

# The Impact of Price on Youth Tobacco Use

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**INTRODUCTION** Over the past three decades, numerous econometric studies have researched the impact of price and tobacco control policies on tobacco use. These studies have examined the applicability of a fundamental principle of economics—the law of the downward sloping demand curve—to tobacco use. This principle states that as the price of a product rises, the quantity demanded of that product falls. To economists, price includes not only the monetary cost of purchasing a product, but also the time and other costs associated with buying that product, as well as the health consequences and other costs from using the product.

The demands for tobacco products, however, differ from those for most other products because of the addictive drug they contain—*i.e.*, nicotine. For years, the conventional wisdom was that addictive consumption was an irrational behavior that did not follow the basic laws of economics, including that of the downward sloping demand curve. However, a variety of econometric studies conducted over the past several decades clearly indicate that cigarette smoking and other tobacco use are not exceptions to the principles of economics. Several of the most recent studies apply economic models of addiction that explicitly recognize the intertemporal links in the consumption of addictive substances (Becker and Murphy, 1988). That is, economic models of addiction incorporate the acquired tolerance, reinforcement, and withdrawal effects that distinguish the consumption of addictive goods, including tobacco products, from the consumption of nonaddictive substances. The key implication of these models is that changes in addictive behavior in response to changes in price will not occur quickly, as they would for nonaddictive goods, but that the effects of permanent price changes will grow gradually over time.

**PRICES AND ADULT TOBACCO USE** Many studies have examined the effects of prices and tobacco control policies on overall cigarette demand and other tobacco use using diverse econometric and other statistical methods, employing data from the United States and many other countries. Several have used aggregate time-series data for a single geographical unit, while others have employed pooled cross-sectional time-series data; still others have used individual-level data taken from surveys. Most of these studies ignored the addictive aspects of tobacco use, although several recent studies have theoretically and empirically modeled addiction. Several clear conclusions emerge from this large, increasingly sophisticated, and rapidly expanding literature.

Permanent, inflation-adjusted increases in cigarette prices, which could be achieved by increasing cigarette taxes, will lead to significant reductions in cigarette smoking rates. Economists use the term “price elasticity of demand” to describe the impact of a change in price on consumption, defining it as the percentage change in consumption that results from a 1 percent increase in price. Price elasticity estimates from recent studies of cigarette demand fall in a relatively wide range, but most are in the narrow range from  $-0.3$  to  $-0.5$ . These estimates imply that a 10 percent increase in price reduces cigarette demand among adults by approximately 3 to 5 percent. Similar findings are obtained for other tobacco products, although there are fewer studies for these products (Chaloupka and Warner, 2000).

The smoking reductions resulting from increased cigarette prices are not limited to reductions in the number of cigarettes smoked, but also include significant reductions in smoking prevalence. Several recent estimates based on individual level data from large, nationally representative surveys imply that a permanent, real 10-percent increase in price reduces smoking prevalence by 1 to 2 percent. For example, the Centers for Disease Control and Prevention (CDC, 1998) estimated that the price elasticity of smoking prevalence in the United States was  $-0.15$ , based on 13 of the National Health Interview Surveys (NHIS) conducted from 1976 through 1993. The changes in prevalence estimated using cross-sectional survey data are assumed to reflect reduced smoking initiation among youths and increased smoking cessation and reduced relapse among adults. Few studies have directly addressed these issues, however, given the lack of appropriate longitudinal data. However, by using retrospective data on smoking initiation from the NHIS, Douglas (1998) concluded that a 10-percent increase in price would reduce the duration of smoking by approximately 10 percent.

In the context of the economic models of addiction, cigarette smoking is clearly an addictive behavior in that current cigarette demand depends on past smoking. The most important policy implication of this is that the long-run impact of a permanent price increase or change in tobacco control policy will grow over time. Estimates imply that the long-run effect of a permanent price increase is approximately double the short-run impact (Chaloupka, 1991; Becker *et al.*, 1994). Thus, a 10-percent increase in cigarette price is expected to reduce cigarette smoking by approximately 8 percent in the long run.

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ADULT SMOKING**

Economic theory suggests that the price sensitivity of cigarette demand will be inversely related to age for several reasons.

First, the share of young smokers’ disposable incomes spent on cigarettes is likely to be larger than that of adult smokers. Economic theory implies that the price sensitivity of demand will be greater the greater the share of income spent on a good, assuming that there is a positive impact of income on demand. Recent studies of youth smoking with good measures of youths’ disposable income (Chaloupka and Grossman, 1996) provide clear evidence that youths with greater disposable income smoke more than those with fewer resources.

Second, peer influence is more important to youths than to adults. This has a positive multiplying effect for cigarette price increases—in addition to reducing a given youth's smoking directly, his or her smoking is reduced indirectly as peers reduce their smoking. In addition, because they have been smoking for a shorter time, youths are likely to be less addicted than adults and, consequently, youths' smoking decisions will be more immediately responsive to price.

