Chapter 7
Tax, price and tobacco use among the poor

In general, the prevalence of tobacco use is higher among the poor.[1] Several reasons are given to explain why the poor smoke more (Bobak *et al.,* 2000). First, people at lower socioeconomic status tend to be less aware of the adverse health consequences of smoking and thus more likely to be smokers. Second, smoking is an outlet for releasing stress resulting from material deprivation of the poor (Graham, 1987). Third, a smoker sees his/her smoking habit as a way of rewarding himself/herself, an attitude more likely to be observed among the poor (Graham, 1994). Fourth, the loss of productivity and income due to ill health caused by smoking-induced diseases is lower for the low-income people. Thus, the poor seem to have more reasons to adopt the practice of smoking as a part of their life.

The high level of smoking prevalence among the poor imposes a heavier disease burden on this disadvantaged group of the population and widens social and economic disparity between the rich and the poor. However, the poor are also generally more responsive to price changes, which makes them more inclined to cut tobacco consumption in response to increased tobacco taxation. Also, by reducing consumption or quitting, the poor benefit most by avoiding the health and economic cost from tobacco use. Thus, increasing taxes on tobacco is considered a win-win situation, not only because it serves the dual goal of curbing the tobacco epidemic and increasing government revenue, but also due to the fact that it works more effectively for the poor than for the rich.

Raising tobacco excise taxes as a tobacco control policy is often criticized because of the regressivity of tobacco taxes. It is argued that the increase in taxes on tobacco may increase the burden on low-income people by reducing the overall ability to purchase and consume other goods and services and thus increasing the inequality in the post-tax distribution of income.

This chapter concentrates on smoking prevalence, price sensitivity and tobacco consumption by socioeconomic status, and their implications on potential regressivity of tobacco taxes. It is organized as follows: First, the patterns of tobacco use within countries with different income levels and socioeconomic status are presented. The opportunity cost of spending on tobacco is discussed in the second section. A third explores the relationship between tobacco use and poverty. The possible regressivity of tobacco taxes is discussed and the existing evidence from several countries is then presented, followed by the existing evidence on price elasticity of tobacco use for different income or socioeconomic status in several counties. The empirical evidence found on price sensitivity of different socioeconomic groups is then explained, and the chapter concludes with a discussion on the implications of the empirical findings.

Patterns of tobacco use within countries by socioeconomic status

The relationship between smoking behaviour and socioeconomic status is well documented in the literature. In general, the studies examining this relationship measure socioeconomic status with respect to a wide range of variables such as income level, education, profession, expenditure levels and other relevant socioeconomic characteristics.

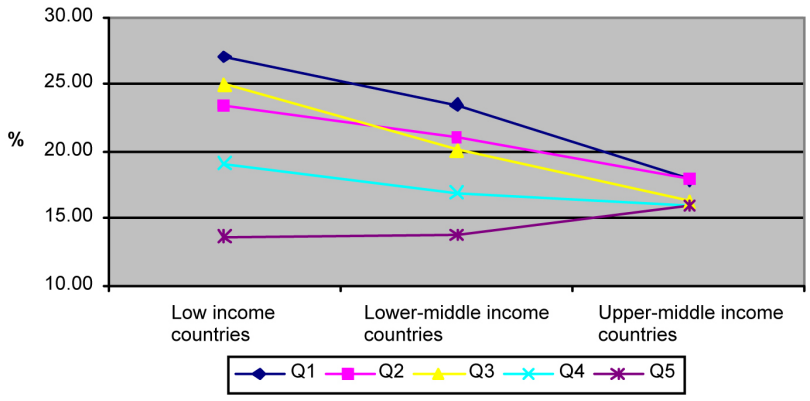
[1] Throughout the chapter, the status of poverty has been identified with low socioeconomic status of individuals or households in terms of household income, expenditure, level of education of individuals. Depending on how different empirical studies conceptualized poverty and defined low socioeconomic status of population, we have used the two concepts (i.e. low socioeconomic status or poverty) interchangeably without further specification of how poverty is measured in general. In most cases, the stratification of the poor and the non-poor is based on the classification of households by total household income or expenditure.

The effect of socioeconomic status or education or income on smoking differs from one country to another and depends on the diffusion of smoking within the country (Graham, 1996). If the country is in the later stage of the tobacco epidemic, when the smoking prevalence rate is declining, smoking is typically observed more in the lower socioeconomic sector of the population (Pierce *et al.* 1989; Lopez *et al.* 1994; Graham, 1996). Bobak *et al.* (2000) reported the ratio of smoking prevalence rate of the lowest socioeconomic groups to the highest socioeconomic groups, calculated from 74 studies which examined this relationship in 41 countries. In many countries this ratio is found to be greater than 1, which indicates that people in the lowest group have a higher smoking prevalence rate than those in the highest socioeconomic group. However, there are huge differences between the countries, even within the same income category. For example, among low-income countries, the ratio of smoking prevalence in the lowest socioeconomic group relative to the highest socioeconomic group varied between 9 in India and 1 in China. Among lower-middle-income countries the ratio varied between 3 in the Russian Federation to less than 1 in Thailand and Bolivia. Thus, in the latter two countries people in the lowest socioeconomic group have lower smoking prevalence than people in the highest socioeconomic group. Among high-income countries the ratio is typically greater than 1, indicating that smoking prevalence is higher among the poor than the rich. An exception is Japan, which has a ratio of less than 1.

The examination of the relationship of smoking prevalence with socioeconomic status of people, using the World Bank's classification of countries, reveals more information about the economic gradient of tobacco use. Evidence from the World Health Survey 2003 showed that tobacco smoking is mostly strongly related to household permanent income or wealth (WHO, 2007). As shown in Figure 7.1 reproduced from WHO (2010), poorer people tend to have greater smoking prevalence than richer people in low-income- and lower-middle-income as well as upper-middle-income countries, and the disparity in terms of smoking prevalence rate is more apparent among the lower-income groups of countries.

The general pattern observed in high-income countries is that as the level of income or education of individuals increases, smoking prevalence rate declines. Those at the lowest income group or those with the lowest level of education have a higher smoking prevalence rate than those at the highest income group or those with highest level of education. However, there are some exceptions as well. For example, among old (aged 50–79) Italian males, smoking prevalence did not change with their education level – it is around 25%, whereas among old Italian women there was a positive relationship between education level and smoking prevalence rates (Federico *et al.,* 2004). Similarly, in Portugal and Greece, women with higher education and in higher income groups are more likely to smoke. The differences among the EU countries were explained by the stage of the country in the tobacco epidemic. If the country is at the earlier stages, then smoking prevalence might be positively associated with education, i.e. more educated men and women were more likely to smoke than less-educated individuals. More recent studies reported that the gaps in the prevalence rates between low-income and high-income groups has widened in recent years because even though the prevalence rates are generally declining, the decrease is greater among those with higher levels of education or those with low income (for example, Townsend *et al.*

Figure 7.1. Prevalence of daily tobacco smoking by income group and income quintile



Notes: 1. Q1 to Q5 indicate income quintiles. Q1 represents the lowest income group and Q5 is the highest income group. 2. The graph was made using average prevalence figures from 44 countries. Prevalence of China and India were removed from these averages to avoid skewed results from their large population weights. 3. High-income countries are not included in the graph.
Source: Adapted from David A, Esson K, Perucic AM, Fitzpatrick C (2010).Tobacco use: equity and social determinants. In: Blas E, Sivasankara Kurup A, editors. Equity, social determinants and public health programmes. Geneva: World Health Organization.

(1994), Federico *et al.* (2004), Franks *et al.* (2007), Khang *et al.* (2009)).

Compared to high-income counties, the evidence on the relationship between income level and prevalence rate is different in upper-middle income countries. According to the results of the limited number of studies, as education level or the income level of household increases, smoking prevalence and tobacco consumption increase as well (Onder (2002) for Turkey, Sayginsoy *et al.* (2002) for Bulgaria and van Walbeek (2002a) for South Africa).

The relationship between prevalence rate and socioeconomic status in lower-middle-income and low-income countries is similar to that observed in high-income countries. In general, those with higher income level or those with more education have lower smoking prevalence rates than those with lower income level or those with less education. Although this is the general trend, there are some differences in rural or urban parts of the country as well as the types of tobacco consumed. Table 7.1 presents the prevalence rates of individuals or households by socioeconomic status in different countries grouped according to World Bank income classification.

Opportunity cost of tobacco use

Opportunity cost is defined as the cost of an alternative that must be foregone to purchase a particular product, in this case tobacco. Spending on tobacco often constitutes a significant part of smoking households' budgets. Its share in smoking households' budgets varies between close to 1 percent in areas such as Mexico and China's Hong Kong Special Administrative Region to around 10 percent in Zimbabwe and China (John, 2008). Since in high-income, lower-middle-income and low-income countries the poor smoke more than the rich and their income level is lower, it means that, on average, they spend a higher share of their income on tobacco than the rich. It is reasonable to expect that tobacco expenditures have a higher opportunity cost among the poor. Spending on tobacco would be expected to reduce the consumption of food and non-food items, thus reducing the quality of life (Wang *et al.,* 2006).[2]

The percentage of income spent on tobacco products is generally found to be higher when the level of household income or expenditure is lower. For example, in Myanmar, in 2000, the share of tobacco expenditures constituted 4.04% of total household expenditures of all households in the lowest income quintile, compared to 1.58% in the highest income quintile (Kyaing, 2003). In Indonesia, cigarette expenditure as a percentage of income was 7.24% for the low-income group and 3.02% for the high-income group (Adioetomo *et al.,* 2005). On average, poor households in Morocco spent the same amount on tobacco products and education, while their cigarette expenditure was half of the average spending on health (Aloui, 2003). Similarly, in Turkey in 1994, the households in the lowest income quintile spent 3.08% of their monthly income on cigarettes, whereas this percentage was only 1.65% for the households in the highest income quintile (Onder, 2002). Siahpush (2003) reported that average tobacco expenditure as a percentage of total household expenditures varied from 7.7% in the lowest income quintile to 2.4% in the highest income quintile in Australia. Using the 1998–99 Household Spending Surveys, Thomson *et al.* (2002) reported that low-income smoking households in New Zealand spent almost 14% of non-housing spending on tobacco. In contrast to other studies, John (2008) reported that in India, the share of tobacco expenditure in poor households' total budget was slightly less than that of richer households even though the poor had a higher prevalence rate of tobacco use in India. These results are summarized in Table 7.2.

Several studies estimated the share of income or expenditures spent on tobacco and what individuals could purchase with that money if they were to divert it away from tobacco. For example, a study conducted by Efroymson *et al.* (2001) in Bangladesh showed that during 1992–1996, the average male smoker spent more than twice as much on cigarettes as he spent on clothing, housing, health, and education combined. Moreover, on average male and female smokers would be able to buy 1402 calories and 770 calories of rice, respectively, with the money saved by quitting.

This study further showed that in Bangladesh in 1995/96, the lowest household expenditure (below $18) group spent almost 10 times as much on tobacco as on education. If the poor had reallocated 69% of their tobacco expenditure to food, which a typical lowest-income household without smokers would do, then over 10.5 million fewer people would have been malnourished and about half of them would be from the hard core poor group (consuming below 1805 calories/day). More strikingly, if parents were to use their tobacco expenditure for feeding their children, it would save 127 750 children under 5 years from death from malnourishment each year in Bangladesh alone.

[2] Only selected papers are reviewed in this section.

Table 7.1. Smoking prevalence rates by socioeconomic status

Publication (location, author, year)	Data sets and year	Prevalence rate (%)
Low-income and lower-middle-income countries		
China (Hu and Tsai, 2000)	Household survey from rural areas in 3 Chinese provinces: Henan, Fujian and Shanxi, conducted during 1996–1998	**By Education** *Illiterate* 24.1 *Primary school* 32.8 *Junior high school* 32.5 *Senior high school or higher* 37.1 **By Occupation** *Farmer* 32.2 *Worker* 34.1 *Other* 26.2 *Student or housekeeper* 12.6
Bangladesh (Efroymson *et al.*, 2001)	The National Health and Demographic Survey, 1995	**By monthly household income (currency: US$)** *<24* 58.2 (M) *24–30* 56.7 (M) *30–35* 54.4 (M) *35–47* 53.7 (M) *47–59* 45.6 (M) *59–71* 46.1 (M) *71–94* 38.4 (M) *94–118* 36.3 (M) *118+* 32.3 (M)
Bangladesh (Ali *et al.*, 2003)	Bangladesh Bureau of Statistics Survey, 1995	**By monthly household income (currency: Taka)** *<1000* 58.2 (M) *1000–1499* 56.7 (M) *1500–1999* 53.7 (M) *2000–2499* 45.6 (M) *2500–2999* 46.1 (M) *3000–3999* 38.4 (M) *4000–4999* 36.3 (M) *5000+* 32.3 (M) **By Education** *No education* 61.4 (M)

