Reassessing the Link between Voter Heterogeneity and Political Accountability: A Latent Class Regression Model of Economic Voting

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ABSTRACT

While recent research has underscored the conditioning effect of individual characteristics on economic voting behavior, most empirical studies have failed to explicitly incorporate observed heterogeneity into statistical analyses linking citizens' economic evaluations to electoral choices. In order to overcome these drawbacks, we propose a latent class regression model to jointly analyze the determinants and influence of economic voting in Presidential and Congressional elections. Our modeling approach allows us to better describe the effects of individual covariates on economic voting and to test hypotheses on the existence of heterogeneous types of voters, providing an empirical basis for assessing the relative validity of alternative explanations proposed in the literature. Using survey data from the 2004 U.S. Presidential, Senate and House elections, we find that voters with college education and those more interested in political campaigns based their vote on factors other than their economic perceptions. In contrast, less educated and interested respondents assigned considerable weight to economic assessments, with sociotropic jugdgments strongly influencing their vote in the Presidential election and personal financial considerations affecting their vote in House elections. We conclude that the main distinction in the 2004 election was not between 'sociotropic' and 'pocketbook' voters, but rather between 'economic' and 'non-economic' voters.

The crucial link between citizen knowledge and democratic accountability has been long recognized in the political science literature (Inglehart, 1977). In order to be able to hold government accountable, citizens must be able to use information in constructing attributions of governmental responsibility (Main, Przeworski and Stokes, 1999; Gomez and Wilson, 2006). The relationship between information, cognition and attribution of governmental responsibility has been extensively analyzed in the empirical and theoretical literature, particularly in the context of economic voting (Lewis-Beck and Paldam, 2000).

The fact that citizens hold elected officials accountable for fluctuations in the economy has long been established in the political science literature (Kramer, 1971; Fiorina, 1981; Kinder and Kiewet, 1979, 1981; Hibbs, Rivers and Vasilatos, 1982). However, the precise mechanism by which individual voters use economic information in their electoral choice or, in other words, the process by which voters attribute causal responsibility for economic developments, is still also under considerable

debate. Different scholars have underscored the role of specific mechanisms and explanations for economic voting, such as institutional variables (e.g., Lewis-Beck, 1983; Powell and Whitten, 1993), media usage (Weatherford, 1983), political culture and core values (Feldman, 1982; Kinder and Mebane, 1983), race (Dawson, 1994), information (Weatherford, 1983; Duch, 2001), education (Abramowitz, Lanoue and Ramesh, 1988), electoral campaigns (Godbout and Belanger, 2007) and political sophistification (Gomez and Wilson, 2001,2003,2006).

Most prominent work in the field, however, tends to assume monolithic voters that attribute economic responsibilities in essentially identical way, asking whether the electorate as a whole engages in economic voting behavior and ignoring systematic differences across voters that might determine whether and why some voters engage in economic voting and others don't (Gomez and Wilson, 2001). In the words of (Gomez and Wilson, 2006), this limitation "diminishes our understanding of economic voting behavior and, more generally, of how governmental accountability is constructed in the minds of citizens" (p. 129). At the empirical level, the vast majority of studies aimed at analyzing the causes of economic voting simply rely on standard generalized linear models and draw conclusions about the effect of relevant individual characteristics based on the sign and statistical significance of the parameter estimates for the predictors of interest. Other analyses (e.g., Gomez and Wilson, 2001) have sought to explicitly account for the possibility of heterogeneous groups of voters by using stratified samples, splitting the population under analysis according to the distribution of particular covariates of interest and estimating the effect of these covariates on the probability of supporting incumbent governments for each of the exogenously determined subsamples.

In this paper we adopt a different approach, using a latent class regression model to examine the role of individual-level characteristics on voters' economic voting behavior, focusing on their influence on voters' ability to attribute economic responsibility to incumbent governments. This approach can accommodate the existence of subpopulations exhibiting different patterns of economic voting behavior without the need to exogenously segment the sample based on covariates chosen a priori or to impose the assumption that the same statistical model holds for all voters. In fact, our latent class regression model allows us to test whether and to what extent individual characteristics discriminate between different types of economic voters and to identify and characterize these heterogeneous groups. In addition, the specification we adopt in this paper enables us to examine how voters attribute blame or credit for economic outcomes among different political actors. A growing number of articles have highlighted the potential impact of the institutional and electoral context in economic voting (Powell and Whitten, 1993; Anderson, 2000; Godbout and Belanger, 2007). In particular, Powell and Whitten (1993) note that the division of political control between agents and institutions may affect voters' ability to hold any one political actor responsible for governmental performance, and thus voters may differ in the way in which they attribute credit or blame for the economic performance among the relevant political actors such as the President and members of Congress (Gomez and Wilson, 2001, 2003). Our modeling strategy enables us to take advantage of the fact that Presidential, Senate and House elections are held simultaneously, allowing to jointly estimate the relative influence of economic voting across races. We illustrate our approach fitting a latent class regression model to the ANES 2004 survey, the last election year in which both Presidential and Congressional elections were held.