Finally, youths are generally assumed to behave more myopically than adults. This implies that many of the future consequences of smoking will be more heavily discounted by youths than by adults, while the more immediate costs, particularly the monetary price, will be relatively more important.

The hypothesis that cigarette smoking by younger persons will be relatively more responsive to price than smoking among older persons is confirmed by several recent studies of cigarette demand based on cross-sectional surveys of youths and young adults. Recent estimates indicate that youths are up to three times more sensitive to price than adults, with a 10-percent price increase estimated to reduce youth smoking prevalence by 5 percent or more and also to reduce cigarette consumption among continuing young smokers (Chaloupka and Grossman, 1996; Evans and Huang, 1998; Lewit *et al.*, 1997). These empirical findings are consistent with the findings from recent qualitative research on youth smoking conducted by the CDC's network of prevention research centers (Balch, personal communication) as well as with the sharp increases in youth smoking prevalence observed after the prices of branded cigarettes were sharply reduced in April, 1993.

There appear to be important differences in price sensitivity among population subgroups. A recent study by Chaloupka and Pacula (1998a) concluded that young Blacks and young men are relatively more responsive to changes in price than are young Whites and young women, a finding consistent with the CDC's (1998) evidence on price responsiveness among adult population subgroups.

Similarly, several recent econometric studies based on cross-sectional data conclude that young adults are somewhat less responsive to price than youths, but more responsive than older adults. For example, the CDC found that persons ages 18 through 24 years were about 40 percent more responsive to price than those 25 through 39 years and almost six times more responsive than older adults (CDC, 1998). Similarly, Chaloupka and Wechsler (1997) found that college students were significantly more responsive to price than older persons.

Tauras and Chaloupka (1999a), using longitudinal data on young adult smoking from the Monitoring the Future surveys, provide additional evidence that young adults are more responsive to price than adults, but less responsive than youths, estimating an average overall price elasticity of  $-0.79$ . Also, as expected, in the context of an economic model of addictive behavior, they find that the long-run impact of a sustained price increase is

larger than the short-run effect (Chaloupka *et al.*, 1999b). Finally, they find strong evidence that increases in cigarette prices significantly raise the probability of smoking cessation among young adults, estimating that a sustained inflation-adjusted price increase of 10 percent increases the probability of cessation among young adult male and female smokers by 11 and 12 percent, respectively (Tauras and Chaloupka, 1999b).

Other tobacco control policies that raise the “costs” of smoking and other tobacco use lead to significant reductions in overall cigarette demand and smoking prevalence, particularly increased information on the health consequences of tobacco use, strong restrictions on cigarette smoking in public places and private workplaces, and counter-advertising campaigns (Chaloupka and Warner, 2000). Chaloupka and Grossman (1996), for example, concluded that strong restrictions on smoking reduced both the prevalence of youth smoking and cigarette consumption among young smokers. In contrast, they found little evidence that laws limiting youth access to tobacco reduced youth smoking, a finding they attributed to the relatively poor enforcement of these laws. Chaloupka and Pacula (1998b) examined the impact of enforcement directly, concluding that policies limiting youth access to tobacco that were comprehensive, aggressively enforced, and resulted in higher retailer compliance could produce relatively modest reductions in the prevalence of youth smoking.

**DISCUSSION** While much is known from economic research about the impact of price on cigarette demand, there is much more to learn. Advances in econometric methods, more and better data, and increased interdisciplinary research can help to address many of these issues.

The econometric evidence on the impact of price on cigarette smoking and other tobacco use is based on the relatively small changes in price that occur cross-sectionally and over time. Little is known, however, about the impact of relatively large price increases on cigarette demand, particularly among youths. The relatively new field of behavioral economics provides some evidence on this issue, suggesting that the price elasticity of demand rises as price rises (Bickel and Madden, 1998). This issue is currently being researched using more recent U.S. data that include several large state cigarette tax increases.

In addition, relatively little is known about the impact of large price increases on the growth of a black market in tobacco products and its subsequent impact on demand, particularly among youths. To the extent that organized and casual smuggling of tobacco products would result from large tax and price increases, the effects of the increases on tobacco use might be smaller than otherwise expected. The limited research in this area, however, suggests that the presence of a black market in tobacco products may be just as, or more, related to other factors—including the presence of informal distribution networks, nonexistent or weak policies concerning black market sales, and their lack of enforcement—as it is to prices (Joossens and Raw, 1995). Clearly, this issue needs to be explored more carefully.

