Ratiocination

Eric Gaze
Director of the Quantitative Reasoning Program
Bowdoin College

A column devoted to ratios in all their guises: indices, coefficients, constants, percentages, rates, scales, conversions, etc. Ratios are comparisons between the relative size of two quantities, a simple idea which surprisingly underlies much of the way we use numbers to communicate.

Swing Votes: How Elastic is our Representation?

Numb: The swing vote ratio was 1.3 for the US in the period 1978-2008.
Number: The swing vote ratio for the US in the period 1978-2008 was 1.3, meaning either political party could expect to increase their percentage share of seats in the House of Representatives by 1.3 percentage points for every 1 percentage point increase in popular vote share nationwide.
Num-best: The swing vote ratio for the US in the period 1978-2008 was 1.3, meaning either political party could expect to increase their percentage share of seats in the House of Representatives by 1.3 percentage points for every 1 percentage point increase in popular vote share nationwide. This responsiveness of representation to votes has been steadily declining over the past century, from 2.20 in the period 1870-1944 to 0.23 in the most recent 2012 elections.

One of the central tenets of our Republic is that representation is a function of popular vote. This is seen most directly in the House where the 435 Representatives reflect a proportional distribution of citizens drawn from districts of roughly the same population size, as opposed to the 2 senators from each state who give smaller states more "vote per capita." Rhode Islanders vastly outweigh Californians in senate voting, getting 1 vote per 500,000 residents while Californians have 1 senate vote per 19 million residents. California however, does have 53 seats in the House, with 702,000 residents per seat, very close to the average of 714,000 residents per seat in the country. Rhode Island only gets 2 seats in the House. Presidential elections highlight the electoral college system, with the possibility of winning the election without a majority of the popular vote. Less well known is the imbalance of votes and seat share that occurs in the House, e.g. in 2012 the Democratic party won the popular vote by a margin of 1.4 million votes yet lagged the Republicans in seats controlled 234 to 201. In this column we will explore the relationship between national vote share and number of seats controlled by each party. In particular we will analyze how a change in vote share impacts a change in seats in the House over time, giving us insight into how responsive our system is to voter preference.

Politics seems to be increasingly partisan and divisive with each party voting as a block often to the detriment of actually accomplishing anything. One possible explanation for this partisanship is how responsive legislative seat share is to the popular vote, something we can quantify with the *swing ratio*. The swing ratio is defined by political scientists as "the percentage change in legislative seats associated with a 1% change in legislative votes." [Linzer, 2012][1] Unfortunately this definition is incorrect, in terms of how they actually compute the

[1] Linzer, Drew. 2012. *The Relationship Between Seats and Votes in Multiparty Systems*. Political Analysis 20:400-416

swing ratio. In the paper just cited, Drew Linzer computes swing ratios for the 1979 Canadian election by modeling the distribution of votes using statistical techniques and then randomly "re-voting" using a probabilistic technique known as Monte Carlo simulation. Thus he can compute the swing ratio by randomly increasing the national vote for each of the 4 parties involved and measuring the impact on legislative seats obtained. He arrives at a swing ratio of 2.1 for the two dominant parties. The Progressive Conservatives received only 36% of the vote but acquired 48% of the seats, while the Liberal party received 40% of the vote but a smaller percentage, 40%, of the seats. Linzer then states that the Progressive Conservatives "would have only needed one additional percentage of the national popular vote, or 37%, to win a majority (i.e. 50%) of seats on the House of Commons. In contrast, the Liberal Party would have needed another 5% of the national vote to reach a majority." [Linzer, p. 410] Thus he clearly is using the swing ratio of 2.1 to equate a 2 **percentage point** gain in seat share with a 1 **percentage point** gain in vote share. The distinction being made is subtle, the political scientists should define the swing ratio as follows:

Swing Ratio: The ratio of total change in percentage of legislative seats associated with a 1 percentage point change in percentage of legislative votes received.

