

# When Natural Experiments Are Neither Natural Nor Experiments: Supplemental Material

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# 1 Details about the Redistricting Application

## 1.1 Data

For Texas, data on electoral returns were collected from the Texas Legislative Council (TXLC) at the VTD level. VTDs are census blocks grouped to approximate voting precincts as closely as possible, providing a link between census data and electoral data.<sup>1</sup> Since there is a one-to-one mapping between VTDs and 2000 census blocks, we are able to track the electoral returns of the same geographical unit over time. Election returns reported by the TXLC include congressional, state house, state senate, U.S. Senate, and presidential elections. Data files also include total and Hispanic voter registration, voter turnout, and candidate information including name, party affiliation, race, ethnicity and incumbency status.

For California, data on electoral returns were collected from the Statewide Database (SWDB) at the 2000 census block level.<sup>2</sup> As in Texas, using 2000 census blocks as the unit of analysis allows us to track the electoral returns of the same geographical unit over time. Electoral returns include congressional, state house, state senate, U.S. senate, and presidential elections. The data also include registration and turnout figures. The roster of congressional candidate and incumbents was obtained directly from the California Secretary of State, and data on race and ethnicity were obtained from the *Hispanic Americans in Congress* website, maintained by the Library of Congress, and the Congressional Research Service Report for Congress 2008.

We added data on challengers' quality to both the California and Texas datasets.<sup>3</sup> We also merged data from the 2000 census. For Texas, census data from Summary File 1 was easily obtained at the VTD level by aggregating census blocks; for California, we merged block-level data directly. Census data from Summary File 3 was converted to the VTD-level for Texas and to the block-level for California.<sup>4</sup> Variables include population by age, white, black and Hispanic population, and population by language spoken at home, employment status, place of birth, and education level. Every VTD and

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<sup>1</sup>For details about VTDs and other issues regarding data construction, see Texas Legislative Council (2000, 2001).

<sup>2</sup>Data for 1998 and 2000 were directly obtained at the block level, while data for 2002 through 2006 were obtained at the precinct level and converted to 2000 census block level using conversion files provided by the SWDB.

<sup>3</sup>Challenger quality data were kindly provided by Gary C. Jacobson.

<sup>4</sup>The assignment of Summary File 3 variables to blocks and VTDs is only approximate because the smallest geographical unit for which Summary File 3 variables are reported is the block-group level.

block in each dataset was assigned to the congressional district it belonged to in each general election between 1998 and 2006.

Texas’s territory is divided into 8,634 2004-VTDs and 675,062 2000-census blocks. Since even unpopulated areas were assigned a census block in 2000, 207 of these 8,634 VTDs have zero population and hence zero election returns. Of the remaining VTDs, some had to be discarded due to the phenomenon of “multiple congressional districting” which occurs when a VTD reports election returns for more than one congressional district in a given election. We exclude from the analysis all VTDs for which multiple redistricting occurs once or more in the period under analysis. After imposing these restrictions, the sample size is 8,040 VTDs. California’s territory is divided into 533,163 2000-census blocks, of which 344,356 have positive population. Since 46,843 of these blocks have population of less than 10, many blocks have no votes cast in some or all of the years under analysis. We restrict our sample to those blocks with a positive number of votes cast in all congressional elections between 1998 and 2006. After imposing this restriction, the sample size is 284,040 blocks.

As mentioned in the paper, the SBOT design must condition on crucial covariates related to voters’ previous history in their old districts. For this reason, when estimating the personal vote using this design, we restrict our analysis to movements between incumbents of the same race, ethnicity, and gender. Our substantive results are unchanged if we don’t restrict the analysis in this way. Our analysis also excludes incumbents whose original districts are modified so radically that the share of old voters in the newly redrawn district is almost zero.

