# Heuristics, Hillary Clinton, and Health Care Reform

## A Bivariate Ordered Probit Analysis of Public Attitudes on Health Care Policy

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This study relies on data collected by the National Elections Studies project at the University of Michigan. Any errors in interpretation or analysis are the responsibility of the authors.

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A widely recognized debate in the political behavior field is whether voters have sufficient political interest and knowledge to engage in policy voting. On one side of this debate is the extensive research documenting the low levels of political sophistication among the electorate (e.g. Converse 1970; Neuman 1986; Smith 1989). On the other side is more recent research contending that citizens can behave as if fully informed through the use of heuristics (e.g. Lupia 1992, 1994; but see Bartels 1996.)

Reflecting this debate is the implicit assumption that a positive relationship exists between sophistication and the use of heuristics (e.g. Sniderman, Brody and Tetlock 1991). If heuristics address an information shortfall, it is logical to assume that less sophisticated citizens are more likely to use heuristics than are more sophisticated citizens. In this paper, we question whether this assumption holds for all heuristics in all policy contexts. More specifically, we propose a more general theory of heuristic use in which the conditioning role of sophistication depends on the policy context. A necessary condition for heuristic use is recognizing that a connection exists between the heuristic and the policy area. We posit that for certain heuristics and policy contexts this condition is only met at medium to high levels of sophistication, thereby producing a curvilinear or positive relationship between sophistication and heuristic use.

The theoretical discussion presented here focuses on the use of a likeability heuristic. But contrary to Brady and Sniderman (1985), we consider affect toward a policy maker rather than a group. In turn, the necessary condition for use of this likeability heuristic is whether the respondent recognizes the connection between the policy maker and the policy realm about which they are asked to express an opinion. Those who fail

to recognize the connection do not use the heuristic, so heuristic use can actually increase rather than decrease with sophistication. We theorize that the likelihood of recognizing the connection varies with public awareness of the policy maker and the salience of the policy area.

In order to investigate our theoretical argument, we consider attitudes toward health care reform at the beginning of the first Clinton Administration. At the time of Bill Clinton's inauguration, most pundits believed that his plan to create a government-run health care system for all Americans would be a major achievement of his administration. The proposal was the centerpiece of Clinton's legislative program during his first two years in office, and he took the unprecedented step of delegating the task of drafting the legislation to a task force led by his wife, Hillary Rodham Clinton. Her public leadership on the issue made her name virtually synonymous with the program; it became known, particularly to its detractors, as "Hillarycare." By the time of the 1994 midterm elections, however, the program was widely unpopular.[1]

What accounts for the unpopularity of the Clinton approach? We believe that citizens, particularly those with higher levels of sophistication, came to associate the plan with Hillary Clinton, thus basing their evaluations of the plan on their attitudes towards the first lady. This effect should not be as pronounced when respondents are asked to evaluate whether or not the United States should have any government-run insurance program.

[1]The 1994 National Election Study indicates that only 36.7% (plus or minus 2.5%) of Americans supported the plan ($N$ = 1659). Even among supporters of government insurance in general, only 56.9% also supported the Clinton plan ($N$ = 260). See also Koch (1998). A complete study of attitudes towards Hillary Clinton during this period can be found in Burden and Mughan (1999).

# 1 Theoretical Background

The literature on public opinion and political psychology suggests that the opinions that respondents provide in survey responses are usually not directly recalled from memory; instead, they are believed to be generated "on-line" by the respondent from the most accessible information in their heads (Lodge, McGraw and Stroh 1989; McGraw, Lodge and Stroh 1990; Lodge, Stroh and Wahlke 1990; Zaller 1992). This has important implications for the study of opinion, as respondents' professed attitudes may differ depending on how questions are phrased, sometimes in unpredictable ways.[2] Research has also shown that survey respondents often give inconsistent responses to identical questions, suggesting that survey responses may be contaminated by error from "non-attitudes" expressed by citizens lacking true attitudes towards the subjects at hand (Converse 1970).