Linzer is simply using a definition from other papers on the subject. Another example from a paper delivered at the American Political Science Association Meetings defines the swing ratio as "the relationship of changes in the percentage of House seats relative to the change in the partisan percentage of the vote" [Stonecash, 2010][2] which might be correct, but only if interpreted properly. Stonecash computes swing ratios for the United States "by regressing the percentage changes in seats on the percentage changes in votes." [Stonecash, p. 2], and now we are back to the incorrect definition. Take for example 2010 when the Republicans won 63 additional seats, from 179 to 242, while their percentage of national vote increased by 17 percentage points (pp). [Silver, 2012][3] What is the swing ratio? The percentage change in legislative seats is 63/179 or 35.2% which when compared to 17% gives a swing ratio of 2.1 using the definition from the political science papers. But this is incorrect, they actually compute the swing ratio by using total change in percentage of legislative seats, from 41.1% (179/435) to 55.6% (242/435) or 14.4 percentage points, compared to the 17 pp increase in vote share yields the correct swing ratio of 0.85 for 2010. I say *correct*, meaning this is how political scientists compute the swing ratio, regardless of how they define it. Stonecash computes swing ratios using "regression" by plotting total change in percentage of legislative seats against total change in percentage of votes for various periods in American history. He then uses the slope of the line of best fit, the rise over run giving us the desired swing ratio.

	Democrats		Republicans	
Years	Swing Ratios	R^2	Swing Ratio	R^2
1870-1944	2.21	0.60	2.07	0.65
1944-1976	1.73	0.67	1.79	0.90
1978-2008	1.35	0.73	1.26	0.77

[2] Stonecash, Jeffrey. 2010. *The Declining Swing Ratio: Incumbent Insulation or Realignment?*. American Political Science Association Meetings

[3] Silver, Nate. 2012. *As Swing Districts Dwindle, Can a Divided House Stand?*. New York Times. December 27, 2012.

Notice how our value of 0.85 in 2010 continues the downward trend of swing ratios. The R-squared values, e.g. 0.73, can be interpreted by saying 73% of the variability in change in legislative seats can be attributed to variability in legislative votes. Stonecash says that the increasing correlation and declining swing ratios is a mystery that: "represents conflicting evidence that has thus far been neglected." [Stonecash, p.3] This is *conflicting* because the declining swing ratio indicates that legislative seats are becoming less responsive to vote share, while the increasing correlation says the opposite! This I think is a good example of not taking the interpretation of the R-squared value as literal truth, but more as a convenient rule of thumb for interpretation (along the lines of correlation does not imply causation). Stonecash spends the remainder of his paper making a strong case to explain the declining swing ratio in terms of our political parties' *realignment* of strong support in core bases, not *incumbency* or *gerrymandering*. Indeed the evidence he presents showing the growth of more "***safe***" seats (meaning the Representative won with more than 60% of the vote) is quite compelling. The realignment he refers to is the switch of the Democratic party base from Southern, rural white voters to urban non-whites, while the Republican party moved from a solid base in the Northeast to the South. The sudden shift in 1966 is quite shocking to see.

Republicans lagged Democrats in the percentage of safe seats they controlled for the first half of the 20th century. Roughly 40% of Republican seats were safe compared to about 70% for the Democratic strongholds in the South. This abruptly changed in 1966 with the Republicans seeing a rapid increase of safe seats up to the levels of the Democrats. Stonecash attributes this change to a "negative reaction to Democrats because of Vietnam, urban riots, increased crime, and enactment of expensive new programs." [Stonecash, p.25] He captures the realignment of Republican party beautifully by categorizing every state according to the percentage of votes for Nixon+Wallace in 1968:

1. *States where less than 55% voted N+W.*
2. *States where 55%-64% voted N+W.*
3. *States where 65% plus voted for N+W.*

Then he computes the percentage of Republican seats that are safe in each of the three categories of states:

	Percentage of Republican Seats that are *Safe* in States by Nixon + Wallace vote in 1968		
	Less than 55% for N+W	*55%-64% for N+W*	*65% plus for N+W*
1900-1960	44.7%	36.0%	32.3%
1960's	58.5%	48.7%	48.6%
1970-2008	62.7%	62.2%	71.3%

There are two things to notice about this table. First note that in the 1970-2008 period the Republicans have over 60% of safe seats in all districts, a major "improvement" from 1900-1960. Second note that in the 3rd column, which represents states strongly supporting Nixon + Wallace, the Republicans saw a complete realignment of their core base of supporters.

