

Chapter 6

Economic Approaches

Introduction 295

Supply of Tobacco and Tobacco Products 295

Tobacco Price Supports 298

 Minimum Prices, Nonrecourse Loans, and Quotas 300

 Effects of Price Supports on Market Prices 300

 Assessments to Offset Federal Costs of Price Supports 301

 Discussion 302

Evolution of the U.S. Cigarette Industry 306

 Economic Implications of Concentrated Tobacco Production 308

 High Tobacco Concentration and the Impact of Prevention Policies 308

 Discussion 311

Trade Policy, Tobacco, and Tobacco Products 311

 Past Tobacco-Related Trade Policy 312

 Section 301 of the Trade Act of 1974 312

 Multinational Trade Agreements 316

 Discussion and Recent Developments 318

Economic Impact of the U.S. Tobacco Industry 320

Effect of Price on Demand for Tobacco Products 322

Studies Using Aggregate Data 323

Studies Using Individual-Level Data 327

Behavioral Economics Studies of Cigarette Demand 335

Studies of Smokeless Tobacco Use and Price 335

Cigarette Prices and Other Substance Use 336

Discussion 337

Taxation of Tobacco Products 337

Rationales for Tobacco Taxation 338

 Historical or Comparative Standard 338

 Cigarette Taxes and Cigarette Prices 341

 International Tobacco Taxes 345

 Discussion 350

Fairness Standard and Optimal Cigarette Taxes 350

 Equity, Incidence, and Distribution of the Tobacco Tax Burden 350

 Estimates of the Costs of Smoking 352

 Theoretically Optimal Cigarette Taxes 353

 Cigarette Taxes and Health 355

 Tobacco Taxation and Revenues 357

Conclusions 359

References 360

Introduction

This chapter reviews recent research on economic aspects of tobacco production and the use of tobacco products in the United States. Much of the chapter focuses on the impact of various governmental policies related to tobacco. As was the case with the regulatory effects examined in Chapter 5, the “interventions” recounted here require a broader definition and a different set of measurement tools (see Chapter 1).

The chapter first considers the supply of tobacco and tobacco products. The history of tobacco and the evolution of the cigarette industry in the United States are briefly discussed. More comprehensive summaries can be found in the 1992 Surgeon General’s report *Smoking and Health in the Americas* (U.S. Department of Health and Human Services [USDHHS] 1992) and in several sources cited herein. Tobacco-related supply-side policies are reviewed in more detail. In particular, the tobacco support program is closely examined, and its economic implications are discussed. That section is followed by a discussion of the impact of tobacco taxes and other prevention policies on prices in the highly concentrated U.S. cigarette markets. U.S. trade policy relating to tobacco and tobacco products is reviewed, followed by a discussion of the domestic and international impact of these policies. Finally, the

economic impact of tobacco on the U.S. economy and its implications for policy are described.

In the second part of the chapter, economic studies of the demand for tobacco are reviewed. Although several factors affect the demand for tobacco products, this section focuses on the effects of tobacco prices (particularly as they are raised by increasing tobacco taxes) on demand. Recent econometric and other informative studies of the demand for tobacco products are described. (A more detailed review of early studies is contained in the 1989 Surgeon General’s report *Reducing the Health Consequences of Smoking: 25 Years of Progress* [USDHHS 1989].)

The third part of the chapter focuses on the most important economic policy in the campaign to reduce tobacco use—higher cigarette excise taxes. This section reviews the alternative rationales for imposing cigarette and other tobacco taxes, including a historical or comparative approach, one based on the economic costs of cigarette smoking, one focused on the health benefits of higher taxes, and one based on the revenue potential of the taxes. Discussion of the appropriate level of the taxes suggested by each approach follows its review.

Supply of Tobacco and Tobacco Products

Tobacco is a truly American plant. The first known evidence of tobacco use is depicted in carvings on a Mayan temple in Chiapas, Mexico, that date from A.D. 600–900 (Wagner 1971). Europeans were first introduced to tobacco in 1492 when American Indians presented gifts of the substance to Christopher Columbus. On Columbus’ return home, tobacco was introduced to Spain and throughout Europe. Tobacco was widely grown by early English settlers in America and was exported from the colonies to England, where it was reexported to many other destinations. Colonial tobacco exports to England grew from 100,000 pounds in 1620 to 100 million pounds just before the Revolutionary War, making tobacco the single most important

commodity exported from the colonies to England (Johnson 1984). Indeed, tobacco was so important in some colonies that it was sometimes used as the unit of account (Johnson 1984).

The high tariffs imposed by England on tobacco and other imports from the colonies contributed to the start of the Revolutionary War. In the newly formed United States, tobacco soon became the leading agricultural export commodity. The tobacco industry played a significant part in the U.S. economy of the 19th and early 20th centuries. Although tobacco consumption has declined in recent years, it is still economically important in major tobacco-producing states.

In many ways, tobacco is an ideal crop to grow. It grows under a variety of soil and climatic conditions and thrives under specific but fairly common circumstances. The tobacco plant has prodigious leaf growth yet takes up relatively little field space, and the financial return for tobacco is both absolutely and relatively high compared with other agricultural commodities (Goodman 1993). For example, in 1993, the per acre value of tobacco in the United States, \$3,780, was well above the values for other crops (Grise 1995). Because of these factors, tobacco is grown in more than 120 countries and thus is the most widely grown non-food crop in the world (cotton acreage substantially exceeds that of tobacco, but tobacco is grown in about twice as many countries as cotton is). In the United States, tobacco is a highly profitable crop for other reasons, including agricultural price supports that guarantee relatively high prices; the availability of loans from government, or tobacco companies, or both; the provision of seed, fertilizer, and other agricultural input from external sources; and export subsidies (Food and Agriculture Organization of the United Nations 1990). Counter to these profitable arrangements, tobacco growing is relatively labor-intensive, demands heavy use of fertilizers and pesticides, and often requires the use of fuel for tobacco curing.

Tobacco is a storable product, and its quality initially improves with age. After being harvested, tobacco goes through several steps in a processing course, including sorting and grading (according to type and quality) and curing and drying by various techniques (including flue, fire, sun, and air curing). Most of this processing is done on the tobacco farm before the product is sold to the producers of cigarettes and other tobacco products.

Several types of tobacco are grown in the United States and throughout the world. Burley and flue-cured tobacco, the primary ingredients in cigarettes, are the most important of the domestically grown types of tobacco; they account for about 93 percent of total production (Tables 6.1 and 6.2). Most burley tobacco is grown in Kentucky and flue-cured tobacco is grown primarily in North Carolina. These two states account for about two-thirds of domestically grown tobacco.

Although several other types of tobacco are grown in 14 other states, about one-quarter of the total domestic production is concentrated in Georgia, South Carolina, Tennessee, and Virginia. Other important types of domestically grown tobacco include Maryland tobacco, an important component of cigarettes because it burns slowly; fire-cured tobacco, which is used in snuff; dark air-cured and sun-cured tobaccos, which are used in chewing tobacco and small

dark cigars; and other types used for cigar leaf (Johnson 1984).

In 1992, the United States had about 124,000 farms producing tobacco, down sharply from 330,000 in 1964 (U.S. Department of Agriculture [USDA] 1998a). Tobacco was grown on an estimated 644,000 acres in 1999, down sharply from its recent peak of 836,000 acres in 1997. In 1998, tobacco farms produced almost 1.5 billion pounds of tobacco at a total value of approximately \$2.7 billion. After inflation is accounted for, however, the value of domestically grown tobacco has fallen since 1980. More than 1.4 billion pounds of domestically grown tobacco were used in 1998, with less than two-thirds of this used domestically, while the remainder was exported (Table 6.3).

Domestic consumption of domestically grown, unmanufactured tobacco fell steadily from the 1950s through the early 1990s, from a peak of almost 1.6 billion pounds in 1952 to about 900 million pounds in 1993 (Table 6.3). After rising for a few years, domestic consumption of domestically grown tobacco fell to just over 900 million pounds in 1998. Declining prevalence of tobacco use is not the only—or even the main—factor behind the long-term decrease; domestically produced cigarettes contain about 35 percent less tobacco than they did 40 years ago (Womach 1994b). Furthermore, the use of imported tobacco in domestically produced cigarettes has greatly increased in recent years. In 1950, the imported tobacco content of domestically produced cigarettes was approximately 6 percent. By 1993, this proportion had risen to about 40 percent. The increased use of foreign tobacco is partly due to improvements in the quality of this tobacco, its relatively low price, reduced barriers to trade in tobacco, and the increased market penetration of lower-quality generic cigarettes, which include a higher share of imported tobacco.

The decline in the domestic use of tobacco grown in the United States has been offset somewhat by increased exports of domestically grown tobacco. However, unmanufactured exports peaked at 765 million pounds in 1978 and have fallen fairly steadily since; in 1998, total exports were 539 million pounds (Table 6.3). The largest export markets for U.S.-grown tobacco in recent years have been Japan, Germany, the Netherlands, and Turkey (USDA 1998a).

The combination of declining U.S. tobacco exports and increased tobacco production in foreign countries (particularly Argentina, Brazil, Malawi, and Zimbabwe) has reduced the U.S. share in world tobacco exports. In 1960, the United States' share of world tobacco exports was 27 percent. By 1997, this share had fallen to 11 percent. Moreover, in 1993, the United States

Table 6.1. Burley tobacco production and value, 1975–1998

Crop year	Production (million lbs.)	Average price to farmers (cents/lb.)	Real price to farmers* (cents/lb.)	Farm value (million \$)	Real farm value* (million \$)
1975	640	105.5	196.1	675.1	1,254.8
1976	664	114.2	200.7	758.3	1,332.7
1977	613	120.0	198.0	735.6	1,213.9
1978	614	131.2	201.2	805.8	1,235.8
1979	472	145.2	200.0	685.6	944.4
1980	558	165.9	201.3	925.7	1,123.4
1981	726	180.7	198.8	1,311.9	1,443.2
1982	777	181.0	187.6	1,406.4	1,457.4
1983	527	177.3	178.0	934.4	938.1
1984	674	187.6	180.6	1,264.4	1,217.0
1985	542	159.7	148.4	865.6	804.4
1986	420	156.5	142.8	657.3	599.7
1987	428	156.3	137.6	669.0	588.9
1988	468	161.0	136.1	753.5	636.9
1989	498	167.2	134.8	832.7	671.5
1990	592	175.3	134.1	1,037.8	794.0
1991	657	178.8	131.3	1,174.7	862.5
1992	700	181.5	129.4	1,270.5	905.6
1993	627	181.6	125.7	1,138.6	788.0
1994	568	184.1	124.2	1,045.7	705.6
1995	480	185.5	121.7	890.4	584.3
1996	516	192.2	122.5	991.8	632.1
1997	629	188.5	117.4	1,185.7	738.7
1998 [†]	590	190.3	116.7	1,123.3	688.9

*Real price to farmers and real farm value are obtained by dividing the nominal average price and farm value by the national Consumer Price Index; the average of 1982–1984 is the benchmark.

[†]Subject to revision.

Sources: U.S. Department of Agriculture 1996, 1999a; U.S. Department of Labor 1999.

lost to Brazil its historically dominant position as the leading exporter of tobacco (Womach 1994b).

These trends for domestically grown, unmanufactured tobacco have not been observed for domestic production of the chief manufactured tobacco product—the cigarette (Table 6.3). Although total annual domestic consumption fell fairly steadily from a 1982 peak of 634 billion cigarettes to an estimated 435 billion in 1999, total

domestic cigarette consumption peaked in 1996. The difference is the result of large increases in the export of domestically produced cigarettes. In 1985, the United States exported 58.9 billion cigarettes. Exports peaked in 1996 at more than 240 billion cigarettes, almost one-third of total domestic production in that year. Since 1996, however, cigarette exports have fallen, to an estimated 150 billion by 1999.

Table 6.2. Flue-cured tobacco production and value, 1975–1998

Crop year	Production (million lbs.)	Average price to farmers (cents/lb.)	Real price to farmers* (cents/lb.)	Farm value (million \$)	Real farm value* (million \$)
1975	1,415	99.8	185.5	1,412.2	2,624.9
1976	1,316	110.4	194.0	1,452.9	2,553.4
1977	1,124	117.6	194.1	1,321.8	2,181.2
1978	1,206	135.0	207.1	1,628.1	2,497.1
1979	974	140.0	192.8	1,363.3	1,877.5
1980	1,086	144.5	175.4	1,569.3	1,904.5
1981	1,144	166.4	183.1	1,903.6	2,094.2
1982	994	178.5	185.0	1,774.3	1,838.6
1983	855	177.9	178.6	1,521.0	1,527.2
1984	850	181.1	174.3	1,539.4	1,481.6
1985	789	171.9	159.8	1,356.3	1,260.5
1986	667	152.7	139.3	1,018.5	929.3
1987	683	158.7	139.7	1,083.9	954.2
1988	796	161.3	136.3	1,283.9	1,085.3
1989	838	167.4	135.0	1,402.8	1,131.3
1990	920	167.3	128.0	1,539.2	1,177.6
1991	882	172.3	126.5	1,519.7	1,115.8
1992	901	172.6	123.0	1,555.1	1,108.4
1993	892	168.1	116.3	1,499.5	1,037.7
1994	807	169.8	114.6	1,370.3	924.6
1995	854	179.4	117.7	1,532.1	1,005.3
1996	897	183.4	116.9	1,645.1	1,048.5
1997	1,014	172.0	107.2	1,744.1	1,086.7
1998 [†]	815	175.5	107.7	1,430.0	877.5

*Real price to farmers and real farm value are obtained by dividing the nominal average price and farm value by the national Consumer Price Index; the average of 1982–1984 is the benchmark.

[†]Subject to revision.

Sources: U.S. Department of Agriculture 1996, 1999a; U.S. Department of Labor 1999.

Tobacco Price Supports

Despite being such a profitable crop, tobacco, like other U.S. crops, has benefited from agricultural price supports that have been in place for much of the 20th century. In the 1920s, before these supports were in place, tobacco cooperatives had formed in various regions in an attempt to control the supply of tobacco

and consequently raise tobacco prices and the incomes of tobacco farmers. These and other agricultural cooperatives were largely responding to the steep reductions in the prices of tobacco and other agricultural products during the recession of 1921. The cooperatives had little success and were eventually disbanded.

Table 6.3. Selected production and trade statistics for U.S.-grown, unmanufactured tobacco and for U.S.-produced cigarettes, 1975–1999

Year	Pounds of tobacco* (millions)				Number of cigarettes [†] (billions)		
	Total production	Actual use			Total production	Domestic consumption [‡]	Exports
		Total	Domestic use	Exports			
1975	2,182	1,941	1,286	655	651.2	607.2	50.2
1976	2,136	1,907	1,229	678	693.4	613.5	61.4
1977	1,913	1,895	1,202	693	665.9	617.0	66.8
1978	2,054	1,955	1,190	765	695.9	616.0	74.4
1979	1,527	1,869	1,175	694	704.4	621.5	79.7
1980	1,786	1,759	1,109	649	714.1	631.5	82.0
1981	2,064	1,762	1,065	697	736.5	640.0	82.6
1982	1,994	1,662	1,034	628	694.2	634.0	73.6
1983	1,429	1,532	936	596	667.0	600.0	60.7
1984	1,728	1,621	955	666	668.8	600.4	56.5
1985	1,511	1,620	1,000	620	665.3	594.0	58.9
1986	1,163	1,572	981	591	658.0	583.8	63.9
1987	1,191	1,688	1,115	573	689.4	575.0	100.2
1988	1,370	1,565	1,010	555	694.5	562.5	118.5
1989	1,367	1,677	1,096	582	677.2	540.0	141.8
1990	1,625	1,794	1,163	631	709.7	525.0	164.3
1991	1,664	1,616	976	640	694.5	510.0	179.2
1992	1,722	1,590	960	630	718.5	500.0	205.6
1993	1,614	1,436	898	538	661.0	485.0	195.5
1994	1,583	1,604	1,080	523	725.5	486.0	220.2
1995	1,268	1,491	958	533	746.5	487.0	231.1
1996	1,503	1,698	1,068	630	754.5	487.0	243.9
1997	1,714	1,494	962	532	719.6	480.0	217.0
1998	1,489	1,440	901	539	679.7	485.0	201.3
1999 [§]	1,267	Δ	Δ	Δ	635.0	435.0	150.0

*Marketing year, beginning July 1 for flue-cured and cigar wrapper and October 1 for all other types.

[†]Calendar year. May contain imported tobacco.

[‡]Allows for estimated inventory change.

[§]Preliminary estimate.

^ΔNot available.

Sources: U.S. Department of Agriculture 1997c, 1998a, 1999a.

The price support system came into existence a decade later. In response to the impact that the 1930s' Great Depression had on farmers, Congress passed the Agricultural Adjustment Act of 1933 (Public Law 73-10) to control the supply of tobacco and other agricultural products whose prices had fallen sharply. The intent of this and subsequent agricultural price support programs was to support the income of farmers and stabilize the quantity and prices of agricultural commodities. These programs also gave tobacco farmers some ability to counteract the economic power of the highly concentrated cigarette producers (Warner 1988).

Minimum Prices, Nonrecourse Loans, and Quotas

The federal program for tobacco price supports involves specific economic interventions and assistance. To stabilize the price and quantity of tobacco produced, the program guarantees minimum market prices and establishes marketing quotas. Minimum (or support) prices are essentially determined by past tobacco prices adjusted for changes in cost indexes. When unable to find a private buyer at a price at or above the support level, a tobacco farmer is eligible for a nonrecourse government loan from a local price stabilization cooperative. This type of loan allows for a commodity, in this case tobacco, to be used as collateral for the loan at the support price. Under annual contracts with the cooperatives, USDA's Commodity Credit Corporation loans funds it has borrowed from the U.S. Treasury (in the past, at less than market rates of interest [Johnson 1984]). Each cooperative processes and stores the tobacco it has received as the farmer's collateral, and the Commodity Credit Corporation collects interest on the loan. The cooperative then attempts to sell the tobacco. If the cooperative can receive a price above the support price, the proceeds are used to repay the loan, and any excess receipts go to the tobacco farmer. This process has created the appearance that tobacco farmers are not being directly subsidized (Johnson 1984).

Marketing quotas, determined by the U.S. Secretary of Agriculture, are intended to be sufficient to meet the domestic and foreign demand for U.S. tobacco at a price above the government support price. Originally, tobacco could be grown only on land that had been assigned a quota, which was based on that farm's proportion of tobacco produced when the program was initiated (with a limited amount of new production allowed each year). Consequently, almost the only way to begin growing tobacco was to buy or rent a farm that had been granted the right to grow tobacco. In 1961, farmers who grew flue-cured tobacco approved

intracounty lease and transfers of allotments; burley tobacco farmers followed suit in 1971. For the first several decades, these quotas were implemented through national acreage allotment systems. The acreage allotments were replaced by poundage quotas in 1965 for flue-cured tobacco and in 1971 for burley tobacco. The switch to poundage quotas increased flexibility for tobacco growers. In any given year, tobacco farmers could sell up to 10 percent more than their quota if yields exceeded expectations (because of favorable weather conditions, for example). In the following year, however, farmers would have to sell proportionately less than that quota. The opposite would apply when yields fell short of expectations. If yields fell short for several years, tobacco farmers could accumulate excess quotas up to an amount equal to their normal quota. This arrangement resulted in a more stable supply of flue-cured and burley tobacco (Johnson 1984).

Every three years, tobacco farmers vote on whether to continue the price support program and whether to approve any substantive changes in the system. If the referendum is approved by a two-thirds majority, tobacco farmers are subject to marketing quotas.

Effects of Price Supports on Market Prices

Despite the numerous factors that affect the supply and demand for tobacco, the quota and price support system keeps market prices at or above the support level. This effect has been evident—and its correction attempted—almost from the outset. As a result of the Agricultural Adjustment Act of 1933, tobacco prices increased almost immediately. These increases resulted from limits on output achieved by voluntary agreement. In 1934, Congress passed the Tobacco Control Act (Public Law 73-483) to deter non-cooperative tobacco farmers from overproducing and taking advantage of the relatively high prices resulting from the reduced supplies of participating farmers. This act led to sharp reductions in tobacco production and consequently to a steep rise in tobacco prices. In early 1936, however, the United States Supreme Court found sections of the Agricultural Adjustment Act unconstitutional, which led Congress to repeal the Tobacco Control Act as well.

In 1935, Congress enacted the Tobacco Inspection Act (Public Law 74-314), which required the USDA to provide tobacco grading (or quality evaluation) services at no cost to tobacco growers. In 1936, the Soil Conservation and Domestic Allotment Act (Public Law 74-461) was passed. This act covered tobacco, as well as most other agricultural products covered by the

Agricultural Adjustment Act of 1933, and rewarded farmers for diverting production from soil-depleting crops (including tobacco) to soil-conserving crops. The limited success of the Soil Conservation and Domestic Allotment Act led to the passage in 1938 of the second Agricultural Adjustment Act (Public Law 75-430). The new act included quotas for tobacco and other agricultural products and imposed penalties on farmers who violated their quotas. Even with subsequent amendments, the tobacco price support program established by the Agricultural Adjustment Act of 1938 is essentially the same today.

The Agricultural Adjustment Act of 1938 set the support price at 75 percent of parity (where parity reflects average tobacco prices from 1919 through 1929). At the beginning of World War II and later through the Agricultural Act of 1949 (Public Law 81-439), this proportion was raised to 90 percent of parity, which was based on average prices for the preceding 10 years. In 1960, to slow the rate of growth in tobacco prices, Congress set new support levels based on the 1959 level and a three-year moving average of prices paid by farmers. Similarly, in 1980, the support prices for the eight lowest quality grades of tobacco were lowered directly.

Assessments to Offset Federal Costs of Price Supports

Until new legislation was passed in the 1980s, the costs to the federal government from operating the tobacco support program were substantial. In 1981 alone, the total administrative cost of the program was \$13.1 million. Moreover, the federal government, through the Commodity Credit Corporation, bore all costs if the local cooperatives were unable to sell the tobacco they received as collateral for the nonrecourse loans. By April 1982, losses from unpaid loan principal totaled \$57 million, and interest losses amounted to \$591 million by the end of 1981 (General Accounting Office [GAO] 1982). These losses spurred opposition to the tobacco support program, which was being threatened with dissolution. To reduce some of the costs of operating the program, in 1981 Congress amended the Tobacco Inspection Act, imposing fees on tobacco growers sufficient to cover the cost of the grading services provided by the USDA.

Far more significant changes to the tobacco support program were introduced by the No Net Cost Tobacco Program Act of 1982 (Public Law 97-218), which was mandated by the Agriculture and Food Act of 1981 (Public Law 97-98). The act was intended to reduce the losses of the tobacco support program by

imposing an assessment on every pound of tobacco brought to market under the loan program. The assessments were supposed to generate revenues sufficient to offset all future losses from these loans. Thus, aside from the administrative costs, the tobacco support program was supposed to operate at no net cost to taxpayers. Other changes were introduced through the act. Rather than distributing excess receipts from the sale of loan tobacco to farmers, these profits were retained by the Commodity Credit Corporation. Farmers of flue-cured tobacco could sell their right to grow tobacco to other active tobacco growers in the same county; moreover, institutional owners of these rights were required to sell them by December 1984. Finally, the U.S. Secretary of Agriculture was given the authority to slow the growth in the support price by allowing the price to increase by as little as 65 percent of the increase implied by the parity formula. These changes led four relatively small associations of tobacco growers (growers of cigar tobacco in three areas) to stop participating in the support program (Miller 1994).

Initially, assessments were expected to be relatively low because of the size of past losses. However, as a result of the tobacco support program, U.S. support prices were well above tobacco prices in world markets, which led producers of cigarettes and other tobacco products to increase their use of imported tobacco. At the same time, reductions in quotas were limited by statute. Consequently, the quantity of tobacco produced exceeded the quantity demanded at the support price, and the surplus was used as collateral for nonrecourse loans (Miller 1994). By 1985, with a growing stock of U.S.-grown tobacco under loan, the no-net-cost assessment on flue-cured tobacco was high: 25 cents per pound (Miller 1994). (The assessment on burley tobacco would have been 30 cents per pound but was limited to 4 cents by legislation.)

The high assessments, the growing importance of imported tobacco in the production of cigarettes and other tobacco products, the increasing stocks of tobacco under loan, and the falling quotas of the early to mid-1980s created a crisis for tobacco farmers and the tobacco support program (Northup 1993). Congress responded by making several changes to the support program (Tobacco Program Improvements) contained in the Consolidated Omnibus Budget Reconciliation Act of 1985 (Public Law 99-272). The 1985 act lowered the tobacco support price by 26 cents per pound for both flue-cured and burley tobacco. In addition, both buyers and sellers of surplus tobacco were required to bear part of the burden of running the program (growers of other types of tobacco continued to be responsible for the full assessment). These changes were

meant to encourage the use of domestically grown tobacco over imported tobacco in the manufacturing of cigarettes and other tobacco products (Miller 1994).

Also as a result of this legislation, the amount of flue-cured and burley tobacco that could be sold without penalty was reduced from 110 percent of quota to 103 percent. The formulas used to determine the support prices for flue-cured and burley tobacco were also changed. These prices were now based on their levels in the preceding year, and adjustments were to be made from a five-year moving average of prices and changes in the cost of production. Past prices would be given two-thirds weight, and the remainder would be based on production costs (which included general variable expenditures but excluded costs of land, overhead, assessments, and other expenses not directly related to tobacco growing). The legislation also brought the major cigarette manufacturers into the quota-setting process, because they would be annually providing the U.S. Secretary of Agriculture with their intended purchases of tobacco. These manufacturers would be penalized if they did not purchase at least 90 percent of this intended amount.

When these changes took place, U.S. cigarette companies agreed to buy all future surplus stocks of tobacco (for the next eight years for flue-cured tobacco and the next five years for burley tobacco). Some of the existing stocks under loan were sold at sharp discounts; the federal government absorbed the losses. These changes were somewhat successful in reducing surplus tobacco stocks as well as the amount of tobacco brought under loan in any given year. Over the next five years, stocks of tobacco declined by nearly 40 percent, and total loan outlays fell by nearly 90 percent.

To fund deficit reduction of the federal budget, the Omnibus Budget Reconciliation Act of 1990 (Public Law 101-508) added further marketing assessments on all commodity price support programs between 1991 and 1995; the marketing assessments were subsequently extended through 1998 (USDA 1997c). Tobacco growers and buyers each paid an additional assessment equal to 0.5 percent of the support price level. These additional assessments generated estimated revenues of more than \$28 million in fiscal year 1997 (Womach 1999).

To further curb the use of imported tobacco, the Omnibus Budget Reconciliation Act of 1993 (Public Law 103-66) included the requirement that, beginning in 1994, domestically produced cigarettes include a minimum of 75 percent domestically grown tobacco. If this law was violated, the cigarette manufacturer was assessed on the amount of foreign-grown tobacco used in excess of the 25-percent limit. The assessment rate

was determined by the difference between average prices of imported and domestic tobacco. Those producers who used an excess of imported tobacco were further required to make up the shortfall by purchasing tobacco stocks under loan. The act also subjected imported tobacco to the no-net-cost assessments beginning in 1994. Effective September 13, 1995, however, the domestic content requirement was dropped as part of a presidential tariff-rate quota proclamation because of its inconsistency with the General Agreement on Tariffs and Trade (GATT).

In general, the tobacco quotas have fallen in recent years, while support prices, after adjustment for inflation, have fallen sharply (Tables 6.4 and 6.5). As of March 31, 1995, the principal and interest value of tobacco loan inventory was \$1.6 billion (Robert H. Miller, Tobacco loan status report, unpublished data), which was down significantly from the \$2.75 billion held as of June 30, 1986 (Warner 1988).

The no-net-cost assessment for the 2000 crop of flue-cured tobacco is 2.5 cents per pound for the producer and 2.5 cents per pound for the purchaser. Similarly, the no-net-cost assessment for the 2000 crop of burley tobacco is 3 cents per pound for both the grower and the buyer.

In fiscal year 2000, the federal government budgeted approximately \$14 million for administering the tobacco support program (Womach 1999). In total, the directly tobacco-related activities of the USDA generated an estimated \$174 million in net revenues in fiscal year 1999. The positive net revenues are the result of revenues generated by the loan program and various assessments that more than offset the expenditures on the tobacco program and other tobacco-related activities (including subsidized tobacco crop insurance, tobacco inspection and grading, tobacco research, data collection and analysis, and other activities) (Womach 1999).

Discussion

Several conclusions emerge from analyses of the tobacco support program. The program's success in stabilizing tobacco prices is particularly evident when they are compared with the prices of other agricultural commodities (including those covered by their own support programs). One result of the price stability is that output has also been relatively stable. As Johnson (1984) notes, "growing tobacco has been as close to a sure thing as one can find in U.S. agriculture" (p. 55).

The quantity of tobacco grown domestically is artificially low as a result of the supply restrictions created by the tobacco support program. Consequently,

Table 6.4. Characteristics of the tobacco support program: flue-cured tobacco, 1975–2000

Year	National marketing quota (million lbs.)	National average support price (cents/lb.)	Real average support price* (cents/lb.)	No-net-cost assessment [†] (cents/lb.)	
				Producers	Buyers
1975	1,491	93.2	173.2		
1976	1,268	106.0	186.3		
1977	1,116	113.8	187.8		
1978	1,117	121.0	185.6		
1979	1,095	129.3	178.1		
1980	1,094	141.5	171.7		
1981	1,013	158.7	174.6		
1982	1,013	169.9	176.1	3.0	
1983	910	169.9	170.6	7.0	
1984	804	169.9	163.5	7.0	
1985	775	169.9	157.9 [‡]	2.50	
1986	729	143.8	131.2	2.50	1.50
1987	707	143.5	126.3	2.00	2.00
1988	754	144.2	121.9	1.13	1.13
1989	891	146.8	118.4	1.12	1.12
1990	878	148.8	113.8	1.00	1.00
1991	878	152.8	112.2	1.00	1.00
1992	892	156.0	111.2	1.00	1.00
1993	892	157.7	109.1	1.00	3.00
1994	803	158.3	106.8	3.00	5.00
1995	935	159.7	104.8	0.80	1.80
1996	874	160.1	102.0	1.00	1.80
1997	974	162.1	101.0	1.00	1.00
1998	814	162.8	99.9	1.00	1.00
1999	666	163.2	98.0	1.00	1.00
2000	543	164.0	95.6 [§]	2.50	2.50

*Real average support price is obtained by dividing the nominal support price by the national Consumer Price Index; the average of 1982–1984 is the benchmark.

[†]No-net-cost assessment includes marketing budget deficit assessments from 1991 through 1998.

[‡]The effective support price in 1985 was 165.0 cents/lb. by reduction of certain grades.

[§]Preliminary estimate.

Sources: U.S. Department of Agriculture 1997b, 1999a,b.

Table 6.5. Characteristics of the tobacco support program: burley tobacco, 1975–2000

Year	National marketing quota (million lbs.)	National average support price* (cents/lb.)	Real average support price† (cents/lb.)	No-net-cost assessment‡ (cents/lb.)	
				Producers	Buyers
1975	670	96.1	178.6		
1976	635	109.3	192.1		
1977	636	117.3	193.6		
1978	614	124.7	191.3		
1979	614	133.3	183.6		
1980	614	145.9	177.1		
1981	660	163.6	180.0		
1982	680	175.1	181.5	1.0	
1983	647	175.1	175.8	5.0	
1984	582	175.1	168.5	9.0	
1985	524	148.8	138.3	4.0	
1986	493	148.8	135.8	2.75	1.25
1987	464	148.8	131.0	2.00	2.00
1988	473	150.0	126.8	0.80	0.80
1989	587	153.2	123.5	1.00	1.00
1990	601	155.8	119.2	1.00	1.00
1991	724	158.4	116.3	1.00	1.00
1992	668	164.9	117.5	1.00	1.00
1993	602	168.3	116.5	1.00	3.50
1994	536	171.4	115.7	4.50	4.60
1995	546	172.5	113.2	1.00	1.00
1996	631	173.7	110.7	1.00	1.00
1997	704	176.0	109.7	1.00	1.00
1998	635	177.8	109.1	3.00	3.00
1999	451	178.9	107.4	3.00	3.00
2000	247	180.5	105.2§	3.00	3.00

*The support price was reduced from 178.8 cents/lb. and the no-net-cost assessment was reduced from 30 cents/lb. by Public Law 99-157, sec. 6 (1985).

†Real average support price is obtained by dividing the nominal support price by the national Consumer Price Index; the average of 1982–1984 is the benchmark.

‡No-net-cost assessment includes marketing budget deficit assessments from 1991 through 1998.

§Preliminary estimate.

Sources: U.S. Department of Agriculture 1997a; 1998a,b; 1999a, 2000.

prices for domestically grown tobacco are artificially high. Some estimates of the distortions resulting from the support program were provided by Sumner and Alston (1985) in their analysis of the economic consequences of removing the tobacco price support system. Their estimates were based on a detailed simultaneous equations model of the supply and demand for tobacco and tobacco products (cigarettes) that allows for substitution between domestic and foreign tobacco in cigarette production. The authors estimated that domestic tobacco output would rise by 50–100 percent or more if supply restrictions were eliminated. This large increase in the quantity of tobacco supplied would lead to sharp reductions in tobacco prices. As a result of the increase in output, tobacco prices would fall by 20–30 percent, and the variability of tobacco prices would increase. However, overall revenues from tobacco growing would rise by 15–60 percent or more.

