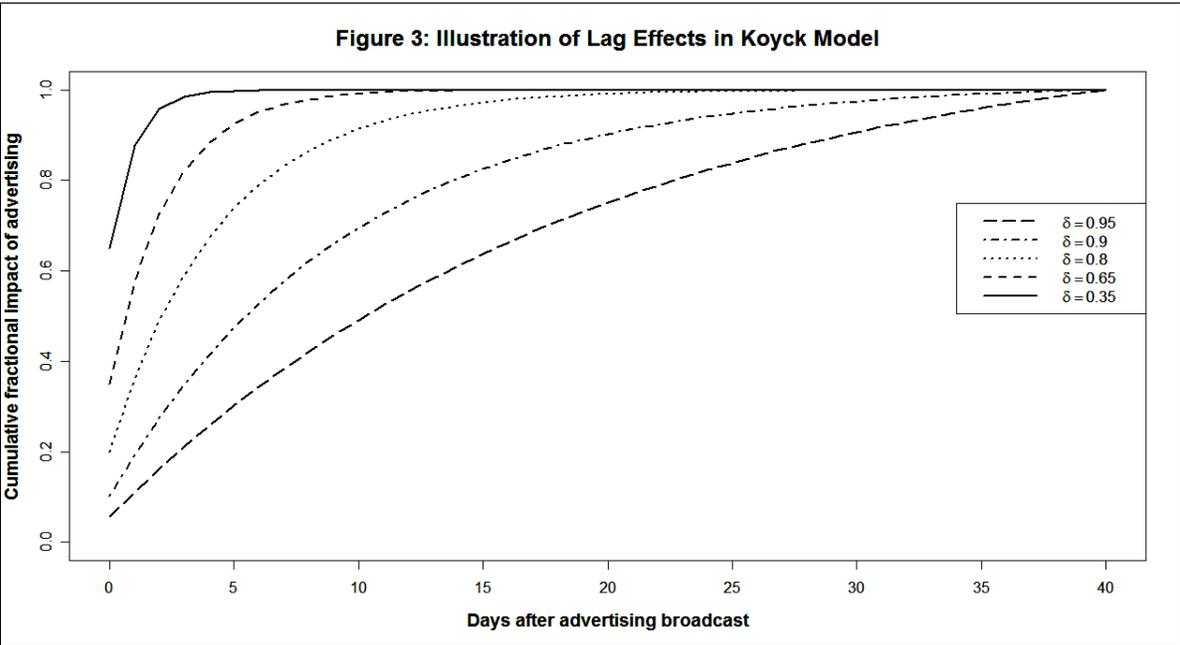
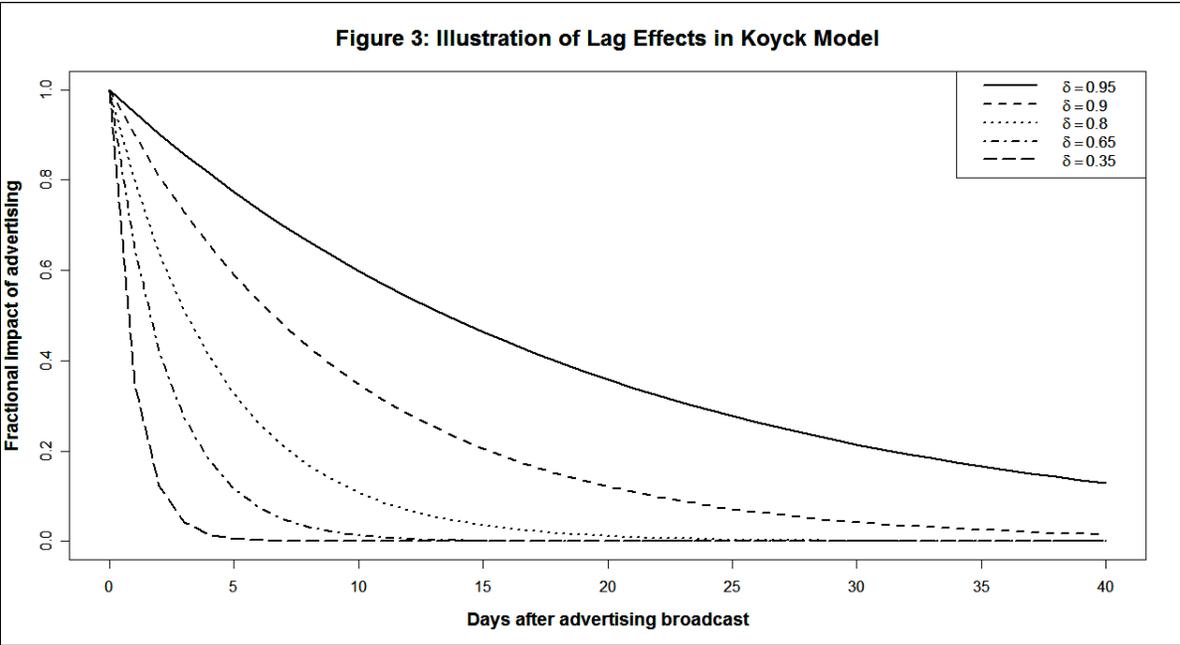
**Figure 2. Time Trends in advertising advantage and share of vote intention.**

**A. Trend in Bush-Gore ad differential (Bush GRP – Gore GRP)**

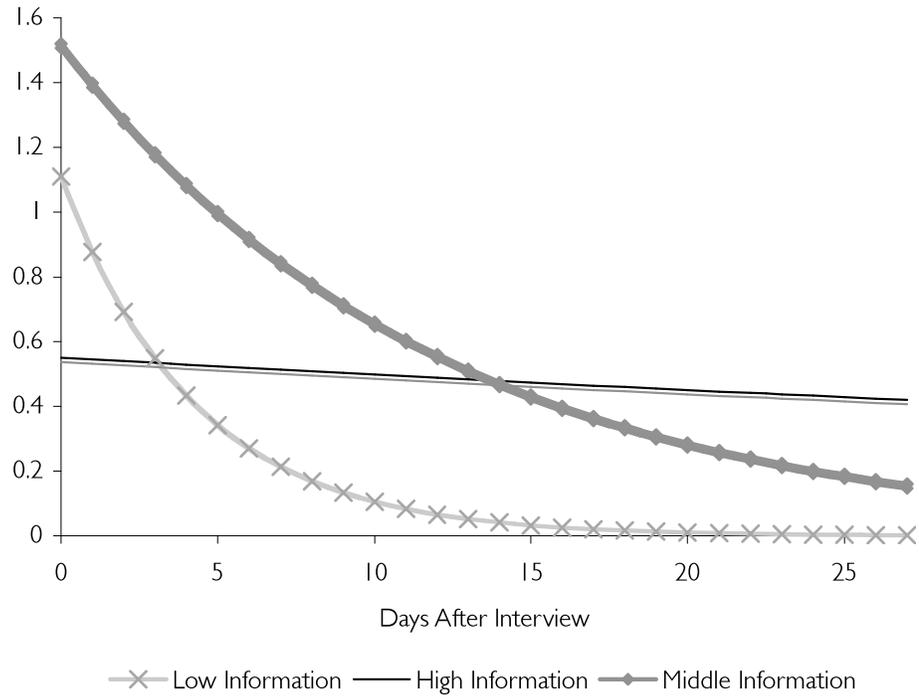


**B. Trend in Bush share of two-candidate vote**





**Figure 4. The Effect of a 1 GRP (10 Ad) Margin for Bush on Bush Vote Moving Away from Date of Interview**



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