More information is needed about the compensating behavior of smokers in response to price and policy changes that may offset some of the health benefits expected to result from the changes. The one study in this area suggests that some smokers respond to price increases by switching to longer and/or higher tar and nicotine cigarettes (Evans and Farrelly, 1998), with the largest effects found among the youngest smokers, thus offsetting some of the potential health benefits resulting from the reductions in smoking prevalence produced by a tax increase. Cummings and his colleagues (1997a) provided some related evidence based on data from the National Cancer Institute's Community Intervention Trial for Smoking Cessation that show that the use of generic cigarettes (typically higher in tar and nicotine) is higher in areas where average cigarette prices are higher, particularly among lower-income and heavier smokers.

Similarly, little is known about the potential for substitution between tobacco products and other licit and illicit addictive substances in response to higher cigarette prices and stronger tobacco control policies. In the recent debate over proposed national tobacco legislation, for example, some opponents of large tax increases argued that these would lead more youths to take up marijuana use even if they succeeded in reducing youth smoking. The very limited evidence on this issue, however, suggests that increases in cigarette prices will reduce not only cigarette smoking, but can also reduce alcohol and marijuana use among youths and young adults (Pacula, 1998; Chaloupka *et al.*, 1999a). Much more research is needed, however, to clarify these relationships.

Similarly, more research is needed to elucidate the impact of prices and tobacco control policies on the pathways and trajectories of smoking. This is particularly true with respect to the process from first use, through experimentation, and eventually to addiction, as well as with the processes around cessation and re-initiation. One recent study by a group of economists at Cornell University (DeCicca *et al.*, 1998) attempted to directly address the issue of the impact of price on smoking initiation using data from the National Education Longitudinal Survey of 1988 (U.S. Department of Education, 1988). The survey results concluded that higher cigarette taxes had little impact on the initiation of daily smoking between 8th and 12th grade. A similar analysis, using the same data but treating respondents with missing data differently, produced estimates of the price elasticity of smoking initiation comparable to the prevalence elasticities obtained from cross-sectional survey data described above (Dee and Evans, 1998). Comparable analyses examining this and other aspects of the uptake and cessation processes that employ better longitudinal data are needed to adequately address these issues.

Information about the effects of the pricing, availability, and marketing of nicotine replacement products on both the demand for these products and on cigarette smoking and other tobacco use is needed. Until very recently, the tobacco industry held a virtual monopoly on the distribution of products containing nicotine. Economic theory suggests that the increased availability of nicotine replacement products should both reduce

the demand for tobacco products as well as increase the price sensitivity of demand, potentially making tax increases an even more effective tobacco control policy. Some have argued, however, that the increased availability of these products and the marketing that accompanies them may affect youths' perceptions of the long-term consequences of tobacco use by creating the illusion that it is relatively easy to quit. If true, this reduction in the perceived "cost" of smoking may have contributed to the increases in youth smoking prevalence observed over the past decade as nicotine replacement products (NRP) became more widely available and heavily marketed. The very limited empirical information on the determinants of the use of nicotine replacement products suggests that economic influences, including income and price, may be particularly important (Cummings *et al.*, 1997b). More information is needed on the determinants of the demand for these alternative products and the impact of their availability on the demand for tobacco products, particularly among youths. This is relevant both to the long-term use and to the potential for abuse of these products. Long-term use could be considered part of a broader market for nicotine delivery products that includes cigarettes.

While much is known about the independent effects of price and tobacco control policies, more research is needed on the interaction between these interventions. There may be important, unrealized synergies between policies that could be used to enhance the effectiveness of tobacco control programs. For example, there is clear evidence that the earmarking of revenues from cigarette tax increases for anti-tobacco media campaigns and other efforts to reduce tobacco use have been very successful in California and Massachusetts (Hu *et al.*, 1995; CDC, 1996). In contrast, less is known about the interaction of a variety of other macro-level approaches to tobacco control.

**CONCLUSIONS** While there is still much to be learned, the existing research clearly indicates that macro-level interventions, including increased tobacco taxation and stronger tobacco control policies, can be very effective in reducing cigarette smoking and other tobacco use, particularly among youths and young adults. Moreover, because of its addictive nature, the long-run reductions in tobacco use resulting from sustained macro-level interventions will be even larger than those realized immediately.

## REFERENCES

- Becker, G.S., Grossman, M., Murphy, K.M. An empirical analysis of cigarette addiction. *American Economic Review* 84(3):396-418, 1994.
- Becker, G.S., Murphy, K.M. A theory of rational addiction. *Journal of Political Economy* 96(4):675-700, 1988.
- Bickel, W.K., Madden, G.J. *The Behavioral Economics of Smoking*. National Bureau of Economic Research Working Paper No. W6444, 1998.
- Centers for Disease Control and Prevention. Cigarette smoking before and after an excise tax increase and an antismoking campaign—Massachusetts, 1990–1996. *Morbidity and Mortality Weekly Report* 45(44):966-970, 1996.
- Centers for Disease Control and Prevention. Response to increases in cigarette prices by race/ethnicity, income, and age groups—United States, 1976–1993. *Morbidity and Mortality Weekly Report* 47(29):605-609, 1998.

