Chapter 7 – King's EI: Breaking Apart the Southern Cross-Tab

Previous methods of ecological inference are fundamentally flawed, especially because they are incapable of producing findings when both blacks and whites shift their behavior contextually. The inadequacy of other alternatives, however, does not necessarily mean that Gary King's solution to the ecological inference problem is any better. Before I can proceed to analyze aggregate election data from the Southern states, I need to validate the success of EI, the software currently available to implement King's approach.

One way to do this is to defend the approach on grounds of statistical theory. However, King (1997) has already covered that burden in his own volume introducing the method. Others have challenged his proposal on similar grounds, arguing (for example) that the method falls short on several statistical properties normally considered important in a method of estimation (Cho 1998). Top scholars in statistics and political methodology are still hammering away at this question, and perhaps eventually social science will reach a consensual verdict. This is not the proper venue for continuing such an involved, and highly technical, debate.

Another way to assess King's method, though, is simply to give it a trial run in the sort of data with which one hopes to make use of it. This sort of diagnostic is particularly useful for my needs, because King's approach builds into it a technique called the "method of bounds" to prevent estimates from going astray. An additional push in the right direction, ensuring that EI will not spit out impossible numbers, can be a valuable safety net–one that, given informative data, could go a long way toward getting the truth even when some of the model's statistical assumptions are dicey.

Other hands-on attempts to verify EI's success have returned spotty results. Cho (1998), in the

highest-profile attack, gives EI a workout on 1984 California survey data. Because she created the

artificial "real aggregate data" from individual-level numbers, Cho naturally knows the values EI

ought to return. She illustrates that the program is not terribly successful estimating education rates

by race, unless she takes into account each area's income levels.[1] However, there are reasons why

EI would fail in this example, reasons that do not apply to the genuine aggregate data that I will be

using.[2] It is quite possible that EI could succeed consistently at predicting racial voting behavior,

and yet be unable to predict racial education rates.

This chapter therefore turns to two examples of Louisiana *voting* data where the truth is known.

The numbers that I happen to know in these two cases, because of Louisiana's excellent data

collection efforts, are exactly the sort one would need to estimate as part of backlash research

elsewhere. If EI does a good job estimating racial behavior here, then there's every reason to believe

it would be comparably successful elsewhere with parallel data–as long as the user possesses

adequate substantial information to know when the conditions should have changed.

The Wallace Campaign in Louisiana

Louisiana reports parish-level voter registration broken down by race. If we consider the vote

as a three-stage process–the decision to register, the decision to vote, the vote choice–the first stage

of that process does not require estimation in this rare instance. These registration figures are of

course imperfect. Some parishes purged their voter rolls of dead weight more frequently than

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[1] A second trial predicts the vote for a Chinese candidate from voters who are and are not Chinese. But EI's performance is not unambiguously disappointing in that case.

[2] First, the aggregations she created had almost no variation by race, unlike with most political units. Second, she chose a quantity to predict that has far more variation *within* races than it does across races, unlike with more politically relevant data, where people are "divided by color" (Kinder and Sanders 1996). Indeed, any researcher with a minimal amount of sociological knowledge would be aware that people sort themselves out residentially by their socioeconomic status, and that the assumptions underlying King's method would not apply. That is, Cho assumes a very naive researcher indeed. Third, her data only include 30 precincts, whereas almost any election above the level of city councillor will offer many more. Finally, it is not clear what she did with Latinos in her analysis, but throwing them in with whites would be an obvious violation of the model.

others.[3] Some hosted federal election examiners eager to expand the voting rolls.[4] Yet one usually

may not vote without registering first, so this additional information (while flawed) moves us closer

to knowing who voted than ignoring it would.[5]

Table 7-1 presents this more complex version of voting behavior at the state level. The actual

figures for race registration appear within the cells, in the place of question marks. About 17% of

Louisiana's adult population consisted of unregistered whites, and another 12% of unregistered

blacks. Therefore more than twice as many black adults remained unregistered (46.4%) as did

whites (22.7%). Furthermore, black registration varied wildly from one parish to the next. In East

Carroll, a Delta parish in the far northeastern corner of Louisiana, 309 blacks were registered from

an adult population of 3,452, for a registration rate of less than 9%.[6] In Madison Parish, a

neighboring Delta parish, 3,805 black adults appeared on the rolls, out of only 4,337 in the

population, for an 87.7% registration rate. Local registration practices therefore shaped 1968 voting

significantly, which only highlights the importance of having registration data already available.

To estimate white support for Wallace, I could proceed in three steps: (1) Estimating the

registration rates for each group, (2) Estimating the turnout for each set of registered voters, and then

(3) Estimating the vote among those who turned out. The first stage, obviously, is unnecessary

because I know the answers. The idiosyncratic variation in this stage also violates one of EI's

assumptions. Yet I will begin by estimating racial registration rates, because it provides a useful test

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[3] In fact, eight parishes report more registered whites than they contained voting-age white adults (using 1970 census figures), and two similarly reported black registration exceeding possible levels. In those instances, I adjusted registration downward to 100% to keep it within possible bounds, but otherwise tolerated the measurement error contained in the numbers.

[4] Nine Louisiana parishes contained a federal examiner in 1966, according to the Matthews and Prothro data set maintained by Jim Alt (1994, 372-73).

[5] I say that one *usually* must register to vote because three parishes reported more presidential-election votes in 1968 than they reported registered voters. Two of these, East and West Feliciana, reported extremely low registration rates though. In no parish did the 1968 vote exceed the voting-age population.

[6] Only three blacks were registered in this majority-minority parish in 1962 (Wright 1987, 26)!

Table 7-1: Wallace's 1968 Vote with Race Registration

	For Wallace	Against Wallace	No Vote	Unregistered	Total Voting-Age Population
Voting-Age Whites	?	?	?	341,940	1,508,009
Voting-Age Blacks	?	?	?	247,180	532,947
All Races	530,300	567,150	354,386	589,120	2,040,956

	For Wallace	Against Wallace	No Vote	Unregistered	Total Voting-Age Population
Voting-Age Whites	?	?	?	0.17	0.74
Voting-Age Blacks	?	?	?	0.12	0.26
All Races	0.26	0.28	0.17	0.29	1.00

Note: Data on voting-age population comes from the Census Bureau. Election results are from *America Votes*. Registration figures come from the Louisiana Secretary of State's office. Whites" represent everyone who did not identify as black. Proportions within the cells of the bottom table are joint frequencies, not racial registration figures.

of EI's robustness in the face of an inconvenient data set, the sort that historical studies of Southern

voting behavior are likely to confront.

Estimating 1968 Parish Racial Registration

The data for the first stage is represented in table 7-2, where I know how many adults registered and know how many adults are black, but pretend not to know how many blacks registered. This table is for Louisiana as a whole, the left with absolute figures and the right with equivalent proportions, but again I possess parallel data from each of 64 parishes.