As Downs (1957) argues, it is rational for voters to not seek information about candidates and issues; it follows that what little knowledge most people have about politics comes as a by-product of experiences encountered when they are not looking for political messages, rather than from specifically searching for political information (also see Page and Shapiro 1992: ch. 2). However, even in the absence of data, there is evidence that voters act on what Popkin (1991) terms "gut rationality." Stroh (1995) argues that voters make a trade-off between maximizing their accuracy and minimizing their effort in making political judgments. Voters are, in his words, "pragmatic cognitive misers" who use available information to impute the political beliefs of unknown actors from their

[2]See, for example, footnote 73 in Glynn et al. (1999: 297), which details how the difference of one word in a survey question caused a 37-percentage-point difference in survey responses.

existing knowledge of politics. Sniderman, Glasser and Griffin (1990) similarly find that voters, particularly those who are well-educated, can impute values onto political actors to help clarify their voting decisions. Voters also use affective responses to particular groups to help evaluate political issues: they know how they feel about particular issues, and they know how they feel about particular groups, so they use this information to impute how those groups feel about the particular issues at hand, utilizing what Brady and Sniderman (1985) call the *likability heuristic*—for example, an individual might reason that a Republican candidate opposes abortion rights because she supports abortion rights and dislikes Republicans. While there is considerable debate in the literature over whether heuristic reasoning is able to compensate for the public's overall lack of knowledge about politics[3], nonetheless it appears that most voters can do better than push buttons or mark circles at random in the voting booth.

While imperfect, the likability heuristic has been demonstrated to work in a variety of settings (Conover and Feldman 1989; Kuklinski, Metlay and Kay 1982; Mondak 1993b; but see Martin 2001). Moreover, a similar heuristic process allows voters to figure out where they should stand on issues based on their attitudes towards information providers.[4] Mondak (1993a) suggests that individuals use the source of information about

[3]Notably, Lupia and McCubbins (1988); Popkin (1991); Page and Shapiro (1992); Lupia (1994); Berggren (2001) argue that low levels of sophistication and knowledge are offset by averaging effects across the population or mitigated by institutional factors, while Bartels (1996); Althaus (1998); Kuklinski and Quirk (2000); Kuklinski, Quirk and Jerit (2001) note considerable divergence between the ability of less-informed and highly-informed voters to make choices consistent with "fully informed" preferences.

[4]Brady and Sniderman use the term "likability heuristic" to refer to both processes. Sobel (1985) proposes a similar approach based on the perceived credibility of the source of information. Iyengar and Valentino (2000) independently derive a credibility-based approach through research into the effects of campaign advertising. Group membership and identification may also help to promote this process (Conover 1984; Grofman and Norrander 1990; Huckfeldt and Sprague 1990).

issues in two ways: knowledge of where others stand helps to promote the opinion-formation process, and it can also guide the directionality of individuals' opinions. Yet even the heuristics available to voters are limited by their level of political sophistication: if an American voter is unable to associate senators John McCain or Russ Feingold with campaign finance reform, or a German voter cannot link Foreign Minister Joseph (Joschka) Fischer with Germany's foreign policy, he or she will be unable to make use of this association as a heuristic.[5] The ability of voters to use heuristics is thus also limited by their level of political knowledge—specifically, their ability to associate political objects with other salient referents.

The ability to make connections between attitudes towards information providers and the programs they espouse is limited by the amount of cognition needed for the individual to use their feelings towards that provider in forming an evaluation. For example, a voter will have more difficulty associating their attitude towards George W. Bush with the general issue of missile defense than if they are asked about Bush's national missile defense plan. More sophisticated and informed voters should be able to associate Bush with missile defense without the added cue of Bush's name; less sophisticated voters will need more specific information about the issue before they can use their attitude towards Bush as a heuristic—for example, a referent they are familiar with, such as the president or other public figure associated with the issue. This suggests that the likability heuristic is more effective for sophisticated voters, who have more information to draw

[5]See Lodge and Stroh (1993); Lodge and Taber (2000); Taber, Lodge and Glathar (2001) for a discussion of associative reasoning in the context of the on-line model.

