Expert Report for *Bethune-Hill v. Virginia State Board of Elections*

Maxwell Palmer

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I Statement of Inquiry

1. I have been asked to examine the composition of twelve House of Delegates districts under the map enacted by the Virginia General Assembly in HB 5005 (the "Enacted Map"). I was asked to examine racial predominance in the drawing of the district lines and racially polarized voting in these districts. In addition to my own analysis, I was asked to evaluate the opinions expressed by the other experts prepared for the 2015 trial before this court.

2. The twelve districts I was asked to examine are Districts 63, 69, 70, 71, 74, 75, 77, 80, 89, 90, 92, and 95 (the "challenged districts"). I restricted my analysis to these districts and, when necessary, those that border these districts or that exchanged population with these districts from the map used from 2001 to 2010 (the Benchmark Map).

II Summary of Analysis and Findings

3. There is substantial evidence that race predominated in the ways that VTDs, cities, towns, and census places were divided between challenged and non-challenged districts. With few exceptions, these areas were divided such that the portions allocated to challenged districts had a higher BVAP percentage than the portions allocated to non-challenged districts.

4. In the case of split VTDs, the divisions by race are especially strong evidence of racial predominance, as there was no party or electoral information available to the mapmakers when dividing these areas.

5. The movement of populations between districts highlights how HB 5005 selected Black voters in drawings the challenged districts. Black voters were moved out of non-challenged districts and into challenged districts at a higher rate than White voters or than Democratic voters. At the same time, White voters and Democratic voters were moved out of the challenged districts and into the non-challenged districts at a higher rate than Black voters.

6. Race had a much larger effect than party on the assignment of VTDs to challenged districts. Using a properly specified version of Dr. Katz's statistical model of VTD assignment, I find that there is a large and significant relationship between BVAP

and VTD assignment, but no such relationship between Democratic vote share and VTD assignment.

7. A 55% BVAP threshold was not necessary for the challenged districts to continue electing African-American candidates of choice. I find that the challenged districts would have continued electing the African-American candidates of choice by significant margins if BVAP were reduced to lower levels.

III Qualifications

8. I am currently an Assistant Professor of Political Science at Boston University. I joined the faculty at Boston University in 2014, after completing my Ph.D. in Political Science at Harvard University. I teach and conduct research on American politics and political methodology.

9. I have published academic work in leading peer-reviewed academic journals, including *The American Political Science Review* and *The Journal of Politics*. I have published work on compactness in redistricting in *The Ohio State University Law Review* and on traditional redistricting principles in *The Journal of Politics*. My curriculum vitae is attached to this report. My published research uses a variety of analytical approaches, including statistics, geographic analysis, and simulations.

10. I have served as a litigation consultant on numerous cases involving the Voting Rights Act, including redistricting, voter identification, and early voting. I assisted Dr. Ansolabehere in the research and analysis on multiple cases concerning congressional and state legislative districting, including: *Perez v. Perry*, in the U.S. District Court in the Western District of Texas (No. 5:11-cv-00360); *LULAC v. Edwards Aquifer Authority* in the U.S. District Court for the Western District of Texas, San Antonio Division (No. 5:12cv620-OLG,); *Harris v. McCrory* in the U. S. District Court for the Middle District of North Carolina (No. 1:2013cv00949); *Guy v. Miller* in the U.S. District Court for Nevada (No. 11-OC-00042-1B); *In re Senate Joint Resolution of Legislative Apportionment* in the Florida Supreme Court (Nos. 2012-CA-412, 2012-CA-490); and *Romo v. Detzner* in the Circuit Court of the Second Judicial Circuit in Florida (No. 2012 CA 412).

11. I am being compensated at a rate of $300/hour for my work in this case.

IV Data

12. I relied on the following primary data sources for this report.

1. 2010 United States Census data, provided by the Commonwealth of Virginia Division of Legislative Services (`http://redistricting.dls.virginia.gov/2010/Census2010.aspx`) and the U.S. Census Bureau.
2. Cartographic shape files, provided by the Division of Legislative Services (districts, VTDs) and the U.S. Census Bureau (census blocks, census places).
3. Precinct-level election results for elections held in Virginia from 2008 to 2014, collected from the Virginia Department of Elections (`https://apps.elections.virginia.gov/SBE_CSV/ELECTIONS/ELECTIONRESULTS/`).
4. Data files and code provided by Dr. Katz from his expert report in the preceding trial.

V Split Geographies

13. Respecting existing political boundaries is a core traditional redistricting principle. Here, I examine violations of this principle by identifying splits at the VTD and municipal levels.

14. 31 of the 32 VTDs split between challenged and non-challenged districts are divided such that the portion assigned to the challenged district has a higher BVAP than the portion assigned to the non-challenged district. On average, BVAP is 24% higher in the parts of each split VTD assigned to a challenged district. Because there is no party or electoral information below the VTD level, party, as defined by past electoral performance, cannot be a factor in these splits.

15. In the seven VTDs split *between* challenged districts, BVAP was allocated to meet the 55% BVAP threshold in each challenged district.

16. In addition, ten cities, four incorporated places, one military base, and ten unincorporated places are split between challenged and non-challenged districts. In all 25 places, the areas assigned to the challenged districts have a higher BVAP than the areas assigned to the non-challenged districts.

V.A Split VTDs

17. The Ansolabehere Report and the Hood Report both examine voting tabulation district (VTD) splits. The number of split VTDs increased from the benchmark map to HB 5005, and split VTDs are more common in the challenged districts than the remainder of Virginia (Ansolabehere, ¶60–65; Hood p.5).

18. I extend the VTD split analysis in the Ansolabehere Report by examining the differences in populations in each piece of a split VTD. Each VTD is made up of a number of census blocks.[1] The 2010 U.S. Census provides detailed population data at the census block level. I used GIS shape files of census blocks and VTDs to determine the VTD of every census block, and to calculate the composition of each piece of a split VTD. Figure 1 provides an example of one such VTD split in the Enacted Map, and how census block data can be used to consider race in splitting the VTD.

19. Election data is not available at the census block level. The lowest level of reported elections results are at the VTD level. Consequently, individual census blocks cannot be assigned to districts on the basis of voting data.[2] The only data available when splitting VTDs by census block is census data, which does not include any partisan or electoral data. The public redistricting data provided by the Commonwealth of Virginia did not include any partisan or electoral data below the VTD level.

20. To the best of my knowledge, the data below the VTD level that was available to the legislature when drawing the Enacted Map was limited to U.S. Census data. The census block data available from the Division of Legislative Services includes only counts of total population and voting age population (VAP) by race and ethnicity. The standard census form sent to every household collects data only on each individual's race, ethnicity, age, and sex (`https://www.census.gov/history/pdf/2010questionnaire.pdf`).

21. There are 39 VTDs split such that part of the VTD is in a challenged district and where both parts of the VTD are populated.[3] There are split VTDs in 11 of the 12 challenged districts; only District 92 avoids split VTDs. Table 1 lists the number

[1] No census block is split across multiple VTDs or districts.

[2] Election results can be disaggregated to blocks on the basis of total population or VAP. This does not provide any variation in party preferences across the VTD. Another approach would be to use a model based on demographics in the census block, but such models are restricted to census data, which excludes electoral data.

[3] This analysis excludes six VTDs that are split but where all of the population in the VTD resides in only one district.

of VTDs split by district. Ten challenged districts have VTDs that are split with a non-challenged district. Seven districts have VTDs that are split with another challenged district.

VTDs Split Between Challenged and Non-Challenged Districts

22. In this section I analyze the VTDs split between challenged and non-challenged districts in two ways. First, I identify every VTD split and show that 31 of the 32 VTDs split in this way are divided such that the higher BVAP portion of the VTD is assigned to a challenged district and the lower BVAP portion of the VTD is assigned to a non-challenged district. Second, I use a logistic regression model to estimate the probability that a census block within a split VTD will be assigned to a challenged district.[4] I show that there is a strong positive relationship between the BVAP of a census block in a split VTD and its assignment to a challenged district.

23. There are 32 VTDs split between a challenged and a non-challenged district where both parts of the VTD are populated.[5] Of these 32 split VTDs, 31 VTDs have a higher BVAP in the portion of the VTD assigned to a challenged district than the portion of the VTD assigned to a non-challenged district.

24. The average BVAP of the parts of a split VTD assigned to challenged districts is 24% higher than the average BVAP of the parts of the split VTDs assigned to non-challenged districts.

25. When a VTD is split, census blocks are assigned individually to districts.[6]

26. Among the VTDs that are split between a challenged district and a non-challenged district, a census block is significantly more likely to be assigned to a challenged district when its BVAP is higher. Figure 2 shows the positive relationship between BVAP and assignment to a challenged district. As the BVAP of a

[4] A logistic regression is a type of regression where the outcome (dependent variable) is binary rather than continuous. In this case, the outcome for each census block is either *assigned to challenged district* = 1 or *assigned to a non-challenged district* = 0.

[5] Three VTDs are split three ways, between one challenged district and two non-challenged districts: Courts Bldg and Rives in Prince George and Reservoir in Newport News.

[6] Census tracts or census block groups could also be assigned. However, it is common for the next level of geography after VTDs to be census blocks. For example, in the map viewer available from the Virginia Department of Legislative Services (at `http://redistricting.dls.virginia.gov/2010/RedistrictingPlans.aspx#map`), the only level of geography smaller than VTDs is census blocks. Similarly, the Department of Legislative Services provides census data at the VTD and block levels, but not at the block group or tract levels.

census block increases, the probability that it is assigned to a challenged district increases.

27. A second way to demonstrate the relationship between BVAP and assignment to a challenged district is through a logistic regression. This model estimates the probability that a census block will be assigned to a challenged district versus a non-challenged district, while recognizing that this probability must be bounded between zero and 100%. Table 2 presents the results of this analysis.[7] I first estimate this relationship for all of the challenged districts together (the top section of Table 2), and then separately for each district.

28. In Table 2, the *BVAP Coef.* column identifies the estimate of the relationship between census block BVAP and assignment to a challenged district. The larger the coefficient, the stronger the relationship. The five columns on the right-hand side of the table use this model to estimate the probability that a census block with a given BVAP will be assigned to a challenged district. For example, using the model with all districts together (the top row), a census block with a 25% BVAP has a 31% chance of being assigned to a challenged district, while a census block with a 75% BVAP has a 78% chance of being assigned to a challenged district. In other words, a block with 75% BVAP is 2.5 times more likely to be assigned to a challenged district than a block with 25% BVAP. A block with 100% BVAP is 6.6 times more likely to be assigned to a challenged district than a block with 0% BVAP (91% vs. 14%).

29. From Table 2, I conclude that there is a positive and statistically significant relationship between assignment to a challenged district and BVAP for all of the districts together and for models estimating block assignment in each challenged district individually. In short, this model indicates that VTDs that were split between challenged and non-challenged districts were divided by race.

30. The analysis below walks through the split VTDs in each region at issue in this case, and demonstrates that VTDs split between challenged and non-challenged districts are consistently divided by race: Black voters are placed in challenged districts while White voters are placed in adjacent non-challenged districts. The analysis further shows that, with respect to each challenged district, the higher the BVAP of a given census block, the more likely it is to be included in the district.

[7] The sample for this regression is every populated census block located in a precinct that is split between a challenged district and a non-challenged district and where both parts of the split VTD are populated (see Tables 3–6). N=2,146 census blocks. Observations are weighted by total population.

VTDs Split in the Dinwiddie-Greenville Area (Districts 63 and 75)

31. There are 12 VTDs split between a challenged district and a non-challenged district in the Dinwiddie-Greenville area. Table 3 lists these split VTDs and the populations and BVAP percentage for each part of the VTD.

32. There are four populated VTDs split between District 63 and a non-challenged district. In all four cases, the portion of the VTD assigned to District 63 has a higher BVAP than the portion assigned to the other districts. The difference is especially stark in Hopewell Ward 7. The VTD is split such that District 63 gets 29% of the population, but 51% of the BVAP. Figure 3 illustrates how Ward 7 was divided by race.

33. Using logistic regression, there is a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 63 relative to the census blocks assigned to Districts 62 and 64. A census block with 75% BVAP is 1.3 times more likely to be assigned to District 63 than a census block with 25% BVAP (see Table 2).

34. District 75 displays a similar pattern — among the eight populated VTDs split between District 75 and a non-challenged district, all of them reflect a higher BVAP in the portion of the VTD assigned to District 75 than the portion assigned to the other districts. The differences are especially large in Camp's Mill and Precinct 2-1 (see Table 3). In Camps Mill, the VTD is split such that District 75 gets 67% of the population, but 93% of the BVAP. In Precinct 2-1, the VTD is split such that District 75 gets 47% of the population, but 69% of the BVAP. Figure 3 illustrates how these two VTDs were divided by race.

35. Using logistic regression, there is a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 75 relative to the census blocks assigned to Districts 61 and 64. A census block with 75% BVAP is 1.8 times more likely to be assigned to District 75 than a census block with 25% BVAP (see Table 2).

VTDs Split in the Richmond Area

36. There are six VTDs split between a challenged district and a non-challenged district in the Richmond area. Table 4 lists these split VTDs and the populations

and BVAP percentage for each part of the VTD.

37. There are two populated VTDs split between District 69 and a non-challenged district. In both cases, the portion of the VTD assigned to District 69 has a higher BVAP than the portion assigned to the other districts. For instance, Precinct 410 is split such that District 69 gets 77% of the population, but 93% of the BVAP. Figure 4 illustrates how this VTD was divided by race.

38. There is also a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 69 relative to the census blocks assigned to Districts 27 and 68. A census block with 75% BVAP is 1.4 times more likely to be assigned to District 69 than a census block with 25% BVAP (see Table 2).

39. There is one populated VTD split between District 70 and a non-challenged district, Dorey VTD in Henrico County. The BVAP of the part of the VTD is District 70 is nearly double the BVAP of the part of the VTD in District 62 (see Table 4).

40. Table 2 further indicates a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 70 relative to the census blocks assigned to District 62. A census block with 75% BVAP is 1.3 times more likely to be assigned to District 70 than a census block with 25% BVAP.

41. There are three populated VTDs split between District 74 and a non-challenged district. In all three cases, the portion of the VTD assigned to District 74 has a higher BVAP than the portion assigned to the other districts. For instance, the Moody VTD is split such that District 74 gets 38% of the population, but 85% of the BVAP. Figure 4 illustrates how this VTD was divided by race.

42. Once again, there is a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 74 relative to the census blocks assigned to District 72. A census block with 75% BVAP is 1.3 times more likely to be assigned to District 74 than a census block with 25% BVAP (see Table 2).

VTDs Split in South Hampton Roads

43. There are nine VTDs split between a challenged district and a non-challenged district in South Hampton Roads. Table 5 lists these split VTDs and the populations and BVAP percentage for each part of the VTD.

44. There are two populated VTDs split between District 77 and a non-challenged

district. In both cases, the portion of the VTD assigned to District 77 has a higher BVAP than the portion assigned to the other districts. For instance, the John F. Kennedy VTD is split such that District 77 gets 75% of the population, but 96% of the BVAP. Figure 5 illustrates how this VTD was divided to capture almost all of the VTD's African-American population in District 77.

45. Table 2 reveals a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 77 relative to the census blocks assigned to Districts 76 and 78. A census block with 75% BVAP is 2.5 times more likely to be assigned to District 77 than a census block with 25% BVAP.

46. There is one populated VTD split between District 80 and a non-challenged district. Consistent with the other split VTDs, the portion of the VTD assigned to District 80 has a higher BVAP than the portion assigned to District 79.

47. There is also a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 80 and the census blocks assigned to District 79 (see Table 2). The 10 census blocks assigned to District 80 in the split VTD average 98% BVAP, and range from 93% to 100% BVAP. The 86 blocks assigned to District 79 in the split VTD average 57% BVAP.[8]

48. In District 90, the Aragona, Shell, and Reon VTDs (all in Virginia Beach) are split with Districts 83 or 85. In all three cases, the portion of the VTD assigned to District 63 has a higher BVAP than the portion assigned to the other districts. The Aragona VTD is split such that District 90 gets 25% of the population, but 50% of the BVAP. Figure 5 illustrates how this VTD was divided by race.

49. Once again, there is a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 90 relative to the census blocks assigned to Districts 83 and 85. A census block with 75% BVAP is 3.1 times more likely to be assigned to District 90 than a census block with 25% BVAP (see Table 2).

50. There are three populated VTDs split between District 89 and a non-challenged district. Granby and Titustown Center fit the pattern seen with almost every other VTD split between challenged and non-challenged districts: the portion of the VTD assigned to District 89 has a higher BVAP than the portion assigned to the other

[8] It is impossible to calculate the relative probability the a census block with 75% BVAP will be assigned to District 80 relative to the probability that a census block with 25% BVAP will be assigned, as the probability of the latter event is 0.

districts.

51. The Zion Grace VTD is the lone exception to the rule. There, the portion of the VTD assigned to District 89 has a lower BVAP than the portion assigned to District 79. Notably, the portion of Zion Grace assigned to district 89 is very small, and includes only 6% of the population of the VTD.

52. Even with the Zion Grace outlier, there is a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 89 relative to the census blocks assigned to Districts 79 and 100. A census block with 75% BVAP is 2.9 times more likely to be assigned to District 89 than a census block with 25% BVAP (see Table 2).

VTDs Split in North Hampton Roads

53. Where there are no split VTDs in District 92, its neighboring District 95 contains five (see Table 6).

54. In all five cases, the portion of the VTD assigned to District 95 has a higher BVAP than the portion assigned to the other districts. For instance, the Jenkins VTD is split such that District 95 gets 50% of the population, but 70% of the BVAP. Figure 6 illustrates how this VTD was divided by race.

