

# **Point Estimates and Sampling Variability**

# Parameter estimation

- We are often interested in *population parameters*.
- Since complete populations are difficult (or impossible) to collect data on, we use *sample statistics* as *point estimates* for the unknown population parameters of interest.
- While the **recipe (estimator)** is established prior to data collection, the **values** of the sample statistics (**estimates**) vary from sample to sample.
- Quantifying how sample statistics vary provides a way to estimate the *margin of error* associated with our point estimate.
- But before we get to quantifying the variability among samples, let's try to understand how and why point estimates vary from sample to sample.

# Young, Underemployed and Optimistic

*Coming of Age, Slowly, in a Tough Economy*

**Young adults hit hard by the recession.** A plurality of the public (41%) believes young adults, rather than middle-aged or older adults, are having the toughest time in today's economy. An analysis of government economic data suggests that this perception is correct. The recent indicators on the nation's labor market show a decline in the

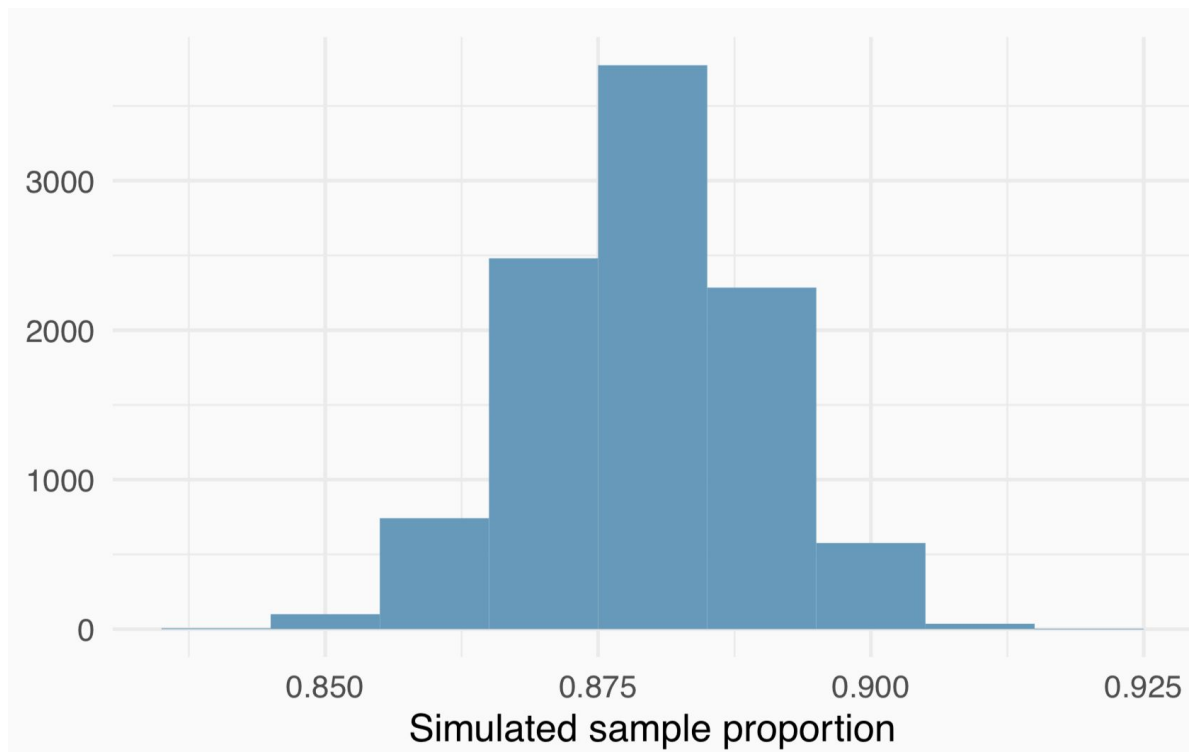
**Tough economic times altering young adults' daily lives, long-term plans.** While negative trends in the labor market have been felt most acutely by the youngest workers, many adults in their late 20s and early 30s have also felt the impact of the weak economy. Among all 18- to 34-year-olds, fully half (49%) say they have taken a job they didn't want just to pay the bills, with 24% saying they have taken an unpaid job to gain work experience. And more than one-third (35%) say that, as a result of the poor economy, they have gone back to school. Their personal lives have also been affected: 31% have postponed either getting married or having a baby (22% say they have postponed having a baby and 20% have put off getting married). One-in-four (24%) say they have moved back in with their parents after living on their own.

Suppose that you don't have access to the entire population of all American adults, which is a quite likely scenario. In order to estimate the proportion of American adults who support solar power expansion, you might sample from the population and use your sample proportion as the best guess for the unknown population proportion.

