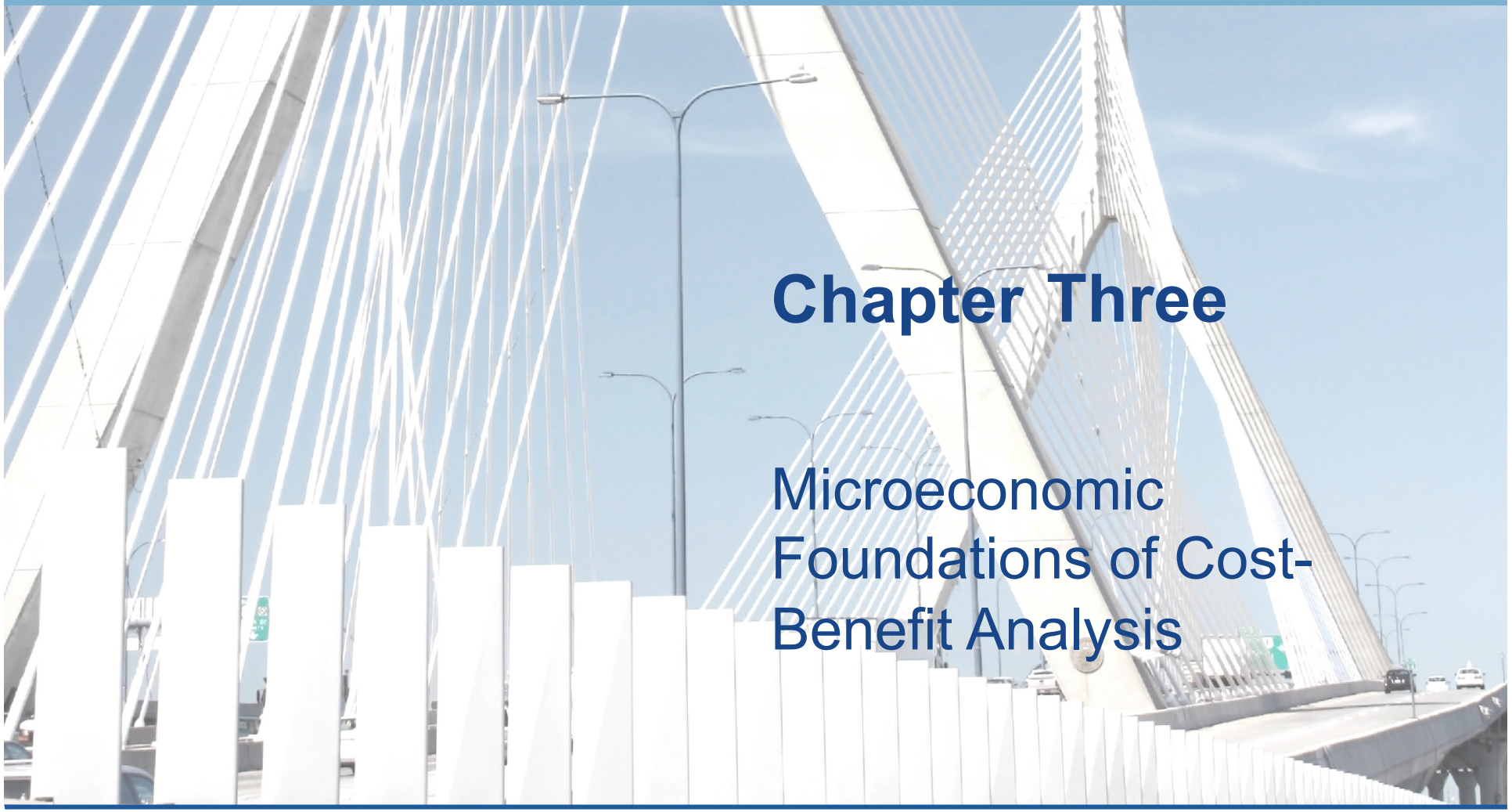
Cost-Benefit Analysis

Concepts and Practice

FOURTH EDITION



Chapter Three

Microeconomic Foundations of Cost-Benefit Analysis

PEARSON

Cost-Benefit Analysis: Concepts and Practice, Fourth Edition
Boardman • Greenberg • Vining • Weimer