Nate Silver also talks about the increase of safe seats as "swing districts dwindle." He defines a swing district as a district being "within 5 percentage points of the national popular vote margin." [Silver, p. 2] Districts that vote 5 to 10 percentage points more Democrat/Republican (D/R) are defined as "lean D/R", 10 to 20 percentage points more D/R are "strong D/R" and at least 20 percentage points more D/R are "landslide D/R". Not surprisingly, there has been a rapid decline of swing districts with subsequent rise in landslide districts.

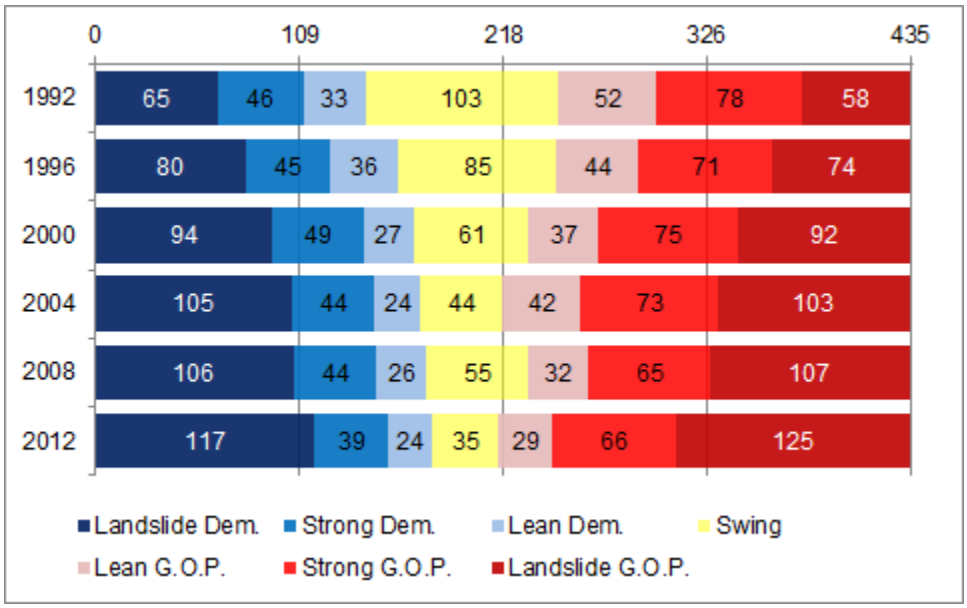

Figure 1: Nate Silver's graphic displaying the decline in swing districts and the growth in landslide districts.

This growth in partisan districts, realignment of core base not redistricting, is what both Silver and Stonecash argue is significantly driving the decline in the swing ratio. Sam Wang argues for redistricting in his article on the effects of gerrymandering in the 2012 elections.[4] There is no doubt that gerrymandering, the redrawing of district line to favor one parties control of legislative seats, does effect the responsiveness of legislative seat share to vote share. In the 7 states that Wang identifies as flagrantly redistricting for the Republican party, the popular vote was essentially tied yet Republicans won 73 seats to the Democrat's 34 seats. Interestingly no one seems to be arguing for incumbency, the ability of a representative to win reelection based on their superior performance, as having any impact on the swing ratio! In any case, the combination of realignment and redistricting has brought the swing ratio to its lowest point. In 2012 , Democrats saw a 8 percentage point gain in popular vote nationally, but this translated into a meager 1.8 percentage point increase in seat share (from 193 seats to 201). The swing ratio is thus 1.8/8 = 0.23, awfully close to zero! Economists refer to the responsiveness of demand for an item associated to a price change as *elasticity*, taking the ratio of percentage change in demand to percentage change in price of an item. Eggs are very inelastic, with a ratio of 0.1, meaning the demand for eggs is relatively unaffected by price changes. Air travel on the other hand is very elastic, with a ratio of 2.4 indicating this is more of a luxury item that people cut back on when prices rise. So there are two ways we can view the declining swing ratio and 2012's value of 0.23: either our representation has been moving from a luxury good to a staple or it has completely gone to the birds.

Sapere Aude!

[4] Wang, Sam. 2012. *The Great Gerrymander of 2012*. New York Times. February 2, 2013.