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How the Efficiency Gap Works

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The efficiency gap is a standard for measuring partisan gerrymandering that is currently at the heart of the Wisconsin gerrymandering case, *Whitford v. Nichol*.[1]

Developed by Nicholas Stephanopoulos, Professor at the University of Chicago Law School, and Eric McGhee, Research Fellow at the Public Policy Institute of California, the efficiency gap counts the number of votes each party wastes in an election to determine whether either party enjoyed a systematic advantage in turning votes into seats.[2] Any vote cast for a losing candidate is considered wasted, as are all the votes cast for a winning candidate in excess of the number needed to win.

Hypothetical Scenario

To understand how the efficiency gap works, consider a hypothetical state with 500 residents that is divided into five legislative districts, each with 100 voters. In the most recent election cycle, Democrats won Districts 1 and 2 by wide margins, while Republicans won Districts 3, 4, and 5 in closer races. Overall, Democratic candidates received 55 percent of the statewide vote but won just 40 percent of the legislative seats, while Republican candidates received 45 percent and won 60 percent of the seats. The table below shows the election results for each district.

District	D Votes	R Votes	Result
1	75	25	D wins
2	60	40	D wins
3	43	57	R wins
4	48	52	R wins
5	49	51	R wins
Total	275	225	

[1] Whitford v. Nichol, No. 15-cv-421 (W.D. Wis. filed July 8, 2015).
[2] Nicholas O. Stephanopoulos & Eric M. McGhee, *Partisan Gerrymandering and the Efficiency Gap*, 82 U. CHI. L. REV. 831 (2015).

Calculating the Efficiency Gap

Calculating the efficiency gap involves three steps.

Step 1: The first step is to determine the total number of votes each party wasted in the election. Again, any votes cast for a losing candidate are considered wasted. Likewise, any vote cast for a winning candidate in excess of the number needed to win is also wasted. In our scenario, a candidate needs 51 votes to win since there are 100 voters in each district, so any votes above that threshold are wasted. The table below shows the election results in each district, as well as the number of wasted votes.

District	D Votes	R Votes	D Wasted Votes	R Wasted Votes	Net Wasted Votes
1	75	25	24	25	1 R
2	60	40	9	40	31 R
3	43	57	43	6	37 D
4	48	52	48	1	47 D
5	49	51	49	0	49 D
Total	275	225	173	72	101 D

Since the Democratic candidate in District 1 received 75 votes but only needed 51 to win, 24 Democratic votes were wasted (75 – 51 = 24). Likewise, all 25 Republican votes in District 1 were wasted since the Republican candidate lost.

Repeating this process for the other districts shows that in District 2 Democrats wasted 9 votes and Republicans wasted 40 votes, in District 3 Democrats wasted 43 votes and Republicans wasted 6 votes, in District 4 Democrats wasted 48 votes and Republicans wasted 1 vote, and in District 5 Democrats wasted 49 votes and Republicans wasted 0 votes.

Step 2: Next, the process requires calculating the total number of votes wasted by each party and finding the net wasted votes. In this scenario, Democrats wasted 173 votes (24 + 9 + 43 + 48 + 49 = 173) and Republicans wasted 72 votes (25 + 40 + 6 + 1 + 0 = 72). Thus, Democrats had a net waste of 101 votes (173 – 72 =101), meaning they wasted 101 more votes than Republicans.

Step 3: The final step in calculating the efficiency gap is to divide the net wasted votes by the total number of votes cast in the election. The net number of wasted votes was 101 and there were 500 total votes, which produces an efficiency gap of 20 percent (101 ÷ 500 = .202).

In other words, Republicans were better able to convert their votes into legislative seats. As a result, they won 20 percent more seats (which translates to one additional seat since 20 percent of five equals one) than they would have if both parties had wasted an equal number of votes.

In their paper, Stephanopoulos and McGhee propose efficiency gap thresholds above which a district plan would be presumptively unconstitutional. For congressional plans, an efficiency gap of two or more seats indicates a constitutional problem. For state legislative plans, the threshold is an efficiency gap of 8 percent or greater.

Efficiency Gap Equation

As an equation, the efficiency gap looks like this:

Efficiency Gap = (Total Democratic Wasted Votes – Total Republican Wasted Votes) ÷ Total Votes

Simplified Efficiency Gap Calculation

If either party's seat margin and vote margin for a given election are known, then the efficiency gap can also be calculated using the following formula:

Efficiency Gap = (Seat Margin – 50%) – 2 (Vote Margin – 50%)

Applying this formula to the hypothetical yields the following algebraic process:

Efficiency Gap = (Republican Seat Margin – 50%) – 2 (Republican Vote Margin – 50%)

Efficiency Gap = (60% – 50%) – 2 (45% – 50%)

Efficiency Gap = (10%) – 2 (-5%)

Efficiency Gap = (10%) – (-10%)

Efficiency Gap = 20%

Alternatively, using the Democratic seat and vote margins, the formula yields:

Efficiency Gap = (Democratic Seat Margin – 50%) – 2 (Democratic Vote Margin – 50%)

Efficiency Gap = (40% – 50%) – 2 (55% – 50%)

Efficiency Gap = (-10%) – 2 (5%)

Efficiency Gap = (-10%) – (10%)

Efficiency Gap = -20%

When calculated using the margins for Republicans, who were better able to turn votes into seats, the efficiency gap is positive, indicating an electoral advantage. The converse is true when using the Democratic margins.

The simplified method for calculating the efficiency gap can be much faster than the district-by-district method, but note that the results are only exactly equal when voter turnout is equal in every district, as it is in this hypothetical.