The rest of the paper is organized as follows. The next section briefly reviews the literature on economic voting and on the effect of voter heterogeneity on economic voting behavior, and describes the main advantages of using latent class regression models in order to account for the conditioning effect of individual characteristics on economic voting. Section 3 presents the data

and the model used to analyze the determinants of economic voting and the influence of economic voting on electoral behavior in the 2004 Presidential, House and Senate elections, and Section 4 discusses our empirical findings from the analysis. Finally, Section 5 concludes.

1. INDIVIDUAL HETEROGENEITY, ECONOMIC EVALUATIONS AND VOTE CHOICE

Scholarly research has indisputably established that economic considerations strongly affect citizens' electoral behavior (Kramer, 1971; Tufte, 1975; Hibbs, Rivers and Vasilatos, 1982). Empirical evidence conclusively supports the hypothesis that voters who perceive an improvement in economic conditions are more likely to support incumbents during an election for a variety of offices, both at the state and national levels (Kramer, 1971; Fiorina, 1983; Gomez and Wilson, 2001, 2003). There is much less consensus, however, about the precise nature of the connection between the vote choice and the economy or, more specifically, on the relationship between voters' characteristics, their assessment of economic information in their electoral choice.

One possible explanation for economic voting, formalized in the the 'sociotropic hypothesis' (Kinder and Kiewet, 1979, 1981), is that voters consider macroeconomic conditions, i.e., the economic well being of the nation as a whole, when voting for or against incumbents. In contrast, other scholars (e.g., Campbell et al., 1960; Kramer, 1971, 1983) have argued that people vote according to changes in their own personal economic and financial circumstances; that is, they vote according to their own 'pocketbook'. Sociotropic judgments have been generally shown to be better cross-sectional predictors of voting behavior than pocketbook evaluations (Godbout and Belanger, 2007), although Nannestad and Paldam (1997) find strong influences of pocketbook considerations - even to the exclusion of sociotropic effects - and still other studies (e.g., Monroe and Erickson, 1986) find weak evidence of any form of economic voting. Nonetheless, few studies examine why and to what extent voters rely on one kind of economic perception rather on the other when casting their vote, and how these differences among voters might affect electoral outcomes. In fact, the influence of individual characteristics on economic voting behavior in general has not been thoroughly analyzed.

In order to form economic judgments and relate this information to electoral choices by attributing credit or blame for economic performance to relevant political actors, a certain amount of information and cognitive skills is necessary. Hence, recent research examining the influence of individual characteristics on economic voting behavior have focused on the role of political information or sophistication, broadly defined as the quantity and organization of a person's political awareness, information and cognition (Luskin, 1987; Sniderman, Brody and Tetlock, 1991), in explaining heterogeneous economic voting behavior. For instance, Duch (2001) argues that information conditions voters' ability to cast an economic vote: higher levels of information tend to decrease the ambiguity regarding the link between government policy and economic performance, and hence more informed citizens would be more likely to attribute political responsibilities for economic outcomes and engage in economic voting. In the same direction, individuals' consumption of media information and exposure to political campaigns would affect attributions of economic responsibility, as well as the likelihood of pocketbook versus sociotropic evaluations (Weatherford, 1983; Mutz, 1992; Hetherington, 1996; Godbout and Belanger, 2007). In particular, this conception of economic voting as a process of information acquisition suggests that less informed or politically engaged citizens would be inclined to rely on personal financial circumstances when making judgments about government economic performance, since this information is easier to gather and process. In contrast, more sophisticated voters would be able to use other relevant information - such as indicators of the state of the national economy - in formulating their policy expectations (Lupia, 1994; Delli

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Carpini and Keeter; Goren, 1997; Krause, 1997). From a different perspective, Gomez and Wilson (2001) propose a theory of economic voting that underscores the role of political sophistication in attributing causal responsibility for economic developments, rather than on information acquisition. Focusing on the distinction between pocketbook and sociotropic evaluations, these authors argue that the associative link between personal finances and macroeconomic policy is too 'distal' for less sophisticated voters, whereas the relationship between the state of the national economy and the government is considerably easier to establish. In contrast, politically sophisticated individuals are more likely to understand how changes in government's economic policies may affect their personal finances, while at the same time being able that several political or economic factors beyond the government's control may affect macroeconomic outcomes. Hence, in their opinion, sociotropic evaluations will be more prevalent among low sophisticates, while more sophisticated voters will place relatively less weight on national economic evaluations and more on pocketbook circumstances. A similar argument is made by Abramowitz, Lanoue and Ramesh (1988) regarding the effects of voters' education levels.

In addition, differences in citizens'level of political information, sophistication and experience can also affect how voters attribute credit or blame for economic development across different political actors and institutional layers. While the connection between national economic conditions and vote choice might be easy to establish in Presidential elections, the task of assigning responsibility for economic developments in Congressional elections is more complex (Mayhew, 1974). As noted by Jacobson (1997), Congressional elections are national contest in which local contexts matter and hence, when attributing responsibilities for economic outcomes, voters might focus on all the incumbents, or on the candidates of the party that controls Congress, on all candidates of the President's party (Gomez and Wilson, 2003). Here too, differences in voters' levels of political awareness, information and sophistication is likely to affect whether and how voters link their economic perceptions to their electoral choice. For instance, since less sophisticated voters will tend to focus attributions of responsibility for the economic performance on the single most obvious actor in the relevant sphere (Gomez and Wilson, 2001, 2003), economic voting should be more prevalent among these voters in Presidential than in Congressional elections. In contrast, sophisticated and informed citizens should be able to recognize that the executive branch does not have complete control for the state of the national economy (Godbout and Belanger, 2007) and might be more likely to attribute at least part of the responsibility for economic outcomes to other political actors such as members of Congress (Gomez and Wilson, 2001).

