Then turn to Table 3.5 on page 84, which shows estimates of income elasticities. It differentiates between inferior goods (with negative elasticities) and normal goods. Among normal goods, it differentiates between necessities (with positive elasticities below unity) and luxuries (with elasticities above unity).

Finally, Table 3.6 on p. 85 presents cross-price elasticities for a number of substitute and complementary goods. Note that similar estimates for independent goods would produce elasticities of zero.

THE MANIFOLD USES OF ELASTICITY ESTIMATES

The British economist Gregory King (1648–1712) noted that bumper crops always seem to spell bad times for farmers and that poor crops spelled good times. Anyone with a knowledge of the low own-price and income elasticities for farm products can easily solve the puzzle. Indeed, recognition of this fact led American farmers during this century, with the help of their government, to *restrict* output and *raise* their revenues. Take another look at panel (b) of Figure 3.17. Mentally reverse the arrows shown there, and interchange the "gain" and "loss" labels. When demand is own-price inelastic, a relatively small cut in quantity allows price to be raised so much that consumers spend, and producers receive, more money than before. In addition, the lower quantity lowers the producers' costs.

The Parker Pen Company followed this strategy in the 1950s when it realized the low own-price elasticity for its ink (called Quink). Various telephone companies in 1977 followed this strategy when they became aware of the low own-price elasticity for directory assistance calls and started charging for such calls. The owners of ball parks who are aware of the low own-price elasticity for spectator sports know what they are doing when they do *not* lower price to fill the empty seats [as from *Oc* to *Od* in panel (b) of Figure 3.17].

On the other hand, consider panel (a) of Figure 3.17. When demand is own-price elastic, a cut in price causes consumers to buy so much more that their expenditures, and the revenues of producers, rise. Henry Ford I followed this strategy in the early decades of the auto company. So did the Columbia Record Company in the 1930s and AT&T's long-distance department in the 1960s.

Government officials find knowledge of elasticities to be just as crucial in their decision making. A nationwide tax hike that raises the price of a product with inelastic demand (such as alcohol, movies, cigarettes, water, coffee, or gasoline) will raise lots of extra revenue but may not cut quantity demanded very much. If a large cut in quantity is desired (to cure cancer from cigarettes or conserve water or gasoline) only a very large hike in the tax will do the trick. On the other hand, a tax hike that raises the price of a product with elastic demand (such as restaurant meals and legal gambling) will decrease government revenues and also cut quantity demanded very much, as people turn to substitutes (such as cooking at home and illegal gambling).

Business and government leaders who do not heed the crucial information embodied in elasticity estimates can make serious mistakes. When the railroads of the 1930s raised their fares (in the face of price-elastic demand), their revenues plummeted. When city government in the 1950s raised property tax rates (in the face of price-elastic demand), many businesses and house-

TABLE 3.3

Selected Estimates of Own-Price Elasticities of Demand in the United States (absolute values)

Good	|Elasticity|	Source*	Good	|Elasticity|	Source
Cottonseed oil	6.92	C	Air travel (foreign)	0.70	J
Tomatoes (fresh)	4.60	J	Shoes	0.70	J
Green peas (fresh)	2.80	J	Household appliances	0.67	J
Scrod	2.20	A	Legal services	0.61	J
Legal gambling	1.91	Q	Physicians' services	0.58	J
Lamb	1.90	G, O	Rail travel (commuter)	0.54	J
Restaurant meals	1.63	J	Jewelry, watches	0.54	J
Marijuana	1.51	M	Water	0.52	F
Peaches	1.50	G	Cigarettes	0.51	L
Butter	1.40	N	Stationery	0.47	J
Automobiles	1.35	S	Radio, TV repair	0.47	J
China, glassware	1.34	J	Sea scallops	0.46	A
Apples	1.30	G	Toilet articles	0.44	J
Giving to charity	1.29	E	Cabbage	0.40	J
Taxi service	1.24	J	Auto repair	0.36	J
Cable TV	1.20	B	Medical insurance	0.31	J
Chicken	1.20	G	Margarine	0.30	N
Radios, TV sets	1.19	J	Potatoes	0.30	D
Beer	1.13	I	Coffee	0.25	D
Furniture	1.01	J	Eggs	0.23	C
Housing	1.00	J	Spectator sports	0.21	J
Alcohol	0.92	J	Bus travel (intercity)	0.20	J
Beef	0.92	U	Theatre, opera	0.18	J
Telephone calls	0.89	B	Natural gas (residential)	0.15	J
Sports equipment, boats, etc.	0.88	J	Gasoline and oil	0.14	J
Movies	0.87	J	Milk	0.14	C
Flowers, seeds	0.82	J	Electricity (residential)	0.13	J
Citrus fruit	0.80	G	Newspapers, magazines	0.10	J
Bus travel (local)	0.77	J	Mail (letters)	0.05	B

*Sources follow Table 3.6.