Figure 3-1 Consumers' Total Benefits and Consumer Surplus

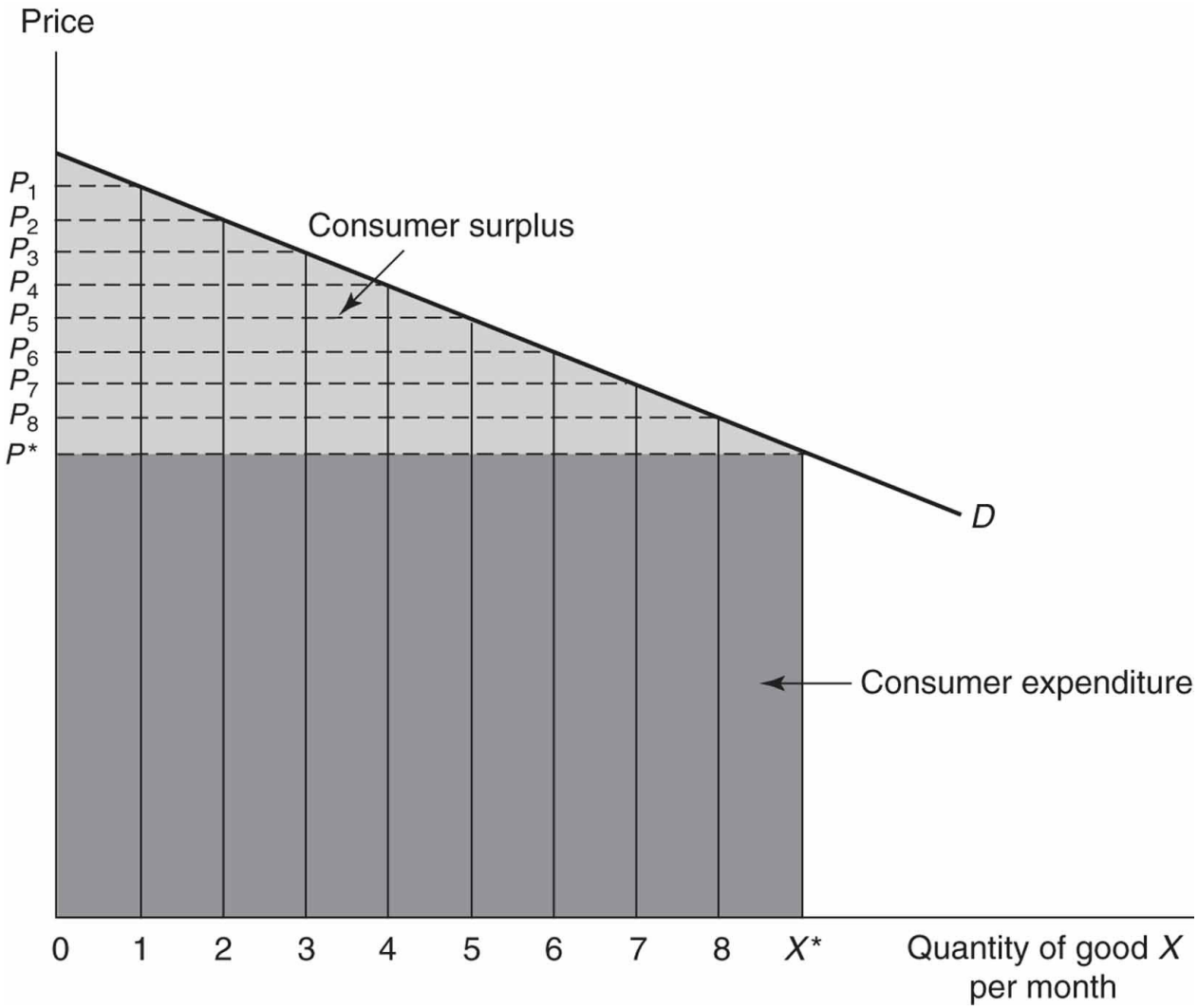


Figure 3-2 Change in Consumer Surplus Due to a Price **(a)** Decrease **(b)** Increase