Table 7-2: Estimating Registration Rates in 1968

	Registered	Not Registered	Total VAP		Registered	Not Registered	Total VAP
Voting Age Whites	?	?	1,508,009	**Voting Age Whites**	?	?	0.74
Voting Age Blacks	?	?	532,947	**Voting Age Blacks**	?	?	0.26
All Races	1,451,836	589,120	2,040,956	**All Races**	0.71	0.29	1.00

Note: Data on voting-age population comes from the Census Bureau. Registration rates are from Louisiana's Secretary of State's office. "Whites" include all citizens who did not identify themselves as African Americans.

EI begins by identifying the complete set of values that might fill a table's cells. The obvious first limit is that registration rates for each race must fall between 0% and 100%, but the "method of bounds" allows even greater precision. For example, since almost 1.5 million people registered, but the white voting-age population exceeds 1.5 million, at least 56,000 whites are not registered. That is, the "upper bound" on white registration is 96.3% (computed either as 1.45 million divided by 1.51 million, or as .71/.74). Similarly, even if every single black adult registered, that would only contribute 532,947 to the total, so at least 918,899 whites must be registered. The "lower bound" is 60.9% white registration. By contrast, at the state level the method of bounds does not help narrow the range of possible African-American behavior. Any registration rate from 0% to 100% is mathematically possible given the aggregate results. However, EI considers the bounds of each parish used in the analysis, which can narrow the state-level range considerably.

Each possible registration level for one group is paired with a unique registration rate for

the other, whether expressed as absolute numbers or as proportions. The following formula presents

the four components of statewide registration φ, parallel to the four components of Wallace's vote:

$$\varphi = X * \varphi^\beta + (1-X) * \varphi^\omega$$

We know two of the four components–the black and white population proportions–as well as the

overall registration rate on the left-hand side. So the range of possible statewide results fits the

following formula:

$$0.71 = 0.26\varphi^\beta + 0.74\varphi^\omega$$

If we fix one race's registration rate, the equation takes on a standard linear form, so the other race's

registration rate has a unique value. For example, if 80% of whites registered, the African-American

registration rate must have been:

$$
\begin{array}{lcl}
0.26\varphi^\beta + 0.74 * 0.8 & = & 0.71 \\
\varphi^\beta & = & 0.454
\end{array}
$$

EI has reduced the range of possible estimates to a series of exclusive pairs, all within the range of

possible values. The same process is possible for the observed behavior in each parish i:

$$\varphi_i = X_i * \varphi_i^{\ b} + (1-X_i) * \varphi_i^{\ w}$$

In Bienville Parish, for example, 80.2% of the voting-age population was registered. About 40.7%

of the county's 9,539 potential voters were black. If 63.8% of black adults registered in Bienville,

roughly 91.5% of whites must have done so as well.[7] Each other possible value of black registration

similarly has a unique white registration rate associated with it. And, as with the state level, $\varphi_i^{\ b}$ may

not be so large or so small as to push $\varphi_i^{\ w}$ outside the range of possible values [0,1], and vice versa.

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[7] Aside from rounding error, these hypothetical figures are the correct ones for Bienville.

If we graph black registration by white registration, then, the known information about each parish will be represented by a line segment, the set of all possible registration combinations. Figure 7-1 presents a "tomography plot," King's name (drawn from medical imaging) for the combined line segments of all 64 parishes. This plot summarizes all deterministic information contained in the election data; no assumptions were required to produce it. Horizontal lines–that is, lines with very narrow bounds for white registration–correspond to almost entirely white parishes. They contain so few African Americans that we know quite precisely how whites behaved (betaW), but almost nothing about blacks (which is why the slant of such a line only allows a small range of possible values on the Y-axis but any value on the X-axis). A segment becomes more vertical, however, as the black population increases. We are less sure how many whites registered in these mixed parishes, because the aggregate data also include a large black population.

Somewhere on each line segment is a single point that represents the true black and white registration rates for the parish. Since Louisiana reports racial registration rates, we do know these values, but usually the aggregation process prevents further narrowing of the options in this way. Deriving more specific registration estimates is impossible without making distributional assumptions of some kind. The usual assumption would be that the real points tend to cluster wherever the lines converge. Here it's rather hard to identify such a point visually, an indication that Wallace's 1968 parish vote could be a challenge for EI. However, the lines do seem to group more heavily near the top, right corner–so EI's assumption will be that true registration rates also cluster around there.

More formally, King's proposal (1997, 92-94) is to make three assumptions about the process generating racial voting behavior: (1) that each precinct's black rate and white rate together are one draw from a bell-shaped curve, called the bivariate normal distribution, truncated so that neither rate is outside the limits of 0% and 100%, (2) that aside from any covariates used to capture

Figure 7-1: Tomography Plot for Louisiana Registration, 1968
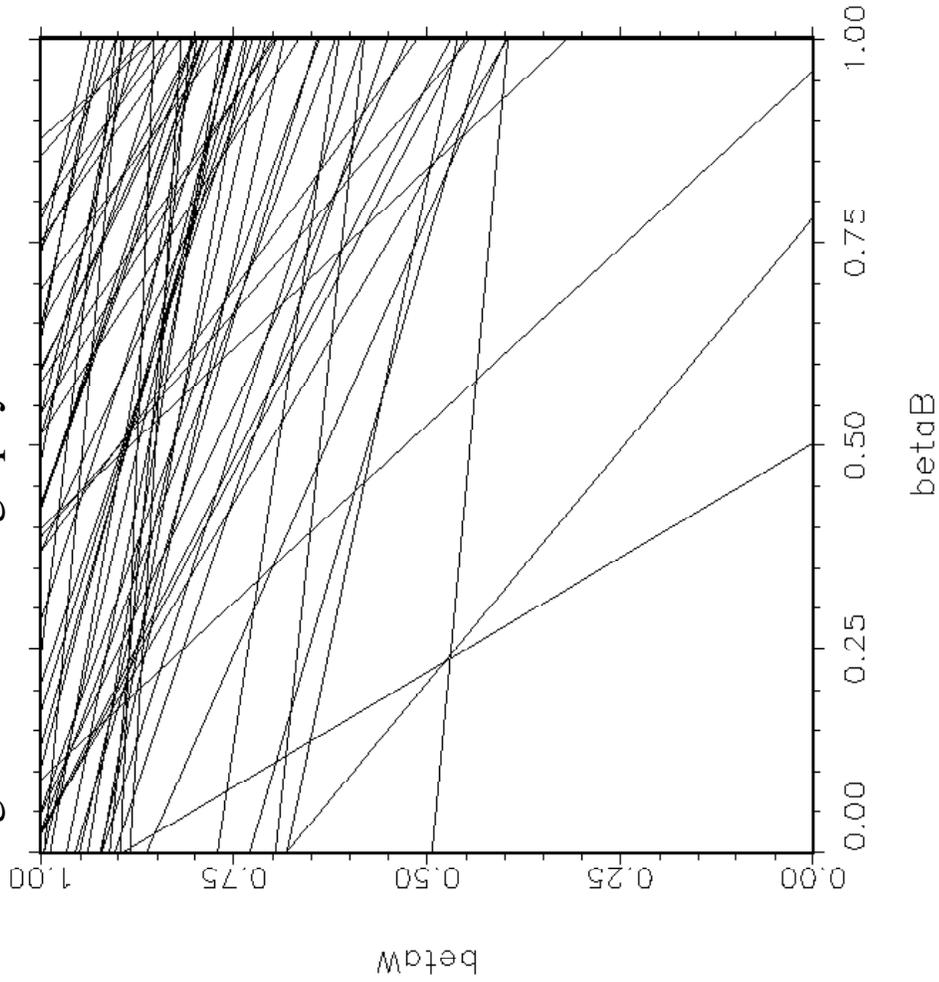
NOTE: Each line segment represents one parish. The vertical axis represents possible white registration rates. The horizontal axis represents possible black registration rates. Overall, this plot represents all known information about parish registration from the voting-age population and the overall registration rates. See text for more detail. Produced using King's EI.

aggregation bias, each precinct's rates are mean independent of racial density, and (3) that,

conditional on the precinct's racial makeup, voting in one precinct is independent of that in others.