Moreover, this analysis predicted that the sharp drop in domestic tobacco prices that would follow the removal of supply restrictions would lead domestic producers of cigarettes and other tobacco products to use less foreign-grown tobacco. These estimates assumed the elimination of the program in 1983 and thus do not take into account the more recent changes in its operation. More recent estimates from Zhang and colleagues (2000) suggest that the conclusions of Sumner and Alston (1985) still apply. For example, they estimated that the price support program raised tobacco leaf prices by 36 cents a pound in 1994. This price is about 21 percent above the estimated price in the absence of the support program.

The removal of the support program would also make domestic tobacco growers more competitive in world markets. In the 1980s, U.S. tobacco prices exceeded world market prices by 40–60 cents per pound (Warner 1988). Although part of the differential can be explained by the higher quality of U.S. tobacco, a significant factor is the U.S. tobacco support program. Sumner and Alston (1985) predicted that U.S. tobacco exports would have grown by about 100 percent if the tobacco support program had been eliminated in 1983. This change would have had an adverse impact on foreign tobacco growers, as producers of foreign cigarettes and other tobacco products increased their use of tobacco grown in the United States.

Although the artificially high prices resulting from the support program tend to increase the income of small tobacco farmers, they likely receive relatively less benefit from the program than the tobacco quota owners. Because most small tobacco farmers rent some or all of their allotments from the quota owners at a significant cost (Watkins 1990), these farmers pay rents

equivalent to the excess value created by the support program. In the absence of the program, reduced income for these farmers would likely be offset by the resulting reduced rent they paid. Quota owners, on the other hand, have been estimated to lose about \$800 million annually were the support program eliminated (Sumner and Alston 1985).

Despite the differing likely effects on quota owners and small tobacco growers, eliminating the tobacco support program would probably not alter existing trends in the concentration of tobacco production into larger farms (Sumner and Alston 1985). Rucker and colleagues (1995) have estimated that eliminating the program's intercounty restrictions on the transfer of tobacco quotas would have little overall impact beyond redistributing wealth from some tobacco growers and quota owners to others. (Consequently, these researchers suggest that the restrictions have remained in effect not because the gains associated with them are large but because the political costs of removing them are.) Moreover, removing supports would cause a movement away from regions where the costs of growing tobacco are relatively high toward those where costs are relatively low. The loss of income to quota owners would lead to reductions in personal income of up to 2–3 percent for counties that are highly dependent on tobacco; larger losses would occur in the relatively high-cost counties. However, total incomes would rise in areas that experienced a great expansion in tobacco growing. In comparison, the effect of altering another government program would be considerable. Increases in cigarette excise taxes are also likely to bring significant losses to quota owners. Sumner and Wohlgenant (1985) estimated that doubling the federal cigarette excise tax in 1983 would lower quota owners' lease income by an average of 13 percent, or about \$44 million.

As a result of the sharp drop in the price of tobacco, cigarette prices could fall. Tobacco costs, however, are a relatively small component of cigarette prices. Grise (1995) estimates that the 40- to 50-cent per pound drop in tobacco prices resulting from the elimination of the support program would reduce cigarette prices by only 1–2 percent. Zhang and colleagues (2000) estimate an even smaller impact, concluding that cigarette prices are 0.52 percent higher than they would be in the absence of the support program. As noted by Sumner and Alston (1985), a reduction in cigarette prices would lead to a rise in U.S. cigarette exports. Moreover, estimates of the price responsiveness of cigarette demand (described in "Effect of Price on Demand for Tobacco Products," later in this chapter) suggest that the reduction would lead to an increase of no more

than 1 percent in cigarette smoking. At least part of the increase would come from increased smoking among young people.

Opponents of the tobacco support program suggest that it can be removed with little impact on the farmers it is intended to benefit. For example, the less than 2-percent reductions in cigarette price that would result from eliminating the support program could be more than offset by an increased excise tax on cigarettes. A portion of the revenues generated from the tax hike could be used to help tobacco farmers diversify into other crops (through low-interest loans, grants, or other programs) or to purchase the farmer's tobacco base to retire it from tobacco growing (Northup 1993). Similarly, some of the funds could be used to develop nonfarm businesses, train farmers for other occupations, provide income support, and offer other economic support for local economies in transition (Womach 1994a).

Critics also point out that the support program creates indirect political consequences: the dependence created by the support program results in a strong political constituency, composed of tobacco farmers and holders of tobacco allotments, that can impede legislation to reduce tobacco use (Taylor 1984; Warner 1988; Zhang and Husten 1998). In the absence of the support program, tobacco growing would likely become much more concentrated (Sumner and Alston 1985). Warner (1988) has observed that the reduction in numbers would lead to reduced political influence. Moreover, he describes the apparent inconsistency present when one arm of the federal government seemingly endorses tobacco production by continuing an economic support program even as another engages in numerous activities to reduce tobacco use (Warner 1988).

Evolution of the U.S. Cigarette Industry

Through much of the 19th century, most of the demand for tobacco products centered on smokeless tobacco and cigars (see Chapter 2). Cigarettes were relatively less popular, although the demand for them increased gradually during the middle of the century (USDHHS 1992). The watershed year for the cigarette, however, was 1881, when James Albert Bonsack announced his development of a machine that replaced hand-rolling as the primary means of making cigarettes. The mechanization of production significantly reduced the costs of manufacturing cigarettes and, consequently, reduced cigarette prices. The steep declines in cigarette prices relative to the prices of other tobacco products, due largely to Bonsack's cigarette

machine, contributed significantly to the rapid rise in the popularity of cigarettes during the late 19th and early 20th centuries (Wagner 1971).

James Buchanan Duke was the first cigarette producer to acquire rights to the new machines, which he installed in 1884. Duke entered into long-term contracts with Bonsack to use the machines at a cost lower than Bonsack would make them available to other producers. Because of the resulting substantial cost advantage in production for his company, Duke successfully waged price wars with other producers while still earning relatively high profits. Over the next decade, the Duke family formed a holding company, which was composed of their firm and several competitors they had acquired. By 1889, as a result of its aggressive pricing and marketing strategies, the holding company effectively monopolized U.S. cigarette markets (controlling more than 90 percent of the market), as well as portions of the markets for other tobacco products. Eventually, in an attempt to avoid antitrust prosecution under the Sherman Act, the Dukes converted the holding company into The American Tobacco Company. By 1901, The American Tobacco Company dominated all of the U.S. tobacco markets except cigars. The company was also a considerable presence in cigarette markets around the world.

In response to allegations that The American Tobacco Company was abusing its market position, the U.S. Department of Justice charged the firm with violating the Sherman Act. In 1911, the Supreme Court dissolved the company, thereby creating several new firms from the conglomerate, including a new American Tobacco Company (which later became American Brands, Inc.), Liggett & Myers Tobacco Company, R.J. Reynolds Tobacco Company, and Lorillard Tobacco Company. The American Tobacco Company was also divested of its foreign holdings (Imperial Tobacco Ltd. and British-American Tobacco Company Ltd. [B.A.T. Company]). Imperial Tobacco Ltd. eventually monopolized cigarette manufacturing in Great Britain, and B.A.T. Company concentrated on manufacturing in British colonies and elsewhere. Both companies ultimately resumed some operations in the United States (Johnson 1984). Although Imperial Tobacco Ltd. eventually dropped out of U.S. markets, B.A.T. Industries PLC, the parent company of B.A.T. Company, owns Brown & Williamson Tobacco Corporation, a large U.S. cigarette manufacturer.

R.J. Reynolds Tobacco Company (which had no cigarette production after the breakup) soon developed a new type of cigarette by using burley tobacco, which was quickly copied by the other producers. By the 1920s, the cigarette producers were competing

aggressively in promoting their main brand—for example, R.J. Reynolds Tobacco Company’s Camel, The American Tobacco Company’s Lucky Strike, and Liggett & Myers Tobacco Company’s Chesterfield. In addition, firms on the competitive fringe attempted to compete through price with their so-called 10-cent brands (Robert 1967). (For a more detailed discussion of the domestic operations of U.S. cigarette firms before World War II, see the Surgeon General’s report *Smoking and Health in the Americas* [USDHHS 1992]).

The U.S. Department of Justice eventually challenged the four producers’ coordinated wholesale and retail pricing practices. In 1941, on the basis of conduct starting as early as 1933, these producers were charged with violating the Sherman Act by conspiring to restrain trade in an attempt to monopolize the industry. Their wholesale tobacco-purchasing practices were deemed to be monopsonistic—that is, characteristic of a market situation where one buyer exerts a disproportionate influence—and their retail pricing was thought to reflect collusive behavior. In 1946, basing its decision on the novel legal concept of “conscious parallelism,” the Supreme Court upheld a jury decision that found the firms guilty. The uniformity of prices at both the wholesale and the retail level (a result that could occur in any highly competitive market), the near-synchronous increases in prices, and the raising of wholesale prices when labor costs were falling were viewed by the court as evidence of tacit collusion.

As a result, the firms were fined up to \$250,000 each, a relatively minor penalty compared with their profits.

Johnson (1984) and others have noted that the Court’s decision was not supported by purely economic reasoning. There was little if any evidence that cigarette firms were jointly restricting output to raise cigarette prices and, consequently, profitability. Similarly, there was no evidence that the firms limited their wholesale purchases of tobacco to depress tobacco prices and production costs and, consequently, to increase profits.

The Court’s decision had little impact on the subsequent structure of the U.S. cigarette industry. The practical result has been that, from 1946 until today, the combined market shares of the six major firms (five after the merger of Brown & Williamson and American Brands, Inc.) has exceeded 99 percent, although individual market shares have changed significantly (Table 6.6).

More important in changing relative market shares was the release of information during the 1950s and 1960s on the health consequences of cigarette smoking. In the 1950s, Philip Morris Companies Inc., R.J. Reynolds Tobacco Company, and Lorillard Tobacco Company aggressively marketed filtered cigarettes (Marlboro, Winston, and Kent, respectively), which were perceived as less dangerous than standard unfiltered cigarettes; The American Tobacco Company and Liggett & Myers Tobacco Company were not as

Table 6.6. Domestic market shares of U.S. cigarette firms, selected years

Year	R.J. Reynolds	Philip Morris	Brown & Williamson	American Brands	Lorillard	Liggett & Myers	Total
1913	0.2	NA*	NA	35.3	22.1	34.1	91.7
1925	41.6	0.5	NA	21.2	1.9	26.6	91.8
1940	21.7	9.6	7.8	29.5	5.4	20.6	94.6
1955	25.8	8.5	10.5	32.9	6.1	15.6	99.4
1970	31.8	16.8	16.9	19.3	8.7	6.5	100.0
1975	32.5	23.8	17.0	14.2	7.9	4.4	99.8
1980	32.8	30.8	13.7	10.7	9.8	2.2	100.0
1985	31.7	35.8	11.8	7.4	8.2	5.0	99.9
1991	27.8	43.4	11.1	7.0	7.3	3.4	100.0
1996	24.6	47.8	17.2	NA	8.4	1.9	99.9

*NA = Not available.

Sources: Tennant 1950; Overton 1981; Clarifeld 1983; Standard & Poor’s 1989, 1993; Federal Trade Commission 1997.

successful in marketing their competing brands (Johnson 1984). Similarly, after the 1964 release of the U.S. Surgeon General's first report on the health consequences of cigarette smoking, and after the Federal Trade Commission's (FTC) publishing of tar and nicotine content in the late 1960s, Philip Morris Companies Inc. and R.J. Reynolds Tobacco Company introduced and aggressively marketed low-tar and low-nicotine cigarettes (again, products perceived as healthier than existing cigarettes), whereas the other companies were less successful. As a result of the brand loyalty these two firms were able to establish at this time, they came to dominate cigarette markets; in 1996, the two firms had a combined market share of 72.4 percent.

Another notable change in the tobacco industry, beginning in the 1960s, was the diversification of the cigarette-manufacturing companies. Perhaps in part to offset the impact that the campaign to reduce tobacco use had on the industry's profitability, the six major domestic cigarette producers acquired or merged with U.S. firms in a variety of nontobacco markets, including food, alcoholic beverages, and transportation. Both U.S. and international cigarette producers significantly expanded their international activities. Diversification was relatively easy because of the high profitability from cigarettes and the low long-term debt of these firms (Overton 1981). By 1972, no major domestic cigarette company was completely dependent on tobacco for its revenue (Johnson 1984). During the 1980s, diversification strategies and successes among the six firms varied markedly; some firms returned to a focus on cigarettes and other tobacco products, whereas others diversified further. By the late 1980s, a three-tiered classification of world cigarette producers, based on their international activities, had emerged: those involved in most global tobacco markets (Philip Morris Companies Inc., B.A.T. Industries PLC, R.J. Reynolds Tobacco Company, and Rothmans International Tobacco Ltd.); those with some international, but not global, activities (including American Brands, Inc.); and smaller firms concentrating primarily on their domestic markets (including Liggett & Myers Tobacco Company and Lorillard Tobacco Company) (USDHHS 1992).

Economic Implications of Concentrated Tobacco Production

The concentration of production among relatively few firms in the cigarette industry has implications for cigarette pricing, marketing, product development, and other activities. Clearly, the cigarette industry is an oligopoly; no more than six firms have controlled virtually all cigarette output in the United States for the

past 80 years (Table 6.6). Economic theory suggests that firms in oligopolistic industries have substantial market power in that their production decisions will have a significant impact on price. Moreover, these firms recognize their interdependence. That is, each firm recognizes that its pricing and marketing strategies have a significant impact on the sales and profitability of its competitors, as well as on its own sales and profitability. Consequently, each firm understands that its competitors are likely to respond to any changes in its own pricing, marketing, or other strategies.

Economic theory provides several possibilities regarding the conduct and performance of firms in an oligopolistic industry. At one extreme, if entry is easy and if sunk (nonrecoverable) costs are low, firms in an oligopolistic industry will behave competitively. That is, firms will have little market power (their output decisions will have little impact on market prices), prices will reflect the costs of production, and firms will not earn excessive profits. At the other extreme, firms could behave collusively, jointly restricting output, raising prices well above costs, and earning very high profits. Most theoretical models of oligopolistic industries suggest behavior between the two extremes: prices and profitability will be above and output will be below what would result from highly competitive behavior, and output will be higher and prices and profitability will be lower than their levels in a monopolized or highly collusive industry.

Casual empiricism suggests that cigarette prices have historically been well above costs, thereby allowing cigarette producers to achieve a rate of return well above that earned in most other industries. Even after the health consequences of cigarette smoking became apparent, the U.S. tobacco industry led all U.S. industries in profitability (Miles 1982). Moreover, in the two major antitrust cases brought against the cigarette industry in the 20th century, firms were found guilty in 1911 of monopolization and in 1946 of a conspiracy to restrain trade (collusion). Most industry analysts suggest that the primary source of market power in the cigarette industry is the entry barriers resulting from marketing efforts, which create significant brand loyalties that are nearly impossible for a new producer to overcome.

High Tobacco Concentration and the Impact of Prevention Policies

The high concentration of the cigarette industry and the apparent market power this concentration engenders have implications for the effects of changes in cigarette taxes and other prevention policies on the

pricing, marketing, and other strategies of cigarette firms. For example, the historically high profitability of existing cigarette producers provides them with the resources needed to successfully develop and market new products, as was seen in the development and introduction of filtered cigarettes in the 1950s and low-tar and low-nicotine cigarettes in the 1960s in response to the initial reports linking cigarette smoking to lung cancer. More recently, in response to the increased awareness of the harmful effects of environmental tobacco smoke (ETS) on nonsmokers and the widespread restrictions on smoking that have been designed to protect nonsmokers, R.J. Reynolds Tobacco Company introduced its Eclipse brand in several test markets beginning in mid-1996, and Philip Morris Companies Inc. is currently testing its Accord brand in the United States and Japan. Both are ostensibly “smokeless” cigarettes, primarily heating rather than burning tobacco; consequently, both generate less secondhand smoke than conventional cigarettes.

Economic theory can predict some effects of increases in excise taxes on price, output, and profitability. At one extreme, tax increases in a perfectly competitive market with constant costs of production should result in price increases of the same magnitude with no impact on long-run profitability. Reductions in output would depend on the effect that price has on demand. At another extreme, standard models for a monopolized market suggest that producers and consumers would share the burden of the tax increase but consumers would pay a greater share of the tax, because demand is less sensitive than production to price. Output and profitability would fall, with smaller reductions in both—again because demand is less sensitive to price. Recent advances in the theoretical and empirical study both of oligopolistic behavior and of the supply of addictive goods have yielded several interesting predictions. Perhaps most interesting is the possibility that prices will increase by more than the amount of the tax increase when excise taxes are raised.

Several early studies of these relationships produced generally inconsistent conclusions concerning how much cigarette prices would increase after an increase in cigarette taxes (Barzel 1976; Johnson 1978; Sumner 1981; Sumner and Ward 1981; Bulow and Pfleiderer 1983; Bishop and Yoo 1985; Sullivan 1985; Sumner and Wohlgenant 1985; Ashenfelter and Sullivan 1987). One general weakness of these studies was their failure to account for the dynamic interaction of firms in an oligopolistic industry. Instead, the studies generally assumed that rules for the firms’ behavior were established, and then, with observed prices and taxes, the studies worked backward to

determine the degree of competition within the industry (Harris 1987).

More recent studies have addressed these weaknesses. Harris (1987) used the estimates obtained from several studies of cigarette demand and supply to evaluate the impact of doubling the federal cigarette excise tax in 1983; moreover, Harris’ framework allowed the change in the tax to affect the interaction of firms in the industry. Using data on wholesale and retail cigarette prices as well as the costs of production, Harris concluded that the 8-cent increase in the tax led to a 17-cent increase in the retail price of cigarettes. He further argued that the price increase above the tax hike could not be accounted for by increases in production costs. Instead, this increase was attributed to the recognized interdependence of cigarette firms in an oligopolistic industry; that is, the firms recognize that their profitability would rise if all could successfully restrict output and raise prices. However, because formal agreements on output and prices are illegal, the firms are alert to other bases on which they can coordinate their behavior. Harris suggested that such a base was the announced increase in the federal tax, scheduled for January 1, 1983, which served as a coordinating mechanism for a joint oligopolistic price increase. As Barnett and colleagues (1995) note, Harris’ analysis fails to account for existing trends in cigarette prices. Barnett and colleagues argue that Harris attributed too much of the coordinated rise in price to the increase in the federal tax, because the upward trend in prices predates the consideration of the tax hike. The authors suggest that producers used the introduction of discount cigarettes in 1981 to coordinate the earlier price hikes for premium brands, because the lower-priced “generic brands” would keep more price-sensitive smokers in the market. The spirit of this argument is the same as Harris’, because both suggested that certain events served as focal points allowing firms to engage in more collusive behavior without appearing to establish a formal agreement.

Keeler and colleagues (Sung et al. 1994; Barnett et al. 1995; Keeler et al. 1996) used national- and state-level data to estimate the effects of cigarette tax increases on price. Their empirical models have been used to examine the interaction of cigarette supply and demand in determining cigarette prices. By using alternative assumptions about firm behavior, these studies formally account for the oligopolistic aspects of the cigarette industry in their empirical models of cigarette supply. At least some of these models also account for the addictive nature of cigarette demand.

In a study using data on all U.S. states from 1960 through 1990, Keeler and colleagues (1996) conclude

that the oligopolistic behavior of the industry results in increases in cigarette prices that exceed increases in state excise taxes. A 1-cent increase in the state tax would raise retail prices in that state by an average of 1.11 cents. Moreover, the researchers conclude that producers selectively lower prices in states with stronger state and local antismoking laws, offsetting the impact of tobacco control policies. Similarly, a study using data on 11 western states for the same period predicts that the state cigarette price would rise by 1.27 cents for every 1-cent increase in the state cigarette tax (Sung et al. 1994).

Another study by Barnett and colleagues (1995) suggests that increases in federal cigarette excise taxes would generate larger increases in cigarette prices than those that would result from state tax hikes. These investigators attribute this phenomenon to the increase in sales across state borders, which can result from a state tax increase and can thereby limit the impact of the tax increase on price. A 1-cent increase in the federal cigarette tax was predicted to raise cigarette prices by just over 1.0 cent, whereas a comparable increase in state cigarette taxes would yield an estimated retail price increase of about 0.9 cents. The investigators conclude that the industry has been less competitive since 1980; they attribute this finding both to the relatively lax enforcement of antitrust laws associated with the deregulatory climate of the 1980s and to the focal points that triggered more collusive behavior.

Basing their analysis on a published economic model of addictive behavior (Becker and Murphy 1988), Becker and colleagues (1994) suggest an alternative explanation for the observation that cigarette prices increase more than cigarette taxes increase: tobacco companies raise prices to obtain maximum profit from current smokers, for whom cost concerns alone will likely motivate reducing but not quitting their addictive behavior; these increased profits are intended to help offset future losses from the reduced demand that will occur among would-be new smokers, who will be put off by any price increase, whether from taxes or other causes. As is discussed later in this chapter (in "Effect of Price on Demand for Tobacco Products"), addiction is to some extent a wild card in estimates of price and demand. Becker and colleagues (1994) express this only-apparent paradox as follows: "If smokers are addicted and if the industry is oligopolistic, an expected rise in future taxes and hence in future prices induces a rise in current prices even though current demand falls when future prices are expected to increase" (p. 413). The same effect would apply to other anticipated changes in policies that would be expected to reduce future cigarette smoking. The authors

explain this hypothesis as follows: cigarette firms with market power may set relatively low prices to "hook" consumers on their addictive product, thus raising the future demand for their cigarettes; policies (including tax increases) that reduce future smoking also reduce the firms' profitability of maintaining low prices. Nevertheless, the relatively low prices of these forward-looking firms (compared with those of more myopic firms) will still exceed the marginal and average costs of production and distribution. A similar hypothesis has been used to explain studies that found that cigarette producers appear to advertise beyond the profit-maximizing level (Showalter 1991). These firms may be engaging in excessive advertising (i.e., more than can be recouped through brand switching among current smokers) to attract new consumers and hoping to later benefit from a higher demand for cigarettes as a result of these newly addicted consumers.

The rapid increases in cigarette prices since the early 1980s, which are only partly explained by increases in taxes and costs, thus reflect profit-maximizing behavior by a highly concentrated cigarette industry that anticipates decreased future demand as additional efforts to reduce tobacco use are implemented (Becker et al. 1994). An empirical application of this model to the supply and demand for cigarettes (Showalter 1991) supports these hypotheses concerning the behavior of firms with market power that are selling an addictive product.

A second group of empirical studies has focused on the relationships between industry concentration, restrictions on cigarette advertising, cigarette prices, and market power. One such analysis supports the conventional wisdom that advertising is an important competitive strategy in developing and maintaining brand loyalty for firms in the cigarette industry (Nguyen 1987). Another analysis, using an empirical model that allows firms in an oligopolistic industry to have some degree of market power, concludes that advertising raises market power and, consequently, profitability in the cigarette industry (Tremblay and Tremblay 1995). A likely explanation of this effect is that by fostering loyalty to existing brands, cigarette advertising raises barriers to other brands that try to enter the market and share in the profits.

Several studies (Porter 1986; Mitchell and Mulherin 1988; Eckard 1991) have concluded that banning cigarette advertising from television and radio made the industry even less competitive, thereby further raising profitability. One such study attributed the increases in cigarette prices after the advertising ban to the reduced competition resulting from the ban (Porter 1986). This conclusion was supported, to some

extent, by the observation by Doron (1979) that cigarette firms apparently favored the 1971 ban on television and radio advertising, although the firms' concerns about counteradvertising may have played a role as well (see "Advertising and Promotion" in Chapter 5).

Discussion

The highly concentrated, oligopolistic structure of the U.S. cigarette industry has important implications for the effects of increases in cigarette excise taxes and of stronger prevention policies on cigarette prices. Much of the recent research on the supply of cigarettes has found that the cigarette industry became less competitive in response to the 1971 ban on cigarette advertising on television and radio. One consequence of this reduced competition was that cigarette prices rose more rapidly than they would have otherwise. Moreover, this research suggested that further reductions have occurred in competition since the early 1980s, partly because of the relaxed regulatory climate for business. Increases in cigarette excise taxes and stronger prevention policies have also contributed to the reduced competition. The net result of the increased market power of cigarette producers is that cigarette prices have risen more rapidly than production costs have increased. In addition, increases in cigarette taxes during this period resulted in greater than a 1:1 increase in cigarette prices.

Two recent activities, however, suggest that price competition in the cigarette industry is increasing at both the wholesale and the retail levels. In 1993, cigarette manufacturers experimented with price reductions on premium brand cigarettes through coupon and promotional activities beginning in April. This experiment was soon followed by a 25-percent drop in wholesale cigarette prices, which resulted in a sharp decline in retail prices (USDA 1994b). Although prices were eventually raised, these activities indicate that there may be greater price competition among cigarette producers in the future. Similarly, the recent growth of low-price stores specializing in the sale of cigarettes, such as the Cigarettes Cheaper! chain in the San Francisco area and Puff 'N' Stuff in northern Illinois, has also reduced the retail price of cigarettes. These stores, which depend on high volume to profit, charge significantly less for cigarettes than supermarkets and other outlets do. For example, in mid-1994, a carton of premium cigarettes that cost \$18–22 in many outlets in California sold for \$14.99 at Cigarettes Cheaper!, and some name brands sold for even less (Schevitz 1994).

In contrast, the proposed June 20, 1997, national tobacco settlement would have reduced competition in the cigarette industry by granting cigarette companies an antitrust exemption to achieve the aims of the agreement. In its analysis of the proposed settlement, the FTC (1997) concluded that, based on past behavior and the structure of the industry, firms were likely to coordinate substantial price increases that would likely exceed the cost of the payments required by the agreement. Given this, the FTC concluded that the proposed settlement might generate substantial profits for cigarette producers.

Trade Policy, Tobacco, and Tobacco Products

Although acreage devoted to tobacco production has fallen worldwide, technological improvements have led to overall increases in tobacco production (Roemer 1993). In 1999, estimated global production of tobacco was more than 6 million metric tons; more than 60 percent of this was accounted for by four countries: China (34.9 percent), India (9.7 percent), the United States (9.4 percent), and Brazil (8.2 percent). In some producing countries (e.g., Zimbabwe), nearly all tobacco production is exported.

Up to 85 percent of global tobacco production is used for cigarettes. In 1996, global cigarette production was nearly 6 trillion cigarettes; more than half of this production was accounted for by three areas: China (30.0 percent), the European Community (13.7 percent), and the United States (13.1 percent) (USDA 1997c). Although cigarette consumption is falling in industrialized countries, global consumption is rising because of significant increases in developing countries. This global increase in demand has created opportunities for U.S. and other global cigarette firms to expand. World trade in cigarettes has grown steadily for at least the past 30 years. U.S. cigarette firms capitalized on this growth, expanding cigarette exports from an average of 24.3 billion per year in the late 1960s to a peak of almost 250 billion in 1996; as a result, domestic cigarette production rose even as domestic sales declined rapidly.

Through the 1990s, nearly 30 percent of all cigarettes produced in the United States were exported. The major U.S. cigarette exporters are Philip Morris Companies Inc., R.J. Reynolds Tobacco Company, and Brown & Williamson Tobacco Corporation; these companies account for more than 99 percent of U.S. cigarette exports (FTC 1997). In 1981, the three firms formed the U.S. Cigarette Export Association to compete more

effectively in foreign markets (this type of association is exempt from antitrust law under the Webb-Pomerene Act).

As Grise (1990) notes, trade in tobacco and tobacco products would be even higher if not for general trade policies and, in particular, widespread agricultural and industrial policies that protect domestic tobacco growers and producers of tobacco products. Numerous countries have policies that support domestic tobacco growing; in the United States, examples are the tobacco support program and the short-lived mandatory minimum content of domestic tobacco in domestic cigarettes. Likewise, both tariff and nontariff barriers to trade in tobacco and tobacco products have been erected around the world. These barriers include quotas, restricted product lists, exchange controls, prior deposits, mixing regulations, licensing requirements, and limits on advertising and other promotional activities (Grise 1990). Moreover, in several countries (including Japan, South Korea, and Thailand), various aspects of the manufacture and distribution of cigarettes have long been controlled by government monopolies that have largely prevented the import of foreign cigarettes (GAO 1992).

When tariff and nontariff barriers to trade are used to protect domestic tobacco and tobacco products, total supply of these products is usually lower than it would be otherwise, whereas domestic supply is higher. In the case of tobacco products, this arrangement has public health benefits resulting from the generally higher prices and reduced consumption of the protected products. Domestic suppliers benefit by supplying more at higher prices. Foreign suppliers, however, are likely to lose in this arrangement, because their access to these markets is limited and costs of supplying the markets are higher. In addition, restrictions on advertising and promotion in given countries are likely to make it difficult for new firms to successfully enter newly opened markets where existing brands are firmly entrenched (Chaloupka and Corbett 1998).

Past Tobacco-Related Trade Policy

In general, tobacco products exported from the United States are specifically exempted from federal laws and regulations concerning the export of potentially harmful products, including the Federal Hazardous Substances Act (Public Law 86-613), the Toxic Substances Control Act (Public Law 94-469), and the Controlled Substances Act (Public Law 91-513) (GAO 1992). Similarly, although federal regulations (1) require that all cigarette packaging and advertising in the United States contain health warning labels and

(2) prohibit television and radio cigarette advertising, there are no federal regulations or laws concerning the packaging or advertising of domestically produced cigarettes that will be exported (GAO 1992).

Various U.S. policies and programs have been used to help domestic tobacco growers and cigarette companies expand into foreign markets (Connolly and Chen 1993). These policies include the USDA's Food for Peace Program, which sent more than \$1 billion in domestically produced tobacco to developing countries in the 1970s and early 1980s, and the 1984 Export Credit Guarantee Program, which exported domestically grown tobacco and helped U.S. cigarette producers enter Mideast markets (including Algeria, Egypt, Iraq, and Turkey) (Taylor 1984). Perhaps the most important, however, is Section 301 of the Trade Act of 1974 (Public Law 93-618) and its subsequent amendments.

Section 301 of the Trade Act of 1974

The Trade Act of 1974 was initiated by the Nixon administration when it sought permission to begin the Tokyo Round of GATT. GATT, an international trade agreement honored by nearly 120 countries, governs various aspects of international trade. (GATT is discussed in greater detail in "Multinational Trade Agreements," later in this chapter.) The first of these agreements was reached among 23 nations shortly after the conclusion of World War II. Since then, seven rounds have occurred, including the Uruguay Round, which concluded in April 1994 after more than seven years of negotiations.

The Trade Act of 1974 included in its final legislation various measures with the stated purpose of promoting free trade. One of these measures was Section 301, which gave the President the authority to investigate cases where trade and other practices of foreign countries were considered unjustifiable, unreasonable, or discriminatory in that they limited the ability of U.S. firms to sell their goods and services in foreign markets.

Section 301 expanded the authority given to the President by the Trade Expansion Act of 1962 (Public Law 87-794). That earlier legislation allowed for investigations of unjustifiable trade sanctions (those that directly violated GATT). Consequently, the act applied only to goods covered by GATT (which at the time excluded agricultural products, including tobacco). Section 301 expanded presidential authority to include trade in all U.S. goods and services and allowed the investigation of practices that were unreasonable but did not necessarily violate GATT. If negotiations were not successful in reducing or eliminating the unjustifiable

or unreasonable limits on trade, Section 301 authorized the President to impose retaliatory trade sanctions. Initially, Section 301 received little attention, although it would later become a widely used tool of U.S. trade policy (Nivola 1993).

Section 301 of the Trade Act of 1974 was strengthened by the Trade and Tariff Act of 1984 (Public Law 98-573) and the Omnibus Trade and Competitiveness Act of 1988 (Public Law 100-418). Now known as “Super 301,” the section required the U.S. Trade Representative to annually identify countries and their practices that consistently limited market access to U.S. firms. More important, if negotiations failed to eliminate the unfair trading practices of these countries, mandatory retaliatory measures were to be imposed unless the President deemed these measures harmful to U.S. economic interests.

Four Section 301 cases in the late 1980s dealt with cigarettes: cases against Japan in 1985 and Taiwan in 1986 were initiated by the U.S. Trade Representative at the President’s request, and cases against South Korea in 1988 and Thailand in 1989 were the result of the U.S. Cigarette Export Association’s petitioning of the U.S. Trade Representative. Threats of retaliatory sanctions under Section 301 led to agreements with each country; as a result, U.S. cigarette firms were permitted access to those markets. The opening of the markets resulted in aggressive tobacco advertising by U.S. firms (Roemer 1993). Each of the four newly “opened” countries has laws, regulations, and ordinances concerning cigarette advertising and promotion. The governments of some of the countries have alleged that U.S. cigarette companies have violated restrictions on advertising and promotion.

A brief review of the four Section 301 cases follows; more details are contained in reports from the GAO (1990, 1992), and an empirical analysis of their impact on cigarette smoking is contained in Chaloupka and Laixuthai (1996).

Japan

The tobacco industry in Japan is largely monopolized by the company Japan Tobacco Inc. In 1979, Japan was the subject of two Section 301 cases, one involving cigars, which was prompted by the Cigar Association of America, and a second related to pipe tobacco, which was initiated at the request of the Associated Tobacco Manufacturers. The two cases were resolved in an agreement with Japan, which reduced market restrictions and lowered import duties (GAO 1990).