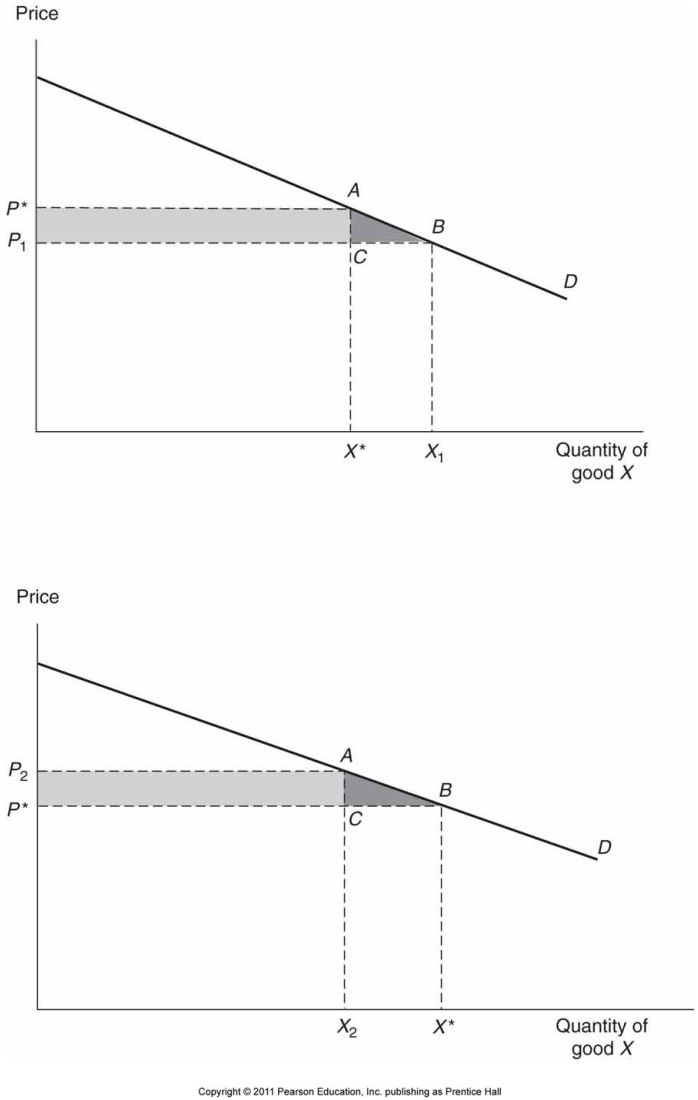


Figure 3-3 Individual Firm's Supply Curve

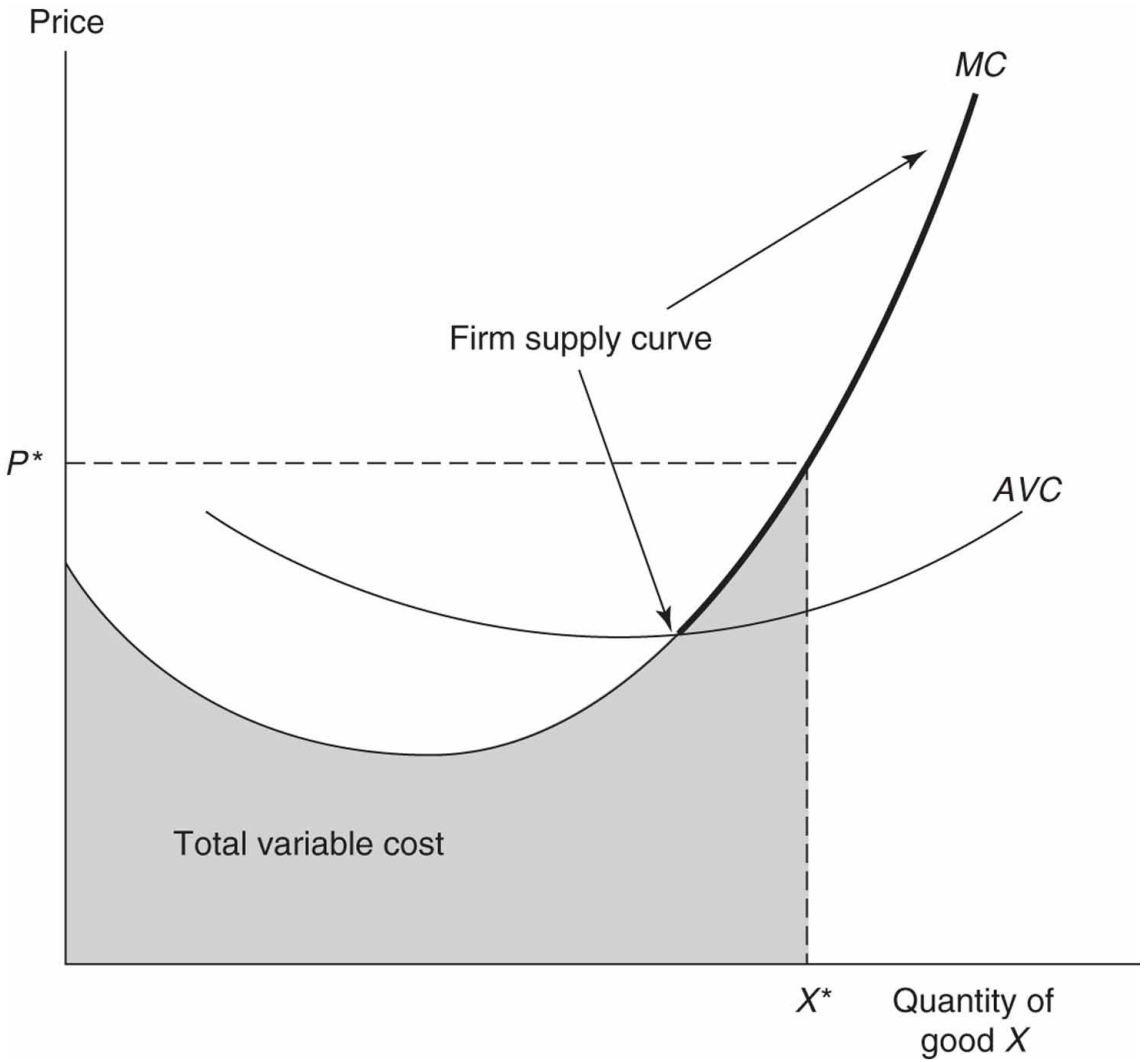


Figure 3-4 Market Supply Curve

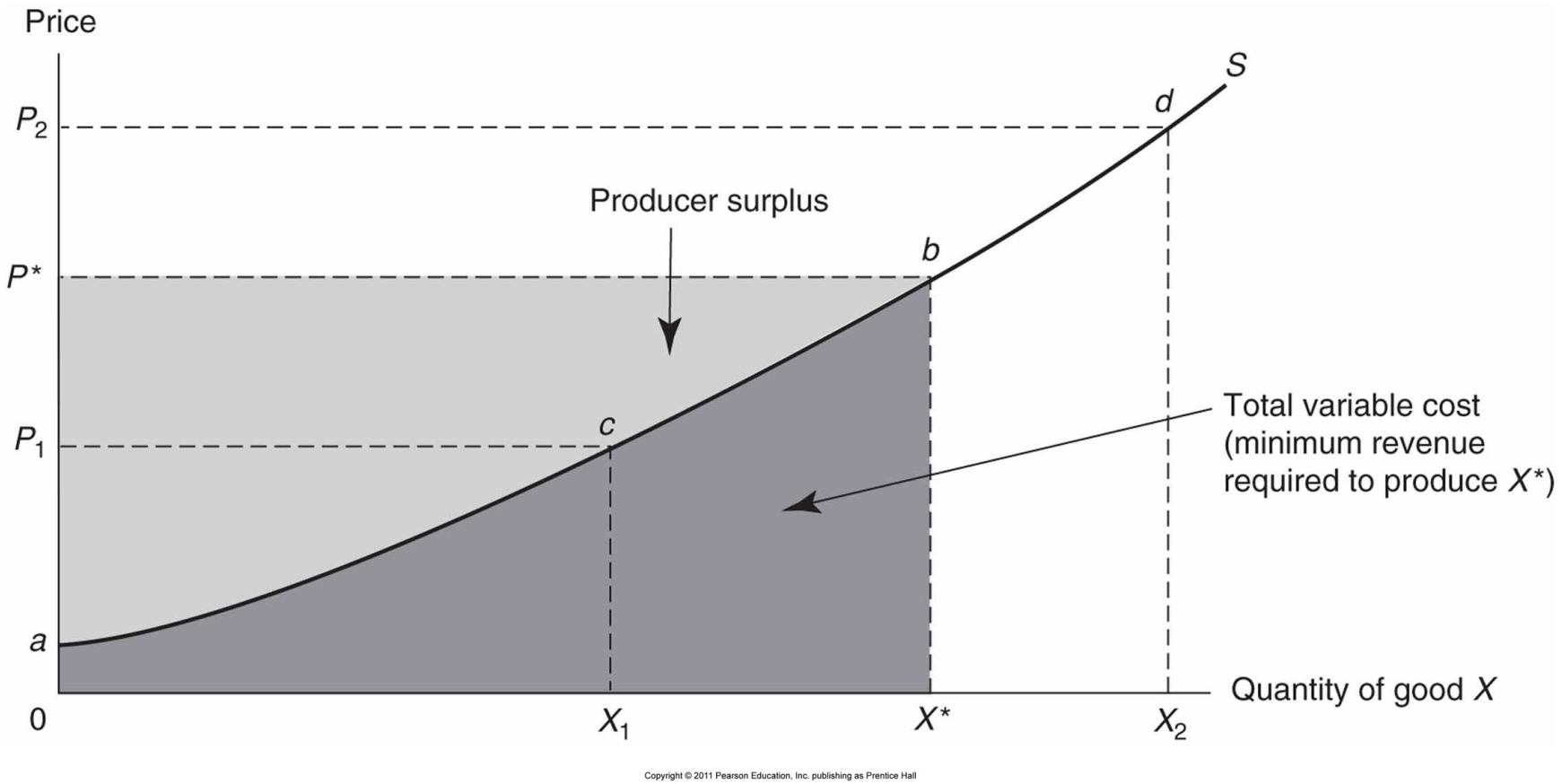


Figure 3-5 Social Surplus

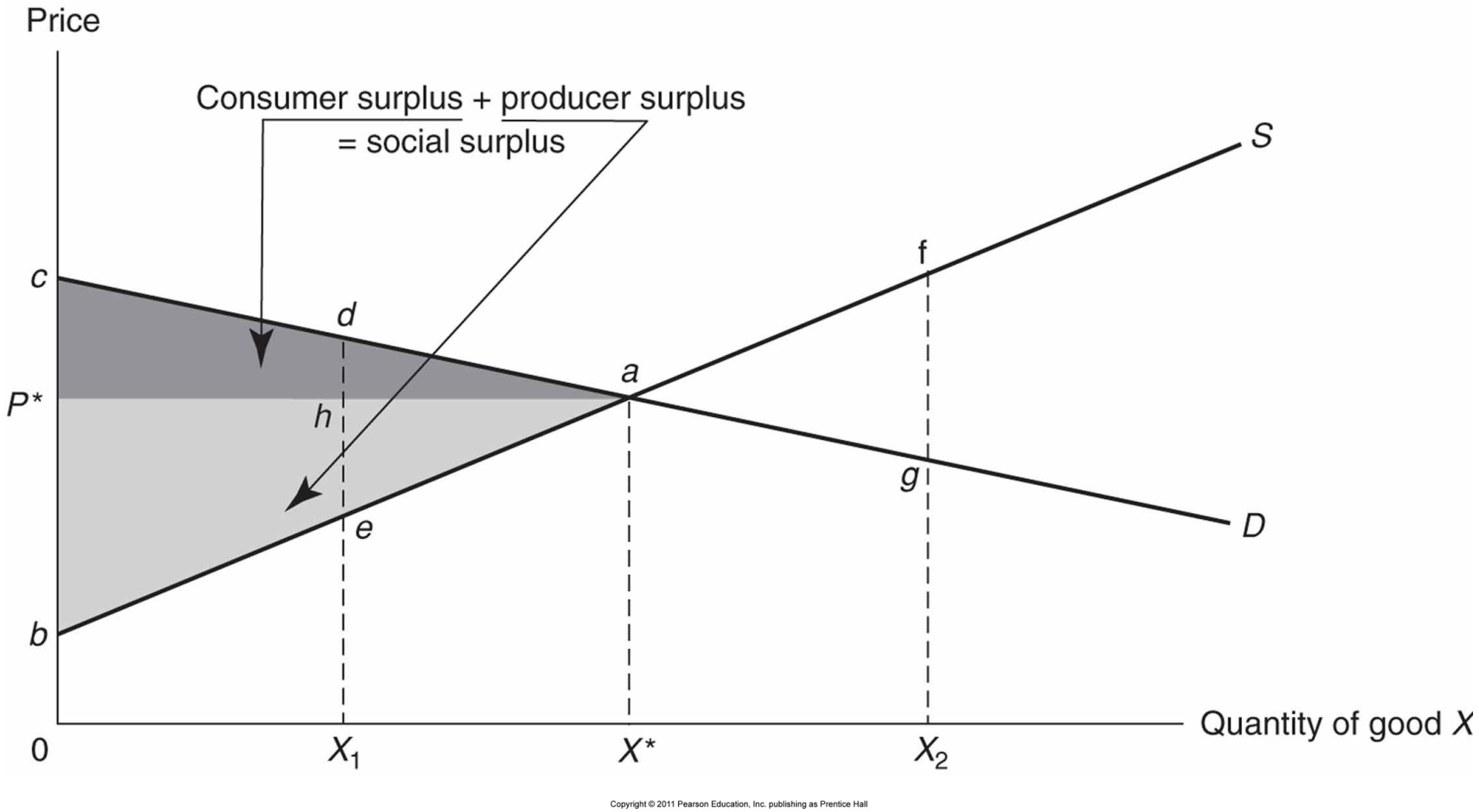


Figure 3-6 Target Pricing Example

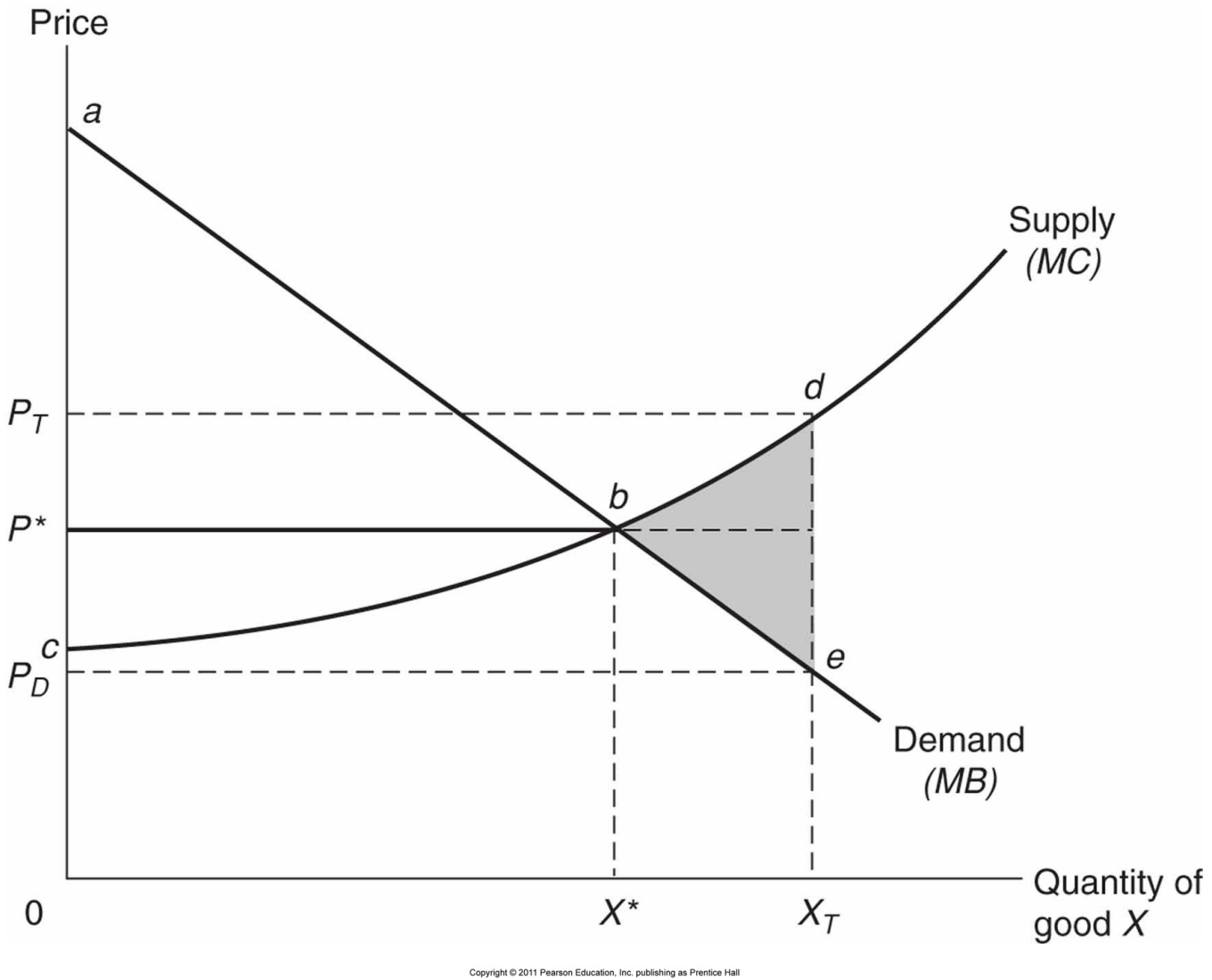


TABLE 3-1 Breakdown of Incremental Benefits, Incremental Costs, and Changes in Surpluses in Target Pricing Example

Group	*Incremental Benefit*	*Incremental Cost*	*Change in Surplus*
Consumers	P^*beP_D		P^*beP_D
Producers	$P_T dX_T O - P^*bX^*O$	$bdX_T X^* - P_T deP_D$	$P_T dbP^*$
Government			$-P_T deP_D$
Net (Social)			$-bde$

EXHIBIT 3-1