While these studies disagree on the specific mechanisms linking individual assessments of economic conditions and vote choice, they underscore the need to account for the conditioning role of individual heterogeneity and contextual factors when analyzing economic voting behavior. Nonethess, as mentioned in the Introduction, the vast majority of empirical analyses fail to explicitly account for the fact that citizens' economic voting behavior might be strongly conditioned by their individual characteristics (Gomez and Wilson, 2003). The few applied studies that actually tried to account for the existence of groups of voters with different economic voting patterns (Gomez and Wilson, 2001) focus only on the distinction between sociotropic and pocketbook evaluations, considering only one possible source of heterogeneity (political sophistication) and imposing exogenous criteria based on the levels of the covariate of interest (level of political sophistication) in order to classify voters into the pre-defined groups. More importantly, most of the recent studies focusing on the influence of individual characteristics on economic voting behavior have highlighted the role of voter heterogeneity in distinguishing between 'sociotropic' and 'pocketbook' *versus* pocketbook voters (Gomez and Wilson, 2001, 2003, 2006; Godbout and Belanger, 2007). Very few studies, if

any, have attempted to model and account for the effect of individual characteristics in the more basic distinction between 'economic' and 'non-economic'. In addition, while previous empirical research studied economic voting behavior across different electoral contexts and types of races, comparisons have proceeded almost exclusively by contrasting results from different periods, elections or statistical models. In our knowledge, no study has analyzed the determinants of economic voting in simultaneous Presidential and Congress elections, jointly analyzing the process by which voters use economic information and attribute credit or blame for economic developments across different political actors and electoral races. In order to overcome these difficulties, we propose a latent class regression model to analyze economic voting behavior in Presidential, House and Senate elections in the U.S.

Latent class models are particular finite mixture models (Everitt and Hand, 1981; Titterton, Smith and Makov, 1985) originally introduced by Lazarsfeld and Henry (1968) as a way of formulating latent attitudinal variables from dichotomous survey items, and were later formalized and extended to deal with broader classes of response and covariate variables as well as with sparse data, boundary solutions and other problem areas (Goodman, 1974; Formann, 1992; Bandeen-Roche et al., 1997; Muthen and Muthen, 2000; Muthen, 2001). The basic idea underlying latent class models is that the population under study is comprised of a finite number of subpopulations or groups comprised of similar individuals within each group, but where the group affiliations are not known (McLachlan and Peel, 2000). Observed relationships among measured or observed variables are assumed to result from an underlying classification of the data produced by a latent categorical variable with as many categories as groups. The observed variables are assumed to be mutually independent within subpopulations and to have different marginal distributions among them, and the parameters of the model fitted to the data are assumed to differ in some respect within these subpopulations. While latent class models are related to random effects models in the sense that they can be used to explain both observed and unobserved heterogeneity in the data, they do not not require to specify the distribution of the parameters and hence impose considerably less restrictive assumptions for modeling heterogeneity. In addition, latent class models are more intuitively interpreted in terms of different segments or groups in the data (Vermunt and Van Dijk, 2002; Agresti, 2002).

Latent class regression models extend traditional latent class analysis to allow the probabilities of class membership and the distribution of the observed response variables given class membership to be related to concomitant variables (Vermunt, 1997; Huang and Bandeen-Roche, 2004; Huang, 2005). This approach enables us to better describe the effects of individual covariates on economic voting, assessing the relative validity of the alternative explanations proposed in the literature and estimating the influence of economic voting in simultaneous Presidential and Congressional elections. The next section describes the data and model specification used to analyze economic voting in the 2004 U.S. election.

2. A LATENT CLASS REGRESSION MODEL OF ECONOMIC VOTING

2.1. *Data*

In our analysis of the determinants of economic voting, we use survey data from the 2004 ANES study, covering the last presidential election held in the country. Using an election year in which both Presidential and Congressional elections are held allows us to jointly analyze the influence of economic voting across different races, contributing to better understand how voters attribute

credit or blame for the economic performance among the relevant political actors and institutional levels.

The outcome vector comprises a series of indicator variables coded as 1 if the respondents voted for the incumbent candidate or party in each of the races considered. In the case of Presidential election, this coding reflects the fact that economic voting is essentially a referendum on government performance, and hence a vote for any challenger amounts to a vote against the incumbent (Downs, 1957; Fiorina, 1981; Gomez and Wilson, 2001). In the case of House and Senate elections, the coding of the corresponding indicator is less straightforward since, as mentioned above, it is unclear whether the target of economic voting are all incumbents (regardless of party), all candidates of the party controlling Congress, or all candidates of the President's party. We agree with Gomez and Wilson (2003) in the sense that economic voting in Congressional elections should basically reflect a partisan orientation, and thus we use the vote for the President's party to define the response variable in Congressional. Nonetheless, we also fit models using the other two potential credit/blame attributions, with little effect on the main substantive results.