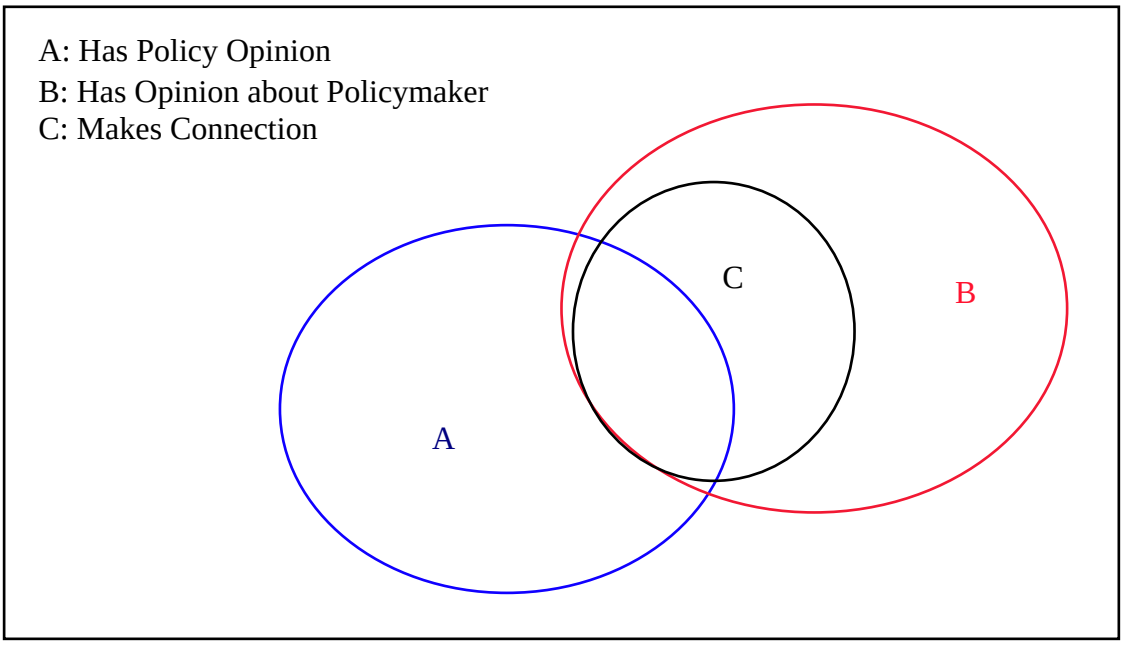


Figure 1: Venn diagram of policy and policymaker opinions

upon, than unsophisticated voters.[6]

For example, on any given issue some group of voters ($A$) may have an opinion about that issue, while another, possibly overlapping, group of voters ($B$) may have an opinion about the policymaker who is responsible for that issue, of whom a subset ($C$) will recognize the connection between the policymaker and the issue; see Figure 1 for an illustration of the case where the policymaker is reasonably salient. Voters who have an opinion about the policymaker and are aware of her connection to the issue, but do not have an opinion about it (in set theoretic terms, $C \backslash A$), can use their attitudes toward the policymaker to decide their own position on the issue; they are potential users of

[6]This is consistent with Zanna, Klosson and Dalley (1976), who find that individuals who have more non-political information available to them are more capable of arriving at accurate and reliable conclusions.

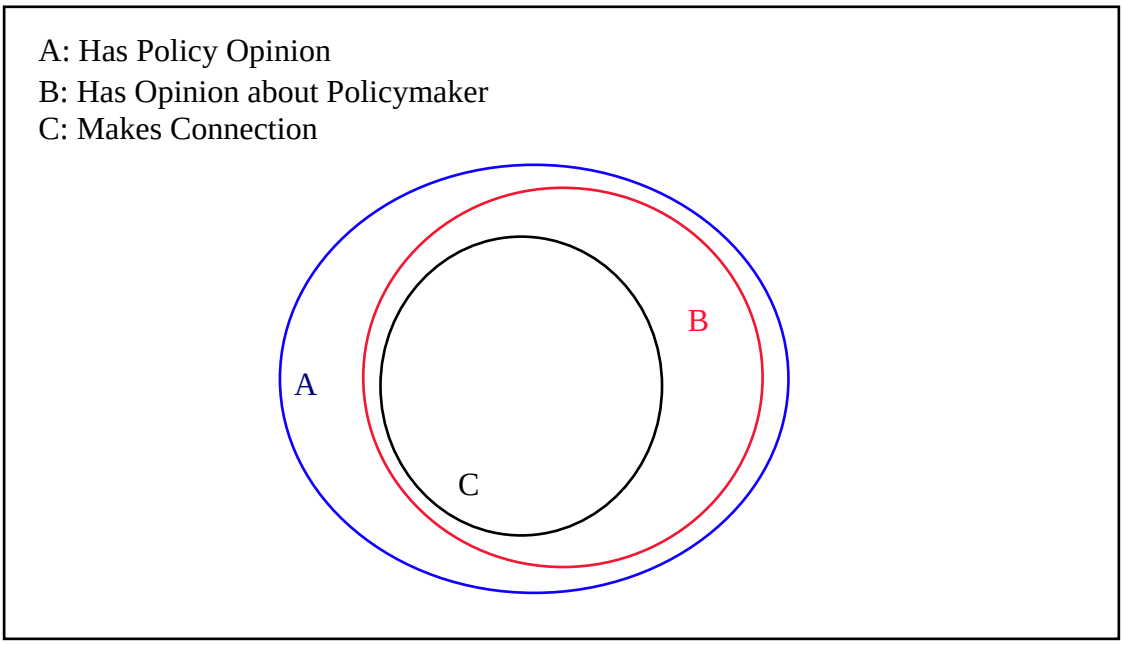


Figure 2: The case of an obscure policymaker

the likability heuristic. In some cases (such as in Figure 2), the policymaker may be so obscure that everyone who knows she is responsible for the issue—presumably the most sophisticated voters—will also have an opinion about the policy.

