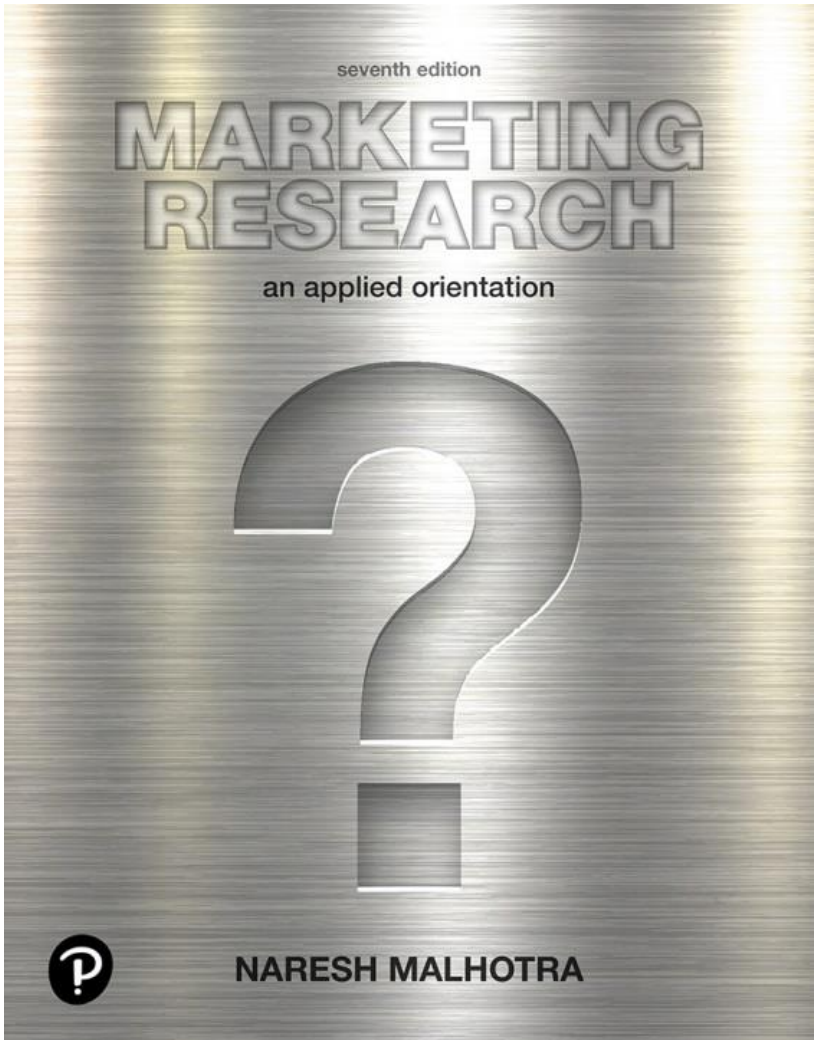
Marketing Research: An Applied Orientation

Seventh Edition



Chapter 12

Sampling: Final and Initial Sample Size Determination

Definitions and Symbols (1 of 2)

- **Parameter**: A **parameter** is a summary description of a fixed characteristic or measure of the target population. A parameter denotes the true value which would be obtained if a census rather than a sample was undertaken.
  - Population mean, population variance
- **Statistic**: A **statistic** is a summary description of a characteristic or measure of the sample. The sample statistic is used as an estimate of the population parameter.
- **Finite Population Correction**: The **finite population correction** (fpc) is a correction for overestimation of the variance of a population parameter, e.g., a mean or proportion, when the sample size is 10% or more of the population size.

Definitions and Symbols (2 of 2)

- **Precision level**: When estimating a population parameter by using a sample statistic, the **precision level** is the desired size of the estimating interval. This is the maximum permissible difference between the sample statistic and the population parameter.
- **Confidence interval**: The **confidence interval** is the range into which the true population parameter will fall, assuming a given level of confidence.
- **Confidence level**: The **confidence level** is the probability that a confidence interval will include the population parameter.