In fact, violating these assumptions may not mess up EI estimates, thanks to the safeguards provided

by the method of bounds.

Once EI has estimated (using Maximum Likelihood) the truncated bivariate normal

distribution with the greatest probability of generating a state's parish-level data, that probability

distribution can be turned around to select parish-level estimates. The location of the other

tomography lines therefore determines the point estimate on any one. EI picks, as the point estimate

for each parish, the pair of racial registration rates with highest probability (thus requiring that the

pair of black and white registration rates be *possible*). These parish-level estimates are aggregated

to produce our state-level estimate, one that therefore incorporates all known information from every

parish within it.

Obviously this assumed pattern could be invalid in any one case. Indeed, it almost certainly

would be invalid for a Louisiana election conducted before the Voting Rights Act of 1965 took

effect. Majority-black Delta parishes were local tyrannies, some with almost zero black registration,

whereas many South Louisiana bayou parishes set up few obstacles to black political mobilization

(Wright 1987, 23). By 1968, however, federal examiners had broken apart the insurmountable

institutional barriers once present in many locales.[8] A few intransigent parishes, such as Judge

Leander Perez' Plaquemines Parish stronghold, certainly remained–but not enough to rule out the

model's general assumptions about the process generating the data, and a researcher with some

substantive expertise will know these sorts of exceptions.[9]

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[8] Once we move on to contemporary elections, the multitude of minor factors adding up to voter turnout almost certainly approach a bivariate normal distribution within districts or counties.

[9] I did exclude five parishes from the estimation stage, during which EI chooses parameters for the bivariate truncated normal. Two of these–Evangeline and La Salle–reported registration numbers that equaled or exceeded their voting age population, and therefore were unrepresentative. They appear as dots in the top, right corner of the tomography plot. Three others–Vernon and the Felicianas–reported excessively low

A Comparison of the Methods

For my initial run, I did not take advantage of EI's more advanced features (such as modeling parameters of the truncated bivariate normal to vary with other relevant quantities). I want to compare the estimates from this simple EI analysis both to the real numbers and to estimates produced by other methods of ecological inference (see Table 7-3).

The first row reports the real racial registration rates: 53.6% of blacks and 77.3% of whites. The following set reports bounds on the estimates, as listed earlier for the state data. They do not constrain black registration estimates at all, but pinch possible white registration rates to a span of roughly 35 percentage points. The bounds based upon parish-level limitations squeeze the range of valid estimates for whites even more, and rule out the more extreme levels of black registration as well. One quick and dirty method of estimating behavior, taking the midpoint between the bounds, performs surprisingly well. The estimates of 75.9% white and 57.5% black registration are much closer to the truth than this method normally promises.

Naive ecological regression produces quite impossible estimates: 86% registration for whites (more than two large standard deviations from the truth), and 57% registration for blacks. For the entire state, this implies a 78.5% registration rate, underscoring the importance of weighting ecological inferences drawn from linear regression (Palmquist 1993, 31-33; Voss 1996a).[10] Therefore I repeated the ecological regression using weighted least squares, which Brad Palmquist

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registration. They appear toward the lower end of the plot, Vernon almost completely horizontal right below the 50% white registration mark, and the two Felicianas crossing Vernon's line segment at the same rough point. Vernon contains Ft. Polk military base, while West Feliciana holds the state's infamous prison at Angola. Both contain residents who will register at very low rates, nor is the reason for this part of the natural stochastic variation in voter behavior that should be incorporated into the truncated bivariate normal. EI does guess at their registration rates once armed with the parameters, however, and they appear in all analysis.

[10] King (1997, 61-65) notes that using weights to compute the estimated state aggregate, as in "weighted" average, is different from using weights for estimation purposes, as in "weighted least squares." However, since the coefficients produced by Goodman's approach *are* the aggregate estimates, the distinction seems to blur for that method.

Table 7-3: Statewide 1968 Registration Estimates

	White Registration	Black Registration	Total Registration
Truth	77.3	53.6	71.1
STATE DATA			
Lower Bound	60.9	0.0	
Upper Bound	96.3	100.0	
Midpoint	*78.6*	*50.0*	71.2
PARISH DATA			
Lower Bound	61.1	15.6	
Upper Bound	90.7	99.3	
Midpoint	*75.9*	*57.5*	71.1
Naive ER	86.0	57.0	78.5
	(4.0)	(9.6)	
Weighted ER	77.9	60.0	73.2
	(4.0)	(10.6)	
Neighborhood	71.5	70.2	71.2
Homogeneous	85.4		
EI (simple)	76.7	55.2	71.1
	(6.1)	(17.2)	
EI (final)	77.1	54.0	71.1
	(5.7)	(16.0)	

Note: Methodological details of each estimation appear in the text. Numbers in parentheses are standard errors. No estimate of black behavior appears for homogeneous unit analysis because Louisiana contains no homogeneous black parishes.

and I (1996) have found to hold up fairly well in precinct-level Southern voting data. The white registration rate then comes amazingly close–within a percentage point of the truth–although the black registration rate rises to more than six percentage points away. The estimates are still impossible too, since they represent a 73.2% statewide registration rate.

Ecological regression does not produce parish-level estimates–77.9% of whites and 60% of blacks presumably registered in each parish–but we can evaluate these figures as surrogate parish estimates. Together the racial estimates are impossible in all but, at best, two or three parishes (as indicated by how few lines in figure 7-1 cross that point). Even looking one race at a time, though, the white registration rate is impossible for 33 parishes, too low for 27 and too high for 6. The black registration rate is impossible for 14 parishes. That the bounds are so active signifies more than just the failure of Goodman's method. It also encourages further exploration of contextual effects.

Only four of the 59 parishes used in my EI estimation contain more than a 90% white voting-age population, and none are more than 90% black.[11] The limits of homogeneous parish analysis are therefore obvious. The registration rate in those four parishes, computed as a weighted average, comes to 85.4% percent–far higher than the white registration rate in the state. As expected, all-white parishes were not representative. The neighborhood model is similarly unimpressive, estimating almost equal registration rates for blacks and whites when the true results are much more polarized.