Publication (location, author, year)	Data sets and year	Prevalence rate (%)
Bangladesh (Ali *et al*., 2003) (contd)		*Class I-V* 40.7 (M) *Class VI-IX* 31.3 (M) *At least secondary school* 25.0 (M) **By monthly household income (currency: Taka)** *<1000* 53.0(M) *1000–1499* 48.1 (M) *1500–1999* 47.2 (M) *2000–2499* 44.2 (M) *2500–2999* 42.4 (M) *3000–3999* 38.7 (M) *4000–4999* 34.4 (M) *5000+* 31.7 (M) **By Education** *No education* 59.5 (M) *Class I-V* 34.9 (M) *Class VI-IX* 28.5 (M) *At least secondary school* 31.6 (M)
India (Rani *et al*., 2003)	National Family Health Survey-2 (1998–1999)	**By residence** *Urban* 21.4 (M); 0.8 (F) *Rural* 32.5 (M); 3.0 (F) **By Household wealth** *Richest 20%:* 16.0 (M); 0.5 (F) *2nd richest* 25.7 (M); 1.3 (F) *Middle* 31.6 (M); 2.4 (F) *2nd poorest* 36.4 (M); 3.3 (F) *Poorest 20%* 39.8 (M); 4.9 (F) **By years of schooling** *11+ years* 12.8 (M); 0.1 (F) *6–10 years* 22.3 (M); 0.3 (F) *1–5 years* 36.9 (M); 0.9 (F) *No education* 45.3 (M); 4.1 (F)
India (John, 2005)	The 50th and 55th Round National Sample Survey, July 1993–June 1994 and July 1999–June 2000	**By household income** *Smoke tobacco* Lowest (<30th percentile) 32.5 (R); 28.7 (U) Middle (30–70) 44.4 (R); 30.5 (U)

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Publication (location, author, year)	Data sets and year	Prevalence rate (%)
India (John, 2005) (contd)		Higher (>70th percentile) 45.6 (R); 27.3 (U) *Smokeless tobacco* Lowest (<30th percentile): 32.7 (R); 17.0 (U) Middle (30–70) 29.5 (R); 14.7 (U) Higher (>70th percentile) 24.7 (R); 10.9 (U) *Total* Lowest (<30th percentile) 59.1 (R); 42.6 (U) Middle (30–70) 65.7 (R); 41.5 (U) Higher (>70th percentile) 60.8 (R); 34.5 (U)
Nepal (Karki *et al*., 2003)	Nepal Smoking Behaviour Survey, November–December 2000	**By illiteracy** *Literate* 31.9 (M); 7.5 (F) *Illiterate* 59.9 (M); 38.6 (F) **By length of education** *Illiterate* 50.6 *<6 years* 45.8 *6–12 years* 32.7 *>12 years* 32.9
Upper-middle-income countries		
Bulgaria (Sayginsoy *et al*., 2002)	Living Standards Measurement Study Household Survey, 1995	**By household income group** *Lower and lower middle* 32.3 *Upper middle* 43.5 *High* 51.4
South Africa (van Walbeek, 2002a)	All Media and Products Survey, 1993 and 2000	**By education** *Year 1993* No education 26.8 Primary education 33.6 Secondary education 31.4 Tertiary education 29.8 *Year 2000* No education 23.6 Primary education 29.5 Secondary education 27.0 Tertiary education 25.7 ***By household income (currency: Rand (R))*** *Year 1993* R1–R499 29.4

Publication (location, author, year)	Data sets and year	Prevalence rate (%)
South Africa (van Walbeek, 2002a) (contd)		R500–R899 30.6 R900–R1399 31.8 R1400–R2499 31.6 R2500–R3999 34.2 R4000–R6999 35.2 R7000–R11999 33.0 R12000+ 28.1 *Year 2000* R1–R499 23.5 R500–R899 23.2 R900–R1399 25.7 R1400–R2499 29.8 R2500–R3999 29.3 R4000–R6999 30.7 R7000–R11999 35.1 R12000+ 31.0
Turkey (Onder, 2002)	Household Expenditure and Consumption Survey, 1994	**By household income** *Lowest* 52.0 *2nd quintile* 62.6 *3rd quintile* 65.1 *4th quintile* 68.2 *Highest* 70.3
High-income countries		
United Kingdom (Townsend, 1987)	Central Statistical Office, 1982	**By social class** *Professional* 20 (M); 21 (F) *Employers and managers* 29 (F) *Skilled manual* 40 (F) *Semi-skilled manual* 40 (F) *Unskilled working* 49 (M); 40 (F)
USA (Farrelly *et al.*, 2001)	National Health Interview Survey, 1976–1980, 1983, 1985, 1987–1993	**By real family income** ≤ *Median income* 31.7 ≥ *Median income* 27.5

Table 7.1. Smoking prevalence rates by socioeconomic status

Publication (location, author, year)	Data sets and year	Prevalence rate (%)
USA (Barbeau *et al.*, 2004)	National Health Interview Survey, 2000	**By education level** *0–12 grade, no diploma < 24 y* 30.9 *0–12 grade, no diploma > 24 y* 36.7 *12th grade, diploma* 31.9 *GED diploma* 53.1 *Some college/assoc degree* 24.2 *≥ 4-year college degree* 12.5 **By income/poverty** *Poor* 34.7 *Near poor* 34.2 *Middle income* 31.4 *Higher income* 20.7 *Unreported income* 25.5 **By occupational class** *White collar* 20.3 *Service workers* 31.1 *Farm workers* 24.2 *Blue collar* 35.4 *Not in labour force* 27.2
Australia (Siahpush, 2003)	Household Expenditure Survey, 1998–1999	**By household income** *Lowest* 33.0 *2nd quintile* 31.6 *3rd quintile* 33.6 *4th quintile* 35.0 *Highest* 32.8 **By education** *No qualification* 36.3 *Diploma* 34.0 *Degree* 19.8 *Unknown* 46.5 **By occupation** *Blue collar* 44.0 *White collar* 38.4 *Professional* 27.6

Publication (location, author, year)	Data sets and year	Prevalence rate (%)
Australia (White *et al.*, 2008)	Triennial cross-sectional national studies of representative random samples of secondary students aged 12–17 years, 1987–2005	**By socioeconomic status, aged 12–15 years** *Lowest* 15 (1987); 8 (2005) *Second* 16 (1987); 7 (2005) *Third* 16 (1987); 6 (2005) *Highest* 16 (1987); 5 (2005) **By socioeconomic status, aged 16–17 years** *Lowest* 25 (1987); 16 (2005) *Second* 25 (1987); 17 (2005) *Third* 30 (1987); 17 (2005) *Highest* 30 (1987); 15 (2005)
Italy (Federico *et al.*, 2004)	National Health Interview Surveys, 1980	**By education** *Aged 25–49 years* Elementary 64.7 (M); 17.2 (F) Lower secondary 65.2 (M); 30.9 (F) Upper secondary 61.6 (M); 37.7 (F) Post-secondary 53.6 (M); 40.5 (F) *Aged 50–79 years* Elementary 53.6 (M); 6.2 (F) Lower secondary 48.3 (M); 19.4 (F) Upper secondary 49.8 (M); 22.8 (F) Post-secondary 42.9 (M); 25.3 (F)
	National Health Interview Surveys, 1999–2000	**By Education** *Aged 25–49 years* Elementary 50.2 (M); 24.6 (F) Lower secondary 45.0 (M); 27.1 (F) Upper secondary 34.2 (M); 24.6 (F) Post-secondary 26.9 (M); 21.7 (F) *Aged 50–79 years* Elementary 25.6 (M); 9.2 (F) Lower secondary 26.0 (M); 16.5 (F) Upper secondary 24.4 (M); 19.2 (F) Post-secondary 24.4 (M); 20.0 (F)
EU countries (Austria, Belgium, Denmark, Germany, Greece, Finland, Ireland, Italy, Portugal, Spain, United Kingdom) (Huisman *et al.*, 2005)	The fifth wave of the European Community Household Survey, 1998	**By education** *Highest* 22 (M); 19 (F) *Middle* 33 (M); 22 (F) *Lowest* 40 (M); 28 (F)

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Publication (location, author, year)	Data sets and year	Prevalence rate (%)
EU countries (Austria, Belgium, Denmark, Germany, Greece, Finland, Ireland, Italy, Portugal, Spain, United Kingdom) (Huisman *et al.*, 2005) (contd)		**By household income** *Lowest* 39 (M); 25 (F) *2nd quintile* 34 (M); 22 (F) *3rd quintile* 32 (M); 21 (F) *4th quintile* 30 (M); 20 (F) *Highest* 27 (M); 19 (F)
Japan (Fukuda *et al.*, 2005)	Comprehensive Survey of the Living Conditions of People on Health and Welfare, 2001 (aged 18–54)	**By household income** *Lowest* 58.8 (M); 23.6 (F) *2nd quintile* 61.0 (M); 20.1 (F) *3rd quintile* 57.5 (M); 16.9 (F) *4th quintile* 57.3 (M); 13.7 (F) *Highest* 52.4 (M); 11.6 (F) **By Employment status** *Unemployed* 33.2 (M); 14.6 (F) *Employed* 59.2 (M); 17.5 (F) **By residential area** *Non-urban* 57.8 (M); 15.8 (F) *Urban* 52.6 (M); 21.6 (F)
Republic of Korea (Khang *et al.*, 2009)	Social Statistics Survey, 1999 and 2006	**Year 1999** *By education* College or higher 61.7 (M); 1.9 (F) High school 73.1 (M); 2.8 (F) Middle school or less 74.3 (M); 3.7 (F) *By Income quartile* I Highest 67.1 (M); 2.8 (F) II 70.0 (M); 1.9 (F) III 71.4 (M); 3.1 (F) IV Lowest 72.7 (M); 4.5 (F) *By occupational class* Non-manual 62.3 (M); 2.0 (F) Manual 74.1 (M); 4.1 (F) Others 70.7 (M); 2.6 (F) **Year 2006** *By education* College or higher 49.1 (M); 1.6 (F) High school 62.3 (M); 4.0 (F)

Publication (location, author, year)	Data sets and year	Prevalence rate (%)
Republic of Korea (Khang *et al.*, 2009) (contd)		Middle school or less 64.7 (M); 7.9 (F) *By income quartile* I Highest 51.4 (M); 2.2 (F) II 55.3 (M); 2.4 (F) III 57.7 (M); 3.5 (F) IV Lowest 61.5 (M); 4.8 (F) *By occupational class* Non-manual 48.3 (M); 1.5 (F) Manual 61.6 (M); 4.7 (F) Others 59.1 (M); 2.9 (F)

HH, M and F represent household, male and female prevalence rates respectively. Similarly, R and U stand for rural and urban areas.

Table 7.2. Tobacco expenditure as a percentage of total household expenditure/income by socioeconomic status of households

Publication (location, author, year)	Tobacco expenditure as % of household expenditure/income
Low and middle-income countries	
Turkey (Onder, 2002)	**% of income by income quintile** (1) 4.25 (2) 2.87 (3) 2.52 (4) 2.17 (5) 1.65
Egypt (Nassar, 2003)	**% of household expenditure by expenditure level (Currency: LE)** *−1200 LE* 3.60 (R); 1.11 (U) *3200- LE* 1.69 (R); 1.04 (U) *5600- LE* 0.95 (R); 0.48 (U) *10 000- LE* 0.62 (R); 0.26 (U) *14 000- LE* 0.50 (R); 0.15 (U)
Myanmar (Kyaing, 2003)	**% of household expenditure by income quintile** (1) 3.77 (R); 5.12 (U) (2) 3.31 (R); 4.03 (U) (3) 1.83 (R); 2.52 (U) (4) 1.68 (R); 2.64 (U) (5) 1.35 (R); 2.09 (U)
Nepal (Karki *et al.*, 2003)	**% of household expenditure by income quintile** (1) 4.4 (2) 5.7 (3) 3.5 (4) 3.3 (5) 2.3
Sri Lanka (Arunatilake and Opatha, 2003)	**% of household income by income quintile** Overall: 1.5 (1) 3.2 (2) 3.2 (3) 2.8 (4) 2.2 (5) 0.6
China (Hu *et al.*, 2005)	**% of household expenditure** *Poor* 11.3 (R); 6.6 (U) *Near-poor* 9.9 (R); 6.7 (U) *Non-poor* 8.4 (R); 9.1 (U) **% of household income** *Poor* 7.1 (R); 5.8 (U) *Near-poor* 8.9 (R); 5.9 (U) *Non-poor* 5.7 (R); 4.6 (U)
Indonesia (Adieotomo *et al.*, 2005)	**% of household expenditure** *Low-income* 7.24 *Middle-income* 5.53 *High-income* 3.02

Publication (location, author, year)	Tobacco expenditure as % of household expenditure/income
Indonesia (Barber *et al.*, 2008)	**% of total monthly expenditure by income quintile for households with smokers** (1) 11.9 (2) 12.3 (3) 12.4 (4) 11.7 (5) 9.2
South Africa (van Walbeek, 2005)	**% of household income by income quartile for urban smoking households** *Cigarette* 1990 (1) 1.71 (2) 1.54 (3) 0.96 (4) 0.49 1995 (1) 1.79 (2) 1.29 (3) 1.06 (4) 0.66 2000 (1) 3.17 (2) 2.84 (3) 2.61 (4) 1.53 *All tobacco products* 1990 (1) 1.74 (2) 1.57 (3) 0.99 (4) 0.51 1995 (1) 1.68 (2) 1.29 (3) 1.06 (4) 0.66 2000 (1) 2.87 (2) 2.71 (3) 2.57 (4) 1.55
Viet Nam (Kinh *et al.*, 2006)	**% of household expenditure by income quintile** (1) 5.29 (2) 4.58 (3) 4.30 (4) 4.06 (5) 3.60
Mexico (de Miera Juarez *et al.*, 2007)	**% of total household expenditure by income quintile** (1) 5.5 (2) 4.0 (3) 3.7 (4) 4.7 (5) 2.5
High-income countries	
USA (Gruber and Koszegi, 2002)	**% of income by income quartile** (1) 0.032 (2) 0.014 (3) 0.009 (4) 0.004 **% of expenditure by consumption quartile** (1) 0.015 (2) 0.013 (3) 0.010 (4) 0.004

Table 7.2. Tobacco expenditure as a percentage of total household expenditure/income by socioeconomic status of households

Publication (location, author, year)	Tobacco expenditure as % of household expenditure/income
USA (Gruber and Koszegi, 2002) (contd)	**% of income by education groups** *High school dropouts* 0.014 *High school graduates* 0.013 *Some college education* 0.008 *College graduates* 0.003
USA (Colman and Remler, 2008)	**% of income among smokers by income group** *Low* 7.7% *Medium* 3.1% *High* 1.4%
Canada (Gruber *et al*., 2003)	**% of income by income quartile** (1) 4.14 (2) 2.16 (3) 1.72 (4) 1.01 **% of expenditure by expenditure quartile** (1) 2.28 (2) 1.82 (3) 1.43 (4) 0.93

(R) and (U) stand for rural and urban respectively

Wang *et al.* (2006) examined the opportunity cost of smoking in China by estimating the impact of tobacco spending on expenditure on other goods, controlling for demographic characteristics of households. They found that tobacco spending was negatively and significantly related to spending on food, education, farming, medical care and durable goods. John (2008) compared the expenditures on several categories of food and non-food items by tobacco-consuming and non-consuming households in India. He found that tobacco-consuming households had a lower share of their income spent on the consumption of milk, education, clean fuels and entertainment, but a higher share devoted to health care, clothing and fuels. He estimated that an increase in tobacco expenditure leads to a fall in the budget share devoted to food, education and entertainment and a rise in the budget share of health care in both rural and urban India. He reported that the change in budget shares was similar in both low-income and high-income households.