55. Using logistic regression, there is a strong positive and statistically significant relationship between BVAP and the census blocks assigned to District 95 relative to the census blocks assigned to Districts 93 and 94. A census block with 75% BVAP is 3.0 times more likely to be assigned to District 95 than a census block with 25% BVAP (see Table 2).

56. Figure 7 maps the five split VTDs in District 95, with each census block shaded by BVAP. This figure depicts a pattern seen across the challenged districts: VTDs are consistently split along racial lines such that high BVAP areas are concentrated in the challenged districts and lower BVAP areas are allocated to adjacent non-challenged districts.

57. The data and figures make clear not only that race predominated over the principle of maintaining the integrity of VTDs in the challenged districts, but also that, with one exception, race explains every single VTD split between a challenged and non-challenged district.

VTDs Split Between Challenged Districts

58. There are seven VTDs split between two challenged districts, where both parts of the VTD are populated (see Table 7). In this section I analyze these seven VTDs and show that split VTDs were used to increase BVAP in the challenged districts that required additional BVAP to meet the 55% BVAP threshold.

59. Four of these VTDs are split between District 63 and District 75. None of these VTDs were plit in the Benchmark Map, and all were fully allocated to District 63.

60. These splits served to increase the BVAP of District 75 above 55%. Other configurations of these four VTDs that avoid such splits maintain equal population but drop BVAP in District 75 just below the threshold. For instance, If New Hope and Dinwiddie VTDs were fully allocated to District 63, and Rohoic and Edgehill were fully allocated to District 75, both districts would have near population equality (79,688 in District 63 and 79,209 in District 75). However, in District 75, the BVAP wold drop to 54.7%.

61. There are two VTDs split between challenged districts in the City of Richmond (see Table 7). VTD 505 is split between Districts 69 and 71, and VTD 703 is split between District 70 and 71. District 69 is 55.2% BVAP, District 70 is 56.4% BVAP, and District 71 is 55.3% BVAP.

62. VTD 505 is 15% BVAP. Under the Benchmark Map it was entirely in District 71. Under the Enacted Map, splitting this VTD was necessary to achieve the BVAP threshold in both Districts 69 and 71. Holding all else constant, if all of VTD 505 were allocated to District 69, BVAP in District 69 would drop to 54.4%. Likewise, if all of VTD 505 were allocated to District 71, BVAP in District 71 would drop to 54.5%. In short, including all of the VTD in either district would have added too many white voters to satisfy the 55% BVAP threshold.

63. VTD 703 is 89.9% BVAP. Under the Benchmark Map it was entirely in District 70. Under the Enacted Map, it is divided between Districts 70 and 71. Splitting this VTD was necessary to achieve the BVAP threshold in District 71. Holding all else constant, if all of Precinct 703 were returned to District 70, then BVAP in District 71 would drop to 54.9%.

64. There is one VTD split between challenged districts in the City of Norfolk (see Table 7). The Brambleton VTD is split between District 89 (which has a BVAP of 55.5%) and District 90 (which has a BVAP of 56.6%). Under the Benchmark Map, this VTD was entirely in District 90. The Brambleton VTD is 96% BVAP, and

contains 4,071 people. Splitting this precinct was necessary to achieve the BVAP threshold in District 89. Holding all else constant, if all of Brambleton VTD were returned to District 90, then BVAP in District 89 would drop to 54.7%.

65. Based on my analysis, split VTDs between any two challenged districts served to distribute black and white voters across both districts so that both of them could satisfy the 55% BVAP threshold.

V.B Splits of Municipality and Census Designated Places

66. Respecting municipal boundaries is a traditional redistricting principal.

67. In an analysis that was unchallenged by any other expert, Dr. Ansolabehere examined the divisions of counties and independent cities between the Benchmark and Enacted Maps (Ansolabehere ¶52, Table 3).

68. In this section I extend Dr. Ansolabehere's analysis to examine the division of census places in the challenged districts under the Enacted Map and how these places were divided by race.

69. Census places are a range of entities that include incorporated places (such as cites or towns) and census designated places, which are places that are identifiable by name.[9] There are four types of census places that are relevant to this case:[10]

1. C1: Incorporated Towns. "An active incorporated place that does not serve as a county subdivision equivalent." Example: Town of Kenbridge in Lunenberg County.
2. C7: Incorporated Cities. "An incorporated place that is independent of any county." Example: City of Richmond.
3. M2: Military Bases. "A military or other defense installation entirely within a place." Example: Fort Lee.
4. U1: Unincorporated Places. "A census designated place with an official federally recognized name." Example: Lakeside in Henrico County.

[9] `https://www.census.gov/geo/reference/gtc/gtc_place.html`

[10] Definitions below from the U.S. Census Bureau, `https://www.census.gov/geo/reference/class.html`. There are many other types of census places, but they are either not present in Virginia or not split in the challenged districts.

70. To analyze the division of smaller census places (towns, unincorporated places, and military bases), I used GIS analysis to match census blocks to census places.[11] To analyze splits of cities, I used the locality defined in the Virginia redistricting data.[12] Below, I examine all of the census places that are split with at least one challenged district.[13]

71. There are 25 census places (ten cities, four towns, one military base, and ten unincorporated places) that are divided between challenged and non-challenged districts.

72. The larger cities in the challenged districts are divided across multiple districts. Most of these cities, such as Virginia Beach, Norfolk, or Richmond, must necessarily be split across districts because their populations are too large to fit into a single district. While these splits are necessary, there are many different ways that they can be divided. Across the four regions, there are 10 cities split between one or more challenged districts and one or more non-challenged districts. In all ten cities, every area of a city assigned to a challenged district has a higher BVAP than every area of that city assigned to a non-challenged district. There is not a single case of a city split where a non-challenged district gets a higher BVAP area of a city than a challenged district.

73. The same pattern is seen in splits of unincorporated places: across all ten places, the areas allocated to challenged districts have significantly higher BVAP than the areas in non-challenged districts.[14]

Place Splits in the Dinwiddie-Greenville Area

74. Table 8 lists the incorporated places (Class C1) split between challenged and non-challenged districts. All four of these splits divide towns between District 75 and Districts 61 or 64. In all four cases, the towns are split such that the areas with higher BVAP are assigned to District 75, and the areas with lower BVAP are

[11] A small number of census blocks (6 in the split geographies discussed below, totaling 58 people) are split across two census places; I exclude these blocks from the analysis.

[12] For example, all of the census blocks assigned to the city of Richmond are given the locality "Richmond" in the data provided by the state. This information is not provided for smaller census places, however, necessitating the GIS matching.

[13] I ignore any census place splits where part of the split has zero population.

[14] The only exception to this pattern is the seven people in Sandston CDP allocated to district 70.

assigned to Districts 61 or 64. Figure 8 maps these towns and illustrates how they are divided by race.

75. There are two split cities in the Dinwiddie-Greenville area, Franklin and Hopewell (Table 9). Franklin is split between districts 75 and 64. The area of the city assigned to district 75 has a BVAP that is more than four times higher than the area assigned to district 64. Hopewell is split between districts 63 and 62. The area assigned to district 63 has a BVAP that is more than three times higher than the area in district 62. Franklin has a total population of 8,582, and Hopewell a total population of 22,591. Given that the target of a House district is 80,010, it was not necessary to split either city for the purposes of achieving equal population. Figure 9 maps the division of these cities.

76. There is one split military base, Fort Lee in Prince George County, which is split between districts 63 and 62, such that the portion of the base in District 63 has a BVAP that is 1.3 times higher than the portion of the base assigned to District 62 (Table 10). Figure 10 maps the division of Fort Lee by race.

77. There are three unincorporated places that are split between challenged and non-challenged districts in the Dinwiddie-Greenville area (Table 11). In all three places, the areas allocated to challenged districts have significantly higher BVAP than the areas in non-challenged districts. Figure 11 maps these divisions by race.

Place Splits in the Richmond Area

78. The City of Richmond is divided between challenged districts 69, 70, 71, and 74, and non-challenged District 68 (Table 12). Overall, the portions of Richmond in the challenged districts have a collective BVAP of 56.2% compared to a BVAP of 6.8% in the portion assigned to the non-challenged districts. Figure 12 maps the division of the City of Richmond.

79. There are seven unincorporated places that are split between challenged and non-challenged districts in the Richmond area (Table 13). In all seven places, the areas allocated to challenged districts have significantly higher BVAP than the areas in non-challenged districts.[15]

[15] The only exception to this pattern is the seven people in Sandston CDP allocated to district 70.

Place Splits in South Hampton Roads

80. There are five cities in South Hampton Roads split between challenged and non-challenged districts (Table 14). All five cities are split such that the portions in challenged districts universally have substantially higher BVAP than the portions in non-challenged districts. Overall, the areas of these five cities in challenged districts have BVAP of 56.8% compared to BVAP of 20.0% in the portions of the five cities assigned to the non-challenged districts.

Place Splits in North Hampton Roads

81. There are two cities in North Hampton Roads split between challenged and non-challenged districts (Table 15). Both cities are split such that the portions in challenged districts universally have substantially higher BVAP than the portions in non-challenged districts. Overall, the areas of these two cities in challenged districts have BVAP of 60.4% compared to BVAP of 26.1% in the portions of the five cities assigned to the non-challenged districts. The division of the City of Hampton is especially noteworthy; 82% of the BVAP is allocated to Districts 92 and 95. Figure 13 maps the division of the City of Hampton

82. The tables and figures in this section make clear that race predominated over the principle of keeping political subdivisions whole. Cities, towns, unincorporated places, and even a military base were all divided according to race.

VI Population Shifts

83. Dr. Ansolabehere analyzed population flows between districts and concluded that there were racial differences in the areas moved into and out of the challenged districts. In this section, I extend Dr. Ansolabehere's analysis by illustrating the population flows between districts and analyzing the aggregate racial effects of these population movements.

84. Table 16 lists the districts that transferred population to a challenged district under the HB 5005. With the exception of District 100, discussed below, the 15 other non-challenged districts that transferred population to challenged districts all

transferred portions of the district that had a higher BVAP than the district as a whole.

85. Table 17 lists the challenged districts that transferred population to a non-challenged district under HB 5005, and the population and BVAP of the areas moved out of the district and into non-challenged districts. All nine challenged districts that transferred population to a non-challenged district transferred portions of the district that had a lower BVAP than the district as a whole.

Population Shifts in the Dinwiddie-Greensville Area

86. As depicted in Figure 14, five non-challenged districts transferred population to challenged districts in the Dinwiddie-Greensville area. In all five cases, the areas sent to the challenged districts had higher BVAP than the areas that were not moved.

Population Shifts in the Richmond Area

87. The population shifts in the Richmond area are complex. Each challenged district exchanged populations with five to seven other districts. Figure 15 shows all of the population flows for the full area.

88. Three non-challenged districts transferred population to challenged districts in the Richmond area. In all three cases, the areas sent to the challenged districts had higher BVAP than than the areas that were not moved.

89. Three challenged districts transferred population to non-challenged districts in the Richmond area. In all three cases, the areas sent to the non-challenged districts had lower BVAP than the areas that were not moved.

90. Under the Benchmark Map, District 70 has a population of 79,380 and a BVAP of 61.8%. It did not require any changes to its composition to be sufficiently close to population equality or reach the targeted BVAP of 55%. Despite this, District 70 was substantially reconfigured.

91. The population transfer between District 68 and District 71 is particularly noteworthy: roughly equal-sized populations were moved from 68 to 71 and from 71 to 68, but with a 10% difference in BVAP between the two groups. This change was not necessary for population equality, but was necessary to increase the BVAP of

District 71 above 55%. Without this change, District 71 would have had a BVAP of 54.8%. After this change, District 71 had a BVAP of 55.3%.

Population Shifts in South Hampton Roads

92. As in the Richmond area, the population shifts in South Hampton Roads are complex. Figure 16 shows all of the population flows for the full area.

93. Six non-challenged districts transferred population to challenged districts in the South Hampton Roads. In five of the six cases, the areas sent to the challenged districts had higher BVAP than the areas that were not moved. The only exception to this pattern is District 100, which transferred 628 people with 10.1% BVAP to District 89, and received 3,593 people with 22.9% BVAP from District 89. District 100 was uniquely limited in its possible population swaps to achieve population equality due to its position in the Eastern Shore.

94. Four challenged districts transferred population to non-challenged districts in South Hampton Roads. In all four cases, the areas sent to the non-challenged districts had lower BVAP than the areas that were not moved.

Population Shifts in North Hampton Roads

95. Three non-challenged districts transferred population to challenged districts in North Hampton Roads. In all three cases, the areas sent to the challenged districts had a higher BVAP than the areas that were not moved.

96. One challenged district transferred population to a non-challenged district in North Hampton Roads. The area sent to the non-challenged district had a lower BVAP than the area that were not moved.

VI.A Net Effects of Population Shifts

97. The preceding sections illustrated population shifts across challenged and non-challenged districts and between challenged districts. Here, I examine the aggregate effects of all of these shifts at the district level.

98. For every district involved in a population shift with a challenged district, I calculate four quantities. Comparisons of these quantities can help us identify racial

patterns in moving populations.

1. The percentage of the total population moved out the district.
2. The percentage of the Black Voting Age Population moved out of the district (BVAP).
3. The percentage of the White Voting Age Population moved out of the district (WVAP).
4. The percentage of Democratic voters moved out of the district.[16]

99. 16 non-challenged districts sent population to challenged districts under the Enacted Map. Table 18 lists these districts and the rates of population movement from each district to any challenged district.

100. Across 15 of the 16 districts (all except District 100), the rate at which the Black voting age population was moved out of the districts and into challenged districts exceeded the rate at which the population of the district as a whole was moved. Similarly, Black voters were moved out of the districts and into challenged districts at higher rates than White voters. Finally, Black voters were moved out of the districts and into challenged districts at a higher rate than Democratic voters.

101. For example, consider Benchmark District 94. District 94 moved 10.7% of its total population into District 95. District 94 moved 24.5% of its BVAP into District 95, more than double the rate of the general population, but only 3.6% of its WVAP. Thus, Blacks were nearly seven times more likely to be moved into District 95 than Whites. Finally, District 94 moved 12.2% of its Democratic voters into District 95. In other words, Blacks were twice as likely to be moved into District 95 than were Democrats.

102. The only exception to this pattern is in District 100, where 0.9% of the total population (628 people) under the Benchmark Map was moved to District 89. Unlike the other districts discussed above, Benchmark District 100 was uniquely constrained in how it could transfer population because it was located in the Eastern Shore.

103. The shifts from challenged to non-challenged districts, meanwhile, reflect a starkly different pattern. Table 19 shows the same quantities as above for the 11 challenged districts that transferred population to non-challenged districts. (District

[16]Democratic vote share is calculated as the average of the Democratic share of the two-party vote in the 2008 presidential and the 2009 gubernatorial elections.

95 did not transfer any population to a non-challenged district.)

104. Across all eleven districts, the rates at which Blacks are transferred out of the challenged districts are lower than the rates at which population as whole are transferred out. Whites are much more likely to be transferred out than Blacks. Similarly, Democrats are more likely to be transferred out of the challenged districts to non-challenged districts than Blacks. The effects of these transfers is that Blacks are retained in the challenged districts at higher rates than either Whites or Democrats.

105. For example, consider Benchmark District 80. District 80 sent 14,057 people to District 79. 19.9% of the total population was moved out of District 80 to District 79, but only 11.5% of the Black VAP was moved out. 33.2% of Whites were moved out of the district, roughly three times the rate of Blacks. 17.2% of Democrats were moved out of the district, 1.5 times the rate of Blacks.

106. Figure 18 illustrates these patterns. The left two graphs plot the percentage of BVAP moved out of non-challenged districts to challenged districts, against WVAP moved out (top) and Democrats moved out (bottom). Each point represents one district. With the exception of the bottom leftmost point, District 100, all of the points fall above the blue line representing an equal relationship between the two variables. This illustrates that Blacks are moved out of these districts at higher rates than Whites (top) or Democrats (bottom). The right two graphs plot the same measures, but for populations moved out of challenged districts into non-challenged districts. Here, all the points fall below the blue line, showing that Whites and Democrats are moved out of challenged districts at higher rates than Blacks.

VII Race vs. Party Analysis

107. Dr. Ansolabehere (at ¶79–94, ¶104–129, Tables 6, 7, 8, 9, 10, 11 and 12) presented seven different analyses demonstrating that race, not party, was the predominant factor in the drawing of the boundaries of the challenged districts. Only one such analysis, using multiple regression, was disputed by Dr. Katz (Katz 4.3). All other analyses of race vs. party predominance in Dr. Ansolabehere's report were undisputed.

108. In this section I use statistical models to measure and compare the effects of race and party on the assignment of VTDs to challenged districts. I show that Dr. Katz's multiple regression analysis is flawed and that, upon correcting the error,

produces the same conclusions as Dr. Ansolabehere's analysis.

109. Dr. Ansolabehere (¶115–122; Tables 11–12) and Dr. Katz (pp.19–20; Table 1) both use multiple regression analysis to measure the effects of race and party on VTD assignments using a statewide analysis that includes every VTD in Virginia. Both experts estimate the probability that a VTD is assigned to a challenged district as a function of the VTD's BVAP and Democratic vote share, using a statewide model that includes every VTD in the state.

110. Both Dr. Ansolabehere and Dr. Katz estimate a linear probability model (ordinary least squares).[17]

111. Dr. Ansolabehere and Dr. Katz measure Democratic vote share slightly differently. Dr. Ansolabehere estimates his models with three different measures of Democratic vote share: the average Democratic vote share across the 2008 presidential, 2012 presidential, and 2012 U.S. Senate elections; the 2008 presidential election alone; and the 2013 gubernatorial election alone. All three variables produce similar results. Dr. Katz estimates his models using the average of the Democratic vote share in the 2008 presidential and 2009 gubernatorial elections.[18]

112. Both experts include a variable indicating whether the VTD was in a challenged district under the Benchmark Plan.

113. Dr. Ansolabehere weights each observation by the VTD's population. Dr. Katz does not weight observations in his analysis.