Even a simple EI estimation clearly outperforms every method except weighted ecological regression. It estimates that 76.7% of whites registered, within a percentage point of the truth, and that 55.2% of blacks registered, within 2 percentage points of the truth. Given the wide variation from one parish to the next, as revealed in figure 7-1, these estimates are fantastic. The one

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[11] There's no consensus on what constitutes a "homogeneous" place. I've used a 90% threshold. Lower levels might bring in more white precincts, but no Louisiana parish exceeded a 70% black voting-age population, so estimating black behavior this way was impossible.

drawback is that standard errors are very large. This is a reassuring drawback, though, since it means EI's standard errors reflect the high degree of uncertainty much better than those from naive ecological regression did.

This simple EI run also predicts the true white registration rates in each parish amazingly well. Figure 7-2 presents a scatterplot of the EI estimates against the true white registration rates (a circle's radius indicates size of the parish's white population). The solid slanted line, flanked by an 80% confidence interval, represents where cases would fall when estimates were exactly correct. Circles to the left of the line mean estimates were too low, those to the right that estimates were too high. As the graph shows, the bulk of parishes fall right on or around the solid line, indicating a wonderful fit with the real answers. The exception is a handful of very small parishes with white voting estimates that are too low. In these rural parishes, black registration was below 25%, a legacy of Jim Crow that no simple EI analysis captures because it violates the model's assumptions.

EI is robust in the presence of aggregation bias, even when the researcher makes no overt attempt to model that bias, because the method of bounds often forces estimates to change in response to shifting behavior. In fact, consistent with previous research (Matthews and Prothro 1966; Price 1957), the real registration data do indicate a strong pattern of aggregation bias, with black registration declining sharply as black density increases. As the black density increases 10 percentage points, black registration rates on average decrease 4.1 percentage points, and the white rate climbs 1.4 points. The simple EI analysis picked up on some, but not all, of this pattern. The black registration *estimates* on average decrease 2.4 percentage points with the same 10 percentage-point shift in black density.

I tried several refinements to the estimation, hoping that they would reduce standard errors on the estimates. However, I did not allow the true answers to drive my attempts, since normally I would not hold this information. I chose approaches that would make sense given the Southern

Figure 7-2: EI's Success Estimating With Poor Data
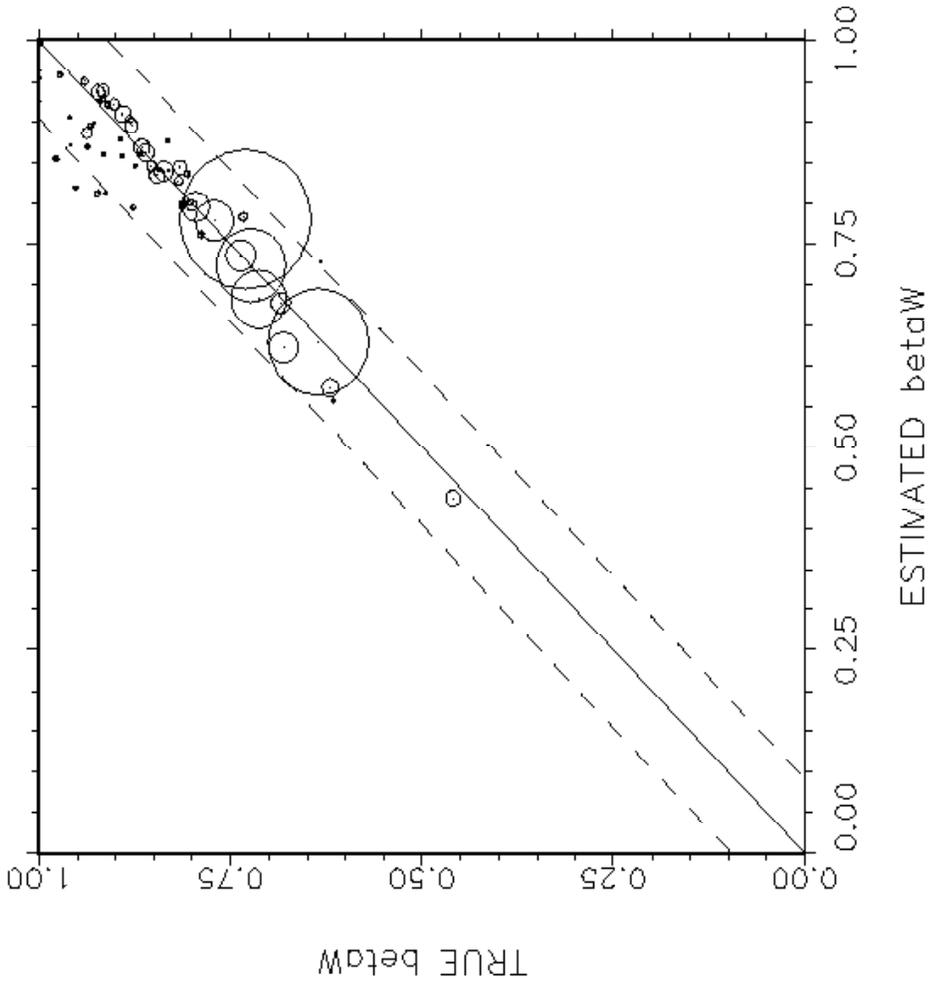
NOTE: Each circle represents one parish. The diameter of each circle indicates the number of registered voters. The vertical axis represents the actual white registration rates, which were not used in the estimation stage. The horizontal axis represents the estimated rates. Distance from the 45-degree line indicates the amount of error. Produced using King's EI.

politics literature. For example, I tried to model aggregation bias explicitly, consistent with the white backlash hypothesis. I allowed black registration rates to shift according to presence of a federal election examiner. I allowed white rates to shift according to parish demographics, such as white family income or median school years. As is often true with EI, once the method of bounds worked its magic, it was no longer necessary to model most of these influences on registration rates.

Ultimately, I settled on a model that allowed registration rates to shift according to two variables. I allowed the parameters to react to the black density of the population, in keeping with previous literature. I also allowed the black registration rate to decline in two areas historically known for their racial sensitivity: the Mississippi Delta parishes in the state's northeast corner, and Plaquemines Parish. These refinements did improve estimates, although the uncertainty remained high. Estimates for both races were within half a percentage point of the truth, and better reflected the aggregation bias in the true data. The black registration estimates on average decrease 3 percentage points with a 10 percentage-point increase in black density, and the white estimates inch upward (whereas in the simple analysis they remained static).

In sum, my EI estimation of Louisiana's 1968 parish registration rates is imperfect. Standard errors are quite conservative, given the amazing success of the overall approach, and a few intransigent parishes that violate the model assumptions do stump the program. Yet the main lesson of this exploration is that EI is robust even in the most troublesome cases that I am likely to face in modern Southern voting data, even when the model assumptions do not apply. Nor, when faced by a tough case, does EI underestimate the uncertainty contained in its best estimates.