The magnitudes of the inefficiencies of agricultural price supports in the United States have at times been very large. For example, Gordon C. Rausser estimated the economic impacts of price support programs for wheat, corn, cotton, peanuts, and dairy products during the mid-1980s. He estimated additional annual costs to consumers of between $3.27 billion and $4.57 billion, annual transfers to producers of between $12.8 billion and $14.9 billion, and annual costs to taxpayers of between $13.5 billion and $15.7 billion. The annual net social cost of these effects on consumers, producers, and taxpayers was between $1.9 billion and $7.4 billion. That is, the social surplus loss of these policies was several billion dollars annually.

The Federal Agricultural Improvement and Reform Act of 1996, the so-called Freedom to Farm Act, called for phasing out price supports by 2002. Beginning in 1998 with falling world agricultural prices, Congress began reversing the phase-out of price supports. By fiscal year 2001 direct government subsidies to farmers had risen to $20 billion annually.

Sources: Adapted from Gordon C. Rausser, "Predatory Versus Productive Government: The Case of U.S. Agricultural Policies," *Journal of Economic Perspectives* 6(3) 1992, 133–157; and David Orden, "Reform's Stunted Crop: Congress Re-Embraces Agricultural Subsidies," *Regulation* 25(1) 2002, 26–32.

EXHIBIT 3-2

The following table, which was adopted with modifications from a study by Edgar Browning, is based on a hypothetical society with only five households. The idea is to tax everyone to obtain $1,350 in additional revenue and then distribute this equally to everyone. In effect, as shown