114. Dr. Katz claims that the Ansolabehere model is "fundamentally misspecified" for neglecting to control for the distance between the VTD and the challenged district. Since VTDs that are farther away from a benchmark challenged district are less likely to be included in the enacted challenged district, Dr. Katz measures the distance from the centroid (geographical center) of each VTD to the centroid of each benchmark challenged district. He adds twelve variables to his models, measuring the distance from each VTD to each challenged district.

115. Dr. Ansolabehere finds that race had a much larger effect on the assignment to a challenged district than Democratic vote. Dr. Katz, with the addition of distance

[17]Dr. Katz criticized the use of ordinary least squares in his analysis of racial polarization because such a model could produce probability estimates that were below zero or above one. The model used here by both Dr. Ansolabehere and Dr. Katz has the same feature, but here Dr. Katz does not raise this objection.

[18]Dr. Katz criticized use of statewide or federal elections in his analysis of racial polarization. In this part of his report, however, he uses statewide elections without comment.

variables, finds that the effects are both small and nearly equal.

116. For simplicity in comparing results across models, I use Dr. Katz's data for the following analysis, including his measurement of distance between VTDs and challenged districts and his measure of average Democratic vote. All differences between Dr. Katz's model and the other models I discuss below are due to differences in the models, not discrepancies in data or measurement of variables.

117. I begin by replicating the Ansolabehere model using the Katz data (Table 20, Model 1). The results are slightly different than those reported by Dr. Ansolabehere (Ansolabehere Table 12, column 2), due to differences in the sample and the measurement of average Democratic vote share. However, the coefficients are very similar and the interpretation is the same: Race, not party, is the predominant factor in the assignment of VTDs to challenged districts.

118. The second column of Table 20 replicates Dr. Katz's model (Table 1, Specification 1) exactly.

119. While the variables (with the exception of controls for distance) are exactly the same in both models, there is a critical difference between Dr. Ansolabehere's model and Dr. Katz's model: the weighting of observations. Dr. Ansolabehere weights each VTD by its total population, while Dr. Katz neglects to do so. This is an important difference. VTDs in the sample range in population from 3 to 23,502 people with a median of 2,996 people. In the Ansolabehere model, a VTD with a population of 5,000 people is 100 times more important to the estimate of the result than a VTD with 50 people. In the Katz model these two VTDs are equally important. When drawing district lines, the assignment of a VTD with 5,000 people is more consequential than the assignment of a VTD with 50 people. Weighting each VTD by its population recognizes this important fact. Without weights, Dr. Katz's model is missing an inportant component.

120. When population weights are added to Dr. Katz's model, the results are drastically different. Model 3 in Table 20 presents the results. The coefficients are very similar to those in the Ansolabehere model (Model 1), and the interpretation of both models is the same. When observations are properly weighted, Dr. Katz's twelve distance control variables do not have a meaningful effect on the model results. The coefficient on BVAP is twice as large as in the unweighted model, and substantially similar to Dr. Ansolabehere's estimate. The coefficient on Democratic vote share is less than half the size as in the unweighted model, and not statistically significant. The difference between the effect of BVAP and the effect of Democratic vote share on assignment to a challenged district is large and statistically significant. The

conclusion from this model is that race, not party, is the predominant factor in the assignment of VTDs to challenged districts.

121. A second problem with Dr. Katz's model is that he simultaneously controls for the distance of each VTD to all twelve challenged districts. This produces illogical estimates for the effect of distance in the results. Table 21 includes the coefficients from each of the twelve distance measures that Dr. Katz includes in his benchmark model.[19] We should expect that the relationship between assignment to a challenged district and distance from that district to be negative; the farther away a VTD is from a district, the less likely it should be that it is assigned to it (Katz p.19). In the results from Dr. Katz's baseline model, some of the coefficients on distance are strongly negative, as expected, but others, such as the coefficients on distance from districts 63, 69, 90, 77, 92, 71, and 74, are positive and statistically significant. The model predicts that holding BVAP and Democratic vote share constant, VTDs that are far away from these districts are more likely to be assigned to a challenged district than VTDs that are close to them. This confusing result stems from the inclusion of all twelve distance measures in the model.

122. To address this problem, I use an alternate measure of distance: the distance from each VTD to the nearest challenged district.[20] Model 4 in Table 20 presents the results (unweighted). The results are significantly closer to the Ansolabehere model than to Dr. Katz's benchmark model, and the difference between the effect of BVAP and Democratic vote share is large and statistically significant. Additionally, the coefficient on "Distance to Closest Challenged District" is negative and statistically significant. Holding everything else equal, the farther away a VTD is from its closest challenged district, the less likely it is to be assigned to a challenged district. This is the logical result we should expect from a variable measuring distance.[21]

123. Model 5 in Table 20 addresses both the weighting problem and the distance measurement problem by using the "Distance to Closest Challenged District" measure and weighting each VTD by its total population. The results of this model are

[19] Dr. Katz omits the coefficients on the distance from each district variables in his report (Table 1). I include these coefficients here by exactly replicating Dr. Katz's analysis.

[20] This is simply the minimum of Dr. Katz's twelve distance measures.

[21] I also considered other alternative measures of distance, such as the the inverse of the distance to the closest challenged district. The results of these models are similar to the results in Models 5 (unweighted) and 6 (weighted). Another alternative approach to this problem is to drop some of the distance variables for districts that are very close together. If for example, we only control for distance from District 63, 70, 80, and 92 (one for each cluster of challenged districts), the effect of race is positive, statistically significant, and significantly larger than the effect of party in both weighted and unweighted models.

extremely close to the Ansolabehere model. The results show that the effect of race is much larger than that of party in the assignment of VTDs to challenged districts. While the effect of race is large and statistically significant, there is no substantive effect of Democratic vote share on the assignment of a VTD to a challenged district.

124. In short, the difference between Dr. Katz's results and Dr. Ansolabehere's results is due to errors in Dr. Katz's model. When these errors are corrected, Dr. Katz's results, including measures of the distance between VTDs and challenged districts, are similar to the Ansolabehere model.

125. When the Dr. Katz's model is corrected, the results and conclusions match those of Dr. Ansolabehere. BVAP has a much larger effect on assignment to a challenged district than Democratic vote share. Race predominates over party in the assignment of VTDs to challenged districts.

VIII Evaluating the 55% BVAP Threshold

126. Under HB 5005, every challenged district has a BVAP of 55% or greater. In this section, I analyze the necessity of such a threshold for the creation of districts where African-American voters are able to elect their candidates of choice.

127. Table 22 lists the populations, BVAP, and Democratic vote share of each challenged district, under the Benchmark Map and under HB 5005. With the exception of District 74, which was overpopulated by 143 people, and District 70, which was underpopulated by 630 people, all of the districts required additional population under the new map.

128. Under the Benchmark Map, every district except for Districts 71, 80, and 89 was at least 55% BVAP.

129. Every challenged district was majority Democratic in recent elections at the time of the redistricting.[22] The most competitive district was District 75, which averaged 56% Democratic vote under the Benchmark Map. In all other Districts, Democrats won with at least 62% of the two-party vote.

130. I use ecological inference on statewide election results in each challenged district to determine the candidates of choice of African-American and White voters, and

[22] Democratic vote share is calculated as the average of the Democratic share of the two-party vote in the 2008 presidential and the 2009 gubernatorial elections.

the level of support for candidates of each party of each racial group.

131. Dr. Ansolabehere uses the Ecological Regression (ER) method to estimate racial voting patterns. Dr. Katz uses the Ecological Inference (EI) method. Both methods seek to answer the same question: given that we only observe election results in aggregate, at the precinct level, and that we do not observe individual vote choice, how do we estimate differences in vote choices across race? If we could observe the actual votes and race of each voter, such a problem would be trivial. Without such data, these methods seek to identify a relationship between the racial makeup of precincts and election results in those precincts.

132. Both ecological regression and ecological inference are common methodological techniques used in redistricting cases to estimate racial voting patterns. The Court expressed a preference for ecological inference over ecological regression in its memorandum opinion. Accordingly, I use ecological inference here.

133. Statewide elections allow for analysis across all of the challenged districts. Dr. Katz restricts his ecological inference analysis to the seven challenged districts that had contested races for House of Delegates between 2007 and 2013. Such a restriction makes it impossible to evaluate racial voting patterns in the other districts and excludes the majority of information we have about voting behavior in the challenged districts. While we are ultimately interested in voting patterns in House of Delegates elections, statewide elections serve as a useful proxy.

134. Statewide elections are highly correlated with House of Delegates elections. Figure 19 illustrates the relationship between the average Democratic vote share in the 2008 presidential and 2009 gubernatorial elections and the average Democratic vote share in House of Delegates elections, for the seven districts with contested House of Delegates elections between 2007 and 2013. Each district is graphed separately. On each graph, each dot represents a precinct in the enacted version of the district. The strong positive correlation between average statewide elections vote and average House of Delegates elections vote is illustrated by the pattern of the dots and the red line: a precinct's Democratic vote share in statewide elections increases with that precinct's Democratic vote share in House of Delegates elections.

135. I estimate ecological inference models for each of the challenged districts under the Enacted Map using results from the 2008 presidential election, the 2009 gubernatorial elections, and the average results of these two elections. For each election, I calculate the two-party vote share for each party, and estimate support for each party by Blacks, Whites, and all other groups combined using the HB 5005 district

boundaries. Figures 20, 21, and 22 and Table 23 presents the results of this analysis.

136. Across all twelve districts, African-Americans vote cohesively for the Democratic candidate. The average level of African-American support for the Democratic candidate across the twelve districts is 95%, based on the model estimated using the average of the two elections. From these analysis, it is clear that Democratic candidates are the African-American candidates of choice.

137. The ecological inference models show significantly different levels of support for Democratic candidates from White voters. White support for Democrats ranges from 16% in District 75 to 70% in District 71, and averages 40% using the average of the two elections. District 71, had the lowest BVAP of the challenged districts under the Benchmark Map at 46.3% (and was the only challenged district without a majority BVAP), but had a large Democratic majority that included high levels of Democratic support among White voters.

138. Overall, Table 22 shows that the African-American preferred candidates were winning by large margins in all of the challenged districts *except* District 75. Adding additional African-American population to these districts was not necessary to preserve safe electoral margins for African-American preferred candidates. If all of the population needed in each underpopulated district were made up with White voters who unanimously voted against the African-American preferred candidates, the African-American preferred candidates would still win by large margins in every district except District 75 (see Table 24).

139. A second way to examine the necessity of the 55% BVAP threshold in the challenged districts is to use the ecological inference results to estimate the Democratic vote share (the vote share of the African-American preferred candidate) at different levels of BVAP. I calculate this using the ecological inference estimates from the average of the 2008 presidential and 2009 gubernatorial elections. Holding the Other voting age population (OVAP) constant, I calculate the White voting age population (WVAP) as a function of different levels of BVAP. I multiply each population share by the group's coefficient from the ecological inference model to find the vote shares for each party.

140. For example, consider the Democratic vote share in District 89, which was 52.5% BVAP under the Benchmark Map and increased to 55.5% BVAP under HB 5005. The average of the EI estimates is that 94.6% of African American voters supported the Democratic candidate, 53.7% of White voters supported the Democratic candidate, and 59.1% of voters of other races supported the Democratic candidate. District 89 is 6% OVAP. Holding OVAP constant, if District 89 were 50% BVAP, it

would be 44% WVAP. Multiplying the size of each racial group by their respective Democratic vote shares, we would expect Democratic candidates to win around 74% of the vote. If District 89 were 45% BVAP, 6% OVAP, and 49% WVAP, we would expect Democratic candidates to win around 72% of the vote.

141. Table 25 presents the results of this analysis for all of the challenged districts. All challenged districts would elect the African-American candidate of choice at 55% or 50% BVAP. At 45% BVAP, all challenged districts would elect the African-American candidate of choice with the exception of District 75, where the lower average vote share at 45% BVAP is estimated at 50.4%, but the lower bound of the confidence interval is below 50%.[23]

142. These analyses show that, given the cohesiveness of African-Americans as a voting block and the lack of consistent polarization among White voters, 55% BVAP is not necessary for the African-American candidates of choice to win elections.

IX Conclusions

143. Four different analyses demonstrate that race predominated in the drawing of the challenged districts. The results from examining (1) the division of VTDs, (2) the division of cities, towns, and places, (3) population flows between districts, and (4) the assignment of VTDs all provide substantial evidence of racial predominance.

144. VTDs were split in service of increasing BVAP in challenged districts relative to non-challenged districts and served to satisfy the 55% BVAP threshold in all challenged districts. 31 of the 32 VTDs that are divided between challenged and non-challenged districts are split such that the area assigned to the challenged district has a higher BVAP than the area assigned to the non-challenged district. VTDs cannot be divided on the basis of party or election results because such information is not available below the VTD level.

145. Splits of cities, towns, and other places reveal the same pattern: deviations from the traditional redistricting principle of preserving political communities were

[23]This analysis is not intended to suggest that the BVAP of the challenged districts should have been 50% or 45%, nor is intended to establish the minimum BVAP required to allow African Americans the ability to elect their candidates of choice. It simply demonstrates that an individualized analysis of each of the challenged districts indicates that a 55% BVAP threshold is unwarranted in at least 11 of them.

in service of concentrating Black voters in challenged districts.

146. Black voters were moved from non-challenged to challenged districts at a higher rate than White voters or Democratic voters. Conversely, Black voters were moved out of challenged districts to non-challenged districts at a lower rate than White voters or Democratic voters. These shifts in both directions demonstrate that race was the predominant factor in moving populations between districts.

147. Statistical models of the assignment of VTDs to challenged and non-challenged districts show that VTDs with higher BVAP were more likely to be assigned to challenged districts, and that political party does not have a significant effect. Differences in this analysis between Dr. Ansolabehere and Dr. Katz are due to problems with Dr. Katz's model. When these issues are corrected, all of the models show that race, not party, was a large and significant factor in VTD assignment.

148. The 55% BVAP threshold was not necessary to enable African-Americans to elect their candidates of choice. Two individualized analyses, which examine electoral performance of each district, both show that even if the BVAP threshold made sense in District 75, it was not required in the remaining 11 districts.

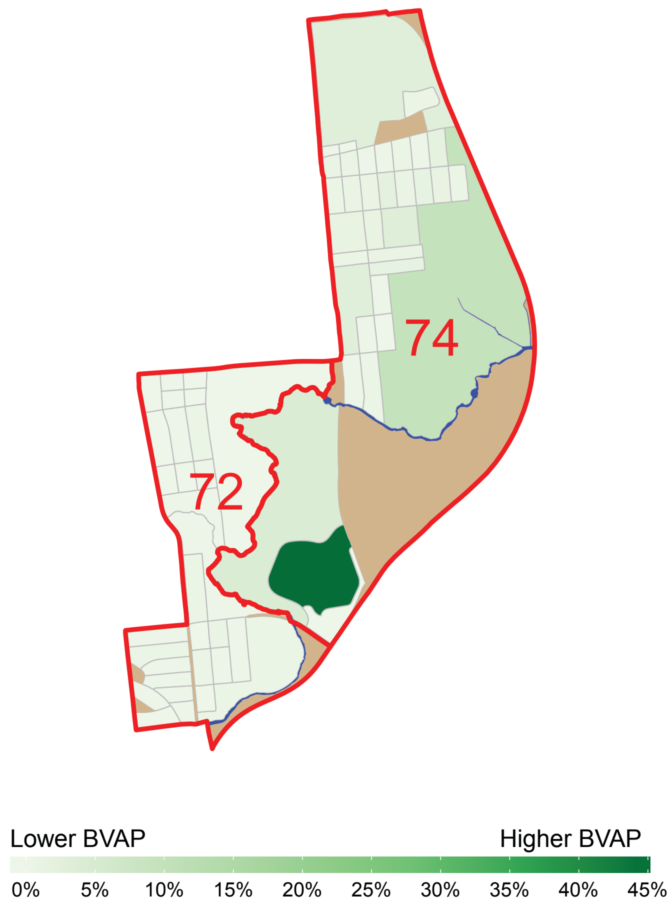


Figure 1: Map of Belmont VTD in Henrico County, Split Between Districts 74 and 72

This figure maps the Belmont VTD in Henrico County, which is split between District 74 (57.2% BVAP) and District 72 (13.4% BVAP). Each census block is shaded based on the share of the Black Voting Age Population of the VTD residing in the block. The division of the VTD is identified with the red line. The left part of the VTD, assigned to District 72, contains 1,239 people and is 6.1% BVAP. The right part of the VTD, assigned to District 74, contains 2,190 people and is 46.0% BVAP. Unpopulated areas shaded in tan (land) or blue (water).