Our focus lies in determining the effect of several individual characteristics of interest on economic voting. We include both measures of both pocketbook and sociotropic judgments in the analysis. *Sociotropic evaluation* is defined based on respondents answer to the survey question: 'Would you say that over the past year the nation's economy has gotten better, stayed about the same, or gotten worse?'. The variable is coded on a 5-point scale running from 1 (much worse) to 5 (much better). *Pocketbook evaluation* is measured using the question: 'Would you say that you (and your family) are better off or worse off financially than you were a year ago?'. Given the purposes of our study, self-reports of economic conditions are preferable to objective aggregate economic indicators (Kramer, 1971, 1983), and previous research has shown that these self-reports are very reliable and they correlate with economic data on real disposable personal income as well as with personal events such as loss of a job or falling behind on bills (Rosenstone, Hansen and Kinder, 1986; Gomez and Wilson, 2003).

Along the lines of the different theoretical explanations reviewed in Section 1, we consider the mediating effect of education, political interest, information and sophistication on the linkage between economic evaluations and vote choice, examining whether these individual characteristics discriminate between groups of voters with relatively homogeneous economic voting patterns. We include an indicator for *College education*, and measure *Interest in political campaigns* based on the NES survey items tapping this issue.[1] To operationalize *Political sophistication*, we follow Godbout and Belanger (2007) and construct an additive scale from a series of six factual questions asked in the NES surveys for the period under analysis aimed at capturing voters' knowledge and information about politics. Four of these items ask respondents to identify the political office held by key political figures: the Speaker of the House of Representatives, the Vice-President, the Supreme Court's Chief Justice and former British Primer Minister Tony Blair. The other two questions ask respondents to identify which party controlled the House and the Senate before the election.

Finally, we include a series of sociodemographic and attitudinal variables affecting the conditional probability of voting for incumbents. These include *Party identification*, coded on a 7-point scale ranging from 0 ('strong democrat') to 6 ('strong republican'), and dummy variables for *African American*, *Male* and *South*. We also include indicators for *Open seat* for each of the two Congressional elections. Although the results reported in Section 3 are based on a complete-case analysis using list-wise deletion, the estimation methodology can be extended to account for missing and

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[1]The number of the survey items used to define these two variables are V043254, V045001, respectively.

partially observed data, both under MAR/NMAR assumptions (Little and Rubin, 1987; Fay, 1986; Schafer, 1997; Vermunt, 1997).

2.2. *The Statistical Model*

Let $y_i = (y_{i,1}, y_{i,2}, y_{i,3})$, denote the set of vote choices of respondent i, $i = 1, \ldots, n$, in election k, $k = 1, 2, 3$, where $y_{i,k} = 1$ if the respondent i supports a Republican candidate in race k and 0 if she supports any other candidate. Without loss of generality, $k = 1$ corresponds to the Presidential election, $k = 2$ to the Senate election, and $k = 3$ to the House election. Our model postulates an underlying categorical latent variable $\eta_i \in 1, 2$ denoting respondent i's unobserved class. The choice of two underlying class of voters is determined both by theoretical considerations from the literature on economic voting as well as for identifiability reasons, since mixtures of logistic distributions are not identifiable unless the number of components is limited with respect to the number of observations per person (Grun 2002; Grun and Leisch, 2008).

Given η_i, the votes of respondent i in the different races are assumed to be mutually independent. Thus, letting $\pi_j = \Pr(\eta_i = j)$, the distribution of y_i can be expressed as:

$$\Pr(y_i|\pi, p) = \sum_{j=1}^{2} \pi_j \prod_{k=1}^{3} p_{j,k}^{y_{i,k}} (1 - p_{j,k})^{(1-y_{i,k})} \tag{1}$$

where $p_{j,k} = (y_{i,k} = 1|\eta_i = j)$ is the probability that respondent i, who belongs to latent class j, votes for the incumbent candidate in election k.

In order to allow the classification of survey respondents into heterogeneous groups to depend on relevant individual characteristics while adjusting for variables that determine vote choice other than the underlying group membership, we specify both the probabilities of the latent class membership and the distribution of the observed vote choices as functions of individual covariates of interest. We denote by (x_i, v_i, z_i) be vectors of covariates for respondent i, where $x_i = (1, x_{i,1}, \ldots, x_{i,p})^T$ are individual characteristics hypothesized to be associated with latent class membership η_i, and $v_i = (v_{i,k,1}, \ldots, v_{i,k,l})^T$ and $z_i = (1, z_{i,k,1}, \ldots, z_{i,k,m})^T$ are two sets of individual characteristics assumed to affect vote choice in election $k = 1, 2, 3$. The difference between the covariates included in v_i and z_i is that, while we assume that the conditional effect of the former on the observed response $y_{i,k}$ is the same for members of both latent classes, we allow the effect of the latter to depend on η_i. Hence, the model is similar to a mixed-effects model (Pinheiro and Bates, 2000), although the distribution of the coefficient of the z_i is unknonw and has to be estimated. In our application, we model the conditional probability of class membership as a function of *College education*, *Interest in political campaigns* and *Political sophistication*, as indicated in Section 2.1. The covariates in v_i are *African American*, *Male*, *South* and *Party ID*, with *Open seat* included in $v_{i,2}$ and $v_{i,3}$. Finally, z_i includes our two measures of economic perception, *Sociotropic evaluation* and *Pocketbook evaluation*.