## **1.2 Additional details about QQ-plots in Figure 1 and placebo test**

Figures 1(a) and 1(b) below reproduce Figures 1(a) and 1(b) in the paper. As mentioned in the paper, these figures the empirical Quantile-Quantile (QQ) plots of the baseline vote share received by the incumbent U.S. House member in the election before redistricting, comparing units that were to be redistricted to a different incumbent in the following election (*would-be treatments*) to units that were to remain with the same incumbent after redistricting (*would-be controls*). The unit of analysis is the Voting Tabulation District for Texas, and the 2000 census block for California. For Texas, we use 2002 as the baseline year, and compare 2002 incumbent vote shares between units that will be

moved in the 2004 redistricting and units that will remain with their old incumbent after the 2004 redistricting. Using 2000 as the baseline instead of 2002 does not change the direction of the results, although differences become smaller. For California, the baseline year is 2000, and we compare 2000 incumbent vote shares between units that will be moved in the 2002 redistricting and units that will remain with their old incumbent after the 2002 redistricting.

As discussed in the paper, Figure 1 shows that, in both states, units with a lower incumbent vote share in the election before redistricting are more likely to be moved to a different incumbent when redistricting is implemented. Figure 2 presented here shows that this bias remains even after both types of voters are matched on their partisan attachments as measured by presidential vote shares. Figures 2(a) and 2(b) show the same QQ plots as figures 1(a) and 1(b), respectively, but this time the QQ plots are produced after would-be treatments and would-be controls are matched on their Democratic share of the two-party presidential vote. Even after matching, would-be treatments still vote for their old incumbent at a lower rate. If at least part of this tendency of new voters to vote for their incumbent at a lower rate persists in the future, comparing old voters and new voters will be biased towards finding a positive personal vote even when there is none.

This additional QQ-plots matching on presidential vote suggest that presidential vote alone will not be enough to pass the placebo test discussed in the paper. Table 1 below confirms this. Row (1) in this table reproduces the results in Table 2 in the paper. Row (2) shows that presidential vote alone is not sufficient to satisfy this placebo test. (We present results here for using the 2000 presidential vote as the estimate of the normal vote, but we have also conducted placebo tests using means and medians of a number of past presidential elections.) We obtain excellent balance on Presidential vote in 2000 when we match only on this variable (results not shown in the table, but shown graphically below). However, as shown in Row (2) of Table 1, unlike the case for the rich conditioning set used in the estimate of the first row, there is a significant treatment effect on House vote in 2002 when we compare placebo treatments to placebo controls after matching on this variable only. Conditioning on party registration instead of or in addition to the presidential vote is also insufficient to pass the placebo test.

The covariates we used to perform the matching for our placebo test are reported in Table 1 in the paper. As discussed in the paper, our dataset allows us to draw on a rich set of covariates based

on electoral returns, registration files, and census data. We use past presidential vote returns, returns from statewide offices, registration figures, past turnout numbers, and the past vote for the Democratic Party’s House candidate. Moreover, since both the treated and control units in this placebo test are in the same congressional district before redistricting occurs (as they are in the FBTT design), we match by construction on the party of the incumbent, the historical quality of challengers, and other aspects of past races at the local, statewide and national level as experienced by the units we are matching.

The results in Table 1 are illustrated graphically in Figures 3 and 4. Figure 3 plots the QQ-plot for the incumbent vote in 2002 between treatment and control groups. The figure visually presents the results in row (1) in Table 1. It is clear that the result for incumbent vote is zero, as it should be in this placebo test. But, as mentioned above, past presidential vote is not sufficient to satisfy this placebo test. Figure 4(a) presents the balance on Presidential vote in 2000 matching on only this variable. As can be seen, balance is excellent. Figure 4(b) presents the QQ-plot for the estimand in question, House vote in 2002. Unlike the case for our rich set of covariates, there is a significant treatment effect. This figure corresponds to the results presented in row (2) of Table 1 above.