Furthermore, we would expect a nonlinear relationship between voter sophistication and the use of the likability heuristic; among voters with low sophistication relatively few voters will have an opinion about either the policymaker or the issue, while among the highly sophisticated most voters will have already formed an opinion about the issue and thus will not need a heuristic (see Figure 3). For many issues and public figures, we believe the moderately sophisticated will be most likely to need and use this heuristic.

For some issues and policy makers, however, the connection between the issue and

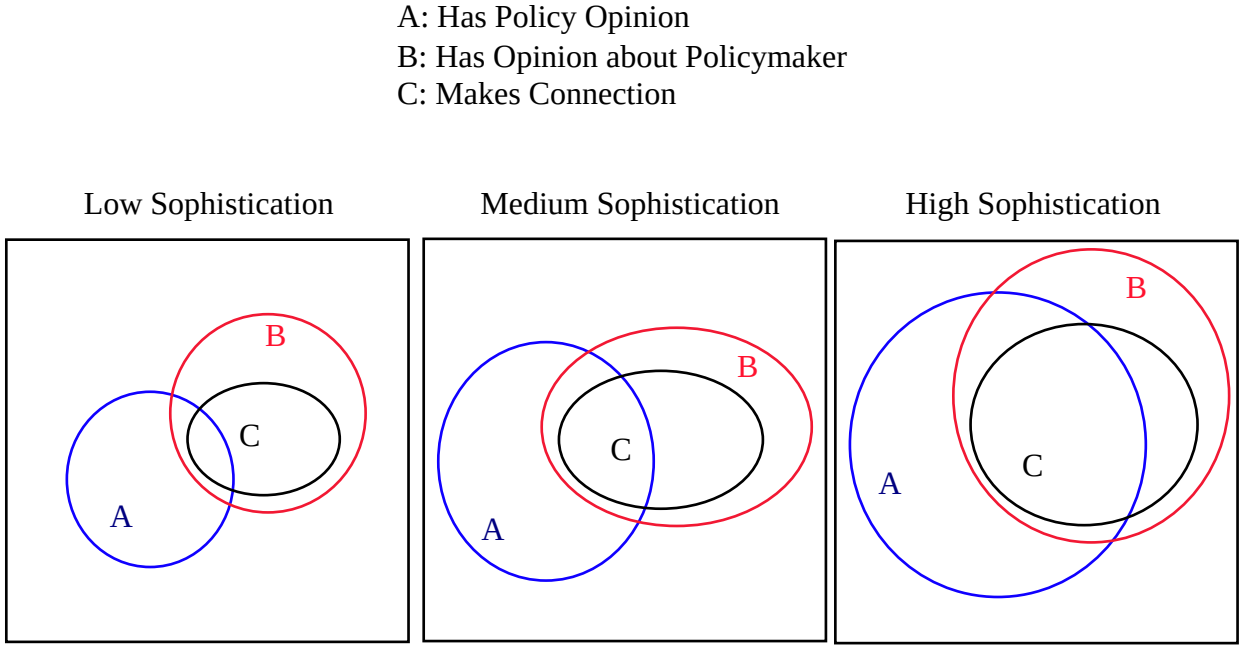


Figure 3: The curvilinear relationship between sophistication and heuristic use

the policy maker might be obscure enough that the use of the likeability heuristic increases with sophistication (but not so obscure that the likeability heuristic is irrelevant). In this case, the size of the *C* subset for Medium Sophistication in Figure 3 decreases in size so that the *C**A* subset is larger for High Sophistication. Alternatively, low salience issues might produce positive relationships between sophistication and heuristic use. In this case, the intersection of subsets *A* and *C* for High Sophistication decreases enough in size so that a positive relationship results.

In the case of the issue of government health insurance, we have an opportunity to test this effect. While Americans had generally been bombarded with information about President Clinton's support for a national health insurance system, less sophisticated

voters, particularly those who had ceased to be attentive after the 1992 campaign, would not be as likely to associate Hillary Clinton with the issue of health care reform. Less sophisticated voters would also be less likely to connect Mrs. Clinton's role in producing the Clinton health insurance proposal to attitudes towards health insurance in general. Accordingly, for less sophisticated voters responses to questions about Clinton's approach to health care reform should be based in part on attitudes toward Hillary Clinton, while thoughts about health care reform in general should not be associated, due to the larger "cognitive gap" that would have to be crossed.