Before 1986, the domestic cigarette monopoly was protected from foreign competition through tariffs of 28 percent on all imported cigarettes and through Japanese distribution practices, which discriminated against imported cigarettes. The threat of Section 301 sanctions led to an October 1986 agreement that eliminated Japanese cigarette tariffs and changed excise tax payment procedures and other distribution practices that adversely affected imports of U.S. cigarettes. Existing Japanese policies related to cigarette advertising and other promotional practices were not affected by the agreement.

The agreement resulted in a significant expansion of U.S. cigarette firms in Japan. Japanese imports of U.S. cigarettes more than tripled in 1987 alone and continued to rise in 1988 and 1989, by which time the market share of U.S. firms was more than 15 percent (Grise 1990). This growth appeared to have slowed or stopped in the early 1990s. Total U.S. cigarette exports to Japan ranged from 54.0 billion to 57.7 billion annually during 1991–1993.

A downward trend during the 1970s and 1980s in per capita cigarette consumption in Japan appears to have reversed itself after the Japanese cigarette markets were opened to U.S. firms. Overall per capita consumption appears to have remained steady or increased slightly in recent years. However, among Japanese women, smoking prevalence rose from 8.6 percent in 1986 (before the agreement) to 18.2 percent by 1991. The 1991 rates were even higher among young adult women (27 percent) (Connolly and Chen 1993).

Part of this increase may be the result of advertising and promotional activities by U.S. cigarette firms in Japan. Between 1987 and 1990, total expenditures on cigarette advertising and promotion by U.S. cigarette companies in Japan nearly doubled. Most of these expenditures were on television advertising, which is allowed in Japan (but subject to some restrictions). Before the agreement, the domestic monopoly did not engage in extensive advertising. Afterward, it significantly expanded its advertising and promotional efforts. As a result, cigarette advertising moved from 40th to 2nd place in total television advertising in Japan (Sesser 1993).

Taiwan

Virtually all aspects of the tobacco industry in Taiwan are controlled by a state-run monopoly. In 1986, the U.S. Trade Representative threatened Taiwan with retaliatory trade sanctions over several governmental policies that limited the market access of U.S. cigarette companies. These policies included quotas and tariffs

on imported cigarettes, a ban on the retail sale of imported cigarettes, and a ban on print advertising of imported cigarettes. An agreement was reached in December 1986 that reduced tariffs and eliminated other barriers, thereby allowing U.S. cigarette companies greater access to the Taiwanese cigarette market. The agreement also contained several restrictions relating to cigarette packaging (which was required to have a specified health warning label) as well as advertising and promotional activities (e.g., the distribution of free samples was limited and point-of-purchase promotions were restricted to licensed establishments).

The agreement greatly increased U.S. cigarette companies' access to the Taiwanese cigarette market. In 1987 alone, total U.S. cigarette shipments to Taiwan increased 24-fold, and the market share of U.S. cigarette companies rose from 2 to 17 percent (Grise 1990); by 1997, the market share of imported cigarettes had risen to 30 percent (Hsieh and Yin 1998). Moreover, Taiwan's imports of relatively higher-quality U.S. tobacco rose, as the portion of U.S. tobacco in Taiwanese cigarettes increased from 35 to 55 percent to better compete with imported cigarettes (Grise 1990). However, per capita consumption of cigarettes, after increasing somewhat during the 1970s and early 1980s, fell from 1987 through 1996, due to public and private antismoking policies (Hsieh and Yin 1998). Smoking prevalence among Taiwanese women significantly increased in the late 1980s and has remained stable throughout the 1990s (Hsieh and Yin 1998).

Advertising and promotion of U.S. cigarettes after the agreement are likely to have contributed to the large rise in the market share of U.S. cigarette companies in Taiwan. Before the agreement, the only advertising and promotion permitted by the Taiwan Tobacco & Wine Monopoly Bureau were new product announcements and the use of billboards in the bureau's branch offices and distribution centers (GAO 1992). In 1987, spending on advertising and promotional activities by U.S. cigarette firms in Taiwan rose sharply but fell somewhat in the next three years. Nevertheless, total spending rose by 43.8 percent from 1987 to 1990 (GAO 1992). Given preagreement restrictions on advertising and promotion, almost all of these expenditures would have been for point-of-purchase and magazine advertising. Advertising by the Taiwanese cigarette monopoly, however, was limited even further after the agreement.

Authorities in Taiwan have alleged that point-of-purchase promotional activities by U.S. cigarette companies have violated the terms of the 1986 agreement (GAO 1992). The agreement limits these activities to licensed wholesale, distribution, and retail establishments,

which the Taiwan Tobacco & Wine Monopoly Bureau defines as those with a permit registering them as profit-seeking enterprises. Taiwanese authorities contend that U.S. cigarette firms have distorted this definition to include unlicensed retailers selling cigarettes, resulting in widespread advertising and unauthorized sales of U.S. cigarettes (GAO 1992).

After 1987, the government of Taiwan enacted several strong tobacco control policies, largely in response to the liberalization of cigarette trade resulting from the Section 301 agreement (Hsieh and Yin 1998). Many of these policies were initially rejected by the U.S. Trade Representative as unfair or discriminatory toward the tobacco industry and in violation of the 1986 agreement. One contentious issue pertained to the health warning labels proposed for cigarette advertising and packaging. The Taiwanese government initially proposed a set of strong, rotating health warning labels that would appear on the front of cigarette packaging and on all advertising. In response to the U.S. Trade Representative's opposition, the content of the label was changed to "excessive smoking is dangerous to health," and the label was placed on the side of packaging (Hsieh and Yin 1998). Eventually, in 1992, the labels were changed to include six rotating warnings communicating more specific information about the hazards of smoking.

The dispute over the Smoking-Hazards Prevention Act, introduced in 1991 with the stated aim of protecting the public health by preventing and controlling damage from tobacco products, was even more contentious (GAO 1992). The aim of the act would be accomplished by prohibiting smoking by those under 18 years of age, banning vending machine sales of tobacco products, limiting the tar and nicotine content of all cigarettes, requiring that the packaging of all tobacco products include not only health warning labels but also tar and nicotine content in Chinese, and banning all tobacco advertising and certain other promotional activities. The act was immediately challenged by the U.S. Trade Representative as a unilateral violation of the 1986 agreement that allowed U.S. cigarette companies to advertise in Taiwan (GAO 1992). Sesser (1993) reports that a confidential position paper drafted by the U.S. Trade Representative in January 1992 stated that the proposal was an attempt to protect the Taiwanese cigarette monopoly from foreign competition and that the various measures proposed would have little impact on smoking. In July 1993, the Clinton administration's U.S. Trade Representative, Michael Kantor, stated that his office would not challenge the act if it was enacted (Sesser 1993). Six years after its introduction, the Smoking-Hazards Prevention Act was

finally enacted with compromise clauses that permit cigarette advertising in magazines (Hsieh and Yin 1998).

South Korea

South Korea's Tobacco & Ginseng Corporation controls all aspects of that country's tobacco growing and production, which had traditionally been protected by high tariffs imposed on foreign cigarettes. In 1982, South Korea enacted and aggressively enforced legislation making it a criminal offense to sell, buy, or possess foreign cigarettes (Eddy and Walden 1993). Beginning in 1987, almost all cigarette advertising and other promotional activities were banned by the Tobacco Monopoly Act. After petitioning by the U.S. Cigarette Export Association in January 1988, the U.S. Trade Representative investigated these practices. In response to the threat of retaliatory sanctions on South Korean textile exports to the United States, a Record of Understanding was signed by the two countries in May 1988. This agreement opened South Korean cigarette markets to U.S. firms by eliminating the ban on the sale of foreign cigarettes, reducing the tariff on imported cigarettes, allowing the distribution of free samples, and allowing some print advertising of cigarettes and the sponsorship of sporting events. The agreement also prohibited advertising that targeted women and young people (smoking is prohibited in South Korea for persons under 20 years of age). Finally, all cigarette packaging and magazine advertising were required to include a health warning label.

Although cigarette smoking had been increasing steadily in South Korea during the 1980s, the rate of growth in smoking more than tripled when cigarette markets were opened to foreign competition (Roemer 1993). Much of the increase appeared to have been the result of dramatic increases in smoking prevalence among young people. From 1988 to 1989 alone, smoking prevalence among male teenagers rose from 18 to 30 percent, and smoking prevalence among female teenagers increased from 2 to 9 percent (Sesser 1993). Much of the increase in consumption was accounted for by the increased use of imported cigarettes. Import share in the market rose from 0.06 percent before the agreement to nearly 8.5 percent in 1994 and continued to increase steadily (U.S. Department of Commerce, Tobacco Export Task Force Analysis, unpublished data, November 13, 1995). Part of the increase may be attributable to an increase in advertising by U.S. cigarette companies in South Korea after the liberalization of cigarette trade. In late 1988, South Korea passed the Tobacco Business Act (effective January 1, 1989), which limited advertising and promotional efforts to point-of-purchase

advertising, magazine advertising, and sponsorship of public events (GAO 1992). In 1991, the Korea Tobacco Association (comprising the U.S. Cigarette Export Association firms and the Korean tobacco monopoly) outlined a self-regulating voluntary marketing agreement to comply with the Record of Understanding and the Tobacco Business Act.

Nevertheless, the South Korean government indicates that some promotional activities of U.S. cigarette companies violate the spirit of the Tobacco Business Act. These allegations concern distribution of free cigarettes, advertising placement for televised events sponsored by U.S. tobacco firms, the distribution of nontobacco "gifts" bearing company trademarks, and the targeting of youth. Although no formal actions related to these violations were initiated, the Koreans did begin renegotiating the Record of Understanding with the United States in 1995. In August 1995, the United States government agreed to modify the market access agreement with the Koreans to allow them greater flexibility to impose nondiscriminatory, health-based measures that restrict the use of tobacco products, including limitations on tobacco product advertising.

Thailand

Perhaps the most publicized and contentious Section 301 dispute was initiated by the U.S. Trade Representative in response to petitioning by the U.S. Cigarette Export Association in April 1989 over Thailand's virtual ban on the import of cigarettes and complete ban on cigarette advertising and other promotional activities in that country. The complaint cited various restrictions on the importation and sale of cigarettes and referred to discriminatory duties and taxes on cigarette imports (GAO 1992). All aspects of the domestic tobacco markets in Thailand are controlled by a government-run monopoly, which stopped its own cigarette advertising and promotion in April 1988. However, foreign companies continued their activities, which prompted a total government ban on cigarette advertising in Thailand in February 1989. The formal investigation began in May. After no agreement could be reached, the U.S. Trade Representative consented to submit the complaint to the GATT dispute resolution process.

The panel created by GATT investigated the U.S. complaint that the import barriers and advertising restrictions were a violation of the international agreement's principles. In October 1990, the GATT Council sustained the panel's recommendations and ruled that the ban on imports was a violation of the

GATT treaty. However, the council upheld the high Thai cigarette excise taxes (applied to both domestic and foreign cigarettes) and the right of the government to restrict the overall supply of cigarettes. Regarding the Thai advertising ban, the council noted that GATT allows member nations to use various policies to protect public health if the policies are applied to both domestic and foreign products. A cigarette advertising ban that made it difficult for new foreign firms to compete with existing domestic firms was ruled justifiable under the treaty, because allowing advertising could stimulate the demand for cigarettes, particularly among youth (Contracting Parties to the General Agreement on Tariffs and Trade 1991; Roemer 1993). This decision was based on Article XX of GATT, which states that:

Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting parties of measures . . . necessary to protect human . . . health [or] necessary to secure compliance with laws or regulations which are not inconsistent with the provisions of this Agreement.

The GATT ruling led to an agreement in November 1990 between the United States and Thailand that allowed the importation of U.S. cigarettes into Thailand. Imported cigarettes were then subject to the same laws and regulations as those marketed by the Thai Tobacco Monopoly (GAO 1992). Thus, U.S. cigarettes would be taxed the same and subjected to the same supply restrictions, and the advertising and promotion of these cigarettes (including the use of cigarette company logos, trademarks, and other symbols on nontobacco products) would be prohibited. The Thai government, however, has indicated that U.S. cigarette companies have tried to circumvent the ban on promotional activities by tactics such as sponsoring sporting events and placing cigarette logos or symbols in televised programming. No formal complaints have been filed.

After its success in upholding the ban on advertising and promotion, the Thai government in 1992 enacted two laws restricting smoking: the Non Smokers Health Protection Act and the Tobacco Products Control Act. The first act restricted smoking in designated public places. The second was a comprehensive act that required that all tobacco products disclose

their ingredients, allowed the Ministry of Public Health to determine all aspects of labeling, including health warnings, and banned the following: smoking by those under 18 years of age (imposing fines on violators); vending machine sales; distributing free samples, exchanges, and gifts of cigarettes; tobacco advertising (including, under the Thai definition of advertising, the use of cigarette logos and other symbols on nontobacco products) except in international magazines and live telecasts originating outside Thailand; advertising products with the same name as tobacco products; producing, importing, advertising, and selling products imitating tobacco products; and selling cigarettes not complying with the labeling provisions (Roemer 1993).

The cigarette trade agreement that opened the Thai cigarette market to U.S. firms has led to a rise in imports from less than 1 percent of the market before the agreement to about 4 percent in 1993. Because of current trends, this change is likely to increase substantially in the future (e.g., U.S. cigarette exports to Thailand rose by more than 56 percent from 1992 to 1993). Part of the increase may be the result of increased smoking prevalence among women and young people in Thailand (USDA 1994a).

Multinational Trade Agreements

The North American Free Trade Agreement

In 1993, the United States approved the North American Free Trade Agreement (NAFTA), a comprehensive agreement that eliminated most of the barriers to trade between the United States, Canada, and Mexico; implementation began January 1, 1994. This agreement further reduced already low trade barriers between the United States and Canada resulting from an earlier free trade agreement. More important, the new agreement substantially reduced existing trade barriers between the United States and Mexico by eliminating all nontariff barriers to trade and by phasing out most tariffs. Mexican tariffs on U.S. tobacco and tobacco products were initially set at 50 percent; the 1998 rate was 25 percent. Supporters of the agreement argued that it would lower prices, lead to a net increase in jobs (particularly in export industries), and spur economic growth in all three countries. Opponents countered that U.S. firms would have an incentive to shift production to Mexico to reduce labor and other operating costs, thereby leading to a net reduction in U.S. employment.

Before the agreement, some trends in tobacco production in the United States, Canada, and Mexico were similar. Total tobacco production and acreage devoted to tobacco growing in 1990 were well below their 1981 levels in all three countries, but downward trends in the United States had reversed by 1987. Similarly, in recent years, tobacco production in Mexico has been expanding (USDA 1997d). During the 1980s and early 1990s, cigarette consumption fell sharply in both the United States and Canada but rose in Mexico. At least part of the increase in the Mexican demand for cigarettes resulted from increases in income, which contributed to a shift to the consumption of higher-quality cigarettes among Mexican smokers (USDA 1992). Since 1994, however, cigarette imports into Mexico have fallen as consumer purchasing power declined; no imports were expected in 1997 (USDA 1997d).

Trade in tobacco among the three countries was relatively limited before the agreement. Mexican exports of tobacco to the United States were about 5 percent of total exports, or less than 2 percent of total U.S. tobacco imports. Similarly, less than 4 percent of U.S. tobacco imports came from Canada, and about 7 percent of U.S. tobacco exports went to Canada. Finally, almost no tobacco was exported from the United States to Mexico (USDA 1992).

Trade in tobacco products (mainly cigarettes) was even more limited before the agreement. In 1990, just over 0.1 percent of total U.S. cigarette exports went to Mexico, and only 0.07 percent went to Canada. Similarly, there was no trade in cigarettes between Canada and Mexico. The only exception was for exports of cigarettes from Canada to the United States, which were almost 64 percent of total Canadian cigarette exports and almost 20 percent of total Canadian production (USDA 1992). However, as is discussed later in this chapter (see "International Tobacco Taxes"), most of these cigarettes were reintroduced into a Canadian black market to evade the significantly higher Canadian cigarette taxes (Sweanor and Martial 1994).

Because of the earlier free trade agreement between the United States and Canada, NAFTA does not appear to have had a significant impact on trade in tobacco and tobacco products between the two countries. If anything, the reduction in Canadian cigarette taxes in 1994 has led to a substantial reduction in Canadian cigarette exports to the United States, as the smaller differential in cigarette prices reduced the incentive to export cigarettes to the United States for bootlegging back into Canada.

The agreement's elimination of Mexican import licenses on tobacco and cigarettes, and gradual reduction

in Mexican tariffs on tobacco and tobacco products, however, were expected to increase Mexican imports of both flue-cured and burley tobacco as well as cigarettes from the United States (USDA 1992). The elimination of U.S. tariffs on Mexican tobacco and the improved quality of this tobacco were also expected to result in increased Mexican tobacco exports to the United States. Privatization of the unmanufactured tobacco industry in Mexico, however, has changed the nature of the industry and has led to an improvement in the quality of Mexican leaf tobacco (USDA 1997d). The slow elimination of tariffs and the improved quality of domestically grown tobacco, coupled with the decline in the value of the peso, appear to have limited the impact of NAFTA on trade between the United States and Mexico in tobacco and tobacco products. This may change, however, as tariffs are further reduced and, eventually, eliminated and if the peso continues its recent strengthening against the dollar.

Uruguay Round of GATT

This latest GATT agreement, which concluded in April 1994, involved 117 countries, and many other nonmembers have agreed to abide by its provisions. Formal approval of the agreement by the U.S. Congress came at the end of 1994.

Several basic principles are outlined in GATT: a commitment to achieving free trade by limiting and eventually eliminating tariff and nontariff barriers to trade, the nondiscriminatory application of any restrictions on trade to all member countries, the compensation of trading partners for any damages resulting from changes in trade barriers, and the negotiated settlement of any trade disputes through an orderly process rather than through retaliation. However, GATT has had no enforcement power.

Since the conclusion of its first round in 1947, GATT has led to sharp reductions in tariffs and other impediments to trade in manufactured goods. Before the most recent round, GATT had not been applied to trade in agricultural commodities or services. The 1994 Uruguay Round, however, significantly expanded GATT's coverage to include trade in agricultural products, services, and more. Moreover, the new agreement created the World Trade Organization, a permanent forum for GATT members to address trade-related issues among member countries. This forum strengthened GATT's ability to resolve trade disputes.

Supporters of the GATT treaty have argued that it will lead to a substantial increase in world trade to the economic benefit of all countries involved. For example, President Bill Clinton stated in the introduction to the

Uruguay Round Agreements Act that the treaty, when fully implemented, would add \$100–200 billion to the U.S. economy annually and would create hundreds of thousands of new jobs. He went on to note that because the United States is the world's largest trading nation, it would be the biggest beneficiary of the treaty (U.S. Congress 1994).

The Uruguay Round of GATT was expected to benefit the U.S. tobacco industry by reducing the historically high tariffs on tobacco and tobacco products imposed in numerous countries and by reducing other widely used nontariff barriers to trade. For example, the European Community would reduce tariffs on cigars by 50 percent, tariffs on cigarettes and other manufactured tobacco products by 36 percent, and tariffs on unmanufactured tobacco by 20 percent, and the Philippines would reduce tariffs on leaf tobacco, cigars, and cigarettes by 10 percent (USDA 1994b). Similarly, foreign access to U.S. markets would rise, as U.S. tariffs on cigar wrappers would be eliminated. At the same time, U.S. tariffs on cigar filler and binder tobacco, cigars, and most cigarettes would be reduced by 55 percent; tobacco stems and refuse by 20 percent; and other unmanufactured tobacco and smoking tobacco by 15 percent (USDA 1994b).

More important, Section 422 of the Uruguay Round Agreements Act allowed the President of the United States to waive Section 1106(a) of the Omnibus Budget Reconciliation Act of 1993 if he determined that this action was necessary or appropriate to comply with international trade agreements that include the United States. As noted previously, the 1993 legislation requiring that cigarettes manufactured in the United States include a minimum of 75 percent domestically grown tobacco or face penalties was waived by President Clinton's tariff rate-quota proclamation in September 1994.

The reductions in tobacco-related trade barriers achieved in the Uruguay Round appear to have had a dramatic impact on global trade in tobacco and tobacco products (Chaloupka and Corbett 1998). From 1994 to 1997, for example, there was a 12.5-percent increase in unmanufactured tobacco exports globally, following a decade of almost no growth; similarly, global cigarette exports rose by 42 percent from 1993 to 1996, while global cigarette consumption rose by 5 percent (Chaloupka and Corbett 1998). As discussed previously, however, the GATT Council's resolution of the tobacco-related dispute between Thailand and the United States clearly indicates that the adoption and implementation of strong tobacco control policies aimed at improving public health is consistent with the liberalization of trade.

Discussion and Recent Developments

The threat of retaliatory trade sanctions under Section 301 of the Trade Act of 1974 has successfully opened some foreign markets to U.S. cigarette manufacturers, thereby significantly expanding trade in tobacco products between the United States and these countries. Chaloupka and Laixuthai (1996), in their empirical examination of these agreements, concluded that the market share of U.S. cigarette companies in the affected countries was 600 percent higher, on average, in 1991 than it would have been in the absence of these agreements. More important, they concluded that overall cigarette smoking rose as a result of the Section 301 agreements. Chaloupka and Laixuthai (1996) estimated that per capita cigarette consumption in 1991 was 10 percent higher, on average, in the four countries than it would have been had the markets remained closed to U.S. cigarettes. They attributed the increase in smoking to greater competition in the cigarette markets, resulting in lower cigarette prices and increased cigarette advertising. In addition, they predicted that similar actions in other historically closed countries would lead to similar increases in cigarette smoking.

Similarly, the implementation of multinational agreements liberalizing trade, including trade in tobacco and tobacco products, is likely to further increase U.S. exports of tobacco and tobacco products to countries around the world. A probable consequence of this increase is that the prices of cigarettes and other tobacco products will fall as trade barriers are reduced or eliminated and competition is enhanced. As is discussed in detail later in this chapter (see "Effect of Price on Demand for Tobacco Products"), reductions in price will stimulate the use of cigarettes, particularly among adolescents and young adults. Because of the substantial health consequences associated with cigarette smoking, one likely result of the increased liberalization of trade in tobacco and tobacco products, then, is a global increase in morbidity and mortality related to cigarette smoking and other tobacco use. Recent estimates confirm the relationship between trade liberalization and tobacco use. Taylor and colleagues (in press) conclude that reductions in trade barriers globally have led to increased tobacco use, with the largest impact in low- and middle-income countries.

The apparent conflict between some U.S. policies that promote free trade and help U.S. firms enter foreign tobacco markets and other U.S. policies that both discourage smoking domestically and support international efforts to reduce tobacco use has been described in two GAO reports. The reports were completed at

the request of congressional members concerned about U.S. efforts to open foreign cigarette markets. In the second report, the GAO (1992) presented the U.S. Trade Representative's position "that as long as cigarettes remain a legal commodity in the United States and abroad, there is no legal basis to deny cigarette manufacturers assistance in gaining market access. Thus, when [the U.S. Trade Representative] determines that unfair foreign trade barriers, such as import restrictions and discriminatory practices, hinder the import and marketing of U.S. cigarettes abroad, it negotiates for their removal" (p. 23). Similarly, the U.S. Trade Representative maintained that the USDHHS's "jurisdiction does not extend to trade policy—it does not have a foreign affairs mandate. Its clear responsibility lies in the domestic realm, not the international one" (p. 24).

In the first report on this predicament, the GAO (1990) had offered three alternatives for reconciling those apparent conflicts in U.S. policy.

- If Congress believes that trade concerns should dominate, it may choose to do nothing to alter efforts aiding U.S. cigarette exporters even while it continues to promote awareness (domestically and internationally) of the health consequences of smoking and to encourage efforts to reduce smoking.
- If Congress believes that health considerations should have primacy, it may grant the USDHHS the responsibility to decide whether to pursue trade initiatives involving products with substantial health consequences (including cigarettes and other tobacco products).
- Rather than having one policy dominate, Congress could require that health matters be included in the trade policy process through the participation of the USDHHS so that these issues could be considered case by case.

Several factors indicate that the apparent dichotomy between trade and health policy is changing in favor of the third approach suggested by the GAO. For example, in 1989 a bill was introduced in Congress to (1) require U.S. cigarette firms in foreign markets to operate under the same guidelines as they do in domestic markets, (2) mandate health warning labels on all exported tobacco products, and (3) strongly discourage the executive branch from assisting U.S. tobacco company efforts to open foreign tobacco markets (Roemer 1993). Later that year, as a result of the U.S. Trade Representative's investigation of Thailand's trade practices, a public hearing on the case was held.

Numerous congressmen, public health officials, and others (including former U.S. Surgeon General C. Everett Koop) testified against tobacco-related U.S. trade policies (Eddy and Walden 1993). Although neither effort was successful (the bill did not pass, and the hearing produced no change in trade policy), both linked the issue of the health consequences of tobacco use to U.S. trade policy. The 1990 GAO report, for example, was the direct result of the failed 1989 bill.

More recently, interagency discussions between the office of the U.S. Trade Representative and officials from the USDHHS have pursued the harmonization of trade and health policy while representatives from the USDHHS have participated in recent negotiations with Taiwan, South Korea, and others concerning cigarette trade issues (Holzman 1997). Moreover, the U.S. Trade Representative has shown greater sensitivity to public health concerns and has not opposed nondiscriminatory tobacco control legislation in other countries (Bloom 1998; National Cancer Policy Board 1998). This position has been formalized as part of the Doggett Amendment to the Department of Commerce and Related Agencies Appropriations Act, 1998, that allows for the use of Section 301 in very limited circumstances. Specifically, the Doggett Amendment, sponsored by Lloyd Doggett (D-TX), states that:

None of the funds provided by this Act shall be available to promote the sale or export of tobacco or tobacco products, or to seek the reduction or removal by any foreign country of restrictions on the marketing of tobacco or tobacco products, except for restrictions which are not applied equally to all tobacco or tobacco products of the same type (Public Law 105-119, Section 618).

Similar guidelines were distributed by the Clinton administration to all diplomatic posts in February 1998. These guidelines state that:

In light of the serious health consequences of tobacco use, the U.S. Government will not promote the sale or export of tobacco or tobacco products or seek the reduction or removal by any foreign country of nondiscriminatory restrictions on the marketing of tobacco or tobacco products. At the same time, the U.S. Government will continue to seek elimination of discriminatory trade practices and will strive to ensure that U.S. firms are accorded the same treatment in foreign countries as that country's own firms and firms from other countries (The National Economic Council and The National Security Council of the White House,

Final Guidelines on Health, Trade, and Commercial Issues, facsimile transmission to all diplomatic and consular posts, February 16, 1998).

Moreover, as part of the guidelines, U.S. diplomatic "posts are encouraged to assist and promote tobacco-control efforts in host countries."

Several important issues remain unresolved. Perhaps most important is the opening of Chinese cigarette markets to U.S. and other multinational tobacco companies as part of China's World Trade Organization accession. With more than 300 million cigarette smokers (67 percent of men but only 7 percent of women), China is a particularly attractive market for international cigarette producers. In recent years, U.S. and other multinational tobacco companies have entered the Chinese tobacco markets through joint ventures with the Chinese government's tobacco monopoly, the China National Tobacco Corporation (Holzman 1997).

Economic Impact of the U.S. Tobacco Industry

Tobacco growing played a key role in the development and growth of the U.S. economy. Throughout much of the 20th century, however, the importance of tobacco to the overall economy has diminished significantly, although its regional and local importance in some areas remains high. Several recent studies provide more detailed evidence concerning the economic importance of tobacco to the U.S. economy.

A recent study by American Economics Group, Inc. ([AEG] 1996), which was funded by the tobacco industry, provides some information concerning the impact of tobacco on the U.S. economy in 1994. The report updates similar previous reports by other firms, including that by Price Waterhouse (1992). AEG divided the macroeconomic effects of tobacco into those affecting the core sector, which includes tobacco production and distribution, and those affecting the supplier sector, which consists of industries producing and distributing intermediate goods for the core sector (including the goods and services used in cigarette production). The analysis also separately considered expenditure-induced impacts, which depend on the multiplier effects associated with spending by those in the core and supplier sectors, and tobacco-related tax revenues, including those raised by tobacco taxes, general sales taxes on tobacco products, and income and other taxes on tobacco industry employees and firms. The study estimated that in 1994, more than 1.8

million persons were employed, earning \$54.3 billion in wages and benefits, as a result of the tobacco business in the United States. Total estimated tax revenues from tobacco were almost \$36 billion in 1994. The report concluded that tobacco made a significant contribution in every state and the District of Columbia.

Several recent studies, however, have indicated that these estimates significantly overstated the economic impact of tobacco on the U.S. economy. At the request of the Coalition on Smoking OR Health (CSH), Arthur Andersen Economic Consulting (1993) reviewed the Price Waterhouse estimates for 1990. They concluded that, as a result of several methodological flaws, the Price Waterhouse "employment and job loss figures are grossly inflated" (p. 1). For example, of the 681,351 jobs Price Waterhouse attributed to tobacco in its core and supplier sectors, only 259,616 were directly related to tobacco growing, manufacturing, warehousing, and wholesaling. Of the difference, 166,791 were retail jobs and 254,944 were supplier jobs, most of which were not devoted full-time to tobacco. Thus, stating that these jobs depended on tobacco was inaccurate.

Other studies questioned the Price Waterhouse assumption that every one job that is dependent on tobacco creates, through the multiplier effect, an additional 2.35 jobs throughout the economy. This assumed effect would result because those who purchase tobacco products would generate income for those who produce and those who distribute tobacco, who in turn would spend this income on other goods and services—thereby generating income for others, as this effect spread even further. Warner (1994) and Arthur Andersen Economic Consulting (1993) noted that this multiplier effect is likely to significantly overstate the impact of tobacco, because it implicitly makes the incorrect assumption that money spent on tobacco would not be spent elsewhere in the absence of tobacco. Instead, those funds not spent on tobacco would be spent on other goods and services, creating jobs and generating income that would also be spent.

Warner and Fulton (1994) addressed these issues by using a macroeconomic model to consider the net impact of tobacco on the economy of one state, Michigan. The Price Waterhouse study had estimated that direct tobacco-related employment in Michigan was 7,724 in 1990 and that all tobacco-related employment in Michigan totaled 69,575. Warner and Fulton (1994) estimated that in 1992 in Michigan, 7,843 jobs directly depended on tobacco but that only an additional 11,284 jobs were either indirectly related to tobacco or induced by spending from those whose jobs were dependent on tobacco. (This estimate for indirect tobacco-related jobs did not consider [as the Price Waterhouse estimate

did] the impact of income derived from tobacco production and distribution in the rest of the nation and spent on products produced in Michigan.) These researchers further estimated that, in the absence of tobacco, total employment in Michigan would have risen by about 5,600 because of a redistribution of spending away from tobacco products to other goods and services, including those more integral to the Michigan economy. As a result of the changes in employment, total incomes in Michigan would have been \$226 million higher in 1992 in the absence of tobacco. This amount resulted not only from incomes associated with new jobs but also from higher incomes for those with existing jobs (in part because of a change in job mix from lower-income to higher-income jobs in the absence of tobacco).

Warner and colleagues (1996) extended this analysis to examine the impact of tobacco on the regional economies of the United States. The researchers examined the effects of reducing or eliminating domestic expenditures on tobacco on nine regional economies (the eight regions defined by the U.S. Department of Commerce, Bureau of Economic Analysis, subdividing the Southeast into two parts based on tobacco growing and producing). They estimated that the elimination of spending on tobacco products in 1993 would have led to 303,000 fewer jobs in the Southeast tobacco region, while increasing jobs in all other regions by about the same amount. By the year 2000, they estimated that, under this scenario, the loss in jobs in the tobacco region would fall to about 222,000 as the regional economy adjusts, while the net impact nationally would be an increase in jobs of 133,000. A more realistic scenario—one that doubles the recent rate of decline in tobacco use—is estimated to have smaller effects on employment. Warner and colleagues (1996) estimated a loss of 36,600 jobs in the tobacco region by the year 2000, an amount equal to 0.2 percent of total regional employment. They concluded that the industry's claims concerning job losses resulting from reduced tobacco use are significantly overstated and that the impact of tobacco on employment should not be a primary concern, given the magnitude of the toll it takes on health.

The AEG and Price Waterhouse reports were limited also because they presented static estimates of the economic impact of tobacco (Arthur Andersen Economic Consulting 1993). That is, the reports ignored underlying trends in the domestic demand for cigarettes, trends in the import and export of tobacco and tobacco products, and changes in agricultural and manufacturing technologies that themselves are reducing employment in tobacco growing and manufacturing. Warner and

Fulton (1994) considered these factors by predicting the net impact that eliminating tobacco-related revenues would have on the Michigan economy if existing downward trends in tobacco sales continued: by 2005, the loss of revenue from tobacco in Michigan would yield a net gain of 1,500 jobs in the state.

A similar issue was considered in two recent reports of the USDA (1993, 1997c). The reports noted that the large declines in tobacco production throughout the 1980s had a relatively minor impact on the macroeconomics of major tobacco-growing regions. Indeed, total personal income, adjusted for inflation, grew by 14–57 percent from 1979 through 1989 in the nine major regions analyzed; the average growth in all U.S. tobacco-growing counties was 28 percent (USDA 1993). This phenomenon was attributed to the relatively small share of tobacco in these diverse regional economies (on average, less than 1 percent of total income was accounted for by tobacco in tobacco-growing counties). Even though acreage devoted to tobacco growing has declined over time, rising prices have helped to keep gross income from tobacco growing relatively stable, while clearly reducing the share of tobacco in local economies (USDA 1997c).