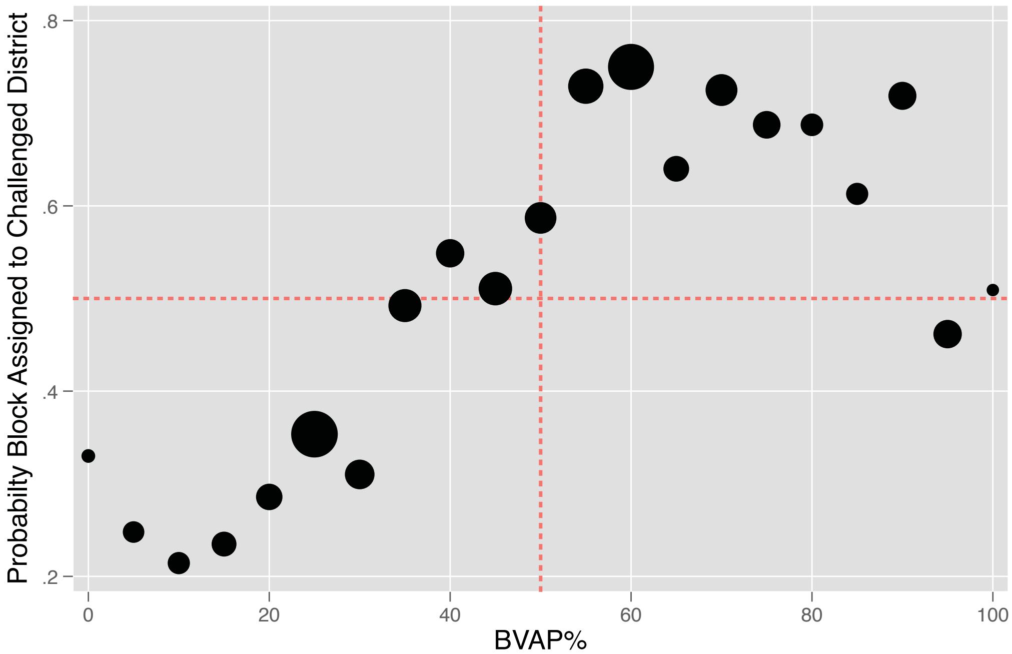
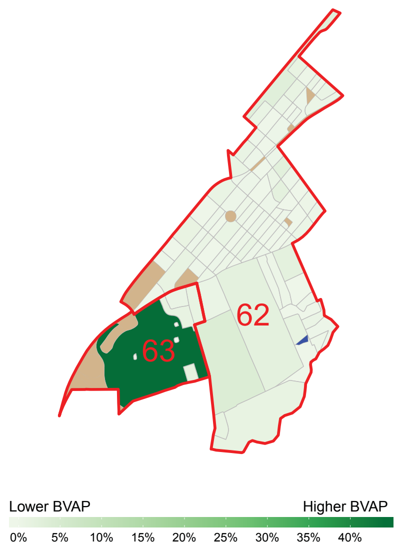


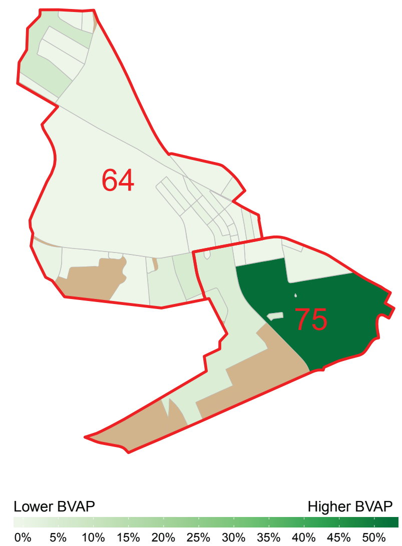
Figure 2: Probability that a Census Block in a Split VTD Is Assigned to a Challenged District, by BVAP

Each observation is a census block in a VTD split between a challenged and a non-challenged district. Each circle represents a set of census blocks, grouped in 5% increments by BVAP. Circle size is proportional to the average population of the blocks in each group.

District 63: Hopewell / Ward 7



District 75: Franklin city / Precinct 2-1



District 75: Isle of Wight / Camps Mill

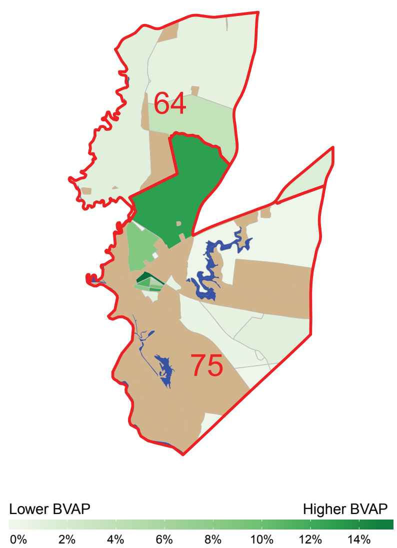


Figure 3: Maps of Split VTDs in the Dinwiddie-Greenville Area

Each census block is shaded based on the share of the Black Voting Age Population of the VTD residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

District 69: Richmond City / 410

District 74: Henrico / Moody

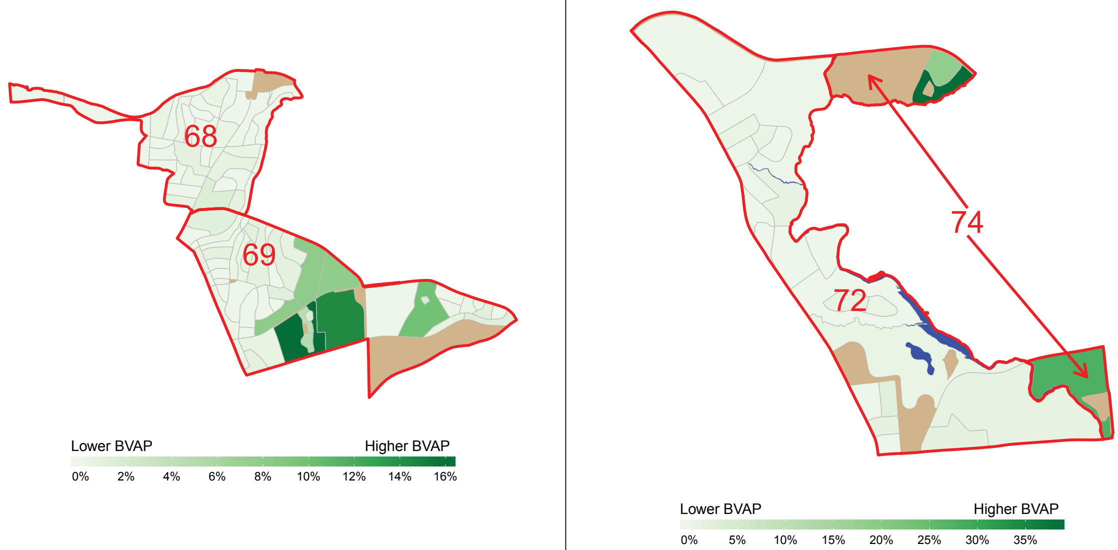


Figure 4: Maps of Split VTDs in the Richmond Area

Each census block is shaded based on the share of the Black Voting Age Population of the VTD residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

District 77: Suffolk / John F. Kennedy | District 90: Virginia Beach / Aragona

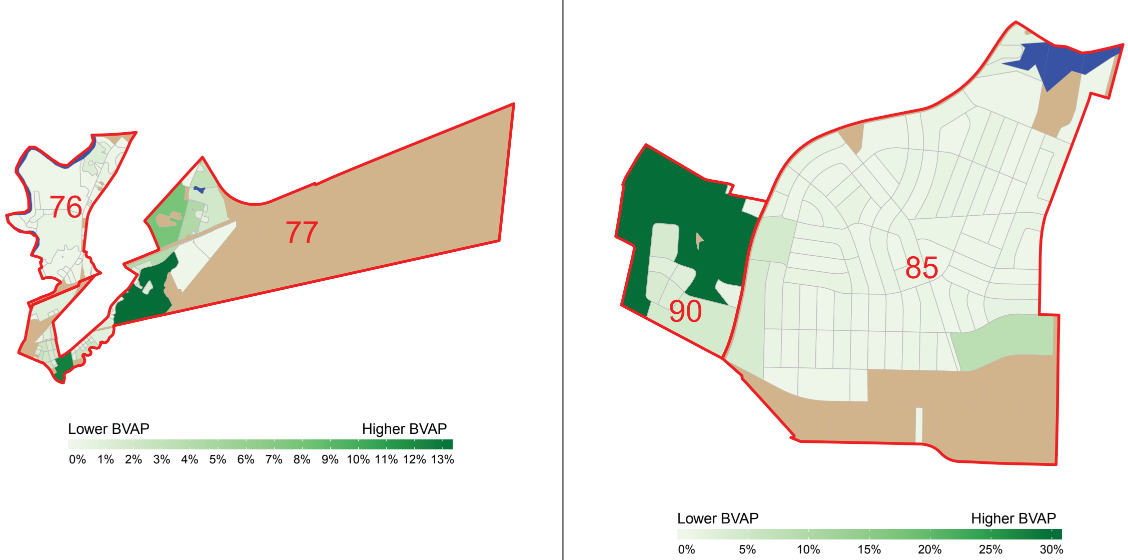


Figure 5: Maps of Split VTDs in South Hampton Roads

Each census block is shaded based on the share of the Black Voting Age Population of the VTD residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

District 95: Newport News / Jenkins

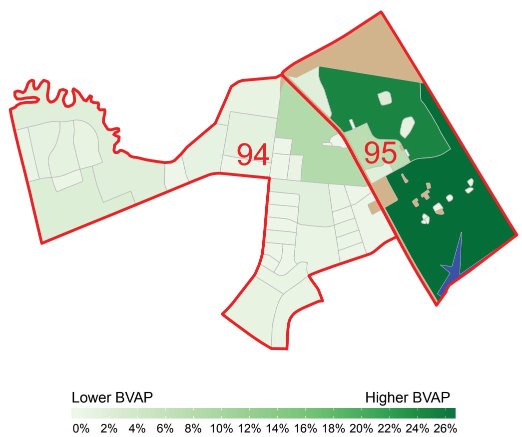


Figure 6: Map of Jenkins VTD in North Hampton Roads

Each census block is shaded based on the share of the Black Voting Age Population of the VTD residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

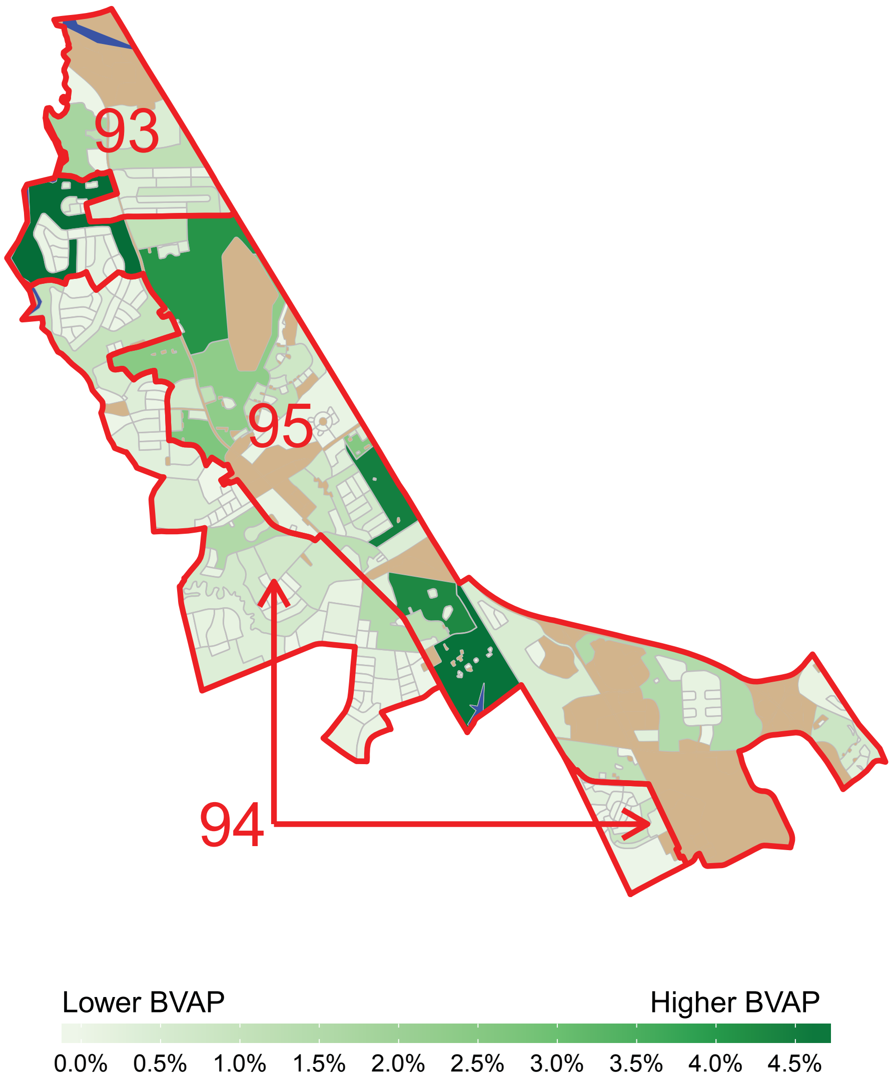


Figure 7: Split VTDs in District 95, Shaded by BVAP

Each census block is shaded based on the share of the Black Voting Age Population of the area residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

Figure 8: Divisions of Towns by BVAP in the Dinwiddie-Greenville Area

Each census block is shaded by the percentage of the town-wide BVAP residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

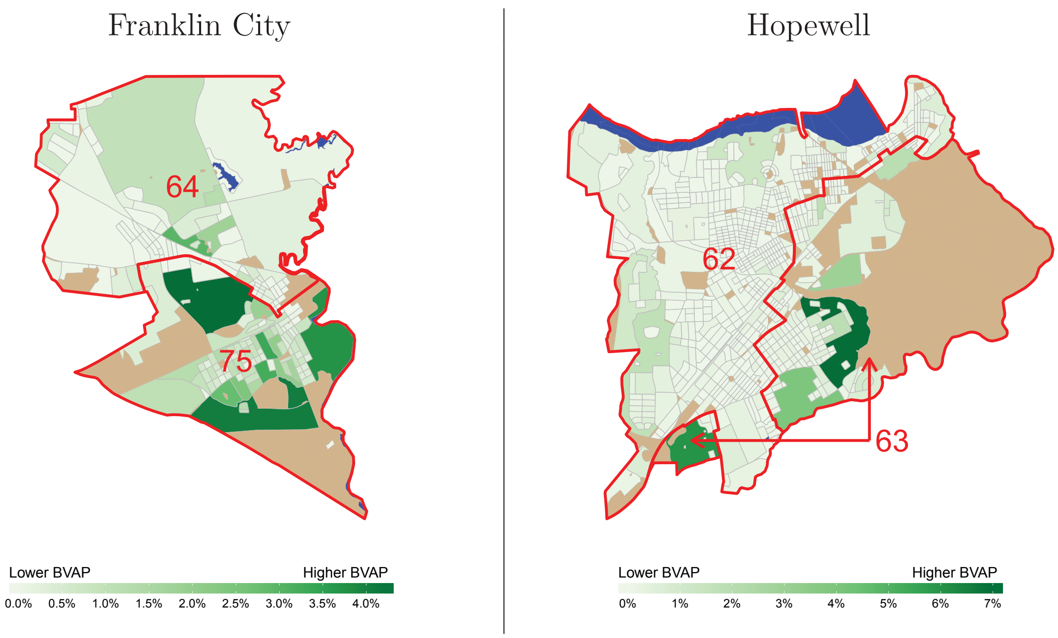


Figure 9: Divisions of Cities by BVAP in the Dinwiddie-Greenville Area

Each census block is shaded by the percentage of the city-wide BVAP residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

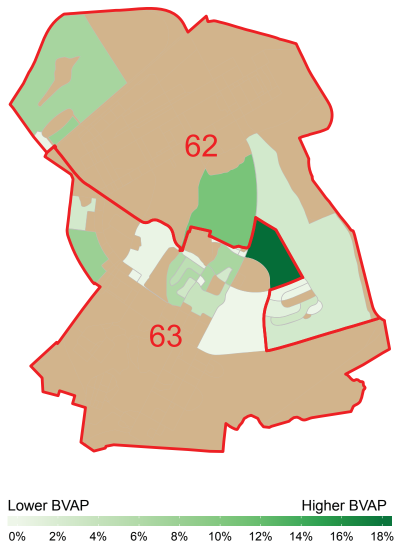


Figure 10: Division of Fort Lee by BVAP

Each census block is shaded by the percentage of the town-wide BVAP residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

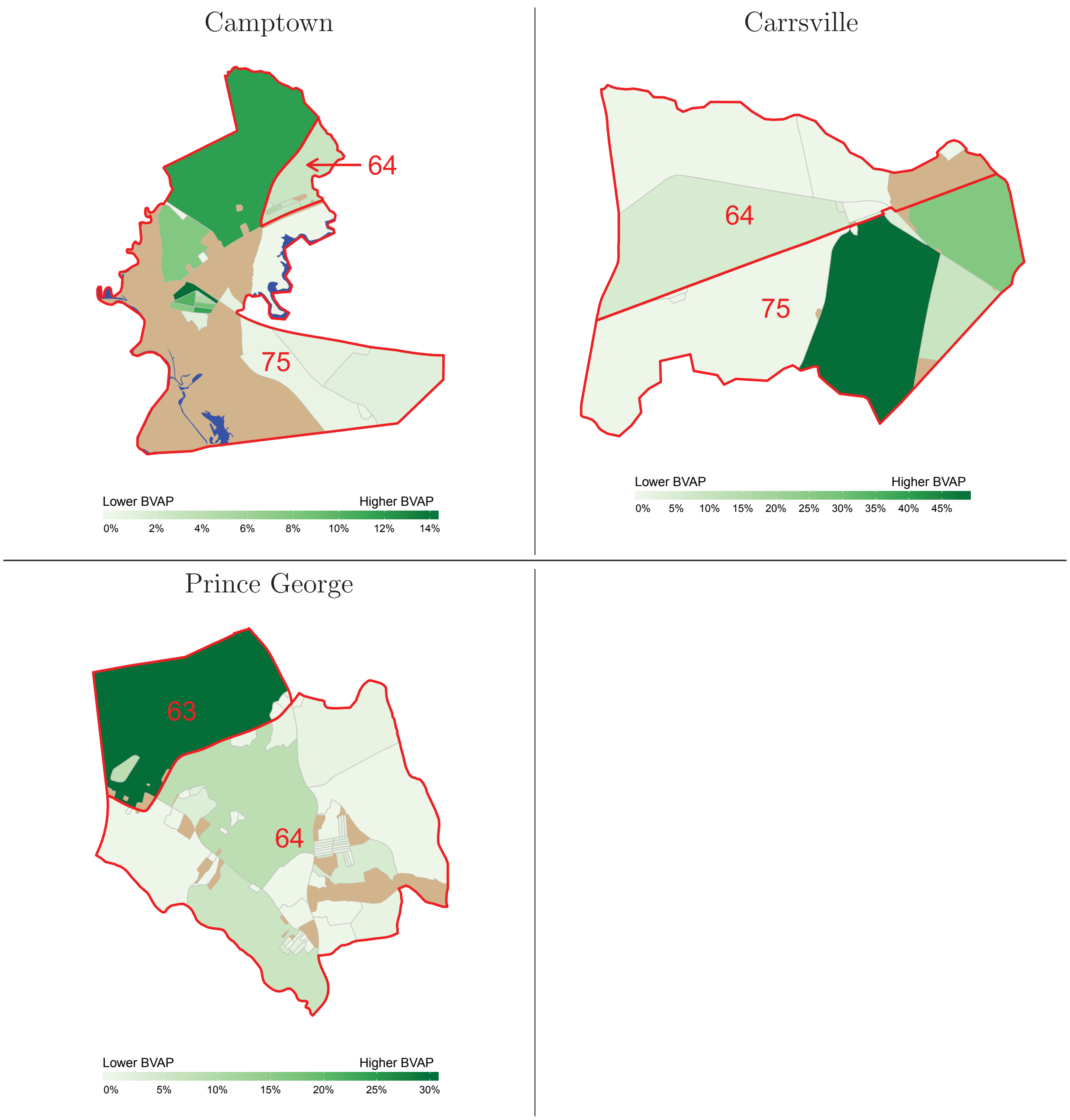


Figure 11: Divisions of Unincorporated Places by BVAP in the Dinwiddie-Greenville Area

Each census block is shaded by the percentage of the place-wide BVAP residing in the block. Unpopulated areas shaded in tan (land) or blue (water).