Equation 1 can be therefore rewritten as

$$\Pr(y_i|\pi, p, x_i, v_i, z_i) = \sum_{j=1}^{2} \pi_j(x_i^T\beta) \prod_{k=1}^{3} [p_{j,k}(\alpha_{j,k} + v_{i,k}^T\delta_k + z_{i,k}^T\gamma_{j,k})]^{y_{i,k}} [1 - p_{j,k}(\alpha_{j,k} + v_{i,k}^T\delta_k + z_{i,k}^T\gamma_{j,k})]^{(1-y_{i,k})} \tag{2}$$

with $\pi_j(x_i^T \beta)$ and $p_{j,k}(\alpha_{j,k} + v_{i,k}^T \delta_k + z_{i,k}^T \gamma_{j,k})$ defined as in the generalized linear framework (Mc-Cullagh and Nelder, 1989). In particular, adopting logit link functions, we can write

$$log\left(\frac{\pi_1(x_i^T \beta)}{\pi_2(x_i^T \beta)}\right) = log\left(\frac{\pi(x_i^T \beta)}{1 - \pi(x_i^T \beta)}\right) = \beta_0 + \beta_1 x_{i,1} + \cdots + \beta p x_{i,p} \tag{3}$$

and

$$log\left(\frac{p_{j,k}(\alpha_{j,k} + v_{i,k}^T \delta_k + z_{i,k}^T \gamma_{j,k})}{1 - p_{j,k}(\alpha_{j,k} + v_{i,k}^T \delta_k + z_{i,k}^T \gamma_{j,k})}\right) = \alpha_{j,k} + \delta_{k,1} v_{i,k,1} + \cdots + \delta_{k,l} v_{i,k,l} + \gamma_{j,k,1} z_{i,k,1} + \cdots + \gamma_{j,k,m} z_{i,k,m} \tag{4}$$

Note that we allow for election-specific covariates in the conditional probability model in 2, and we also specify class and election-varying intercepts $\alpha_{j,k}$, $j = 1, 2, , k = 1, \ldots, 3$, in order to capture potential overdispersion due to, for instance, important omitted covariates. It is assumed that class membership probabilities are associated only with the covariates in x_i, and that, conditioning on class membership, responses are only dependent on v_i and z_i. In addition, as mentioned above, respondent i's votes in the different races are independent given η_i, v_i, z_i. That is,

$$\Pr(\eta_i = j | x_i, v_i, z_i) = \Pr(\eta_i = j | x_i) \tag{5}$$

$$\Pr(y_i | \eta_i, x_i, v_i, z_i) = \Pr(y_i | \eta_i, v_i, z_i) \tag{6}$$

and

$$\Pr(y_i | \eta_i, v_i, z_i) = \prod_{k=1}^{3} \Pr(y_{i,k} | \eta_i, v_{i,k}, z_{i,k}) \tag{7}$$

The parameter vector $\psi = (\beta, \alpha, \delta, \gamma)$ can either be estimated within a frequentist framework, within the Bayesian framework using MCMC samplers, or with moment estimators (Grun and Leisch, 2007; McLachlan and Peel, 2000). The most popular method for estimating latent class models with fixed number of components is frequentist maximum likelihood with the Expectation-Maximization (EM) algorithm (Dempster, Laird and Rubin, 1977; McLachlan and Krishnan, 1997).[2] Since class membership η_i is unobservable, the latent class regression model in 2 becomes an incomplete or missing-data problem. Hence, the EM algorithm uses an iterative data

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[2]In general, the number of latent classes has to be fixed a priori or is simultaneously estimated with ψ (Huang, 2005). In our case, as mentioned above, identification constraints prevent us from fitting a model with more than two latent classes.

augmentation scheme in which the missing class membership indicators $\eta_{i,j}$, $i = 1, \ldots N$; $j = 1, 2$ are imputed based on the estimated posterior probabilities given the most recent estimates of the parameters in ϕ using , and the 'complete-data' likelihood is then maximized. Specifically, in the E-step, given the current parameter estimates ϕ^r in the r-th iteration, the missing data indicators $\eta_{i,j}$, $i = 1, \ldots N$; $j = 1, 2$ are replaced by

$$\omega_{i,j}(\phi^r) = E(\eta_{i,j}|y_i, \phi^{(r)}, x_i, z_i) =$$

$$\frac{\pi_j(x_i^T \beta^{(r)}) \prod_{k=1}^{3} [p_{j,k}(\alpha_{j,k}^{(r)} + v_{i,k}^T \delta_k^{(r)} + z_{i,k}^T \gamma_{j,k}^{(r)})]^{y_{i,k}} [1 - p_{j,k}(\alpha_{j,k}^{(r)} + v_{i,k}^T \delta_k^{(r)} + z_{i,k}^T \gamma_{j,k}^{(r)})]^{(1-y_{i,k})}}{\sum_j \pi_j(x_i^T \beta^{(r)}) \prod_{k=1}^{3} [p_{j,k}(\alpha_{j,k}^{(r)} + v_{i,k}^T \delta_k^{(r)} + z_{i,k}^T \gamma_{j,k}^{(r)})]^{y_{i,k}} [1 - p_{j,k}(\alpha_{j,k}^{(r)} + v_{i,k}^T \delta_k^{(r)} + z_{i,k}^T \gamma_{j,k}^{(r)})]^{(1-y_{i,k})}}$$