In sum, our expectation is that a curvilinear relationship exists between sophistication and the use of affect toward Hillary Clinton as a heuristic for evaluating health care reform. Yet, it is also possible that Hillary Clintons role in formulating the Clinton Administrations health care policy was obscure enough that a positive relationship exists.

## 2 Hypotheses and Independent Variables

The following hypotheses about health care reform are suggested either by the literature or simply by common sense:

1. Respondents who do not have health care insurance should generally be more supportive of a government-run health care system. (Operationalized by V941022.)
2. Respondents who find medical bills to be a financial burden should be more supportive of a government-run health care system. (Operationalized by V941025.)
3. Republican identifiers should be less supportive of a government-run health care system than Democratic identifiers. Partisanship is operationalized by V940655, with higher levels indicating greater strength of Republican identification.[7]

[7]Bartels (2000) suggests that the party identification scale does not truly refect the strength of partisan

4. Citizens who like Bill Clinton should be more supportive of a government-run health care system.

5. Citizens who like Hillary Clinton should be more supportive of the Clinton health care plan, but they should not be more supportive of government-run health care in general.

6. Political sophisticates should use their attitudes towards Hillary Clinton as a heuristic for evaluating government-run health care; thus, sophisticates who like Hillary Clinton will be more supportive of government insurance (in the abstract or the Clinton plan), while sophisticates who dislike Hillary Clinton will be less supportive.

7. In addition, control variables are introduced for gender (V941434), region (V940011), age (V941203), and race (V941434).

Affect towards Bill Clinton is operationalized by responses to a feeling thermometer, V940223; likability of Hillary Clinton is similarly derived from V940229. The level of political sophistication was measured using the interviewer's rating of the respondent's intelligence, V941439. [8]

# 3 Data and Methodology

The data for this study are taken from the 1994 National Election Study conducted by the Center for Political Studies and Survey Research Center at the University of Michigan. Of the 1795 respondents, 1536 (85.6 percent) had usable responses to the dependent variables operationalizing the hypotheses. Missing values of independent variables were set to the

feeling; notably, that weak partisans tend to be less partisan in their behavior than so-called "independent leaners."

[8]This measure is believed to be quite reliable and is comparable in its findings to summated scales based on political knowledge. In addition, using post-high school education as a proxy for sophistication in the model gave very similar results. See Zaller (1992: 339) for a discussion.

mean in the case of continuous variables, and set to the modal category in the case of discrete variables.

The dependent variables in this analysis are derived from two items in the 1994 NES. Respondents' support for the Clinton reform plan was derived from questions asking whether respondents approved or disapproved of how President Clinton was handling health care reform and how strongly they held that view (V940207); respondents indicating approval were coded as supporters of the Clinton plan. Respondents' attitudes toward government-run health care in general were measured by a question asking where respondents placed themselves on a seven-point scale between supporting government-run insurance and private insurance (V940950); respondents rating themselves in the interval 1–3 on the scale were coded as supporters of government-run insurance.

Both dependent variables are dichotomous in nature; accordingly, an estimator such as logit or probit (Aldrich and Nelson 1984; Greene 2000) would normally be appropriate. However, as the error terms of the two models are believed to be correlated, an extension of probit known as bivariate probit (Greene 2000) is the most appropriate estimator. The joint probability that $Y_1 = y_{i1}$ and $Y_2 = y_{i2}$ is given by

$$\begin{aligned} \Pr(Y_1 = y_{i1}, Y_2 = y_{i2}) &= \Phi_2(q_{i1}\beta_1' x_{i1}, q_{i1}\beta_2' x_{i2}, q_{i1}q_{i2}\rho), \\ q_{ij} &= 2y_{ij} - 1, j = 1, 2 \end{aligned}$$

where $\Phi_2$ is the bivariate normal cumulative density function,

$$\Phi_2(w_1, w_2, \rho) = \int_{-\infty}^{w_2} \int_{-\infty}^{w_1} \frac{e^{-(1/2)(z_1^2+z_2^2-2\rho z_1 z_2)/(1/\rho^2)}}{2\pi\sqrt{1-\rho^2}}\, dz_1\, dz_2.$$

The bivariate probit model estimates the coefficient vectors $\beta_1$ and $\beta_2$ for the two equations and $\rho$, the correlation between the error terms of the equations, as well as standard errors for these parameters. We can then test whether or not the correlation between the equations is statistically significant, to decide whether the bivariate estimator was necessary.[9] We also estimated the model using a bivariate ordered probit model (for details, see the statistical appendix on page 19), as we were concerned that dichotimizing the dependent variables led to discarding important information from the model. The bivariate probit model was estimated using Stata 7, while the bivariate ordered probit model was estimated in LIMDEP 7.0.