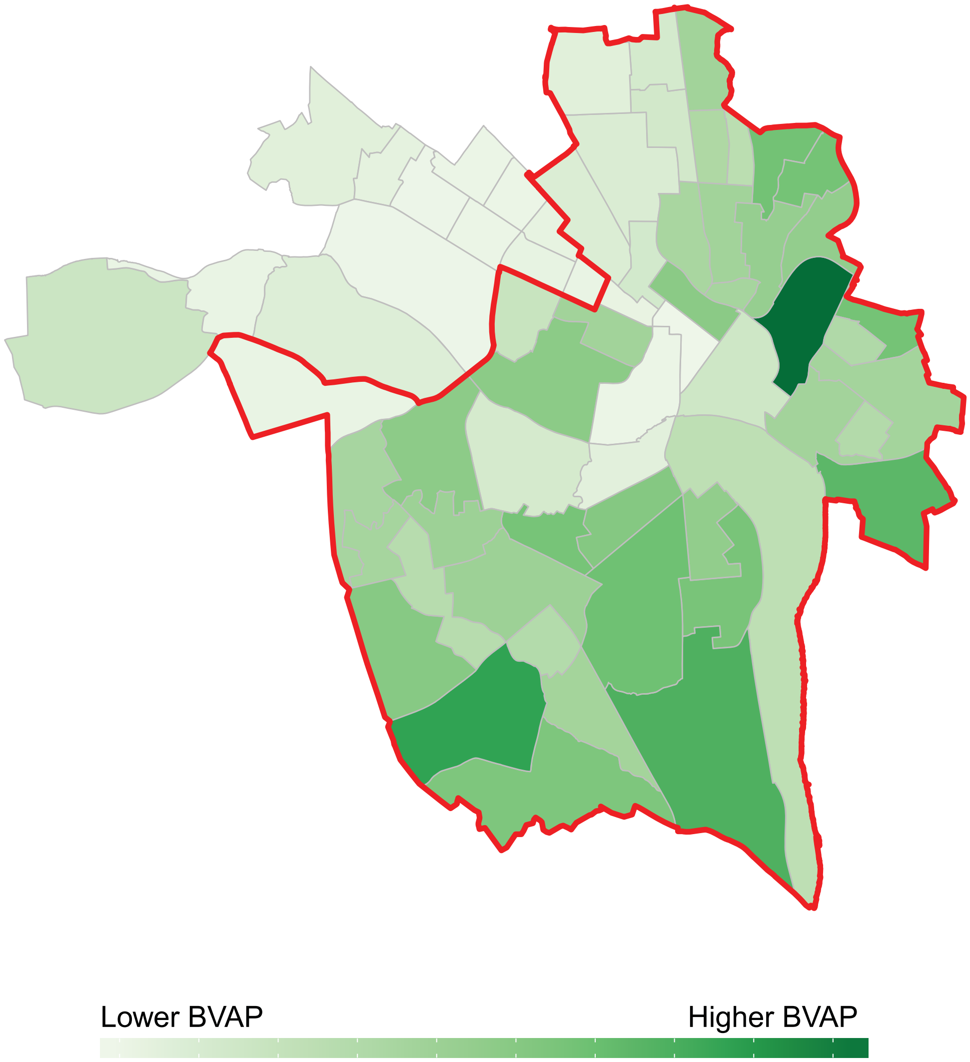


Figure 12: Division of Richmond City by BVAP

The red boundary encloses the portion of the city allocated to the challenged districts. The remaining portion is allocated to non-challenged districts. Each VTD is shaded by the percentage of the city-wide BVAP residing in the VTD.

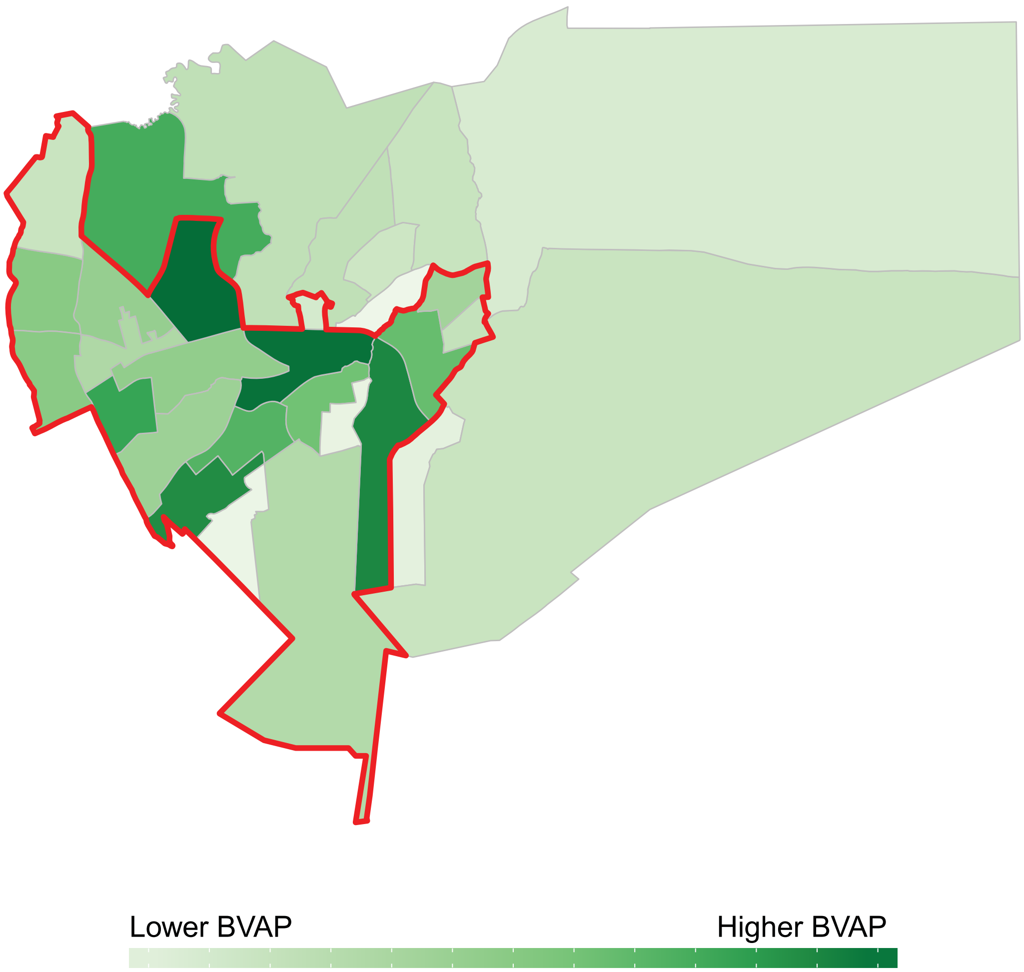


Figure 13: Division of Hampton City by BVAP.

The red boundary encloses the portion of the city allocated to the challenged districts. The remaining portion is allocated to non-challenged districts. Each VTD is shaded by the percentage of the city-wide BVAP residing in the VTD.

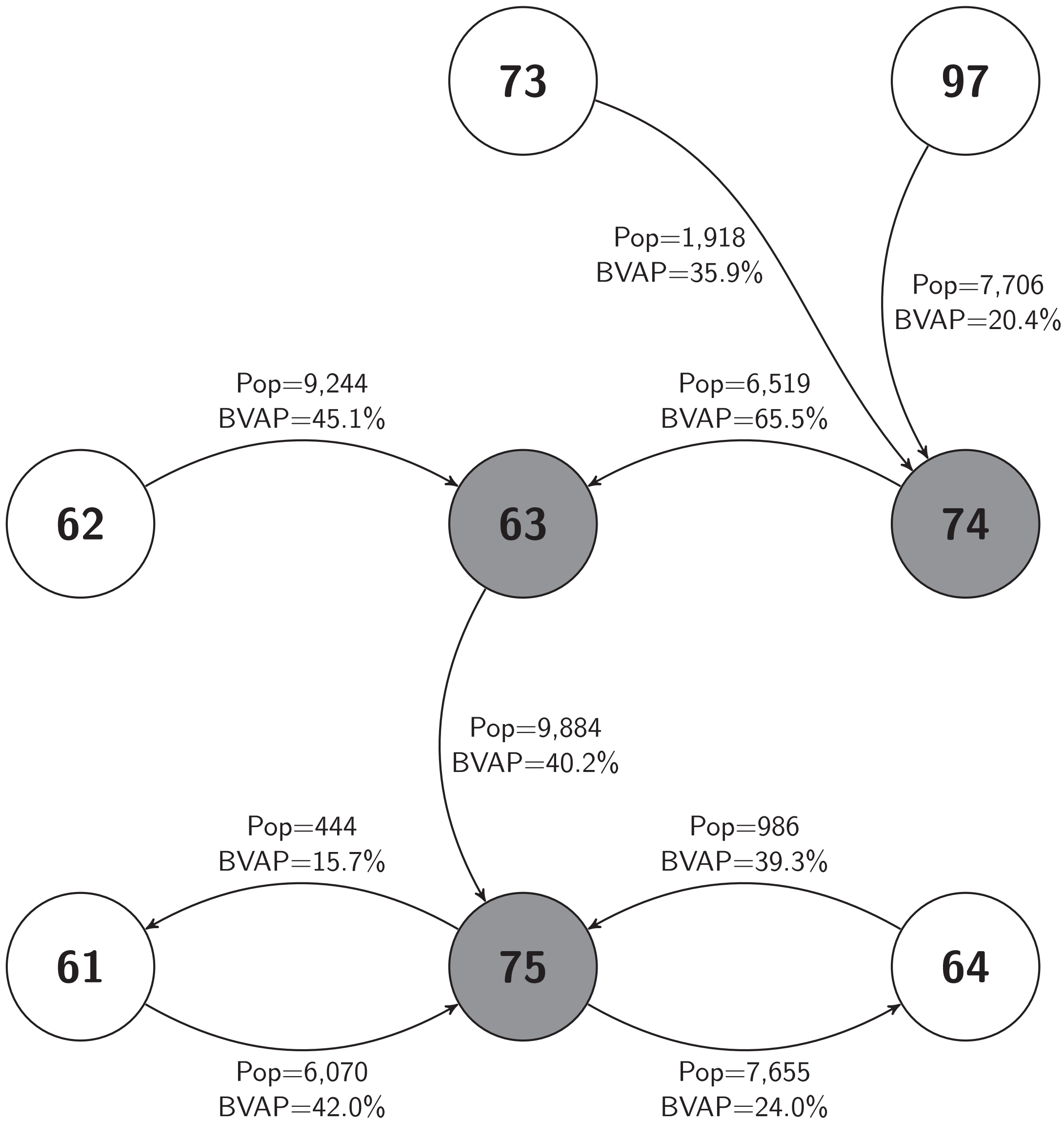


Figure 14: Dinwiddie-Greensville Area Population and BVAP Shifts

Shifts between non-challenged districts are omitted. A shift of 67 people from District to 74 to District 62 is also omitted.

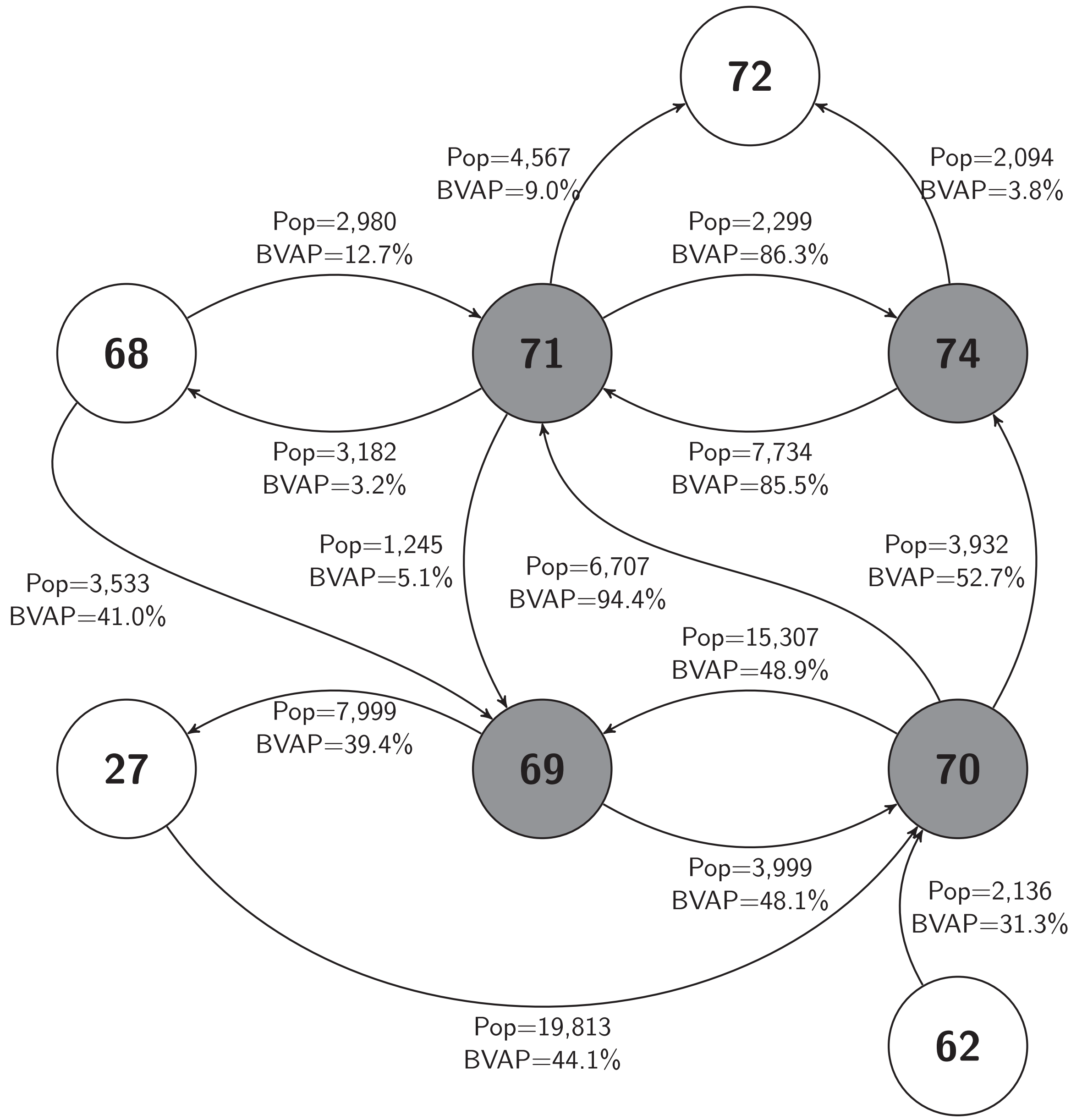


Figure 15: Richmond Area Population and BVAP Shifts

Shifts between non-challenged districts are omitted. Two populations transfers to District 74 are omitted (shown in Figure 14).