*Estimating 1968 Parish Racial Turnout*

Normally the next stage would be to estimate turnout, using the racial registration estimates as a base (King 1997, chap. 15). However, since I possess the right answers for the initial estimation

stage, I will use those instead. Estimating turnout, therefore, follows an identical procedure to that used estimating registration in the previous test case. I know how many registered whites and blacks appear in each parish, and how many people voted, but I don't know how many of each voted.

Predicting turnout from the registration figures is quite difficult, just as predicting registration was. Louisiana only contains 64 units, and these parishes lack sufficient variation in black population to allow very secure results. Fortunately, once I have registration in hand, turnout among those registered is much more consistent than registration rates. Voting, which is a relatively quick and low-profile activity, was less responsive to local idiosyncracies than the risky decision whether to register in the first place. This difference shows up, for example, in a tomography plot representing all known information about turnout (see figure 7-3). The tomography lines cluster much more heavily in the top portion of the unit square, and do seem to crisscross an identifiable (albeit rather broad) portion of the figure.

For this analysis, I allowed white turnout to increase as black density increased, since Wallace's anti-segregation message played very well in the Black Belt. The ovals in Figure 7-3–which are contour lines, representing the estimated bivariate normal much as contours portray hills on an aerial map–probably capture the underlying process governing turnout fairly well. Once again, EI then chooses for each line segment the black and white turnout rates that seem most likely. Translated into specific estimates for each parish, this truncated bivariate normal means that 79.5% of registered whites voted in the presidential election, whereas 59.2% of registered blacks did so. Figure 7-4 shows the tomography plot again, this time with the estimated turnout rates for each parish indicated as dots. The findings resemble the 50-60% turnout rates estimated for Louisiana's

Figure 7-3: Louisiana's 1968 Turnout Easier to Predict
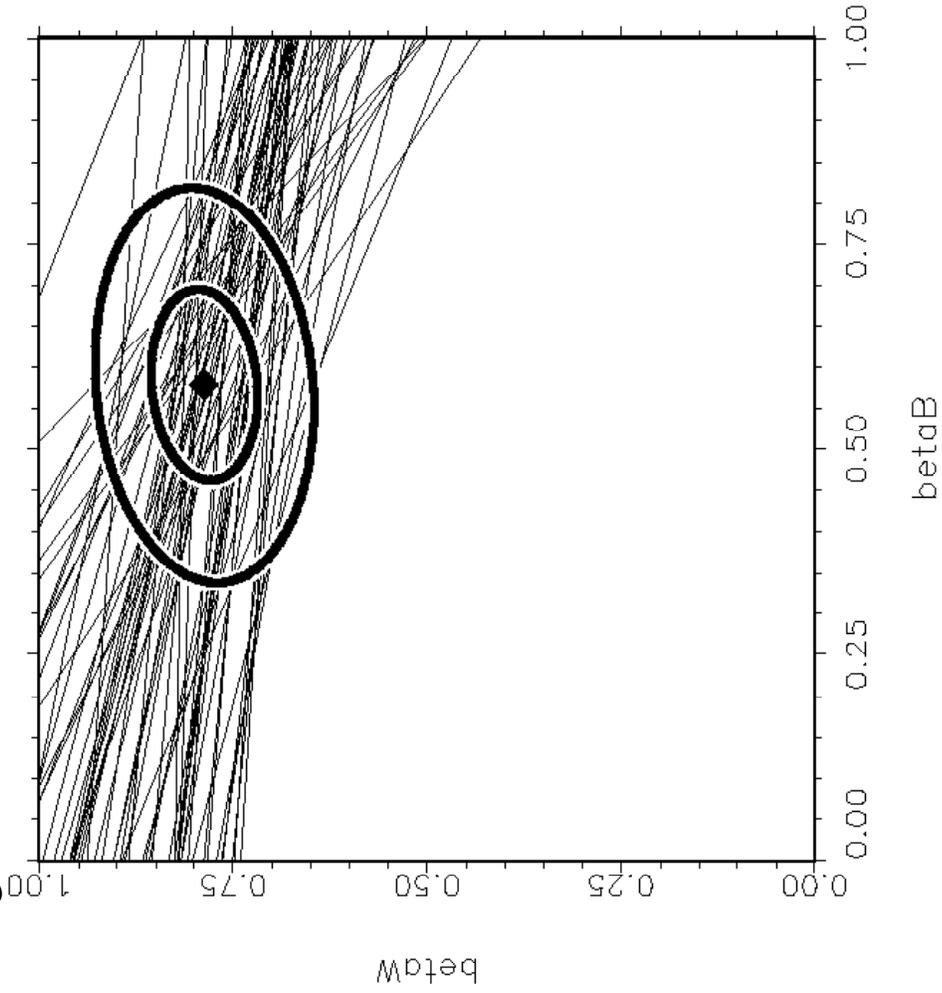
registered blacks in 1966 (Campbell and Feagin 1975, 136).

Now we can proceed to the next step: estimating the vote of those who turned out. Of course, at this point most researchers might be willing to assume, say, a 1.5% rate of support for Wallace among black voters; turnout was the real source of uncertainty. But I'll carry it through for purposes of demonstration. This procedure is almost identical to the previous stage. We know the distribution of votes, and we possess reliable estimates of turnout for each race (from the last stage), but we don't know the voting preferences of each group.[12]

A simple EI analysis, with no embellishments, produces rather disheartening results: approximately one quarter of African-American voters appear to have supported George Wallace analysis not shown). However, this is better than implied in other ecological studies of the Wallace vote, which indicated *rising* Wallace support as the black population increased. Furthermore, this is a case in which prior knowledge can inform estimation without assuming the answers outright. EI can estimate aggregation bias informed by the prior expectation that whites in heterogeneous parishes were more supportive of Wallace.[13] This simple refinement simultaneously removes the absurd numbers, as no previous statistical analysis of the aggregate Wallace vote has been able to do, and brings the results in line with white backlash research from the period. Now 1.8% of blacks apparently backed Wallace, either by intent or not (which is surprisingly realistic given the large standard error of 6.2). And we have by far the best available estimate of Wallace's white support from each Louisiana parish, which comes to 57.1% at the state level.[14]

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[12] EI uses "multiple imputation" to account for the additional uncertainty that comes from using estimated turnout rates.

[13] EI options: _Eeta=2 and _EalphaW=0.5~0.1.

[14] The standard error for this estimate is 1.4. It is, of course, quite possible that an analysis of Wallace's vote that drew strength from voting in other states would improve these estimates.