Critics of higher cigarette excise taxes and other policies to reduce tobacco use have argued that the macroeconomic consequences of these policies would be significant, particularly for some state and local economies. For example, economist Dwight R. Lee predicted that the 75-cent increase in the federal cigarette excise tax included in the proposed 1993 Health Security Act would lead to a loss of about 82,000 jobs and \$1.9 billion in incomes in the tobacco sector, which would cause an additional loss of 192,000 jobs and an attendant loss of income throughout the economy (U.S. House of Representatives 1994). He further noted that southern states would be particularly hard hit by this tax increase.

Similar arguments, based on the AEG and Price Waterhouse analyses, were made in the recent debate over proposed national tobacco legislation. For reasons noted previously, predictions based on these estimates are almost certain to substantially overstate the effects of higher tobacco taxes and stronger prevention policies on the U.S. macroeconomy. As discussed previously, Warner and colleagues' (1996) regional analysis of the economic role of tobacco concluded that tobacco has a negative net economic impact in all but the most tobacco-dependent region. Thus, it appears inappropriate to raise concerns about adverse economic impact in opposing policy measures that would discourage tobacco use.

Moreover, many supporters of legislation calling for increases in the cigarette excise tax have urged that measures be included to mitigate the possible adverse economic impact of the higher taxes for tobacco-producing regions. For example, Richard J. Durbin (D-IL) suggested that part of the revenues from higher cigarette excise taxes could be earmarked for efforts to help tobacco farmers switch to other crops, thereby easing the transition for tobacco-producing regions. Likewise, the CSH (1994) recommended that a portion of new tobacco tax revenues be earmarked for buying out tobacco allotments, constructing infrastructure and modernizing equipment for agricultural diversification, and stimulating economic development in areas relatively dependent on tobacco. Similarly, President Clinton called for assistance for tobacco farmers and their communities to be included in any tobacco legislation sent to him (USDA 1998a).

A final objection to the AEG and Price Waterhouse estimates is that they failed to consider the health and other consequences of cigarette smoking (Arthur Andersen Economic Consulting 1993). In one sense, they underestimated the economic contribution of cigarette smoking. As Schelling (1986) and Warner (1994) note with some irony, the employment figures in these and other industry-funded studies do not

include the income that tobacco generates for health care personnel, undertakers, and a variety of other persons whose jobs are related to the negative health consequences of tobacco use; nor do these industry estimates include the considerable income derived from specifically smoking-related services, such as air filtration systems. The total amount spent in the United States to treat smoking-related illnesses has been estimated to exceed the total amount spent on tobacco products (Centers for Disease Control and Prevention [CDC] 1994; Warner 1994). Similarly, as described in greater detail later in this chapter (in "Estimates of the Costs of Smoking"), the Price Waterhouse study did not include other economic costs associated with cigarette smoking, such as lost productivity due to smoking-related morbidity and mortality. Finally, as Northup (1993) states, the Price Waterhouse estimates of employment dependent on tobacco invite a disturbing comparison, for they imply that "one person must die each year to sustain two jobs. Put another way, at least twenty-two people must die to support the forty-four year career of a [tobacco industry] employee. Surely, no one would argue that this is an acceptable trade-off. It is absurd for the tobacco industry to use lost jobs as a rationale for not saving lives" (p. 86).

Effect of Price on Demand for Tobacco Products

One of the fundamental laws of economics is that of the downward-sloping demand curve: as the price of a product rises, the quantity demanded of that product falls. In the terminology of economists, this inverse relationship arises from the process known as the consumer's constrained utility maximization. That is, when facing a given set of prices, consumers will try to maximize the benefits or satisfaction they receive from consuming, but these efforts are constrained by the consumers' available resources, including income and time.

The demand for tobacco products is different from the demands for most other consumer goods because of the addictive drug (nicotine) found in these products. The key implication that addiction has for demand is that past consumption decisions will be an important determinant of current choices. For example, to an addicted smoker, one of the benefits of continued cigarette smoking is avoiding nicotine

withdrawal. In the past, many researchers viewed addictive consumption as an irrational behavior not conducive to standard economic analysis (e.g., Elster 1979; Winston 1980; Schelling 1984). This view implied that the demand for addictive products, including tobacco, did not follow the basic laws of economics, including that of the downward-sloping demand function that ordinarily applies when constraints (such as cost) are raised against use. However, as will be described later in this section, numerous studies of cigarette smoking and other tobacco use, including several recent studies that explicitly account for tobacco's addictive nature, find a strong inverse relationship between price and consumption.

To economists, price includes not only the money price of purchasing a product but also the time and other costs associated with buying and using that product. Measures that limit minors' access to tobacco, for

example, may discourage underaged smoking by raising the time and potential legal costs associated with obtaining these products. Similarly, sufficiently stringent restrictions on smoking in public places will raise the costs of smoking, whether by forcing people outdoors if they want to smoke (thereby increasing time and perhaps comfort costs) or by imposing fines for smoking in restricted areas (thereby increasing money costs).

The health consequences associated with cigarette smoking are another important component of the price of cigarettes. As consumers perceive greater health risks from cigarette smoking, their demand for cigarettes tends to fall. This effect is clearly seen in the reductions in smoking prevalence and average cigarette consumption that occurred soon after the release of the 1964 Surgeon General's report on smoking and health, which for the first time drew widespread public attention to the health problems caused by cigarette smoking (U.S. Department of Health, Education, and Welfare 1964). Thus, when economists and others study the demand for tobacco products, efforts are made to include not only money prices but also measures that reflect the other costs of consuming these products.

In addition to price, several other factors affect the demand for any product. Disposable income, for example, is an important determinant of demand. In general, as income rises, so does consumption of most goods. Economists define these goods as normal goods. Inferior goods, on the other hand, are those for which demand falls as income rises. An individual's tastes or preferences will also affect demand. Because these tastes are difficult to observe and measure, certain sociodemographic characteristics are usually included as proxies in studies of the demand for tobacco. These characteristics include sex, ethnicity, education, religious beliefs, marital status, and employment status.

Finally, because the addictive nature of tobacco use has been clearly documented, many recent studies of demand have tried to account for the effects of past consumption on current consumption. Many of these studies were based on a model that applies the standard rational, utility-maximizing paradigm of economics to the consumption of addictive substances (Becker and Murphy 1988). This model explicitly recognizes the intertemporal links in consumption by making current consumption decisions dependent on past choices. The model thus incorporates the elements of tolerance, reinforcement, and withdrawal, which distinguish the consumption of addictive from non-addictive substances (USDHHS 1988).

Although many of the factors described in this introduction have an important impact on demand, the studies subsequently reviewed in this section emphasize the effects of money prices on cigarette smoking and other tobacco use. In reviewing empirical studies of the demand for cigarettes and other tobacco products, this section focuses primarily on estimates of the price elasticity of demand, which is defined as the percentage change in consumption that results from a 1-percent increase in price. (An overall reduction in cigarette consumption comprises both a reduction in the number of cigarettes consumed by current, persisting smokers and a reduction in the prevalence of smoking itself—which itself comprises both an increase in smoking cessation and a decrease in smoking initiation.)

Numerous studies have estimated the price elasticity of demand for cigarettes. These studies used diverse econometric and other statistical methods on different types of data from many countries. Relatively few studies have examined the demand for other tobacco products, and none have examined the effects on brand choice of the price differentials between premium brands and the lower-price discount and generic cigarettes.

Studies Using Aggregate Data

Several studies of the demand for cigarettes in the United States have used aggregate data (Table 6.7). Some of these were time series studies for the nation as a whole or for geographic units (notably California). Others employed pooled cross-sectional time series data consisting of annual observations for some or all states over time. Price elasticity (the percentage change in the quantity demanded resulting from a 1-percent increase in price) estimates obtained from recent studies using aggregate data fall in the overall wide range of -0.14 to -1.12 , but most of these estimates are between -0.3 and -0.5 . Differences in the estimates resulted from differences in theoretical and empirical modeling, in the data employed, and in the econometric and statistical methods used to analyze these data.

All but two of these studies were econometric studies that tried to control for other factors that could affect the demand for cigarettes, including income, socioeconomic and demographic factors, and existing policies for reducing tobacco use. The other two studies (Baltagi and Goel 1987; Peterson et al. 1992) used alternative quasi-experimental methods that compared changes in cigarette consumption in states with tax increases with those in states with no tax increases; both studies obtained estimates of the price

Table 6.7. Recent estimates of the price elasticity of cigarette demand from aggregate data

Study	Estimated price elasticity	Comments
Advisory Commission on Intergovernmental Relations 1985	-0.45	Time series of state cross-sections, 1981–1983; ordinary least squares methods; detailed effort to account for short-distance smuggling of cigarettes.
Bishop and Yoo 1985	-0.45	Time series for United States, 1954–1980; three-stage least squares methods; simultaneous model of supply and demand.
Baltagi and Levin 1986	-0.14	Time series of 46 state cross-sections, 1963–1980; instrumental variables methods; partial adjustment model used to account for habitual consumption.
Porter 1986	-0.27	Time series for United States, 1947–1982; two-stage least squares methods; simultaneous model of supply and demand.
Baltagi and Goel 1987	-0.56 (1956–1964) -0.17 (1972–1983)	Time series of state cross-sections, 1956–1983; quasi-experimental methods.
Seldon and Doroodian 1989	-0.40	Time series for United States, 1952–1984; three-stage least squares methods; simultaneous model of demand and advertising.
Seldon and Boyd 1991	-0.22 (short run) -0.37 (long run)	Times series for United States, 1953–1984; varying parameter methods.
Showalter 1991	-0.56 to -0.71	Time series of annual state cross-sections, 1956–1988; simultaneous modeling of supply and demand with addiction; detailed modeling of short- and long-distance smuggling.
Simonich 1991	-0.37	Quarterly time series for United States, 1960–1983; two-stage least squares methods.
Tegene 1991	-0.66 (1956) -0.15 (1985)	Time series for United States, 1956–1985; Kalman filter methods; allows change in elasticity over time.
Chaloupka and Saffer 1992	-0.28	Time series of state cross-sections, 1975–1985; two-step endogenous law model; detailed modeling of short- and long-distance smuggling.
Flewelling et al. 1992	-0.25 to -0.35	Quarterly time series for California, 1980–1990; ordinary least squares and ridge regression methods.
Peterson et al. 1992	-0.49	Time series of state cross-sections, 1955–1988; epidemiologic approach.

Table 6.7. Continued

Study	Estimated price elasticity	Comments
Keeler et al. 1993	-0.3 to -0.5 (short run) -0.5 to -0.6 (long run)	Monthly time series for California, January 1980–December 1990; detailed modeling of addiction; full information maximum likelihood with instrumental variables and correction for autocorrelation.
Becker et al. 1994	-0.36 to -0.44 (short run) -0.73 to -0.79 (long run)	Time series of annual state cross-sections, 1956–1985; instrumental variables methods; detailed modeling of short- and long-distance smuggling and addiction.
Harris 1994	-0.47 (1993)	Annual time series for United States, 1964–1993; separate modeling of smoking participation and average consumption; controls for changes in average nicotine delivery per cigarette.
Hu et al. 1994	-0.39 (long run)	Monthly time series for California, January 1984–December 1991; intervention analysis.
Sung et al. 1994	-0.40 (short run) -0.48 (long run)	Time series of annual state cross-sections for 11 western states, 1967–1990; recursive model of supply and demand with addiction; generalized least squares methods correcting for heteroscedasticity and autocorrelation.
Barnett et al. 1995	-0.76 to -1.12	Annual time series for United States, 1955–1989; simultaneous modeling of supply and demand.
Goel and Morey 1995	-0.28 to -0.37	Time series of annual state cross-sections, 1959–1982; joint demands for cigarettes and alcohol; accounts for addiction.
Hu et al. 1995b	-0.30 (state tax elasticity)	Quarterly time series for California, 1980–1992; autoregressive moving-average time-series methods.
Moore 1995	Not applicable	Time series of annual state cross-sections, 1954–1988; reduced form estimates of impact of cigarette taxes on various smoking-related mortality rates.
Tremblay and Tremblay 1995	-0.41	Annual time series for United States, 1955–1990; simultaneous modeling of supply and demand.
Yurekli and Zhang 2000	-0.48 to -0.62	Time series of annual state cross-sections, 1970–1995; detailed modeling of smuggling and clean indoor air laws.

elasticity of demand comparable to those obtained in the econometric studies.

Several difficulties can be encountered when analysts use time series data to estimate the demand for cigarettes. In a time series model, estimated price and income elasticities of demand are sensitive to the inclusion of variables controlling for the effects of other determinants of smoking, including advertising, changes in existing policies for reducing tobacco use, and increased awareness of the health consequences of smoking. A serious problem can also result from the high correlations that are likely to exist among many of the variables reflecting key determinants of smoking. These correlations can lead to unstable estimates for the parameters of interest. However, excluding potentially important but highly correlated determinants of demand could produce biased estimates of the impact of the included variables on demand. Time series estimates are also more likely to estimate the short-run responses of demand to changes in independent variables rather than the long-run responses that are of greater interest to policymakers. However, recent studies using state-of-the-art econometric methods for time series data have appropriately addressed many of these difficulties (Seldon and Boyd 1991; Simonich 1991; Flewelling et al. 1992; Barnett et al. 1995; Hu et al. 1995b; Meier and Licari 1997). Almost all of the estimates obtained from time series methods based on alternative economic theories and applied to various data produced estimates of the price elasticity of demand in a relatively narrow range, which was centered on -0.4 .

The use of state cross-sectional data over time can also create various estimation problems. In general, such studies considered in this section employed data on state taxes paid for cigarette sales; these data may not accurately reflect average cigarette smoking within the states, because cigarettes may have been smuggled from low-tax states into high-tax states. (This problem is discussed in detail in "Theoretically Optimal Cigarette Taxes," later in this chapter.) In particular, these sales data are likely to overstate consumption in low-tax states and understate consumption in high-tax states. If this smuggling is not controlled for, estimates of the price elasticity of demand from these data are likely to overstate the impact of price on cigarette smoking. However, many of the most recent studies of cigarette demand that employed pooled time series cross-sectional data for states made careful efforts to control for both casual and organized smuggling of cigarettes (Advisory Commission on Intergovernmental Relations [ACIR] 1985; Baltagi and Levin 1986; Showalter 1991; Chaloupka

and Saffer 1992; Becker et al. 1994; Yurekli and Zhang 2000). Although imperfect, these efforts should have significantly reduced the biases associated with the use of the pooled state data. When analyses controlled for the possible smuggling of cigarettes from low-tax to high-tax states, estimated price elasticities of demand that were based on state tax-paid sales data were generally in the range of -0.3 to -0.5 .

A further problem in the analysis of aggregate data arises because cigarette prices are determined by the interaction of supply and demand. Failing to account for simultaneity would lead to biased estimates of the price elasticity of demand. Several recent studies that employed both pure time series data and pooled state-level data have theoretically and empirically modeled the supply and demand for cigarettes (Bishop and Yoo 1985; Porter 1986; Showalter 1991; Sung et al. 1994; Barnett et al. 1995; Tremblay and Tremblay 1995). Most studies that controlled for the potential simultaneity biases in their aggregate data produced estimates of the price elasticity of demand that were in the narrow range found in other studies. An alternative approach to the simultaneity problem is to use natural experiments, such as the large increase in the California cigarette excise tax, to look at the impact of price on demand. Several recent studies have used this approach (Sung et al. 1994; Hu et al. 1995b). Estimates of the price elasticities of demand based on this natural experiment are consistent with those in other studies.

Many of the most recent studies of cigarette demand that used aggregate data empirically modeled the addictive aspects of cigarette consumption in the context of Becker and Murphy's (1988) economic model of addictive behavior (Showalter 1991; Becker et al. 1994; Sung et al. 1994). One of the most interesting implications of the economic models of demand for addictive goods, including cigarettes, concerns short-run versus long-run effects. Economists generally define the short run as a period during which at least some factors have not fully responded to the change being examined. In contrast, the long run is when all changes have occurred; the Congressional Research Service (CRS) defined the long run for cigarette demand as 69 years, a time period that would allow the current 12- to 80-year-old population (which includes almost all smokers) to adjust to a change in cigarette taxes (Gravelle and Zimmerman 1994). For addictive goods, the long-run impact of price on demand will exceed the short-run impact because the latter largely entails current consumption, which represents an established addiction that tends to be slow to decrease even in the face of a price increase. In the

studies that used such a model, the estimated long-run impact of price elasticities of demand indeed exceeded—by up to twice as much—the estimates for the short-run impact, presumably because the long-run impact reflected would-be newly addicted consumers who were put off by price increases. (These short- and long-run effects are further discussed in “Tobacco Taxation and Revenues,” later in this chapter.)

Finally, studies employing aggregate data are generally limited because they estimate the effects of prices and other factors on aggregate or per capita estimates of cigarette consumption. Such studies thus cannot provide information on the effects of prices and other policies on smoking prevalence, initiation, cessation, or quantity and type of cigarette smoked. Similarly, these studies cannot explore differences that sex, age, and socioeconomic status may have on responsiveness to price and other policies. Furthermore, aggregate studies are of only limited use in considering the health effects of changes in existing policies for reducing tobacco use. A few recent studies have addressed some of these limitations. Harris (1994) used annual time series data on both smoking prevalence and average cigarette consumption among smokers during 1964–1993. The study estimated that the price elasticity of smoking prevalence in 1993 was -0.238 and that the elasticity for average consumption among smokers was comparable; the 1993 total price elasticity of demand of -0.47 was comparable to that obtained in other studies. Townsend and colleagues (1994) used aggregate data on smoking prevalence and average consumption constructed from the biennial data gathered in the British General Household Surveys from 1972 through 1990. The study found that men and women in lower socioeconomic groups were most responsive to changes in cigarette prices, that women were more responsive to price than men, and that smokers in the youngest age groups (16–19 years and 20–24 years) were least affected by price. In another study, Moore (1995) used state data from 1954 through 1988 to analyze the effects of cigarette taxes on smoking-related death rates. The study estimated that a 10-percent increase in cigarette taxes would prevent an estimated 5,200 smoking-related deaths each year.

Studies Using Individual-Level Data

Relatively few studies of cigarette demand have been based on individual-level data. Table 6.8 summarizes the findings of these studies for samples of adults, and Table 6.9 presents the results of studies focusing on adolescents and young adults.

In general, the estimated price elasticities of demand obtained from these studies were comparable to those found in the aggregate studies. By using self-reported measures of smoking prevalence and average cigarette consumption, these studies avoided some of the problems associated with aggregate data on state taxes paid for cigarette sales. Each of these studies also carefully considered the effect that casual smuggling could have on their estimates of the price elasticity of demand. Moreover, because an individual smoker’s purchase decisions are too small to affect the market price of cigarettes, the use of individual-level data in these studies avoided the potential simultaneity biases inherent in the use of aggregate data. However, the use of individual-level data may be subject to a substantial ecological bias, to the extent that omitted variables affecting tobacco use may be correlated with the included determinants of demand. Excluding these variables will, consequently, produce biased estimates for the included variables (see the later discussion of Wasserman et al. 1991). Furthermore, the use of individual-level data is subject to potential reporting biases. Studies using individual-level data have implicitly assumed that underreporting is proportional to true consumption (i.e., heavy, moderate, and light smokers underreport by the same proportion). With this assumption, elasticity estimates will not be systematically biased.

The use of individual-level data allows researchers to explore issues difficult to address adequately with aggregate data. In particular, researchers can use a two-part method to distinguish between the effects of cigarette price on two decisions: whether to smoke (smoking prevalence) and how many cigarettes to smoke (cigarette consumption). Likewise, the effects of cigarette prices on smoking cessation can be investigated. Individual-level data also allow researchers to explore the differential responses of various socioeconomic and demographic groups to changes in cigarette prices and existing prevention policies. However, the potential underreporting of cigarette consumption can be problematic in interpreting these data (Warner 1978).

Lewit and colleagues (Lewit et al. 1981; Lewit and Coate 1982; Grossman et al. 1983) were the first to use individual-level data to examine the effects of prices and smoking prevention policies. Lewit and Coate (1982) used data on 19,288 persons aged 20–74 years who had participated in the 1976 National Health Interview Survey. The investigators first estimated the effects of cigarette price on smoking prevalence and then looked at the effects of price on cigarette consumption. These equations were estimated not only for

Table 6.8. Estimates of the price elasticity of cigarette demand for adults from individual-level data

Study	Estimated price elasticities	Comments
Lewit and Coate 1982	-0.42	1976 National Health Interview Survey; ordinary least squares methods; elasticities by age and sex.
Mullahy 1985	-0.47	1979 National Health Interview Survey; instrumental variables and probit methods; detailed modeling of addiction; elasticities by sex.
Chaloupka 1990	-0.60 (men) not statistically different from zero (women)	Second National Health and Nutrition Examination Survey, 1976–1980; instrumental variables methods; detailed modeling of addiction; elasticities by sex.
Chaloupka 1991 and 1992	-0.27 to -0.48	Second National Health and Nutrition Examination Survey, 1976–1980; instrumental variables methods; detailed modeling of addiction; elasticities by age and educational attainment.
Wasserman et al. 1991	0.069 (1970) -0.23 (1988)	1970, 1974, 1976, 1979, 1980, 1983, and 1985 National Health Interview Surveys; generalized least squares and two-part methods; allow changes in elasticity over time.
Hu et al. 1995a	-0.46	California Behavioural Risk Factor Surveys, 1985–1991; two-part methods; controls for interdependence of other behavioral risk factors and smoking.
Ohsfeldt et al. 1997	-0.05 (tax elasticity, males)	1985 Current Population Survey, males aged 16 years and older; treats taxes and control policies as endogenous; elasticity estimates for prevalence only.
Centers for Disease Control and Prevention 1998	-0.25 (full sample) -0.14 (whites) -0.32 (blacks) -1.89 (Hispanics) -0.29 (at or below median income) -0.17 (above median income) -0.26 (men) -0.19 (women)	1976–1980, 1982, 1985, 1987–1992 National Health Interview Surveys; two-part methods.
Evans and Ringel 1999	-0.25 to -0.56	Nativity Detail data, 1989–1992, pregnant women; two-part models.
Ohsfeldt et al. 1999	-0.15 (tax elasticity, males)	1992/93 Current Population Survey, males aged 16 years and older; treats taxes and control policies as endogenous; elasticity estimates for prevalence only.

the full sample but also for subsamples based on age (20–25 years, 26–35 years, and 36–74 years) and sex. Price had a greater impact on whether a respondent smoked at all than on how many cigarettes a respondent smoked. The estimated elasticity of demand for smoking prevalence was -0.26 for the full sample, and the total price elasticity of demand was -0.42 . The effects of price were larger for younger persons: the total estimated price elasticity for persons 20–25 years old was approximately double that for persons 26–74 years old. The study also found that men, particularly those aged 20–35 years, were quite responsive to changes in cigarette prices, whereas women were almost unaffected by price.

These findings regarding age are substantiated as well by Lewit and colleagues (1981), who used data from Cycle III of the Health Examination Survey (1966–1970) to examine the impact that prices and the anti-smoking advertisements broadcast under the Fairness Doctrine had on cigarette smoking among 6,768 adolescents (12–17 years old). Using the same basic methods employed in the study by Lewit and Coate (1982), this analysis estimated that the impact of price on adolescent smoking (measured at a total price elasticity of -1.44) was about three times that for adult smoking (Lewit and Coate 1982). The study by Lewit and colleagues (1981) also confirmed that price had a greater impact on the decision to smoke (elasticity of -1.20) than on the average quantity of cigarettes consumed by smokers (elasticity of -0.25). These findings were generally supported by another analysis of data from the 1974, 1976, 1977, and 1979 National Household Surveys on Drug Abuse (Grossman et al. 1983).

Mullahy (1985) was the first to estimate cigarette demand on the basis of a theoretical and empirical model treating cigarette smoking as an addictive behavior. This model implied that a person's smoking decisions at any point in time are dependent on that person's smoking history. However, unlike most of the more recent econometric applications of addictive behavior, this analysis assumed that individuals behave myopically—that is, they ignore the future consequences of their cigarette addiction when making current smoking decisions. Using data on 13,794 persons who participated in the 1979 National Health Interview Survey, Mullahy (1985) estimated smoking prevalence and average cigarette consumption separately for men and women (aged 17 years and older). In finding that a person's past cigarette smoking had a significant impact on current smoking decisions, the analysis supports the hypothesis that cigarette smoking is an addictive behavior. The study also found that both smoking prevalence and average cigarette consumption

were inversely related to cigarette prices. Finally, Mullahy estimated that men were somewhat more responsive to price than women (total price elasticities of demand were -0.56 and -0.39 , respectively).

Wasserman and colleagues (1991) used data from several of the National Health Interview Surveys from the 1970s and 1980s to consider how the price sensitivity of cigarette demand changed over time. Using a generalized linear model, the investigators concluded that cigarette demand has become more responsive to price over time. In the earlier years of their sample, they found that increased cigarette prices did not reduce cigarette smoking. However, they estimated that, beginning in 1985, when the overall price elasticity of cigarette demand was -0.23 , increases in cigarette prices would reduce smoking. As part of the same study, these investigators used data on 1,891 youth aged 12–17 years who had participated in the Second National Health and Nutrition Examination Survey (1976–1980). Unlike Lewit and colleagues (1981), Wasserman and colleagues (1991) found that the estimated price elasticity for youth was not statistically different from that for adults. Indeed, the estimated effects of price on youth smoking were not statistically different from zero in any of the models. The investigators attributed their relatively low estimates of the price elasticity of demand to their including in their demand equations an index that controlled for smoking restrictions. This index, which was highly correlated with price, had a negative significant effect on smoking (particularly on young people's decision to smoke). Wasserman and colleagues argued that because of the high correlation between the index and cigarette prices, excluding this index would lead to biased estimates of the effect of prices on demand. Indeed, when they excluded the index from their estimated equations, their estimated price elasticities were comparable to those from other studies.

Chaloupka (1990, 1991, 1992) used data from the Second National Health and Nutrition Examination Survey (1976–1980) in applying the Becker and Murphy (1988) model of rational addiction to cigarette smoking. The assumption of rational (or nonmyopic) addictive behavior implies that individuals consider, to some degree, the future consequences of their current smoking decisions (which depend on past choices). Chaloupka's estimates supported the hypotheses that smoking is an addictive behavior and that the future consequences of this addiction are an important determinant of current cigarette smoking. Moreover, the estimated long-run price elasticity of demand (in the range of -0.27 to -0.48) was well above that obtained when the addictive aspects of cigarette

Table 6.9. Estimates of the price elasticity of cigarette demand for youth and young adults from individual-level data

Study	Estimated price elasticities			Comments
	Prevalence	Quantity	Total	
Lewit et al. 1981	-1.20	-0.25	-1.44	Health Examination Survey, Cycle III, 1966–1970; ordinary least squares methods for consumption and smoking participation; aged 12–17 years.
Lewit and Coate 1982	-0.74	-0.20	-0.89	1976 National Health Interview Survey; ordinary least squares methods; elasticities by age and sex; aged 20–25 years.
Grossman et al. 1983	0.88 -0.62 -0.93 -0.89	-1.55 0.11 0.91 0.73	-0.67 -0.51 -0.02 -0.16	(1974) (1976) (1977) (1979) National Household Surveys on Drug Abuse, 1974, 1976, 1977, and 1979; least squares methods; aged 12–17 years.
Chaloupka 1991	Not statistically different from zero			Second National Health and Nutrition Examination Survey, 1976–1980; instrumental variables methods; detailed modeling of addiction; aged 17–24 years.
Wasserman et al. 1991	Not statistically different from adults (generalized linear modeling); not statistically different from zero (two-part model)			Second National Health and Nutrition Examination Survey, 1976–1980; generalized (iterative weighted) least squares and two-part methods; aged 12–17 years.
Douglas and Hariharan 1994	No significant effect of prices on smoking initiation decisions			1988 and 1989 National Health Interview Surveys; hazard models of smoking initiation; detailed modeling of addiction.
Chaloupka and Grossman 1996	-0.675	-0.638	-1.313	1992, 1993, and 1994 Monitoring the Future surveys of 8th, 10th, and 12th graders; two-part methods; mostly aged 12–18 years.
Chaloupka and Wechsler 1997	-0.53	-0.58	-1.11	1993 Harvard College Alcohol Study; two-part methods; college students mostly aged 18–22 years.
Chaloupka et al. 1997	-0.43	-0.16	-0.59	1992, 1993, and 1994 Monitoring the Future surveys of 8th, 10th, and 12th graders; smokeless tobacco use by young males; two-part methods; mostly aged 12–18 years.

Table 6.9. Continued

Study	Estimated price elasticities			Comments
	Prevalence	Quantity	Total	
Lewit et al. 1997	-0.87 (prevalence) -0.95 (intentions)			1990 and 1992 data from COMMIT* sites; 9th graders.
Centers for Disease Control and Prevention 1998	-0.37	-0.21	-0.58	1976–1980, 1982, 1985, 1987–1992 National Health Interview Surveys; two-part methods; aged 18–24 years.
Douglas 1998	No significant effects of prices on smoking initiation decisions; elasticity of approximately -1.0 for duration of smoking			1987 National Health Interview Survey; hazard models of smoking initiation and cessation; detailed modeling of addiction.
DeCicca et al., unpublished data, April 1998	-1.32 (8th grade) -0.95 (10th grade) -0.71 (12th grade) -0.03 (smoking onset, 8th to 12th grade)			1988 National Education Longitudinal Survey; treats each wave independently for prevalence; longitudinal data used to estimate effect of price on smoking onset.
DeCicca et al., unpublished data, August 1998	-1.994 to -0.746 (8th grade) -1.230 to -0.660 (10th grade) -0.982 to -0.274 (12th grade) -0.505 to -0.025 (smoking onset, 8th to 12th grade)			1998 National Education Longitudinal Survey; treats each wave independently for prevalence; longitudinal data used to estimate effect of price on smoking onset.
Dee and Evans, unpublished data, 1998	-2.19 to -2.01 (8th grade) -1.15 to -0.94 (12th grade) -0.79 to -0.63 (smoking onset, 8th to 12th grade)			Re-analysis of DeCicca et al. April 1998 data with same methods; differences in sample construction and variable definitions.
Evans and Huang, unpublished data, 1998	-0.20 (1977–1992) -0.50 (1985–1992)			1977–1992 Monitoring the Future surveys; high school seniors; state-aggregated prevalence rates; allow for state effects and state-specific time trends.
Chaloupka and Pacula 1999	-0.928 (men) -0.595 (women) -0.639 (whites) -1.108 (African Americans)			1992, 1993, and 1994 Monitoring the Future surveys of 8th, 10th, and 12th graders; prevalence only; mostly aged 12–18 years.

*COMMIT = Community Intervention Trial for Smoking Cessation.

Table 6.9. Continued

Study	Estimated price elasticities			Comments
	Prevalence	Quantity	Total	
Harris and Chan 1999	-0.831	-0.165	-0.996	1992–1993 Current Population Survey; two-part methods; also considered differential effects of premium and discount brand prices.
		(aged 15–17 years)		
	-0.524	-0.255	-0.779	
		(aged 18–20 years)		
	-0.370	-0.274	-0.644	
		(aged 21–23 years)		
	-0.202	-0.455	-0.657	
		(aged 24–26 years)		
	-0.095	-0.234	-0.329	
		(aged 27–29 years)		
Tauras 1999	0.269 to 0.466 price elasticity of cessation			Monitoring the Future survey longitudinal data; young adults; multiple failure duration analysis; parametric and semi-parametric models.
Tauras and Chaloupka 1999b	-0.121	-0.67	-0.791	Monitoring the Future longitudinal data formed from high school senior surveys for 1976–1993; mostly aged 18–32 years.
Gruber 2000	-0.666	-0.059 (older teens, Monitoring the Future surveys)		1991–1997 Monitoring the Future surveys of 8th, 10th, and 12th graders; 1991, 1993, 1995, and 1997 Youth Risk Behavior Surveys; 1991–1997 Vital Statistics Natality Detail files for teens giving birth before age 19; two-part models; state and year fixed effects.
	-0.210	-0.003 (younger teens, Monitoring the Future surveys)		
	-0.311	-0.029 (all teens, Monitoring the Future surveys)		
	-1.534	-1.576 (older teens, Youth Risk Behavior Survey)		
	0.419	-0.227 (younger teens, Youth Risk Behavior Survey)		
	-0.126	-0.526 (all teens, Youth Risk Behavior Survey)		
	-0.376	-0.145 (older teens, Natality Detail files)		
	-0.240	-0.058 (younger teens, Natality Detail files)		
	-0.353	-0.124 (all teens, Natality Detail files)		

smoking were ignored. Furthermore, these estimates of the price responsiveness of demand were not sensitive to the inclusion of variables reflecting smoking restrictions. Chaloupka (1990, 1991, 1992) found that young adults were not responsive to changes in cigarette prices (in contrast to the findings of Lewit and Coate [1982]) and that men and less-educated persons were much more responsive to changes in cigarette prices than were women and more-educated persons.