TABLE 3.4

Long-Run Versus Short-Run Elasticities[a]

Good	|Elasticity| Short-Run	|Elasticity| Long-Run	Good	|Elasticity| Short-Run	|Elasticity| Long-Run
China, glassware	1.34	8.80	Radio, TV repair	0.47	3.84
Alcohol	0.92	3.63	Toilet articles	0.44	2.42
Sports equipment, boats, etc.	0.88	2.39	Medical insurance	0.31	0.92
Movies	0.87	3.67	Bus travel (intercity)	0.20	2.17
Flowers, seeds	0.82	2.65	Theatre, opera	0.18	0.31
Bus travel (local)	0.77	3.54	Natural gas (residential)	0.15	10.74
Air travel (foreign)	0.70	4.00	Gasoline, oil	0.14	0.48
Shoes	0.70	1.20	Electricity (residential)	0.13	1.90
Rail travel (commuter)	0.54	1.70	Newspapers, magazines	0.10	0.52
Jewelry, watches	0.54	0.67			

[a]Own-price elasticities of demand, United States, absolute values; source for each item is the source for the same item in Table 3.3.

holds abandoned the cities, producing lowered city-property values and tax collections, as well as suburban sprawl, road congestion, and air pollution.

SUMMARY

1. A person's demand for a consumption good is a function of many variables, such as the good's own price, the prices of other goods, and the consumer's budget and tastes. With the help of indifference-curve analysis, one can, among other things, derive the demand for a good as a function of its own price alone. Normally, such demand curves follow the "law" of downward-sloping demand. A rare exception is Giffen's paradox.

2. Demand for a good can also be derived as a function of income alone. This demand is pictured by an Engel curve. Engel curves for normal goods are upward-sloping; those for inferior goods are downward-sloping.

3. Every price change—other prices, money income, and tastes being constant—can be considered to change quantity demanded for two different reasons: the substitution effect and the income effect. Given any initial level of real income, a utility-maximizing consumer facing a price change is bound to change the composition of the optimal bundle of consumption goods, substituting more of the now relatively cheaper good for less of other, now relatively more expensive goods. This is the substitution effect. Given money income, the price change, however, changes real income and thus changes the quantity demanded for that reason as well. This is the income effect. The substitution effect of lowered price, for example, always increases quantity demanded. The income effect of lowered price reinforces the substitution effect in the case of normal goods but works against it in the case of inferior goods. This may (but need not) produce Giffen's paradox. Depending on how real income is defined, the substitution and income effects can be measured in two different ways (the Hicksian way and Slutsky's way); accordingly, one can derive two different income-compensated demand curves (that only show the substitution effect of price changes).

TABLE 3.5

Selected Estimates of Income Elasticities of Demand in the United States

Good	Elasticity	Source	Good	Elasticity	Source
Automobiles	2.46	J	Giving to charity	0.70	E
Alcohol	1.54	J	Mail (letters)	0.65	B
Housing, owner-occupied	1.49	J	Tobacco	0.64	J
Furniture	1.48	J	Gasoline, oil	0.48	J
Books	1.44	J	Housing, rental	0.43	J
Dental services	1.42	J	Butter	0.42	T
Restaurant meals	1.40	J	Eggs	0.37	T
Shoes	1.10	J	Electricity, residential	0.20	R
Clothing	1.02	J	Coffee	0	K
Water	1.02	J	Margarine	−0.20	T
Medical insurance	0.92	J	Starchy roots	−0.20	K
Cable TV	0.83	B	Pig products	−0.20	K
Telephone calls	0.83	B	Flour	−0.36	T
Physicians' services	0.75	J	Whole milk	−0.50	K

TABLE 3.6

Selected Estimates of Cross-Price Elasticities of Demand in the United States and the United Kingdom

Good with Quantity Change	Good with Price Change	Elasticity	Source
Florida Interior oranges	Florida Indian River oranges	+1.56	H
Margarine	Butter	+0.81	T
Butter	Margarine	+0.67	T
Natural gas	Fuel oil	+0.44	R
Beef	Pork	+0.28	T
Electricity	Natural gas	+0.20	R
Pork	Beef	+0.14	T
California oranges	Florida Interior oranges	+0.14	H
Fruits	Sugar	−0.28	P
Cheese	Butter	−0.61	P

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Table 1: Estimated Price Elasticities of Demand for Selected Products

Product	*Price Elasticity of Demand*
Salt	0.1
Water	0.2
Coffee	0.3
Cigarettes	0.3
Shoes and footwear	0.7
Housing	1.0
Automobiles	1.2
Foreign travel	1.8
Restaurant meals	2.3
Air travel	2.4
Motion pictures	3.7
Specific brands of coffee	5.6

Sources: Frank Chaloupka, "Rational Addictive Behavior and Cigarette Smoking," *Journal of Political Economy,* August 1991, pp. 722–742; Gregory Chow, *Demand for Automobiles in the United States* (Amsterdam: North-Holland, 1957); David Ellwood and Mitchell Polinski. "An Empirical Reconciliation of Micro and Grouped Estimates of the Demand for Housing," *Review of Economics and Statistics,* vol. 61, 1979, pp. 199–205; H. F. Houthakker and Lester B. Taylor, *Consumer Demand in the United States: Analysis and Projections,* 2nd ed. (Cambridge, MA: Harvard University Press, 1970); John R. Nevin, "Laboratory Experiments for Estimating Consumer Demand: A Validation Study," *Journal of Marketing Research,* vol. 11, August 1974, pp. 261–268; Herbert Scarf and John Shoven *Applied General Equilibrium Analysis* (New York: Cambridge University Press, 1984).