The confidence intervals reported in Table 1 in this document and in Tables 2 through 4 in the paper are obtained from Hodges-Lehmann Interval Estimation. Rosenbaum (2002) provides details, and Hill and Reiter (2006) provide a simulation study comparing the performance of Hodges-Lehmann intervals relative to other methods of interval estimation for treatment effects using matching. All substantive results in these tables are unchanged if either bivariate overdispersed GLM models (McCullagh and Nelder 1989) are estimated on the matched data or if Abadie-Imbens standard errors (Abadie and Imbens 2006) are used instead.

### **1.3 Texas and California redistricting plans in the 2000s**

Texas implemented six different congressional district plans between 1990 and 2006.<sup>5</sup> After the reapportionment that followed the 1990 census, the districts enabled by the old C001 plan were redrawn. The 1992 elections were held under the new districts enacted by plan C657, which remained in

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<sup>5</sup>See the Texas Legislative Council’s Redistricting website <http://www.tlc.state.tx.us/redist>, Texas Legislative Council (2000), and Texas Legislative Council (2001) for details about Texas’s redistricting plans during the 1990s and 2000s.

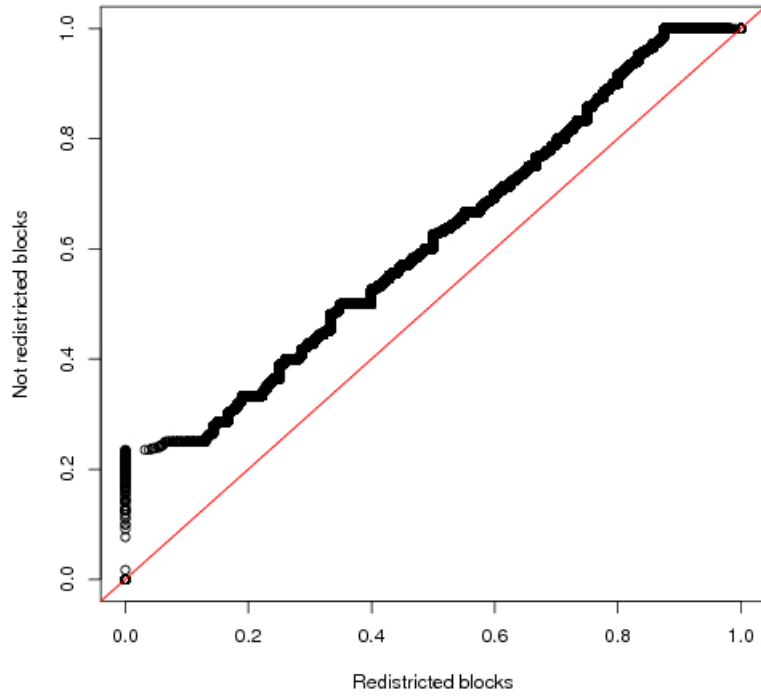
effect until the 1996 primaries. In August 1996, 13 of Texas's 30 congressional districts were redrawn. The new plan, C746, was used in the 1996 general election and it remained in effect during the 1998 and 2000 elections.

In 2001, after the reapportionment following the 2000 census that created two new congressional seats, the Texas Legislature was in charge of redrawing the senate, house, congressional, and State Board of Education districts during the regular session of the 77th Legislature. But the plans failed to be considered by the full Senate and the full House, and the legislature adjourned without enacting new districts. A number of congressional proposals were submitted to state and federal courts. Finally, on November 14, 2001, the U.S. District Court issued an order adopting new congressional districts (Plan C1151) for the 2002 elections. But plan C1151 was only in effect for the 2002 elections. In 2003, Republican majority leader Tom Delay led an effort to enact a new congressional district plan, with the objective of maximizing the number of Texas's Republicans elected to Congress in the 2004 and subsequent elections. After a legislative battle that included Democratic lawmakers massively fleeing to New Mexico and Oklahoma to avoid quorum, the new plan (Plan C1374) was passed in October, 2003. The 2004 primaries and general election were held under this new plan. Congressional districts were redrawn one more time in 2006.