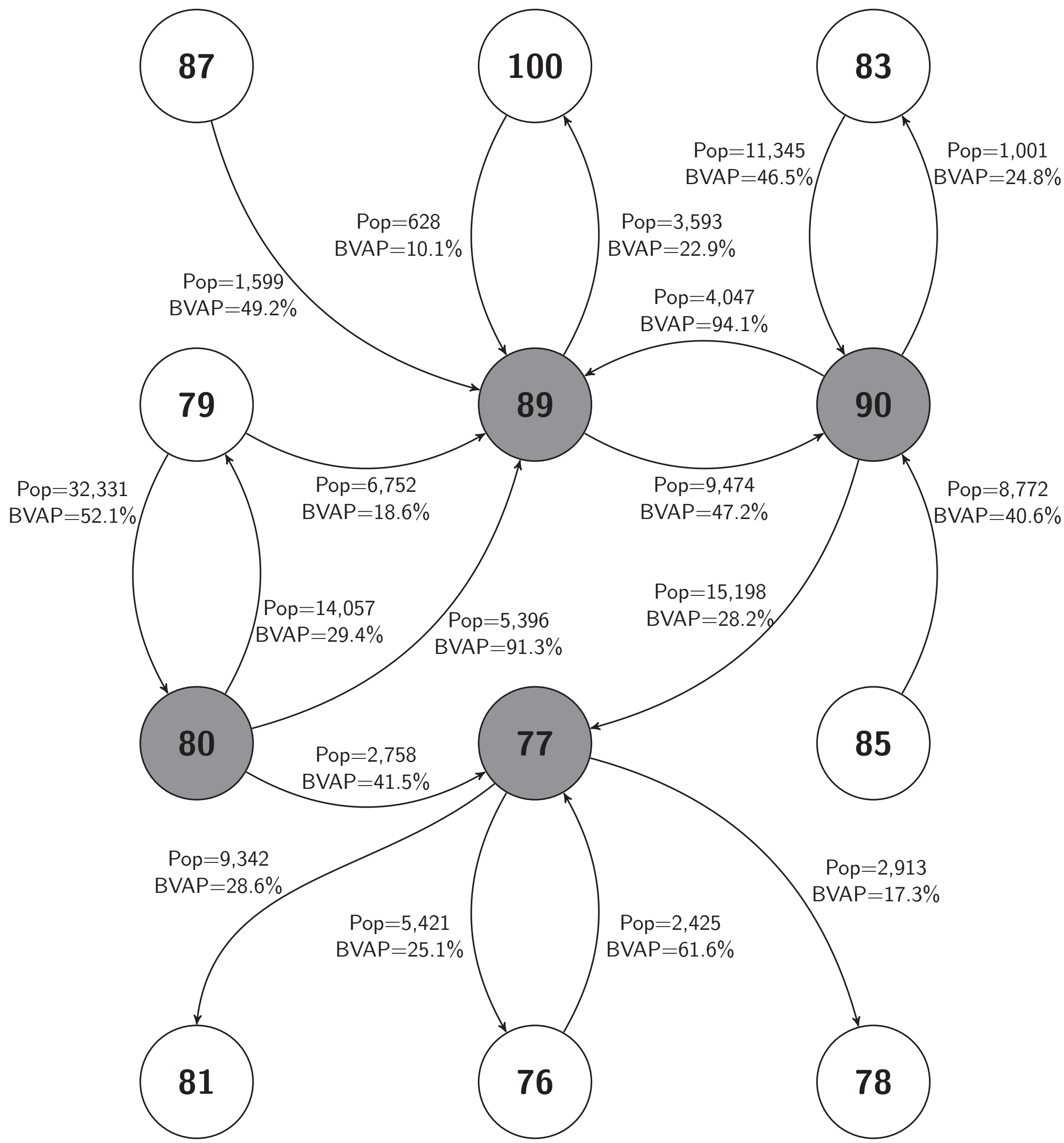


Figure 16: South Hampton Roads Population and BVAP Shifts

Shifts between non-challenged districts are omitted. District 87 omitted. A shift of 5 people from District 77 to District 64 is omitted.

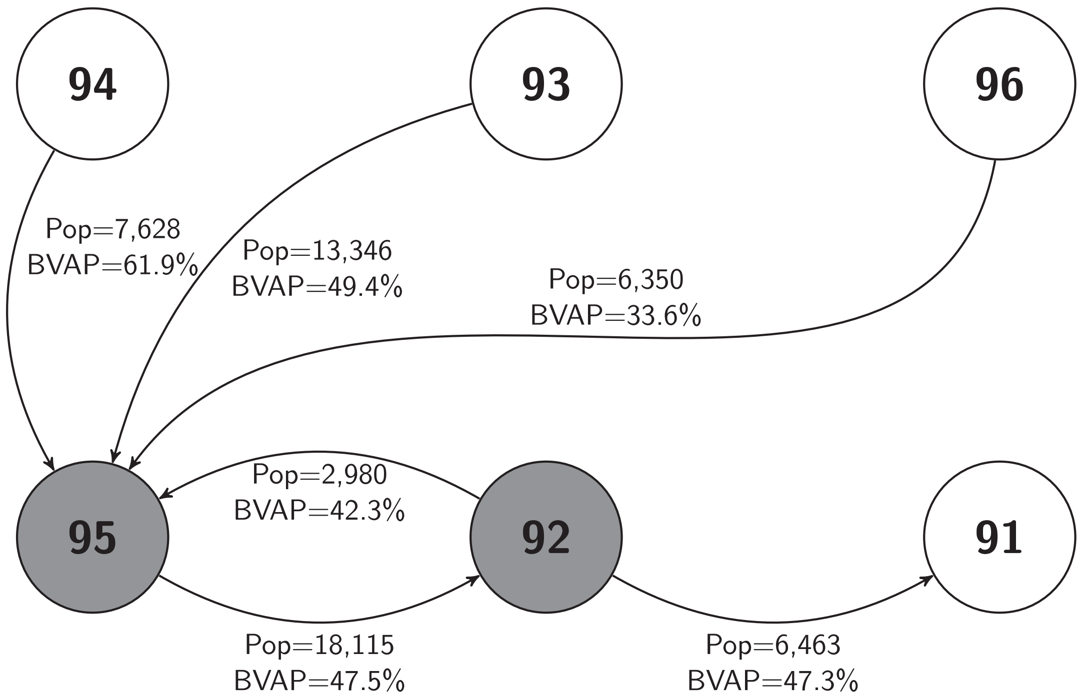


Figure 17: North Hampton Roads Population and BVAP Shifts

Shifts between non-challenged districts are omitted

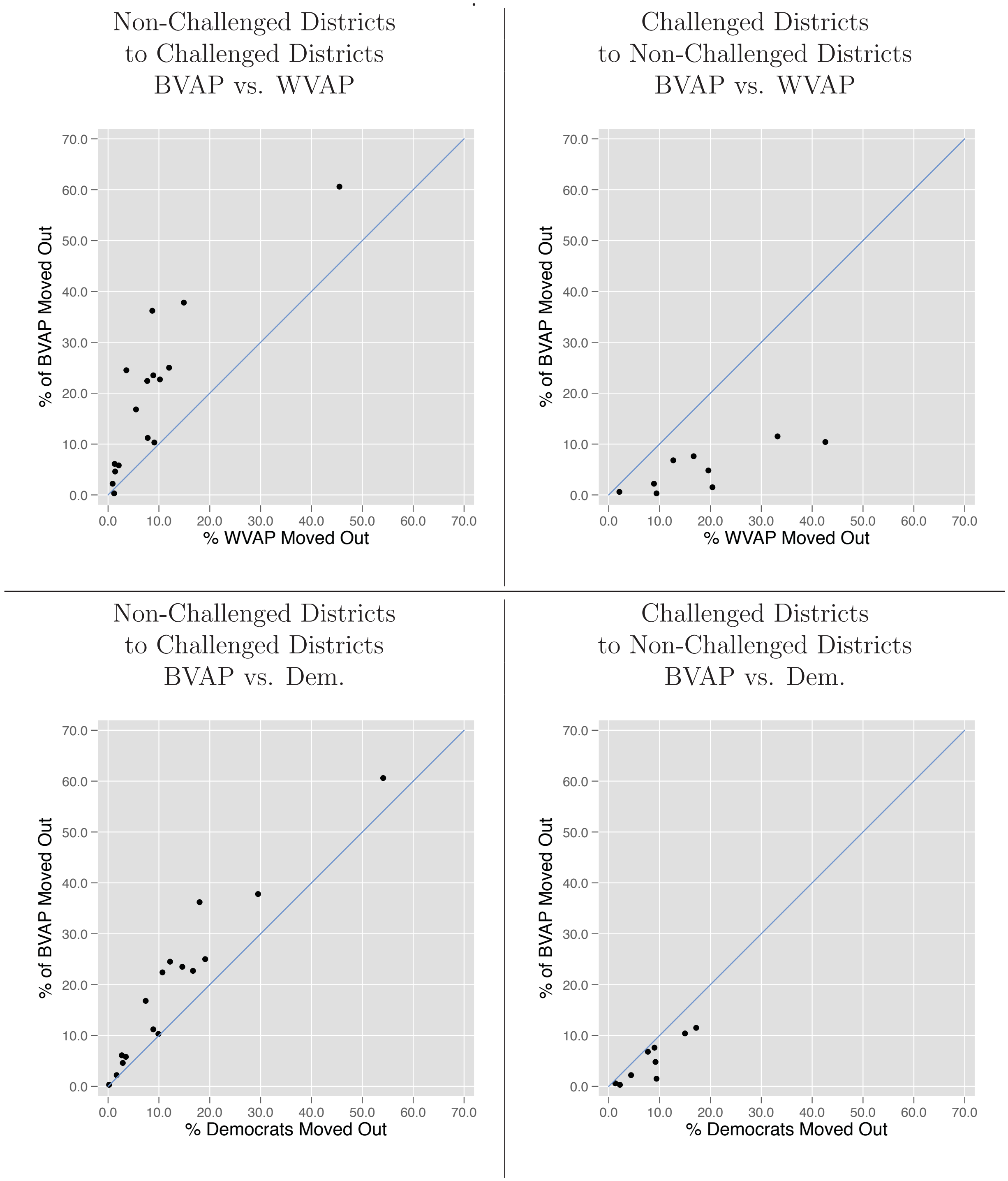


Figure 18: Net Population Shifts

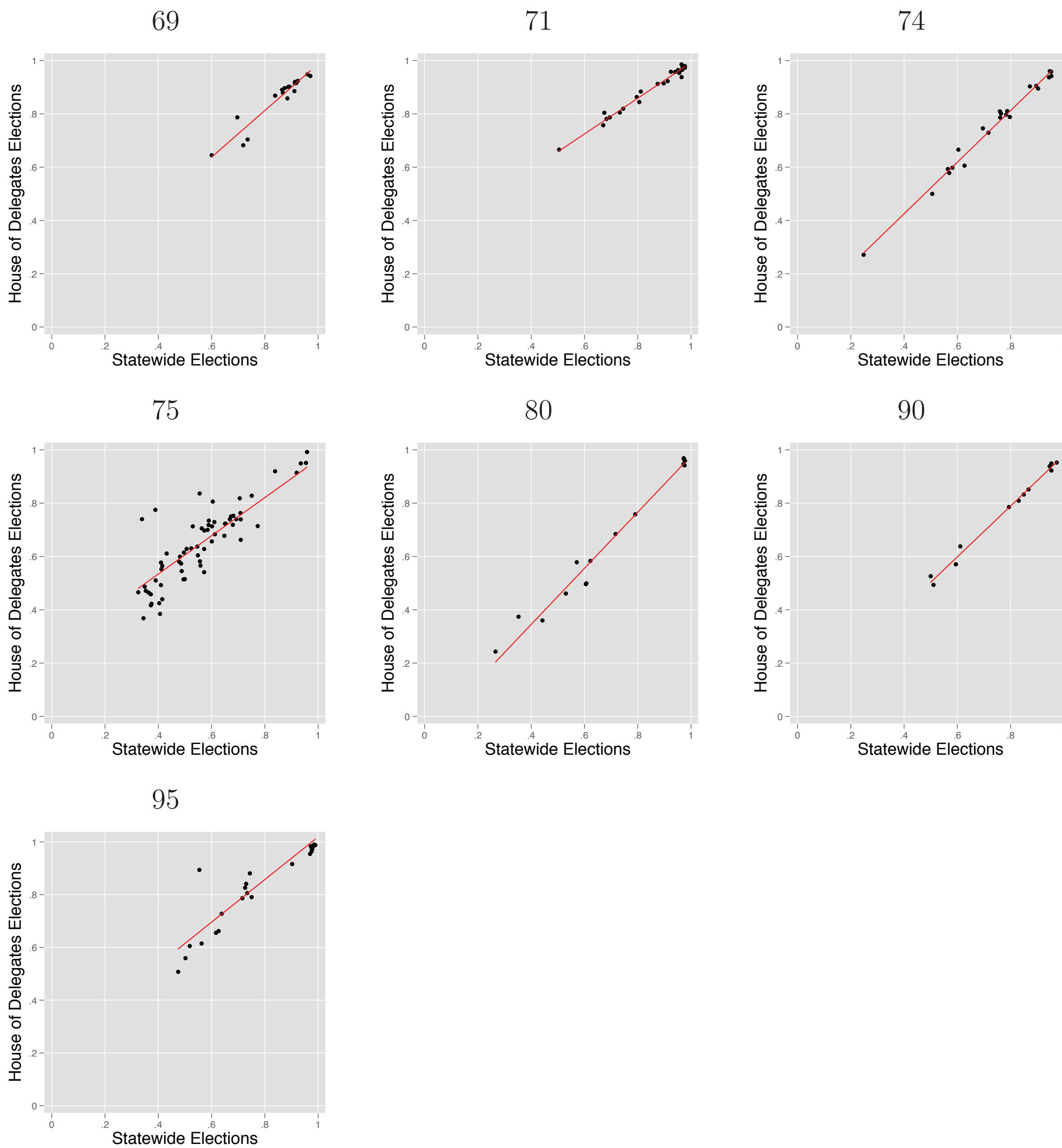


Figure 19: Correlations Between Average Democratic Vote Share in Statewide Elections and Average Democratic Vote Share in State Legislative Elections in Challenged Districts with Contested House of Delegates Elections

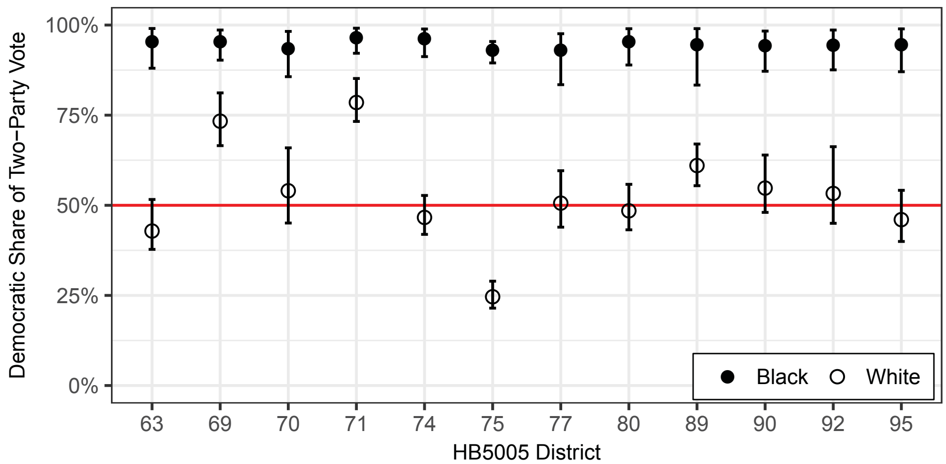


Figure 20: Ecological Inference Using the 2008 Presidential Election

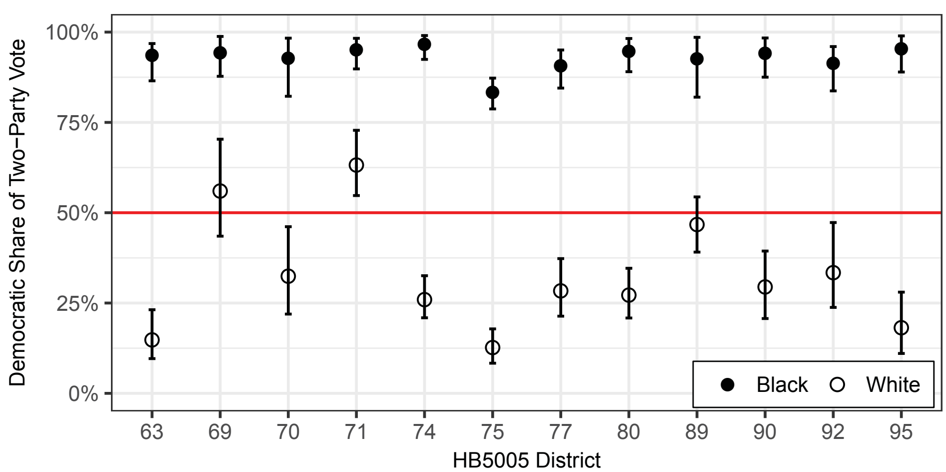


Figure 21: Ecological Inference Using the 2009 Gubernatorial Election

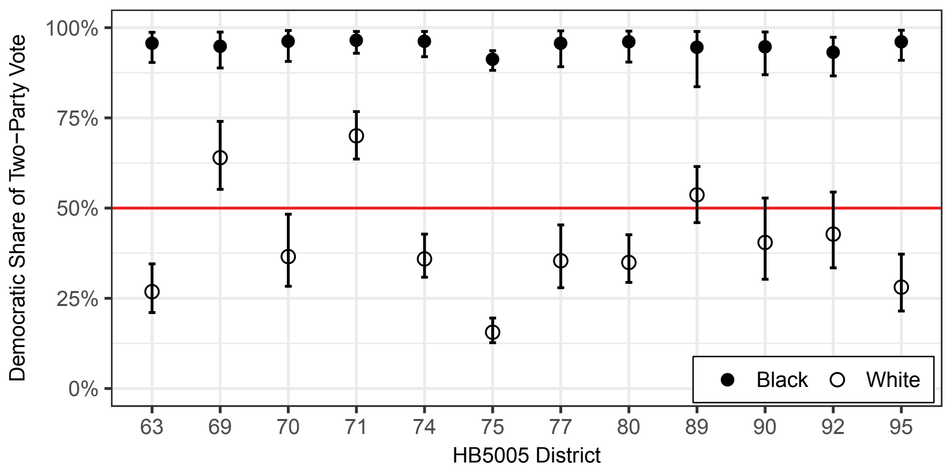


Figure 22: Ecological Inference Using the Average of the 2008 Presidential and 2009 Gubernatorial Elections