and the new parameter estimates ϕ^{r+1} are obtained in the M-step by maximizing

$$Q(\beta^{(r+1)}|\phi^{(r)}) = \sum_{i=1}^{N} \sum_{j=1}^{2} \omega_{i,j}^{(r)} log(\pi_j(x_i^T \beta^{(r+1)}))$$

and

$$Q(\psi^{(r+1)}|\phi^{(r)}) = \sum_{i=1}^{N} \sum_{j=1}^{2} \sum_{k=1}^{3} \omega_{i,j}^{(r)} \bigg(y_{i,k} log \big(p_{j,k}(\alpha_{j,k}^{(r+1)} + v_{i,k}^T \delta_k^{(r+1)} + z_{i,k}^T \gamma_{j,k}^{(r+1)}) \big)$$

$$+ (1 - y_{i,k}) log \big(1 - p_{j,k}(\alpha_{j,k}^{(r+1)} + v_{i,k}^T \delta_k^{(r+1)} + z_{i,k}^T \gamma_{j,k}^{(r+1)}) \big) \bigg)$$

where $\psi = (\alpha, \delta, \gamma)$. We run the EM 10 times with different initializations, choosing the solution that maximizes the log likelihood (Grun and Leisch, 2007). Additional details of the EM algorithm for estimating the regression latent class model can be found in Muthen and Shedden (1999, Appendix) and Bandeen-Roche (2004, Appendix B).

It is important to mention that the model in Equations 2 - 7 is not necessarily identified (Huang and Bandeen-Roche, 2004; Grun and Leisch, 2008). In contrast, under mild regularity conditions (Huang and Bandeen-Roche, 2004, p. 8-11), the sufficient conditions for the identifiability of the model are met if we adopt the restriction $\gamma_{j,k} = \gamma_k$, $j = 1, 2$, i.e., if we do not allow the coefficients of $v_{i,k}$ to vary across latent classes. This would pose no problem if the sole aim of our analysis was to assess the relative influence of economic voting across different elections. Nonetheless, as mentioned above, we are also interested in determining whether the effect of economic judgments on vote choice vary for different types or groups of voters. In order to overcome this difficulty, we adopt two different empirical approaches to check the local identifiability of the estimated model. First, following Muthen and Shedden (1999), we start by estimating our model imposing the assumption that $\gamma_{j,k} = \gamma_k$, $j = 1, 2$ in order to ensure identifiability, and then check whether relaxing this restriction - which amounts to adding extra parameters - changes the observed-data log-likelihood. We perform this check via a LR-test for the unrestricted and restricted models.

In addition, we use parametric bootstrap method based on Grun and Leisch (2004) to assess the stability of the estimated coefficients for the unrestricted model. These two checks revealed no substantive identifiability problems for the unrestricted model.[3]

3. EMPIRICAL FINDINGS

Figure 1 presents the parameter estimates and confidence intervals for the model of vote choice in the Presidential, House and Senate elections. The signs of the sociodemographic and attitudinal variables affecting the conditional probability of voting for George W. Bush in the presidential election and for the Republican party in the Congressional elections are in line with the theoretical expectations: african americans are less likely to vote for Republicans in the three elections considered, while southern voters and Republican identifiers are much more likely to support the Republican candidates. The effect of *Open seat* is not statistically significant in either of the two Congressional races at the usual confidence levels. Given the purposes of our analysis, however, the most interesting findings concern the coefficients of the two indicators of economic perceptions across races as a function of class membership.

Looking first at class membership, the evidence reported in the figure shows that for respondents assigned to $\eta = 1$, neither of the two indicators of economic judgments are statistically significant at the usual confidence levels in any of the three electoral races considered. Thus, there is no evidence of economic voting among these respondents. In contrast, for voters assigned to to $\eta = 2$, economic perceptions did have a significant and positive effect on the probability of supporting Republican candidates in the Presidential and House elections. Among these voters, sociotropic considerations had a strong positive effect on the probability of casting a ballot for George W. Bush in the 2004 Presidential election: *ceteris paribus*, voters who believed that the economy had gotten much better during the previous year were on average 4.5 percentage points more likely to vote for the incumbent President than those who believed that the economy had gotten much worse, and this difference is significant at the 0.01 level. While *Pocketbook evaluations* area also positively correlated with vote choice in the Presidential election for these respondents, its effect is not statistically signifficant even at the 0.1 level, as was the case for voters in $\eta = 1$. In contrast, in the House elections, economic voting among respondents assigned to $\eta = 2$ was driven by personal financial considerations: respondents in $\eta = 2$ who felt that their own economic situation had gotten much better in the previous year were on average 9.8 percentage points more likely to vote for Republican candidates than those who believed that their personal finance had become much worse. Again, this difference is significant at the 0.05 level. Neither *Sociotropic evaluations* nor *Pocketbook evaluations* had a significant effect on vote choice in the Senate race, even for the class of 'economic voters'.