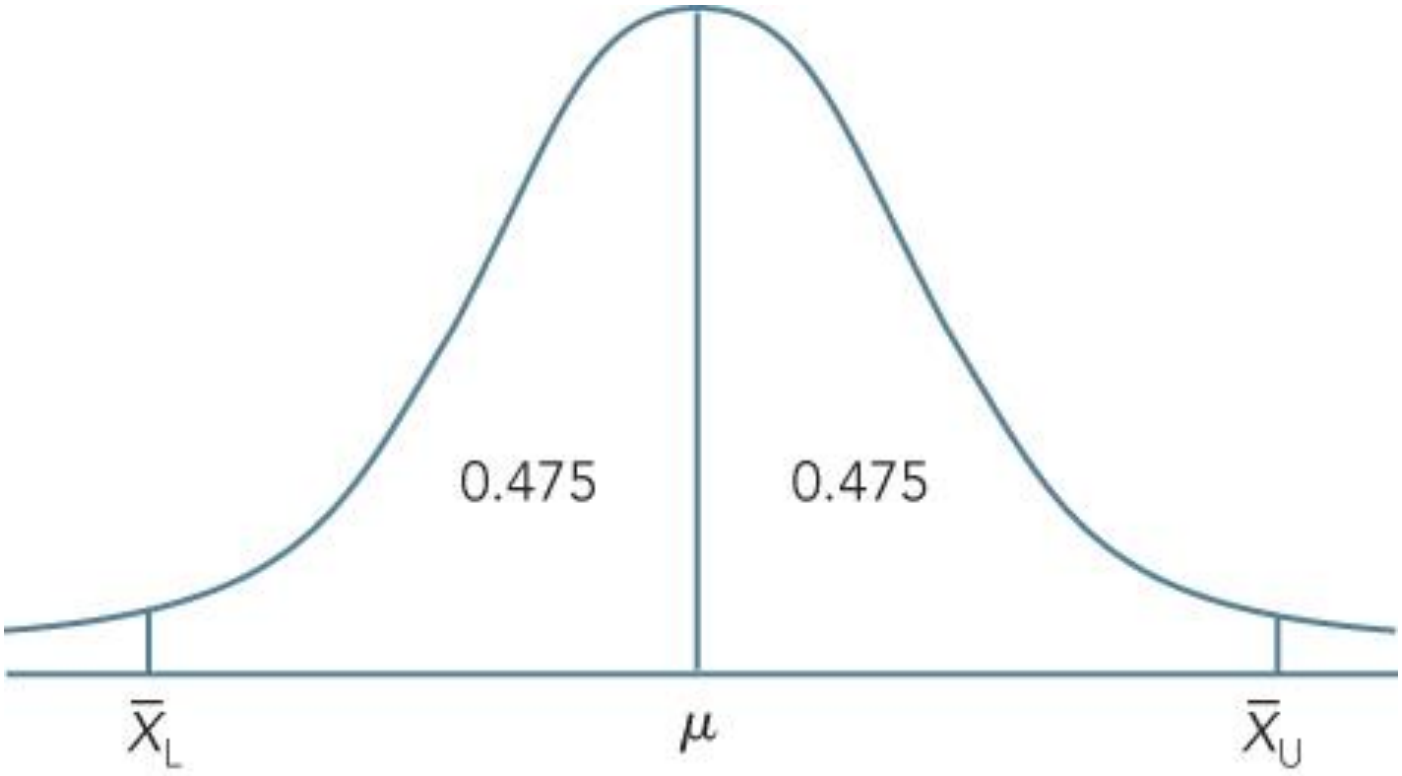
Symbols for Population and Sample Variables

Table 12.1 Symbols for Population Parameters and Sample Statistics

Variable	Population	Sample
Mean	μ	$\bar{X}$
Proportion	π	p
Variance	σ^2	s^2
Standard deviation	σ	s
Size	N	n
Standard error of the mean	$\sigma_{\bar{X}}$	$s_{\bar{X}}$
Standard error of the proportion	σ_p	s_p
Standardized variate (z)	$\frac{X-\mu}{\sigma}$	$\frac{X-\bar{X}}{s}$
Coefficient of variation (CV)	$\frac{\sigma}{\mu}$	$\frac{s}{\bar{X}}$

95% Confidence Interval

Figure 12.1 95 Percent Confidence Interval



Sample Size Determination for Means and Proportions (1 of 2)

Table 12.2 Sample Size Determination for Means and Proportions

Steps	Means	Proportions
1. Specify the level of precision.	$D = \pm \$5.00$	$D = p - \pi = \pm 0.05$
2. Specify the confidence level (CL).	CL = 95%	CL = 95%
3. Determine the z value associated with the CL.	z value is 1.96	z value is 1.96
4. Determine the standard deviation of the population.	Estimate σ: $\sigma = 55$	Estimate π : $\pi = 0.64$
5. Determine the sample size using the formula for the standard error.	$n = \frac{\sigma^2 z^2}{D^2}$ $n = \frac{55^2(1.96)^2}{5^2}$ $= 465$	$n = \frac{\pi(1-\pi)z^2}{D^2}$ $n = \frac{0.64(1-0.64)(1.96)^2}{(0.05)^2}$ $= 355$

Sample Size Determination for Means and Proportions (2 of 2)

[**Table 12.2** Continued]

Steps	Means	Proportions
6. If the sample size represents > = 10% of the population, apply the finite population correction (fpc). 7. If necessary, reestimate the confidence interval by employing *s* to estimate σ.	$n_c = \frac{nN}{N+n-1}$ $= \overline{X} \pm zs_{\overline{x}}$	$n_c = \frac{nN}{N+n-1}$ $= p \pm zs_p$
8. If precision is specified in relative rather than absolute terms, then use these equations to determine the sample size.	$D = R\mu$ $n = \frac{CV^2z^2}{R^2}$	$D = R\mu$ $n = \frac{z^2(1-\pi)}{R^2\pi}$

Sample Size for Estimating Multiple Parameters

Table 12.3 Sample Size for Estimating Multiple Parameters

	Mean Household Monthly Expense On:		
	Department Store Shopping	**Clothes**	**Gifts**
Confidence level	95%	95%	95%
z value	1.96	1.96	1.96
Precision level (*D*)	$5	$5	$4
Standard deviation of the population (σ)	$55	$40	$30
Required sample size (*n*)	465	246	217

Adjusting the Statistically Determined Sample Size

Incidence rate refers to the rate of occurrence or the percentage, of persons eligible to participate in the study.

In general, if there are c qualifying factors with an incidence of Q_1, Q_2, Q_3, ...Q_C, each expressed as a proportion:

Incidence rate = Q_1 x Q_2 x Q_3....x Q_C

$$\text{Initial sample size} = \frac{\text{Final sample size}}{\text{Incidence rate} \times \text{Completion rate}}$$

Finding Probabilities Corresponding to Known Values

Figure 12A.1