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Measuring the Electoral and Policy Impact of Majority-Minority Voting Districts

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The Voting Rights Act guarantees minority voters an "equal opportunity to elect the candidate of their choice." Yet the implementation of this requirement is beset with technical difficulties: first, current case law provides no clear definition as to who qualifies as a candidate of choice for the minority community; second, traditional techniques for estimating equal opportunity rely heavily on ecological regression, which is prone to statistical bias; and third, no attempt is made to systematically evaluate the impact of alternative districting strategies on the substantive representation of minority interests rather than just descriptive representation. We offer an alternative approach to majority-minority districting that (1) explicitly defines the term "candidate of choice;" (2) determines the point of equal opportunity without relying on ecological regression; and (3) estimates the expected impact of competing districting schemes on substantive representation. We then apply this technique to a set of alternative districting plans for the South Carolina State Senate.

1. INTRODUCTION

The framers of the 1965 Voting Rights Act (VRA) intended, first and foremost, to dismantle the panoply of physical and legal barriers that had effectively disfranchised many minority voters. In this respect, the VRA has been a success: minorities now register and vote in roughly the same proportion as whites. Once these obvious impediments to voting had been removed, however, attention turned to the more subtle problem of vote dilution; that is, laws and practices that, in the words of Davidson (1992, 24), ". . . diminish or cancel the voting strength of at least one minority group."¹ Over the past two decades, the vote dilution provisions of the VRA (found in Section 2 of the Act) have been invoked in a series of cases to overturn

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¹A partial list of dilutionary practices includes: at-large rather than district elections, majority runoffs, full slate laws, annexation or de-annexation to reduce the proportion of minorities in a city, and racial gerrymandering. Excellent reviews of the history of voting rights litigation under Sections 2 and 5 of the VRA can be found in Davidson (1992) and Kousser (1992) from a political point of view and the essays in the December 1993 *Michigan Law Review*, especially Polsby and Popper (1993), from a legal point of view.

existing electoral arrangements or to prevent proposed changes that would disadvantage minority voters. Redistricting has become especially contentious in the shadow of this voting rights litigation as many states have had to pass two, three, or more districting schemes in order to secure Justice Department approval.

These developments have given rise to a debate over the efficacy and advisability of carving up the political landscape into ever greater numbers of majority-minority districts. Defenders of these districts, such as Guinier (1994), argue that they are a necessary evil given the degree of polarized voting both within the electorate and in legislatures.² In fact, some argue that majority-minority districts do not go far enough in alleviating racial inequality, leading Guinier to advocate alternative voting systems such as cumulative voting and proportional representation. Opponents of racial redistricting (Swain 1993; Thernstrom and Thernstrom 1997), on the other hand, argue that minorities do have substantial chances of winning office outside of majority-minority districts if they appeal to a broad constituency, and that highly gerrymandered districts serve only to further polarize the electorate, impeding the formation of biracial coalitions that were the original impetus behind the Voting Rights Act.

To systematically evaluate these competing claims, one must be able to measure the impact of majority-minority districts on both the electoral outcomes and the substantive representation of minority interests. A good starting point in this analysis comes from the legal definition of vote dilution established by the Supreme Court in the 1986 case *Thornburg v. Gingles*.³ The Court ruled that a Section 2 violation of the VRA occurred if: (1) the minority group in question is "sufficiently large and geographically compact to constitute a majority of a single member district"; (2) the minority group is "politically cohesive"; and (3) the white majority votes "sufficiently as a bloc to enable it...usually to defeat the minority's preferred candidate." The first criterion, dealing with the compactness of residential housing patterns, raises interesting issues of its own concerning the shape and contiguity of voting districts. But most attention has been paid to the latter two criteria, which amount to a test for polarized voting serious enough to warrant government intervention.

However, the current technique for implementing this definition, which we term the ER/EA method since it combines ecological regression (ER) and so-called equalization analysis (EA), has a number of serious shortcom-

²These concerns are echoed by Grofman, Handley, and Niemi (1992, 3), who describe racial redistricting as the "politics of the second-best."

³*Thornburg v. Gingles*, 478 U.S. 30 (1986).

ings both statistically and substantively. First, this method provides no clear test to determine who qualifies as a candidate of choice for the minority community. The Supreme Court has made it clear that a candidate of choice need not be a member of any particular minority group. But beyond that, definitions are notoriously vague and hard to apply in specific circumstances so that too often, *de facto*, only minority officeholders are eligible to be a candidate of choice. In addition, the lack of a good definition often means that evaluations of elections to a given body—such as a state legislature—are based on data drawn from completely different types of elections such as presidential primaries or gubernatorial races.

Second, the ER/EA method for determining the point of equal opportunity relies heavily on ecological regression estimation techniques, which have often been criticized as vulnerable to statistical bias. This bias is especially pernicious in voting rights cases because it can arise in the presence of increased voter mobilization or biracial campaign appeals in concentrated minority districts—the very phenomena the VRA was intended to promote—and can therefore lead to the drawing of districts that overconcentrate minority voters.

Third, a basic question arises regarding the impact that majority-minority districts have on the substantive representation of minority interests. A number of observers have claimed that these districts may actually harm the overall representation of minorities by concentrating these populations too heavily, thereby marginalizing their policy concerns in surrounding districts. If this is true, then heavily gerrymandered districts may actually be counterproductive from a policy standpoint, allowing greater numbers of minorities to gain office but minimizing their influence in the political decision making process once they arrive. A method of predicting the point past which these perverse policy consequences arise will help evaluate the overall impact of concentrated minority districts on public policy.

We address these three thorny issues of evaluating the electoral and substantive impact of voting arrangements. First, we present a definition of the candidate of choice for the minority community consistent with the Supreme Court's rulings on the Voting Rights Act. We then provide an unbiased measure of polarization and equal opportunity that relies on categorical estimation methods (logit and probit) rather than ecological regression. Finally, we estimate the relation between districting, the number of minorities elected to office, and policy outcomes. In each instance our new definitions and techniques are applied to a particular case, the South Carolina State Senate. We conclude by placing our analysis in the broader context of Voting Rights litigation and the substantive representation of minority interests.

2. MEASURING CANDIDATE OF CHOICE

Judicial interpretations of the 1965 Voting Rights Act have been scrupulous to avoid equating a minority community's "candidate of choice" with a candidate from that particular minority community or racial background. In theory, according to the Supreme Court, minority voters may well prefer nonminority representatives, and to assume otherwise is to do an injustice to their freedom to choose their preferred candidate, just as discriminatory voting systems might violate this right. Justice Brennan argued this point emphatically in *Gingles*, stating that "It is the *status* of the candidate as the *chosen representative of a particular group*, not the race of the candidate that is important."⁴ Therefore, it would seem that some method of separating out such candidates of choice, other than race, would be an essential element in any evaluation of voting patterns under the VRA.

2.1 Candidates of Choice and Polarized Voting

Such a test, however, has never been developed. The reason for this surprising lack of a general definition is that the standard ER/EA method assumes that polarized voting (the degree to which minority and nonminority voters cast their ballots for different candidates) is constant across elections. If this is true, then one need only to measure polarization in a few elections to have an accurate picture of voting patterns within a given geographic area. White voters, that is, are assumed to have a certain tendency to vote for or against the black community's preferred candidate, and if this resistance is sufficient to "usually defeat the minority's preferred candidate," then a Section 2 violation of the VRA has been established.