Figure 7-4: Ultimate 1968 Louisiana Turnout Estimates
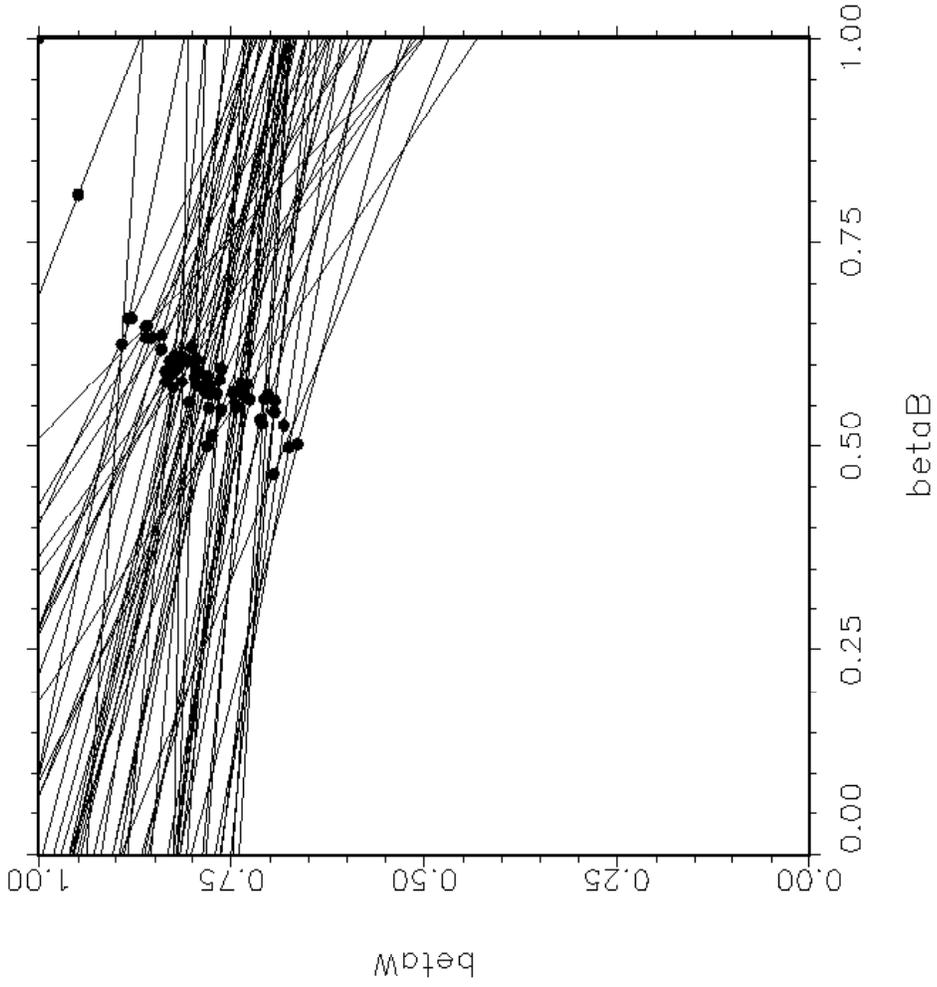
NOTE: Each line segment represents one parish. The vertical axis represents possible white registration rates. The horizontal axis represents possible black registration rates. The dots on each line segment represent the values chosen after Maximum Likelihood selects the bivariate normal's parameter estimates. See text for more detail. Produced using King's EI.

Estimating Turnout in Precinct-Level Data

Louisiana's 1968 voting behavior was interesting, because it threw EI up against a particularly tough case in which the answers could be verified. However, my research is primarily focused on contemporary racial politics. For the current period, data are much better than what I used in the last example. Precinct-level race and election data are widely available, especially from Southern states that collect such information to document their compliance with the Voting Rights Act. Most states that can provide racial data derive them from the Census, computing voting-age population estimates based upon the census blocs used to construct their precincts. Others, such as North Carolina or Alabama, actually collect racial registration data, asking registrants to declare their racial category and aggregating those figures. Two states, Louisiana and South Carolina, even keep track of turnout by race.

The availability of precinct-level data is the key to why King's method will work so consistently with racial voting studies. Residential segregation is still the norm in American society. A third of African Americans live around few whites (Massey and Denton 1993, 75-77), and many whites live in neighborhoods with only token black presence. The aggregation process discards relatively little information about these segregated voters, as far as producing racial estimates is concerned, limiting the scope of ecological inference necessary to produce accurate estimates. This sort of segregation is less severe in the South, where interracial contact has always been more common that in hyper-segregated Northern cities, yet still appears when data are measured at low levels.

Take Louisiana's racial registration figures for 1992. Out of 3,998 usable precincts, 11.6% are entirely uniform: 440 without a single African American registered to vote, 25 with nothing but African Americans. So we know the exact racial characteristics of 150,000 voters; no estimation

is necessary and no uncertainty present.[15] A third of the state's precincts contained almost no blacks (i.e., fewer than 5% of registered voters), such that more than half of the white population resides in "homogeneous precincts." Another 260 precincts were almost exclusively black, containing more than a quarter of the African-American population. Using a lower standard, in which only 90% of the population must be uniform, means that 58% of Louisiana voters appeared in segregated locales where we have little doubt about what one racial category is doing.

The result of all this segregation is that, in many precincts, we know roughly how the dominant race behaved–a certainty that greatly informs statewide estimates as well. Leaving aside the uniform precincts, where we have no doubt at all, the range of possible white turnout is less than 10 percentage points in 1,829 precincts. The range of possible black turnout is equally narrow in 343 more. Thanks to the bounds imposed by racial registration rates in these informative precincts, white turnout for the state *must* have been between 75% and 88.9%, and black turnout between 51.5% and 87.9%. But results near these extremes would entail rather implausible behavior, the sort of thing a researcher with substantive expertise would know about, so it would be a safe bet estimates were somewhere within an even narrower range.[16] The bounds work similarly for voting choices. Thanks to bounds imposed by racial turnout rates in each precinct, the white vote for Clinton must have been between 29.5% and 44%, the black vote between 54.3% and 97.7%, with the plausible results falling within an even narrower range.

Segregation is one condition common with racial data that assists King's method. Another condition that adds to the certainty is extreme behavior. When the phenomenon being studied approaches consensual levels, such as 0% or 100% of residents engaging in a particular activity, then we know with fair certainty how people of all races behaved there. Racial voting behavior

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[15] I am talking about estimation error here, not measurement error, which may be present to some degree.

[16] The real answers, which we know because Louisiana reports racial turnout, in fact were near the center of each range: 81.4% for whites and 71% for blacks.

frequently runs up against this sort of boundary, since variance in voter choice can be quite high, with 9 in 10 black voters backing the Democratic party and rural whites heavily endorsing Republicans. In the Louisiana case, we see such extreme behavior with turnout as well, because most registered voters go to the polls.

Georgia, by contrast, does not report racial registration, so estimates must build from the entire population of adults, for whom turnout rates are not so high. This does widen the bounds, but segregation is nevertheless the norm. Out of 2,641 usable precincts, not a single black adult appeared in 109 of them. Roughly 43% of Georgia's white adults and 15.5% of black adults live in precincts where their race predominates (i.e., more than 95% of population). Lower the threshold to 90%, and 61.4% of whites and 23.3% of blacks inhabit homogeneous precincts. The bounds are therefore still quite helpful. Statewide racial turnout for the 1992 presidential contest must have fallen between 53.8% and 71.5% among whites adults, 24.1% and 79.3% among black adults. With 1992 congressional voting, similarly, the bounds on white turnout were tiny in four of Georgia's 11 districts (i.e., the range of possible white turnout was less than 10 percentage points). And the range only exceeded 20 percentage points in the three heavily black districts.