Douglas and Hariharan (1994) applied ideas from Becker and Murphy's (1988) economic model of addiction to look at smoking initiation decisions. Using data from the 1978 and 1979 smoking supplements to the National Health Interview Survey, Douglas and Hariharan estimated a parametric duration model that accounted for observed patterns of smoking initiation: the "hazard" of smoking initiation rises sharply from ages 12 through 20 and then declines dramatically, with initiation being unlikely after age 25. On the basis of this model, the analysis found that increases in cigarette prices had no impact on teenagers' decisions to begin smoking. Douglas (1998) extended this work by estimating a model of the hazards of smoking initiation and cessation using data from the cancer risk factor supplement to the 1987 National Health Interview Survey. Douglas also finds little empirical evidence that higher cigarette prices would reduce smoking initiation. However, the investigators noted that their estimated price effects were likely to be biased downward because of problems with the measurement of the price variables they employed. Douglas did find, however, that increases in cigarette prices significantly increase the likelihood of smoking cessation, concluding that a 10-percent increase in price would reduce the duration of smoking by approximately 10 percent.

More recent work by Tauras confirms the findings that higher cigarette prices induce smoking cessation (Tauras 1999; Tauras and Chaloupka 1999a). Using the longitudinal data on young adults from the Monitoring the Future project, Tauras (1999) estimated parametric and semi-parametric duration models that allow for multiple cessation attempts by young adult smokers. His estimates indicate that the likelihood of an initial cessation attempt and the probabilities of subsequent attempts rise as cigarette prices rise, with an average price elasticity of cessation of 0.343. In a somewhat less sophisticated analysis using the same data that examined the potential for gender differences in the effects of price on cessation, Tauras and Chaloupka (1999b) concluded that the likelihood of smoking cessation among both young adult men and young adult women rises significantly as cigarette prices rise.

Hu and colleagues (1995a) used data from the 1985–1991 California Behavior Risk Factor Surveys to estimate smoking prevalence and average cigarette consumption through equations that accounted for the interdependence of smoking and other behavioral risk factors. Using two-part methods, Hu and colleagues found that their estimates of the price elasticity of smoking prevalence were significantly lower when allowing for the interdependence of smoking and other behavioral risk factors (such as drinking and obesity), whereas their estimates of the effect of price on average cigarette consumption by smokers were unaffected. The analysis estimated that the price elasticity of demand was -0.46 overall, -0.24 for smoking prevalence, and -0.22 for cigarette consumption.

More recently, data from the 1976–1980, 1983, 1985, and 1987–1992 National Health Interview Surveys have been used to study the effects of prices on smoking among adults (CDC 1998). Researchers found that both the probability of smoking and the average cigarette consumption among smokers were inversely related to cigarette prices, with an overall estimated price elasticity of demand of -0.25 . In addition, they found significant differences in price responsiveness for various subpopulations, including those defined by race/ethnicity, age, family income, and gender. They found that blacks are twice as responsive as whites to changes in cigarette prices and that Hispanics are even more price sensitive. Similarly, the researchers' estimated price elasticity of -0.58 for young adults (aged 18–24 years) is well above that estimated for the full sample, whereas individuals with family incomes at or below the sample median were about 70 percent more responsive to price than those with higher family incomes. Finally, they found that men are much more price responsive than women.

To determine whether smokers engage in any form of compensating behavior in response to higher cigarette taxes, Evans and Farrelly (1998) focused on the data from the 1979 Smoking and 1987 Cancer Control Supplements to the National Health Interview Survey. These supplements were unique in that they collected information on the brand of cigarettes smoked. This information was converted into detailed data on tar and nicotine content, length of cigarette, and type of filter. The investigators found that continuing smokers engage in compensating behavior in response to higher cigarette taxes. That is, they found that smokers in high-tax states were more likely than smokers in low-tax states to smoke higher-tar and higher-nicotine cigarettes as well as longer cigarettes. This compensating behavior by continuing smokers left their average daily tar and nicotine intake unchanged. Moreover,

younger smokers were much more likely to engage in this compensating behavior, so much so that the higher taxes led to an increase in average daily tar and nicotine intake among continuing young adult smokers.

Recent research by Chaloupka and colleagues focused on the price responsiveness of cigarette smoking among adolescents and young adults. Chaloupka and Wechsler (1997) used 1993 data from 16,277 students in 140 U.S. colleges and universities to estimate the price elasticity of cigarette smoking among young adults. Using two-part methods, the investigators separately estimated the effects of prices on smoking prevalence and on average consumption among smokers after controlling for restrictions on cigarette smoking and limits on youth access to tobacco. College students, who were mostly aged 18–22 years, were very responsive to changes in cigarette prices. The estimated price elasticity of smoking prevalence in this population was -0.53 , and the elasticity for average cigarette consumption was -0.58 , for an overall price elasticity of demand of -1.11 .

Chaloupka and Grossman (1996) employed similar methods to examine cigarette smoking among more than 110,000 young people participating in the 1992, 1993, and 1994 Monitoring the Future surveys of 8th-, 10th-, and 12th-grade students. Like several other researchers, Chaloupka and Grossman found that smoking by younger persons is very responsive to changes in cigarette prices. Their estimated elasticity of smoking prevalence for this sample of mostly 12- through 18-year-olds was -0.675 , with an overall estimated price elasticity of demand centered on -1.313 . Chaloupka and Pacula (1999) used these data to look at the differential response by gender and race, concluding that young men and young African Americans are more responsive to price than young women and young whites.

Most recently, Tauras and Chaloupka (John A. Tauras and Frank J. Chaloupka. Price, clean indoor air laws, and cigarette smoking: evidence from longitudinal data for young adults, unpublished data, July 1, 1998) used data from the longitudinal component of the Monitoring the Future surveys to estimate the effects of price on young adult smoking. Using 35 panels formed from the 1976 through 1993 high school senior surveys, they estimated models controlling for unobserved state and individual factors affecting cigarette demand. For their sample of young adults, mostly aged 18–32, Tauras and Chaloupka estimated an overall price elasticity of demand centered on -0.79 . Taken together, these estimates imply that increases in cigarette prices would lead to relatively large reductions in smoking among adolescents and young adults.

This conclusion is supported by recent studies by Lewit and colleagues (1997) and Evans and Huang (William N. Evans and Lynn X. Huang, Cigarette taxes and teen smoking: new evidence from panels of repeated cross-sections, unpublished data, April 15, 1998; Harris and Chan 1999; Gruber 2000). Lewit and colleagues used data for ninth-grade students in 1990 and 1992 collected in the 22 North American communities from the Community Intervention Trial for Smoking Cessation (COMMIT). They found that both youth smoking prevalence and youth intentions to smoke are inversely related to cigarette prices, with estimated price elasticities of -0.87 and -0.95 , respectively. Evans and Huang estimated a somewhat smaller effect of -0.20 for high school seniors by using annual, state-level measures of smoking prevalence aggregated from the 1977 through 1992 Monitoring the Future surveys. However, they concluded that this had increased over time, estimating an elasticity of -0.50 for the period from 1985 through 1992. Harris and Chan (1999), using data from the 1992–1993 Tobacco Use Supplement to the Current Population Survey, provide consistent evidence that price responsiveness falls with age. Their estimated elasticities range from -0.996 for 15- to 17-year-olds to -0.329 for 27- to 29-year-olds. Gruber (2000) reaches a somewhat different conclusion using data from the 1991 through 1997 Monitoring the Future surveys, the 1991, 1993, 1995, and 1997 Youth Risk Behavior Surveys, and the 1991 through 1997 Vital Statistics Natality Detail files for teens giving birth before their 19th birthday. His estimates indicate that older teens are relatively more responsive to price than younger teens (approximately 17 to 18 years of age compared with approximately 13 to 16 years of age). His estimated price elasticity of smoking prevalence for older teens centers on -0.67 , while he finds that younger teens, on average, are not sensitive to price. In addition, he concludes that price sensitivity among older teens is greatest for more socioeconomically disadvantaged groups, such as young blacks or those with less educated parents.

In contrast, DeCicca and colleagues (Philip DeCicca, Donald Kenkel, and Alan Mathios, Putting out the fires: will higher taxes reduce youth smoking?, unpublished data, April 1998) concluded that higher cigarette taxes have a very small impact on smoking initiation among youth. Using data from the 1988, 1990, and 1992 waves of the National Education Longitudinal Study (NELS) of 1988, and treating each wave separately, the investigators estimated price elasticities for youth smoking prevalence comparable to those discussed above. However, when they used the longitudinal data to examine the onset of daily smoking

between 8th and 12th grade among youth not smoking in 8th grade, DeCicca and colleagues found little effect of price. In a separate analysis of the same data, Dee and Evans (Thomas S. Dee and William N. Evans, A comment on DeCicca, Kenkel, and Mathios, unpublished data, May 10, 1998) come to the opposite conclusion. Dee and Evans made two adjustments to the construction of the sample used by DeCicca and colleagues—including respondents with missing data on some covariates (about 20 percent of the sample) and redefining several variables based on the categorical data. After making these changes, Dee and Evans estimated a price elasticity for the onset of smoking of -0.63 , consistent with several of the other recent studies of youth smoking based on cross-sectional data.

In response to Dee and Evans, DeCicca and colleagues (Philip DeCicca, Donald Kenkel, and Alan Mathios, Putting out the fires: will higher taxes reduce youth smoking?, unpublished data, August 1998) conducted a reanalysis of NELS data by using an alternative approach to dealing with the problem of missing data. Their reanalysis produced somewhat more significant estimates for the effect of cigarette taxes on the onset of daily smoking between 8th and 12th grade; the implied price elasticities from alternative specifications ranged from -0.025 to -0.505 . However, smaller, less significant effects are found for models that employ cigarette prices. After obtaining separate estimates based on race and ethnicity, DeCicca and colleagues concluded that higher cigarette taxes have little impact on smoking onset by black and white youth but significantly reduce onset among Hispanic youth and youth of other races. The use of longitudinal data to research the impact of cigarette tax and price changes on smoking initiation is clearly an important and appropriate step. The differing conclusions from earlier studies of the same data suggest, however, that these discordant results should be weighed cautiously against the prevailing findings of recent studies.

Finally, two recent studies by Ohsfeldt and colleagues (1997, 1999) examined the impact of cigarette and other tobacco taxes on the probabilities of cigarette and smokeless tobacco use by males 16 years of age and older using data from the 1985 and 1992/1993 Current Population Surveys. To account for the potential reverse causality between demand and tobacco control policies (including taxes), the researchers estimate a simultaneous equations model. They find consistent evidence that higher cigarette taxes reduce the probability of smoking.

Behavioral Economics Studies of Cigarette Demand

Behavioral economics is the relatively new application of the principles of consumer demand theory to experimental psychology (Hursh and Bauman 1987). In a laboratory setting, behavioral economists studying addiction-related behaviors focus on the impact of unit price on drug dependence, including nicotine dependence. Price, in this literature, is defined as the response required to receive one dose of the drug (Bickel et al. 1993; Bickel and Madden 1999). As in standard economic theory, a key prediction of this branch of behavioral economics is that drug consumption is inversely related to price. One advantage of this experimental approach in the analysis of cigarette demand is that it allows researchers to study the effects of differences in cigarette prices that are many times larger than the price differences observed in cross-sectional data, time series data, or both. One limitation, however, is that these methods are generally applicable only to dependent individuals. Thus, for example, they do not pertain to initiation.

In a series of papers, Bickel, DeGrandpre, and their colleagues reported the results of research on cigarette smoking in their behavioral economics laboratory (Bickel et al. 1991, 1992; DeGrandpre et al. 1992, 1994; Bickel and DeGrandpre 1996). In the experiments, nicotine-dependent smokers were rewarded with two puffs on a cigarette after the completion of a specified number of responses. The total number of puffs received is the measure of consumption, and the number of responses required is the measure of price. The number of responses required to receive two puffs varied from 100 to 3,200, thereby allowing the researchers to study the impact of price on demand over a large range of prices. As in the econometric and other studies described previously, this experimental approach found an inverse relationship between cigarette smoking and price. More interesting, however, is the nature of the relationship between price and consumption. The investigators found that the price elasticity of demand rose as price rose. That is, the percentage reduction in consumption for a given percentage rise in price was larger at higher prices.

Studies of Smokeless Tobacco Use and Price

Although numerous studies have examined the impact of cigarette prices and smoking prevention policies on cigarette smoking, relatively few studies

have examined the corresponding issues for smokeless tobacco use, and virtually none consider such use in diverse culture groups. Similarly, few analyses have examined the possible substitution of smokeless tobacco products or cigarettes in response to changes in their relative prices.

Ohsfeldt and colleagues begin to address these gaps in the literature in two studies of smokeless tobacco use (Ohsfeldt and Boyle 1994; Ohsfeldt et al. 1997, 1999). Using state-level data for males aged 16 years and older who had participated in the September 1985 Current Population Survey, Ohsfeldt and Boyle examined the impact of various tobacco taxes on the prevalence of smokeless tobacco use. Their analysis, which controlled for other determinants of demand, found that higher taxes on smokeless tobacco were associated with lower use of smokeless tobacco. The prevalence of smokeless tobacco use, however, was positively related to cigarette excise taxes. The investigators suggested that these findings might partly explain the growth in smokeless tobacco use among young males during the 1980s. During this period, when cigarette excise taxes were rising more rapidly than smokeless tobacco taxes, comparatively larger increases occurred in cigarette prices. As the research previously described indicates, increases in cigarette prices significantly reduce cigarette smoking. Ohsfeldt and Boyle's analysis, however, suggested that tobacco use overall might not be significantly reduced, because some smokers might turn to using the comparatively less expensive smokeless tobacco products. These findings were generally confirmed by the analysis by Ohsfeldt and colleagues (1997) of the individual-level data from the September 1985 Current Population Survey and their subsequent analysis of data from the September 1992, January 1993, and May 1993 surveys (Ohsfeldt et al. 1999). The authors concluded that higher smokeless tobacco taxes reduce the probability of smokeless tobacco use but that higher cigarette taxes, while reducing the probability of smoking, increase the likelihood of smokeless tobacco use.

Similarly, using data on young males from the 1992, 1993, and 1994 Monitoring the Future surveys of 8th-, 10th-, and 12th-grade students, Chaloupka and colleagues (1997) concluded that both the prevalence and the frequency of smokeless tobacco use are inversely related to its price. They estimated an overall price elasticity of smokeless tobacco demand by young males of -0.59 , with more than two-thirds of the effect on the prevalence of smokeless tobacco use.

Cigarette Prices and Other Substance Use

Little is known about the relationships between cigarette prices and other substance use, whereas much is known about the impact of cigarette price on smoking. Economists define two goods as complements if an increase in the price of one good reduces the consumption of not only that good but also the consumption of the other. Conversely, substitutes are goods for which an increase in the price of one results in an increase in the consumption of the other. A few very recent econometric studies have examined the relationship between cigarette prices and other substance use (Pacula 1998a,b; Chaloupka et al. 1999; Farrelly et al. 1999; Pacula et al. 2000).

Research on patterns of substance use among youth generally concludes that youth begin with tobacco, or alcohol, or both and that some youth progress to marijuana and other illicit drug use (Kandel 1975; Kandel and Yamaguchi 1993; USDHHS 1994). Other research concludes that cigarette smoking is a significant predictor of both the probability and the frequency of other drug use (USDHHS 1988; Henningfield et al. 1990). This research suggests that cigarettes and other substances are complements for one another and that higher cigarette prices, by discouraging smoking among youth, could significantly reduce youth and adult drinking and illicit drug use.

Pacula (1998a), in the first econometric examination of this "gateway hypothesis," used data from the National Longitudinal Survey of Youth to examine the impact of cigarette prices in earlier years on current marijuana use by young adults. Her estimates are consistent with the gateway hypothesis; that is, higher past cigarette prices (which are expected to reduce past cigarette smoking) reduce the likelihood that a young adult currently uses marijuana. However, she finds no relationship between contemporaneous cigarette prices and marijuana use (Pacula 1998b). Chaloupka and colleagues (1999) used data from the 1992 through 1994 Monitoring the Future surveys of 8th-, 10th-, and 12th-grade students to examine the relationship between current cigarette prices and current cigarette smoking and marijuana use. They found that higher cigarette prices, in addition to reducing current cigarette smoking, also reduce current marijuana use. Farrelly and colleagues (1999) found similar evidence for adults using several of the recent National Household Surveys on Drug Abuse. In addition, they found that higher cigarette prices reduced alcohol use. More recently, using a longer time series of data from the Monitoring the Future surveys of 12th-grade students, Pacula and colleagues (2000) found little impact of

cigarette taxes on youth marijuana use. The growing evidence suggests that cigarettes and marijuana are not substitutes for one another, implying that higher cigarette prices will not lead to increased marijuana use, with several studies implying the opposite—that higher cigarette prices will reduce both cigarette and marijuana smoking. Much more research is needed, however, to firmly establish these relationships.

Discussion

A few general conclusions can be drawn from these studies of the effects of cigarette prices on smoking. First, increases in cigarette prices lead to significant reductions in cigarette smoking; most studies, using a wide variety of data and methods with various strengths and weaknesses, predict that a 10-percent increase in price will reduce overall cigarette consumption by 3–5 percent. Second, the effects of increases in

cigarette prices are not limited to reductions in average cigarette consumption among smokers but include significant reductions in smoking prevalence. These effects on smoking prevalence constitute both an increase in smoking cessation among smokers and a reduction in smoking initiation among potential young smokers. Third, although evidence concerning the effects of prices on adolescent smoking is mixed, the majority of the evidence from recent studies indicates that adolescents and young adults are significantly more responsive than adults to changes in cigarette prices. Most recent studies found that adolescents and young adults were two to three times more sensitive than adults to price. Ongoing research, particularly that based on longitudinal data, will help clarify this issue. Finally, the limited number of studies of smokeless tobacco use suggest that increases in smokeless tobacco prices would reduce the prevalence of smokeless tobacco use.

Taxation of Tobacco Products

As the preceding section indicates, numerous studies of the demand for cigarettes confirm a fundamental principle of economics: increased tobacco prices will reduce tobacco use. In general, several factors will determine the retail prices of cigarettes and other tobacco products. For example, factors that reduce the supply of tobacco will raise the prices of tobacco products. As described previously, these factors include tobacco price support programs, market power and collusive behavior among firms in the markets for tobacco products, and restrictions on trade in tobacco and tobacco products. The most important policy-related determinants of prices, however, are taxes on tobacco products.

In the United States, tobacco is taxed in various ways by the federal, state, and local governments. The most important of these are the excise, or per unit, taxes imposed on cigarettes and the general sales tax (an ad valorem tax) applied to cigarettes and other tobacco products in most states. Ad valorem taxes are a fixed percentage of the price and thereby increase or decrease as price changes. Excise taxes, on the other hand, do not change over time with prices.

Tobacco taxes have relatively low administrative costs and can generate substantial revenues. In recent years, increased taxation of tobacco products has been used as a strategy to reduce tobacco consumption and thereby to improve public health. For example, the health benefits of tax-induced reductions in smoking were often cited by supporters of the federal cigarette excise tax proposed as part of the Clinton administration's proposed Health Security Act of 1993, which included an increase of 75 cents per pack. (The act did not pass.) Similarly, anticipated large reductions in youth smoking were, in part, the rationale for tax increases of up to \$2.00 per pack proposed as part of most proposals for national tobacco legislation and the average \$2.00 state and federal tax set as a goal for 2010 by the Healthy People 2010 initiative. The health benefits of higher taxes were also the focus of the large voter-initiated tax increases in Arizona, California, Massachusetts, Michigan, and Oregon, as well as the large legislated tax increases in Alaska, Maine, and elsewhere.

Rationales for Tobacco Taxation

Alternative approaches have been used to determine the appropriate level of cigarette and other tobacco taxes. One such approach is the historical or comparative standard, which looks at the relative value of these taxes over time or cross-sectionally. A second approach is to use an efficiency standard based on the external costs of smoking; this approach implies that tobacco taxes can be thought of as "user fees" sufficient to cover the external costs of tobacco use. This approach, however, raises questions concerning the fairness of such taxes. A further argument has been made for substantial increases in tobacco taxes, because these tax hikes would lead to substantial reductions in the morbidity and mortality associated with cigarette smoking. Finally, because taxes on cigarettes and other tobacco products are a relatively simple way to generate revenues, it has been suggested that these taxes can be set at levels that maximize their returns. Each of these alternatives will be discussed.

Historical or Comparative Standard

Federal Tobacco Taxes

Tobacco has been taxed in North America since the British government first imposed taxes during colonial times. Beginning in 1794, the U.S. government imposed tobacco taxes that periodically rose with revenue needs and subsequently fell because of consumer opposition. Since 1864, when cigarette and other tobacco taxes were included in a package to finance the Civil War, taxes on tobacco in one form or another have remained a part of the federal tax system. Taxes continued to rise and fall over the next 87 years, generally increasing with revenue needs during the Spanish-American War, World Wars I and II, and the Korean War (Table 6.10). The final war-related increase in the federal excise tax per pack of cigarettes was from 7.0 cents to 8.0 cents per pack on November 1, 1951, where it remained for the next three decades.

The most recent federal tax increases were motivated by a need to raise revenues for a different purpose—to reduce the increasing federal budget deficit. The first of these hikes in the federal cigarette excise tax came as part of the Tax Equity and Fiscal Responsibility Act of 1982 (Public Law 97-248), which temporarily doubled the per pack tax to 16.0 cents, effective January 1, 1983. The tax was to revert to 8 cents on October 1, 1985, but after several extensions, the 16-cent tax was made permanent in 1986. As the result of two 4-cent increases included in the Omnibus Budget Reconciliation Act of 1990, the tax per pack

was increased to 20.0 cents on January 1, 1991, and then to 24.0 cents on January 1, 1993. Finally, as a result of the 1998 budget agreement, federal cigarette excise taxes are scheduled to rise by 10 cents per pack in 2000 and by an additional 5 cents per pack in 2002.

Also as part of the Consolidated Omnibus Budget Reconciliation Act of 1985, taxes of 8.0, 24.0, and 45.0 cents per pound were imposed on chewing tobacco, snuff, and pipe tobacco, respectively. These were the first new federal taxes on chewing tobacco and snuff since 1965, when the taxation was set at 10 cents per pound. These taxes are currently 12.0, 36.0, and 67.5 cents per pound (Table 6.11). This assessment amounts to approximately 2.7 cents per 1.2-ounce can of snuff, 2.3 cents per 3-ounce pouch of chewing tobacco, and 6.3 cents per 1.5-ounce pouch of pipe tobacco. Tobacco for roll-your-own cigarettes is not taxed at the federal level.

State and Local Tobacco Taxes

All 50 states and the District of Columbia currently impose excise taxes on cigarettes. The first of these was a tax levied by Iowa in 1921. It was followed in 1923 by taxes in Georgia, South Carolina, South Dakota, and Utah. On October 1, 1969, North Carolina became the last state to impose a tax on cigarettes. As of May 1, 2000, these taxes ranged from 2.5 cents per pack in Virginia to \$1.11 per pack in New York (Table 6.12). Forty-four states currently impose taxes on tobacco products other than cigarettes (Table 6.13); only 17 states imposed such taxes in 1964. In general, these other taxes are ad valorem taxes. The general sales tax in most states applies to cigarettes and other tobacco products, with the tax base in most states including the excise tax. As of November 1, 1999, these sales taxes added 8–25 cents per pack to the price of cigarettes (Table 6.12). In eight states, 450 cities and counties impose additional taxes on the sale of cigarettes, and 85 of these also tax other tobacco products. The largest of the local cigarette taxes are those imposed in Chicago (combined county and city taxes of 34 cents per pack) and New York City (8 cents per pack).

At least until the 1950s, state taxes on cigarettes were enacted and raised to generate revenues rather than to discourage consumption. The average year such taxes were initiated in the six major tobacco-producing states (1939) slightly predates the average year for the other states (1940) (Warner 1981). Before the widespread publicity on the health consequences of smoking, the average tax rate in the six tobacco states was only slightly lower than that in the other states

(2.5 vs. 2.9 cents per pack). Since the release in the mid-1950s of the first reports describing the adverse health effects of cigarette smoking, and even more so since the 1964 release of the initial Surgeon General’s report on smoking and health, state governments have actively used cigarette taxes as a principal tool in their

Table 6.10. Federal cigarette excise taxes, selected dates, 1864–2002

Effective date	Tax per pack of 20 cigarettes (cents)
June 30, 1864*	0.8, 2.4
April 1, 1865 [†]	2.4, 4.0
August 1, 1866 [‡]	4.0, 8.0, 8.0+20%
March 2, 1867	10.0
July 20, 1868	3.0
March 3, 1875	3.5
March 3, 1883	1.0
August 15, 1897	2.0
June 14, 1898	3.0
July 1, 1901 [§]	1.08, 2.16
July 1, 1910	2.5
October 4, 1917	4.1
February 25, 1919	6.0
July 1, 1940	6.5
November 1, 1942	7.0
November 1, 1951	8.0
January 1, 1983	16.0
January 1, 1991	20.0
January 1, 1993	24.0
January 1, 2000	34.0
January 1, 2002 ^Δ	39.0

*Lower rate applied to cigarettes valued at \$6 or less per 100 packs of 25 each.

[†]Lower rate applied to cigarettes valued at \$5 or less per 100 packs of 25 each.

[‡]Lower rate applied to cigarettes valued at \$8 or less per 1,000. Higher rate applied to cigarettes valued at more than \$12 per 1,000.

[§]Lower rate applied to cigarettes valued at \$2 or less per 1,000.

^ΔScheduled.

Source: Orzechowski and Walker 2000.

campaigns to reduce tobacco use. For example, the number of tax increases has risen from an average of less than three per year in the early 1950s to an average of more than eight per year in the late 1950s, and a record 22 states increased their cigarette taxes in 1965 (Table 6.14). Similar activity occurred during 1967–1970, when antismoking ads were broadcast under the Fairness Doctrine and after cigarette advertising on television and radio was banned in 1971. The once-negligible difference in cigarette excise tax rates between the tobacco-producing states and other states grew substantially over this period. By May 1, 2000, the simple average of cigarette taxes in the six largest tobacco-growing states was 7.1 cents compared with 46.5 cents in the remaining states and the District of Columbia.

The use of increased cigarette and other tobacco taxes to discourage all tobacco use was even more obvious in the late 1980s and early 1990s. In November 1988, California voters approved the Tobacco Tax and Health Protection Act (Proposition 99), the then-largest single increase (25 cents per pack) in any state excise tax on cigarettes. New taxes were also imposed on other forms of tobacco. The novel feature of this tax hike was that 20 percent of the new revenues generated by the tax increase was earmarked for tobacco-related education activities and 5 percent was allocated to tobacco-related research.

The success of Proposition 99 in California led to a similar voter-approved measure in Massachusetts. In November 1992, voters passed Question 1, which raised the state cigarette tax from 26 cents to 51 cents per pack and increased the state tax on chewing

Table 6.11. Federal excise tax rates (cents/pound) on chewing tobacco, snuff, and pipe tobacco, selected years, 1986–2002

Year	Chewing tobacco	Snuff	Pipe tobacco
1986	8.0	24.0	45.0
1991	10.0	30.0	56.25
1993	12.0	36.0	67.5
2000	17.0	51.0	95.67
2002*	19.5	58.5	109.69

*Scheduled.

Sources: Advisory Commission on Intergovernmental Relations 1991; Bureau of Alcohol, Tobacco and Firearms 2000.

Table 6.12. State cigarette excise taxes and sales taxes (cents/pack) applied to cigarettes

State	Excise tax rate May 1, 2000	Sales tax November 1, 1999	State	Excise tax rate May 1, 2000	Sales tax November 1, 1999
Alabama	16.5	11.0	Montana	18.0	0
Alaska	100.0	0	Nebraska	34.0	13.0
Arizona	58.0	16.0	Nevada	35.0	20.0
Arkansas	31.5*	13.0	New Hampshire	52.0	0
California	87.0	25.0	New Jersey	80.0	17.0
Colorado	20.0	0	New Mexico	21.0	14.0
Connecticut	50.0	19.0	New York	111.0	13.0
Delaware	24.0	0	North Carolina	5.0	10.0
District of Columbia	65.0	19.0	North Dakota	44.0	18.0
Florida	33.9	17.0	Ohio	24.0	13.0
Georgia	12.0	8.0	Oklahoma	23.0	12.0
Hawaii	100.0	15.0	Oregon	68.0	0
Idaho	28.0	14.0	Pennsylvania	31.0	17.0
Illinois	58.0	20.0	Rhode Island	71.0	23.0
Indiana	15.5	13.0	South Carolina	7.0	13.0
Iowa	36.0	14.0	South Dakota	33.0	11.0
Kansas	24.0	13.0	Tennessee	13.0	21.0
Kentucky	3.0	15.0	Texas	41.0	18.0
Louisiana	20.0	11.0	Utah	51.5	15.0
Maine	74.0	18.0	Vermont	44.0	15.0
Maryland	66.0	16.0	Virginia	2.5	11.0
Massachusetts	76.0	18.0	Washington	82.5	23.0
Michigan	75.0	20.0	West Virginia	17.0	15.0
Minnesota	48.0	19.0	Wisconsin	59.0	16.0
Mississippi	18.0	19.0	Wyoming	12.0	11.0
Missouri	17.0	11.0			

*Arkansas tax can rise to 34 cents if the state does not appropriate adequate funds for breast cancer research and control.

Sources: Orzechowski and Walker 2000; Centers for Disease Control and Prevention, Office on Smoking and Health, State Tobacco Activities Tracking and Evaluation System, unpublished data.

tobacco by 25 percent. Although Massachusetts law prevents funds raised by the tax from being earmarked for tobacco-related education and prevention efforts, the funds are placed into a Health Protection Fund, and the wording of the approved measure strongly

recommended that at least part of the funds be allocated to activities related to reducing tobacco use.

More recently, Michigan voters in 1994 enacted Proposal A, which changed the financing for Michigan public schools. Part of this plan included raising

the general state sales tax (which is applied to cigarettes and other tobacco products) from 4 to 6 percent and tripling the state excise tax on cigarettes to 75 cents per pack, representing the largest single increase in cigarette taxes ever implemented in the United States. New taxes were also imposed on various other tobacco products. Six percent of the new revenues were earmarked for health improvement activities, including tobacco-related education and prevention efforts.

In November 1994, Arizona voters approved the Tobacco Tax and Health Care Act, which included a 40-cent increase in the state cigarette tax with earmarking provisions similar to those in California, Massachusetts, and Michigan. At the same time, however, voters in Colorado rejected a tax hike of 50 cents per pack with similar features. In November 1996, Oregon voters approved Measure 44, which increased cigarette taxes by 30 cents per pack, raised the tax on other tobacco products from 35 to 65 percent of wholesale price, and dedicated a portion of the increased revenue to tobacco use prevention and education. Similar large cigarette-tax increases, including some that dedicate significant funds to tobacco control activities, have been recently legislated in a number of states, including Alaska, Maine, New Jersey, and New York. In addition, in 1998, voters in California approved an additional 50-cent per pack increase in the state cigarette tax.

The relative ease with which cigarettes and other tobacco products can be transported and the potential profits from illegal activity of this kind have limited state and local governments' ability to further raise tobacco taxes. The large disparities in price resulting from differences in tobacco taxation create incentives to (1) smuggle on a casual level (involving small quantities for personal use) or on an organized level (involving large quantities, generally for resale); (2) purchase cigarettes through tax-free outlets, including military stores and American Indian reservations; and (3) illegally divert cigarettes within the usual distribution system by forging tax stamps, which results in underreporting. Altogether, this "butt legging" (ACIR 1977) can result in a net loss of revenues when tobacco taxes are increased.

Although casual smuggling has always been a problem, states reported that organized smuggling activities rose significantly after the cigarette tax hikes of the late 1960s. In response to state pressure, the Trafficking in Contraband Cigarettes Act of 1978 (Public Law 95-575) was enacted. This act, which dealt only with the organized smuggling of cigarettes, prohibited the single-transaction transport, receipt, shipment, possession, distribution, or purchase of more than

60,000 cigarettes not bearing the tax indicia of the state in which the cigarettes were initially sold. The ACIR (1985) suggests that the law was even more effective than its proponents predicted. Casual smuggling, however, may become a more significant problem as the differences between cigarette taxes in neighboring states increase as the result of some of the recent large tax hikes in some states.

Several econometric analyses of cigarette demand have carefully considered the effects of price differentials on organized and casual cigarette smuggling on state cigarette sales (Baltagi and Levin 1986, 1992; Chaloupka and Saffer 1992; Becker et al. 1994; Saba et al. 1995; Jackson and Saba 1997; Yurekli and Zhang 2000). In general, these studies concluded that smuggling has a significant, but small, impact on cigarette demand, implying that a state cigarette tax increase will lead to some smuggling. Yurekli and Zhang (2000), for example, estimate that, on average, 6 percent of state cigarette tax revenues were lost due to smuggling activities in 1995. However, given the magnitude of these estimates, Merriman (1994) and Baltagi and Levin (1992) estimated that state cigarette taxes are below their revenue-maximizing levels. Thus, states can raise cigarette taxes and generate increased revenues, even as cigarette sales decline and interstate smuggling increases.

Cigarette Taxes and Cigarette Prices

Increases in cigarette and other tobacco taxes result in higher prices for these products. Most cigarette taxes, however, are excise taxes; unless they are increased regularly over time, the value of the tax will fall in real terms (after analysis accounts for the effects that inflation, as measured by the Consumer Price Index, has on the tax). Because taxes are an important component of price, one of the consequences of an excise tax system with relatively infrequent increases is that, at least during the period between excise tax increases, the real price of cigarettes will fall over time as the prices of other goods and services increase more rapidly.