# 4 Results

The results of the bivariate probit model appear in Table 1, while the bivariate ordered probit model's results appear in Table 2. The $\rho$ parameter is highly significant, indicating that the error structures of the equations are correlated, suggesting that the bivariate model is the correct specification. The models together perform substantially better than the naïve model that respondents oppose government insurance and do not support Clinton's handling of the health insurance issue.

[9] If the correlation is not significant, separate estimation of the equations is preferable as bivariate probit

| Variable | Coefficients (Robust Standard Error) Gov't Insurance | Clinton's Handling |
|---|---|---|
| Feeling Thermometer: Bill Clinton | 0.010*** | 0.019*** |
| | (0.002) | (0.003) |
| Feeling Thermometer: Hillary Clinton | –0.018*** | –0.004 |
| | (0.005) | (0.006) |
| Can afford health care expenses (dummy) | –0.393*** | –0.139 |
| | (0.078) | (0.088) |
| Has health insurance (dummy) | –0.374** | 0.126 |
| | (0.134) | (0.125) |
| Party identification scale | –0.112*** | –0.100*** |
| | (0.021) | (0.023) |
| Black (dummy) | 0.108 | 0.028 |
| | (0.120) | (0.127) |
| Female (dummy) | 0.002 | –0.149† |
| | (0.073) | (0.081) |
| South (dummy) | –0.049 | –0.202* |
| | (0.075) | (0.084) |
| Over 50 (dummy) | –0.179* | –0.206* |
| | (0.075) | (0.085) |
| Respondent intelligence rating | –0.501*** | –0.633*** |
| | (0.107) | (0.158) |
| FT Hillary × intelligence | 0.008*** | 0.008** |
| | (0.001) | (0.002) |
| Constant | 1.235*** | –0.349 |
| | (0.309) | (0.415) |
| $\rho$ | 0.155** | |
| | (0.050) | |
| Log likelihood | –1508.4549 | |
| Wald test of full model: $\chi^2(22)$ | 635.33*** | |

- Coefficients are maximum-likelihood bivariate probit estimates. $N = 1536$.
- *** indicates $p(z) < .001$; ** $p < .01$; * $p < .05$; † $p < .10$ (two-tailed test).

Table 1: Bivariate probit model of support for government health insurance and Clinton's handling of health care reform.

| Variable | Coefficients (Robust Standard Error) Gov't Insurance | Clinton's Handling |
|---|---|---|
| Feeling Thermometer: Bill Clinton | 0.008*** | 0.019*** |
| | (0.002) | (0.003) |
| Feeling Thermometer: Hillary Clinton | –0.016*** | –0.004 |
| | (0.004) | (0.006) |
| Can afford health care expenses (dummy) | –0.377*** | –0.139 |
| | (0.072) | (0.089) |
| Has health insurance (dummy) | –0.382*** | 0.125 |
| | (0.104) | (0.127) |
| Party identification scale | –0.116*** | –0.098*** |
| | (0.019) | (0.023) |
| Black (dummy) | 0.079 | 0.027 |
| | (0.109) | (0.133) |
| Female (dummy) | 0.048 | –0.152 |
| | (0.065) | (0.083) |
| South (dummy) | –0.027 | –0.203* |
| | (0.067) | (0.084) |
| Over 50 (dummy) | –0.113 | –0.205* |
| | (0.066) | (0.087) |
| Respondent intelligence rating | –0.430*** | –0.639*** |
| | (0.086) | (0.167) |
| FT Hillary × intelligence | 0.008*** | 0.008** |
| | (0.001) | (0.003) |
| $\mu_0$ | 1.686*** | –0.335 |
| | (0.261) | (0.420) |
| $\mu_1$ | 0.631*** | — |
| | (0.033) | — |
| $\rho$ | –0.155** | |
| | (0.050) | |
| Log likelihood | –2077.49 | |
| Wald test of full model: $\chi^2(23)$ | 1074.3*** | |

- Coefficients are maximum-likelihood bivariate ordered probit estimates. $N = 1536$.
- *** indicates $p(z) < .001$; ** $p < .01$; * $p < .05$ (two-tailed test).

Table 2: Bivariate ordered probit model of support for government health insurance and Clinton's handing of health care reform.