Tobacco use and poverty

The poor smoke more than the rich in many countries, and they are observed to have more reasons to adopt the practice of smoking as a part of their life (Bobak *et al.,* 2000). However, smoking can make people poor—it adversely affects the income level of individuals or households in several ways in addition to the decline in the availability of income for other goods and services and its opportunity cost. Evidence shows that increased premature deaths and healthcare cost associated with smoking-related illnesses increase the cost of smoking. Cutler *et al.* (2002) estimated that on average smokers lived six years less than comparable non-smokers because of the increase in heart and lung diseases.

In addition to losses due to premature deaths and increases in healthcare cost, smoking may reduce the earnings and wages of individuals. Smokers may earn less than non-smokers for several reasons: smoking may reduce productivity, and smokers may be costly to their employers with increased absenteeism, higher health and insurance premiums, higher maintenance cost and negative effects on morale. Levine *et al.* (1997) compared the wages of continuous smokers and those of the workers who quit smoking in the USA, and estimated that the former group had about 4–8%

lower wages than the latter group, after controlling for observable and unobservable time-invariant characteristics. Similarly, Heineck and Schwarze (2003) reported that smoking workers have 2–8% lower earnings compared to non-smoking workers aged between 25–55 years in Germany. The evidence from Netherlands and Canada also indicated lower earnings because of smoking. Van Ours (2003) estimated that the wages of male smokers were 10% lower than those of identical non-smokers in the Netherlands. Auld (2005) found that the difference was 24%. Lokshin and Beegle (2006) report that male smokers earn 20% less than similar non-smokers in Albania, after controlling for observed characteristics and unobserved heterogeneity in personal characteristics.

All of these studies indicate that smoking can reduce the income level of individuals. Moreover, smoking-attributable deaths and smoking-related diseases reduce the productivity of individuals as well. Furthermore, smoking-attributable medical expenses reduce the income available for other expenditures. For example, Liu *et al.* (2006) reported that on average, smokers spend 45% and 28% more on medical services than non-smokers in urban and rural China, respectively, in 1998.

Liu *et al.* (2006) further showed that even though high-income people had spent more on smoking-attributable medical expenditures than low-income individuals in absolute terms, the percentage of income spent on these types of expenditures was 6.5% for the lowest-income quintile group and only 1.5% for individuals in the highest-income quintile in urban China. They also estimated that because of medical expenditures attributable to smoking, 12.1 million people (5.8 million from urban areas and 6.3 million from rural areas) fall below the poverty line. Moreover, they predicted that smoking-related expenses pushed 41.8 million low-income people into poverty (24.7 million urban residents and 17.1 million rural residents). All of these findings indicate that a reduction in tobacco use would not only improve public health but also would reduce global poverty.

Regressivity of tobacco taxes

Since those individuals with low income are more likely to smoke and spend a higher share of their income on tobacco compared to individuals with high income, when increasing tobacco taxes are discussed, the dispute focuses on equity. The debate considers whether taxes make the income distribution more or less equal. If the tax is paid only by the wealthy, it will reduce income inequality. On the other hand, if the tax is paid by the poor, the post-tax income disparity widens, increasing the inequality. If a tax raises income inequality, it is regressive, whereas if it reduces inequality, it is progressive. If the taxes paid are an equal share of income for all income groups, tax is said to be neutral and it does not influence income redistribution.

The notion of vertical equity is one approach to measure the regressivity of taxes. The basic tenet of vertical equity is as follows: Individuals with the greater ability to pay taxes should be taxed more. The example is an income tax system which has the characteristic that the tax rate increases with the amount of income earned. However, taxes on tobacco and tobacco products seem to violate this notion, because in many countries the tobacco use prevalence rate and expenditure on tobacco as a percentage of income are higher among low-income individuals.

Another concern for any tax policy is the principle of horizontal equity, i.e. the principle that individuals who have similar ability to pay should pay the same or similar amount of taxes. Tobacco taxation seems to violate this principle as well, since otherwise-identical people who consume different quantities of tobacco products will be taxed differently.

As is observed in high- and low-income countries (but not higher middle-income countries), the prevalence of tobacco use is inversely related to income level. Hence, the regressivity of tobacco taxes is exacerbated. In the few countries where tobacco use increases with income levels, tobacco taxes can be considered to be less regressive, even though tobacco taxes as a share of income declines as income level increases. This definition can be considered as an accounting method to assess the tax burden (Remler, 2004).

As a second definition of tax burden, Fullerton and Rogers (1993) considered the welfare effect. They argued that the utility or the welfare of the individual will decline because of the decline in the consumption of the cigarettes with the increase in price. A third method to assess the tax burden was developed by behavioural economists (Gruber & Koszegi, 2004). According to this definition, smokers do want to quit smoking but have difficulty doing so because they have a conflict between their desire for nicotine and their desire for good health. The model is described in Chapter 4. The tax increase helps them to quit so they are doing what they are willing to do in the long run. This is called time-inconsistent preferences (Gruber and Koszegi, 2004). If the poor are willing to quit but have difficulty, the tax increase will help them to quit, thus reducing the tax burden.

Table 7.3. Effects of higher cigarette taxes on three types of smokers, measured under three alternative methods of assessing tax burden

	Response to tax increase	Accounting (income share) tax burden	Willingness-to-pay welfare-based tax burden	Time-inconsistent welfare-based tax burden
Smoker A	Quits	Better off	Worse off owing to cigarette consumption decrease Better off owing to lower tax bill Overall worse off since not compensated for being forced to quit	Better off owing to commitment device: eventual gains of quitting outweigh costs of quitting
Smoker B	No change in smoking	Worse off	Worse off owing to higher expenditures on cigarette	Worse off owing to higher expenditures on cigarette
Smoker C	Cuts back to keep tax expenditures constant	Same as before	Worse off owing to both higher price paid per cigarette and cutting back cigarette consumption	Somewhat better off owing to commitment device; eventual gains of quitting outweigh cost of quitting

Source: Used with permission of DK Remler, Poor smokers, poor quitters, and cigarette tax regressivity. American Journal of Public Health, 94:225–229, 2004. Copyright American Public Health Association.

Remler (2004) summarized the effects of higher cigarette taxes on three types of smokers using these three methods to assess the tax burden (Table 7.3). The first smoker (Smoker A) responds to the increase in taxes by quitting; the second smoker (Smoker B) does not change his/her consumption of cigarettes after the tax increase; the third smoker (Smoker C) reduces the cigarette consumption to keep his/her tax expenditure the same. Smoker A is better off with quitting because of the decline in the share of tobacco expenditure in total expenditures according to the accounting definition of tax burden, but worse off because the decline in cigarette consumption might reduce the utility according to willingness-to-pay welfare-based tax burden, and better off since s/he accomplishes quitting according to time-inconsistent definition. The smoker who does not change his/her consumption pattern (smoker B) will be worse off under three measures of regressivity. Smoker C, who reduces consumption so that there will be no change in tax share, will be worse off based on willingness-to-pay welfare-based tax burden and better off according to the time-inconsistent welfare-based tax burden measure.

Average versus marginal progressivity/regressivity of increases in tobacco tax

To determine whether a tax is progressive or regressive using the accounting measure, the share of taxes paid from a person's income must be calculated. Let *ut* represent the unit excise tax on tobacco and *Q* and *Y* be the quantity of tobacco consumed and income levels respectively. Then, an individual pays *(ut*Q)/Y* fraction of his/her

income as tax. If this ratio does not change with income, then tax is said to be neutral. If it increases as income level declines, then taxes are considered to be regressive, meaning that the poor pay a larger proportion of their income in the form of tobacco taxes. On the other hand, if this ratio increases as the income level increases, taxes are defined as progressive, since the rich pay a greater share of their income as tobacco taxes. This measure of progressivity (or regressivity) is defined as average progressivity (or regressivity) because it examines the fairness of total taxes. Because the poor have lower incomes and consume more tobacco in general, we can say that tobacco taxes are regressive.

Although tobacco taxes may be regressive on average, they may not be marginally regressive, as pointed out by Warner (2000), who used an alternative approach to assess the regressivity of tobacco taxes. He argued that tobacco taxes may not be regressive because if the poor are more sensitive to price increases than the rich, then an increase in cigarette taxes and a resulting increase in cigarette prices make the poor quit smoking or reduce their consumption more than the rich would do. This could shift the burden of tax from the poor to the rich. Hence, an increase in cigarette taxes may turn out to reduce the regressivity of the tax, depending on whether the poor are more sensitive than the rich to the price.

From the policy perspective, the marginal regressivity of tobacco taxes is important. It is calculated as a ratio of the change in tobacco taxes paid because of the change in taxes, or tax rates, to income. It can be explained by using the example specified in Chaloupka *et al.* (2000). Assume that there are two smokers, consuming x units of cigarettes; one has an income of Y (low-income) and the other one earns three times higher income (3Y). Suppose that the low-income smoker has a higher price responsiveness (−0.80) than the high-income smoker has (−0.20), and 50% of price is tobacco tax. If the price of cigarettes (p) increases as result of doubling taxes (assume that it increases from $P = 1$ to $P = 1.5$ and all of the increase is transferred to consumers), then total tax paid will rise from 0.5x/Y to 0.6x/Y (=(1–0.80*0.50) x/y) for the low-income smoker and from 0.167x/Y (= 0.5x/3Y) to 0.3x/Y (=(1–0.20*0.50) x/3y) for the high-income smoker at the new consumption levels. The increase will be 0.1x/Y for the low-income smoker and 0.133x/Y for the high-income smoker. Hence, although taxes are regressive at the beginning, the tax increase is less regressive and total regressivity of tobacco taxes is reduced with the increase in tax.

Evidence about regressivity of tobacco taxes

Incidence analyses of tobacco excises have been extensive in high-income countries, notably in the USA and United Kingdom (Browning, 1978; Townsend, 1987; Congress of the United States, Congressional Budget Office, 1990, 2001; Borren and Sutton, 1992; Fullerton and Rogers, 1993; Townsend *et al.,* 1994; Lyon and Schwab, 1995; Evans *et al.,* 1999; Viscusi, 2002; Colman and Remler, 2004). Overall, these studies found that current excises on tobacco are regressive. Viscusi (2002) argued that cigarette taxes in the USA fell predominantly on the very poor, so that in 1990, low-income people who earned less than US$10 000 a year paid almost twice as much in cigarette taxes as higher-income people who earned US$50 000 and more a year. Recently, Colman and Remler (2008) examined the regressivity of increases in excise taxes on cigarette products in the USA using both tax-expenditure based (share of tax paid in income) and welfare (using consumer surplus estimates) measures of regressivity. They claimed that cigarette tax increases are not close to being progressive, regardless of the measures used. Moreover, according to the results of the recent study, Gospodinov and Irvine (2009) concluded that in Canada "there is little reason to overturn the traditional concerns about regressivity."

Studies from low- and middle-income countries also observed that the burden of current excise taxes falls heavily on poor smokers. In these countries, the share of cigarette expenditure in household income or expenditure varies between 4.25% and 7.2%. The tax burden decreases by income, with the share in rich households ranging from 1.65% to 3% (Onder, 2002; Arunatilake and Opatha, 2003; Karki *et al.,* 2003; Adioetomo *et al.,* 2005). Excise taxes were found to be more regressive mainly due to the high smoking prevalence rate or low income level among the poor. However, results are mixed in terms of the regressivity of excise tax increases.

Studies using a budgetary approach in estimating the progressivity of excise tax increases have supported the claim that an increase in excise taxes may not be regressive. For example, Arunatilake and Opatha (2003) found that current excises are regressive in Sri Lanka. However, this study projected that after a 100% tax increase, the pre-tax regressivity gap (the difference between the share of household income spent on tobacco) would be reduced between the poorest and the richest groups, from a pre-tax level of 3.2% to a post-tax level of 2.3% for

the poorest group and from a pre-tax level of 0.6% to a post-tax level of 0.9% for the richest group. Similarly, Sayginsoy *et al.* (2002) found that after a 72% tax increase in Bulgaria, the share of cigarette expenditure in poor households was reduced from a pre-tax level of 4.9% to 3.96%. In fact, the budget burden of cigarette tax was observed to be more equal among groups: 3.96%, 3.45% and 3.43% from the lowest to the highest income group respectively. In another study, Rajemison *et al.,* (2003) showed that excise taxes on cigarettes were progressive, but that this result was driven by the peculiarities of the Madagascar market. Cigarettes, which are taxed, are consumed by the better-off; while another tobacco product (parakay), which is not taxed, is consumed widely by the poor.