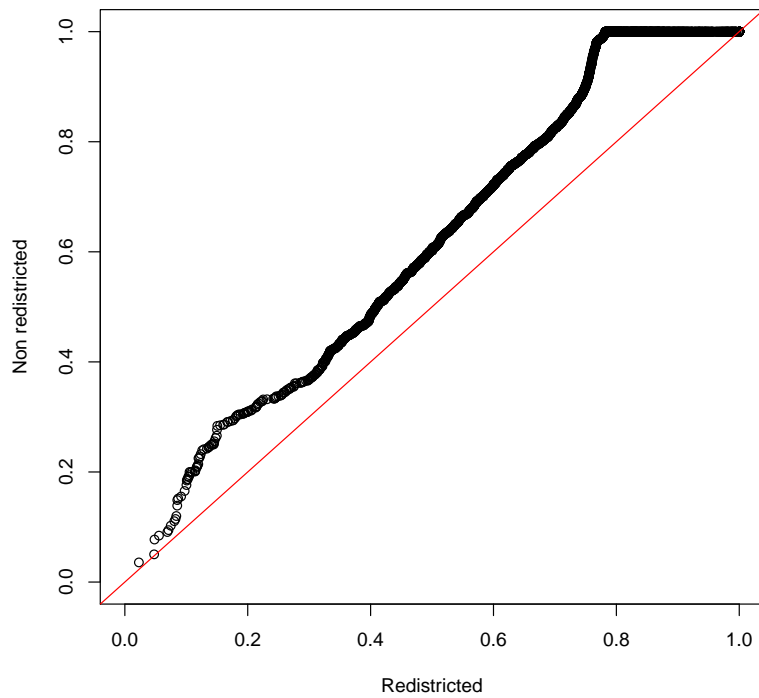
In California, there was only one redistricting plan implemented in the 2000s. The districts in effect during the 1990s were redrawn by the 2001 redistricting plan, which was enacted in two separate bills in September 2001. Bill AB632 established Senate and Congressional districts, and bill SB802 established Assembly and Board of Equalization districts.

Tables A1, A2 and A3 present the number of VTDs and census blocks in our sample that were affected by these redistricting plans in both states – both overall and separately by pre-redistricting incumbent party.

Figure 1: QQ Plots of Baseline Vote Share for Incumbent House Member  
California and Texas