As we might expect, respondents who do not have difficulty affording their own health care expenses and those with health insurance are less supportive of government financing of health insurance. However, these relationships completely disappear when they evaluate Clinton's handling of the health care issue. While it is possible that this is the result of Clinton's failure to pass legislation mandating government health insurance, it is more likely that voters considered the Clinton plan in partisan terms. It is surprising, however, that the groups the plan was primarily intended to benefit were no more supportive of Clinton's handling of the health care issue than similar individuals with affordable access to health care through existing channels, suggesting that the administration's campaign in favor of the proposal had not succeeded in convincing these core constituencies that would have been needed to help pressure legislators to support the proposal. As we would probably expect, partisanship affected support for both government insurance and Clinton's handling of the issue; Republicans were less supportive than Democrats of both Clinton's proposal and the idea of government insurance.

An interesting finding was that Americans over the age of 50 were less supportive of government insurance in general and the Clinton health care plan than we might otherwise expect. This population includes all of the beneficiaries of Medicare, whom we would at least expect to support the idea of government insurance, if not the Clinton proposal. It is possible that respondents over 50 were concerned that universal health care coverage might lead to greater rationing of health care in the Medicare program or increases in general taxes that seniors would receive a disproportionately small benefit

is less efficient than standard models when the errors are not correlated.

from; it is also possible that older Americans were reflecting a lack of enthusiasm for the Medicare program in their responses to both questions, as they would be more familiar with government insurance than younger Americans.

Another significant finding was a regional disparity in support for the health care plan; respondents in southern states were significantly less likely to support Clinton's handling of the health care issue, despite not being significantly less likely to support government insurance in general. It is unclear why this relationship might appear; it may reflect a regional sense that Clinton's program would be too bureaucratic, or it may be an artifact of where opponents of the Clinton proposal targeted their media campaigns against the plan.[10]

Attitudes towards Bill Clinton affected support for both insurance in general and the Clinton plan in particular; in fact, it was the best predictor of support. As President Clinton had by the 1994 elections been personally associated with the health care issue for nearly three years, it is not surprising that attitudes towards Clinton carried over into support for insurance in abstract terms; it is also likely that he was personally associated by respondents with "the government." This variable may also be capturing some underlying partisan or ideological attitudes that are not tapped by the party identification scale.

Perhaps the most interesting findings revolve around respondent attitudes towards Hillary Clinton and sophistication. Due to the interaction with the respondent's level of intelligence, a direct discussion of the coefficients would be misleading. However, from Figure 4, we can see the interaction between intelligence and attitudes towards the first

[10]Presumably, the opponents of the proposal targeted congressional districts with weak Democratic incumbents; in 1994, this was the case in many southern districts.

See Attachment

Figure 4: Estimated effect of affect toward Hillary Clinton on approval of health care reform

lady rather clearly. As we might expect, there was a curvilinear relationship at work, with attitudes towards Hillary Clinton having a greater effect on support for both the Clinton approach and government insurance in general among the politically sophisticated, and a smaller effect among the less sophisticated.

# 5 Conclusions

This paper examined the connections between attitudes towards a political actor (the first lady) and an issue that the actor had been actively involved in promoting. The central finding of this analysis is that voters' ability to use their attitudes towards actors to locate themselves in policy space is limited by their ability to connect the actors to the policies they espouse. Politically sophisticated voters used evaluations of Hillary Clinton to place themselves in response to a question about the abstract concept of "government-run health insurance" than less sophisticated voters, but those differences were less significant when voters were asked to evaluate the President's handling of the issue. More generally, it appears that less sophisticated voters have fewer resources to draw upon when deciding their own issue positions.

This paper also suggests that attitudes towards political actors other than the president may be important in evaluating proposals by the executive branch, particularly when those actors are publicly-visible advocates of a proposal. While few—if any—

administrations have had such a high-profile task delegated publicly to a publicly-visible figure, presidents cannot rely on their own popularity to curry support for proposals that have been associated with other actors. In particular, we might want to look at the role of attitudes towards members of Congress in promoting public support for legislation they are shepherding through Congress on behalf of the president. In a comparative context, we might also want to examine the role of attitudes towards cabinet ministers in public support for a government's legislative proposals; for example, attitudes towards Britain's Chancellor of the Exchequer may be used as heuristics in addition to attitudes towards the prime minister or ruling party when politically sophisticated Britons consider economic policy issues. This relationship might be particularly important in multiparty cabinets, where ministers from different parties may be able to act as policy entrepreneurs against the wishes of the prime minister.