As a result of these basic assumptions, the ER/EA approach relies on a small set of "benchmark" elections in conjunction with ecological regression analysis to determine the extent of polarized voting. Since polarization is assumed to be constant, the elections analyzed can be to any office. For convenience, those who employ the ER/EA method usually analyze elections in which one candidate is indisputably the candidate of choice for the minority community—the 1988 presidential primary in which Jesse Jackson participated is a popular choice. Therefore, no general definition of "candidate of choice" which can be applied to an arbitrary election has ever been developed. The drawback to this approach, of course, is that often these benchmark elections may have only a tenuous relation to the case at hand. Consequently, when voting patterns in presidential primaries differ for any reason from those in state legislative elections, the conclusions drawn from the analysis will be faulty.

⁴*Gingles*, p. 68. This view was reiterated in subsequent cases brought under the VRA; see for instance *Collins v. City of Norfolk*, 679 F.Supp. 577 (E.D. Va. 1988).

2.2 Proposed Definition

As we depart from this usual approach, the present section develops a new, general definition of the phrase “candidate of choice.”⁵ We propose that an elected official be deemed the candidate of choice (CoC) for the minority community if two conditions hold:

- 1) In no election was a significant negative correlation observed between black voter turnout and votes for that candidate, at the precinct level;
- 2) The candidate must be:
 - a) a minority candidate, or
 - b) elected from a majority-minority district.

This definition includes all minority officeholders as long as minority voters supported that candidate in each election. It could therefore exclude candidates such as U.S. Representatives Gary Franks (R-Conn.) and J.C. Watts (R-Okla.) if these minority office-holders win office without the support of minority voters.⁶ The definition also excludes nonminority candidates who win elections with minority support from non-majority-minority districts (for instance, a white Democrat winning with minority support in a 10 percent black district) on the grounds that the minority community may jointly prefer to elect a minority candidate, but such a candidate may have been deterred from running by the scant chance of success. This definition does allow for a nonminority candidate to be classified as a candidate of choice, but only if the candidate won office from a majority-minority district *and* had minority support at every stage. Thus, the definition above may constitute a somewhat conservative measure in order to remain consistent with the courts’ rulings regarding candidate characteristics and their classification as candidates of choice.

To determine whether a given candidate meets the first criterion, precinct-level voting data are used to estimate the regression:

$$\text{Votes}_i = \alpha + \beta * \text{PctNWTurn}_i, \quad (1)$$

where Votes_i is the percentage of the votes for the given candidate in precinct i and PctNWTurn_i is the percentage of nonwhite voters among those who turned out to vote in precinct i . In this regression, the value of β

⁵In the discussion that follows, the minority group in question will be taken to be black voters, but the technique can be easily extended to any other identifiable minority group or set of groups (such as Hispanic or Native American voters) that is held to be a community of interest under the VRA.

⁶For Franks, the higher the percent of black voters in a given district yielded a lower proportion of the vote. With Watts, the correlation between votes and percent minority is slightly positive, although not statistically significant.

measures the degree to which votes for the given candidate rise as non-white voter turnout increases. If it is positive then, on average, a candidate receives more votes in areas with large nonwhite turnouts, and if it is negative then the candidate's votes fall the more nonwhite voters cast their ballots.

A given candidate is deemed the recipient of minority voter support unless the coefficient on β in Equation 1 is negative and statistically different from 0 at the 5 percent significance level.⁷ Note that this definition is neutral with respect to party, so Republicans as well as Democrats can be candidates of choice. Also, all candidates who run without opposition in a majority-minority district are counted as a candidate of choice; in these districts a representative who is unresponsive to minority concerns could more easily draw a credible minority challenger. On the other hand, only unopposed minority candidates running from nonmajority-minority districts are automatically classified as candidates of choice.

2.3 Application

We now apply this technique to determine which elections to the South Carolina State Senate resulted in the election of a candidate of choice. This is a convenient case to analyze; South Carolina falls under the preclearance provisions of the VRA, and its minority voting population is composed almost entirely of blacks, thus avoiding the more complicated issues that arise when more than one minority group is classified as a community of interest. Furthermore, state legislatures often contain a number of voting districts in which the voting age population is 30–50 percent black, allowing more precise characterization of electoral outcomes in these concentrated minority districts.

First, let us start with a little background: In South Carolina, 29.82 percent of the state's total population and 26.93 percent of the state's voting age population are black. The state senate has forty-six seats, and in the regular election cycle, all senators are elected every four years—there are no staggered terms. Between 1988 and 1994, there were ninety-seven elections to the South Carolina State Senate. Of these, forty-six occurred in the regular election cycles in both 1988 and 1992, and five were special elections to fill vacancies. Republican candidates won twenty-eight of these elections and Democrats won sixty-nine; of the Democratic victors, fifty-six were non-minority candidates and thirteen were minorities, or 13.4 percent of all elections. Of the ninety-seven elections, twenty were held in majority-black dis-

⁷Note that our technique of identifying a candidate of choice relies to some extent on ecological regression, but only to determine the sign of the relationship between candidate votes and minority turnout; the actual coefficient is not used. Thus our approach is much less susceptible to the ecological fallacy described below.

tricts. Of these, minority candidates were elected in eleven and nonminorities were elected in nine. In addition, there were two elections in which a minority candidate won in a district that was less than majority-minority. Minorities were elected to the Senate from districts as low as 47.74 percent Black Voting Age Population (BVAP), and districts as high as 59.92 percent BVAP elected nonminority senators to office.

Given this background, Table 1 lists all potential candidates of choice from the ninety-seven South Carolina State Senate elections in our sample; that is, those candidates who satisfy our criterion (2) above. As indicated, this list includes twenty-one elections from 1988 and 1992. To determine if the candidates also meet the first criterion, precinct level voting data were analyzed for the 1988 and 1992 Senatorial races, both primary and general elections, using the regression specified in Equation 1.

As shown in Table 1, eight senators elected in 1988 and ten senators elected in 1992 meet all the criteria to be classified as a candidate of choice.⁸ In twelve of these eighteen elections, minority representatives were elected to office with minority support, and all but two of these came from a majority-minority district. The other six elections had white candidates winning office in majority-minority districts with minority support at every stage. Senator Short, however, was not deemed a candidate of choice in 1992, even though she won in a 51.6 percent minority district (in the Democratic primary election a negative correlation was found between nonwhite turnout and her vote percent). In this election, two minority candidates ran and split the opposition, allowing Senator Short to win office. On the other hand, Senator Williams, a nonminority candidate elected from a majority-minority district in both 1988 and 1992, does meet all criteria to be classified as a candidate of choice.

3. ESTIMATING EQUAL OPPORTUNITY: ECOLOGICAL VS. CATEGORICAL REGRESSION

3.1 Measuring Polarization and Equal Opportunity with Ecological Regression

Given this definition of candidate of choice, how can one measure polarized voting, and where does the point of equal opportunity lie? To answer this question, contemporary voting rights case law has largely depended on measures of polarized voting, which can be defined loosely as the tendency of white and black voters to vote in blocs for different candidates.⁹ As the requirements of a secret ballot prevent researchers from measuring racial

⁸Primary data were not available for 1988. To avoid possible misclassification, Senators McLeod and Lourie were eliminated as candidates of choice in 1988 because each of their districts elected a minority representative within the next four years.

⁹These techniques are summarized in Grofman, Handley, and Niemi (1992), Chapter 4.

