ILLUSTRATION 6.2

Empirical Elasticities of Demand

When we use the appropriate data and statistical techniques, it is possible to estimate price, income, and cross-price elasticities from actual demand schedules. We have collected a sample of estimated demand elasticities from a variety of sources and present them in the accompanying table. In the chapter on empirical demand functions, we will show how to estimate actual demand elasticities.

Looking at the price elasticities presented in the table, note that the demand for some basic agricultural products such as butter, chicken, pork, and eggs is inelastic. Fruit, for which consumers can find many substitutes, has a much more elastic demand than chicken, pork, or eggs. Whether ground into hamburger or cut into steaks, beef is usually more expensive than the other two basic meats, chicken and pork. Since beef represents a larger fraction of households' grocery bill, consumers are more sensitive to change in beef prices than to changes in chicken prices. And, because steaks are more expensive than ground beef, consumers will be more sensitive to steak prices. Apparently consumers of beer, wine, and cigarettes can find few substitutes for these items since the demand elasticities are quite inelastic for all three. Demand for clothing, something most of us are unwilling to go without, is inelastic. A recent study found that buyers of dynamic random access memory (DRAM) chips are so insensitive to price changes that it estimated demand to be perfectly inelastic for DRAM chips! We do not wish to dispute the results of this study, but we suspect the demand for DRAM chips is perfectly inelastic only for a very narrow range of prices. As prices for bandwidth decline, Internet service providers (ISPs) apparently gobble up bandwidth to transmit data between different countries on fiber-optic cables. For any particular type and brand of ready-to-eat cereal, consumers can find plenty of readily available substitutes. Consequently, the demand for raisin bran cereal is rather large for both leading brands. Another factor affecting price elasticity is the length of time consumers have to adjust to a price change. For example, electricity demand is more price-responsive in the long run than in the short run. It is interesting that gasoline demand is inelastic in the short run but elastic in the long run.

Normal goods have positive income elasticities of demand (E_M), and inferior goods have negative income elasticities. Ground beef and potatoes are inferior goods since E_M is negative. Steaks are more strongly normal than chicken or pork, indicating that a given percentage increase in income causes over a fourfold (fivefold) increase in steak consumption than chicken (pork) consumption. Wine is more strongly normal than beer. The high income elasticity of demand for foreign travel indicates that consumer demand for foreign travel is quite responsive to changes in income. Life insurance is a normal good for both Japanese and Americans, but Japanese demand for life insurance is nearly twice as sensitive to changes in income as U.S. demand for life insurance.

We explained in the text that cross-price elasticities are positive for substitutes and negative for complements. All four pairs of goods in the table are substitutes ($E_{XY} > 0$). Steaks and chicken are weak substitutes, while margarine and butter seem to be rather strong substitutes. Beer and wine drinkers substitute between the two alcoholic beverages but apparently not with much enthusiasm. The extremely low cross-price elasticity of demand between Kellogg's and Post brands of raisin bran cereal suggests that buyers of Kellogg's brand possess strong brand-loyalty and are quite unwilling to switch to the Post brand.

▣ **Relation** The cross-price elasticity measures the responsiveness of the quantity demanded of one good when the price of another good changes, holding the price of the good and all other determinants of demand constant. Cross-price elasticity is positive (negative) when the two goods are substitutes (complements).

Table of Empirical Elasticities of Demand

Price elasticities of demand (E):	
Butter	−0.24
Chicken	−0.30
Pork	−0.77
Eggs	−0.26
Beef (ground)	−1.01
Beef (steaks)	−1.15
Fruit	−3.02
Beer	−0.20
Wine	−0.67
Cigarettes	−0.51
Clothing	−0.62
Dynamic Random Access Memory (DRAM) chips	−0.0
Transnational fiber-optic bandwidth	−2.0
Kellogg's Raisin Bran	−2.06
Post Raisin Bran	−2.03
Electricity (short run)	−0.28
Electricity (long run)	−0.90
Gasoline (short run)	−0.43
Gasoline (long run)	−1.50
Income elasticities of demand (E_M):	
Beef (ground)	−0.19
Beef (steaks)	1.87
Chicken	0.42
Pork	0.34
Potatoes	−0.81
Beer	0.76
Wine	1.72
Life insurance in Japan	2.99
Life insurance in United States	1.65
Cross-price elasticities of demand (E_{XR}):	
Beef (steaks) and chicken	0.24
Margarine and butter	1.53
Beer and wine	0.56
Kellogg's Raisin Bran and Post Raisin Bran	0.01

Sources: For price, cross-price, and income elasticities for agricultural products, see Dale Heien, "The Structure of Food Demand: Interrelatedness and Duality," *American Journal of Agricultural Economics*, May 1982; and K. S. Huang, "A Complete System of U.S. Demand for Food," *Technical Bulletin* No. 1821, Economic Research Service, U.S. Department of Agriculture, Sept. 1993. For cigarettes price elasticity, see Frank Chaloupka, "Rational Addictive Behavior and Cigarette Smoking," *Journal of Political Economy*, Aug. 1991. For clothing price elasticities, see Richard Blundell, Panos Pashardes, and Guglielmo Weber, "What Do We Learn about Consumer Demand Patterns from Micro Data," *American Economic Review*, June 1993. For alcohol elasticities, see Jon Nelson, "Broadcast Advertising and U.S. Demand for Alcoholic Beverages," *Southern Economic Journal*, Apr. 1999. For cereal elasticities, see A. Nevo, "Mergers with Differentiated Products: The Case of the Ready to Eat Cereals Industry," *RAND Journal of Economics*, Autumn 2000. For short-run and long-run gasoline and electricity elasticities, see Robert Archibald and Robert Gillingham, "An Analysis of Short-Run Consumer Demand for Gasoline Using Household Survey Data," *Review of Economics and Statistics*, Nov. 1980; and Chris King and Sanjoy Chatterjee, "Predicting California Demand Response: How Do Customers React to Hourly Prices?" *Public Utilities Fortnightly* 141, no. 13 (July 1, 2003). For income elasticity of demand for electricity, see Cheng Hsiao and Dean Mountain, "Estimating the Short-Run Income Elasticity of Demand for Electricity by Using Cross-Sectional Categorized Data," *Journal of the American Statistical Association*, June 1985. For the price elasticity of fiber-optic bandwidth, see the editorial "Fear of Fiber-Optic Glut May be Misguided," *Lightwave* 17, no. 9 (Aug. 2000). Life insurance elasticities can be found in Dai I. Chi, "Japan: Life, But Not as We Know It," *Euromoney*, Oct. 1998. For the price elasticity of DRAM chips, see Jim Handy, "Has the Market Perked Up Yet?" *Electronics Times*, June 5, 2000.

6.7 SUMMARY

The price elasticity of demand measures the responsiveness or sensitivity of consumers to changes in the price of a good. Price elasticity is the ratio of the percentage change in quantity demanded to the percentage change in the price of the good. Over a specified price range, demand is said to be either elastic, unitary elastic, or inelastic according to whether the absolute value of the price elasticity is greater than, equal to, or less than 1, respectively.