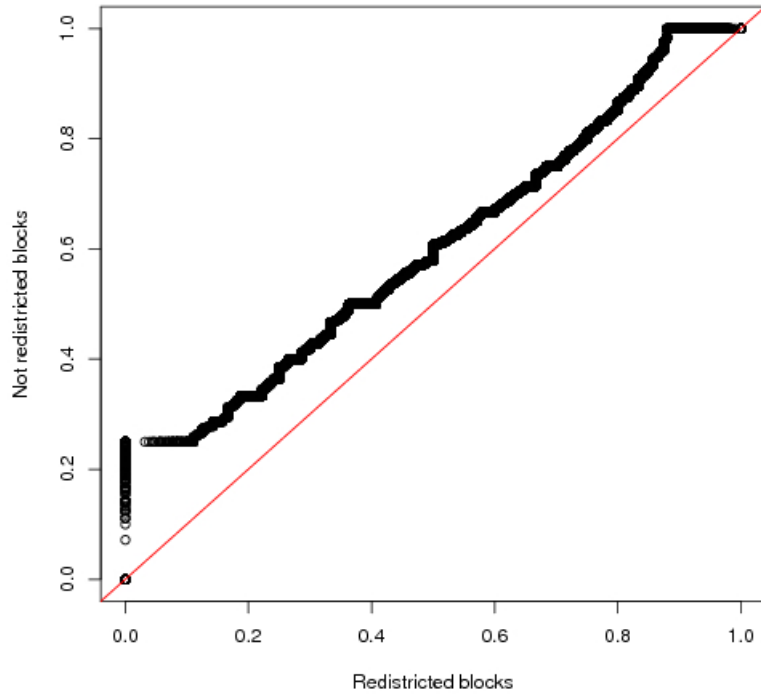


(a) CA 2000, unconditional

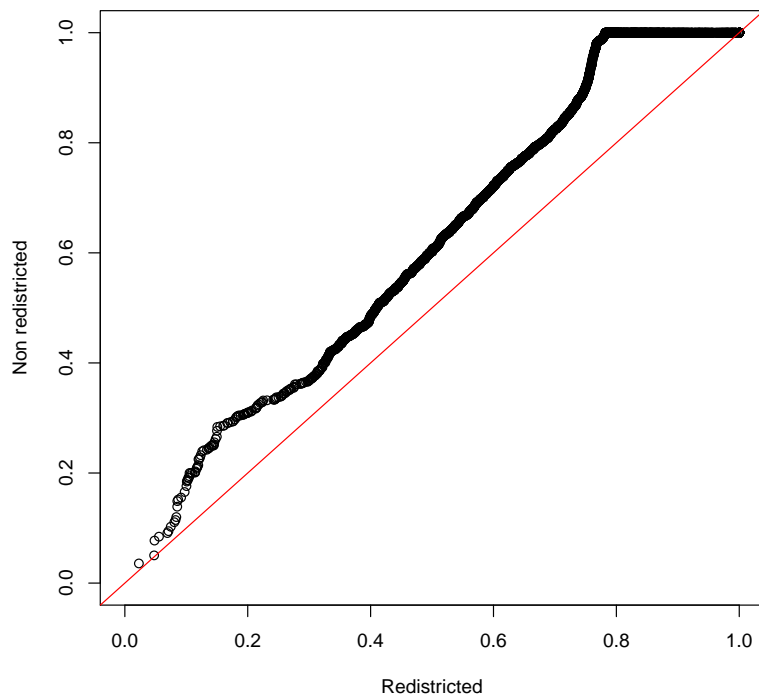


(b) TX 2002, unconditional

Figure 2: QQ Plots of Baseline Vote Share for Incumbent House Member  
California and Texas