Table 1. Precinct Analysis of Candidate of Choice

1988 Election						
Candidate	District	Primary		General		Candidate of Choice?
		Constant	PctNWTurn	Constant	PctNWTurn	
Fielding	42	N/A		0.996 (1054.66)	0.003 (2.46)	YES
Gilbert	30	N/A		0.41 (11.19)	0.56 (7.49)	YES
Land	36	N/A		Uncontested		YES
Lourie	21	N/A		Uncontested		NO
Mathews	39	N/A		0.94 (21.05)	0.09 (1.02)	YES
McGill	32	N/A		0.59 (18.77)	0.34 (5.79)	YES
McLeod	45	N/A		0.65 (34.39)	0.31 (8.69)	NO
Mitchell	7	N/A		0.95 (214.90)	0.046 (5.35)	YES
Patterson	19	N/A		Uncontested		YES
Williams	40	N/A		0.99 (8312.19)	0.00009 (0.37)	YES

Note: t-statistic in parentheses.

**1988 Primary data not available.

(continued on next page)

bloc voting patterns directly, some type of statistical inference must be employed. We discuss the most widely used method for measuring polarized voting, bivariate ecological regression coupled with equalization analysis. We then present an alternative method that does not fall prey to statistical bias and apply our method to the South Carolina elections.

In its simplest form, bivariate ecological regression works as follows: for each precinct, the percent of black voters among all those who turned out to vote ($%T_B$) and the percent of white voters among all those who turned out to vote ($%T_W$) are obtained from the voting rolls (so that $%T_B + %T_W = 1$). Then, for each precinct the percent of votes going to the minority-supported candidate ($%V_{CoC}$) is also tabulated. These data are used to estimate the regressions:

Table 1. Precinct Analysis of Candidate of Choice (continued)

1992 Election						
Candidate	District	Primary		General		Candidate of Choice?
		Constant	PctNWTurn	Constant	PctNWTurn	
Ford	42	0.131 (1.41)	0.465 (4.37)	Uncontested		YES
Glover	30	Uncontested		Uncontested		YES
Jackson	21	0.302 (4.97)	0.312 (3.42)	0.251 (8.07)	0.732 (12.40)	YES
Land	36	Uncontested		Uncontested		YES
Mathews	39	Uncontested		Uncontested		YES
McGill	32	0.420 (16.14)	0.286 (6.20)	0.401 (12.23)	0.623 (10.64)	YES
Mitchell	7	0.362 (8.50)	0.543 (8.64)	0.622 (21.72)	0.392 (6.00)	YES
Patterson	19	Uncontested		Uncontested		YES
Short	17	0.563 (13.88)	-0.468 (-5.93)	0.407 (9.63)	0.311 (3.57)	NO
Williams	40	Uncontested		Uncontested		YES
Washington	45	Uncontested		Uncontested		YES

Note: t-statistic in parentheses.

$$\%V_{CoC} = \alpha_W + \beta_W \%T_W; \tag{1}$$

$$\%V_{CoC} = \alpha_B + \beta_B \%T_B. \tag{2}$$

so that the α and β terms are the constant and slope from a linear regression of votes on white and black percent turnout, respectively.

The importance of the α and β coefficients can be made clear if we look at the voting data from another angle. Assume that white voters cross over to vote *for* the minority-supported candidate at a uniform rate of C'_W and black voters cross over to vote *against* this candidate at a rate of C'_B , let T_i and C_i be the total turnout and crossover from voters of race i , respectively, and let T be the total turnout in the given election ($T = T_W + T_B$). Then we can derive the percentage of votes obtained by the candidate of choice as:

$$\begin{aligned}
 V_{CoC} &= T_B - C_B + C_W \\
 &= T_B - T_B C'_B + T_W C'_W \\
 &= T_B(1 - C'_B) + T_W C'_W \\
 \frac{V_{CoC}}{T} &= \frac{T_B(1 - C'_B)}{T} + \frac{T_W C'_W}{T} \\
 \%V_{CoC} &= \%T_B(1 - C'_B) + \%T_W C'_W \\
 &= \%T_B(1 - C'_B) + (1 - \%T_B)C'_W \\
 &= C'_W + (1 - C'_B - C'_W)\%T_B.
 \end{aligned} \tag{3}$$

Comparing Equations 2 and 3 indicates that if the assumptions of the model hold, the constant term α_β in the ecological regression is the white crossover rate C'_W , and the sum $\alpha_\beta + \beta_\beta$, which is the estimated intercept at $\%T_B = 1$, is $1 - C'_B$, the percent of blacks who vote for their preferred candidate. Furthermore, the slope β_β is equal to $1 - C'_B - C'_W$, the difference between the rates at which white and black voters support the minority-preferred candidate. This quantity serves as a convenient measure of polarization—it equals 0 if black and white voters cast their ballots equally for candidates of each race, and it reaches a maximum of 1 when $C'_B = C'_W = 0$, implying that neither black nor white voters ever cross over to vote for the other's preferred candidate. The ER/EA test for polarization, then, compares the magnitude of the β_β coefficient to 1.

To estimate the point at which minorities have an equal opportunity to elect their candidate of choice, the ER results are combined with registration and turnout data in what is known as equalization analysis. For the given political district, the registration rates for blacks and whites (R'_B and R'_W) are averaged across precincts, the turnout rates are obtained directly from election data, and the crossover rates are estimated from the ecological regression analysis above. These estimates are then employed as correction factors to construct districts that are effectively 50 percent minority: $2R'_W/(R'_B + R'_W)$ for registration, $2T'_W/(T'_B + T'_W)$ for turnout, and $(1 - 2C'_W)/(1 - C'_W + C'_B)$ for crossover.¹⁰ Thus, the point of equal opportunity is calculated as:

$$50\% * \frac{2R'_W}{R'_W + R'_B} * \frac{2T'_W}{T'_W + T'_B} * \frac{1 - 2C'_W}{1 - C'_W - C'_B}.$$

¹⁰For instance, if the only difference between white and black voters is in the registration rates, with whites registering at a rate of $R'_W = 70$ percent and blacks at a rate of $R'_B = 40$ percent, then a district that is composed of $50\% * (2 * 70 / (70 + 40)) = 63.6\%$ total black voters will have an equal number of registered white and black voters.

When both primary and general elections are held, the point of equal opportunity must be calculated for each, and then the maximum of these two calculations is taken to be the overall equalization percentage.

The extensive use of ecological regression in determining racially polarized voting is, however, problematic. A basic maxim of statistical analysis states that using data collected at one level (i.e., precinct-level voting data) to make inferences about behavior at a lower level (i.e., individuals' votes) introduces what is known as aggregation bias.¹¹ The result is that the estimates derived from ecological regressions can be systematically incorrect, and that policy prescriptions based on these estimates may be faulty. In fact, the term "ecological fallacy" has been coined to describe the errors that can arise from taking the results of ecological regressions at face value.¹²

Specifically, ecological regression fails whenever factors affecting the phenomenon being studied (i.e., votes in favor of the minority candidate) are correlated with changes in the factor of main substantive importance (i.e., the percent of black voters in a district). For instance, suppose that voter registration rates are not constant across districts, but rather increase as the percent of black voters in a district rises. In such a case, ecological regression would account for the rise in the number of votes for the minority-preferred candidate to polarized voting, when in fact this rise is partly due to increased minority registration.

In this example of the ecological fallacy, the estimates of polarized voting obtained through ecological regression would be higher than the true rate of polarization, and as a result, they would lead to over-gerrymandered minority districts. This type of statistical bias would also arise if minority candidates made more biracial campaign appeals in districts that have significant portions of minority voters, leading to higher white crossover. In other cases, such as increased white voter mobilization as a backlash to potential minority mobilization, ecological regression would underestimate the extent of polarized voting. Note that in these examples the circumstances that give rise to the ecological fallacy, in either direction, are exactly the phenomena that the Voting Rights Act was supposed to either encourage or counteract—minority voter mobilization, biracial campaign appeals, and white backlash. Furthermore, the problems with ecological regression are

¹¹For an excellent review of aggregation bias as it applies to political phenomena, see Achen and Shively (1995).