In broader terms, this paper helps inform the wider debate about how voters use heuristics in making political decisions. It appears that voters who can draw on more heuristics are more likely to arrive at conclusions that would be the same as the "correct," fully informed conclusion, and more sophisticated voters appear more able to draw upon multiple guides for heuristic evaluation than less sophisticated voters, particularly when evaluating more abstract concepts. The "rational public" is rational only to the extent that voters are able to draw upon information to arrive at conclusions about issues, and this ability is largely dependent on how many sources of information voters can draw upon when making their evaluations.

# 6 Statistical Appendix: Bivariate Ordered Probit

The bivariate ordered probit model is a relatively straightforward extension of the bivariate probit model. As in the ordered probit model, threshold parameters are introduced to account for multiple ordered response categories. The presence of multiple response categories increases the set of choice pairs in a multiplicitive fashion, which does complicate the optimization problem. Reflecting the structure of the bivariate probit model, the joint probabilities for the case of two trichotomous (three category) ordered variables are:

$$
\begin{aligned}
p_{00} &= \Pr(y_1 = 0, y_2 = 0) = \Phi_2(-\beta_1' x_{i1}, -\beta_2' x_{i2}, \rho) \\
p_{22} &= \Pr(y_1 = 2, y_2 = 2) = \Phi_2(\beta_1' x_{i1} - \mu_{11}, \beta_2' x_{i2} - \mu_{12}, \rho) \\
p_{10} &= \Pr(y_1 = 1, y_2 = 0) = \Phi_2(\mu_{11} - \beta_1' x_{i1}, -\beta_2' x_{i2}, -\rho) - p_{00} \\
p_{01} &= \Pr(y_1 = 0, y_2 = 1) = \Phi_2(-\beta_1' x_{i1}, \mu_{12} - \beta_2' x_{i2}, -\rho) - p_{00} \\
p_{20} &= \Pr(y_1 = 2, y_2 = 0) = \Phi_2(\beta_1' x_{i1} - \mu_{11}, -\beta_2' x_{i2}, -\rho) \\
p_{02} &= \Pr(y_1 = 0, y_2 = 2) = \Phi_2(-\beta_1' x_{i1}, \beta_2' x_{i2} - \mu_{12}, -\rho) \\
p_{21} &= \Pr(y_1 = 2, y_2 = 1) = \Phi_2(\beta_1' x_{i1} - \mu_{11}, \beta_2' x_{i2}, \rho) - p_{22} \\
p_{12} &= \Pr(y_1 = 1, y_2 = 2) = \Phi_2(\beta_1' x_{i1}, \beta_2' x_{i2} - \mu_{12}, \rho) - p_{22} \\
p_{11} &= \Pr(y_1 = 1, y_2 = 1) = \Phi_2(\beta_1' x_{i1}, \beta_2' x_{i2}, \rho) - p_{12} - p_{21} - p_{22}
\end{aligned}
$$

Given these joint probabilities, we can define the log-likelihood function as follows:

$$
\log L = \sum_{j=0}^{2} \sum_{k=0}^{2} \sum_{i} d_{ijk} \ln p_{jk}
$$

$$
\text{where} \quad d_{ijk} = \begin{cases} 1 & : \quad y_{i1} = j \quad \text{and} \quad y_{i2} = k \\ 0 & : \quad \text{otherwise} \end{cases}
$$

In our analysis, one of the dependent variables (government health insurance) is an ordered trichotomous measure while the other (Clinton's handling of health care) is dichotomous. This simplifies the joint probabilities as follows:

$$
\begin{aligned}
p_{00} &= \Pr(y_1 = 0, y_2 = 0) = \Phi_2(-\beta_1' x_{i1}, -\beta_2' x_{i2}, \rho) \\
p_{10} &= \Pr(y_1 = 1, y_2 = 0) = \Phi_2(\mu 11 - \beta_1' x_{i1}, -\beta_2' x_{i2}, -\rho) - p_{00} \\
p_{01} &= \Pr(y_1 = 0, y_2 = 1) = \Phi_2(-\beta_1' x_{i1}, \beta_2' x_{i2}, -\rho) \\
p_{20} &= \Pr(y_1 = 2, y_2 = 0) = \Phi_2(\beta_1' x_{i1} - \mu_{11}, -\beta_2' x_{i2}, -\rho) \\
p_{11} &= \Pr(y_1 = 1, y_2 = 1) = \Phi_2(\mu_{11} - \beta_1' x_{i1}, \beta_2' x_{i2}, \rho) - p_{01} \\
p_{21} &= \Pr(y_1 = 2, y_2 = 1) = \Phi_2(\beta_1' x_{i1} - \mu_{11}, \beta_2' x_{i2}, \rho)
\end{aligned}
$$

Note that only $p_{01}$, $p_{11}$ and $p_{21}$ change.

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