(a) CA 2000, matched on 2000 presidential vote



(b) TX 2002, matched on 2000 presidential vote



Figure 3: QQ Plot for Placebo Test Conditioning on All Key Covariates

2002 Vote for the Incumbent House Member

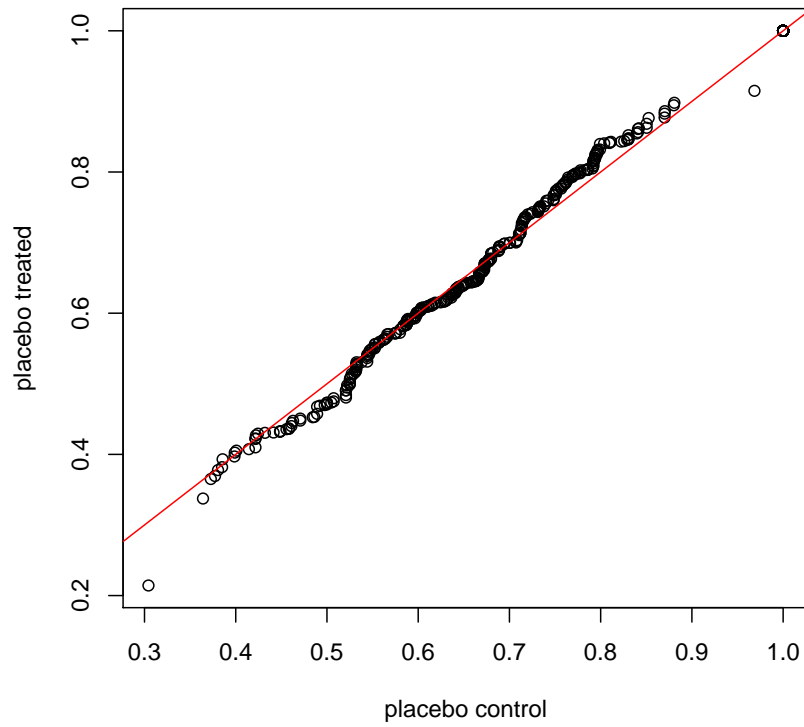
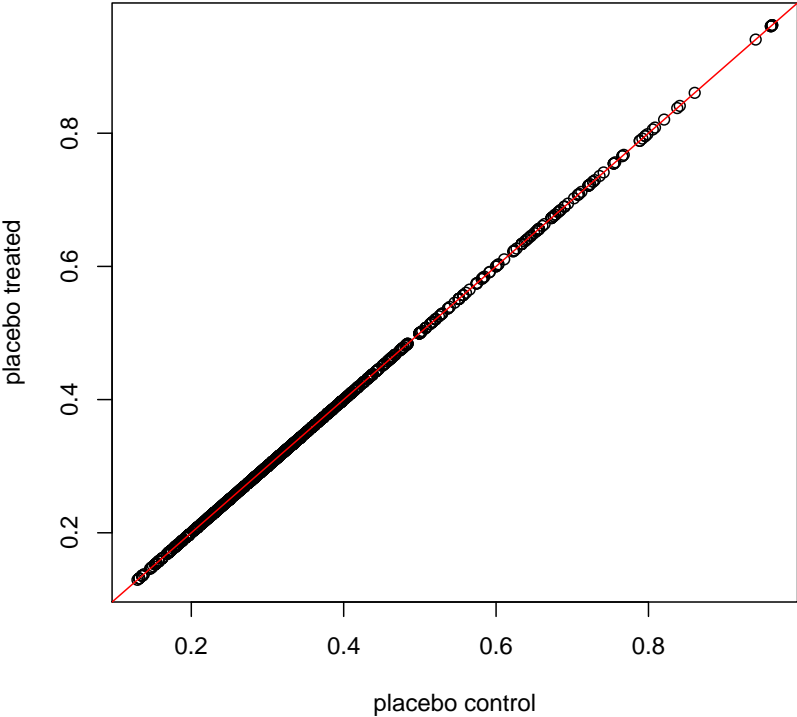
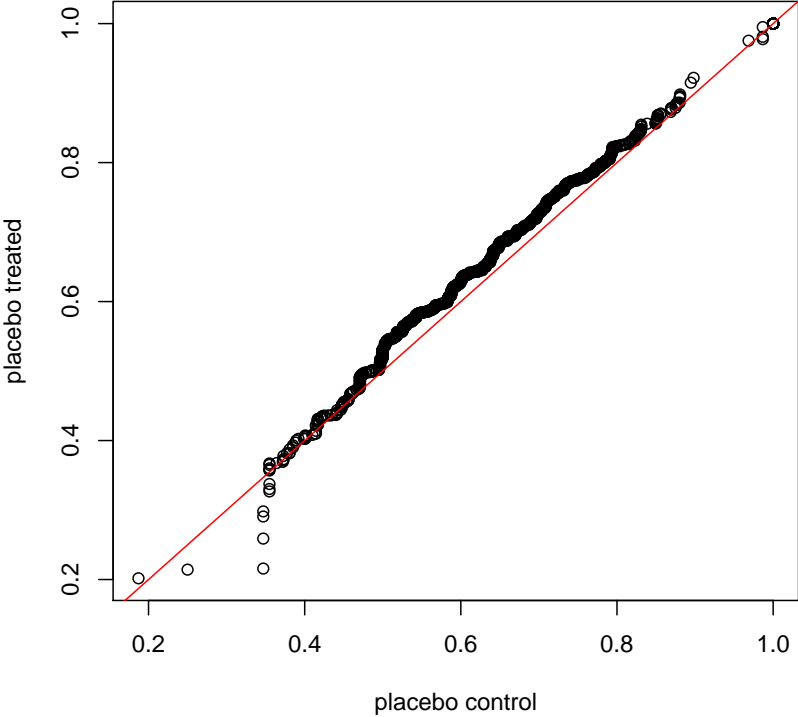