¹²Although this is an intrinsic problem with ecological regression approaches to estimation, it can be mitigated to some extent through more sophisticated approaches to ecological estimation. See in particular the method described by King (1997), which reduces bias relative to the standard Goodman regression technique. In certain cases, it should be noted, using some form of ecological regression will simply be unavoidable, as when measuring electoral mobilization and retention rates. For an application of King's technique to South Carolina mobilization, registration, and retention rates in the 1990's, see Alt and Alter (1997).

compounded if more than one such factor is present in a given electoral district. Thus the statistical problems inherent in ecological regressions are real and significant in the context of voting rights litigation.

3.2 Categorical Regression as a Measure of Equal Opportunity

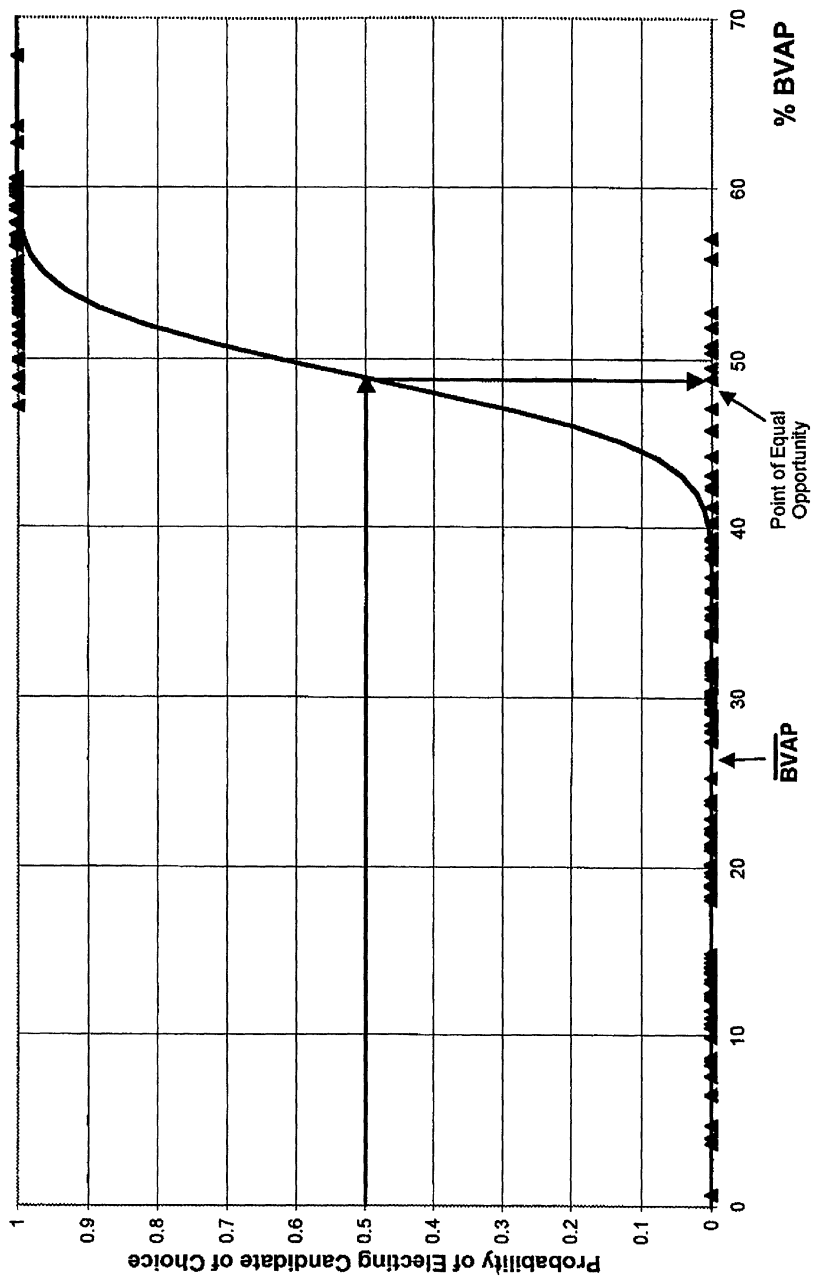
To address these problems, we propose to use categorical regression analysis—logit and probit—to estimate polarization and the point of equal opportunity rather than relying on ecological regression. The unit of observation in our analysis is an election, with the independent variable being the percentage of black voting age population in a district and the dependent variable being the type of representative elected. A graphical illustration is provided in Figure 1, which plots all ninety-seven elections in our data set. The horizontal axis shows the percent BVAP in the senatorial district for a given election, while the vertical axis is a simple 0-1 indicator of whether or not a candidate of choice (CoC) was elected. For instance, it is clear from the graph that no candidate of choice was elected in a district of less than 47 percent BVAP, and that districts as high as 57 percent BVAP at times failed to elect a CoC. The smooth, curved line was estimated using probit analysis, which fits a cumulative normal distribution to the data.¹³ As shown, the line tracks the x-axis until BVAP is about 40 percent, at which point it rises steadily, nearly reaching the top of the graph at about 58 percent BVAP.

The regression line, then, can be thought of as representing the probability that a candidate of choice is elected as BVAP varies from 0 to 100 percent. From this estimated relationship, the degree of polarization can be calculated by the value of the curve when $BVAP = \overline{BVAP}$, the average black voting age population across all districts. In Figure 1, \overline{BVAP} is about 27 percent, at which point the value of the probit function is essentially zero, meaning that candidates of choice will have next to no chance of winning office unless some degree of concentrated minority districts are drawn.

The point of equal opportunity can be calculated as the black voting age population at which a candidate of choice has a 50 percent probability of winning election. This can be read off the graph by starting at the 50 percent mark on the vertical axis, going horizontally over to the graph, and then down to the x-axis. For the data shown, the point of equal opportunity occurs at about 48 percent BVAP.

¹³Probit estimation is appropriate here since the dependent variable takes on one of only two values. If representatives are divided into three or more categories—such as subdividing noncandidates of choice into Republicans and Democrats—then logit analysis is used instead (multinomial logit and not ordered probit to avoid the imposition of any ordering on the types of representatives elected). Both techniques should yield similar results, and using them both can serve as a consistency check on one's findings.

Figure 1. Sample Data and Calculation of Equal Opportunity with Probit Estimation



Categorical regression analysis has a number of advantages over the ER/EA method. First, it can be calculated using only elections to the body in question—the State Senate in this case—rather than unrelated benchmark elections. Second, it automatically accounts for issues of voter registration and turnout without having to estimate these effects separately. For example, when minority voter registration and turnout is high, lower overall levels of BVAP will be necessary for minority voters to elect their candidate of choice, and this will be reflected in the estimates produced. Third, the estimation procedure makes no presumptions about the race of the candidates, focusing instead on actual minority support for the candidate elected. Fourth, it subsumes the primary problem as well by focusing on the eventual winner rather than the winners at each stage of the competition.