Hence, to determine whether tax increases increase the burden on the poor, it is important to know how the poor and the rich will change their consumption because of the increase in prices. In other words, the regressivity of tax increases depends on the price sensitivity of the poor and the rich.

Differences in price sensitivity by socioeconomic status

Studies based on aggregate data are limited by the fact that the estimates are not obtainable by income, education, or any type of indicator of socioeconomic status of individuals who consume tobacco products. Hence, studies estimating price elasticity of tobacco demand by socioeconomic status are based on individual or household-level data.[3] Table 7.4 reports the estimates of price elasticity of cigarette demand by socioeconomic status of smokers in different countries classified according to the World Bank income classification.

Evidence from high-income countries

Chaloupka (1991) was the first to investigate the price responsiveness of different socioeconomic groups' tobacco consumption. Using individual-level data from the Second National Health and Nutrition Examination Survey conducted in the late 1970s, Chaloupka estimated that the price elasticity of cigarette demand was greater for individuals with less than high school education (ranging from −0.57 to −0.62) than those with at least high school education, who were found to be unresponsive to price changes.

Separate estimates of price elasticity of smoking prevalence and smoking intensity were not available until 1998. Pooling data for 14 years (1976–1980, 1983, 1985 and 1987–1993) from the US National Health Interview Survey, CDC (Centers for Disease Control and Prevention, 1998) showed that smoking prevalence among people below the median income level was more price responsive than among people above the median income level. The converse was true for smoking intensity—the number of cigarettes smoked per day by smokers above the median income level was found to be more price elastic than that for smokers below the median income level. However, the overall price elasticity was greater for people in the lower economic class (−0.29) than for people in the upper economic class (−0.17). The greater price responsiveness of low-income people was thus driven by their greater smoking prevalence elasticity.

The CDC (Centers for Disease Control and Prevention, 1998) further observed that Hispanics were more price responsive than were the black and white populations, both with respect to smoking prevalence and smoking intensity. Blacks were more price responsive than whites with respect to smoking prevalence, and less so with respect to smoking intensity. To the extent that race and ethnicity are proxies for socioeconomic status of population groups in the USA, the greater price responsiveness of the minority (Hispanic and Black) is attributable to differences in their socioeconomic status. Subsequent studies by Biener *et al.* (1998), Evans *et al.* (1999), Hersch (2000), Farrelly *et al.* (2001), Gruber and Koszegi (2002; 2004), Stehr (2007), and DeCicca and McLeod (2008) confirm the negative relationship between socioeconomic status and price responsiveness of tobacco demand.

In a recent study using data from the 1984–2004 Behavioural Risk Factor Surveillance System surveys for the US, Franks *et al.* (2007) found that the elasticity of smoking prevalence with respect to cigarette price was larger among the lowest income group (−0.45) compared to the higher income groups (−0.22) in the pre-Master Settlement Agreement (MSA) period (1984–1996), whereas in the post-MSA period (1997–2004), smoking prevalence became price insensitive for all income groups. The study concluded from these results that in the USA, "increasing cigarette prices may no longer be an effective policy tool and may impose a disproportionate burden on poor smokers."

[3] One exception is the study on UK by Townsend et al. (1994) that used aggregate level data to obtain estimates of price elasticity by socioeconomic groups.

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
Low-income countries					
Myanmar (Kyaing, 2003)	Myanmar Study on Tobacco Economics 2001 - OLS estimation of the price equation - Logit model (with independent variables in log) to estimate probability of smoking in the household (extract from their price elasticity of smoking prevalence) - OLS estimation method for the consumption equation. Total price elasticity = (1-probability of smoking)*(price elasticity of smoking prevalence) + price elasticity of smoking intensity	**Overall** −1.62 **By income quintile** (1) −1.06 (2) −1.56 (3) −1.75 (4) −1.73 (5) −1.48	**Overall** −1.28 **By income quintile** (1) −1.09 (2) −1.25 (3) −1.41 (4) −1.38 (5) −1.24	**Overall** −0.34 **By income quintile** (1) −0.42 (2) −0.31 (3) −0.34 (4) −0.36 (5) −0.24	Dependant variable: Monthly consumption of cigarettes, cheroots and phet kyan (per stick) Independent variables: price of cigarettes, cheroots or phet kyan; per capita monthly income; tax on cigarette/cheroots; dummies for age, sex, literacy, marital status, addiction, education level, place of residence
Myanmar (Kyaing *et al.*, 2005)	Survey of low-income consumers Log-log OLS estimation of conditional cigarette demand function	**Price elasticity of demand** *By income (currency unit: Kyat)* Group 1 ≤24 000 Group 2 24 000–45 000 Group 3 45 000 – 75 000 Group 4 ≥75 000 *Cheroots* Overall: −0.36** (1) −0.50** (2) −0.44** (3) −0.22** (4) −0.32* *Cigarettes* Overall: −0.25* (1) −0.15 (2) −0.37* (3) −0.25* (4) −0.14 *Cigarettes and cheroots* Overall: −0.17* (1) −0.29* (2) −0.19 (3) −0.10 (4) −0.27			Dependent variable: consumption of cheroots * $P < 0.05$ ** $P < 0.01$

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
Nepal (Karki *et al.* 2003)	Smoking Behaviour Survey, November–December 2000 - OLS estimation of the price equation - Logit model (with independent variables in log) to estimate the probability of smoking of the household (extract from there price elasticity of smoking prevalence). - OLS estimation method for the consumption equation. Total price elasticity = (1-probability of smoking)*(price elasticity of smoking prevalence) + conditional price elasticity of smokers	**Overall** −0.88 **By income quintile** (1) −0.79 (2) −0.87 (3) −0.83 (4) −0.63 (5) −0.60	**Overall** −0.46 **By income quintile** (1) −0.31 (2) −0.26 (3) −0.35 (4) −0.35 (5) −0.31	**Overall** −0.42 **By income quintile** (1) −0.48 (2) −0.61 (3) −0.48 (4) −0.28 (5) −0.29	Dependant variable - Monthly consumption of cigarettes and bidis (per stick) Independent variables price of cigarettes or bidis, per capita monthly income, cigarette and bidi tax, dummies for: age, sex, occupation, marital status, addiction, education level, place of residence
Viet Nam (Kinh *et al.* 2006)	1997–1998 Household level cross-sectional data from Viet Nam Living Standards Survey -Linear probability model of smoking status -Double log model of cigarette consumption conditional of smoking participation		**Overall** −0.53 **By income** *Two low quintiles* −0.65 *Two high quintiles* −0.42	**Overall** −0.50 **By income** *Two low quintiles* −0.59 *Two high quintiles* −0.40	Dependent variable: dummy variable for smoking status Independent variables: Price of cigarettes, price of piped tobacco, annual per capita income, individual, household, geographic and commune characteristics
Bangladesh (Nargis *et al.* 2010)	International Tobacco Control Policy Evaluation Bangladesh Survey, 2009 Two-step method: (1) Logit estimation of smoking prevalence (2) OLS estimation of cigarette (bidi) consumption of smokers	**Cigarette demand** *Overall* −0.43 *By socioeconomic status* Low −0.43 Medium −0.39 High −0.24 **Bidi demand** *Overall* −0.64 *By socioeconomic status* Low −1.18	**Cigarette demand** *Overall* −0.29*** *By socioeconomic status* Low −0.33*** Medium −0.27** High −0.14*** **Bidi demand** *Overall* −0.46*** *By socioeconomic status* Low −0.90***	**Cigarette demand** *Overall* −0.14*** *By socioeconomic status* Low −0.10 Medium −0.12** High −0.10* **Bidi demand** *Overall* −0.18 *By socioeconomic status* Low −0.28	Dependent variable: Smoking participation, daily cigarette (bidi) consumption Independent variables: Price per pack of cigarette (bidi), level of education, marital status, number of years of smoking since initiation, village dummy, urban/rural residence, socioeconomic status represented by CASHPOR Housing Index * $P < 0.10$ ** $P < 0.05$ *** $P < 0.01$

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
Bangladesh (Nargis *et al.* 2010) (contd)		Medium −0.91 High −0.44	Medium −0.77** High −0.07	Medium: −0.14** High −0.37***	
Lower-middle-income countries					
Sri Lanka (Arunatilake, 2002)	Household level data 1999/2000 First step: logit model estimating the smoking prevalence Second step: OLS estimation of the tobacco consumption Total price elasticity derived from the elasticity estimates of the smoking prevalence and conditional demand equations	**Overall** −0.45 **By expenditure quintiles** (1) −0.74* (2) −0.69* (3) −0.61 (4) 0.03 (5) 0.12			Dependent variable: per capita monthly tobacco consumption Independent variables: tobacco price per unit of tobacco, monthly per capita income, male ratio, occupation, education, age category, and location (equations divided by expenditure groups, quintiles) *$P < 0.05$
Sri Lanka (Arunatilake and Opatha, 2003)	Srilanka Integrated Survey data of households, 1999–2000 Two-part model: 1 – logit model of household decision to smoke 2 – OLS estimation of conditional demand equation for participating households	**Overall** −0.53 **By expenditure quintile** (1) −0.64 (2) −0.55 (3) −0.60 (4) −0.68 (5) −0.29	**Overall** −0.10* **By expenditure quintile** (1) −0.17 (2) 0.17 (3) 0.21* (4) 0.01 (5) 0.34**	**Overall** −0.60*** **By expenditure quintile** (1) −0.52*** (2) −0.67*** (3) −0.74*** (4) −0.69*** (5) −0.56***	Dependent variable: -household decision to smoke - per capita monthly consumption of cigarettes Independent variables: real price of cigarettes, real per capita income, ratio of adult males to adult females, occupation, education, age, location *$P < 0.10$; **$P < 0.05$; ***$P < 0.01$.
Ukraine (Krasovsky *et al.*, 2002)	June 2001 national representative survey 1 – OLS estimation of the demand equation 2 – Binary regression using the ML method to estimate the prevalence equation model	**Overall** −0.40 **1 – For adults aged 18 to 28 by income group** *Low* −0.37 *Medium* −0.42 *High* −0.24 **2 – Aged 29+ years** *Low* −0.28 *Medium* −0.33 *High* −0.15			Dependent variable: number of cigarettes consumed (cigarette expenditure divided by cigarette prices) Independent variables: real price of cigarettes, household income, age, sex, strength of addiction, region dummies, dummy reflecting whether a smoker had underage children

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
China (Mao *et al.*, 2003)	1998 National tobacco survey in 8 cities and 16 counties	**Overall** −0.51 **Low-income** −1.90 **Middle-income** −0.77 **High-income** 0.51			
China (Mao *et al.*, 2007)		**Overall** −0.154 **Poor** −0.589 **Low-income** −0.234 **Middle-income** –0.018 **High-income** 0.257			
Taiwan, China (Lee, 2008)	Cross-sectional data from 483 respondents of a telephone survey of current smokers (15+ years) from all 23 major cities and counties, collected in April–July 2004 Tobit regression model	**By education** *College and above* −0.10 *High school* −0.06 *Junior high school* −0.11 **By monthly income (currency unit: NT$)** *≤ 9999* −0.63* *10 000–29 999* −0.38 *30 000–49 999* –0.48* *≥50 000* 0.18			Dependent variable: willingness of current smokers to quit smoking or reduce cigarette consumption when faced with a tax increase of NT$22 per pack, which would raise the price of cigarettes by 44% Independent variables: cigarette prices, monthly income *$P < 0.05$
Egypt (Nassar, 2003)	1995/1996 and 1999/2000 Household expenditure surveys Log-log estimation of OLS on the pooled data	**Price elasticity of tobacco** *By expenditure quartiles* 1995/96 Urban Rural (1) −0.30 −0.29 (2) −0.33 −0.32 (3) −0.31 −0.35 (4) −0.26 −0.38 1999/00 Urban Rural (1) −0.39 −0.35 (2) −0.42 −0.37			Dependant variable: - tobacco expenditure Independent variables: aggregate prices on different types of tobacco, total household expenditure, education, work status, occupation, urban/rural regions

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
Egypt (Nassar, 2003) (contd)		(3) −0.42 −0.38 (4) −0.47 −0.47 *By education status* 1995/96 Urban Rural (1) −0.37 −0.37 (2) −0.33 −0.37 (3) −0.27 −0.27 (4) −0.25 −0.24 1999/00 Urban Rural (1) −0.47 −0.41 (2) −0.45 −0.38 (3) −0.42 −0.37 (4) −0.41 −0.36			
Thailand (Isra, 2003)	Household socioeconomic survey 2000 (Consumer price index from the Department of Business Economics, Ministry of Commerce) Linear expenditure system model Estimation by 5 income classes in urban and rural areas separately	**Overall** −0.39 **By income class** *Urban* (1) −1.00 (2) −0.36 (3) −0.13 (4) −0.10 (5) −0.04 *Rural* (1) −0.49 (2) −0.05 (3) −0.03 (4) −0.15 (5) −0.07			Variables included: tobacco consumption, expenditure on cigarettes and other tobacco products, cigarette price, household income, prices of 12 consumer goods, age, education Dummy: urban/ rural
Indonesia (Adioetomo *et al*. 2005)	1999 Social and Economic Survey (SUSENAS) household data First step: logit model estimating the smoking prevalence. Second step: OLS estimation of the tobacco consumption conditional on smoking participation. Total price elasticity derived from the elasticity estimates of the smoking prevalence and conditional demand equations	**Overall** −0.61 **By income** *Low* −0.67 *Medium* −0.33 *High* −0.31	**Overall** −0.02 **By income** *Low* −0.03 *Medium* 0.09 *High* 0.20	**Overall** −0.60* **By income** *Low* −0.66* *Medium* −0.37* *High* −0.41*	Dependant variable: Monthly cigarette consumption divided by the number of household members Independent variables: Cigarette price in rupiah per pack of 16 cigarettes (expenditure on cigarettes divided by the quantity of cigarettes consumed), per capita household income per day in rupiah, dummy for urban/rural location, dummies for education, profession, age and sex *$P < 0.01$