The results in Figure 1 highlight the fact that respondents assigned to the two different sub-populations considered in our latent class regression model exhibit substantially different patterns regarding their economic voting behavior. While respondents assigned to $\eta = 1$, comprising 34% of respondents in the sample, based their vote on factors other than economic perceptions, national and personal economic considerations clearly affected remaining 66% of respondents belonging to $\eta = 2$. These differences between 'economic' and 'non-economic voters' translate into very different probabilities of support for the incumbent President and for members of the President's party running for Congress, even after controlling for strong partisan biases. This is clear from Figure 2,

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[3]Additional details on the application of these procedures in order to check local identifiability are available from the authors upon request.
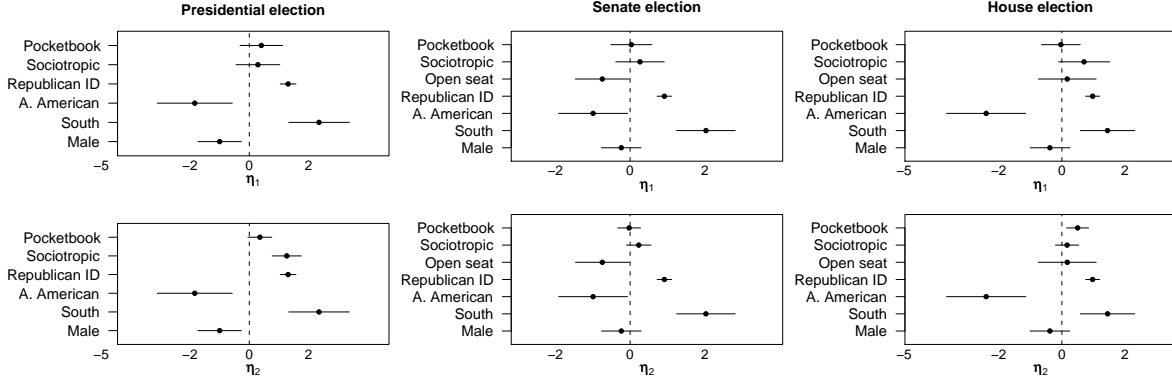
Figure 1: *Coefficients of the conditional model of vote choice in Presidential, Senate and House elections. The center dots correspond to the point estimates of the parameters and the solid lines the 90% confidence interval.*

which plots the sample vote-shares for Republican candidates in each of the three races analyzed and compares them to the average probabilities of support for the two types of voters. 50.2% of the respondents in the sample voted for George W. Bush in the 2004 Presidential election, while 44.8% and 46.3% voted for Republican candidates in the Senate and House elections, respectively. The corresponding average probabilities of support among respondents assigned to $\eta = 1$ where 39.8%, 22.2% and 24.2%. In contrast, the expected vote-shares of Republican candidates among respondents classified as belonging to $\eta = 2$ where all above 50%.

Table 1 explores the sources of heterogeneity between the two subpopulations of voters, reporting the association estimation between latent class membership and the variables measuring voters' education, interest in politics and sophistication. The odds ratios presented in the table are obtained by exponential transformations of the regression coefficients in Equation 3. The results show that, in the 2004 election, voters with college education and those interested in political campaigns were much less likely to belong to the group of 'economic voters', i.e., their vote choice was not significantly affected by their economic perceptions. In contrast, for less educated citizens and for those less interested in politics, economic judgments strongly influenced their vote in the Presidential and House elections. Among these voters, favorable national and personal economic conditions translated in a higher probability of support for the incumbent President and for members of the President's party. A likelihood ratio test comparing our modeling approach with a standard latent class model that did not specify the probabilities of class membership as function of individual characteristics favored our latent class regression model (p-value=0.02), indicating that education and interest in politics contribute to explain the different economic voting patterns between the two types of voters found in the sample.

Together, the evidence presented in Figure 1 and Table 1 indicates that less informed and educated voters clearly took national economic outcomes into account in the Presidential election. Although *Political sophistication* had no significant effect on the probability of class membership, these results are in the spirit of Gomez and Wilson's (2001,2003) 'Theory of Heterogeneous Attribution', in the sense that less sophisticated voters are more likely to attribute credit or blame for national economic developments to the single most obvious actor, the chief of the executive. Our finding that that *Sociotropic evaluations* had no effect on the vote of less informed and educated
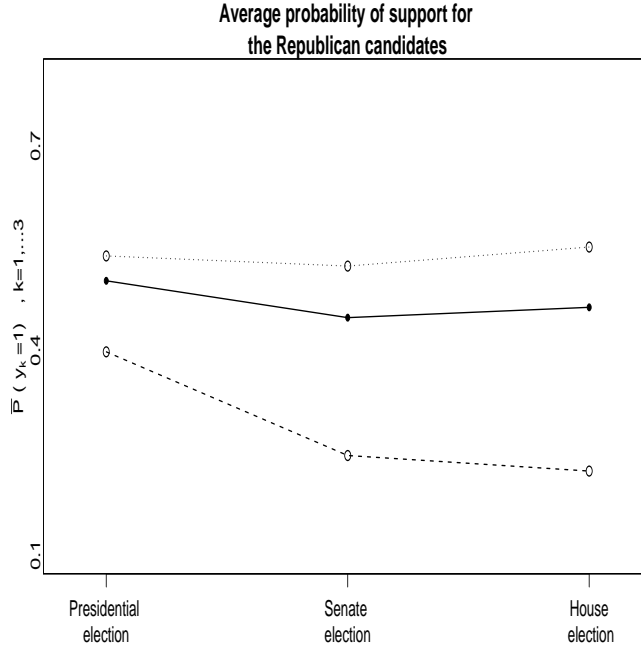
**Average probability of support for
the Republican candidates**