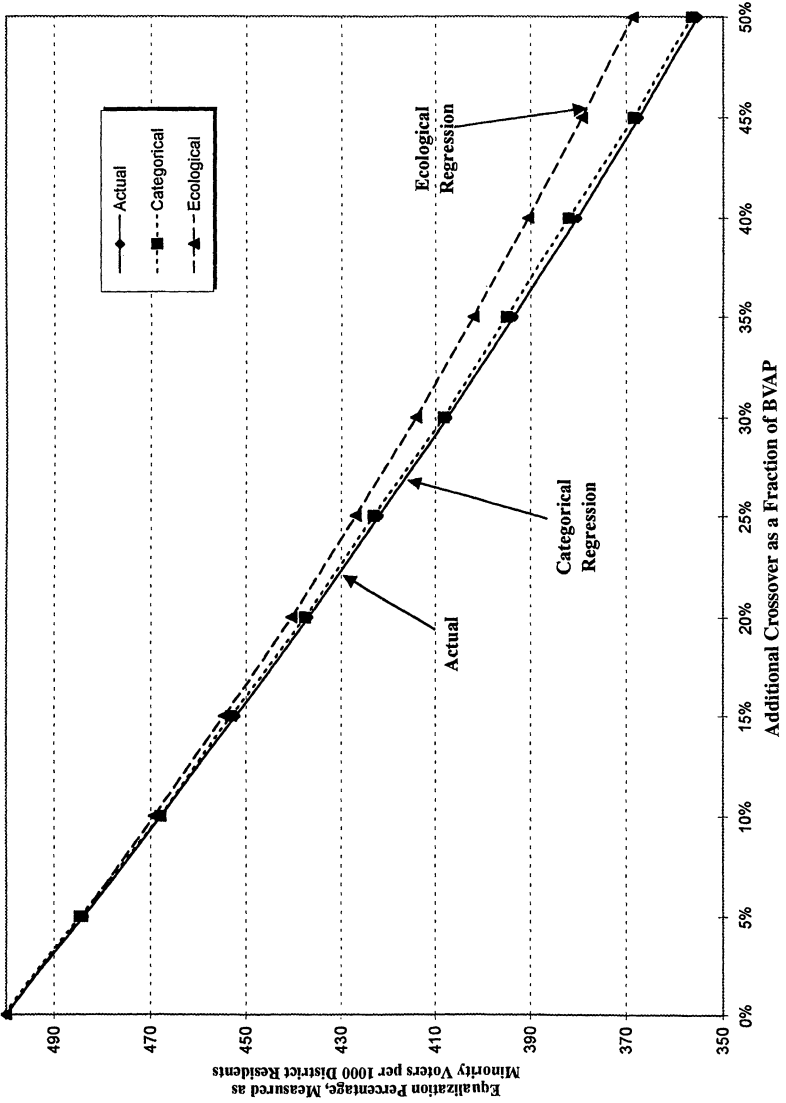
Finally, our methodology avoids the bias inherent in ecological regression by looking not at the various components that may affect electoral results—registration, turnout and crossover—but rather at the election results themselves; that is, it directly examines the relation between district composition and whether or not minority voters were able to elect their candidate of choice, without calculating intermediate results that are unobservable directly and irrelevant to the central problem at hand. In statistical terms, categorical regression is unbiased, even in the same circumstances that give rise to the ecological fallacy.

To demonstrate this point, we compared the ecological and categorical regression techniques using Monte Carlo simulations. The simulations assume that white and black voters behave in the same way except that net white crossover increases as the percentage of black voters in a district increases. We then generated 100-repetition Monte Carlo simulations to see which estimation technique yielded predictions closer to the actual black VAP necessary for equal opportunity.¹⁴

The results are presented in graphical form in Figure 2. The solid line represents the correct equalization percentage of BVAP according to the model's assumptions, the dotted line represents the estimated equalization percentage using categorical regression, and the dashed line represents the estimated equalization percentage using ecological regression. As shown in the figures, the ecological regression technique is biased, leading to over-predictions of the BVAP necessary to equalize electoral efficacy. The categorical regressions, on the other hand, give accurate predictions. Furthermore, the bias in the ecological regressions increases as crossover rates

¹⁴The Excel spreadsheets used to perform the simulation are available upon request from the authors. A second set of simulations was run under the assumption that black voters register at a higher rate as the percentage of black VAP in a district increases, yielding similar results.

Figure 1. Comparison of Ecological and Categorical Regression, Changing Crossover as a Function of Black Voting Age Population



become more sensitive to BVAP. This evidence supports the use of categorical regression techniques whenever available, at least as a check on the ecological regression results.

3.3 Application to South Carolina

Choice of elections

In applying our method, there are two strategies for choosing the set of elections to analyze, depending on whether one wishes to focus on a particular elected body or geographic region. The first approach is to use elections only to the institution being challenged; in this case, the South Carolina State Senate. To obtain a sufficient number of elections to perform valid statistical tests, all senate elections throughout the state must be used, rather than relying on elections solely from the challenged senatorial districts or elections in which a potential candidate of choice participated. This method has the advantage of being limited to the body being studied, but it mixes elections from different regions of the state.

The second alternative is to restrict our attention to the relevant geographic area and use only those elections in which a potential candidate of choice participated. In doing so, we must expand our data set to include additional elections; in the South Carolina case, the easiest way to do this is to include elections to the state assembly as well as the senate. This method has the advantage of hewing more closely to the Supreme Court's dictum of "intensely local analysis" set forth in the *Shaw v. Hunt* decision, but departs from the ideal of studying only elections to the challenged body.¹⁵

In the sections that follow, both of these approaches are applied in turn. For all elections prior to 1992, district populations were taken from the 1990 U.S. Census, as applied to the 1980's senate districts. Data on election results and the race of the candidates were obtained from various editions of the *South Carolina Legislative Manual* and from assistance generously provided by the South Carolina State Library. Summary statistics for all variables are provided in Table 2.

Statewide results

To perform the categorical regression analysis on statewide senate elections, the electoral outcomes were classified by two methods. The first method is the simplest: divide electoral outcomes according to whether or not a candidate of choice (CoC) won. Therefore the dependent variable can take on one of two values, CoC or non-CoC. The second method further subdivides, by party, those elections in which a candidate of choice was not

¹⁵*Shaw v. Hunt*, 116 S. Ct. 2475 (1995).

Table 2. Descriptive Statistics

Variable	Description	Mean	Std. Dev.	Min	Max
BVAP	Percent of blacks of voting age in the district.	27.63%	16.83%	4.52%	64.73%
Party	1 for Republicans; 0 otherwise.	0.70	0.46	0	1
Race	Race of member: 1 for black; 0 otherwise.	0.13	0.34	0	1
Candidate of Choice	1 for candidate of choice; 0 otherwise.	0.20	0.40	0	1
Vote Score	Measure of member's support for minority-preferred positions on roll call votes.	50.12%	28.00%	0%	100%

elected. In this case, the dependent variable takes on three values: CoC, non-CoC Republican, and non-CoC Democrat.

The analysis was also performed on two sets of elections. The pooled data includes all ninety-seven elections in the sample, while the nonpooled data includes only nonspecial elections held in 1992 as the most recent and representative of state senate elections. Again, if voting patterns are stable, then the choice of which elections to analyze should not affect the results. The equal opportunity analysis will thus include four cases, depending on the method of classifying candidates and the set of elections employed. When two outcomes were analyzed, probit estimation is appropriate, and when three possible outcomes were analyzed, multinomial logit analysis is used. The results from the four estimations are reported in the top half of Table 3.¹⁶

These coefficients were then used to calculate the BVAP necessary to produce a 50 percent probability that a candidate of choice was elected. The outcome of these calculations is reported in the bottom half of Table 3. As shown, in every case the point of equal opportunity occurs in districts of less than 50 percent black voting age population. For the pooled sample, equal opportunity is attained at 48.10 percent BVAP for the probit estimates and at 48.12 percent BVAP for the logit estimates. For 1992 nonspecial elections only, equal opportunity is attained at 46.64 percent BVAP and 46.63 percent

¹⁶The excluded group in the probit analyses was nonchoice candidates, and in the logit analyses, the excluded group was nonchoice Democrats.