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
Upper-middle-income countries					
Bulgaria (Sayginsoy *et al.*, 2002)	Living Standards Measurement Study Household survey, 1995 2SLS log-log estimation for overall sample and by income group.			**Overall** −0.80 **By income** *Low and low-middle* −1.33 *High-middle* −1.02 *High* −0.52	Dependent variable: Number of packs of 20 smoked by the household per month per capita Independent variables: average price paid for a pack of cigarette, total household income, mean age of all members of household, years of education received by the most educated household member, litres of alcohol consumed per capita in each household, ratio of number of adult males in each household to the size of the household, Dummy = 1 if the household has at least one member who is a widow(er), divorced, living separate from husband/wife or is older than 35 and not married
South Africa (van Walbeek, 2002b)	The Income and Expenditure household surveys of 1990 and 1995 - Log-log estimation of income elasticity for each income quartile for 1990 and 1995 (log of the cigarette expenditure divided by the income and function of the income quartiles). - Calculation of net change of cigarette consumption between 1990 and 1995 (% change in average cigarette consumption minus the effect of income change on consumption) - Estimation of price elasticity (net change of cigarette consumption divided by real price change)	**By income quartile** (1) −1.39 (2) −1.13 (3) −1.08 (4) −0.81			Dependent variable: Household's annual expenditure on cigarettes Independent variables: real household income subdivided into four income quartiles, real price of cigarettes

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
Turkey (Onder, 2002)	Household Expenditure and Consumption Survey, 1994 First step: Estimation of the smoking participation decision of the households with a logit model for all households and by income quintiles; estimation of the cigarette tax as a function of household income and estimation of the price for non smoker households - Second step: Log-log estimation of the conditional demand for cigarettes by the smoker Two-stage least squares estimation to correct for endogeneity of the price variable	**Overall** −0.41 **By household income** (1) −0.47 (2) −0.90 (3) −0.56 (4) −0.43 (5) −0.16	**Overall** −0.03 **By household income** (1) −0.12 (2) −0.32 (3) −0.11 (4) −0.02 (5) 0.15	**Overall** −0.39 **By household income** (1) −0.35 (2) −0.58 (3) −0.45 (4) −0.41 (5) −0.30	Dependent variables: - number of cigarettes smoked by the smoker households - smoking participation decision (probability of smoking) - cigarette price - cigarette excise tax. Independent variables: cigarette price per package of 20, per capita household income per month, education, gender, age, number of adults in the household, location, region, dummy: employed head, dummy: white collar head
High-income countries					
USA (Chaloupka 1991)	1976–1980 individual-level data from the second National Health and Nutrition Examination Survey Two-stage least-squares estimation	**Long-run price elasticity of cigarette consumption** *Overall* −0.30 to −0.46 *Less than a high school education* −0.57 to−0.62 *At least a high school education* unresponsive			Dependent variable: Average daily cigarette consumption Independent variable: Current price, past price, future price, addictive stock, lagged consumption, future consumption
USA (Centers for Disease Control and Prevention 1998)	Pooled data from 14 years (1976–1980, 1983, 1985, and 1987–1993) from the National Health interview Survey for ≥18 age group -Probit model of smoking prevalence -OLS estimation of conditional demand model of cigarette consumption	**Overall** −0.25 **By income** *≤median* −0.29 *> median* −0.17 **By race** *White* −0.14 *Black* −0.32 *Hispanic* −1.89	**Overall** −0.15 **By income** *≤median* −0.20 *> median* −0.05 **By race** *White* −0.05 *Black* −0.36 *Hispanic* −1.31	**Overall** −0.10 **By income** *≤median* −0.09 *> median* −0.12 **By race** *White* −0.09 *Black* 0.04 *Hispanic* −0.58	-Smoking prevalence Dependent variable: prevalence of smoking -Smoking intensity Dependent variable: cigarettes per day for smokers Independent variables: age, age squared, real family income, family size, state of residence, year, city size, race or ethnicity, educational level, marital status, gender, price of cigarettes

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
USA (Hersch 2000)	1992/93 Current Population Surveys: Tobacco Use Supplement Participation equation estimated by probit model and smokers' consumption equation by OLS regression for men and women		**Male** *Overall* −0.54** *By income* Low −0.58** Medium −0.40** High −0.25 **Female** *Overall* −0.38** *By income* Low −0.99** Medium −0.06 High 0.58*	**Male** *Overall* −0.43** *By income* Low −0.60** Medium −0.44** High −0.13 **Female** *Overall* −0.57** *By income* Low −0.72** Medium −0.55** High −0.30	Dependent variable: smoking participation, cigarette consumption of smokers Independent variables: price, family earning, education, age, age squared, marital status, race, age of youngest child, occupational status *$P < 0.05$ **$P < 0.01$
USA (Farrelly *et al.* 2001)	Pooled data from 14 years (1976–1980, 1983, 1985, and 1987–1993) from the National Health interview Survey for > = 18 age group -Probit model of smoking prevalence -OLS estimation of conditional demand model of cigarette consumption	**Overall** −0.28 **By income** ≤*median* −0.43 > *median* −0.10 **By race** *African-American* −0.35 *Hispanic* −0.93 *White* −0.15	**Overall** −0.13 **By income** ≤*median* −0.21 > *median* 0.01 **By race** *African-American* −0.20 *Hispanic* −0.62 *White* −0.08	**Overall** −0.15 **By income** ≤*median* −0.22 > *median* −0.11 **By race** *African-American* −0.15 *Hispanic* −0.31 *White* −0.15	-Smoking prevalence Dependent variable: prevalence of smoking -Smoking intensity Dependent variable: cigarettes per day for smokers Independent variables: age, age squared, real family income, family size, state of residence, year, city size, race or ethnicity, educational level, marital status, gender, price of cigarettes
USA (Ringel and Evans, 2001)	Cross-sectional Nataly Detail Files (1989–1995) *n* = 20 025 000 pregnant women (14–21 years) Probit model		**By education** *College* −3.39 *Some college* −0.86 *High school* −0.49 < *High school* −0.30		Dependent variable: smoking participation Independent variables: monthly state excise rates (that near the beginning of the pregnancy) in real 1997 prices, age, race/ethnicity, education, marital status, parity of birth, adequacy prenatal care, sex of child, state and month of conception

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
USA (Ringel and Evans, 2001) (contd)			**By race** *Black* −0.55 *White* −0.79 *Hispanic* −0.64 *Others* −0.54		
USA (Gruber and Koszegi, 2004)	Consumer Expenditure Survey, 1980–1998 Instrumental variable estimation of cigarette expenditure function			**Price sensitivity of cigarette expenditure** *By income quartile* (1) −1.09 (2) −0.70 (3) −0.53 (4) −0.39 *By consumption quartile* (1) −1.05 (2) −0.77 (3) −0.31 (4) −0.64 *By education groups* High school dropouts −1.08 High school graduates −0.93 Some college education −0.11 College graduates −0.40	Dependent variable: cigarette expenditure Independent variables: price instrumented by excise tax, age, education, sex, race of the household head, dummies for number of persons in the household, state dummies, year dummies, calendar month dummies
USA (Franks *et al.*, 2007)	1984–2004 Behavioral Risk Factor Surveillance System surveys Logistic regression		**1984–1996** *Lowest income quartile* −0.45* *All other income quartiles* −0.22* **1997–2004** *Lowest income quartile* −0.14 *All other income quartiles* −0.07		Dependent variable: Smoking prevalence Independent variables: Cigarette pack price, age, age squared, gender, race/ethnicity, years of schooling, number of adults in the household, consumer price index, household income, dummy variables for each survey year and each state, Gini coefficient for each year * $P < 0.01$
USA (Stehr, 2007)	Cross sectional (pooled surveys) Behavioral Risk Factor Surveillance System (1985–2000); sample size over 1.3	**Male** *Overall* −0.26 *By income quartile* (1) −0.36	**Male** *Overall* −0.16 *By income quartile* (1) −0.23	**Male** *Overall* −0.09 *By income quartile* (1) −0.13	Dependent variables: smoking participation, cigarette consumption Independent variables: gender, state fixed effects,

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
USA (Stehr, 2007) (contd)	million (age ≥ 18 years) Two-part model: 1) probit (smoking participation) 2) log-log OLS (conditional demand for cigarettes)	(2) −0.11 (3) −0.21 (4) −0.23 **Female** *Overall* −0.51 *By income quartile* (1) −0.59 (2) −0.30 (3) −0.47 (4) −0.53	(2) −0.07 (3) −0.09 (4) −0.15 **Female** *Overall* −0.40 *By income quartile* (1) −0.43 (2) −0.25 (3) −0.30 (4) −0.43	(2) −0.03 (3) −0.13 (4) −0.07 **Female** *Overall* −0.12 *By income quartile* (1) −0.16 (2) −0.05 (3) −0.16 (4) −0.10	income, education, sex, age, ethnicity, and year of interview
USA (Colman and Remler, 2008)	Current Population Survey (CPS) Tobacco Use Supplements (TUS) and March Income Supplements, six pooled cross-sections—1993, 1996, 1999, 2001, 2002, and 2003 Two-part model: First stage—Linear probability model (OLS) Second stage—OLS regression of cigarette consumption among those who smoke	**Low income** −0.37 **Medium income** −0.35 **High income** −0.20	**Low income** −0.24 **Medium income** −0.20 **High income** −0.12	**Low income** −0.13 **Medium income** −0.11 **High income** −0.08	-Smoking prevalence Dependent variable: prevalence of smoking -Smoking intensity Dependent variable: cigarettes per day for smokers Independent variables: cigarette price, family income, year, state indicators, dummies for the education levels of high school, some college, college graduate, and more than college (high-school dropout is the omitted category); Hispanic, non-Hispanic black, and non-Hispanic other race (non-Hispanic white is the omitted category); female; divorced, separated, widowed, and never-married (married is the omitted category); unemployed and not-in-the-labour-force (employed is the omitted category); the occupational categories blue-collar, service, farm, military, and never-employed (white-collar is the omitted category); and several continuous variables, including age and age squared, thenumber of children under 6 years old

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
USA (Colman and Remler, 2008) (contd)					in the family, interactions between year and age and age squared to allow time trends to differ by age, and an index measure of legal restrictions ("clean air index") on indoor smoking
USA (DeCicca and McLeod, 2008)	Cross-sectional (5 surveys) Behavioral Risk Factor Surveillance System (2000–2005) 435 973 adults (45–59 years old) Telephone interview Representative sample US population Two-way fixed effects models (multilevel model)		**By education** *Low* −0.43 *High* −0.12 **By income** *Low* −0.39 *High* −0.09		Dependent variable: smoking participation Independent variables: real monthly state-specific cigarette excise tax rates per pack of 20 cig in 2001 dollars, gender, age, race, education, income, marital status, health status, unemployment rate, state ban in workplaces and restaurants
USA (Farrelly and Engelen, 2008)	Pre and post- Master Settlement Agreement (MSA) estimates as reported by Nielsen Co. 1990–2006 Sample size: 1990–1998: 782 403 1998–2006: 1 763 952 Logistic regression		**By income quartile** *1990–1998 (pre-MSA)* Overall −0.22 Lowest −0.16 Middle 2 quartiles −0.34 Highest −0.14 *1998–2006 (post-MSA)* Overall –0.09 Lowest −0.11 Middle 2 quartiles −0.06 Highest −0.02		Dependent variable: Smoking prevalence Independent variables: Cigarette pack price, age, age squared, gender, race/ethnicity, years of schooling, number of adults in the households, consumer price index, household income, dummy variables for each survey year and each state, Gini coefficient for each year
United Kingdom (Townsend *et al.*, 1994)	Biennial data from British general household survey, 1972–90 Model of smoking prevalence and cigarette consumption by socioeconomic groups		**Men** *All* −0.08 *Socioeconomic group (5)* –0.61* **Women** *All* −0.23* *Socioeconomic group (5)* −0.51**	**Men** *All* −0.47 *By socioeconomic group* (1) 0.03 (2) −0.12 (3) Non-manual −0.67* (4) Manual −0.49* (5) −0.47* (6) −1.02*	Dependent variable: prevalence of smoking, defined by the proportion of adults currently smoking one or more cigarettes a day, and numbers of cigarettes smoked per smoker *$P < 0.05$ **$P < 0.01$