Figure 2: *Average probability of support for Republican candidates across races. The solid line plots the sample vote-shares of Republican candidates in the three elections analzyed. The dashed and dotted lines plot the corresponding average probabilities of support for $\eta = 1$ and $\eta = 2$, respectively*

Table 1: Latent prevalence regression for the relationship between vote choice and education, interest and sophistication

Covariates	Odds ratios (Class 2 versus Class 1)	90% Confidence Interval
Interes in campaigns	0.39	0.13 - 0.95
College education	0.36	0.18 - 0.73
Sophistication	1.15	0.88 - 1.51

voters in either of the two Congressional races is also in line with Gomez and Wilson (2001, 2003), suggesting that this group of voters failed to recognize that other political actors besides the President, such as members of Congress, may also affect national economic developments. However, in contrast to their arguments, we do find that less informed and educated voters took their personal finances into account in the House election and, more importantly, that economic perceptions had actually no effect on the vote of more sophisticated in any of the three elections under analysis. In this sense, our results suggest that the most important difference between sophisticated and unsophisticated voters in the 2004 election did not lie on whether they relied on national or personal economic assessments when casting their vote, but rather on whether their economic perceptions had a significant effect on vote choice or not. That is, while the focus of most recent research on economic voting (Gomez and Wilson, 2001, 2003, 2006; Godbout and Belanger, 2007) has been on the distinction between 'sociotropic' versus 'pocketbook' voters, we find that the main divide in the 2004 U.S. election was between 'economic' and 'non-economic' voters.

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4. CONCLUDING REMARKS

In this study, we examined the impact of individual covariates on economic voting in simultaneous Presidential, Senate and House elections using a latent class regression model. This modeling approach allows us account for associations among citizens' vote choice across races, testing hypotheses on the existence of different patterns of economic voting behavior and determining whether different theories and associated explanatory variables actually discriminate between heterogeneous groups of voters. Using survey data from the 2004 U.S. election, we found that voters' education and information levels had a significant effect on their economic voting behavior. Respondents with college education and those more interested in politics based their vote in the Presidential and Congress , House and Senate elections on factors other than economic perceptions. In contrast, economic assessments had a significant effect on the vote of less educated and interest voters, with sociotropic evaluations strongly affecting the probability of supporting the incumbent President and personal financial judgments influencing vote choice in House elections. Unlike recent empirical analyses of economic voting in the U.S., we find that the main distinction in the 2004 election was not between 'sociotropic' and 'pocketbook voters', but rather between 'economic' and 'non-economic' voters.

Since this work is preliminary, there are many possible extensions for further research. An immediate extension would be to include a larger number of election years in the analysis, examining the patterns and determinants of economic voting behavior across time. Another possible extensions is using a a hierarchical extension of the latent class regression model implemented in this paper, accounting for nested data structures - i.e., allowing for clustering of voters within elections/districts - along the lines of Vermunt and Magidson (2005) and Vermun (2008). Also, benefiting from the ANES panel studies, it is possible to asses the influence of electoral campaigns and economic information on voters' economic voting behavior (Godbout and Belanger, 2007) using latent class regression models for longitudinal data and including both constant and time-varying individual characteristics in the model (Vermunt, Langeheine and Bockenholt, 1999; Vermunt, Tran and Magidson, 2008). In addition, it is possible to relax some of the assumption of the model and compare the results with those presented in this paper. For instance, the assumption that voter's choice across races is independent given her class membership can be substituted and a model assuming that vote in the Presidential race affects vote choice in the Congressional elections could be implemented (Vermunt, 1997). Finally, while estimation in this paper was based on the EM algorithm, Bayesian estimation of latent class models using Markov chain Monte Carlo methods has been recently gaining ground due mainly to improvements in computing power (Hoijtink, 1998; Garrett and Zeger, 2000; Lenk and De Sarbo, 2000). Although the EM-algorithm usually leads to reasonable parameter estimates, it often fails to provide useful measures of uncertainty and can be subject to convergence problems (Braun and Leibsch, 2008). On the other hand, Bayesian estimation of latent class models is particularly susceptible to identifiability problems due to the 'label-switching' problem (Celeux et al., 1997; Stephens, 2000). Hence, the two estimation approaches exhibit advantages and drawbacks that have to be carefully examined in particular applications. While some comparisons of Bayesian vs. maximum likelihood estimation of latent class regression models have been performed and reported (e.g., Vermunt, 2005), these contrasts have been restricted to particular classes of models. Exploring and contrasting the two estimation approaches when applied to examine economic voting using a much broader class of latent class regression models is particularly relevant from a methodological perspective.

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