Table 3. Electoral Equations Classified by Candidate of Choice/Non-Candidate of Choice and Party

Candidate Classification	<i>Electoral Equations</i>			
	Pooled Elections, 1988 & 1992		Non-Pooled Elections, 1992 Only	
	Constant	BVAP	Constant	BVAP
<i>Probit</i>				
<i>Candidate of Choice</i>	-11.67 (-2.15)	0.24 (2.27)	-9.76 (-1.66)	0.21 (1.79)
<i>Logit</i>				
<i>Non-Choice Republican</i>	1.17 (2.04)	-0.09 (-3.06)	2.06 (2.25)	-0.12 (-2.58)
<i>Candidate of Choice</i>	-19.71 (-2.19)	0.41 (2.31)	-17.10 (-1.63)	0.36 (1.75)
<i>No. Obs.</i>	97		46	

Note: t-statistic in parentheses.

(a)

Estimation Method	<i>Percent BVAP Needed to Attain Point of Equal Opportunity</i>	
	Pooled Elections, 1988 & 1992	Non-Pooled Elections, 1992 Only
	BVAP	BVAP
<i>Probit</i>	48.10%	46.64%
<i>Logit</i>	48.12%	46.63%

(b)

BVAP for probit and logit analyses, respectively. Note that neither the estimation method nor the election sample had a significant impact on these findings.

Local results

Next, we estimated equal opportunity using elections from both the state assembly and senate that occurred within the challenged geographic areas. Since these districts are located in the Upper Pee Dee, Coastal, and Low Country regions of the state, respectively, one could sample all state assembly and senate elections from the counties that overlap these three regions. Alternatively, one could rely on only those elections in the counties

that overlap the challenged districts themselves. These two methods produce 81 and 64 elections for analysis, respectively, and both were used as a consistency check on the previous results. Furthermore, voting patterns in some counties are more relevant than others since they overlap more with the challenged districts. The regressions, therefore, employ both weighted and unweighted analysis, using county percentages in each district as weights.

The results of these estimations were nearly identical to those from the statewide analysis: focusing on only local elections produced a range of estimated equalization percentages, from a low of 44.92 percent to a high of 48.67 percent. Moreover, in this case the results obtained using categorical regression are similar to those obtained using traditional ecological regression: calculations based on the data in Weber (1995) yield estimated equalization percentages of 47.65 percent, 47.05 percent, and 44.87 percent for the Upper Pee Dee, Coastal, and Low Country regions, respectively. The conclusions from this part of the analysis, therefore, consistently point to minority voters having an equal opportunity to elect a candidate of their choice in concentrated-minority, but not majority-minority, districts.

4. SUBSTANTIVE REPRESENTATION OF MINORITY INTERESTS

Next, we address the impact that alternative districting plans have on the substantive representation of minority interests. Majority-minority districts concentrate minority voters into relatively few districts, thereby reducing their numbers in nearby areas. These surrounding districts may then elect representatives who are unlikely to vote for policy proposals favored by the minority community, as they need not garner minority support to gain office. Thus, the election of minority candidates may, in some cases, come at the price of lower overall support for minority-favored legislation, and influence over public policy is, ultimately, the primary motivation for creating concentrated minority districts in the first place.¹⁷

Although the topic of substantive representation has been touched upon in the voting rights literature, few systematic empirical studies have explored the links between descriptive representation (electing minorities to office) and substantive representation (passing minority-favored legislation). Those who do find a positive link between the two tend to cover a time period close to the enactment of the VRA (Keech 1968) or smaller voting units such as cities (Yatrakis 1981; Browning et al. 1984). More recent studies, however, paint a slightly more nuanced picture, suggesting that majority-minority districts may come at a cost. For instance, Brace, Grofman, and Handley (1987) find a positive and significant correlation

¹⁷For overviews of redistricting and its political consequences, see Cain (1984) and Butler and Cain (1992).

between the number of majority-minority seats created in proposed South Carolina redistricting plans and the expected number of Republicans elected. Hill (1995) concludes that majority-minority districts cost the Democratic party about six seats in the 1994 congressional elections. Lublin (1997) argues that efforts to maximize the number of black-elected members of the House and pro-black congressional legislation tend to work at cross purposes. And Cameron, Epstein, and O'Halloran (1996) show that given current voting patterns, U.S. House districts between 45–47 percent black voting age population maximize substantive representation in the South.

Some analysts have investigated these questions from a theoretical angle as well. For example, Shotts (1997) develops a model in which many states, acting simultaneously, gerrymander districts in order to influence the median voter in the national legislature, concluding that majority-minority districts can only improve substantive representation. This theoretical finding, however, is based on the premise that 50 percent minority districts will waste no votes; that is, these districts will elect a candidate of choice to office with exactly half of the votes cast. In a world where minority voters' housing patterns are not perfectly compact, or where some white liberals will at times vote for a minority-preferred candidate, these districts would represent an overgerrymander, just as we suggest below.¹⁸

The question at hand, then, is whether the effect of electing a minority candidate to office gains more than it loses in terms of support for minority-sponsored legislation. If the answer is yes, then as many concentrated minority districts as possible should be created to help promote the substantive policy preferences of minority voters. If not, then past a certain level of BVAP districting schemes which result in more minority candidates being elected may have the consequence of lowering the probability that such legislation will be passed. We, therefore, evaluate three alternative districting schemes for the South Carolina State Senate with respect to their impact on substantive minority representation. The estimation strategy, which formalizes and elaborates the methodology first developed in Cameron, Epstein, and O'Halloran (1996), is to determine which types of representatives are likely to be elected given the percent BVAP in a district and then, once elected, how they will vote on issues important to the minority community.

¹⁸In fact, Shotts' findings are better interpreted as favoring gerrymandered minority districts of up to 50 percent, not above, and so his conclusions are not far off from analyses that favor concentrated but not majority-minority districts. Moreover, Shotts' assumption that state-level gerrymanderers care only about the national median, rather than maximizing the number of members from a given party in the state's contingent or preserving incumbents' seats, may also seem a bit unrealistic—rarely do legislators from New Jersey draw lines based on the actions of the Georgia legislature.

Whereas Cameron, Epstein, and O'Halloran (1996) used this method to derive optimal districting schemes, here we compare alternative electoral arrangements in terms of their degree of polarization and median voter within the legislature.

4.1 Data

To estimate the impact of various apportionment plans on the probability that minority-supported legislation will be enacted, all roll calls cast in the South Carolina State Senate between 1990 and 1994 were analyzed. A total of 903 votes were obtained by combining all recorded votes listed in the index of the *South Carolina Senate Journal* with other votes over substantive policy matters not contained in the index (e.g., veto overrides).¹⁹ These data were used to compare three districting plans: the existing districts from the 1980's plan, the interim plan imposed by the South Carolina Federal District Court, and the plan finally passed by the state legislature as Act 49.²⁰ These plans contained nine, eight, and ten majority-minority districts, respectively, out of forty-six total districts.

A member's willingness to support minority-favored legislation, his/her Vote Score, was calculated from the number of times the member voted in accordance with the majority of minority legislators, as follows. First, from the 903 original votes recorded, all unanimous votes were eliminated from the sample. Then for each vote, the number of minority legislators voting Aye, N_A , was calculated, as was the number voting Nay, N_N . In those votes where $N_A - N_N > 1$, an Aye vote was defined as a vote in support of the minority position, and where $N_A - N_N < 1$, a Nay vote was defined as a vote in support of the minority position. Those votes for which $|N_A - N_N| \leq 1$ were excluded from the sample, leaving a total of 544 roll call votes.