- Chaloupka, F.J. Rational addictive behavior and cigarette smoking. *Journal of Political Economy* 99(4):722-42, 1991.
- Chaloupka, F.J., Grossman, M. *Price, Tobacco Control Policies and Youth Smoking*. National Bureau of Economic Research Working Paper No. W5740, 1996.
- Chaloupka, F.J., Pacula, R.L. *An Examination of Gender and Race Differences in Youth Smoking Responsiveness to Price and Tobacco Control Policies*. National Bureau of Economic Research Working Paper No. W6541, 1998a.
- Chaloupka, F.J., Pacula, R.L. *Limiting Youth Access to Tobacco: The Early Impact of the Synar Amendment on Youth Smoking*. Working Paper, Department of Economics, University of Illinois at Chicago, 1998b.
- Chaloupka, F.J., Pacula, R.L., Farrelly, M.C., Johnston, L.D., O'Malley, P.M., Bray, J.W. *Do Higher Cigarette Prices Encourage Youth to Use Marijuana?* National Bureau of Economic Research Working Paper No. W6939, 1999a.
- Chaloupka, F.J., Tauras, J.A., Grossman, M. *Cigarette Smoking and Addiction: Economic Models and New Empirical Evidence*. Manuscript presented at the International Workshop on Nicotine Dependence, Lausanne, Switzerland, 1999b.
- Chaloupka, F., Wechsler, H. Price, tobacco control policies and smoking among young adults. *Journal of Health Economics* 16(3):359-373, 1997.
- Chaloupka, F.J., Warner, K.E. The economics of smoking. In: Newhouse, J.P., Cuyler, A. (Editors). *The Handbook of Health Economics*. New York: North-Holland, 1999/2000-forthcoming.
- Cummings, K., Hyland, A., Lewit, E., Shopland, D. Use of discount cigarettes by smokers in 20 communities in the United States, 1988-1993. *Tobacco Control* 6(S2):25-30, 1997a.
- Cummings, K., Hyland, A., Ockene, J., Hymowitz, N., Manley, M. Use of the nicotine skin patch by smokers in 20 communities in the United States, 1992-1993. *Tobacco Control* 6(S2):63-70, 1997b.
- DeCicca, P., Kenkel, D., Mathios, A. *Putting Out the Fires: Will Higher Cigarette Taxes Reduce Youth Smoking?* Working Paper, Department of Policy Analysis & Management, Cornell University, 1998.
- Dee, T.S., Evans, W.N. *A Comment on DeCicca, Kenkel, and Mathios*. Working Paper. School of Economics, Georgia Institute of Technology, 1998.
- Douglas S. The duration of the smoking habit. *Economic Inquiry* 36(1):49-64, 1998.
- Evans, W.N., Farrelly, M.C. The compensating behavior of smokers: taxes, tar and nicotine. *RAND Journal of Economics* 29(3):578-595, 1998.
- Evans, W.N., Huang, L.X. *Cigarette Taxes and Teen Smoking: New Evidence from Panels of Repeated Cross-Sections*. Working Paper, Department of Economics, University of Maryland, 1998.
- Hu, T.W., Sung, H.Y., Keeler, T.E. Reducing cigarette consumption in California: tobacco taxes vs an anti-smoking media campaign. *American Journal of Public Health* 85(9):1218-22, 1995.
- Joossens, L., Raw, M. Smuggling and cross border shopping of tobacco in Europe. *British Medical Journal* 310(6991):1393-1397, 1995.
- Lewit, E., Hyland, A., Kerrebrock, N., Cummings, K. Price, public policy and smoking in young people. *Tobacco Control* 6(S2):17-24, 1997.
- Pacula, R.L. *Adolescent Alcohol and Marijuana Consumption: Is There Really a Gateway Effect?* National Bureau of Economic Research Working Paper No. W6348, 1998.
- Tauras, J.A., Chaloupka, F.J. *Price, Clean Indoor Air, and Cigarette Smoking: Evidence from Longitudinal Data for Young Adults*. National Bureau of Economic Research Working Paper No. W6937, 1999a.
- Tauras, J.A., Chaloupka, F.J. *Determinants of Smoking Cessation: An Analysis of Young Adult Men and Women*. Manuscript presented at the Taipei International Conference on Health Economics, Taipei, Taiwan. National Bureau of Economic Research Working Paper No. W7262, 1999b.
- U.S. Department of Education. *The National Longitudinal Study of 1988*. Washington, D.C.: U.S. Government Printing Office, 1988.