Product	Elasticity	Product	Elasticity	Product	Elasticity
Price elasticity of demand		**Cross price elasticity of demand**		**Income elasticity of demand**	
Gasoline*	–0.1	Fuel with respect to price of transport	–0.48	Lottery: instant game sales in Colorado	–0.06
Cabbage	–0.25	Alcohol with respect to price of food	–0.16	Ground beef	–0.197
Peanuts	–0.38	Pork with respect to price of poultry	0.06	Potatoes	0.15
Marijuana	–0.4	Poultry with respect to price of pork	0.16	Food**	0.2
Cigarettes	–0.4	Pork with respect to price of ground beef	0.03	Clothing**	0.3
Milk (two different estimates)	–0.49; –0.63	Fresh Christmas trees with respect to price of artificial Christmas trees	0.2	Beer	0.4
Soft drinks	–0.55	Poultry with respect to price of ground beef	0.23	Eggs	0.57
Transportation*	–0.6	Ground beef with respect to price of poultry	0.24	Coke	0.60
Cigarettes (teenagers)	–0.7	Ground beef with respect to price of pork	0.35	Shelter**	0.7
Food*	–0.7	Coke with respect to price of Pepsi	0.61	Beef (table cuts—not ground)	0.81
Beer	–0.7 to –0.9	Pepsi with respect to price of Coke	0.80	Oranges	0.83
Cocaine	–1.0	**Price elasticity of supply**		Apples	1.32
Ground Beef	–1.0	Physicians (specialists)	–0.3	Leisure**	1.4
Gasoline**	–1.5	Physicians (primary care)	0.0	Peaches	1.43
Coke	–1.71	Physicians (young male)	0.2	Health care**	1.6
Transportation**	–1.9	Physicians (young female)	0.5	Education**	1.6
Pepsi	–2.08	Milk*	0.36	Higher education	1.67
Fresh tomatoes	–2.22	Milk**	0.51	Pepsi	1.70
Food**	–2.3	Child care labor	2.0	Cream	1.72
Lettuce	–2.58				
Fresh peas	–2.83				

Note: * = short run; ** = long run.

Sources: See footnotes 4, 5, and 7 and the following: Robert W. Fogel, "Catching Up With the Economy," *American Economic Review* 89(1) (March 1999): 1–21; Michael Grossman, "A Survey of Economic Models of Addictive Behavior," *Journal of Drug Issues* 28:3 (Summer 1998): 631–643; Sanjib Bhuyan and Rigoberto A. Lopez, "Oligopoly Power in the Food and Tobacco Industries," *American Journal of Agricultural Economics* 79 (August 1997): 1035–1043; Ann Hansen, "The Tax Incidence of the Colorado State Lottery Instant Game," *Public Finance Quarterly* 23(3) (July 1995): 385–398; Daniel B. Suits, "Agriculture," pp. 1–33, and Kenneth G. Elzinga, "Beer," pp. 119–151, in Walter Adams and James Brock, eds, *The Structure of American Industry,* 9th ed. (Englewood Cliffs, NJ: Prentice Hall, 1995); Douglas M. Brown, "The Rising Price of Physicians' Services: A Correction and Extension on Supply," *Review of Economics and Statistics* 76(2) (May 1994): 389–393; John A. Rizzo and David Blumenthal, "Physical Labor Supply: Do Income Effects Matter?" *Journal of Health Economics* 13(4) (December 1994): 433–453; George C. Davis and Michael K. Wohlgenant, "Demand Elasticities from a Discrete Choice Model: The Natural Christmas Tree Market," *Journal of Agricultural Economics* 75(3) (August 1993): 730–738; David M. Blau, "The Supply of Child Care Labor," *Journal of Labor Economics* 2(11) (April 1993): 324–347; Richard Blundell et al., "What Do We Learn About Consumer Demand Patterns from Micro Data?" *American Economic Review* 83(3) (June 1993): 570–597; F. Gasmi et al., "Econometric Analysis of Collusive Behavior in a Soft-Drink Market," *Journal of Economics and Management Strategy* (Summer 1992): 277–311; M. R. Baye, D. W. Jansen, and J.W. Lee, "Advertising Effects in Complete Demand Systems," *Applied Economics* 24 (1992): 1087–1096; Gary W. Brester and Michael K. Wohlgenant, "Estimating Interrelated Demands for Meats Using New Measures for Ground and Table Cut Beef," *American Journal of Agricultural Economics* 73 (November 1991): 1182–1194; Mark A. R. Kleinman, *Marijuana: Costs of Abuse, Costs of Control* (Westport, CT: Greenwood Press, 1989); Michael Grossman and Henry Saffer, "Beer Taxes, the Legal Drinking Age, and Youth Motor Vehicle Fatalities," *Journal of Legal Studies* 16(2) (June 1987): 351–374.