in column 6, $270 is transferred from the two richest households to the two poorest households. As shown in column 8, however, the real incomes of the two poorest households increase by $240 in aggregate, whereas the real incomes of the three richest households decrease by $390. Thus, it costs society $390/$240 = $1.63 in lost income for every dollar transferred, ignoring administrative costs.

For purposes of the illustration, it is assumed that all households initially work 2,000 hours a year and face a marginal tax rate of 40 percent. Thus, as indicated in column 2, the gross before-tax hourly wage rate of household A is $5 ($10,000/2,000), but its after-tax net wage rate is only $3 ($5 × 0.6). The gross and net hourly wage rates for the remaining four households may be similarly computed. It is further assumed that the compensated labor supply elasticity for all households is 0.15, a value that is consistent with empirical estimates presented in Chapter 12. In other words, it is assumed that a 1 percent change in net wages, holding income constant,

EXHIBIT 3-2 (continued)

will cause households to change their hours worked by 0.15 percent.

Suppose now that the government introduces a separate income tax of 1 percent that increases each household's marginal tax rate from 40 to 41 percent. This reduces each household's net after-tax wage rate by 1.67 percent (i.e., 0.01/0.60 = 0.0167). As a consequence, hours worked fall by 0.25 percent ($0.15 \times 0.0167 \times 0.0025$), or 5 hours per year. Hence, as shown in column 3, earnings also fall by 0.25 percent.