- Sample, with replacement, 1000 American adults from the population, and record whether they support solar power or not expansion.
- Find the sample proportion.
- Plot the distribution of the sample proportions obtained by repeating the procedure.

# Sampling distribution

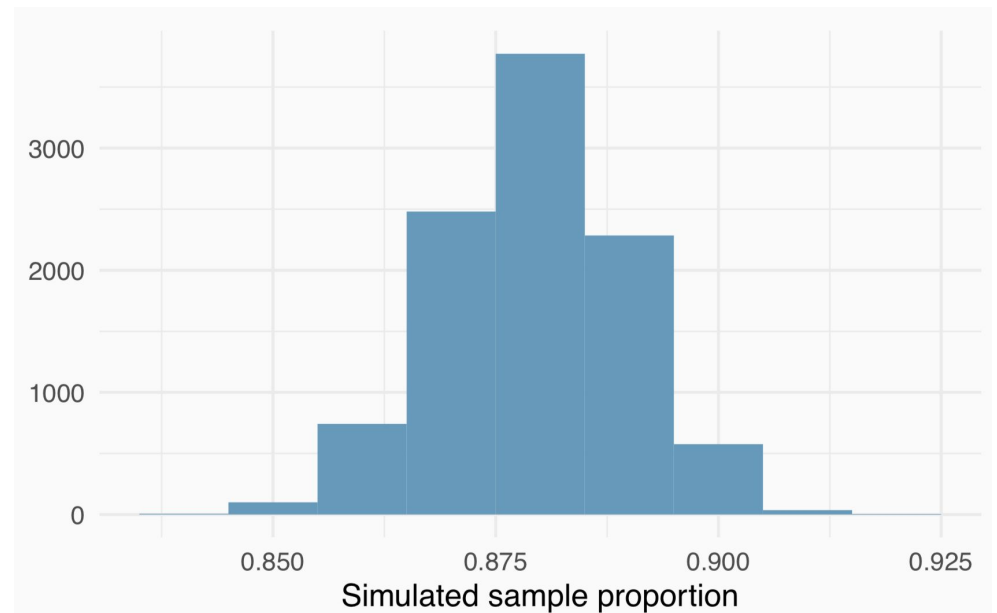
Suppose you were to repeat this process many times and plot the results. You obtain a histogram of observations from the **sampling distribution**.



# Sampling distribution

What is the shape and center of this distribution?

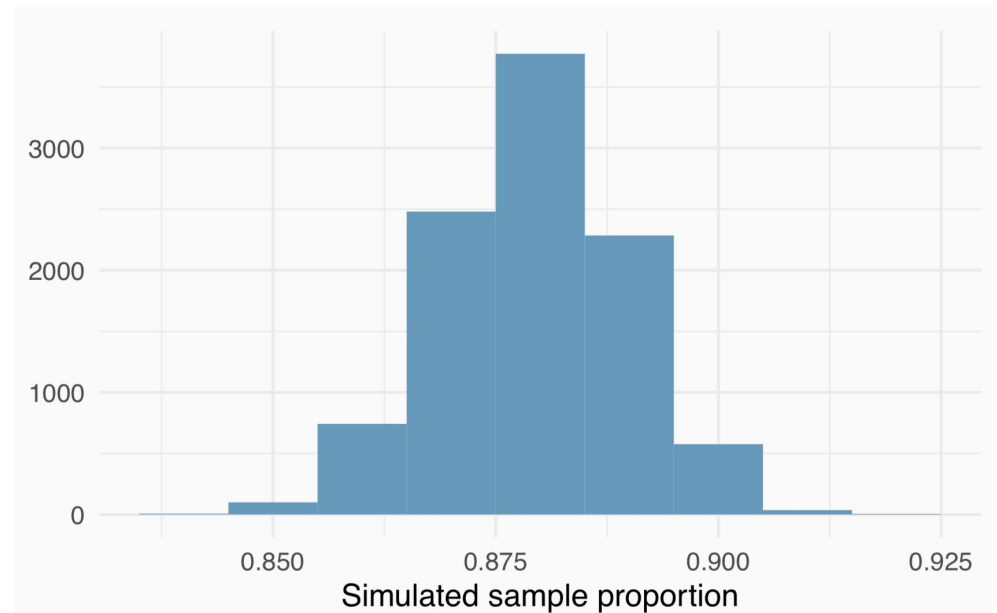
The distribution looks symmetric and somewhat bell-shaped.



# Sampling distribution

Based on this distribution, what do you think is the true population proportion?

The center of the distribution: about 0.88.



# Sampling distributions are never observed

- In real-world applications, we never actually observe the sampling distribution, yet it is useful to always think of a point estimate as coming from such a hypothetical distribution.
- Understanding the sampling distribution will help us characterize and make sense of the point estimates that we do observe.