Next, we ranked state senators according to the number of times they voted with the majority of black senators, weighting each vote by the degree of unanimity among minority senators so the weight W_i was equal to $N_A/(N_A + N_N)$ in cases where $N_A > N_N + 1$ or $N_N/(N_A + N_N)$ if $N_N > N_A + 1$. Those districts represented by members who always voted with the black majority received a maximal score of 100, and those with representatives who on all occasions opposed the black majority would receive the minimal

¹⁹The sample includes only recorded votes associated with a roll call. The sample does not include recorded votes in which a single member asked to record his/her position on a specific motion, but no roll call was taken. In addition, roll calls over procedural matters not mentioned in the index were not coded.

²⁰When the state legislature was unable to agree on a redistricting plan, the court imposed an interim plan that governed the 1992 primary and general elections. The final Act 49 plan was passed in 1994 and used for the 1996 election cycle. This reapportionment plan, in turn, has been ruled unconstitutional and is currently being revised.

score of 0.²¹ The Vote Score, then, is a measure of each district's support for minority-favored legislation; the higher its overall value across districts, the more likely it is that the Senate will pass legislation favored by the minority community.

The average Vote Score for all districts was 49.81 on a 0 to 100 scale. The data also show clear partisan effects: the average Vote Score for all districts with Republican senators was 23.11 with only three Republicans over 50, while the average for all Democrats was 61.02. Within the Democratic party, districts with minority representatives had an average of 93.56, while nonminority Democrats averaged 53.32. As a check on our previous analysis, the Vote Scores for all nonminority candidates elected from majority-minority districts were analyzed. If the Vote Scores for these members were not much different than the scores for the average member of the senate, then an argument could be made that they did not fully represent the interests of their minority constituents. However, in twenty out of the twenty-one observations, the member's Vote Score was not only higher than the mean for the chamber as a whole (49.81), it was also higher than the average for all nonblack Democrat senators (53.32). Thus, nonminority candidates of choice do seem to represent their constituents' preferences more than the average Democratic office-holder.

4.2 Representation Analysis

The object of the analysis in this section is to predict the expected Vote Score given the BVAP in any district and then use these estimates to evaluate the relative impact of the three districting schemes on substantive minority representation. To perform this analysis, two elements are needed. First, for any given level of BVAP, what type of representative is likely to be elected? Second, for any given type of representative and level of BVAP, what Vote Score is likely to result?

The answer to the first question was given in the previous section, which estimated the impact of BVAP on electing different types of representatives. The analysis there used two methods for dividing up the types of representatives: CoC/non-CoC and CoC/non-CoC Democrat/non-CoC Republican. The present analysis introduces two additional methods: the first distinguishes only between minority officeholders and all others; the second distinguishes among minority officeholders, nonminority Democrats, and nonminority Republicans.

²¹The voting scores were also standardized so that the minimum score for each year was equal to 0, and the maximum was 100. This method is similar to that used to construct standard interest group rating scores, such as ADA, COPE, and LCCR scores.

The second part of the equation, relating BVAP to the expected Vote Score, can be estimated by regressing Vote Score (VS) on BVAP for each type of representative. That is, the equation:

$$VS_i = \alpha + \beta * BVAP_i$$

was estimated for each subgroup. To downplay the influence of outliers, robust regression analysis was employed, and in two subgroups (those representing all minority candidates), a piecewise linear regression was fitted to the data to account for nonlinearities.²² The results of this analysis are shown in Table 4.

Given these estimates, the expected Vote Score for any given level of BVAP can be calculated for each of the four methods. For instance, the second row divides legislators into three types: nonchoice Republicans (Rep), nonchoice Democrats (Dem), and candidates of choice (CoC). The expected Vote Score (VS) for a given level of BVAP, according to this method, is

$$E(VS|BVAP) = Pr(Rep|BVAP)*E(VS|Rep,BVAP) + Pr(Dem|BVAP) *E(VS|Dem,BVAP) + Pr(CoC|BVAP)*E(VS|CoC,BVAP).$$

The total expected Vote Score, then, is the likelihood that a given type of representative (Rep, Dem, CoC) will be elected, times the expected Vote Score of each type if they gain office, summed across the different possible types of representative. Given these relationships between BVAP and Vote Scores, then, each districting plan can be assessed by the percent of black voting age population it assigns to each district. Thus the Vote Score analysis provides a standardized method for translating minority voting population into substantive representation.

4.3 Results

We now summarize the results of our analysis with respect to two important political factors: the expected degree of polarization within the legislature and the position of the median legislative voter. The first factor measures the chances of coalition-building within the legislature, and the second measures the overall stance of the legislature with respect to minority-supported legislation.

²²This was done for minority representatives in the bottom half of Table 4. The function used in these cases was a spline with a knot at 55 percent BVAP and robust regression in each linear portion. In all other subgroups, the linear regression line closely tracked a loess (or local regression) line fit to the data, indicating that linear regression methods were appropriate.

Table 4. Representation Equations

<i>Representation Equations</i>				
Estimation	Constant	BVAP	BVAP(2)*	No. Obs.
<i>Non-Choice</i>	18.21 (4.93)	1.05 (6.82)		184
<i>Candidate of Choice</i>	69.68 (2.98)	0.36 (0.84)		46
<i>Non-Choice Republican</i>	18.50 (4.52)	0.25 (1.11)		68
<i>Non-Choice Democrat</i>	34.01 (7.38)	0.74 (4.31)		116
<i>Candidate of Choice</i>	69.68 (2.98)	0.36 (0.84)		46
<i>Non-Minority Representative</i>	18.67 (6.02)	1.02 (9.15)		199
<i>Minority Representative</i>	4.31 (0.22)	1.70 (4.49)	-1.93 (-2.92)	31
<i>Non-Minority Republican</i>	18.50 (4.52)	0.25 (1.11)		68
<i>Non-Minority Democrat</i>	34.36 (9.21)	0.73 (6.18)		131
<i>Minority Representative</i>	4.31 (0.22)	1.70 (4.49)	-1.93 (-2.92)	31

Note: t-statistics in parentheses. * Indicates slope of the second portion of the piece-wise regression line (BVAP > 55%).

The key to passing legislation favored by a particular group is usually its ability to form coalitions with other groups. To the extent that polarized voting within a legislature hinders the possibilities of such coalition building, it also hinders the advancement of substantive minority interests. Figure 3 graphs the distribution of expected Vote Scores under each of the three plans analyzed and indicates each plan's standard deviation. The larger the standard deviation, the more diverse are legislators' preferences, and therefore, this measure serves as a convenient index of polarization within the legislature. As indicated on the graph, the Act 49 plan, which creates the greatest number of majority-minority districts, is also the most highly polarized of all plans.²³ The chart clearly shows a gulf in the middle of the Vote Score

²³The figure is drawn by classifying elections according to the minority status and party affiliation of the winner. The standard deviation for the Act 49 Plan is highest for all other methods as well, as indicated in Table 5.