Figure 4: QQ Plots for Placebo Test Conditioning Only On Presidential Vote



(a) 2000 Presidential Vote (Baseline)



(b) 2002 Vote for the Incumbent House Member (Placebo Test)

Table 1: Placebo Tests for 2002 Incumbent Vote Share in Texas

	Estimate	95% CI		p-value
<b>Matching on all key covariates</b>				
(1) Incumbent vote '02	0.00245	-0.00488	0.00954	0.513
<b>Matching on past presidential vote only</b>				
(2) Incumbent vote '02	0.0237	0.0178	0.0294	0.000

Genetic Matching estimates of vote proportions. There are 474 observations for matching on all key covariates, and 2666 observations for matching on past presidential vote only.

Table A1: Percentage of VTDs affected by 2002 redistricting of congressional districts in Texas

		2002 Incumbent			Total
		Same Incumbent	Different Incumbent	Open Seat	
2000 Incumbent	Democrat	85.8 (3,750)	10.4 (455)	3.8 (165)	100.0 (4,370)
	Republican	56.7 (2,080)	19.0 (698)	24.3 (892)	100.0 (3,670)
	Total	72.5 (5,830)	14.3 (1,153)	13.1 (1,057)	100.0 (8,040)

Note: 2000 Incumbent refers to the incumbent who *won* the 2000 election for U.S. House member. 2002 Incumbent refers to incumbent who *runs* in the 2002 election for U.S. House member. Frequencies in parentheses.

Table A2: Percentage of VTDs affected by 2004 redistricting of congressional districts in Texas

		2004 Incumbent			Total
		Same Incumbent	Different Incumbent	Open Seat	
2002 Incumbent	Democrat	40.2 (1,717)	46.1 (1,970)	13.8 (589)	100.0 (4,276)
	Republican	46.2 (1,738)	38.3 (1,442)	15.5 (584)	100.0 (3,764)
	Total	43.0 (3,455)	42.4 (3,412)	14.6 (1,173)	100.0 (8,040)

Note: 2002 Incumbent refers to the incumbent who *won* the 2002 election for U.S. House member. 2004 Incumbent refers to incumbent who *runs* in the 2004 election for U.S. House member. Frequencies in parentheses.

Table A3: Percentage of blocks affected by 2002 redistricting of congressional districts in California

		2002 Incumbent			
		Same Incumbent	Different Incumbent	Open Seat	Total
2000 Incumbent	Democrat	59.2 (92,756)	34.7 (54,478)	6.1 (9,565)	100.0 (156,799)
	Republican	57.3 (72,915)	34.8 (44,238)	7.9 (10,088)	100.0 (127,241)
	Total	58.3 (165,671)	34.8 (98,716)	6.9 (19,653)	100.0 (284,040)

Note: 2000 Incumbent refers to the incumbent who *won* the 2000 election for U.S. House member. 2002 Incumbent refers to incumbent who *runs* in the 2002 election for U.S. House member. Frequencies in parentheses.

## References

- Abadie, Alberto and Guido Imbens. 2006. “Large Sample Properties of Matching Estimators for Average Treatment Effects.” *Econometrica* 74:235–267. 4
- Hill, Jennifer and Jerome P. Reiter. 2006. “Interval Estimation for Treatment Effects Using Propensity Score Matching.” *Statistics in Medicine* 25(13):2230–2256. 4
- McCullagh, Peter and John A. Nelder. 1989. *Generalized Linear Models*. New York: Chapman & Hall. 4
- Rosenbaum, Paul R. 2002. *Observational Studies*. 2nd ed. New York: Springer-Verlag. 4
- Texas Legislative Council, Research Division. 2000. *Guide to 2001 Redistricting*. Austin, Texas: Texas Legislative Council. 1, 4
- Texas Legislative Council, Research Division. 2001. *Data for 2001 Redistricting in Texas*. Austin, Texas: Texas Legislative Council. 1, 4