The implications should be clear. Much of the work required to produce racial voting estimates is performed by the method of bounds, and therefore milks both the quality of contemporary data and the segregated nature of American society for the information they make available. King's approach to ecological inference does add to the precision, especially when coupled with whatever substantive knowledge the researcher brings to bear, but the method's assumptions do not drive the results as much as they might at first appear.

Nevertheless, it is worth observing how well King's method performs with such highly informative data. In particular, I will show how successful EI is at predicting racial turnout in Louisiana, the sort of thing a researcher normally must estimate (e.g., it is the first stage of "double

regression"). Naturally Louisiana is a unique place, so one may be hesitant to extrapolate from there

to other Southern states. However, for purposes of engaging the success of King's method, there's

no reason to think it poses a particularly easy trial. Segregation is not exceptionally high in

Louisiana's cities, and turnout rates are not extreme. It also may seem unreliable to assume that, if

EI works well predicting turnout, it will perform equally well predicting vote choices for which the

truth cannot be known. Here too, however, my trial is more representative than one might assume.

The main reason EI thrives is racial segregation, and that operates equivalently on both turnout and

vote data.[17] Furthermore, voting behavior is more extreme than turnout in the contemporary period,

so EI should get more purchase estimating votes.

I will use turnout from the 1991 Louisiana gubernatorial open primary, although results are

quite similar with other elections from the period. The actual statewide turnout rates were 65.2%

for blacks and 74.7% for everyone else, underscoring the faultiness of using one-stage ecological

regression. The state-level bounds are not particularly informative; we have no idea what the black

turnout rate would be, and the white rate could be anything greater than 61.6% (all figures appear

in Table 7-4). If the absolute bounds are imposed individually on each precinct and added up to

statewide totals, however, white turnout must be between 67.6% and 82.4%, while black turnout

must fall between 44.7% and 83.9%. The midpoints of these bounds would indicate white turnout

of roughly 75%, and black turnout of 64.3%. The former is off the truth by only 0.3%, while the

latter misses the mark by just under a percentage point, so once again the bounds are pointing us in

the right direction. There's no guarantee for success shooting from the hip this way, but it does

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[17] Palmquist (1993, 89-98) breaks aggregation bias into two components, a specification shift representing the information lost by collecting areal data, and an inflation factor that can magnify the initial error severely. The inflation factor essentially represents traits of the areal units used in an analysis, and therefore would be similar for both estimating turnout and for estimating vote choice. For race, the inflation factor tends to be quite low (Palmquist 1993, 162).

reinforce my point that the plausible bounds are usually narrower than the absolute bounds.[18]

The attractive precinct-level data permit most methods to approximate the truth. Freedman's neighborhood model, for example, estimates that white turnout was 73.8%, black turnout 67.4%. Regular ecological regression places those figures at 75.9% and 63.7% respectively. The white turnout estimate is 1.2 percentage points (or almost 19,000 voters) from the truth, one of the worst provided by any method despite the highly informative data on whites. The estimates also imply a statewide turnout rate that was impossibly high. The worst of the simple methods is homogeneous precinct analysis. I tried it two ways this time: once a simple precinct average, the other weighting that average by the number of registered voters in each precinct. Both are faulty, because white turnout is notably high in all-white precincts, and black turnout notable low in all-black precincts.

Weighted ecological regression does a nice job. It estimates that 75.3% of whites turned out, off by less than a percentage point. The black estimate is more disappointing, since it falls almost 2 percentage points from the truth, but given the less informative data for blacks such an estimate still seems fairly strong. Furthermore, this time the joint estimates do not imply impossible statewide turnout rates. A simple EI run produces roughly the same estimates as weighted ecological regression: 75.4% of whites and 63.3% of blacks.

I ended with a more complex EI analysis, allowing white turnout to decline as black density increased.[19] I've found such a pattern consistently across precinct-level data sets. It makes perfect sense, given that whites in integrated settings tend to have lower socioeconomic status than their segregated counterparts, and socioeconomic resources are an important determinant of political

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[18] For true behavior to approach one of the bounds would require for one racial group to behave in a consistently extreme manner. Whenever a precinct's figures left doubt, for example, black turnout would have to be at the minimum permitted by the data. Any political phenomenon sufficient to produce this strangeness likely would be familiar to a researcher with substantive expertise.

[19] The exact EI prior was _EalphaW=(0~0.3), so there was no indication to EI that it *should* find negative contextual effects. Other priors that did push EI that way, such as (-.3~.2) or (-.2~.2) provided essentially the same estimates.

Table 7-4: Estimated 1991 Primary Turnout

	White Turnout	Black Turnout	Total Turnout
Truth	74.7	65.2	72.1
STATE DATA			
Lower Bound	61.6	0.0	
Upper Bound	100.0	100.0	
Midpoint	*80.8*	*50.0*	72.4
PARISH DATA			
Lower Bound	67.6	44.7	
Upper Bound	82.4	83.9	
Midpoint	*75.0*	*64.3*	72.2
Naive ER	75.9	63.7	72.7
	(0.2)	(0.3)	
Weighted ER	75.3	63.5	72.2
	(0.1)	(0.3)	
Neighborhood	73.8	67.4	72.1
HOMOGENEOUS			
Average	76.3	63.4	72.9
Weighted Average	75.6	62.4	72.2
EI (simple)	75.4	63.3	72.2
	(0.1)	(0.2)	
EI (final)	74.9	64.5	72.2
	(0.1)	(0.1)	

Note: Methodological details of each estimation appear in the text. Numbers in parentheses are standard errors.

activity (Verba, Schlozman, and Brady 1995, 513, 527). Thus allowing for aggregation bias here

does not rely on my unique knowledge of the true data patterns, but on substantive insights gleaned

from previous research.[20] The estimates are then 74.9% turnout for whites, 64.5% for blacks. In

both cases, these estimates are closer to the truth than with any other method used. The white

estimate was only off by a fifth of a percentage point, and the black estimate by less than a

percentage point as well.[21]

The preceding analysis shows that precinct-level data are extremely useful for determining

statewide behavior. Even fairly simple estimation methods come within a percentage point of true

white behavior, and within two percentage points of true black behavior. The Louisiana data allow

another test of EI's performance, however, which is to check the quality of precinct-level estimates

it produces. No other popular method of ecological inference can create precinct-level estimates.

EI might use the precinct data to generate excellent statewide estimates, but still be way off for

individual areal units. As it turns out, however, EI's estimates are amazingly accurate even at the

precinct level. The estimates correlate heavily with the true white turnout rates: a coefficient of .933

when weighted by the number of registered whites, and .983 when weighted by the inverse of EI's

reported precinct standard error (c.f., Burden and Kimball 1998, 539). The figures for blacks are

naturally slightly lower, given the more limited information on black behavior, but still impressive:

.867 when weighted by the number of registered blacks, and .941 when weighted by EI's reported

level of confidence. It is worth noting that the cost of any survey with this level of local precision

would be astronomical, even if people could be trusted to report their turnout properly.