Figure 3. Expected Vote Score Distribution for Each Plan

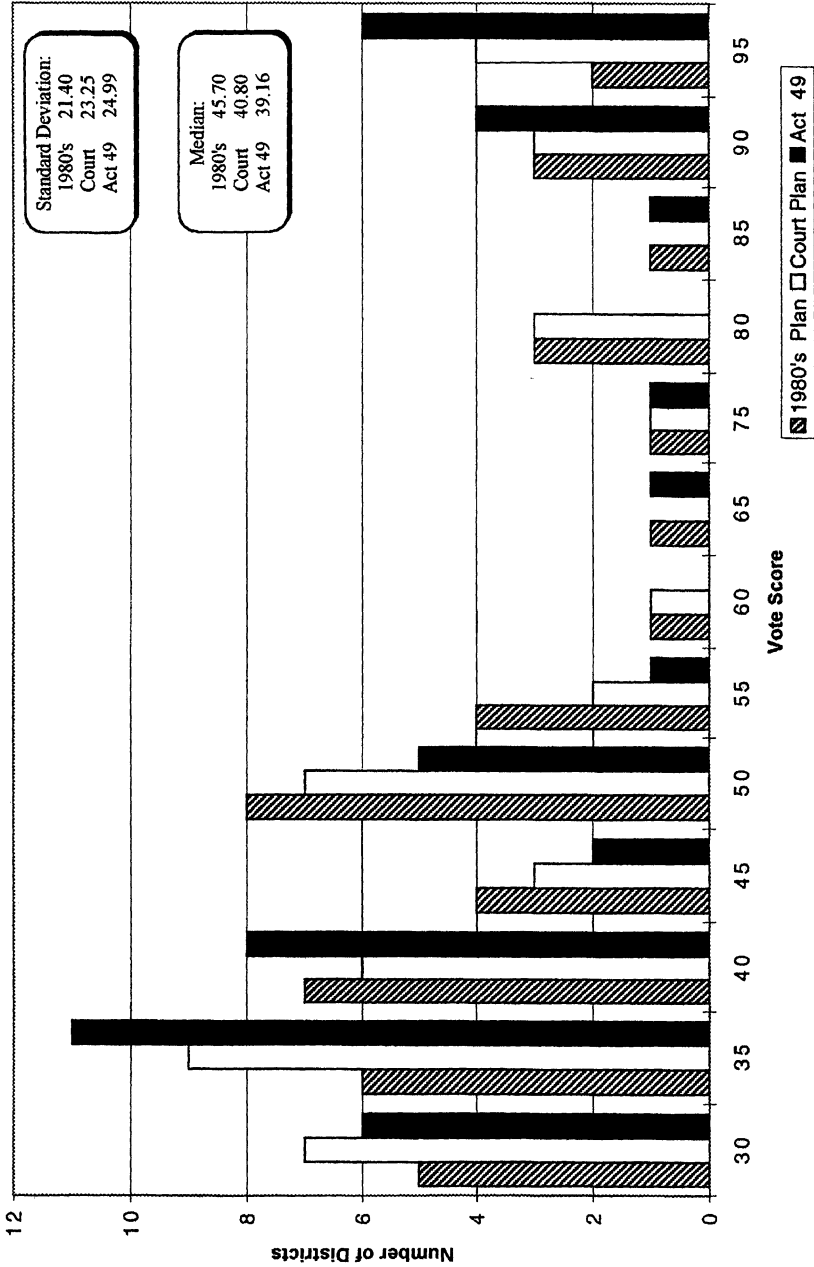


Table 5. Effect of Districting Plans on the Standard Deviation of Vote Scores

<i>Standard Deviation of Vote Scores by Districting Plan</i>				
Classification of Elections	1980's Plan	Court Plan	Act 49 Plan	Highest Standard Deviation
<i>Candidate of Choice</i>	21.40	23.25	24.99	<i>Act 49</i>
<i>Candidate of Choice & Party</i>	20.63	22.38	24.11	<i>Act 49</i>
<i>Minority Representative</i>	20.63	23.01	25.37	<i>Act 49</i>
<i>Minority Representative & Party</i>	19.72	22.05	24.43	<i>Act 49</i>

(a)

Effect of Districting Plans on the Median Vote Score

<i>Median Vote Scores by Districting Plan</i>				
Classification of Elections	1980's Plan	Court Plan	Act 49 Plan	Lowest Median
<i>Candidate of Choice</i>	45.70	40.80	39.16	<i>Act 49</i>
<i>Candidate of Choice & Party</i>	45.21	40.85	39.42	<i>Act 49</i>
<i>Minority Representative</i>	45.57	40.75	39.14	<i>Act 49</i>
<i>Minority Representative & Party</i>	45.81	41.18	39.66	<i>Act 49</i>

(b)

distribution; moderate senators will likely be replaced by extremists, making it more difficult to reach compromises on important pieces of legislation. Insofar as biracial coalitions are a key to passing racially progressive policies, the creation of majority-minority districts may make policy movement more rather than less difficult.

The next summary measure is the position of the median legislator, who can be thought of as the pivotal voter in the passage of legislation. As this median value rises and falls, so does the probability of passing minority-sponsored legislation. The expected median value was calculated by all four classification methods for each of the three plans. As shown in Table 5, the Act 49 plan was again the least favorable for substantive minority representation.

The evidence from this portion of the analysis consistently points to the conclusion that the Act 49 redistricting plan, passed by a coalition of Republicans and black Democrats in the state legislature and containing the greatest number of majority-minority districts, undermines to some degree the substantive representation of minority interests when compared to the interim court plan and the 1980's plan. Although the plan may well result in a greater number of minority officials elected to office, the analysis presented here indicates that it may make the state senate an overall less friendly environment with respect to the passage of legislation supported by minority members.²⁴

5. CONCLUSION

We developed a statistical methodology for evaluating voting districts designed to promote minority interests. The key phrase in voting rights litigation is that minorities should have an "equal opportunity to elect the candidate of their choice," but this is riddled with problems in implementation. "Candidates of choice" have never been fully defined, and the measurement of "equal opportunity" has relied heavily, and unnecessarily, on ecological regression analysis. Furthermore, the substantive impact of these redistricting schemes has never been systematically evaluated.

We presented an alternative estimation approach that employs categorical regression analysis. This method provides a general definition of candidates of choice, uses relevant elections for the analysis, avoids the bias inherent in ecological regression, and allows us to measure the implications of competing districting plans for the substantive representation of minority interests. We then applied our definitions to recent South Carolina State Senate elections. Our findings indicate that given present voting patterns, this elective body was rather overgerrymandered: the districts as drawn were more than necessary to assure minority voters an equal opportunity, and in expectation, they are likely to dilute rather than enhance substantive minority representation. In fact, the point of equal opportunity occurred at around 45 percent to 47 percent BVAP, and highly gerrymandered districts resulted in a legislature that was more polarized and less favorably disposed towards minority concerns.

These results point towards something of a middle ground in the debate over racial redistricting. Proponents of majority-minority districts claim that minority candidates cannot gain office outside of these districts, and that without representatives of their own race in office, minority voters will remain underrepresented in the political process. Opponents point to specific

²⁴In fact, the elections of 1996 saw the Republicans increase their numbers from 16 to 21, enough to block action on any given bill since filibusters can be sustained by seventeen members.

examples of minorities who win office in majority-white constituencies—Douglas Wilder, David Dinkins, and Carol Moseley-Braun, for example—to claim that racial redistricting is both unnecessary and divisive.

Our findings suggest that neither side is completely correct; minorities may win office outside of majority-minority districts, minority voters can be represented well by nonminority office holders, and majority-minority districts may over-concentrate minority voters to the detriment of their impact on policy. On the other hand, a race-neutral approach to districting will probably result in a minimization of minority influence on public policy, as minorities do still face significant difficulties in gaining office. Consequently, the argument favoring some degree of concentrated-minority districts remains strong.

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