When trends are examined in real cigarette prices over the past four decades, three clear periods are observed (Table 6.15). The first is 1955–1971, when states were increasing taxes not only to raise revenues but also to discourage smoking. The real value of state taxes during this period approximately doubled from 13.1 cents (1982–1984 dollars) to 26.4 cents per pack. This increase was more than sufficient to offset the reductions in the real federal tax (from 29.9 cents to 19.8

Table 6.13. State tax rates on tobacco products other than cigarettes as of January 1, 2000

State	Taxes on other tobacco products
Alabama	<p>Cigars retailing for:</p> <ul style="list-style-type: none"> a) ≤ 3.5 cents each or less, \$150 per thousand; b) > 3.5 and ≤ 5 cents each, \$3.00 per thousand; c) > 5 and ≤ 8 cents each, \$4.50 per thousand; d) > 8 and ≤ 10 cents each, \$7.50 per thousand; e) > 10 and ≤ 20 cents each, \$15 per thousand; f) > 20 cents each, \$20.25 per thousand. <p>Little cigars: 2 cents for each 10 or fraction thereof.</p> <p>Smoking tobacco:</p> <ul style="list-style-type: none"> a) ≤ 1.125 ounces, 2 cents; b) > 0.125 ounces and ≤ 2 ounces, 5 cents; c) > 2 ounces and ≤ 3 ounces, 8 cents; d) > 3 ounces and ≤ 4 ounces, 11 cents; e) 3 cents additional tax for each ounce or fraction part thereof over 4 ounces. <p>Chewing tobacco: 0.75 cents of each ounce or fraction thereof.</p> <p>Snuff:</p> <ul style="list-style-type: none"> a) ≤ 0.625 ounces, 0.5 cents; b) > 0.625 ounces, and ≤ 1.625 ounces, 1 cent; c) > 1.625 ounces and ≤ 2.5 ounces, 2 cents; d) > 2.5 ounces and ≤ 3 ounces, 2.5 cents; e) > 3 ounces and ≤ 5 ounces (cans, packages, gullets), 3 cents; f) > 3 ounces and ≤ 5 ounces (glasses, tumblers, bottles), 3.5 cents; g) > 5 ounces and ≤ 6 ounces, 4 cents; h) 1 cent additional tax for each ounce or fraction thereof over 6 ounces.
Alaska	75% of wholesale price.
Arizona	<p>Cigars retailing for:</p> <ul style="list-style-type: none"> a) ≤ 5 cents, 6.4 cents for each 3 cigars; b) > 5 cents, 6.4 cents each. <p>Little cigars: 12.9 cents for each 20 or fraction thereof.</p> <p>Smoking and chewing tobacco and snuff: 6.5 cents per ounce or major fraction thereof.</p> <p>Plug tobacco: 1.6 cents per ounce or fraction thereof.</p>
Arkansas	23% of manufacturers' invoice price.
California*	61.56% of wholesale price. [†]
Colorado	20% of manufacturers' price.
Connecticut*	20% of manufacturers' price.
Delaware	15% of wholesale price.
District of Columbia	None.

*Little cigars taxed at the same rate as cigarettes.

[†]California rate reset at beginning of each fiscal year; New Hampshire rate reset semiannually.

[‡]Maryland tax becomes effective July 1, 2000.

Sources: Orzechowski and Walker 2000; Centers for Disease Control and Prevention, Office on Smoking and Health, State Tobacco Activities Tracking and Evaluation System, unpublished data.

Table 6.13. Continued

State	Taxes on other tobacco products
Florida	Smoking tobacco, chewing tobacco, and snuff: 25% of wholesale price.
Georgia	Little cigars: weighing ≤ 3 pounds per 1,000, 2 mills each. All other cigars: 13% of wholesale price.
Hawaii	40% of wholesale price.
Idaho	40% of wholesale sales price.
Illinois	18% of wholesale price.
Indiana	15% of wholesale price.
Iowa*	22% of wholesale price.
Kansas	10% of original invoice price from the manufacturer to the wholesaler.
Kentucky	None.
Louisiana	Cigars: a) a list price of \$120 per thousand or less, tax is 8% of net invoice price; b) a list price of over \$120 per thousand, tax is 20% of net invoice price. Smoking tobacco: 33% of net invoice price.
Maine*	Chewing tobacco and snuff: 62% of wholesale sales price. Cigars and smoking tobacco: 16% of wholesale sales price.
Maryland [‡]	All other products 15% of wholesale price.
Massachusetts	75% of wholesale price for smokeless tobacco products. 15% of wholesale price for cigars and pipe tobacco.
Michigan	16% of wholesale price.
Minnesota	35% of wholesale price.
Mississippi	15% of manufacturers' list price.
Missouri	10% of manufacturers' price.
Montana	12.5% of wholesale price.
Nebraska	15% of wholesale price.
Nevada	30% of wholesale price.
New Hampshire [†]	Chewing tobacco and snuff: 17.9% of wholesale price invoiced to retailer.
New Jersey	48% of wholesale price.
New Mexico	25% of product value.
New York	20% of wholesale price.
North Carolina	2% of wholesale price.
North Dakota	28% of wholesale price.
Ohio	17% of wholesale price.
Oklahoma	Cigars, cheroots, stogies, etc., weighing > 3 pounds per thousand retailing for: a) ≤ 4 cents each, \$10 per thousand; b) > 4 cents each, \$30 per thousand. Little cigars: 9 mills each. Smoking tobacco: 40% of factory list price. Chewing tobacco and snuff: 30% of factory list price.

Table 6.13. Continued

State	Taxes on other tobacco products
Oregon*	65% of wholesale sales price.
Pennsylvania	None.
Rhode Island	20% of wholesale price.
South Carolina	Cigars, cheroots, stogies, etc., retailing for: a) ≤5 cents each, \$11 per thousand; b) >5 cents each, \$20 per thousand. Little cigars: 2 cents for each 8 or fraction thereof. Smoking tobacco: 36% of manufacturers' price. Chewing tobacco and snuff: 5% of manufacturers' price.
South Dakota	10% of wholesale price.
Tennessee*	6% of wholesale price.
Texas	Cigars: Tax on cigars and tobacco is based on weight per 1,000 and retail selling price. a) ≥3 pounds per 1,000, 1 cent for each 10 cigars; b) >3 pounds per 1,000 and retailing for ≤3.3 cents each, \$7.50 per 1,000; c) >3 pounds per 1,000, retailing for >3.3 cents each and containing a substantial amount of nontobacco ingredients, \$11 per thousand; d) >3 pounds per 1,000, retailing for >3.3 cents each and containing a substantial amount of nontobacco ingredients, \$15 per thousand; e) Chewing, pipe, or smoking tobacco, and snuff: 35.213% of the manufacturers' list price exclusive of any trade discount, special discount, or deal.
Utah	35% of manufacturers' selling price delivered into state.
Vermont	41% of distributors' price.
Virginia	None.
Washington	74.9% of wholesale price.
West Virginia	None.
Wisconsin	20% of wholesale price.
Wyoming	All other products 20% of wholesale price.

cents per pack); as a result, cigarette taxes continued to account for about 50 percent of cigarette prices.

During the 1970s, however, the real price of cigarettes dropped significantly because of the stability of cigarette excise taxes and the relatively rapid increases in the prices of other goods and services. During this period, the real value of the federal cigarette tax (which was unchanged in nominal terms) fell by more than 50 percent, and the real value of state taxes dropped by nearly as much. The net result was a decline of 38.5 percent in the real price of cigarettes. Moreover,

during this period, taxes as a share of cigarette prices fell from 46.8 to 33.1 percent, because the nontax component of real price was relatively stable.

Since 1981, however, the real price of cigarettes has increased sharply, from 69.3 cents to 127.1 cents per pack in November 1992, and further in early 1993. Important factors behind this increase were the federal tax increases in 1983, 1991, and 1993, which tripled the nominal value of the cigarette excise tax. Also important was the steady rise in the real value of average state excise taxes on cigarettes, from a low of

Table 6.14. Number of increases and decreases in state excise taxes on cigarettes, July 1, 1950–May 1, 2000

Year	Increases (Decreases)	Year	Increases (Decreases)
1950	2	1976	1
1951	7 (1)	1977	4
1952	0	1978	1 (1)
1953	2	1979	4
1954	3	1980	2
1955	11	1981	6 (1)
1956	5 (1)	1982	10
1957	8	1983	13
1958	4	1984	4
1959	15	1985	11
1960	4 (2)	1986	6
1961	17 (1)	1987	13
1962	2	1988	3
1963	15	1989	14 (1)
1964	5	1990	8
1965	22	1991	13 (1)
1966	4 (1)	1992	7
1967	12	1993	15 (2)
1968	8	1994	8
1969	20	1995	5
1970	7	1996	2
1971	16	1997	9
1972	5	1998	2
1973	2	1999	3
1974	2	2000	1
1975	5		

Sources: Orzechowski and Walker 2000; Centers for Disease Control and Prevention, Office on Smoking and Health, State Tobacco Activities Tracking and Evaluation System, unpublished data.

14.0 cents per pack in 1982 to 19.4 cents per pack in 1993. However, even with the increases in the real values of the federal and state taxes on cigarettes, taxes as a share of price fell substantially from 1981 to 1993

(from 33.1 to 24.9 percent). The most important factor behind the rise in real cigarette prices, then, was the sharp rise in nontax (i.e., manufacturer-added) price components. In 1981, the real value of the nontax portion of average cigarette prices was 46 cents. By 1993, this amount was 79.5 cents, which is an increase of more than 70 percent. As described earlier in this chapter, in “High Tobacco Concentration and the Impact of Prevention Policies,” much of this increase was attributable to the less than perfectly competitive supply side of the cigarette market. The result of the increases in both the tax and the nontax components of cigarette prices was an increase of almost 85 percent in the real price of cigarettes from 1981 to 1993.

Real cigarette prices declined sharply as a result of “Marlboro Friday” in April 1993, when wholesale cigarette prices, first for Marlboro then soon after for other premium brands, were cut by 25 percent. More recently, however, real cigarette prices have risen significantly. These increases are partly the result of increases in state and federal cigarette excise taxes over the past few years. More important, however, are the significant increases in wholesale cigarette prices beginning in 1997. These prices increased by more than 12 percent between March 1997 and April 1998, returning to their 1992 nominal level (USDA 1998a), in part the result of increased costs associated with tobacco industry settlements with Mississippi, Florida, Texas, and Minnesota. Wholesale prices increased an additional 45 cents per pack in November 1998, on the day the Master Settlement Agreement was announced. This increase, the largest in history, was followed nine months later by an additional 18-cent per pack increase (USDA 2000).

International Tobacco Taxes

Among industrialized countries around the world, the United States has one of the lowest average prices and taxes on cigarettes (Table 6.16). As of December 31, 1996, the average tax in the United States was 66.0 cents per pack, well below the taxes imposed in almost every other industrialized country. At that time, taxes in various other countries, in U.S. dollars, ranged from \$5.23 per pack in Norway to 47 cents per pack in South Africa. Most developed countries have at least double the average tax in the United States. Some interesting features of these taxes include earmarking for tobacco-related education and other health-related activities (in Denmark, Finland, Iceland, Peru, and elsewhere), the creation of state-based Health Promotion Foundations in Australia and the Health Sponsorship Council in New Zealand to fund sporting and artistic

Table 6.15. Cigarette taxes and cigarette prices, 1955–2000 (cents/pack)

Year	Weighted average state tax ^{*†}	Average federal tax [†]	Average cigarette price [‡]	Taxes as a percentage of average price [§]	Real average state tax ^{†Δ}	Real average federal tax ^{†Δ}	Real average cigarette price ^Δ
1955	3.5	8.0	22.7	48.7	13.1	29.9	84.7
1956	3.8	8.0	23.2	47.4	14.0	29.4	85.3
1957	3.9	8.0	23.8	48.8	13.9	28.5	84.7
1958	4.0	8.0	25.0	48.0	13.8	27.7	86.5
1959	4.2	8.0	25.6	46.6	14.4	27.5	88.0
1960	4.7	8.0	26.1	48.9	15.9	27.0	88.2
1961	4.7	8.0	26.1	48.6	15.7	26.8	87.3
1962	5.1	8.0	26.9	48.3	16.9	26.5	89.1
1963	5.2	8.0	26.8	49.4	17.0	26.1	87.6
1964	5.6	8.0	27.9	49.3	18.1	25.8	90.0
1965	5.9	8.0	28.2	49.8	18.7	25.4	89.5
1966	6.9	8.0	30.0	51.4	21.3	24.7	92.6
1967	7.1	8.0	30.5	50.8	21.3	24.0	91.3
1968	8.4	8.0	32.3	49.2	24.1	23.0	92.8
1969	9.1	8.0	32.8	48.9	24.8	21.8	89.4
1970	10.2	8.0	37.1	47.7	26.3	20.6	95.6
1971	10.7	8.0	38.9	46.8	26.4	19.8	96.0
1972	11.6	8.0	40.0	47.7	27.8	19.1	95.7
1973	12.1	8.0	40.3	48.4	27.3	18.0	90.8
1974	12.1	8.0	41.8	47.6	24.5	16.2	84.8

*State taxes are an average of taxes in all taxing states (42 in 1955; 50 in 1970 and thereafter) and the District of Columbia, weighted by tax-paid cigarette sales in those states.

†Nominal and real average state and federal tax data are for the fiscal year ending June 30.

‡Price reflects the median retail price for cigarettes (including generic brands) in all taxing states, generally as of November 1 of the state fiscal year.

§Percentages cannot be calculated directly from the tax and price information, because taxes are weighted average taxes for the entire fiscal year, whereas prices and percentages are generally as of November 1.

ΔReal cigarette taxes and prices are obtained by dividing the nominal taxes and prices by the national Consumer Price Index; the average of 1982–1984 is the benchmark.

¶Preliminary estimate.

Source: Orzechowski and Walker 2000.

events previously backed by the tobacco industry, and the differential taxes on cigarettes with high-tar and high-nicotine content used in previous years in the United Kingdom (Roemer 1993).

One consequence of the differences in cigarette taxes and prices across countries is the potential for casual and organized cigarette smuggling and other forms of tax evasion. The cigarette industry, for example, frequently argues that cigarette tax increases

Table 6.15. Continued

Year	Weighted average state tax ^{*†}	Average federal tax [†]	Average cigarette price [†]	Taxes as a percentage of average price [§]	Real average state tax ^{†Δ}	Real average federal tax ^{†Δ}	Real average cigarette price ^Δ
1975	12.2	8.0	44.5	44.5	22.7	14.9	82.7
1976	12.4	8.0	47.9	41.4	21.8	14.1	84.2
1977	12.5	8.0	49.2	40.5	20.6	13.2	81.2
1978	12.9	8.0	54.3	37.1	19.8	12.3	83.3
1979	12.9	8.0	56.8	35.5	17.8	11.0	78.2
1980	13.1	8.0	60.0	34.5	15.9	9.7	72.8
1981	13.2	8.0	63.0	33.1	14.5	8.8	69.3
1982	13.5	8.0	69.7	29.9	14.0	8.3	72.2
1983	14.7	12.0	81.9	26.8	14.8	12.0	82.2
1984	15.3	16.0	94.7	33.2	14.7	15.4	91.1
1985	15.9	16.0	97.8	32.3	14.8	14.9	90.9
1986	16.2	16.0	104.5	30.8	14.8	14.6	95.3
1987	16.9	16.0	110.0	29.9	14.9	14.1	96.8
1988	18.2	16.0	122.2	28.1	15.4	13.5	103.3
1989	21.8	16.0	127.5	26.5	17.6	12.9	102.8
1990	24.7	16.0	144.1	26.4	18.9	12.2	110.3
1991	25.9	16.0	153.3	25.6	19.0	11.7	112.6
1992	26.5	20.0	173.5	25.6	18.9	14.3	123.7
1993	28.0	22.0	183.7	24.9	19.4	15.2	127.1
1994	31.5	24.0	169.3	31.4	21.3	16.2	114.2
1995	31.2	24.0	175.8	31.0	20.5	15.7	115.4
1996	31.7	24.0	179.6	31.6	20.2	15.3	114.5
1997	31.8	24.0	185.4	30.5	19.8	15.0	115.5
1998	34.1	24.0	195.0	31.5	20.9	14.7	119.6
1999	36.4	24.0	217.5	28.2	21.8	14.4	130.6
2000	39.8 [¶]	29.0 [¶]	292.6	22.1	23.2 [¶]	16.9 [¶]	170.5 [¶]

will actually lead to reductions in tax revenues due to smuggling and other tax evasion (British-American Tobacco Company Limited 1994). The smuggling problem is exacerbated by the relative ease with which tobacco products can be transported, the potential profits from this illegal activity, the presence of corruption and organized crime, the widespread street selling, the availability of tax-free and duty-free cigarettes, and the

nonexistent or relatively weak policies concerning cigarette smuggling and their lack of enforcement (ACIR 1977, 1985; Joossens and Raw 1995; Joossens et al., in press). Joossens and Raw (1995, 1998) argued that many of these other factors can be as important as price differences in spawning cigarette smuggling. For example, they noted that there is little evidence of smuggling in some of the highest priced European

Table 6.16. Average retail cigarette price and total taxes per pack (U.S. dollars/pack), selected countries, December 31, 1996

Country	Average retail price	Total taxes	Tax as a percentage of retail price*
Norway	7.05	5.23	74
United Kingdom	5.27	4.30	82
Ireland	4.94	4.16	84
Denmark	4.75	4.02	85
Finland	4.54	3.48	77
Australia	4.50	2.92	65
Sweden	4.47	3.13	70
New Zealand	4.17	2.79	66
Canada (highest provincial taxes)	4.09	2.97	73
Singapore	3.72	1.87	50
Hong Kong	3.62	1.76	49
France	3.47	2.61	75
Belgium	3.23	2.39	74
Germany	3.18	2.28	72
Canada (average provincial taxes)	3.00	1.97	66
Austria	2.84	2.11	74
Netherlands	2.66	1.94	73
United States (highest state taxes)	2.65	1.24	47
Italy	2.17	1.59	73
Canada (lowest provincial taxes)	2.02	1.12	55
United States (average state taxes)	1.90	0.66	35
Greece	1.82	1.33	73
Portugal	1.77	1.43	81
United States (lowest state taxes)	1.60	0.34	21
Thailand	1.58	0.89	56
Taiwan	1.45	0.62	43
Brazil	1.43	1.06	74
Spain	1.08	0.81	75
South Africa	1.04	0.47	45

Notes: (a) Figures given are for a package of 20 of the most popular price category; (b) exchange rates are from the Bank of Canada Official Exchange Rates as of December 31, 1996.

*The tax as a percentage of retail price refers to the portion of the average retail selling price that composes all applicable taxes and other fees imposed on the product.

Source: Smoking and Health Action Foundation (Canada), unpublished data, April 30, 1997.

countries, including France, Norway, Sweden, and the United Kingdom, whereas there is extensive evidence of smuggling in countries with relatively low prices, such as Spain and Italy. Merriman and colleagues (in press) provide empirical evidence that the perceived level of corruption explains more of the variance in experts' estimates of the magnitude of cigarette smuggling than do cigarette prices. Moreover, Joossens and colleagues (Joossens and Raw 1998; Joossens et al., in press) concluded that much of the smuggling that does occur in Europe and elsewhere is encouraged by multinational tobacco companies. Thursby and Thursby (1994) provided empirical support for this argument, based on their analysis of data from the United States from which they concluded that increases in federal cigarette excise taxes lead to increased commercial cigarette smuggling.

Perhaps the most interesting international comparison is between cigarette tax policy in the United States and Canada. In 1970, average taxes (including sales taxes) on cigarettes were 30 cents per pack in Canada and 20 cents per pack in the United States. By 1980, the average Canadian tax, 46 cents per pack, was double the U.S. tax. Real prices in both countries had fallen sharply throughout the 1970s, but after 1980, the gap between the two countries widened rapidly. One main reason for this change was the adoption of an ad valorem tax by the federal and provincial governments in Canada. As a result, cigarette taxes in Canada doubled between 1980 and 1984, leading to a 25-percent increase in real cigarette prices. In response to pressure from the cigarette industry, however, the ad valorem tax structure was replaced with an excise tax system in 1984.

The growth in Canadian taxes slowed over the next few years. Most taxing took place at the provincial rather than the federal level. In 1988, however, the Canadian federal government committed to an aggressive campaign to reduce tobacco use; highlighting the campaign was a ban enacted that year on tobacco advertising. In 1989, the federal tax was raised by 2 cents per cigarette, and another hike of 3 cents per cigarette occurred in 1991. At the same time, provincial taxes were increasing rapidly. By early 1994, the average tax per pack of cigarettes was \$2.96 (in U.S. dollars), which is more than five times the average U.S. tax.

The large disparities in Canadian and U.S. cigarette prices led to substantial smuggling, which was enabled by the long stretches of unmonitored border between Canada and the United States, the relatively weak border controls, and the high concentration of the Canadian population near U.S. borders (Sweanor

and Martial 1994). Much of the black market trade that resulted was in Canadian-produced cigarettes that had been exported to the United States (exports were not subject to the Canadian taxes) and then smuggled back into Canada. Relatively little black market trade involved cigarettes produced in the United States; U.S. cigarettes use a blend of tobacco different from Canadian cigarettes and are less desired by Canadian smokers (Sweanor and Martial 1994). In a short-lived effort to reduce the smuggling problem, a tax of 80 cents per pack was applied to Canadian cigarette exports in mid-February 1992. This tax was repealed six weeks later, although preliminary evidence indicated that it had been successful in reducing smuggling (Sweanor and Martial 1994). After the repeal of the export tax, Canadian cigarette exports to the United States rose dramatically, and smuggling increased again.

In response to an aggressive industry-sponsored campaign, the federal tax on cigarettes in Canada was reduced by \$5.00 per carton on February 9, 1994. Moreover, the federal government agreed to match provincial reductions in taxes up to an additional \$10.00 per carton. Quebec immediately lowered its provincial tax by \$11.00 per carton for a total tax cut of \$26.00 per carton, leading to a 50-percent drop in price. By August 1994, four other provinces had reduced cigarette taxes substantially. These cuts reduced the average Canadian tax per pack from \$2.96 before the federal tax cut to \$1.97 as of December 31, 1996 (in U.S. dollars), which was an amount still well above the average U.S. cigarette tax of 66 cents per pack at that time.

The Canadian experience was cited by the tobacco industry during the recent debates over the proposed national tobacco settlement as evidence that a black market in cigarettes would develop in the United States in response to large cigarette tax increases. However, there is little evidence to support this contention. Given that Canadian cigarette taxes were reduced because of smuggling from the United States, it is likely that these taxes would be increased if the United States were to adopt large tax increases, making it unlikely that widespread smuggling of cigarettes from Canada into the United States would occur. Cigarette prices in Mexico, however, are well below those in the United States, and large increases in U.S. prices could make smuggling cigarettes from Mexico a highly profitable venture. To date, however, no empirical evidence supports the contention of significant smuggling of cigarettes from Mexico into the United States. Furthermore, unlike the U.S.-Canadian border, the border between the United States and Mexico is relatively short and heavily guarded, making it much more difficult to smuggle large quantities of a bulky product like cigarettes.

Finally, several relatively easy options exist for limiting cigarette smuggling (Joossens and van der Merwe 1997; Joossens et al., in press). These include prominent tax-paid markings on all tobacco products and sizable increases in the penalties for cigarette smuggling. The ACIR (1985), for example, concluded that the Trafficking in Contraband Cigarettes Act (Public Law 95-575), which prohibited the transportation, receipt, shipment, possession, distribution, or purchase of large quantities of cigarettes that did not bear the tax indicia of the state in which the cigarettes are found, led to a significant reduction in interstate cigarette smuggling resulting from interstate price differentials.

Discussion

If one applies Cook and Moore's (1993) discussion of alcohol taxes to cigarette taxes, a provocative question arises when one compares previous cigarette excise taxes with current ones: why is the current tax rate deemed appropriate when it is just over one-half the level that was deemed appropriate in 1951? Unless it is in the public interest to tax cigarettes at a much lower rate now than then (an odd notion, given that in 1951 much less evidence was available on the health hazards of smoking), a case can be made for restoring taxes to their earlier levels. Similar arguments can be made at the state level, particularly in those states where taxes have not changed or have been increased modestly and infrequently over time.

Other, comparative standards for appropriate taxes could be used. For example, as shown in Table 6.12, state excise taxes on cigarettes differ substantially; these differences reflect several factors, including the importance of tobacco for the local economy. At another level of comparison, large differences between cigarette taxes in Canada and the United States gave rise to a significant black market trade, which in turn resulted in reductions in Canadian taxes. At the global level, cigarette and other tobacco taxes in the United States are among the lowest in industrialized countries around the world. Such comparisons suggest that relatively high taxes may be appropriate in some areas and low taxes appropriate in others. On the other hand, one could argue that the taxes on all tobacco products should be equivalent. This last issue is discussed in greater detail in the next section, "Fairness Standard and Optimal Cigarette Taxes."

Taxes on smokeless tobacco products are much lower than taxes on cigarettes, particularly at the federal level. The limited research suggests that increases in cigarette excise taxes may have reduced cigarette smoking but also may have contributed to an increased

use of smokeless tobacco products (Ohsfeldt and Boyle 1994; Ohsfeldt et al. 1997, 1999). Some public health advocates and others have therefore called for the equalization of taxes on tobacco (CSH 1994; U.S. House of Representatives 1994).

Fairness Standard and Optimal Cigarette Taxes

Fair tax policy is an issue that is often debated but difficult to apply when "optimal" taxes of potentially hazardous substances are discussed (Cook and Moore 1993). For taxes on cigarettes and other tobacco products, part of the debate revolves around the perceived health benefits and reductions in social costs associated with higher taxes.

In their analysis of economic interventions to reduce alcohol abuse, Cook and Moore (1993) noted that several criteria can be included to judge fairness by those on both sides of the debate. These criteria include a horizontal equity criterion, which suggests that equals should be treated equally; a vertical equity criterion, which suggests that those with the greatest ability to pay should be taxed more heavily; and a benefit criterion, which suggests that those who receive the greatest benefit from government activities should be taxed more heavily. If the basic notion is accepted that people who are otherwise similar should be taxed differently because one uses more tobacco products than the other (a notion that violates the horizontal equity criterion), then other questions about fairness arise. These include questions concerning the alleged regressivity of the taxes and the external costs of smoking and other tobacco use (Cook and Moore 1993).

Equity, Incidence, and Distribution of the Tobacco Tax Burden

As has been discussed previously, increases in cigarette excise taxes are passed on to consumers through higher cigarette prices. Primarily because of the less than perfectly competitive nature of the cigarette industry, prices have increased by more than recent increases in cigarette taxes. Because consumers will pay at least the full amount of a tax increase in higher cigarette prices, some questions of fairness revolve around the distributional effects of the tax hike. To understand these effects, it is useful to look at the relationship between tobacco use and income (or expenditures). (As Cook and Moore [1993] note, income or expenditures are not the only scale on which fairness can be judged, but they are the most commonly used.)

A 1990 report by the Congressional Budget Office (CBO), which used data from the 1984–1985 Consumer Expenditure Survey, made several observations. For example, expenditures on tobacco products increased with income except for people in the highest income quintile. As a percentage of posttax income, however, spending on tobacco was highest in the lowest income quintile (4.0 percent of posttax income) and fell almost proportionately with increased income. Also, if expenditures on tobacco are considered as a percentage of expenditures on all goods and services, however, the share of tobacco expenditures fell gradually over the first four income quintiles (from 1.6 to 1.1 percent) and dropped sharply only in the top quintile (to 0.7 percent). Thus, the CBO notes, if annual family expenditures are more reflective of lifetime income than annual family income, then expenditures on tobacco are only slightly regressive over income classes. Finally, the CBO noted that younger families spent a higher percentage of income on tobacco products and that their share of spending on tobacco products as a percentage of total expenditures was higher as well.

To examine the distributional impact of cigarette excise tax increases on consumers, the CBO simulated what the effects on expenditures would be were the 1990 federal excise tax on cigarettes (16 cents per pack) doubled. At first glance, the simulated increase appeared to fall most heavily on the lowest income categories, thereby implying that cigarette taxes are regressive. However, when income tax brackets and transfer payments (discussed in the next section, “Estimates of the Costs of Smoking”) were indexed to account for the price increases associated with excise tax hikes, lowering individual income taxes and raising transfer payments, the apparent regressivity of the tax was reduced. When looking at the tax increase relative to expenditures rather than income, the CBO concluded that cigarette taxes were approximately proportional rather than regressive. Finally, the CBO noted that the largest share of the simulated tax increase was paid for by families in the third and fourth income quintiles and that the smallest share was paid by families in the lowest income (first and second) quintiles.

All of the CBO estimates were based on measures of current income. Lyon and Schwab (1995) used an alternative approach that used measures of permanent or lifetime income to examine the distributional effects of cigarette and other “sin” taxes. This approach could account for the intertemporal nature of cigarette consumption decisions. The investigators concluded that cigarette excise taxes are as regressive as was implied by studies based on current income.

Although cigarette taxes fall most heavily on lower income groups, two recent studies suggest that increases in cigarette taxes may reduce the perceived regressivity of these taxes. A study using data from the British General Household Survey concluded that people in the lowest income groups were the most responsive to price increases (Townsend et al. 1994). Similar findings have been obtained in the United States using data from 13 of the National Health Interview Surveys conducted from 1976 through 1993 (CDC 1998). The price elasticity of cigarette demand by those at or below the median income was estimated to be approximately 70 percent higher than that for persons above the median. Another study found that less educated persons were more responsive than more educated persons to cigarette price changes (Chaloupka 1991). Given the high correlation between income and education, the three studies implied that increased cigarette taxes would reduce observed differences in smoking among socioeconomic groups (i.e., that smoking prevalence is higher in the lower socioeconomic groups) and would thereby counter the perception that cigarette taxes are regressive. Recent research from developing countries supports the hypothesis that lower income populations are relatively more sensitive to price (Jha and Chaloupka 1999; see Chaloupka et al., in press, for a thorough review). Indeed, while cigarette taxes may fall more heavily on lower income groups, an increase in the cigarette tax, because of the greater price sensitivity of lower income smokers, may actually be progressive. Moreover, given the estimates from these studies, the health benefits resulting from reductions in smoking stimulated by increased cigarette taxes would be disproportionately larger in the lowest income populations.

Finally, as the CBO report pointed out, although the potential regressivity of cigarette taxes is of some concern, the U.S. tax system is a mix of many different taxes. Increased progressivity of other taxes and transfer programs could be used to compensate low income families for the tax increase. The CBO considered three alternative changes—a 5-percent increase in food stamp payments, a 10-percent increase in the earned income tax credit, and a combination of the two—to offset the potential regressivity of an increase in the cigarette excise tax. In each case, the CBO concluded that these changes would spend about 15 percent of the net revenues resulting from the tax increase. A similar idea was implicit in the proposed Health Security Act of 1993, which proposed a federal tax increase of 75 cents per pack to partially finance the provision of health insurance and the expansion of benefits to the uninsured and underinsured, most of whom are

in lower socioeconomic groups. Likewise, several recent proposals for national tobacco legislation contain provisions that would offset the potential regressivity of large increases in cigarette taxes.

Estimates of the Costs of Smoking

An alternative approach to the question of fairness deals with the notion that smokers and other tobacco users impose costs on nonusers. One of these costs is the health consequences for nonsmokers of exposure to ETS. A second is the financial external effect caused by collectively financed programs (e.g., Medicaid and Medicare) where payments in and out are not tied to changes in costs and life expectancy caused by smoking. Thus it can be argued that it would be fair for smokers and other tobacco users to pay for the consequences of their use. Cigarette and other tobacco taxes are one relatively efficient approach for attaining this result. However, to set taxes at a level sufficient to cover the costs of cigarette smoking and other tobacco use requires an estimate of these costs.

All studies of the economic costs of tobacco use have focused on the costs of cigarette smoking. The Office of Technology Assessment (U.S. House of Representatives 1994) has noted that although measuring these costs is an inexact science, three general components are included:

- The direct costs of providing health care services to those persons with smoking-related diseases. Such costs include expenditures for preventing, detecting, diagnosing, and treating smoking-related diseases and medical conditions.
- The indirect morbidity costs associated with lost earnings from work because of smoking-related illness.
- The indirect mortality costs related to the loss of future earnings from premature death from smoking-related causes.

Researchers have tried to estimate the economic costs of cigarette smoking by using data from the United States (Rice et al. 1986; Manning et al. 1989, 1991; Hodgson 1992; CDC 1994; U.S. House of Representatives 1994; Miller et al. 1998, 1999) and elsewhere (see Lightwood et al., in press, for a comprehensive review). In addition, as part of the research resulting from Proposition 99, several recent studies have estimated these costs for California (California Department of Health Services 1992; Rice and Max 1992; Max and Rice 1995).

Most of the estimates of the economic costs of smoking have been prevalence based. That is, they are based on the estimated prevalence of smoking-related illnesses in a given year and on the costs associated with those illnesses. Because of the long lags between smoking initiation and the onset of most smoking-related illnesses, these estimates reflect historical trends in smoking and thus cannot be used to predict the impact of changes in smoking prevention policies except over long periods. However, this approach has been widely used because of its relatively simple methodology and the availability of reliable data (Rice et al. 1986).