Table 1: Split VTDs in the Challenged Districts

District	Split VTDs	VTDs Split With Non-Challenged Districts	VTDs Split With Challenged Districts
63	8	4	4
69	3	2	1
70	2	1	1
71	2	—	2
74	3	3	—
75	12	8	4
77	2	2	—
80	1	1	—
89	4	3	1
90	4	3	1
92	—	—	—
95	5	5	—
Total	39	32	7

Table 2: Logistic Regression of Census Block Assignment to Challenged Districts as a Function of BVAP Within Split VTDs

	Logit Results		Predicted probability census block assigned to challenged district with BVAP=				
Model	BVAP Coef	N	0%	25%	50%	75%	100%
All	**4.125**	2,146	0.138	0.310	0.557	0.779	0.908
	(0.027)		(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
District 63	**0.995**	265	0.366	0.426	0.488	0.550	0.610
	(0.080)		(0.009)	(0.005)	(0.004)	(0.007)	(0.011)
District 69	**4.856**	149	0.419	0.708	0.891	0.965	0.989
	(0.129)		(0.012)	(0.006)	(0.004)	(0.002)	(0.001)
District 70	**3.615**	35	0.530	0.735	0.873	0.944	0.977
	(0.241)		(0.016)	(0.009)	(0.009)	(0.007)	(0.004)
District 74	**20.453**	111	0.017	0.745	0.998	1.000	1.000
	(0.551)		(0.002)	(0.012)	(0.000)	(0.000)	(0.000)
District 75	**2.602**	569	0.234	0.369	0.528	0.682	0.804
	(0.073)		(0.006)	(0.005)	(0.006)	(0.008)	(0.008)
District 77	**3.750**	205	0.133	0.282	0.501	0.719	0.867
	(0.075)		(0.005)	(0.006)	(0.006)	(0.006)	(0.005)
District 80	**10.494**	96	0.000	0.000	0.002	0.025	0.259
	(1.199)		(0.000)	(0.000)	(0.001)	(0.007)	(0.012)
District 89	**2.932**	253	0.080	0.153	0.273	0.439	0.620
	(0.084)		(0.002)	(0.002)	(0.004)	(0.010)	(0.014)
District 90	**7.932**	184	0.059	0.314	0.769	0.960	0.994
	(0.117)		(0.003)	(0.005)	(0.005)	(0.002)	(0.000)
District 95	**6.698**	279	0.078	0.312	0.708	0.928	0.986
	(0.073)		(0.002)	(0.004)	(0.003)	(0.002)	(0.001)

Standard errors below coefficients. Sample is all populated census blocks within VTDs that are split between one challenged and one or more non-challenged districts where both parts of the split VTD are populated. "All" model includes all challenged districts with split VTDs. Observations are weighted by total population.

Table 3: VTDs Split Between Challenged and Non-Challenged Districts, Dinwiddie-Greenville Area

Locality	VTD Name	District	Pop.	BVAP (#)	BVAP (%)
Isle of Wight	Camps Mill	**75**	**523**	**281**	**69.6%**
		64	259	20	10.1%
Isle of Wight	Carrsville	**75**	**302**	**72**	**31.7%**
		64	915	150	21.5%
Lunenburg	Brown's Store	**75**	**265**	**68**	**33.5%**
		61	1,040	178	22.2%
Lunenburg	Rosebud	**75**	**747**	**206**	**34.3%**
		61	557	76	16.9%
Lunenburg	Peoples Community Center	**75**	**207**	**107**	**64.1%**
		61	725	346	59.6%
Lunenburg	Victoria Public Library	**75**	**1,336**	**761**	**58.6%**
		61	1,086	207	24.8%
Prince George	Rives	**63**	**2,839**	**801**	**41.2%**
		62	555	116	38.4%
		64	386	88	29.4%
Prince George	Courts Bldg	**63**	**3,421**	**959**	**38.0%**
		64	389	70	24.7%
Prince George	Jefferson Park	**63**	**2,127**	**737**	**52.7%**
		62	6,837	3,136	52.2%
Southampton	Forks-Of-The-River	**75**	**394**	**115**	**35.7%**
		64	463	97	26.9%
Franklin city	Precinct 2-1	**75**	**791**	**202**	**37.1%**
		64	894	92	13.2%
Hopewell	Ward 7	**63**	**857**	**398**	**71.6%**
		62	2,085	390	25.5%

Table 4: VTDs Split Between Challenged and Non-Challenged Districts, Richmond Area

Locality	VTD Name	District	Pop.	BVAP (#)	BVAP (%)
Chesterfield	Davis	**69**	**4,994**	**1,836**	**50.4%**
		27	941	306	42.2%
Henrico	Belmont	**74**	**2,190**	**760**	**46.0%**
		72	1,239	62	6.1%
Henrico	Brookland	**74**	**205**	**70**	**41.9%**
		72	839	88	13.3%
Henrico	Moody	**74**	**594**	**191**	**41.7%**
		72	950	34	4.3%
Henrico	Dorey	**70**	**2,136**	**532**	**31.3%**
		62	791	109	16.9%
Richmond city	410	**69**	**3,533**	**1,170**	**41.0%**
		68	1,060	90	10.0%

Table 5: VTDs Split Between Challenged and Non-Challenged Districts, South Hampton Roads

Locality	VTD Name	District	Pop.	BVAP (#)	BVAP (%)
Norfolk	Granby	**89**	**5,126**	**1,466**	**35.7%**
		100	1,493	303	24.8%
Norfolk	Titustown Center	**89**	**574**	**344**	**80.2%**
		79	6,954	1,305	28.6%
Norfolk	Zion Grace	**89**	**1,524**	**128**	**10.2%**
		79	25,856	6,692	26.9%
Portsmouth	Nine	**80**	**402**	**265**	**98.1%**
		79	2,752	1,371	65.2%
Suffolk	John F. Kennedy	**77**	**3,653**	**1,763**	**69.9%**
		76	1,242	81	8.2%
Suffolk	Lakeside	**77**	**1,063**	**603**	**79.4%**
		76	3,313	911	36.1%
Virginia Beach	Aragona	**90**	**1,844**	**788**	**61.6%**
		85	5,436	792	19.0%
Virginia Beach	Shell	**90**	**3,468**	**1,151**	**44.5%**
		83	1,048	99	11.3%
Virginia Beach	Reon	**90**	**2,758**	**1,082**	**55.5%**
		85	964	284	41.3%

Table 6: VTDs Split Between Challenged and Non-Challenged Districts, North Hampton Roads

Locality	VTD Name	District	Pop.	BVAP (#)	BVAP (%)
Newport News	Denbigh	**95**	**4,334**	**1,948**	**62.2%**
		94	2,626	797	39.5%
Newport News	Epes	**95**	**6,877**	**2,948**	**64.2%**
		94	994	221	29.4%
Newport News	Jenkins	**95**	**3,294**	**1,368**	**61.5%**
		94	3,322	585	22.4%
Newport News	Reservoir	**95**	**2,508**	**887**	**49.8%**
		93	3,479	996	39.1%
		94	1,649	375	29.0%
Newport News	Palmer	**95**	**3,961**	**798**	**26.6%**
		94	2,252	292	17.6%

Table 7: VTDs Split Between Challenged Districts

Locality	VTD Name	District	Pop.	BVAP (#)	BVAP (%)
Dinwiddie	Rohoic	**63**	**1,007**	**226**	**27.4%**
		75	**950**	**230**	**34.1%**
Dinwiddie	Edgehill	**63**	**1,531**	**404**	**33.8%**
		75	**479**	**150**	**44.9%**
Dinwiddie	New Hope	**63**	**3,482**	**1,088**	**38.0%**
		75	**1,467**	**600**	**54.9%**
Dinwiddie	Dinwiddie	**63**	**1,436**	**342**	**31.1%**
		75	**1,157**	**483**	**52.6%**
Norfolk	Brambleton	**89**	**1,777**	**1,085**	**97.0%**
		90	**2,294**	**2,173**	**95.1%**
Richmond city	505	**69**	**1,245**	**60**	**5.1%**
		71	**1,548**	**348**	**22.6%**
Richmond city	703	**70**	**2,084**	**1,454**	**91.1%**
		71	**1,231**	**806**	**87.9%**

Table 8: Splits of Incorporated Places Between Challenged and Non-Challenged Districts, Dinwiddie-Greenville Area

Place	District	Pop.	BVAP (#)	BVAP(%)
Brodnax town	**75**	**253**	**93**	**47.0%**
	61	45	5	13.9%
Kenbridge town	**75**	**604**	**269**	**57.4%**
	61	653	89	17.9%
Wakefield town	**75**	**661**	**331**	**65.4%**
	64	266	24	10.7%
Waverly town	**75**	**1,511**	**869**	**74.7%**
	64	638	203	38.4%

Table 9: Splits of Cities Between Challenged and Non-Challenged Districts, Dinwiddie-Greenville Area

Place	District	Pop.	BVAP (#)	BVAP(%)
Franklin city	**75**	**4,951**	**2,973**	**82.2%**
	64	3,631	583	20.0%
Hopewell	**63**	**7,376**	**3,395**	**66.1%**
	62	15,215	2,389	20.3%

Table 10: Split of Fort Lee Between Districts 63 and 62

Place	District	Pop.	BVAP (#)	BVAP(%)
Fort Lee CDP	**63**	**2,019**	**506**	**45.6%**
	62	1,374	255	35.9%

Table 11: Splits of Unincorporated Places Between Challenged and Non-Challenged Districts, Dinwiddie-Greenville Area

Place	District	Pop.	BVAP (#)	BVAP(%)
Camptown CDP	**75**	**482**	**281**	**75.9%**
	64	284	50	25.0%
Carrsville CDP	**75**	**199**	**47**	**30.5%**
	64	160	6	5.1%
Prince George CDP	**63**	**456**	**125**	**37.7%**
	64	1,610	196	16.1%

Table 12: Splits of Cities Between Challenged and Non-Challenged Districts, Richmond Area

Place	District	Pop.	BVAP (#)	BVAP(%)
Richmond city	**69**	**74,392**	**32,678**	**55.5%**
	70	**17,486**	**8,928**	**68.0%**
	71	**75,101**	**33,401**	**53.6%**
	74	**2,299**	**1,509**	**86.3%**
	68	34,936	2,045	6.8%

Table 13: Splits of Unincorporated Places Between Challenged and Non-Challenged Districts, Richmond Area

Place	District	Pop.	BVAP (#)	BVAP(%)
Bellwood CDP	**70**	**2,612**	**694**	**37.1%**
	62	3,740	489	17.6%
Glen Allen CDP	**74**	**7,643**	**1,954**	**34.3%**
	72	3,194	274	11.4%
	73	3,937	500	15.8%
Lakeside CDP	**74**	**1,267**	**490**	**55.7%**
	72	10,582	934	10.9%
Laurel CDP	**74**	**1,209**	**353**	**37.9%**
	72	15,504	3,531	28.9%
Manchester CDP	**69**	**1,774**	**448**	**35.1%**
	27	9,030	2,015	29.0%
Meadowbrook CDP	**70**	**11,588**	**3,623**	**42.2%**
	62	6,724	1,964	38.4%
Sandston CDP	**70**	**7**	**0**	**0.0%**
	74	**4,329**	**1,476**	**46.9%**
	62	3,235	207	8.5%

Table 14: Splits of Cities Between Challenged and Non-Challenged Districts, South Hampton Roads

Place	District	Pop.	BVAP (#)	BVAP(%)
Chesapeake	**77**	**62,684**	**24,318**	**52.9%**
	80	**6,590**	**2,308**	**48.8%**
	21	5,030	715	18.6%
	76	33,222	5,014	20.8%
	78	80,475	10,355	17.1%
	81	34,208	5,847	22.8%
Norfolk	**80**	**3,682**	**372**	**10.7%**
	89	**79,614**	**33,869**	**55.5%**
	90	**50,313**	**23,018**	**61.0%**
	79	41,702	9,094	24.4%
	83	33,008	5,507	21.3%
	100	34,484	6,696	25.0%
Portsmouth	**80**	**56,994**	**26,653**	**61.6%**
	79	38,541	10,583	35.8%
Suffolk	**77**	**16,943**	**9,679**	**81.3%**
	80	**13,439**	**4,935**	**52.8%**
	64	7,112	1,272	22.8%
	76	47,091	10,009	28.1%
Virginia Beach	**90**	**30,112**	**11,051**	**49.2%**
	21	74,578	13,282	24.2%
	81	45,230	5,283	15.4%
	82	80,463	5,786	9.1%
	83	46,530	3,993	10.8%
	84	80,281	12,012	20.4%
	85	80,800	11,770	18.9%

Table 15: Splits of Cities Between Challenged and Non-Challenged Districts, North Hampton Roads

Place	District	Pop.	BVAP (#)	BVAP(%)
Hampton	**92**	**79,689**	**37,224**	**60.7%**
	95	**14,584**	**5,089**	**44.8%**
	91	43,163	9,346	27.9%
Newport News	**95**	**65,487**	**30,305**	**63.6%**
	93	35,803	9,653	36.1%
	94	79,429	13,120	21.0%

Table 16: Populations Moved from Non-Challenged Districts to Challenged Districts

District	Pop. of Benchmark	Pop. Moved Out	% BVAP of Benchmark	% BVAP of Area Moved Out
27	87,915	19,813	26.5	44.1
61	71,425	6,070	33.4	42.0
62	76,461	11,380	25.6	42.2
64	83,940	986	20.8	39.3
68	73,167	6,513	11.6	26.9
73	74,500	1,918	16.5	35.9
76	92,939	2,425	26.2	61.6
79	73,068	39,083	39.4	45.6
83	73,171	11,345	18.9	46.5
85	74,035	8,772	20.3	40.6
87	71,505	1,599	24.2	49.2
93	73,204	13,346	33.5	49.4
94	71,464	7,628	24.4	61.9
96	90,800	6,350	14.7	33.6
97	87,705	7,706	18.3	20.4
100	71,374	628	28.1	10.1

The second and third columns list total population in the district under the Benchmark Map and the portion of the district moved into challenged districts under HB 5005, respectively. The fourth and fifth columns give the BVAP percentage for the district under the Benchmark Map and the portion of the district moved into challenged districts under HB 5005, respectively.

Table 17: Populations Moved from Challenged Districts to Non-Challenged Districts

District	Pop. of Benchmark	Pop. Moved Out	% BVAP of Benchmark	% BVAP of Area Moved Out
69	71,299	7,999	56.3	39.4
71	74,194	7,749	46.3	6.5
74	80,153	2,161	62.7	5.0
75	70,454	8,099	55.3	23.6
77	76,927	17,681	57.6	25.5
80	70,585	14,057	54.4	29.4
89	74,259	3,593	52.5	22.9
90	71,080	1,001	56.9	24.8
92	71,017	6,463	62.1	47.3

The second and third columns list total population in the district under the Benchmark Map and the portion of the district moved into non-challenged districts under HB 5005, respectively. The fourth and fifth columns give the BVAP percentage for the district under the Benchmark Map and the portion of the district moved into non-challenged districts under HB 5005, respectively.

