Statistical Misstep By Fox in Explanation Of Its Debate Lineup

By JUSTIN WOLFERS

Did Rick Perry miss the main Republican debate Thursday night because he was unpopular or because he was unlucky? This turns out to be a far more difficult question that many might realize, and it's one that apparently eluded the Fox News decision desk.

For those of us in the data game, it provides a useful teaching moment, albeit one that comes with a warning: Arcane statistical arguments lie ahead. Seriously, you've been warned.

The memo that Fox News released explaining the omission of Mr. Perry contrasts the fact that John Kasich, Ohio's governor, polled 3.2 percent in the five most recent polls, while Mr. Perry polled only 1.8 percent. So far, so good.

But then Fox goes too far, arguing that this difference of 1.4 percentage points is big enough that it can conclude that with "over 2,400 interviews contained within the five polls, from a purely statistical perspective it is at least 90 percent likely that the 10th-place Kasich is ahead of the 11th-place Perry." But that doesn't follow.

As anyone who has ever taken an introductory statistics course can attest, this is not what a test of statistical significance reveals. Significance tests answer a somewhat different question:

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If Mr. Perry and Mr. Kasich actually have an equal number of supporters, then how unlikely is it that the polls would reveal a difference that is this large?

That is, a significance test describes the probability of the occurrence of a certain set of poll results, given your view about the underlying state of public opinion. It does not describe the probability of the underlying state of public opinion. When a pollster describes a statistical test, the subject of the sentence should be a data set, not a politician.

A simple example may highlight the leap in Fox's logic. Imagine that there are two (but only two) equally likely possibilities. Either Republican voters like Mr. Kasich so much that he is beating Mr. Perry by 20 points, or alternatively they find them both pretty likable, but Perry's new glasses are sufficient to give him a 0.1 percentage point lead. A small poll in which Mr. Kasich edges out Mr. Perry by a mere 1.4 percentage points is more consistent with the latter scenario than the former. And so in this (admittedly contrived) example, the recent polls should be interpreted as evidence that Mr. Perry is the preferred candidate among Republican primary voters.

The more general issue is this: In order to use polls to make probabilistic statements about politicians, you need to be clear about what uncertainties you are hoping that poll can help resolve. Statisticians call this description of the remaining uncertainties "a prior." Unless you state a prior, a poll can't help you make any interesting statement about how likely different political outcomes are.

There's one last point to deal with, and it's technical. Mathematically, there does exist a prior that allows statistical significance tests to be interpreted as probabilities. It's the prior that anything can happen, and everything is equally likely. This is sometimes called an uninformative prior, which sounds reasonable enough. But as Andrew Gelman, a Columbia University political scientist and statistician, has written, this prior replaces my contrived example in which there's uncertainty about whether Mr. Kasich holds a 20-point lead with a prior in which that is as likely as his having a 40-point lead. Bad priors yields bad assessments.

An attempt to answer the wrong question with the results of a poll.

The bottom line is that we can't really say that there's a 90 percent chance that Rick Perry deserved to miss the prime-time debate. It's the sort of nerdy statistical point that you might expect the newly bespectacled Mr. Perry to make.

BRIAN SNYDER/REUT

John Kasich, left, edged out Rick Perry, center, for the final slot in the prime-time Republican debate on Thursday night.

$\hat{p}_1 = 3.2$ $\hat{p}_2 = 1.8$ $H_0: p_1 = p_2$ Test of Equal Proportions

$N = 2{,}400$ $H_1: p_1 > p_2$