Several of the recent estimates of the costs of smoking have been incidence based (Oster et al. 1984; Manning et al. 1989, 1991; Hay 1991; Hodgson 1992). That is, these studies attempt to estimate the average additional costs of smoking over the smoker's lifetime. Cost estimates would differ by the person's age, sex, and level of smoking (i.e., a heavy smoker would have higher lifetime costs than a relatively light smoker with the same characteristics). These estimates of the costs of smoking can be useful for policymakers, who can estimate the change in the costs of smoking associated with a change in smoking behavior resulting from a change in policies to reduce smoking. However, these estimates are sensitive to assumptions about future costs and about issues such as technological change and its diffusion (Hodgson 1988).

Many of the studies of the economic costs of smoking have included notably different direct costs in their computations. For example, most include the costs of hospital and nursing home care, physicians' fees, and medications used to treat smoking-related illnesses. One such study estimated that these costs in 1993 were \$50 billion and that 43.3 percent of them were paid through public sources (CDC 1994). However, some studies of direct costs have been limited to the costs associated with lung cancer only, whereas others examined a more comprehensive list of smoking-related illnesses, including cardiovascular disease and chronic obstructive pulmonary disease.

Other more recent studies have sought a broader measure of the direct costs of smoking by comparing the differences between total health care spending by smokers and nonsmokers. The most sophisticated of these recent studies control for other risk factors likely to be correlated with smoking in an effort to isolate the impact of smoking on medical expenditures (Miller et al. 1998, 1999). These recent studies estimated smoking-attributable medical care costs of between \$53 billion and \$73 billion for 1993, or between 6.5 percent and 11.8 percent of all U.S. health care expenditures.

It is likely, however, that these studies have underestimated the direct costs of smoking for a variety of reasons (Warner et al. 1999). For example, they ignore other significant economic costs, including the costs of transportation associated with obtaining medical care and the costs of nonmedical care associated with accommodating a person with a smoking-related chronic illness. These estimates also generally fail to account for other medical care costs related to cigarette smoking, such as burn care from injuries in smoking-related fires and perinatal care for low-birth-weight infants of mothers who smoke. Few studies have attempted to include the direct costs for nonsmokers of diseases related to exposure to ETS, and none of these studies has tried to estimate the intangible costs of smoking-related illnesses (i.e., the pain and suffering associated with the illness and the grief experienced by family and friends).

A human capital approach is generally used to estimate the indirect morbidity and mortality costs associated with cigarette smoking. This approach views an individual as producing a stream of output or earnings computed at market value or as the imputed value of housekeeping services. Thus, the value of a person is reflected by his or her earnings, and the lifetime value for that person is equal to the discounted stream of future earnings (Max and Rice 1995). This approach places a relatively high value on morbidity and mortality among young adults, men, and the more educated because of the relatively higher earnings that would be lost by these smokers (Markandya and Pearce 1989); moreover, lost earnings may not be an accurate reflection of the value people place on their health or on their lives. Furthermore, the human capital approach is in contrast to the "willingness-to-pay" approach, which tries to estimate the value a person assigns to reducing his or her risk of premature death.

A more controversial component in the computation of the lifetime costs of smoking concerns the treatment of transfer payments. These transfer payments include the reduction in income taxes and insurance premiums paid by smokers because of reduced earnings associated with smoking-related illnesses, the value of Social Security and private pensions foregone because of smoking-related premature deaths, higher health care costs associated with smoking-related illnesses and paid by public and private insurance plans, and increased sick pay and disability benefits paid during smoking-related illnesses. Particularly objectionable to many people is the idea that foregone Social Security and private pension benefits from smokers who die prematurely from smoking-related illnesses should be considered "benefits" to nonsmokers. As

Harris (U.S. House of Representatives 1994) and others have noted, premature deaths are not considered a benefit when policymakers determine what levels of funded research are appropriate for reducing premature deaths from other risk exposures (CSH 1994; Warner et al. 1995, 1999). Nevertheless, several recent estimates of the costs of smoking have considered these foregone benefits in their computations of the economic costs of cigarette smoking (Manning et al. 1989, 1991; Shoven et al. 1989). These studies aim to provide a complete accounting of the costs of smoking to answer the question of whether payments by those who have ever smoked into collectively financed systems such as Medicare and Social Security equal receipts by those who have ever smoked.

Theoretically Optimal Cigarette Taxes

As was just discussed, several estimates of the optimal or fair tax on cigarettes are based on the various studies of the costs of smoking. In the context of the preceding discussion, an optimal tax is one that equates the total revenues from these taxes to the net external costs of cigarette smoking. These estimates have ranged from those implying that current taxes more than cover the external costs of smoking (Manning et al. 1989) to those that have suggested that current taxes are far too low. For example, one such study that included the costs of the long-term intellectual and physical consequences resulting from smoking-related low birth weight among infants born to mothers who smoke indicated that \$4.80 was an appropriate tax on a pack of cigarettes (Hay 1991).

Another study (Pigou 1962) advanced a similar notion in providing a theoretical justification for taxes on goods with market prices not fully reflecting the social costs associated with their production and consumption. From that perspective, these taxes could be viewed as improving economic efficiency by raising a smoker's marginal cost of smoking to a level nearer the social marginal cost. For some goods, taxes could generate revenues that exceed total external costs because the taxes would be based on marginal rather than average external costs (Cook and Moore 1993).

Estimates of optimal taxes on cigarettes imply that smokers are fully informed about the risks associated with cigarette smoking (Cordes et al. 1990). If smokers underestimate these risks, then even higher taxes could be appropriate to discourage people from smoking. This issue may be particularly relevant for an addictive product such as cigarettes if, when people take up smoking, they do not fully understand the addictive properties of consumption and the implications of

addiction for future choices. Gruber and Koszegi (2000), for example, concluded that if these "internalities" are taken into account, they suggest sizable additional taxes of one dollar or more per pack of cigarettes.

Among the most widely cited recent estimates of the optimal tax are the studies of the economic costs of cigarette smoking by Manning and colleagues (1989, 1991). These incidence-based estimates used data from the RAND Corporation's Health Insurance Experiment and the 1983 National Health Interview Survey. To calculate the optimal tax on cigarettes, the analyses estimated both the lifetime external costs associated with cigarette smoking and the perceived "savings" that result from smokers' dying earlier and not realizing their pension and Social Security benefits.

Using their midrange estimates, Manning and colleagues (1989, 1991) concluded that for a new smoker, the total external cost of smoking was 43 cents per pack of cigarettes in 1986. This estimate comprised 1 cent in extra costs for sick leave, 2 cents in costs for smoking-related fires, 5 cents in added costs for group life insurance, 9 cents in lost tax revenues (to finance retirement and health benefits), and 26 cents in spending on additional medical care. These costs would be offset, however, by an estimated 27 cents per pack in external savings resulting from smoking-related premature deaths. Converting these figures to 1995 dollars (based on the medical service price index and the gross national product deflator), the CRS estimated a net external cost of 33 cents per pack for cigarettes, which is approximately two-thirds of the average federal, state, and local taxes on cigarettes of 50 cents per pack in late 1993 (Gravelle and Zimmerman 1994). The CRS thus concluded that smokers were more than paying their way.

Critics of the studies of Manning and colleagues (1989, 1991) contend that many of the assumptions made in obtaining the estimates are inappropriate. If the analyses had not included the effects of unrealized pension and Social Security benefits of smokers who die prematurely, the resulting external costs of smoking would have amounted to approximately 89 cents per pack in 1995 dollars.

Moreover, the studies of Manning and colleagues (1989, 1991) made a debatable distinction between internal costs (those borne by the smoker) and external costs (those that smokers impose on nonsmokers). For example, the lost productivity costs described in those analyses were treated as internal costs, whereas only the higher, collectively financed, group premiums for health, life, and other insurance that nonsmokers paid to cover smoking-related costs not reflected in the premiums paid by smokers were considered external costs.

More controversial, however, was these analyses' assumption that the cost of ETS was an internal cost. This assumption was based on the argument that the family is the economic unit involved in making smoking and other decisions and that the health consequences of ETS are largely confined to the nonsmoking spouses of smokers. As Manning and colleagues (1991) note, when this assumption is modified to treat the consequences of passive smoking as external costs, the estimated external costs of smoking rise significantly. For example, under the assumptions of Gravelle and Zimmerman (1994) concerning prices, the estimates of Manning and colleagues (1991) imply that including the relatively conservative estimate of 2,400 lung cancer deaths from ETS would add approximately 31 cents per pack (in 1995 dollars) to the external costs of smoking. Similarly, updating the researchers' estimates of the costs of neonatal care for smoking-related low birth weight would add more than 4 cents per pack. Doing the same for deaths from smoking-related fires would add 20 cents per pack and for smoking-related fetal deaths would add 31 cents per pack.

These estimates probably understate the true costs of ETS. After reviewing the literature on the links between ETS and heart disease, Glantz and Parmley (1995) concluded that 30,000–60,000 persons die prematurely from heart disease related to ETS. Including these numbers in estimates by using the same assumptions used in the CRS report would add at least another 70 cents to the estimate of the optimal tax. Moreover, the CRS report ignored the 150,000–300,000 cases of ETS-linked lower respiratory tract infections in children up to 18 months old and the ETS-linked worsening of asthma in 200,000 to 1 million children (Environmental Protection Agency [EPA] 1992). Including these costs would lead to an even larger optimal tax. Finally, the estimates excluded the long-term developmental consequences suffered by infants with smoking-related low birth weight (Hay 1991); were these costs included, the optimal cigarette tax would be nearly \$5 per pack.

Using the human capital approach, Manning and colleagues (1989, 1991) estimated that the life of a nonsmoker who died prematurely from ETS exposure was worth \$1.66 million. In a recent cost-benefit evaluation of the proposed Smoke-Free Environment Act of 1993 (introduced in the 103rd Congress but not passed), the EPA (Mudarri 1994) used the willingness-to-pay approach and obtained a \$4.8 million baseline estimate of the value of a life. The EPA also used this approach to include the effects of ETS on heart disease and children's health when calculating the value of benefits from reduced ETS exposure.

By using the willingness-to-pay approach and making some relatively conservative assumptions, the EPA estimated that the total benefits from the reduced ETS exposure that would result from a ban on smoking in all worksites was \$39–71 billion per year. This estimate assumed that the ban would reduce the number of current smokers by 3–6 percent, the number of future smokers by 5–10 percent, and consumption among continuing smokers by 10–15 percent; the resulting total long-run reduction in consumption would be 14–22 percent. The combined effect of these reductions in smoking and of the creation of designated smoking areas was predicted to reduce out-of-home exposures to ETS by 90 percent and in-home exposures by a midrange estimate of 6 percent. Estimates from the 1992 EPA report on ETS and lung cancer suggested that 73 percent of exposures to ETS occur outside the home and that 27 percent occur in the home. The total reduction in ETS exposure was thus predicted to be 66 percent; if it were applied to estimated total ETS costs of \$58.7–106.9 billion, this reduction would yield the EPA's estimated cost benefits of \$39–71 billion. Given current cigarette sales of about 24 billion packs per year, this estimate implied that the per pack external costs of ETS were between \$2.45 and \$4.45. This estimate is likely to be low, because the short-term and long-term costs of fetal and perinatal exposure to ETS were not included in the EPA's computations.

Viscusi (1995), however, reached a much different conclusion in analyzing the social costs of smoking. This investigator updated much of the analysis by Manning and colleagues (1989, 1991), used a willingness-to-pay approach, and included the same ETS risks used in the EPA's analysis (Mudarri 1994). Viscusi, however, argued that the EPA approach overestimated the risks of ETS by failing to account for the change in the tar content of cigarettes and the changes in cigarette consumption per smoker. Noting that the average tar content of cigarettes declined from 46.1 mg per cigarette in 1944 to 12 mg per cigarette in 1994, Viscusi asserted that the health risks associated with cigarette smoking, as well as the risks from exposure to ETS, are linearly related to the tar content of cigarettes. Although presenting no evidence for either assertion, he contended that estimates of the health risks based on consumption of higher-tar cigarettes and exposure to ETS from higher-tar cigarettes need to be adjusted to reflect the decline in tar content. When not adjusting for tar, Viscusi obtained an estimate for the per pack external costs of cigarette smoking well above the average tax on a pack of cigarettes; when adjusting for tar, he concluded that current cigarette taxes exceed the external costs of smoking.

A clear consensus is lacking regarding the optimal tax on cigarettes. Optimal tax calculations from prevalence-based estimates that include the direct and indirect costs of smoking-related morbidity and mortality are likely to be inappropriate, because the calculations include lost productivity and other costs that should arguably be considered internal costs. Similarly, optimal tax calculations from the recent incidence-based estimates probably underestimate the optimal tax, because these calculations exclude many of the external costs of smoking. Nevertheless, because of the growing evidence of the substantial health consequences of exposure to ETS (including fetal and perinatal exposure), a tax that would generate sufficient revenues to cover all external costs from smoking is likely well above the current average of federal, state, and local taxes on cigarettes.

Cigarette Taxes and Health

As the review of studies on cigarette demand demonstrated, increases in cigarette prices lead to substantial reductions in cigarette smoking by deterring smoking initiation among youth, prompting smoking cessation among adults, and reducing the average cigarette consumption among continuing smokers. Because of the substantial health consequences of cigarette smoking and the health benefits of smoking cessation, these reductions in cigarette smoking would lead to significant improvements in health by reducing smoking-related morbidity and mortality. Thus, increases in cigarette excise taxes, which would result in increases in cigarette prices, would be an effective policy tool in improving health.

Several recent studies have provided some estimates of the health benefits resulting from cigarette tax increases. For example, Warner (1986) used published estimates of price elasticity (Lewit et al. 1981; Lewit and Coate 1982) to estimate the impact of higher cigarette excise taxes on smoking and health. The study predicted that a sustained, real 15 percent tax-induced increase in cigarette prices in 1984 (which would have been equivalent to restoring the federal tax to its real value in 1951—a nominal tax of 32 cents per pack) would deter 800,000 young people from smoking and encourage about 2.7 million adults to quit. Using the conservative assumption that one of every four lifelong smokers dies prematurely of a smoking-related illness, the researchers estimated that this tax increase would reduce premature deaths among persons 12 years and older by 860,000.

The GAO (1989) used the same estimates of price elasticity to predict the health benefits from a sustained,

real tax increase of 21 cents per pack in 1989 (which they estimated would raise the price by 15 percent). Using the one-in-four assumptions made by Warner (1986), the analysis estimated that this tax increase would reduce the number of youth who smoke by 500,000 and would subsequently reduce premature deaths from cigarette smoking among youth by 125,000.

Harris (1987) used various estimates of the price elasticity of demand in an analysis of the health implications of the 1983 tax hike and corresponding price increase. The analysis concluded that this tax increase deterred 600,000 young people from smoking. After reviewing the epidemiologic literature, Harris estimated that an additional 54,000 young people and a total of 100,000 people would survive to at least 65 years of age as a result of the tax increase.

Two recent studies directly examined the health benefits of increases in cigarette excise taxes (Moore 1995; Evans and Ringel 1999). Using annual state-level death rates from smoking-related diseases (including heart disease, lung cancer, cardiovascular disease, mouth and throat cancer, and asthma), the study directly estimated, through appropriate econometric methods, the impact of higher taxes on health. The resulting estimates implied that a 10-percent increase in cigarette excise taxes would save approximately 5,200 lives annually. Similarly, Evans and Ringel (1999), using data from the 1989–1992 Natality Detail files, concluded that higher cigarette taxes would significantly improve birth outcomes.

The CSH (1994) analyzed the health benefits of higher cigarette excise taxes by using relatively conservative estimates of the price elasticity of demand and of deaths related to cigarette smoking. The study estimated that, based on 1992 taxes and cigarette smoking data, an increase of 75 cents per pack in the federal cigarette excise would reduce premature deaths by 900,000. The study further estimated that a \$2.00 increase would save an additional 1 million lives.

Similarly, Chaloupka (1998) provided estimates of the effects of alternative cigarette tax and price increases contained in various national tobacco settlement proposals based on Chaloupka and Grossman's (1996) econometric analysis of youth smoking. For example, he estimated that a \$1.50 increase in cigarette taxes and prices, phased in over a relatively short period of time and then adjusted for inflation, would reduce overall cigarette consumption by approximately 30 percent, while cutting the prevalence of youth smoking nearly in half. Given the CDC's recent estimate that 16,620,878 youth in the 1995 cohort of 0- through 17-year-olds would eventually become smokers and

that 32 percent of regular smokers eventually die from a smoking-related disease, Chaloupka (1998) estimated that this tax would prevent approximately 2.5 million premature deaths in this cohort.

The substantial econometric literature clearly indicates that increases in cigarette prices will reduce both smoking prevalence and average cigarette consumption. Because of the well-documented health consequences of smoking, tax-induced increases in cigarette prices would generate substantial improvements in health. Thus, higher taxes on cigarettes and other tobacco products appear appropriate from a public health perspective. In addition, at a gathering convened by the CDC to evaluate the criteria for defining an optimal cigarette tax, economists raised two further reasons for higher cigarette taxes (Warner et al. 1995). First, to the extent that adolescents and young adults do not fully understand the addictive nature of cigarette smoking, the argument could be made that higher cigarette taxes can reduce smoking by youth before it is too late for them to quit easily. Second, to the extent that youth behave more myopically than adults (in particular, more than the adults that they will later be), young people are more likely to take on a habit with long-term health consequences. Thus, by discouraging smoking, the higher tax can help correct youth's myopic behavior.

Although higher cigarette taxes are likely to produce substantial improvements in health, several factors could mitigate the impact of these taxes. First, as the limited research on the demand for smokeless tobacco products suggests (Ohsfeldt and Boyle 1994; Ohsfeldt et al. 1997, 1999), increases in cigarette taxes not matched by similar increases in smokeless tobacco taxes may induce people to substitute other tobacco products with similar health consequences. For example, the large increases in Canada's cigarette excise taxes and the consequent increases in the differential between cigarette taxes and taxes on roll-your-own tobacco led to a sharp rise in the use of the latter (Department of Finance, Canada 1993). This substitution could easily be avoided by increasing all tobacco taxes simultaneously. Canada's experience also raises the issue of equalized taxes between nations, because relatively large tobacco tax hikes resulted in a border-crossing black market in cigarettes and other tobacco products as well as in other efforts to avoid taxes. Alternatively, as Evans and Farrelly (1998) found, the higher taxes may lead smokers to change the kinds of cigarettes they smoke (i.e., they may switch to higher-tar and higher-nicotine cigarettes), thereby reducing the health benefits of higher cigarette taxes. The results of the study by Evans and Farrelly suggest that

taxes based on the tar, nicotine, and carbon monoxide content of cigarettes (first suggested by Harris 1980) may be the most appropriate means to address the public health consequences of smoking.

Of course, cigarettes and other tobacco products are not the only goods that can be taxed on the basis of these arguments. Heavy consumption of alcoholic beverages, for example, also leads to health problems, unintentional injuries, property damage, and other consequences. Cook and Moore (1993) provide a detailed discussion of the rationale for higher alcoholic beverage excise taxes. A number of studies of the “optimal” tax on alcoholic beverages have concluded that current taxes are well below the level that would cover the social costs of alcohol abuse (Manning et al. 1989, 1991; Saffer and Chaloupka 1994).

Tobacco Taxation and Revenues

An alternative rationale for tobacco taxes is that they are a relatively simple way to generate revenues. Even some prominent proponents of the free market philosophy have supported tobacco taxes to generate revenues. “Sugar, rum, and tobacco,” wrote Adam Smith in his 1776 economic treatise, *An Inquiry Into the Nature and Causes of the Wealth of Nations*, “are commodities which are no where necessities of life, which are become objects of almost universal consumption, and which are therefore extremely proper subjects of taxation” (1976, Book V, p. 474).

As described earlier in this chapter (in “Rationales for Tobacco Taxation”), various levels of government have long used cigarette and other tobacco taxes to raise revenues. Such policy is supported by economic theory. An economically efficient way to raise revenues while minimizing the welfare losses associated with the price distortions resulting from taxes is to impose relatively higher taxes on goods with more inelastic demand (one for which the percentage reduction in demand is smaller than the percentage increase in price) (Ramsey 1927). As described earlier in this chapter (in “Effect of Price on Demand for Tobacco Products”), the numerous studies of cigarette demand and the limited studies of the demand for other tobacco products have implied that overall demand, at least in the short run, is inelastic. Thus, large increases in tobacco taxes can generate substantial increases in revenues, particularly in the short run.

Since 1960, the dollar amount of federal revenues generated by tobacco taxes has increased significantly, from \$1.9 billion to nearly \$5.9 billion in 1997. Over this same period, state revenues from tobacco have also increased significantly in nominal terms, from slightly

less than \$1 billion to more than \$7.5 billion. As new sources of tax revenues have been identified, however, tobacco revenues have constituted a smaller proportion of total revenues. Tobacco taxes accounted for 3.36 percent of all federal revenues in 1950, but they were only 0.44 percent of revenues in 1989 (CBO 1990). Similarly, total federal tobacco tax revenues as a share of the gross national product fell from 0.55 percent in 1950 to 0.08 percent in 1989.

Merriman (1994) considered whether cigarette excise taxes are set to maximize the revenues from these taxes. More specifically, Merriman tested the idea that elected officials, in an effort to maximize their own utility, may increase taxes on some goods to the point where revenues from these taxes begin to decline (Buchanan and Lee 1982). Using published estimates of cigarette demand (Becker et al. 1994), the study found that cigarette excise taxes in every state were well below the revenue-maximizing level of these taxes, at least as of 1985. Furthermore, these estimates of the marginal revenue effects of higher taxes were lower-bound estimates, because they held constant other states’ taxes (a consideration that allowed for increases in the casual and organized smuggling of cigarettes in response to a tax hike in a given state). Coordinated state tax increases, as a result, would generate even higher revenues.

Grossman (1993) considered this issue of maximizing the federal excise tax on cigarettes. Using published estimates of cigarette demand (Chaloupka 1991; Becker et al. 1994), Grossman predicted that in the long run, a real federal tax rate of \$1.26 would maximize federal tax revenues at \$16 billion and would generate even larger immediate increases in revenues. Likewise, Becker and Grossman (1994) suggested that the long-run revenue-maximizing value of the federal cigarette excise tax is 95 cents per pack in 1994 dollars. This tax would generate approximately \$12 billion in total revenues and would raise considerably more than in the short run. These estimates were consistent with the prediction that a sustained real increase of 75 cents in the federal tax on cigarettes would in the long run lead to a net increase in cigarette tax revenues of just over \$16 billion (Gravelle and Zimmerman 1994).

Other studies, however, have predicted that higher federal taxes would generate much greater revenues (Harris 1994; Womach 1994a). For example, Harris has predicted that raising the federal tax to \$2.00 per pack would have generated nearly \$20 billion in additional revenues annually, on average, from 1995 through 1999, whereas Chaloupka (1998) estimates that a \$1.50 increase would, in the short run, raise \$22.5 billion annually.

The differences among the predicted revenue effects of higher cigarette taxes may be attributed to different assumptions used to obtain these estimates as well as to differences in the period for which the predictions are made. For example, two studies (Grossman 1993; Becker and Grossman 1994) have assumed a linear demand function for cigarettes. One of the implications of this function is that the price elasticity of demand rises as price rises. Thus, when the effects of a large increase in the cigarette excise tax are predicted, cigarette demand is assumed to become more responsive to price. This assumption implies that there is an inverted U-shaped relationship between cigarette taxes and revenues: increasing cigarette taxes from relatively low levels will initially lead to increased revenues; beyond some point, further increases in taxes will lead to even larger reductions in demand, thereby causing revenues to fall. The same basic argument is implicit in the well-known Laffer curve, which relates income tax rates to income tax revenues.

The assumption of a linear demand function for cigarettes is in contrast to the assumption made by some other analysts that the price elasticity of demand is constant over the range of prices under consideration. Because almost all of the studies described in this section found that the demand for cigarettes is inelastic, the assumption of a constant elasticity implies that even very large increases in taxes will always generate large increases in revenues.

The differences in revenues predicted by these two assumptions, although only minor when analyses predict the impact of relatively small cigarette tax increases, grow with the size of the tax increase. Because either assumption could be questioned, the revenue effects of a tax increase will likely fall somewhere between the predictions obtained from the two (Grossman et al. 1993). The limited evidence from the behavioral economics literature suggests, however, that the effects of large increases in cigarette prices will lead to larger reductions in cigarette demand than predicted by the assumption of a linear demand function (Bickel et al. 1991).

A second key factor leading to the differences discussed here is the distinction between the short-run and long-run effects of the tax hikes. Economic theory implies that the demand for most consumer goods will be more responsive to price in the long run than in the short run. For cigarettes and other tobacco products, additional factors increase the likelihood that the long-run effects of an increase in price on cigarette demand will exceed the short-run effects—that is, price elasticity will increase in a manner similar to the increase for other, nonaddictive goods and services. Increased

cigarette taxes will thus lead to smaller increases in revenues in the long run than in the short run.

That adolescents and young adults are more responsive to prices than older adults are and the fact that cigarette smoking is an addictive behavior are of particular importance when predicting the short-run and long-run revenue effects of higher cigarette taxes. Age difference in price elasticity implies that sustained real tax increases will lead to greater reductions in smoking prevalence and consumption as the number of adolescents and young adults who have not yet decided to smoke replaces the number of older adults who already smoke. The assumption of addiction implies that price has a cumulative effect on consumption: the price increase immediately reduces current consumption by discouraging young people from experimenting or continuing to experiment with smoking, as well as by encouraging current smokers to smoke less; future consumption is then reduced by the continuously fewer current smokers who also continue to smoke less in the face of a sustained real increase in price. The cumulative effect of price on consumption thus exceeds the immediate effect. This sequence ultimately leads to reduced revenues.

In summary, federal and most state excise taxes on cigarettes are undoubtedly well below their revenue-maximizing levels. Thus, relatively large increases in these taxes would lead to substantial gains in revenues, particularly in the short run. Moreover, because of the relatively inelastic demand for cigarettes, increases in cigarette taxes are an economically efficient means of generating substantial revenues while imposing relatively small welfare losses. But if there is little argument that large increases in cigarette taxes would generate substantial increases in tax revenues in the short run, there are some questions on the revenue-maximizing values of these taxes and the long-run stability of revenues generated by large increases in cigarette taxes.

Part of the difficulty in estimating the effects of large taxes on cigarettes is that there is little experience in the United States with relatively large increases. Similarly, it is unlikely that the long-run effects of the more recent large tax increases have been fully played out. The short-term experience in Canada is of limited use in addressing these issues. Cigarette taxes in Canada increased more than 500 percent between 1982 and 1992, which increased real cigarette prices by 170 percent, and total smoking fell by 38 percent (Sweanor and Martial 1994). Because of the effects of other, contemporaneous activities to reduce tobacco use, the impact of the large price increases on smoking were consistent with the estimates from the studies of U.S. cigarette demand

described in this chapter. Moreover, total federal and provincial revenues generated by Canadian cigarette taxes were 240 percent higher in 1992 than in 1981 even with the concomitant considerable black market in

cigarettes. This experience suggests that large increases in cigarette taxes in the United States would generate sizable tax revenues for many years.

Conclusions

1. The price of tobacco has an important influence on the demand for tobacco products, particularly among young people.
2. Substantial increases in the excise taxes on cigarettes would have a considerable impact on the prevalence of smoking and, in the long term, reduce the adverse health effects caused by tobacco.
3. Policies that influence the supply of tobacco, particularly those that regulate international commerce, can have important effects on tobacco use.
4. Although employment in the tobacco sector is substantial, the importance of tobacco to the U.S. economy has been overstated. Judicious policies can be joined to higher tobacco taxes and stronger prevention policies to ease economic diversification in tobacco-producing areas.

References

- Advisory Commission on Intergovernmental Relations. *Cigarette Bootlegging: A State and Federal Responsibility. A Commission Report*. Washington: Advisory Commission on Intergovernmental Relations, 1977.
- Advisory Commission on Intergovernmental Relations. *Cigarette Tax Evasion: A Second Look*. Washington: Advisory Commission on Intergovernmental Relations, 1985.
- Advisory Commission on Intergovernmental Relations. *Significant Features of Fiscal Federalism. Volume 1: Budget Processes and Tax Systems*. Washington: Advisory Commission on Intergovernmental Relations, 1991.
- American Economics Group, Inc. *The U.S. Tobacco Industry in 1994: Its Economic Impact in the States*. Washington: American Economics Group, Inc., 1996.
- Arthur Andersen Economic Consulting. *Tobacco Industry Employment: A Review of the Price Waterhouse Economic Impact Report and Tobacco Institute Estimates of "Economic Losses from Increasing the Federal Excise Tax."* Los Angeles: Arthur Andersen Economic Consulting, 1993.
- Ashenfelter O, Sullivan D. Nonparametric tests of market structure: an application to the cigarette industry. *Journal of Industrial Economics* 1987;35(4):483–98.
- Baltagi BH, Goel RK. Quasi-experimental price elasticities of cigarette demand and the bootlegging effect. *American Journal of Agricultural Economics* 1987;69(4):750–4.
- Baltagi BH, Levin D. Estimating dynamic demand for cigarettes using panel data: the effects of bootlegging, taxation, and advertising reconsidered. *Review of Economics and Statistics* 1986;68(1):148–55.
- Baltagi BH, Levin D. Cigarette taxation: raising revenues and reducing consumption. *Structural Change and Economic Dynamics* 1992;3(2):321–35.
- Barnett PG, Keeler TE, Hu T-w. Oligopoly structure and the incidence of cigarette excise taxes. *Journal of Public Economics* 1995;57(3):457–70.
- Barzel Y. An alternative approach to the analysis of taxation. *Journal of Political Economy* 1976;84(6):1177–97.
- Becker GS, Grossman M. . . . And cigarette revenues up in smoke. *Wall Street Journal*, Aug 9, 1994;Sect A:12 (col 3).
- Becker GS, Grossman M, Murphy KM. An empirical analysis of cigarette addiction. *American Economic Review* 1994;84(3):39–418.
- Becker GS, Murphy KM. A theory of rational addiction. *Journal of Political Economy* 1988;96(4):675–700.
- Bickel WK, DeGrandpre RJ. Modeling drug abuse policy in the behavioral economics laboratory. In: Green L, Kagel JH, editors. *Advances in Behavioral Economics. Volume 3: Substance Use and Abuse*. Norwood (NJ): Ablex Publishing Corporation, 1996;69–95.
- Bickel WK, DeGrandpre RJ, Higgins ST. Behavioral economics: a novel experimental approach to the study of drug dependence. *Drug and Alcohol Dependence* 1993;33(2):173–92.
- Bickel WK, DeGrandpre RJ, Hughes JR, Higgins ST. Behavioral economics of drug self-administration. II. A unit-price analysis of cigarette smoking. *Journal of the Experimental Analysis of Behavior* 1991;55(2):145–54.
- Bickel WK, Hughes JR, DeGrandpre RJ, Higgins ST, Rizzuto P. Behavioral economics of drug self-administration. IV. The effects of response requirement on the consumption of and interaction between concurrently available coffee and cigarettes. *Psychopharmacology* 1992;107(2–3):211–6.
- Bickel WK, Madden GJ. The behavioral economics of smoking. In: Chaloupka FJ, Grossman M, Bickel WK, Saffer H, editors. *The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Economic Research*. Chicago: University of Chicago Press, 1999:31–66.
- Bishop JA, Yoo JH. "Health scare," excise taxes and advertising ban in the cigarette demand and supply. *Southern Economic Journal* 1985;52(2):402–11.