Table 18: Populations Moved from Non-Challenged Districts to Challenged Districts, As a Percentage of Benchmark District Populations

District	% of Pop. Moved Out	% of BVAP Moved Out	% of WVAP Moved Out	% of Dem. Votes Moved Out
27	22.5	37.8	14.9	29.5
61	8.5	11.2	7.8	8.9
62	14.9	22.7	10.2	16.7
64	1.2	2.2	0.9	1.7
68	8.9	22.4	7.7	10.7
73	2.6	5.8	2.1	3.5
76	2.6	6.1	1.3	2.7
79	53.5	60.6	45.5	54.1
83	15.5	36.2	8.7	18.0
85	11.8	23.5	8.9	14.6
87	2.2	4.6	1.4	2.9
93	18.2	25.0	12.0	19.1
94	10.7	24.5	3.6	12.2
96	7.0	16.8	5.5	7.4
97	8.8	10.3	9.1	9.9
100	0.9	0.3	1.2	0.2

Table 19: Populations Moved from Challenged Districts to Non-Challenged Districts, As a Percentage of Benchmark District Populations

District	% of Pop. Moved Out	% of BVAP Moved Out	% of WVAP Moved Out	% of Dem. Votes Moved Out
69	11.2	7.6	16.7	9.0
71	10.4	1.5	20.4	9.4
74	2.7	0.3	9.4	2.2
75	11.5	4.8	19.6	9.2
77	23.0	10.4	42.6	15.0
80	19.9	11.5	33.2	17.2
89	4.8	2.2	8.9	4.4
90	1.4	0.6	2.1	1.3
92	9.1	6.8	12.7	7.7

Table 20: Effect of BVAP and Party on Assignment of VTDs to Challenged Districts

	(1) Ansolabehere	(2) Katz Baseline	(3) Katz Weighted	(4) Closest	(5) Closest Weighted
BVAP	0.388**	0.157**	0.315**	0.269**	0.377**
	(0.026)	(0.033)	(0.032)	(0.028)	(0.027)
Avg. Dem. Vote	0.005	0.136**	0.060	0.045	0.009
	(0.027)	(0.035)	(0.033)	(0.029)	(0.027)
Distance to Closest Challenged District				-0.009**	-0.005
				(0.003)	(0.004)
VTD in Challenged District in Benchmark	0.708**		0.661**	0.750**	0.706**
	(0.014)		(0.015)	(0.014)	(0.014)
Observations	2,338	2,338	2,338	2,338	2,338
R-squared	0.768	0.778	0.781	0.764	0.769

Standard errors in parentheses
** p<0.01, * p<0.05

Table 21: Complete Regression Results for Katz Baseline Model

VARIABLES	(1) Katz Baseline
BVAP	0.157**
	(0.033)
Avg. Dem. Vote	0.136**
	(0.035)
Dist. from 63	0.331*
	(0.130)
Dist. from 69	1.262**
	(0.310)
Dist. from 90	1.042**
	(0.390)
Dist. from 77	0.947**
	(0.215)
Dist. from 80	-0.738
	(0.414)
Dist. from 95	-2.131**
	(0.524)
Dist. from 92	2.129**
	(0.520)
Dist. from 71	0.633**
	(0.225)
Dist. from 74	0.781**
	(0.125)
Dist. from 70	-2.663**
	(0.306)
Dist. from 75	-0.359**
	(0.112)
Dist. from 89	-1.239*
	(0.625)
VTD in Challenged District in Benchmark	0.675**
	(0.015)
Observations	2,338
R-squared	0.778

Standard errors in parentheses
** $p<0.01$, * $p<0.05$

Table 22: BVAP and Democratic Vote Share by District

District	Benchmark Pop.	Pop. Needed	HB 5005 Pop.	Benchmark BVAP	HB 5005 BVAP	Benchmark % Dem.	HB 5005 % Dem.
63	73,723	6,287	79,602	58.1	59.5	62.9	65.2
69	71,299	8,711	79,386	56.3	55.2	80.5	80.9
70	79,380	630	79,382	61.8	56.4	80.1	73.4
71	74,194	5,816	80,322	46.3	55.3	79.2	84.0
74	80,153	-143	79,594	62.7	57.2	75.7	70.0
75	70,454	9,556	79,295	55.3	55.4	56.3	56.5
77	76,927	3,083	79,627	57.6	58.8	69.3	70.3
80	70,585	9,425	80,705	54.4	56.3	72.3	69.4
89	74,259	5,751	79,614	52.5	55.5	75.0	76.7
90	71,080	8,930	80,425	56.9	56.6	69.1	70.9
92	71,017	8,993	79,689	62.1	60.7	75.6	73.3
95	67,882	12,128	80,071	61.6	60.0	72.0	71.0

Table 23: Ecological Inference Results

District	Race	2008 President Est.	2008 President 95% CI	2009 Governor Est.	2009 Governor 95% CI	Avg. of Pres. & Gov. Est.	Avg. of Pres. & Gov. 95% CI
63	Black	0.954	(0.880, 0.990)	0.936	(0.865, 0.968)	0.957	(0.904, 0.987)
	White	0.429	(0.378, 0.516)	0.148	(0.096, 0.231)	0.269	(0.210, 0.345)
	Other	0.730	(0.486, 0.921)	0.572	(0.263, 0.837)	0.676	(0.387, 0.903)
69	Black	0.954	(0.903, 0.986)	0.943	(0.878, 0.988)	0.950	(0.888, 0.988)
	White	0.734	(0.665, 0.812)	0.560	(0.435, 0.704)	0.640	(0.552, 0.740)
	Other	0.781	(0.559, 0.932)	0.664	(0.403, 0.899)	0.729	(0.482, 0.909)
70	Black	0.935	(0.857, 0.982)	0.928	(0.822, 0.983)	0.962	(0.906, 0.992)
	White	0.541	(0.451, 0.659)	0.325	(0.219, 0.461)	0.366	(0.283, 0.483)
	Other	0.761	(0.548, 0.920)	0.641	(0.421, 0.849)	0.758	(0.486, 0.930)
71	Black	0.965	(0.922, 0.991)	0.951	(0.898, 0.983)	0.966	(0.929, 0.989)
	White	0.786	(0.733, 0.852)	0.632	(0.547, 0.728)	0.701	(0.636, 0.767)
	Other	0.759	(0.517, 0.929)	0.555	(0.220, 0.856)	0.560	(0.266, 0.816)
74	Black	0.962	(0.912, 0.989)	0.966	(0.924, 0.990)	0.963	(0.919, 0.989)
	White	0.467	(0.419, 0.527)	0.260	(0.209, 0.326)	0.359	(0.308, 0.428)
	Other	0.761	(0.510, 0.927)	0.717	(0.472, 0.893)	0.761	(0.499, 0.928)
75	Black	0.931	(0.895, 0.954)	0.834	(0.787, 0.873)	0.913	(0.882, 0.936)
	White	0.247	(0.215, 0.289)	0.127	(0.083, 0.178)	0.156	(0.127, 0.195)
	Other	0.681	(0.389, 0.911)	0.493	(0.147, 0.827)	0.477	(0.213, 0.744)
77	Black	0.930	(0.835, 0.976)	0.907	(0.845, 0.950)	0.957	(0.892, 0.991)
	White	0.506	(0.439, 0.596)	0.284	(0.214, 0.373)	0.354	(0.279, 0.453)
	Other	0.643	(0.297, 0.906)	0.635	(0.320, 0.902)	0.551	(0.212, 0.873)
80	Black	0.954	(0.889, 0.990)	0.947	(0.890, 0.982)	0.961	(0.905, 0.990)
	White	0.485	(0.432, 0.558)	0.272	(0.209, 0.346)	0.350	(0.294, 0.426)
	Other	0.854	(0.696, 0.957)	0.603	(0.351, 0.846)	0.726	(0.504, 0.912)
89	Black	0.945	(0.833, 0.990)	0.926	(0.820, 0.986)	0.946	(0.836, 0.989)
	White	0.611	(0.554, 0.670)	0.468	(0.391, 0.544)	0.537	(0.460, 0.615)
	Other	0.801	(0.576, 0.958)	0.545	(0.254, 0.858)	0.591	(0.289, 0.884)
90	Black	0.943	(0.872, 0.983)	0.942	(0.875, 0.984)	0.947	(0.870, 0.988)
	White	0.548	(0.480, 0.639)	0.295	(0.207, 0.394)	0.405	(0.303, 0.528)
	Other	0.745	(0.521, 0.911)	0.427	(0.145, 0.786)	0.555	(0.200, 0.851)
92	Black	0.944	(0.876, 0.986)	0.914	(0.837, 0.960)	0.933	(0.866, 0.973)
	White	0.533	(0.450, 0.663)	0.334	(0.238, 0.473)	0.428	(0.334, 0.544)
	Other	0.640	(0.304, 0.894)	0.565	(0.243, 0.851)	0.588	(0.259, 0.875)
95	Black	0.946	(0.871, 0.989)	0.954	(0.890, 0.989)	0.961	(0.909, 0.993)
	White	0.461	(0.400, 0.541)	0.182	(0.110, 0.280)	0.281	(0.215, 0.372)
	Other	0.855	(0.694, 0.958)	0.602	(0.335, 0.852)	0.800	(0.562, 0.945)

Table 24: Estimated Democratic Vote Share if Population Shortfall Made Up Entirely with Republican Voters

District	Avg. Dem. Votes	Avg. Rep. Votes	New Rep. Votes	New Dem. Share (%)
63	36,491	21,522	4,947	58.0
69	44,473	10,743	6,746	71.8
70	47,284	11,776	469	79.4
71	49,623	13,026	4,911	73.4
74	45,670	14,655	0	75.7
75	31,748	24,619	7,645	49.6
77	38,921	17,213	2,250	66.7
80	40,225	15,420	7,430	63.8
89	42,690	14,232	4,408	69.6
90	36,443	16,309	6,627	61.4
92	41,154	13,318	6,898	67.1
95	36,715	14,293	9,113	61.1

This result is calcualted as follows. Calculate the number of Democratic and Republican votes in the Benchmark disrict as $Avg\_Dem\_Votes = VAP * benchmark\_dem\_share$ and $Avg\_Rep\_Votes = VAP * (1 - benchmark\_dem\_share)$. Assume VAP is added to the district in the same proportion as exists in the district, and all of these voters are Republican: $New\_Rep\_Votes = \frac{VAP}{POP} * pop\_needed$. Then calculate
$New\_Dem\_Share = \frac{Avg\_Dem\_Votes}{(Avg\_Dem\_Votes+Avg\_Rep\_Votes+New\_Rep\_Votes)}$.

Table 25: Estimated Democratic Vote Share At Different Levels of BVAP Using Ecological Inference Estimates

District	Dem Vote: 45% BVAP Est.	95% CI	Dem Vote: 50% BVAP Est.	95% CI	Dem Vote: 55% BVAP Est.	95% CI
63	59.4	(57.6, 61.4)	62.8	(61.3, 64.5)	66.3	(64.8, 67.8)
69	78.8	(76.9, 80.9)	80.4	(78.7, 82.0)	81.9	(80.2, 83.4)
70	67.7	(66.1, 70.0)	70.7	(69.2, 72.4)	73.7	(72.1, 75.0)
71	81.0	(79.1, 83.2)	82.4	(80.5, 84.3)	83.7	(81.8, 85.4)
74	65.4	(63.9, 67.2)	68.5	(67.0, 70.0)	71.5	(69.9, 72.9)
75	50.4	(49.5, 51.3)	54.1	(53.4, 54.9)	57.9	(57.2, 58.6)
77	63.5	(61.5, 66.0)	66.5	(64.6, 68.5)	69.5	(67.6, 71.3)
80	64.2	(62.3, 66.4)	67.3	(65.5, 69.1)	70.3	(68.6, 71.9)
89	72.4	(69.3, 74.8)	74.5	(70.8, 76.7)	76.5	(72.1, 78.7)
90	66.2	(64.1, 68.3)	68.9	(67.0, 70.7)	71.6	(69.5, 73.3)
92	66.4	(64.0, 69.4)	68.9	(66.9, 71.2)	71.5	(69.6, 73.2)
95	62.3	(60.7, 64.4)	65.7	(64.3, 67.4)	69.1	(67.6, 70.5)

Estimates calculated using ecological inference estimates for the Enacted Districts using the average of the two-party votes shares from the 2008 presidential and 2009 gubernatorial elections. Confidence intervals calculated using EI with 100,000 samples and estimating Dem. vote share from each draw.

Maxwell Palmer

Contact

Department of Political Science
Boston University
232 Bay State Road
Boston, MA 02215

E-mail: mbpalmer@bu.edu
Website: www.maxwellpalmer.com
Phone: (617) 358-2654

Academic Employment

Boston University, Boston, Massachusetts

Assistant Professor, Department of Political Science, 2014–Present

Education

Harvard University, Cambridge, Massachusetts

Ph.D., Political Science, May 2014.

Dissertation: *Time and Political Power*

A.M., Political Science, May 2012.

Bowdoin College, Brunswick, Maine

A.B., Mathematics & Government and Legal Studies, May 2008.

Peer Reviewed Publications

Ansolabehere, Stephen, Maxwell Palmer and Benjamin Schneer. Forthcoming. "Divided Government and Significant Legislation, A History of Congress from 1789-2010." *Social Science History.*

Edwards, Barry, Michael Crespin, Ryan D. Williamson, and Maxwell Palmer. 2017. "Institutional Control of Redistricting and the Geography of Representation." *Journal of Politics* 79(2): 722–726.

Palmer, Maxwell. 2016. "Does the Chief Justice Make Partisan Appointments to Special Courts and Panels?" *Journal of Empirical Legal Studies* 13(1): 153–177.

Palmer, Maxwell and Benjamin Schneer. 2016. "Capitol Gains: The Returns to Elected Office from Corporate Board Directorships." *Journal of Politics* 78(1): 181–196.

Gerring, John, Maxwell Palmer, Jan Teorell, and Dominic Zarecki. 2015. "Demography and Democracy: A Global, District-level Analysis of Electoral Contestation." *American Political Science Review* 109(3): 574–591.

Other Publications

Ansolabehere, Stephen and Maxwell Palmer. 2016. "A Two Hundred-Year Statistical History of the Gerrymander." *Ohio State Law Journal* 77(4): 741–762.

Ansolabehere, Stephen, Maxwell Palmer, and Benjamin Schneer. 2016. "What Has Congress Done?" in *Governing in a Polarized Age: Elections, Parties, and Political Representation in America*, eds. Alan Gerber and Eric Schickler. New York, NY: Cambridge University Press.

Working Papers

"Do Mayors Run for Higher Office? New Evidence on Progressive Ambition" (with Katherine Levine Einstein, David M. Glick, and Robert Pressel). Invited to Revise and Resubmit, *American Politics Research*.

"City Learning: Evidence of Policy Information Diffusion From a Survey of U.S. Mayors" (with Katherine Levine Einstein and David M. Glick). *Under Review*

"Post-Political Careers: How Politicians Capitalize on Public Office" (with Benjamin Schneer). *Under Review*

"The Politics of Delay in Local Politics: How Institutions Empower Individuals" (with Katherine Levine Einstein and David M. Glick).

"Reexamining the Gender Gap in Support of War" (with Katherine Krimmel and Douglas Kriner).

"Corporate Political Activity as a Bundle of Goods" (with Daniel Moskowitz and Benjamin Schneer).

"Why Legislatures Elect and Empower Leaders."

"Presidential Legacies and Partisan Balance on the Federal Courts."

Current Projects

Co-principal Investigator, Menino Survey of Mayors, Boston University Institute on Cities, 2017.

"Rainmakers: Former Politicians as Lobbyists" (with Pamela Ban and Benjamin Schneer).

"The Expert's Guide to Redistricting" (with Stephen Ansolabehere).

Grants and Awards

The Center for Finance, Law, and Policy, Boston University, Research Grant for "From the Capitol to the Boardroom: The Returns to Office from Corporate Board Directorships," 2015.

Senator Charles Sumner Prize, Dept. of Government, Harvard University, 2014.

Awarded to the best dissertation "from the legal, political, historical, economic, social or ethnic approach, dealing with means or measures tending toward the prevention of war and the establishment of universal peace."

The Center for American Political Studies, Dissertation Research Fellowship on the Study of the American Republic, 2013–2014.

The Tobin Project, Democracy and Markets Graduate Student Fellowship, 2013–2014.

The Dirksen Congressional Center, Congressional Research Award, 2013.

The Institute for Quantitative Social Science, Conference Travel Grant, 2014.

The Center for American Political Studies, Graduate Seed Grant for "Capitol Gains: The Returns to Elected Office from Corporate Board Directorships," 2014.

The Institute for Quantitative Social Science, Research Grant, 2013.

Bowdoin College: High Honors in Government and Legal Studies; Philo Sherman Bennett Prize for Best Honors Thesis in the Department of Government, 2008.

Selected Presentations

"How Institutions Enable NIMBYism and Obstruct Development," Boston Area Research Initiative Spring Conference, Northeastern University, 2017.

"Corporate Political Activity as a Bundle of Goods," Annual Meeting of the American Political Science Association, Philadelphia, PA, 2016.

"The Corporate Boardroom's Revolving Door," Annual Meeting of the American Political Science Association, San Francisco, CA, 2015.

"The Corporate Boardroom's Revolving Door," Annual Meeting of the European Political Science Association, Vienna, Austria, 2015.

"A Two Hundred-Year Statistical History of the Gerrymander," Congress and History Conference, Vanderbilt University, 2015.

"A New (Old) Standard for Geographic Gerrymandering," Harvard Ash Center Workshop: How Data is Helping Us Understand Voting Rights After Shelby County, 2015.

"Capitol Gains: The Returns to Elected Office from Corporate Board Directorships," Boston University Center for Finance, Law, and Policy, 2015.

"Does the Chief Justice Make Partisan Appointments to Special Courts and Panels?" Annual Meeting of the American Political Science Association, Washington, DC, 2014.

"Capitol Gains: The Returns to Elected Office from Corporate Board Directorships," Annual Meeting of the Midwest Political Science Association, Chicago, IL, 2014.

"Capitol Gains: The Returns to Elected Office from Corporate Board Directorships," Bowdoin College, 2014.

"Corporate Boards as Legislatures," Annual Meeting of the Southern Political Science Association, New Orleans, LA, 2014.

"Presidential Legacies and Partisan Balance on the Federal Courts," Annual Meeting of the Southern Political Science Association, New Orleans, LA, 2014.

"Time and Political Power: Setting the Calendar in a Busy Legislature," Annual Meeting of the Midwest Political Science Association, Chicago, IL, 2013.

"Using Multiple Elections to Evaluate Districting Maps," Annual Meeting of the Midwest Political Science Association, Chicago, IL, 2012.

Teaching

Boston Univeristy

- *Introduction to American Politics* (Fall 2014, Fall 2015, Fall 2016, Fall 2017)
- *Congress and Its Critics* (Fall 2014, Spring 2015, Spring 2017)
- *Formal Political Theory* (Spring 2015, Spring 2017)
- *Prohibition, Regulation, and Bureaucracy* (Fall 2015)
- *Political Analysis* (Fall 2016, Fall 2017)

Harvard University

- *American Government* (Head Teaching Fellow, Fall 2012 and Fall 2013)
- *The Politics of Congress* (Head Teaching Fellow, Spring 2013).
- *Introduction to Congress* (Teaching Fellow, Spring 2012).

Service

Boston University

- College of Arts and Sciences
  - General Education Curriculum Committee, 2017–.
- Department of Political Science
  - American Politics Search Committee, 2016.
  - Graduate Program Committee, 2014–2015.

Reviewer: *American Journal of Political Science*; *American Political Science Review*; *Journal of Politics*; *Quarterly Journal of Political Science*; *Public Choice*; *Political Science Research and Methods*; *Journal of Law, Economics and Organization*; *Election Law Journal*; Oxford University Press.

Coordinator, Harvard Election Data Archive, 2011–2014.

Skills

Python, Stata, R, LaTeX, GIS

Other Experience

Charles River Associates, Boston, Massachusetts 2008–2010

Associate, Energy & Environment Practice
Economic consulting in the energy sector for electric and gas utilities, private equity, and electric generation owners. Specialized in Financial Modeling, Resource Planning, Regulatory Support, Price Forecasting, and Policy Analysis.