Table 7.4. Price elasticity of tobacco use by income/SES/education

Publication (location, author, year)	Methods and model	Total price elasticity of demand	Price elasticity of smoking prevalence	Price elasticity of smoking intensity	Comment
United Kingdom (Townsend *et al.*, 1994) (contd)				**Women** *All* −0.61** *By socioeconomic group* (1) 0.50 (2) −0.29 (3) Non-manual−0.75** (4) Manual −0.71* (5) −0.64* (6) −0.88*	
Canada (Gruber *et al.*, 2003)	1982–1998 Canadian Survey of Family Expenditure Instrumental variable estimation of cigarette expenditure function	**By income quartile** (1) −0.99 (2) −0.45 (3) −0.31 (4) −0.36 **By expenditure quartile** (1) −0.92 (2) −0.73 (3) −0.20 (4) −0.37			Dependent variable: cigarette expenditure Independent variables: price of cigarettes, region, year, gender, income, income squared, regional time trends
Canada (Gospodinov and Irvine 2009)	Statistics Canada/Health Canada Canadian Tobacco Use Monitoring Survey (CTUMS), 2000–2005 Two-part model of estimation	**Overall** −0.30 **< High school** −0.23 **High school** −0.33 **College** −0.30			Dependent variable: smoking participation, cigarette consumption Independent variables: price, province of residence, level of education
Australia (Siahpush *et al.*, 2009)	Australian population survey data collected monthly from January 1991 to December 2006 Sample size: 515 866 individuals aged ≥18 years Poisson regression to estimate monthly smoking prevalence as a function of covariates		**By income** *Low-income* −0.32 *Medium-income* −0.04 *High-income* −0.02		Dependent variable: smoking prevalence Independent variables: price, income, interaction of price with income, education, age, gender, time

The above conclusion sparked an empirical debate regarding the role of socioeconomic status in the welfare consequences of tobacco tax increase. Farrelly and Engelen (2008), for example, reanalysed the data used in Franks *et al.* (2007), adding two years of data after the MSA and limiting the pre-MSA period from 1990 to October 1998. They dropped the earlier years because only 15 US states were included in the data for 1984–1989. Then replicating the same model and analytic approach, they found that the size of the price effect did decline in the post-MSA period, but only among the middle- and high-income people. Thus the lowest income group was still found to be price-sensitive, in contrast to what Franks and his colleagues observed. This disagreement reflects that the results of estimation by socioeconomic status were sensitive to the period of the data they used. Franks *et al.* (2008) immediately responded by pointing out several inconsistencies in Farrelly and Engelen's analysis, especially the loss of sample size by over one million persons due to dropping two years of observations. A contemporary study by Colman and Remler (2008) reinforced the greater price elasticity for lower-income groups: −0.37 for the low-income, −0.35 for the medium-income and −0.20 for the high-income group.

An earlier study by Ringel and Evans (2001) found that among pregnant women in the USA, price responsiveness of cigarette demand was highest among the most-educated cohort and was lower the lower the level of education. They also found lower price responsiveness among black and Hispanic pregnant women than among whites. Their findings suggest that the pregnant women among the white population are more conscious of the adverse health consequences of smoking compared to the minorities and are more responsive to price increases. However, this result applies to the pregnant women in the USA, not necessarily to the general population.

Estimates of price elasticity of smoking intensity reported in Gospodinov and Irvine (2009) for Canada show greater price responsiveness among high school graduates (−0.33) than among those with less than a high school education (−0.23) or among college graduates (−0.30), suggesting an inverse-U relationship between price sensitivity and level of education. However, Gruber *et al.* (2003) found a more systematic relationship between income and cigarette expenditure elasticity in Canada—the estimates were considerably greater in the lowest two quartiles than in the upper two quartiles.

In a seminal study in the United Kingdom, using biennial data from British general household survey (1972–90), Townsend *et al.* (1994) found that both smoking prevalence and intensity among men and women in lower socioeconomic groups were more responsive to changes in cigarette prices and less responsive to information about the adverse health consequences of smoking. The uniqueness of this study lies in the fact that it uses aggregated data by socioeconomic group rather than cross-sectional level data, which form the basis for all other studies in this genre. The price elasticity of smoking prevalence of men in the lowest socioeconomic group among five groups was estimated to be −0.61, while it was −0.08 for the overall male population. For women, smoking prevalence elasticity was −0.51 in the lowest socioeconomic group, compared with −0.23 for overall female population. Similarly, the elasticity of smoking intensity was estimated to be at −1.02 and −0.88 for men and women in the bottom socioeconomic group respectively, compared with −0.47 and −0.61 for the total male and female population. The inverse relationship of price responsiveness of tobacco demand to the socioeconomic status of people in the United Kingdom was further confirmed in Townsend (1996).

The relationship between price responsiveness of smoking prevalence and socioeconomic status is, however, not monotonic. Borren and Sutton (1992) found evidence of an 'inverse-U' relationship of price responsiveness with income status in the United Kingdom—middle-income men were found to be more price elastic than lower- and higher-income men. Their evidence for women, however, corresponds to the more common finding that price elasticity declines as income increases.

Schaap *et al.* (2008) studied the effectiveness of comprehensive tobacco control policies including price and taxation in 18 European countries.[4] They found the strongest association of quit ratio with price policy among all the tobacco control policies implemented in these countries, including taxes on tobacco products, bans or restrictions on smoking in public places, advertising bans, public information campaign spending, health warnings, and treatment. However, they observed no significant difference in the impact of an increase in tobacco price on quitting between high and low education groups. Similarly, Lee (2008) found no significant difference in price responsiveness across different education groups in Taiwan,

[4] Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Portugal, Slovakia, Spain, Sweden and United Kingdom.

China. However, this study found the highest price sensitivity among the smokers with the lowest monthly income.

In Australia, on the other hand, Siahpush *et al.* (2009) found consistently greater price sensitivity of smoking prevalence among lower-income respondents. The difference of price elasticity of smoking prevalence estimated for low-income people (−0.32) from those estimated for medium income (−0.04) and high income (−0.02) groups is stark. This study is unique in using monthly data on smoking prevalence, and presents a significant improvement over the previous studies that were limited by their use of annual prevalence data. The authors argue that annual data are likely to provide inaccurate estimates of the effect of price on smoking behaviour, as it may miss any fast-acting change in smoking behaviour in response to a price increase or stabilization within a given year.

Evidence from low- and middle-income countries

The variation of price responsiveness of smoking prevalence and intensity across socioeconomic groups is evident in low and middle income countries as well. The relevant literature proliferated during 2002–2003 and thereafter with the launching of the HNP Discussion Paper series by the Health, Nutrition and Population Family (HNP) of the World Bank's Human Development Network on the Economics of Tobacco Control, in collaboration with the Tobacco Free Initiative of the World Health Organization. These studies are based on relatively recent data sets and are uniform in method of estimation of price elasticities for smoking prevalence and smoking intensity.

Among low-income countries, evidence from Myanmar suggests an inverse-U relationship of price responsiveness of smoking prevalence to income group—the prevalence elasticity for the third quintile (−1.41) was estimated to be greater than those for the bottom (−1.09) and top quintiles (−1.24) (Kyaing, 2003). The price elasticity of smoking intensity was, however, highest for the lowest income quintile, although the price elasticity did not decrease monotonically with higher economic status. A later study by Kyaing *et al.* (2005) found the highest price elasticity among the lowest income group for cheroots and among the second lowest income group for cigarettes in Myanmar. For Nepal, as shown in Karki *et al.* (2003), the price elasticity of smoking intensity was greatest for the second-poorest income quintile, and it decreased with higher income quintiles. This pattern was also reflected in total price elasticity. Smoking prevalence did not show any systematic relationship with income status in Nepal. On the other hand, Kinh *et al.* (2006) estimated larger elasticities of both smoking prevalence and smoking intensity for the lowest two quintiles compared to the top two quintiles for Viet Nam.

The study on Bangladesh conducted by the International Tobacco Control Policy Evaluation Project in 2009 found systematic evidence of greater price elasticity of smoking prevalence among lower income households for both cigarette and bidi smoking, and mixed evidence on the price responsiveness of smoking intensity. The daily consumption of smokers belonging to lower socioeconomic status was found to be insensitive to price changes in both cigarette and bidi consumption. The moderate- and high-income households did not differ much with respect to the price responsiveness of smoking intensity of cigarette consumption, although for bidi consumption it was greater for high-income people. The total price elasticity, however, reflected the inverse relationship found between smoking prevalence elasticity and socioeconomic status. These results indicate that price has strong influence on the decision to smoke in Bangladesh, but that the effect is less obvious on the average consumption of smokers.

Among the lower-middle-income countries, in China, low-income people's tobacco consumption is more price responsive than that of higher-income people (Mao *et al.,* 2003, 2007). The evidence is again mixed for Egypt; using Household Expenditure Survey data for two years (1995–96 and 1999–2000), Nassar (2003) found no systematic relationship between price elasticity and expenditure quartiles in either urban or rural areas in Egypt in 1995–96; whereas the price elasticity was greater for higher expenditure quartiles in 1999–2000 in both urban and rural areas. This finding stands in contrast with the conventional pattern. However, when price elasticity estimates were ranked by educational status of individuals, people with lower levels of education were consistently found to be more responsive to price changes than those with higher levels of education.

A study on Indonesia by Adioetomo *et al.* (2005) found that smoking intensity in lower-income groups was consistently more sensitive to price changes than in higher-income groups. They estimated the elasticity of smoking prevalence at −0.034 for low-income households. For medium- and high-income households, the elasticities were positive. None of these estimates were, however, statistically

significant. This study, which factors in the number of cigarettes smoked by the smokers, therefore suggests that in Indonesia price is not a significant factor in people's decision to smoke, particularly for the well-off.

Among other lower-middle-income countries, such as Sri Lanka, Thailand and Ukraine, the findings are not systematic enough to reach a conclusion about the variation in price responsiveness among different socioeconomic groups (Table 7.4). This is also the case for upper-middle-income countries, such as Bulgaria and Turkey. In Bulgaria, for example, the average price elasticity of smoking propensity is highest among the low-income group, but the high-income group showed greater price sensitivity than the middle-income group (Sayginsoy *et al.,* 2002). In Turkey, price elasticity was highest for the second income quintile, in line with an inverse-U relationship (Onder, 2002).

In South Africa, on the other hand, price sensitivity was larger at lower income quartiles (van Walbeek, 2002b, 2005). The percentage of households that bought cigarettes decreased from 49% in 1990 to 30% in 2000, while the real price of cigarettes increased by more than 100%. The percentage of households in the poorest income quartile that bought cigarettes decreased from 46% to 22%, while among the richest income quartile that percentage decreased from 43% to 34%. This implies that the poor are significantly more price-sensitive than the rich (van Walbeek, 2005).

Price responsiveness of smoking initiation, quitting and relapse

The evidence available on the price sensitivity of smoking prevalence by socioeconomic characteristics mostly pertains to smoking prevalence in general. The existing literature rarely differentiates between smoking initiation, quitting or relapse, primarily due to the fact that this type of analysis requires longitudinal or retrospective data on individual smoking behaviour. Madden (2007), for example, used retrospective data on a sample of Irish women aged 48 and under to conduct a duration analysis of the factors influencing smoking initiation and quitting. The study found mixed evidence on the effect of price on smoking initiation and quitting by education status of individuals. For starting smoking, the strongest effect of tax was observed on those with intermediate levels of education, and weaker effects for those with least education or higher levels of education, evidence suggesting an inverse-U effect. The finding that the price sensitivity for intermediate levels of education was greater than for higher levels of education was, however, not statistically significant. On the other hand, tax seemed to be most effective in inducing quitting among those with the least education, and there was little evidence of any significant difference in the effectiveness of taxation between groups with higher levels of education.

Explaining differences in price sensitivity by socioeconomic status

The greater price sensitivity of people belonging to lower socioeconomic status, as observed consistently in higher-income countries, has a clear theoretical basis for explanation. It follows from the theory of rational addiction that the variation in the price sensitivity of smokers across different socioeconomic groups in an economy is attributable to the variation in their rate of time preference, which pertains to the premium a person places on enjoyment in the immediate period over delayed gratification (Becker and Murphy, 1988; Becker *et al.,* 1991). An individual with high time preference is focused more on his well-being in the present, and therefore discounts the payoffs in the future more heavily. Individuals with high time preference not only discounts future payoffs more than an average person would do, but they also tend to discount future loss of health or earnings or any harmful effects of current consumption at a higher rate. Smokers from lower socioeconomic status often fall into this category. Relative to people with higher socioeconomic status, they assign greater value to the current gratification from smoking, so much so that it more than compensates for the future loss of health and productivity they expect to incur for their current smoking habit. In the same vein, a given increase in the price of tobacco in the present period imposes greater cost on the addicts belonging to lower socioeconomic status, and induces them to cut tobacco consumption more than well-off addicts would do.

The share of tobacco expenditure in total household expenditure partly accounts for the greater price responsiveness of lower-income people. It can be shown that a 1% increase in the price of cigarettes translates into equal percentage increase in total expenditure on tobacco, given income and the quantity demanded of tobacco. This is the case when the price elasticity of smoking intensity for continued smokers is zero. Tobacco expenditure can increase in response to a price increase even when the quantity demanded of tobacco decreases, provided that the price elasticity is less than one, which is typically the

case for an addictive commodity such as tobacco. When tobacco demand is inelastic, tobacco demand falls less than proportionately in response to a price increase raising the total expenditure on it. Thus as long as demand for tobacco is price-inelastic, a given increase in its price results in greater proportion of household expenditure needed to maintain the habit of tobacco use, other things remaining the same. The lower the level of total household expenditure, the greater is the burden of increased expenditure. Given the scarcity of household resources to meet the basic necessities in low-income households, they incur relatively higher opportunity cost of tobacco use, as discussed above. The greater opportunity cost of an additional unit of money spent on tobacco is greater for lower-income households, which leads the smokers at the lower end of household income distribution to cut down tobacco consumption more in response to price increases than higher-income smokers would do.

The effect of the increase in tobacco price on the share of tobacco expenditure and consequent opportunity cost of tobacco use is accentuated when smokers from lower-income households spend a greater proportion of household expenditure on tobacco to begin with. The relatively greater burden of tobacco expenditure on poorer households is widely evident in the low- and middle-income countries (see Table 7.2 for the evidence on varying expenditure pattern by socioeconomic status of households).