Net additional tax revenue is given in column 4. For example, household A initially paid taxes of $4,000 ($10,000 × 0.4), while after the new income tax, it paid taxes of about $4,090 ($9,975 × 0.41), an increase of approximately $90. The total of $1,350 in additional tax revenue is divided equally, and $270 is distributed to each household. The net transfer (column 5 − column 4) is given in column 6.

Column 7 presents the total change in disposable income, which is obtained by adding columns 3 and 6. The net incomes of the three richest households have been reduced by $570 in aggregate, while the net incomes of the two poorest families have been increased by a total of only $195. But all families are now working less and enjoying more leisure. Assuming that the value of additional leisure equals the after-tax net wage rate, household A receives a leisure gain valued at $15 ($3 × 5 hours), household B receives a leisure gain valued at $30 ($6 × 5 hours), and so forth. The total change in real income (including the value of the gain in leisure) is given in column 8. The real incomes of households A and B increase by $240 in aggregate, while the incomes of households C, D, and E decrease by $390.

EXHIBIT 3-2 (continued)

The Marginal Cost of Redistribution

Household (1)	*Initial (Gross) Earnings (2)*	*Net Change in Earnings (3)*	*Additional Tax Revenue* (4)*	*Transfer (5)*	*Net Transfer (6)*	*Change in Disposable Income (7)*	*Change in Real Income (8)*
A	10,000	−25	90	270	180	155	170
B	20,000	−50	180	270	90	40	70
C	30,000	−75	270	270	0	−75	−30
D	40,000	−100	360	270	−90	−190	−130
E	50,000	−125	450	270	−180	−305	−230
Total	150,000	−375	1,350	1,350	0	−375	−150

**These figures are rounded to the nearest* $10.

Source: Adapted from Edgar K. Browning, "The Marginal Cost of Redistribution," *Public Finance Quarterly* 21(1) 1993, 3–32, Table 1 at p. 5. Reprinted by permission of Sage Publications, Inc.

EXHIBIT 3-3

Boardman and colleagues estimated the welfare gains from the privatization of Canadian National (CN) Railway in 1995. This was one of the largest rail privatizations in history. A unique feature of the study is that the authors were able to create a more credible counterfactual than in other privatization studies based on cost data from Canadian Pacific Railway (CP). Boardman and colleagues argued that the benefit to consumers (shippers) was zero because a variety of evidence suggests that privatization had no impact on CN's or CP's prices or output. The sole factor of production of interest was employees. Employment decreased at CN following privatization, but the rate of decrease in employment was slower after 1992 than before 1992 (when the privatization was announced). Following privatization, wages and salaries at CN increased faster than at CP. Thus, there is no clear evidence that employees were better or worse off as a result of privatization. Attention focused on firms (and their shareholders) and the Canadian government. Using their preferred estimate of the counterfactual, Boardman and colleagues estimated that the increase in profits to foreign (non-Canadian) shareholders was $4.46 billion, the increase in profits to Canadian shareholders was $3.69 billion, and the increase in government surplus (to the Canadian government) was $6.90 billion. Following usual practice in CBA and assigning equal welfare weights to profits and governments (i.e., $\gamma_p = \gamma_g = 1$) implies that the net social benefit equals $15.06 billion. Assuming that only Canadians have standing suggests that the net social benefit to Canadians was $10.59 billion ($6.90 billion + $3.69 billion). As noted in the text, however, there are efficiency arguments for setting $\gamma_g = 1 +$ METB. Boardman and colleagues also argue that there are efficiency arguments for setting $\gamma_p = 1 +$ *shadow price of capital*, a topic that we discuss in detail in Chapter 10. They suggest $\gamma_g = 1.4$ and $\gamma_p = 1.16$, implying that the net benefit to Canadians of the privatization of CN equaled $13.94 billion.

Source: Anthony E. Boardman, Claude Laurin, Mark A. Moore, and Aidan R. Vining, "A Cost-Benefit Analysis of the Privatization of Canadian National Railway," *Canadian Public Policy* 35(1) 2009, 59–83.

Figure 3A-1 Analysis of a Price Change **(a)** Indifference Curve **(b)** Demand Curve