- Bloom JL. International Interests in U.S. Tobacco Legislation, Health Science Analysis Project Policy Analysis Paper No. 3, 1998;<<http://www.advocacy.org/hsap/international.htm>>; accessed: March 3, 2000.
- British-American Tobacco Company Limited. *Tobacco Taxation Guide: A Guide to Alternative Methods of Taxing Cigarettes and Other Tobacco Products*. Staines (UK): British-American Tobacco Company Limited, 1994.
- Buchanan JM, Lee DR. Tax rates and tax revenues in political equilibrium: some simple analytics. *Economic Inquiry* 1982;20(3):344–54.
- Bulow JI, Pfleiderer P. A note on the effect of cost changes on prices. *Journal of Political Economy* 1983; 91(1):182–5.
- Bureau of Alcohol, Tobacco and Firearms. Tax and Rate Fees;<<http://www.atf.treas.gov/firearms/information/aftaxes.htm>>; accessed: July 6, 2000.
- California Department of Health Services. *Health and Economic Impact of Smoking: California, 1988*. Technical Report No. 5. Berkeley (CA): California Department of Health Services, California Chronic and Sentinel Diseases Surveillance Program, 1992.
- Centers for Disease Control and Prevention. Medical-care expenditures attributable to cigarette smoking—United States, 1993. *Morbidity and Mortality Weekly Report* 1994;43(26):469–72.
- Centers for Disease Control and Prevention. Response to increases in cigarette prices by race/ethnicity, income, and age groups—United States, 1976–1993. *Morbidity and Mortality Weekly Report* 1998;47(29):605–9.
- Chaloupka F. Clean indoor air laws, addiction and cigarette smoking. *Applied Economics* 1992;24(2):193–205.
- Chaloupka FJ. *Men, women, and addiction: the case of cigarette smoking*. Working paper no. 3267. Cambridge (MA): National Bureau of Economic Research, 1990.
- Chaloupka FJ. Rational addictive behavior and cigarette smoking. *Journal of Political Economy* 1991;99(4): 722–42.
- Chaloupka FJ. The Impact of Proposed Cigarette Price Increases, Health Science Analysis Project Policy Analysis Paper No. 9, 1998;<<http://www.advocacy.org/pub.htm>>; accessed: September 23, 1999.
- Chaloupka F, Corbett M. Trade policy and tobacco: towards an optimal policy mix. In: Abedian I, van der Merwe R, Wilkins N, Jha P, editors. *The Economics of Tobacco Control: Towards an Optimal Policy Mix*. Cape Town (South Africa): Applied Fiscal Research Centre, University of Cape Town, 1998:129–45.
- Chaloupka FJ, Grossman M. *Price, tobacco control policies and youth smoking*. Working paper no. 5740. Cambridge (MA): National Bureau of Economic Research, 1996.
- Chaloupka FJ, Hu T-W, Warner KE, van der Merwe R, Yurekli A. The taxation of tobacco products. In: Jha P, Chaloupka FJ, editors. *Tobacco Control in Developing Countries*. Oxford: Oxford University Press, in press.
- Chaloupka FJ, Laixuthai A. *U.S. trade policy and cigarette smoking in Asia*. Working paper no. 5543. Cambridge (MA): National Bureau of Economic Research, 1996.
- Chaloupka FJ, Pacula RL. Sex and race differences in young people's responsiveness to price and tobacco control policies. *Tobacco Control* 1999;8(4):373–7.
- Chaloupka FJ, Pacula RL, Farrelly MC, Johnston LD, O'Malley PM, Bray JW. *Do higher cigarette prices encourage youth to use marijuana?* Working paper no. 6939. Cambridge (MA): National Bureau of Economic Research, 1999.
- Chaloupka FJ, Saffer H. Clean indoor air laws and the demand for cigarettes. *Contemporary Policy Issues* 1992;10(2):72–83.
- Chaloupka FJ, Tauras JA, Grossman M. Public policy and youth smokeless tobacco use. *Southern Economic Journal* 1997;64(2):503–16.
- Chaloupka FJ, Wechsler H. Price, tobacco control policies and smoking among young adults. *Journal of Health Economics* 1997;16(3):359–73.
- Clarifield KW. Cigarette sales impress and confound. *Industry Surveys*. Vol. 1. New York: Standard & Poor's Corporation, Jan 1983:B93.

- Coalition on Smoking OR Health. *Trade Policy on Tobacco Exports: Statement of the Coalition on Smoking OR Health*. Washington: Coalition on Smoking OR Health, 1994.
- Congressional Budget Office. *Federal Taxation of Tobacco, Alcoholic Beverages, and Motor Fuels*. Washington: US Government Printing Office, 1990.
- Connolly G, Chen T. International health and tobacco use. In: Houston TP, editor. *Tobacco Use: An American Crisis*. Final report of the conference; Jan 9–12, 1993; Washington, DC. Chicago: American Medical Association, 1993:72–4.
- Contracting Parties to the General Agreement on Tariffs and Trade. Thailand: restrictions on importation of and internal taxes on cigarettes. In: *Basic Instruments and Selected Documents. Supplement No. 37. Protocols, Decisions, Reports 1989–1990 and Forty-Sixth Session*. Geneva: Contracting Parties to the General Agreement on Tariffs and Trade, 1991:200–28.
- Cook PJ, Moore MJ. Taxation of alcoholic beverages. In: Hilton ME, Bloss G, editors. *Economics and the Prevention of Alcohol-Related Problems*. Research Monograph No. 25. Rockville (MD): US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism, 1993:33–58. NIH Publication No. 93-3513.
- Cordes JJ, Nicholson EM, Sammartino FJ. Raising revenue by taxing activities with social costs. *National Tax Journal* 1990;43(3):343–56.
- DeGrandpre RJ, Bickel WK, Higgins ST, Hughes JR. A behavioral economic analysis of concurrently available money and cigarettes. *Journal of the Experimental Analysis of Behavior* 1994;61(2):191–201.
- DeGrandpre RJ, Bickel WK, Hughes JR, Higgins ST. Behavioral economics of drug self-administration. III. A reanalysis of the nicotine regulation hypothesis. *Psychopharmacology* 1992;108(1–2):1–10.
- Department of Finance, Canada. *Tobacco Taxes and Consumption*. Ottawa (Canada): Department of Finance, Canada, 1993.
- Doron G. *The Smoking Paradox: Public Regulation in the Cigarette Industry*. Cambridge (MA): Abt Associates, 1979.
- Douglas S. The duration of the smoking habit. *Economic Inquiry* 1998;36(1):49–64.
- Douglas S, Hariharan G. The hazard of starting smoking: estimates from a split population duration model. *Journal of Health Economics* 1994;13(2):213–30.
- Eckard EW Jr. Competition and the cigarette TV advertising ban. *Economic Inquiry* 1991;29(1):119–33.
- Eddy P, Walden S. Invasion. *Telegraph Magazine*, May 22, 1993:18–32.
- Elster J. *Ulysses and the Sirens: Studies in Rationality and Irrationality*. Cambridge: Cambridge University Press, 1979.
- Environmental Protection Agency. *Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders*. Washington: Environmental Protection Agency, Office of Research and Development, Office of Air and Radiation, 1992. EPA/600/6-90/006F.
- Evans WN, Farrelly MC. The compensating behavior of smokers: taxes, tar, and nicotine. *RAND Journal of Economics* 1998;29(3):578–95.
- Evans WN, Ringel JS. Can higher cigarette taxes improve birth outcomes? *Journal of Public Economics* 1999; 72:135–54.
- Farrelly MC, Bray JW, Zarkin GA, Wendling BW, Pacula RL. *The effects of prices and policies on the demand for marijuana: evidence from the National Household Surveys on Drug Abuse*. Working paper no. 6940. Cambridge (MA): National Bureau of Economic Research, 1999.
- Federal Trade Commission. *Competition and the Financial Impact of the Proposed Tobacco Industry Settlement*. Washington: Federal Trade Commission, Bureaus of Economics, Competition, and Consumer Protection, 1997.
- Flewelling RL, Kenney E, Elder JP, Pierce J, Johnson M, Bal DG. First-year impact of the 1989 California cigarette tax increase on cigarette consumption. *American Journal of Public Health* 1992;82(6):867–9.
- Food and Agriculture Organization of the United Nations. *Tobacco: Supply, Demand and Trade Projections, 1995 and 2000*. FAO Economic and Social Development Paper 86. Rome: Food and Agriculture Organization of the United Nations, 1990.

- General Accounting Office. *Report by the Comptroller General of the United States. Tobacco Program's Production Rights and Effects on Competition*. Washington: General Accounting Office, 1982. CED-82-70.
- General Accounting Office. *Teenage Smoking: Higher Excise Tax Should Significantly Reduce the Number of Smokers*. Washington: General Accounting Office, 1989.
- General Accounting Office. *Trade and Health Issues: Dichotomy Between U.S. Tobacco Export Policy and Anti-smoking Initiatives*. Washington: General Accounting Office, 1990. GAO/NSIAD-90-190.
- General Accounting Office. *International Trade: Advertising and Promoting U.S. Cigarettes in Selected Asian Countries*. Washington: General Accounting Office, 1992. GAO/GGD-93-38.
- Glantz SA, Parmley WW. Passive smoking and heart disease: mechanisms and risk. *Journal of the American Medical Association* 1995;73(13):1047–53.
- Goel RK, Morey MJ. The interdependence of cigarette and liquor demand. *Southern Economic Journal* 1995; 62(2):451–9.
- Goodman J. *Tobacco in History: The Cultures of Dependence*. New York: Routledge, 1993.
- Gravelle JG, Zimmerman D. *Cigarette Taxes to Fund Health Care Reform: An Economic Analysis*. Washington: Library of Congress, Congressional Research Service, 1994. CRS Publication No. 94-214 E.
- Grise VN. *The World Tobacco Market—Government Intervention and Multilateral Policy Reform*. Staff Report No. AGES 9014. Washington: US Department of Agriculture, Economic Research Service, Commodity Economics Division, 1990.
- Grise VN. *Tobacco: Background for 1995 Farm Legislation*. Agricultural Economic Report No. 709. Washington: US Department of Agriculture, Economic Research Service, 1995.
- Grossman M. For best revenue, tax cigarettes \$1.26. *New York Times*, June 18, 1993;Sect A:26 (col 4).
- Grossman M, Coate D, Lewit EM, Shakotko RA. *Economic and Other Factors in Youth Smoking*. Washington: National Science Foundation, 1983.
- Grossman M, Sindelar JL, Mullahy J, Anderson R. Policy watch: alcohol and cigarette taxes. *Journal of Economic Perspectives* 1993;7(4):211–22.
- Gruber J. *Youth smoking in the U.S.: prices and policies*. Working paper no. 7506. Cambridge (MA): National Bureau of Economic Research, 2000.
- Gruber J, Koszegi B. *Is addiction “rational”? Theory and evidence*. Working paper no. 7507. Cambridge (MA): National Bureau of Economic Research, 2000.
- Harris JE. Taxing tar and nicotine. *American Economic Review* 1980;70(3):300–11.
- Harris JE. The 1983 increase in the federal cigarette excise tax. In: Summers LH, editor. *Tax Policy and the Economy*. Vol. 1. Cambridge (MA): MIT Press, 1987: 87–111.
- Harris JE. *A working model for predicting the consumption and revenue impacts of large increases in the U.S. federal cigarette excise tax*. Working paper no. 4803. Cambridge (MA): National Bureau of Economic Research, 1994.
- Harris JE, Chan SW. The continuum-of-addiction: cigarette smoking in relation to price among Americans aged 15–29. *Health Economics* 1999;8(1):81–6.
- Hay JW. The harm they do to others: a primer on the external costs of drug abuse. In: Krauss MB, Lazear EP, editors. *Searching for Alternatives: Drug-Control Policy in the United States*. Stanford (CA): Hoover Institution Press, 1991:200–25.
- Henningfield JE, Clayton R, Pollin W. Involvement of tobacco in alcoholism and illicit drug use. *British Journal of Addiction* 1990;85(2):279–91.
- Hodgson TA. Annual costs of illness versus lifetime costs of illness and implications of structural change. *Drug Information Journal* 1988;22:323–41.
- Hodgson TA. Cigarette smoking and lifetime medical expenditures. *Milbank Quarterly* 1992;70(1):81–125.
- Holzman D. Tobacco abroad: infiltrating foreign markets. *Environmental Health Perspectives* 1997;105(2): 178–83.

- Hsieh C-R, Lin Y-S. The economics of tobacco control in Taiwan. In: Abedian I, van der Merwe R, Wilkins N, Jha P, editors. *The Economics of Tobacco Control: Towards an Optimal Policy Mix*. Cape Town (South Africa): Applied Fiscal Research Centre, University of Cape Town, 1998:306–29.
- Hu T-w, Bai J, Keeler TE, Barnett PG, Sung H-Y. The impact of California Proposition 99, a major anti-smoking law, on cigarette consumption. *Journal of Public Health Policy* 1994;15(1):26–36.
- Hu T-w, Ren Q-F, Keeler TE, Bartlett J. The demand for cigarettes in California and behavioural risk factors. *Health Economics* 1995a;4(1):7–14.
- Hu T-w, Sung H-Y, Keeler TE. Reducing cigarette consumption in California: tobacco taxes vs an anti-smoking media campaign. *American Journal of Public Health* 1995b;85(9):1218–22.
- Hursh SR, Bauman RA. The behavioral analysis of demand. In: Green L, Kagel JH, editors. *Advances in Behavioral Economics*. Vol. 1. Norwood (NJ): Ablex Publishing Corporation, 1987:117–65.
- Jackson JD, Saba RP. Some limits on taxing sin: cigarette taxation and health care finance. *Southern Economic Journal* 1997;63(3):761–75.
- Jha P, Chaloupka FJ. *Curbing the Epidemic: Governments and the Economics of Tobacco Control*. Washington: World Bank, 1999.
- Johnson PR. *The Economics of the Tobacco Industry*. New York: Praeger Publishers, 1984.
- Johnson TR. Additional evidence on the effects of alternative taxes on cigarette prices. *Journal of Political Economy* 1978;86(2 Pt 1):325–8.
- Joossens L, Chaloupka FJ, Merriman D, Yurekli A. Issues in the smuggling of tobacco products. In: Jha P, Chaloupka FJ, editors. *Tobacco Control in Developing Countries*. Oxford: Oxford University Press, in press.
- Joossens L, Raw M. Smuggling and cross border shopping of tobacco in Europe. *British Medical Journal* 1995;310(6991):1393–7.
- Joossens L, Raw M. Cigarette smuggling in Europe: who really benefits? *Tobacco Control* 1998;7(1):66–71.
- Joossens L, van der Merwe R. *Cigarette Trade and Smuggling*. The Economics of Tobacco Control Project Update No. 7. Cape Town (South Africa): School of Economics, University of Cape Town, 1997.
- Kandel D. Stages in adolescent involvement in drug use. *Science* 1975;190(4217):912–4.
- Kandel D, Yamaguchi K. From beer to crack: developmental patterns of drug involvement. *American Journal of Public Health* 1993;83(6):851–5.
- Keeler TE, Hu T-W, Barnett PG, Manning WG. Taxation, regulation, and addiction: a demand function for cigarettes based on time-series evidence. *Journal of Health Economics* 1993;12(1):1–18.
- Keeler TE, Hu T-w, Barnett PG, Manning WG, Sung H-Y. Do cigarette producers price-discriminate by state? An empirical analysis of local cigarette pricing and taxation. *Journal of Health Economics* 1996;15(4):499–512.
- Lewit EM, Coate D. The potential for using excise taxes to reduce smoking. *Journal of Health Economics* 1982;1(2):121–45.
- Lewit EM, Coate D, Grossman M. The effects of government regulation on teenage smoking. *Journal of Law and Economics* 1981;24(3):545–69.
- Lewit EM, Hyland A, Kerrebrock N, Cummings KM. Price, public policy, and smoking in young people. *Tobacco Control* 1997;6(Suppl 2):S17–S24.
- Lightwood J, Collins D, Lapsley H, Novotny T. Estimating the costs of tobacco use. In: Jha P, Chaloupka FJ, editors. *Tobacco Control in Developing Countries*. Oxford: Oxford University Press, in press.
- Lyon AB, Schwab RM. Consumption taxes in a life-cycle framework: are sin taxes regressive? *Review of Economics and Statistics* 1995;77(3):389–406.
- Manning WG, Keeler EB, Newhouse JP, Sloss EM, Wasserman J. The taxes of sin: do smokers and drinkers pay their way? *Journal of the American Medical Association* 1989;261(11):1604–9.
- Manning WG, Keeler EB, Newhouse JP, Sloss EM, Wasserman J. *The Costs of Poor Health Habits*. Cambridge (MA): Harvard University Press, 1991.

- Markandya A, Pearce DW. The social costs of tobacco smoking. *British Journal of Addiction* 1989;84(10):1139–50.
- Max W, Rice DP. The cost of smoking in California, 1993. *Tobacco Control* 1995;4(Suppl 1):S39–S46.
- Meier KJ, Licari MJ. The effect of cigarette taxes on cigarette consumption, 1955 through 1994. *American Journal of Public Health* 1997;87(7):1126–30.
- Merriman D. Do cigarette excise tax rates maximize revenue? *Economic Inquiry* 1994;32(3):419–28.
- Merriman D, Yurekli A, Chaloupka FJ. How big is the worldwide cigarette-smuggling problem? In: Jha P, Chaloupka FJ. *Tobacco Control in Developing Countries*. Oxford: Oxford University Press, in press.
- Miles RH. *Coffin Nails and Corporate Strategies*. Englewood Cliffs (NJ): Prentice-Hall, 1982.
- Miller RH. The no net cost assessments for tobacco. Remarks prepared for the Tobacco Marketing Cost Committee Meeting; Mar 23–24, 1994; Fletcher (NC).
- Miller LS, Zhang X, Rice DP, Max W. State estimates of total medical expenditures attributable to cigarette smoking, 1993. *Public Health Reports* 1998;113(5):447–58.
- Miller VP, Ernst C, Collin F. Smoking-attributable medical care costs in the USA. *Social Science & Medicine* 1999;48(3):375–91.
- Mitchell ML, Mulherin JH. Finessing the political system: the cigarette advertising ban. *Southern Economic Journal* 1988;54(4):855–62.
- Moore MJ. *Death and tobacco taxes*. Working paper no. 95-2. Durham (NC): Duke University, The Fuqua School of Business, Center for the Study of Business, Regulation, and Economic Policy, 1995.
- Mudarri DH. *The Costs and Benefits of Smoking Restrictions: An Assessment of the Smoke-Free Environment Act of 1993 (H.R. 3434)*. Washington: Environmental Protection Agency, Office of Radiation and Indoor Air, Indoor Air Division, 1994.
- Mullahy J. Cigarette smoking: habits, health concerns, and heterogeneous unobservables in a micro-econometric analysis of consumer demand [dissertation]. Charlottesville (VA): University of Virginia, 1985.
- National Cancer Policy Board. *Taking Action to Reduce Tobacco Use*. Washington: Institute of Medicine and Commission on Life Sciences, National Research Council, 1998.
- Nguyen D. Advertising, random sales response, and brand competition: some theoretical and econometric implications. *Journal of Business* 1987;60(2):259–79.
- Nivola PS. *Regulating Unfair Trade*. Washington: Brookings Institution, 1993.
- Northup AM. U.S. agricultural policy on tobacco. In: Houston TP, editor. *Tobacco Use: An American Crisis*. Final report of the conference; Jan 9–12, 1993; Washington, DC. Chicago: American Medical Association, 1993:84–8.
- Ohsfeldt RL, Boyle RG. Tobacco excise taxes and rates of smokeless tobacco use in the US: an exploratory ecological analysis. *Tobacco Control* 1994;3(4):316–23.
- Ohsfeldt R, Boyle RG, Capilouto E. Effects of tobacco excise taxes on the use of smokeless tobacco products in the U.S. *Electronic Health Economics Letters* 1997;1(3):10–9.
- Ohsfeldt RL, Boyle RG, Capilouto EL. Tobacco taxes, smoking restrictions, and tobacco use. In: Chaloupka FJ, Grossman M, Bickel WK, Saffer H, editors. *The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Economic Research*. Chicago: University of Chicago Press, 1999:15–29.
- Orzechowski and Walker. *The Tax Burden on Tobacco: Historical Compilation 1999*. Arlington (VA): Orzechowski and Walker, 2000.
- Oster G, Colditz GA, Kelly NL. *The Economic Costs of Smoking and Benefits of Quitting*. Lexington (MA): D.C. Heath and Company, 1984.
- Overton J. Diversification and international expansion: the future of the American tobacco manufacturing industry with corporate profiles of the “Big Six.” In: Finger WR, editor. *The Tobacco Industry in Transition*. Lexington (MA): D.C. Heath and Company, 1981: 159–96.
- Pacula RL. *Adolescent alcohol and marijuana consumption: is there really a gateway*. Working paper no. 6348. Cambridge (MA): National Bureau of Economic Research, 1998a.

- Pacula RL. Does increasing the beer tax reduce marijuana consumption? *Journal of Health Economics* 1998b; 17(5):557–85.
- Pacula RL, Grossman M, Chaloupka FJ, O'Malley PM, Johnston LD, Farrelly MC. *Marijuana and youth*. Working paper no. 7703. Cambridge (MA): National Bureau of Economic Research, 2000.
- Peterson DE, Zeger SL, Remington PL, Anderson HA. The effect of state cigarette tax increases on cigarette sales 1955–1988. *American Journal of Public Health* 1992;82(1):94–6.
- Pigou AC. *A Study in Public Finance*. 3rd rev. ed. London: Macmillan and Co., 1962.
- Porter RH. The impact of government policy on the U.S. cigarette industry. In: Ippolito PM, Scheffman DT, editors. *Empirical Approaches to Consumer Protection Economics*. Washington: US Government Printing Office, 1986:447–81.
- Price Waterhouse. *The Economic Impact of the Tobacco Industry on the United States in 1990*. Arlington (VA): Price Waterhouse, 1992.
- Ramsey FP. A contribution to the theory of taxation. *Economic Journal* 1927;37(Mar):47–61.
- Rice DP, Hodgson TA, Sinsheimer P, Browner W, Kopstein AN. The economic costs of the health effects of smoking, 1984. *Milbank Quarterly* 1986;64(4):489–547.
- Rice DP, Max W. *The Cost of Smoking in California, 1989*. Sacramento (CA): California State Department of Health Services, 1992.
- Robert JC. *The Story of Tobacco in America*. Chapel Hill (NC): University of North Carolina Press, 1967.
- Roemer R. *Legislative Action to Combat the World Tobacco Epidemic*. 2nd ed. Geneva: World Health Organization, 1993.
- Rucker RR, Thurman WN, Sumner DA. Restricting the market for quota: an analysis of tobacco production rights with corroboration from congressional testimony. *Journal of Political Economy* 1995;103(1):142–75.
- Saba RP, Beard TR, Ekelund RB Jr, Ressler RW. The demand for cigarette smuggling. *Economic Inquiry* 1995;33(2):189–202.
- Saffer H, Chaloupka FJ. Alcohol tax equalization and social costs. *Eastern Economic Journal* 1994;20(1):33–43.
- Schelling TC. *Choice and Consequence*. Cambridge (MA): Harvard University Press, 1984.
- Schelling TC. Economics and cigarettes. *Preventive Medicine* 1986;15(5):549–60.
- Schevitz T. Discount cigarette stores ignite sales. *San Francisco Examiner*, Dec 12, 1994;Sect 4:B1.
- Seldon BJ, Boyd R. The stability of cigarette demand. *Applied Economics* 1991;23(2):319–26.
- Seldon BJ, Doroodian K. A simultaneous model of cigarette advertising: effects on demand and industry response to public policy. *Review of Economics and Statistics* 1989;71(4):673–7.
- Sesser S. Opium war redux. *New Yorker* 1993;69(29):78–89.
- Shoven JB, Sundberg JO, Bunker JP. The social security cost of smoking. In: Wise DA, editor. *The Economics of Aging*. Chicago: University of Chicago Press, 1989:231–54.
- Showalter MH. *Essays in applied econometrics*. Essay III: monopoly behavior with intertemporal demands [dissertation]. Cambridge (MA): Massachusetts Institute of Technology, 1991.
- Simonich WL. *Government Antismoking Policies*. New York: Peter Lang Publishing, 1991.
- Smith A. *An Inquiry Into the Nature and Causes of the Wealth of Nations*. In: Cannan E, editor. Chicago: University of Chicago Press, 1976.
- Standard & Poor's. *Industry Surveys*. Vol. no. 1. New York: Standard & Poor's Corporation, Jan 1989.
- Standard & Poor's. *Industry Surveys*. Vol. no. 1. New York: Standard & Poor's Corporation, Apr 1993.
- Sullivan D. Testing hypotheses about firm behavior in the cigarette industry. *Journal of Political Economy* 1985;93(3):586–98.
- Sumner DA. Measurement of monopoly behavior: an application to the cigarette industry. *Journal of Political Economy* 1981;89(5):1010–9.

- Sumner DA, Alston JM. *Removal of Price Supports and Supply Controls for U.S. Tobacco: An Economic Analysis of the Impact*. Washington: National Planning Association, 1985.
- Sumner DA, Wohlgenant MK. Effects of an increase in the federal excise tax on cigarettes. *American Journal of Agricultural Economics* 1985;67(2):235–42.
- Sumner MT, Ward R. Tax changes and cigarette prices. *Journal of Political Economy* 1981;89(6):1261–5.
- Sung H-Y, Hu T-W, Keeler TE. Cigarette taxation and demand: an empirical model. *Contemporary Economic Policy* 1994;12(3):91–100.
- Sweanor DT, Martial LR. *The Smuggling of Tobacco Products: Lessons from Canada*. Ottawa (Canada): Non-Smokers' Rights Association/Smoking and Health Action Foundation, 1994.
- Tauras JA. *The transition to smoking cessation: evidence from multiple failure duration analysis*. Working paper no. 7412. Cambridge (MA): National Bureau of Economic Research, 1999.
- Tauras JA, Chaloupka FJ. *Determinants of smoking cessation: an analysis of young adult men and women*. Working paper no. 7262. Cambridge (MA): National Bureau of Economic Research, 1999a.
- Tauras JA, Chaloupka FJ. *Price, clean indoor air, and cigarette smoking: evidence from longitudinal data for young adults*. Working paper no. 6937. Cambridge (MA): National Bureau of Economic Research, 1999b.
- Taylor AL, Chaloupka FJ, Guindon E, Corbett M. The impact of trade liberalization on tobacco consumption. In: Jha P, Chaloupka FJ, editors. *Tobacco Control in Developing Countries*. Oxford: Oxford University Press, in press.
- Taylor P. *The Smoke Ring: Tobacco, Money, and Multinational Politics*. New York: Pantheon Books, 1984.
- Tegene A. Kalman filter and the demand for cigarettes. *Applied Economics* 1991;23(7):1175–82.
- Tennant RB. *The American Cigarette Industry: A Study in Economic Analysis and Public Policy*. New Haven (CT): Yale University Press, 1950.
- Thursby MC, Thursby JG. *Interstate cigarette bootlegging: extent, revenue losses, and effects*. Working paper no. 4763. Cambridge (MA): National Bureau of Economic Research, 1994.
- Townsend J, Roderick P, Cooper J. Cigarette smoking by socioeconomic group, sex, and age: effects of price, income, and health publicity. *British Medical Journal* 1994;309(6959):923–6.
- Tremblay CH, Tremblay VJ. The impact of cigarette advertising on consumer surplus, profit, and social welfare. *Contemporary Economic Policy* 1995;13(1):113–24.
- US Congress. *Uruguay Round Trade Agreements, Texts of Agreements, Implementing Bill, Statement of Administrative Action, and Required Supporting Statements: Message from the President of the United States*. 103rd Congress, 2nd Sess. House Document 103-316, Vol. 1. Washington: US Government Printing Office, 1994.
- US Department of Agriculture. *Agriculture in a North American Free Trade Agreement: Analysis of Liberalizing Trade Between the United States and Mexico*. Foreign Agricultural Economic Report No. 246. Washington: US Department of Agriculture, Economic Research Service, 1992.
- US Department of Agriculture. *Agricultural Outlook: Strategies for Wetland Protection and Restoration*. Washington: US Department of Agriculture, Economic Research Service, 1993.
- US Department of Agriculture. *Burley Tobacco: Summary of 1994 Support Program and Related Information*. ASCS Commodity Fact Sheet. Washington: US Department of Agriculture, Agricultural Stabilization and Conservation Service, 1994a.
- US Department of Agriculture. *Flue-Cured Tobacco: Summary of 1994 Support Program and Related Information*. ASCS Commodity Fact Sheet. Washington: US Department of Agriculture, Agricultural Stabilization and Conservation Service, 1994b.
- US Department of Agriculture. *Tobacco: Situation and Outlook Report*. Washington: US Department of Agriculture, Economic Research Service, 1996. TBS-237.

US Department of Agriculture. *Burley Tobacco: 1997 Support Program and Related Information*. Commodity Fact Sheet. Washington: US Department of Agriculture, Farm Service Agency, 1997a.

US Department of Agriculture. *Flue-Cured Tobacco: 1997 Support Program and Related Information*. Commodity Fact Sheet. Washington: US Department of Agriculture, Farm Service Agency, 1997b.

US Department of Agriculture. *Tobacco: Situation and Outlook Report*. Washington: US Department of Agriculture, Economic Research Service, 1997c. TBS-239.

US Department of Agriculture. *Tobacco: World Markets and Trade*. Washington: US Department of Agriculture, Foreign Agricultural Service, 1997d. Circular Series FT-9-97.

US Department of Agriculture. *Tobacco: Situation and Outlook Report*. Washington: US Department of Agriculture, Economic Research Service, 1998a. TBS-241.

US Department of Agriculture. USDA Announces 1998 Burley Tobacco No-Net-Cost Assessment [news release], 1998b;<<http://www.fsa.usda.gov:80/pas/news/releases/1998b/08/1544.htm>>; accessed: August 9, 1999.

US Department of Agriculture. *Tobacco: Situation and Outlook Report*. Springfield (VA): US Department of Agriculture, Economic Research Service, 1999a. TBS-245.

US Department of Agriculture. USDA announces provisions of the 2000 crop flue-cured tobacco program and no net cost assessments [press release]. Washington: US Department of Agriculture, Farm Service Agency, Dec 15, 1999b. Release No. 1672.99.

US Department of Agriculture. Declining cigarette consumption follows price hikes. *Agricultural Outlook/January-February 2000*. Springfield (VA): US Department of Agriculture, Economic Research Service, 2000.

US Department of Health and Human Services. *The Health Consequences of Smoking: Nicotine Addiction. A Report of the Surgeon General*. Rockville (MD): US Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Health Promotion and Education, Office on Smoking and Health, 1988. DHHS Publication No. (CDC) 88-8406.

US Department of Health and Human Services. *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General*. Atlanta: US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1989. DHHS Publication No. (CDC) 89-8411.

US Department of Health and Human Services. *Smoking and Health in the Americas: A Report of the Surgeon General*. Atlanta: US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1992. DHHS Publication No. (CDC) 92-8419.

US Department of Health and Human Services. *Preventing Tobacco Use Among Young People: A Report of the Surgeon General*. Atlanta: US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1994.

US Department of Health, Education, and Welfare. *Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service*. Washington: US Department of Health, Education, and Welfare, Public Health Service, 1964. PHS Publication No. 1103.

US Department of Labor. Consumer Price Index—All Urban Consumers;<<http://www.dol.gov/>>[follow the links “Statistics and Data,” “Bureau of Labor Statistics official databases,” “Most Requested Series,” “Consumer Price Indexes”]; accessed: August 25, 1999.

US House of Representatives. *Financing Provisions of the Administration's Health Security Act and Other Health Reform Proposals: Hearings Before the House Committee on Ways and Means*, 103rd Congress, 1st Sess. Washington: US Government Printing Office, 1994. Serial No. 103-61.

Viscusi WK. Cigarette taxation and the social consequences of smoking. In: Poterba JM, editor. *Tax Policy and the Economy*. Cambridge (MA): MIT Press, 1995: 51–101.

- Wagner S. *Cigarette Country: Tobacco in American History and Politics*. New York: Praeger Publishers, 1971.
- Warner KE. Possible increases in the underreporting of cigarette consumption. *Journal of the American Statistical Association* 1978;73(362):314–8.
- Warner KE. State legislation on smoking and health: a comparison of two policies. *Policy Sciences* 1981;13(2): 139–52.
- Warner KE. Smoking and health implications of a change in the Federal Cigarette Excise Tax. *Journal of the American Medical Association* 1986;255(8):1028–32.
- Warner KE. The tobacco subsidy: does it matter? *Journal of the National Cancer Institute* 1988;80(2):81–3.
- Warner KE. The importance of tobacco to a country's economy. Paper presented at the 9th World Conference on Tobacco and Health; Oct 10–14, 1994; Paris.
- Warner KE, Chaloupka FJ, Cook PJ, Manning WG, Newhouse JP, Novotny TE, Schelling TC, Townsend J. Criteria for determining an optimal cigarette tax: the economist's perspective. *Tobacco Control* 1995;4(4): 380–6.
- Warner KE, Fulton GA. The economic implications of tobacco product sales in a nontobacco state. *Journal of the American Medical Association* 1994;271(10):771–6.
- Warner KE, Fulton GA, Nicolas P, Grimes DR. Employment implications of declining tobacco product sales for the regional economies of the United States. *Journal of the American Medical Association* 1996;275(16): 1241–6.
- Warner KE, Hodgson TA, Carroll CE. Medical costs of smoking in the United States: estimates, their validity, and their implications. *Tobacco Control* 1999;8(3): 290–300.
- Wasserman J, Manning WG, Newhouse JP, Winkler JD. The effects of excise taxes and regulations on cigarette smoking. *Journal of Health Economics* 1991;10(1):43–64.
- Watkins BG III. The tobacco program: an econometric analysis of its benefits to farmers. *American Economist* 1990;34(1):45–53.
- Winston GC. Addiction and backsliding: a theory of compulsive consumption. *Journal of Economic Behavior and Organization* 1980;1(4):295–324.
- Womach J. *Tobacco Price Support: An Overview of the Program*. Washington: Library of Congress, Congressional Research Service, 1994a. CRS Publication No. 94-243 ENR.
- Womach J. *U.S. Tobacco Production: Prospects for the Future*. Washington: Library of Congress, Congressional Research Service, 1994b. CRS Publication No. 94-672 ENR.
- Womach J. *Tobacco-Related Programs and Activities of the U.S. Department of Agriculture: Operation and Cost*. Washington: Library of Congress, Congressional Research Service, 1999. CRS Publication No. 97-417 ENR.
- Yurekli AA, Zhang P. The impact of clean indoor-air laws and cigarette smuggling on demand for cigarettes: an empirical model. *Health Economics* 2000;9(2):159–70.
- Zhang P, Husten C. Impact of the tobacco price support program on tobacco control in the United States. *Tobacco Control* 1998;7(2):176–82.
- Zhang P, Husten C, Giovino G. Effect of the tobacco price support program on cigarette consumption in the United States: an updated model. *American Journal of Public Health* 2000;90(5):746–50.