The studies cited above do not take into account the possibility of substitution from higher-priced to lower-priced smoked tobacco products, nor from smoked to smokeless tobacco products, or any other form of compensatory change in tobacco consumption pattern in response to price increases. To the extent that this happens, smokers maintain their habit and the impact of price increases is reduced. The existing literature provides ample evidence in support of the substitution to cheaper or alternative tobacco products in response to cigarette tax and price increase (e.g. Thompson and McLeod, 1976; Pekurinen, 1989; Ohsfeldt and Boyle, 1994; Ohsfeldt *et al.,* 1997, 1999; Evans and Farrelly, 1998; Laxminarayan and Deolalikar, 2004; Young *et al.,* 2006). These studies, however, do not report whether the likelihood of tax avoidance through product substitution varies by socioeconomic status of smokers; the evidence base to address this issue is very limited.

Using the ITC data set for four countries, USA, Canada, the United Kingdom and Australia, Hyland *et al.* (2006) found evidence of tax avoidance, particularly among younger, non-white, male and higher-income smokers who smoke more cigarettes per day than the older, white, female and lower-income smokers respectively. Smokers who tend to purchase more from low-taxed and untaxed sources of cigarettes or switch to roll-your-own cigarettes are expected to be less likely to quit smoking, and their price sensitivity would be lower than the rest of the population.

Lower-income smokers would likely also seek tobacco products made available through illicit trade at prices cheaper than the market rates. To the extent that they succeed in maintaining their consumption level and expenditure on tobacco by using contraband tobacco products, their responsiveness to tobacco tax increases is reduced. In the United Kingdom, for example, smokers from socioeconomically disadvantaged areas of Edinburgh reported purchases of contraband products to compensate for the rising costs of smoking, and expressed the view that smugglers provide a valuable service to society (Wiltshire *et al.,* 2001). Evidence from Taiwan, China also indicated that low-income and poorly educated smokers are more likely to purchase smuggled cigarettes—smokers with personal monthly income lower than NT$10 000 in 2004 and the lowest level of education were 54% more likely to smoke smuggled cigarettes than the smokers who had either of these two characteristics or none (Lee *et al.,* 2009).

These findings imply that in the presence of widespread tax avoidance and evasion behaviour among tobacco users, the price responsiveness would be lower than intended, and it may vary across the socioeconomic strata of the population. Since lower-income people are more prone to tax avoidance and evasion than others, price elasticity estimates for this group are likely biased upward. Thus the greater price sensitivity of people from lower socioeconomic status found in most studies in high-income countries may prove to be illusive if this compensatory behaviour pattern of lower-income people is taken into account for the estimation of price elasticity of tobacco demand.

The mixed evidence of the relationship of price responsiveness to socioeconomic status in low- and middle-income countries, however, cannot be explained adequately with time preference, share of tobacco expenditure or product substitution behaviour, as explained above. The poorest people are not necessarily the most sensitive to tobacco price changes in these countries. Although circumstances can differ between countries, in some countries this can be attributed to the availability of low-cost or cheaper tobacco

products that are predominantly consumed by lower-income people and are often untaxed or subject to preferential tax treatment. Examples of such products are as kreteks in Indonesia; bidi and chewing tobacco in Bangladesh, India and other southeast Asian regions; waterpipe tobacco in southeast Asia and the eastern Mediterranean, "Eco cigarillos" and fine-cut tobacco in the EU; and "small cigars" in the USA. (Chapter 2 of this volume describes these tobacco products in detail). van Walbeek (2005) found strong evidence that the poor were switching to pipe and other tobacco (presumably to make roll-your-own cigarettes) much more than the rich. In 1990 the poorest quarter of the population spent about 5% of their tobacco purchases on pipe and other tobacco; in 2000 this had increased to 18.7%. Among the second poorest quarter of the population there was also an increase in the relative share of pipe and other tobacco (from 2.4% to 7.1% of total tobacco expenditure), but the share of pipe and other tobacco among the richer half of the population remained unchanged over this period.

Taxes on this type of product are kept low to make them affordable to lower-income consumers. The differential tax rates applied to a wide range of prices across types of tobacco products or even within the same tobacco product encourage substitution of lower-taxed products when taxes are increased, as opposed to quitting or reduction in consumption. It in turn lowers the effectiveness of increased tax, particularly on the lower-income people who primarily consume lower-taxed tobacco products.

The difference in the tax structure between low- and high-income countries is also likely to contribute to the observed pattern of price responsiveness by socioeconomic status of tobacco users. As discussed in Chapter 2, most low-income countries have *ad valorem* taxes, while high-income countries such as the USA, Canada, Australia, New Zealand, Japan and Singapore rely on a specific tax system, and the European countries mostly rely on a mixed structure with both *ad valorem* and specific taxes. It is well recognized that the burden of increased tax is greater on low-priced products under the specific tax system than under the *ad valorem* system. Thus it is expected that consumers of low-priced tobacco products in countries using specific tax system would be more sensitive to tax increases than in countries using an *ad valorem* system.

However, no study has been undertaken to examine the effect of either the differential tax treatment of tobacco products or of different tobacco tax structure across countries that can potentially explain the variation in the price sensitivity of tobacco users across countries or across socioeconomic groups within countries to a great extent. The dichotomy in the evidence base between high- and lower-income countries clearly calls for more rigorous evaluation of the data and methods used for these analyses that are likely to affect the results of estimation, and of country-specific socioeconomic environments and tobacco tax structures that can potentially influence the mechanisms through which tax increase affects tobacco demand.

Conclusion

The prevalence of tobacco use is in general higher among the poor. The greater prevalence of tobacco use among the poor adds to economic and social disparity, with disproportionately larger share of tobacco expenditure and disease burden borne by the poor. In these circumstances, increasing tobacco taxes can yield greater public health gain to them than to the rich.

The price responsiveness of tobacco demand also varies by the socioeconomic status (such as income, expenditure, education, race or ethnicity) of the population groups of a country. It is consistently higher among the poor than the rich in high-income countries. This finding can be explained by the present-oriented nature of poorer people, who tend to discount at a higher rate the future health cost and loss of earning owing to tobacco use. Poor people also incur increasingly higher opportunity cost of tobacco use when tobacco price increases, and thus tend to reduce tobacco consumption more than the rich would do. As a result, the share of the total quantum of tobacco tax paid by the poor is expected to decrease when tobacco tax and prices are increased.

Evidence on the variation of price responsiveness of tobacco demand by socioeconomic status of population groups is mixed in low- and middle-income countries. The poorest people are not necessarily the most sensitive to tobacco price changes in these countries. Although circumstances can differ between countries, in some countries this can be attributed to the availability of untaxed and cheaper tobacco products, which are consumed more by the poor. This explains why the existing empirical literature is not conclusive about the equity implication of the increase in tobacco taxes in low- and middle-income countries.

References

Adioetomo SM, Djutaharta T, Hendratno (2005). Cigarette consumption, taxation and household income: Indonesia case study. HNP Discussion Paper Series, Economics of Tobacco Control Paper No. 26. Washington DC, The World Bank.

Ali Z, Rahman A, Rahman T (2003). Appetite for nicotine: an economic analysis of tobacco control in Bangladesh. HNP Discussion Paper Series, Economics of Tobacco Control Paper No.16. Washington DC, The World Bank.

Aloui O (2003). Analysis of the economics of tobacco in Morocco. HNP Discussion Paper Series, Economics of Tobacco Control Paper No. 7. Washington DC, The World Bank.

Arunatilake N (2002). An economic analysis of tobacco demand in Sri Lanka. *Sri Lanka Economic Journal,* 3:96–120.

Arunatilake N, Opatha M (2003). The economics of tobacco in Sri Lanka. HNP Discussion Paper Series, Economics of Tobacco Control Paper No.12. Washington DC, The World Bank.

Auld M (2005). Smoking, drinking and income. *J Hum Resour,* 40:505–518.

Barbeau EM, Krieger N, Soobader MJ (2004). Working class matters: socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *Am J Public Health,* 94:269–278.doi:10.2105/AJPH.94.2.269 PMID:14759942

Barber S, Adioetomo SM, Ahsan S *et al.* (2008). Tobacco Economics in Indonesia. Paris, International Union Against Tuberculosis and Lung Disease.

Becker GS, Grossman M, Murphy KM (1991). Rational addiction and the effect of price on consumption. *Am Econ Rev,* 84:396–418.

Becker GS, Murphy KM (1988). A theory of rational addiction. *J Polit Econ,* 96:675–700 doi:10.1086/261558.

Biener L, Aseltine RH Jr, Cohen B, Anderka M (1998). Reactions of adult and teenaged smokers to the Massachusetts tobacco tax. *Am J Public Health,* 88:1389–1391.doi:10.2105/AJPH.88.9.1389 PMID:9736885

Bobak M, Jha P, Nguyen SN, Jarvis MJ (2000). Poverty and smoking. In: Jha P, Chaloupka F, editors. Tobacco control in developing countries. Oxford, U.K.: Oxford University Press; p. 41–61.

Borren P, Sutton M (1992). Are increases in cigarette taxation regressive? *Health Econ,* 1:245–253.doi:10.1002/hec.4730010406 PMID:1341940

Browning EK (1978). The burden of taxation. *J Polit Econ,* 86:649–671 doi:10.1086/260703.

Centers for Disease Control and Prevention (CDC) (1998). Response to increases in cigarette prices by race/ethnicity, income, and age groups–United States, 1976–1993. *MMWR Morb Mortal Wkly Rep,* 47:605–609. PMID:9699809

Chaloupka F, Hu TW, Warner KE *et al.* (2000). Taxation of tobacco products. In: Jha P, Chaloupka F, editors. Tobacco control in developing countries. Oxford, U.K.: Oxford University Press; p. 237–72.

Chaloupka FJ (1991). Rational addictive behavior and cigarette smoking. *J Polit Econ,* 99:722–742 doi:10.1086/261776.

Colman G, Remler DK (2004). Vertical equity consequences of very high cigarette tax increases: if the poor are the ones smoking, how could cigarette tax increases be progressive. NBER Working Paper Series. Working Paper #10906. Cambridge, MA, National Bureau of Economic Research.

Colman G, Remler DK (2008). Vertical equity consequences of very high cigarette tax increases: if the poor are the ones smoking, how could cigarette tax increases be progressive? *J Policy Anal Manage,* 27:376–400 doi:10.1002/pam.20329.

Congress of the United States, Congressional Budget Office (1990). Federal taxation of tobacco, alcoholic beverages and motor fuels. Washington DC: US Government Printing Office, Congress of the United States

Congress of the United States, Congressional Budget Office (2001). Historic effective tax rates, 1979–1997. Washington DC: US Government Printing Office, Congress of the United States.

Cutler DM, Gruber J, Hartman RS *et al.* (2002). The economic impacts of the tobacco settlement. *J Policy Anal Manage,* 21:1–19. doi:10.1002/pam.1037 PMID:11887906

David A, Esson K, Perucic AM, Fitzpatrick C (2010).Tobacco use: equity and social determinants. In: Blas E, Sivasankara Kurup A, editors. Equity, social determinants and public health programmes. Geneva: World Health Organization.

de Miera Juarez BS, Jimenez-Ruiz JA, Reynales-Shigematsu LM *et al.* (2007). El consumo de tabaco en los hogares mexicanos, 1994–2005. Salud Publica Mex, 49 suppl.2;263–269.

DeCicca P, McLeod L (2008). Cigarette taxes and older adult smoking: evidence from recent large tax increases. *J Health Econ,* 27:918–929.doi:10.1016/j.jhealeco.2007.11.005 PMID:18178277

Efroymson D, Ahmed S, Townsend J *et al.* (2001). Hungry for tobacco: an analysis of the economic impact of tobacco consumption on the poor in Bangladesh. *Tob Control,* 10:212–217.doi:10.1136/tc.10.3.212 PMID:11544383

Evans W, Ringel J, Stech D (1999). Tobacco taxes and public policy to discourage smoking. In: Poterba JM, editor. Tax Policy and the Economy, Vol.13. Cambridge, MA: MIT Press; p. 1–56.

Evans WN, Farrelly MC (1998). The compensating behavior of smokers: taxes, tar, and nicotine. *Rand J Econ,* 29:578–595. doi:10.2307/2556105 PMID:11794360

Farrelly MC, Bray JW, Pechacek TF, Woollery T (2001). Responses by adults to increases in cigarette prices by sociodemographic characteristics. *Southern Economic Review,* 68:156–165 doi:10.2307/1061518.

Farrelly MC, Engelen M (2008). Cigarette prices, smoking, and the poor, revisited. Am *J Public Health,* 98:582–583, author reply 583–584.doi:10.2105/AJPH.2007.132647 PMID:18309115

Federico B, Kunst AE, Vannoni F *et al.* (2004). Trends in educational inequalities in smoking in northern, mid and southern Italy, 1980–2000. *Prev Med,* 39:919–926.doi:10.1016/j.ypmed.2004.03.029 PMID:15475024

Franks P, Jerant AF, Leigh JP (2008). Franks *et al.* respond. *Am J Public Health,* 98:583–584 doi:10.2105/AJPH.2007.132654.

Franks P, Jerant AF, Leigh JP *et al.* (2007). Cigarette prices, smoking, and the poor: implications of recent trends. *Am J Public Health,* 97:1873–1877.doi:10.2105/AJPH.2006.090134 PMID:17761576

Fukuda Y, Nakamura K, Takano T (2005). Socioeconomic pattern of smoking in Japan: income inequality and gender and age differences. *Ann Epidemiol,* 15:365–372. doi:10.1016/j.annepidem.2004.09.003 PMID:15840550

Fullerton D, Rogers DI (1993). *Who bears the lifetime tax burden?* Washington DC, Borookings Institute.

