The Lead Margin of Error

Authors Stephen Ansolabehere and Thomas Belin wrote in their article "Poll Faulting" (*Chance* magazine) that "our greatest criticism of the reporting of poll results is with the margin of error of a single proportion (usually $\pm 3\%$) when media attention is clearly drawn to the *lead* of one candidate." They point out that the lead is really the *difference* between two proportions ($p_1 - p_2$) and go on to explain how they developed the following rule of thumb: The lead is approximately $\sqrt{3}$ times larger than the margin of error for any one proportion. For a typical pre-election poll, a reported $\pm 3\%$ margin of error translates to about $\pm 5\%$ for the lead of one candidate over the other. They write that the margin of error for the lead should be reported.

Example 1 Large Denominations Less Likely to Be Spent?

In the article "The Denomination Effect" by Priya Raghubir and Joydeep Srivastava, *Journal of Consumer Research,* Vol. 36, researchers reported results from studies conducted to determine whether people have different spending characteristics when they have larger bills, such as a \$20 bill, instead of smaller bills, such as twenty \$1 bills. In one of the trials that they conducted, 89 undergraduate business students from two different colleges were randomly assigned to two different groups. In the "dollar bill" group, 46 subjects were given dollar bills; the "quarter" group consisted of 43 subjects given quarters. All subjects from both groups were given a choice of keeping the money or buying gum or mints. The article includes the claim that "money in a large denomination is less likely to be spent relative to an equivalent amount in many smaller denominations." Let's test that claim using a 0.05 significance level with the following sample data from the study.

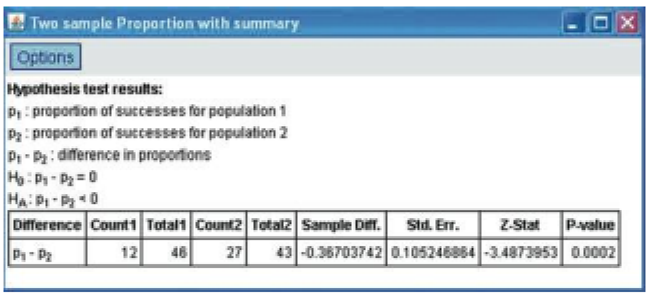
	Group 1	Group 2
	Subjects Given \$1 Bill	**Subjects Given 4 Quarters**
Spent the money	$x_1 = 12$	$x_2 = 27$
Subjects in group	$n_1 = 46$	$n_2 = 43$

Solution

Requirement check We first verify that the two necessary requirements are satisfied. (1) Because the 89 subjects were randomly assigned to the two groups, we will consider the two samples to be simple random samples (but see the interpretation at the end of this example for more comments). The two samples are independent because subjects are not matched or paired in any way. (2) The subjects given \$1 bills include 12 who spent the money and 34 who did not, so the number of successes is at least 5 and the number of failures is at least 5. The subjects given four quarters include 27 who spent the money and 16 who did not, so the number of successes is at least 5 and the number of failures is at least 5. The requirements are satisfied. ✓

Technology Computer programs and calculators usually provide a *P*-value, so the *P*-value method is typically used. See the accompanying StatCrunch results showing the null and alternative hypotheses, the test statistic of $z = -3.49$ (rounded), and the *P*-value of 0.0002.

STATCRUNCH



Two sample Proportion with summary

Options

Hypothesis test results:

p_1 : proportion of successes for population 1
p_2 : proportion of successes for population 2
$p_1 - p_2$: difference in proportions
$H_0 : p_1 - p_2 = 0$
$H_A : p_1 - p_2 < 0$

Difference	Count1	Total1	Count2	Total2	Sample Diff.	Std. Err.	Z-Stat	P-value
$p_1 - p_2$	12	46	27	43	-0.36703742	0.105246864	-3.4873953	0.0002

If technology is not available, see Figure 8-1 in Section 8-2 for the *P*-value method; we will now proceed with that method.

Step 1: The claim that "money in a large denomination is less likely to be spent relative to an equivalent amount in many smaller denominations" can be expressed as $p_1 < p_2$.