The EI estimation I ran took no notice of which precincts fell in which parishes. Although

EI certainly would allow the researcher to adjust estimates based upon county traits, none of my

estimations took advantage of this option–the only geographical features that mattered were the

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[20] The true turnout rates indicate clear aggregation bias, and entirely on the white side. As black population density increases 10 percentage points, white turnout declines 1.5 percentage points, on average. The black rate, meanwhile, increases less than 0.2 percentage points.

[21] About the only sign of trouble was the small measure of uncertainty reported on the black estimate. Other diagnostics, such as ensuring that the true values did not fall consistently at the extremes of their posterior distributions (King 1997, 213), looked adequate.

precincts themselves and the state as a whole. It is worth investigating, therefore, how well the EI precinct estimates aggregate up to county values. Since the estimation routine did not in any way attempt to optimize fit with county behavior, confidence in the numbers should be high if the county estimates reveal minimal fluctuation from the truth.

I created parish-level white (black) turnout estimates by averaging the figures for all precincts in a parish, weighted by the number of whites (blacks) contained in each. The weighting is necessary to indicate the turnout level EI has estimated for the average person, rather than the average precinct (which is not particularly meaningful). The parish-level estimates end up almost as accurate as the statewide estimate, correlating at .987 for whites, .969 for blacks. The largest error for any parish's white turnout estimate is 2.3 percentage points, the largest error among blacks 3.6 percentage points. The average parish error is, of course, much smaller–under a half of a percentage point for both races (see Figure 7-5). Again, this level of precision is astounding when considered in light of what surveys of similar precision would require.

One major concern with King's EI is that, like other methods of ecological inference, it may not pick up enough of the information missing in aggregate data to represent contextual effects accurately. Cho's recent critique (1998), for example, creates a hypothetical "aggregate data set" from survey data, and shows that King's method does not pick up the aggregation bias contained in her particular sample. Is his method equally limited for racial voting studies? This application indicates that, because of the virtues of precinct-level voting data, King's method performs quite well. For example, I regressed EI's parish-level estimates on the parish black density, controlling for the true estimates. If EI falls prey to aggregation bias, errors in predicting the white voting rate should change with the black density. However, the results do not indicate a statistically significant connection between the parish error and the racial demographics (analysis not shown); there is no evidence aggregation bias has made much difference to the parish-level figures.

Conclusion

King's "solution to the ecological inference problem" is not perfect. Improvements are likely to develop in the coming years. But the analysis presented in this chapter indicates that EI has taken us far enough to reopen the study of Southern voting behavior in aggregate data–the method works splendidly for that purpose. I showed this using two Louisiana data sets in which racial behavior was known: one a 1968 parish-level data set where I knew racial rates of voter registration among black and white adults, and one a 1991 precinct-level data set where I knew the racial turnout rates among those registered. The precinct data were so informative that even much less defensible

FIGURE 7-5: County-Level Predictive Accuracy
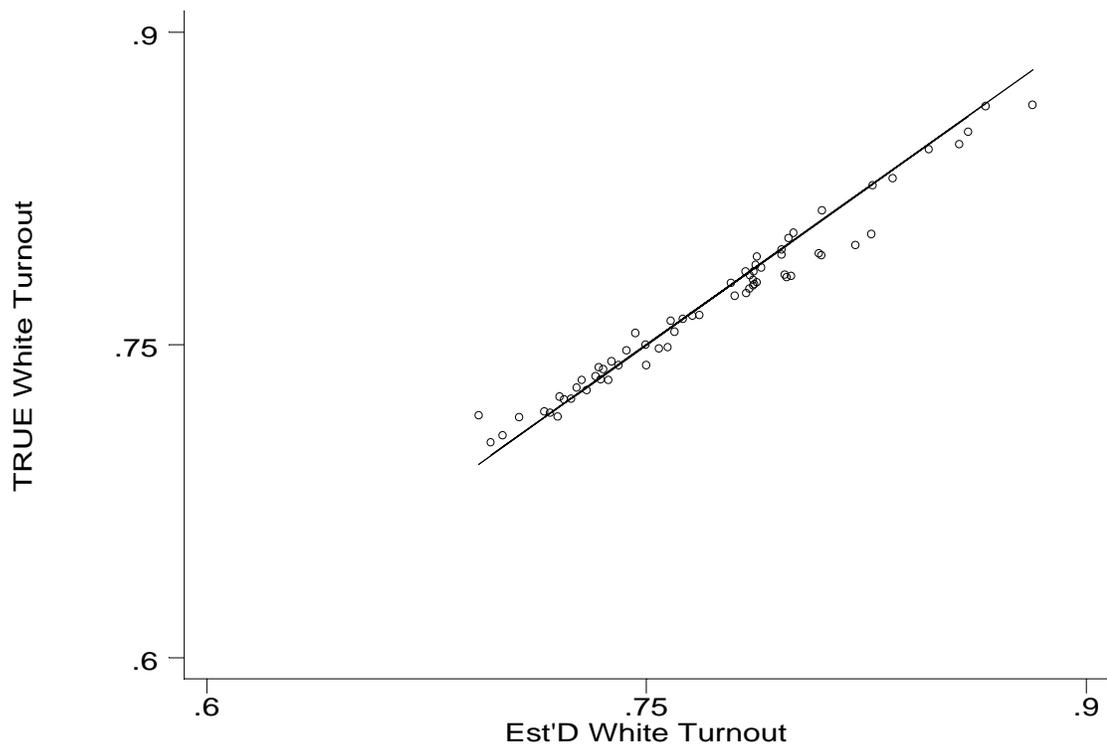
NOTE: Each dot represents a Louisiana parish. The true turnout rates were provided by the state of Louisiana. The estimated numbers come from Gary King's EI, computed as a weighted average from precinct-level figures. The 45-degree line indicates where a parish would fall if the estimation is exactly correct. Dots above the line represent estimates that are too low; those below it are too high.

ecological inference techniques stumbled upon acceptable statewide estimates.   King's EI nevertheless surpassed those alternatives, producing estimates that were extremely accurate at the statewide, parish and precinct levels. The cost of producing surveys with comparable local accuracy would be astronomical. For most research questions, such geographically rich surveys simply do not exist.

EI possesses all the virtues of methods previously used to study Southern voting behavior. It takes advantage of the tangible information found in homogeneous locales, since it precludes impossible results and "borrows strength" from the homogeneous places to estimate behavior in the mixed ones (King 1997, 106-112). However, EI improves greatly upon homogeneous unit analysis. If diverse communities behaved differently from segregated ones, EI will milk the apparent changes for additional information–picking up some, if not all, of the difference. Rarely are the races so mixed that a unit tells us nothing about the voting preferences of one race compared to another. Similarly, it allows two-stage analysis much as ecological regression will, but does not fall prey to aggregation bias as easily in performing that double estimation. Therefore, the method is unmatched by any alternative, whether considered in light of accuracy or of usefulness. I can use it in this research to analyze contemporary elections, which lack even the complications of the 1968 Wallace vote, with reasonable confidence in the validity of my findings. The next several chapters, therefore, are dedicated to milking aggregate data for what they can contribute to consideration of the white-backlash phenomenon.