Gospodinov N, Irvine I (2009). Tobacco taxes and regressivity. *J Health Econ,* 28:375–384.doi:10.1016/j.jhealeco.2008.10.010 PMID:19091432

Graham H (1987). Women's smoking and family health. *Soc Sci Med,* 25:47–56. doi:10.1016/0277-9536(87)90206-1 PMID:3616697

Graham H (1994). Gender and class as dimensions of smoking behaviour in Britain: insights from a survey of mothers. *Soc Sci Med,* 38:691–698.doi:10.1016/0277-9536(94)90459-6 PMID:8171347

Graham H (1996). Smoking prevalence among women in the European community 1950–1990. *Soc Sci Med,* 43:243–254.doi:10.1016/0277-9536(95)00369-X PMID:8844928

Gruber J, Koszegi B (2002). A theory of government regulation of addictive bads: optimal tax levels and tax incidence for cigarette excise taxation. NBER Working Paper Series. Working Paper #8777. Cambridge, MA, National Bureau of Economic Research.

Gruber J, Koszegi B (2004). Tax incidence when individuals are time-inconsistent: the case of cigarette excise taxes. *J Public Econ,* 88:1959–1987 doi:10.1016/j.jpubeco.2003.06.001.

Gruber J, Sen A, Stabile M (2003). Estimating price elasticities when there is smuggling: the sensitivity of smoking to price in Canada. *J Health Econ,* 22:821–842.doi:10.1016/S0167-6296(03)00058-4 PMID:12946461

Heineck G, Schwarze J (2003). Substance use and earnings: the case of smokers in Germany. IZA Discussion Papers, No.743.

Hersch J (2000). Gender, income levels, and the demand for cigarettes. *J Risk Uncertain,* 21:263–282 doi:10.1023/A:1007815524843.

Hu TW, Mao Z, Liu Y *et al.* (2005). Smoking, standard of living, and poverty in China. *Tob Control,* 14:247–250.doi:10.1136/tc.2004.010777 PMID:16046687

Hu TW, Tsai YW (2000). Cigarette consumption in rural China: survey results from 3 provinces. *Am J Public Health,* 90:1785–1787.doi:10.2105/AJPH.90.11.1785 PMID:11076252

Huisman M, Kunst AE, Mackenbach JP (2005). Inequalities in the prevalence of smoking in the European Union: comparing education and income. *Prev Med,* 40:756–764.doi:10.1016/j.ypmed.2004.09.022 PMID:15850876

Hyland A, Laux FL, Higbee C *et al.* (2006). Cigarette purchase patterns in four countries and the relationship with cessation: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control,* 15 Suppl 3;iii59–iii64.doi:10.1136/tc.2005.012203 PMID:16754948

Isra S (2003). The economics of tobacco in Thailand. HNP Discussion Paper, Economics of Tobacco Control Paper No.15. Washington DC, World Bank.

John RM (2005). Tobacco consumption patterns and its health implications in India. *Health Policy,* 71:213–222.doi:10.1016/j.healthpol.2004.08.008 PMID:15607383

John RM (2008). Crowding out effect of tobacco expenditure and its implications on household resource allocation in India. *Soc Sci Med,* 66:1356–1367.doi:10.1016/j.socscimed.2007.11.020 PMID:18187245

Karki YB, Pant KD, Pande BR (2003). A study on the economics of tobacco in Nepal. HNP Discussion Paper Series, Economics of Tobacco Control Paper No.13. Washington DC, The World Bank.

Khang YH, Yun SC, Cho HJ, Jung-Choi K (2009). The impact of governmental antismoking policy on socioeconomic disparities in cigarette smoking in South Korea. *Nicotine Tob Res,* 11:262–269.doi:10.1093/ntr/ntn036 PMID:19251768

Kinh HV, Ross H, Levy D *et al.* (2006). The effect of imposing a higher, uniform tobacco tax in Vietnam. *Health Res Policy Syst,* 26:4–6 doi:10.1186/1478-4505-4-1. PMID:16800880

Krasovsky K, Andreeva T, Krisanov D *et al.* (2002). Economics of tobacco control in Ukraine from the public health prespective. Kiev, Alcohol and Drug Information Centre.

Kyaing NN (2003). Tobacco economics in Myanmar. HNP Discussion Paper Series, Economics of Tobacco Control Paper No.14. Washington DC, The World Bank.

Kyaing NN, Perucic A-M, Rahman K (2005). Study on poverty alleviation and tobacco control in Myanmar. HNP Discussion Paper Series. Economics of Tobacco Control Paper No.31. Washington DC, The World Bank.

Laxminarayan R, Deolalikar A (2004). Tobacco initiation, cessation, and change: evidence from Vietnam. *Health Econ,* 13:1191–1201. doi:10.1002/hec.932 PMID:15386650

Lee JM (2008). Effect of a large increase in cigarette tax on cigarette consumption: an empirical analysis of cross-sectional survey data. *Public Health,* 122:1061–1067. doi:10.1016/j.puhe.2007.12.013 PMID:18602655

Lee JM, Chen SH, Chen HF, Jeng HY (2009). Price sensitivity and smoking smuggled cigarettes. *Eur J Public Health,* 19:23–27. doi:10.1093/eurpub/ckn115 PMID:19039020

Levine P, Gustafson A, Valenchik A (1997). More bad news for smokers?The effect of cigarette smoking on wages. *Ind Labor Relat Rev,* 50:493–509 doi:10.2307/2525187.

Liu Y, Rao K, Hu TW *et al.* (2006). Cigarette smoking and poverty in China. *Soc Sci Med,* 63:2784–2790.doi:10.1016/j.socscimed.2006.06.019 PMID:16959391

Lokshin M, Beegle K (2006). Foregone earnings from smoking: evidence from a developing country. World Bank Policy Research Working Paper No.4018. Washington DC, The World Bank.

Lopez AD, Collishaw NE, Piha TA (1994). A descriptive model of the cigarette epidemic in developed countries. *Tob Control,* 3:242–247 doi:10.1136/tc.3.3.242.

Lyon AB, Schwab RM (1995). Consumption taxes in a life-cycle framework: are sin taxes regressive? *Rev Econ Stat,* 77:389–406 doi:10.2307/2109902.

Madden D (2007). Tobacco taxes and starting and quitting smoking: does the effect differ by education? *Appl Econ,* 39:613–627 doi:10.1080/00036840500447898.

Mao Z, Sung HY, Hu T *et al.* (2007). Demand for cigarette in China. In: Hu TW, ed., *Tobacco control policy analysis in China, Economics and Health.* World Scientific Publishing Co Singapore, 129–157.

Mao Z, Yang GH, Ma JM (2003). Adult's demand for cigarettes and its determinants in China. *Soft Science of Health,* 17:19–23.

Nargis N, Yurekli AA, Bettcher DM (2010). Poverty and development impact. In: Chaloupka FJ, Yurekli AA, Fong GT, eds., *Tobacco control in developing countries.* NCI Monograph 21., 18

Nassar H (2003). The economics of tobacco in Egypt: a new analysis of demand. HNP Discussion Paper Series, Economics of Tobacco Control Paper No.8. Washington DC, The World Bank.

Ohsfeldt RL, Boyle RG (1994). Tobacco excise taxes and rates of smokeless tobacco use in the US: an exploratory ecological analysis. *Tob Control,* 3:316–323 doi:10.1136/tc.3.4.316.

Ohsfeldt RL, Boyle RG, Capilouto E (1997). Effects of tobacco excise taxes on the use of smokeless tobacco products in the USA. *Health Econ,* 6:525–531.doi:10.1002/(SICI)1099-1050(199709)6:5<525::AID-HEC300>3.0.CO;2-Y PMID:9353656

Ohsfeldt RL, Boyle RG, Capilouto E (1999). Tobacco taxes, smoking, restrictions and tobacco use. In: Chaloupka FJ, Grossman M, Bickel WK, *et al.*, editors. The economics analysis of substance use and abuse: an integration of econometrics and behavioral economic research. Chicago: University of Chicago Press; p. 15–29.

Onder Z (2002). The economics of tobacco in Turkey: new evidence and demand estimates. HNP Discussion Paper Series, Economics of Tobacco Control Paper No. 2. Washington DC, The World Bank.

Pekurinen M (1989). The demand for tobacco products in Finland. *Br J Addict,* 84:1183–1192.doi:10.1111/j.1360-0443.1989.tb00714.x PMID:2819275

Pierce JP, Fiore MC, Novotny TE *et al.* (1989). Trends in cigarette smoking in the United States. Educational differences are increasing. *JAMA*, 261:56–60.doi:10.1001/jama.261.1.56 PMID:2908995

Rajemison HS, Haggblade S, Younger SD (2003). Indirect tax incidence in Madagascar: updated estimates using the input-output table. Working paper #147.Cornell University, Food and Nutrition Policy Program.

Rani M, Bonu S, Jha P *et al.* (2003). Tobacco use in India: prevalence and predictors of smoking and chewing in a national cross sectional household survey. *Tob Control,* 12:4. doi:10.1136/tc.12.4.e4 PMID:14660785

Remler DK (2004). Poor smokers, poor quitters, and cigarette tax regressivity. *Am J Public Health,* 94:225–229.doi:10.2105/AJPH.94.2.225 PMID:14759931

Ringel JS, Evans WN (2001). Cigarette taxes and smoking during pregnancy. *Am J Public Health,* 91:1851–1856.doi:10.2105/AJPH.91.11.1851 PMID:11684615

Sayginsoy O, Yurekli A, De Beyer J (2002). Cigarette demand, taxation, and the poor: a case study of Bulgaria. HNP Discussion Paper Series, Economics of Tobacco Control Paper No. 4. Washington DC, The World Bank.

Schaap MM, Kunst AE, Leinsalu M *et al.* (2008). Effect of nationwide tobacco control policies on smoking cessation in high and low educated groups in 18 European countries. *Tob Control,* 17:248–255.doi:10.1136/tc.2007.024265 PMID:18483129

Siahpush M (2003). Socioeconomic status and tobacco expenditure among Australian households: results from the 1998–99 Household Expenditure Survey. *J Epidemiol Community Health,* 57:798–801.doi:10.1136/jech.57.10.798 PMID:14573585

Siahpush M, Wakefield MA, Spittal MJ *et al.* (2009). Taxation reduces social disparities in adult smoking prevalence. *Am J Prev Med,* 36:285–291.doi:10.1016/j.amepre.2008.11.013 PMID:19201146

Stehr M (2007). The effect of cigarette taxes on smoking among men and women. *Health Econ,* 16:1333–1343.doi:10.1002/hec.1223 PMID:17335102

Thompson ME, McLeod I (1976). The effects of economic variables upon the demand for cigarettes in Canada. Mathl Scientist, 1:121–132.

Thomson GW, Wilson NA, O'Dea D *et al.* (2002). Tobacco spending and children in low income households. *Tob Control,* 11:372–375. doi:10.1136/tc.11.4.372 PMID:12432164

Townsend J (1987). Cigarette tax, economic welfare and social class patterns of smoking. *Appl Econ,* 19:355–365 doi:10.1080/00036848700000007.

Townsend J (1996). Price and consumption of tobacco. *Br Med Bull,* 52:132–142. PMID:8746302

Townsend J, Roderick P, Cooper J (1994). Cigarette smoking by socioeconomic group, sex, and age: effects of price, income, and health publicity. *BMJ,* 309:923–927. PMID:7950662

Van Ours J (2003). A pint day raises a man's pay, but smoking blows that gain away. CEPR Discussion papers, 3308.

van Walbeek C (2002a). Recent trends in smoking prevalence in South Africa–some evidence from AMPS data. *S Afr Med J,* 92:468–472. PMID:12146134

van Walbeek CP (2002b). The distributional impact of tobacco excise increases. *S Afr J Econ,* 70:560–578.

van Walbeek CP (2005). Do tax increases on tobacco hurt the poor?

Viscusi WK (2002). The new cigarette paternalism. *Regulation*, 25:58–64.

Wang H, Sindelar JL, Busch SH (2006). The impact of tobacco expenditure on household consumption patterns in rural China. *Soc Sci Med,* 62:1414–1426.doi:10.1016/j.socscimed.2005.07.032 PMID:16137812

Warner KE (2000). The economics of tobacco: myths and realities. *Tob Control,* 9:78–89. doi:10.1136/tc.9.1.78 PMID:10691761

White VM, Hayman J, Hill DJ (2008). Can population-based tobacco-control policies change smoking behaviors of adolescents from all socio-economic groups? Findings from Australia: 1987–2005. *Cancer Causes Control,* 19:631–640.doi:10.1007/s10552-008-9127-8 PMID:18264783

Wiltshire S, Bancroft A, Amos A, Parry O (2001). "They're doing people a service"-qualitative study of smoking, smuggling, and social deprivation. *BMJ,* 323:203–207. doi:10.1136/bmj.323.7306.203 PMID:11473911

World Health Organization (2007). World Health Statistics 2007. Geneva, World Health Organization.

World Health Organization (2010).Equity, social determinants and public health programmes. Geneva, World Health Organization.

Young D, Borland R, Hammond D *et al.*; ITC Collaboration (2006). Prevalence and attributes of roll-your-own smokers in the International Tobacco Control (ITC) Four Country Survey. *Tob Control,* 15 Suppl 3;iii76–iii82.doi:10.1136/tc.2005.013268 PMID:16754951