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The Proposed Tobacco Settlement: Effects on Prices, Smoking Behavior, and Income Distribution

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Jane G. Gravelle
Senior Specialist in Economic Policy
Economics Division

Abstract

This report explores the effect of the proposed tobacco settlement on prices, accounting for the type of payments and industry structure. It reviews economic evidence on the responsiveness of smoking, particularly teenage smoking, to price increases and other policies. It also examines the regressive distributional effects of tobacco taxes. See CRS Issue Brief 98022 for legislative updates.

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Summary

The payments and other features of the proposed tobacco settlement would affect stockholders, customers, and suppliers in the industry. The agreement specifies that payments be reflected in price and one objective of the settlement is to discourage teenage smoking, which has been thought to be quite responsive to price. The economic effect of the settlement, however, would not be dictated by legal agreements. Also, the price mechanism may be less successful than previously thought in discouraging teenage smoking participation.

The analysis in this report suggests that the payments will largely have the same effect as a tax. The annual payment in the June 1997 agreement would be about 62 cents per pack, with up to 8 cents in lookback penalties if teenage smoking does not drop as targeted. S. 1415 imposes payments projected at $1.10 when phased in but dependent on volume in 2003. Lookback penalties are larger and not tax deductible. Some financial analysts have claimed these costs are above $2 per pack.

The payment would affect suppliers. Tobacco farmers could have a reduction in income due to reduced demand. The advertising industry would be little affected in the aggregate, although tobacco advertising is more important in some areas than in others. Tobacco workers could absorb some of the cost in the short run, although probably not in the long run. Some of the payment could fall on stockholders of tobacco firms as well, although the settlement may benefit stockholders by reducing future legal liabilities. The effects on stock prices depend importantly on the extent to which these future liabilities are already reflected in price. The federal deficit would also increase if all payments are used to increase spending or reduce taxes, because of offsets due to deductibility of the payments and other features.

Consumption is estimated to fall by about 12% under the June settlement payments and 20% under the Senate Commerce Committee proposal. Teenage smoking response would decrease but the degree is uncertain. Some recent research suggests participation would fall about 17% and 28% respectively; there would also be a fall in quantity smoked. This more recent research found a much smaller teenage participation response than did earlier studies. Some of the most recent studies suggest even smaller responses. Research is mixed about effects of other policies on teenage smoking participation.

Since most of the burden is likely to fall on consumers, the distributional effect would be similar to that of a tobacco tax, a regressive tax. Lower-income families tend to consume a larger amount of tobacco (unlike most commodities) than higher income families. For the lowest income families that continue to consume tobacco products, current taxes, which are about 50 cents per pack are the same order of magnitude as the individual share of the payroll tax — in excess of 5% of income. Families below the median income pay 1% or more of income. Thus, the proposed payments would impose significant burdens on these low income families.

For updates on legislation, see CRS Issue Brief 98022.

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The Proposed Tobacco Settlement: Effects on Prices, Smoking Behavior, and Income Distribution

The payments and other features of the proposed tobacco settlement may affect stockholders, customers, or suppliers in the industry. An important objective of the proposed settlement is to discourage smoking, particularly teenage smoking. The first section of this report discusses the incidence of the payments. That is, to what degree are they likely to be passed on in product prices, to reduce profits of stockholders, to reduce payments to workers, or to be passed back to suppliers, such as tobacco farmers and the advertising industry? This section also discusses the effect of advertising restrictions. The second section of the report discusses possible effects on suppliers, including tobacco farmers. The third section discusses the consequences of price effects for smoking, especially teenaged smoking. That section also discusses the effects of other tobacco control policies, especially on teenagers, as reflected in the economics literature. The final section discusses income distributional effects.

Most of the research on tobacco demand and related topics is on cigarettes, which dominate tobacco sales and which are the focus of the discussion. In addition, the discussion in this report generally reflects research by economists. The issue of teenage smoking has been addressed by many other disciplines and their findings are reflected in the Surgeon General's 1994 report on teenage smoking.[1]

This analysis discusses the proposed settlement negotiated in June, 1997 between a group of state attorneys general, plaintiff's lawyers, public health advocates, and cigarette manufacturers' representatives and initially introduced as S. 1414, a bill that implements the settlement (although there are some important differences between this bill and the original settlement), as well as the recent proposal agreed to by the Senate Commerce Committee. The June settlement involved payments of $368.5 billion in annual payments over 25 years, reaching $15 billion after a short phase-in period, and averaging 62 cents per pack of cigarettes. The Senate Commerce Committee S. 1415, proposes larger annual payments, summing to $512 billion over twenty five years and averaging at least $1.10 per pack after phase-in, according to preliminary information. There are a number of other important differences between this bill and the original settlement agreement, affecting immunity from prosecution and potential penalties for the failure to reduce underage smoking.

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[1] *Preventing Tobacco Use Among Young People*. A Report of the Surgeon General, U.S. Department of Health and Human Services, Public Health Service, 1994.

A number of related bills have been introduced; some impose a tax-like fee and some increase tobacco excise taxes directly, in some cases by larger amounts than in the initial tobacco settlement. They include S. 1343/H.R. 2764, S. 1491/H.R. 3027, S. 1530, and S. 1638. The President has also proposed an increase in tobacco revenues as part of his budget.

Effect of Payments on Price

In the June settlement, the industry is to pay an up-front payment of $10 billion, allocated according to the stock market value of the individual companies, and then annual payments beginning at $8.5 billion and increasing to $15 billion by the fifth year (with $9.5 billion in the second year, $11.5 billion in the third year, and $14 billion in the fourth year). These payments amount to $368.5 billion over 25 years. The payments would be indexed for inflation and would be deductible from federal income taxes. Penalties may also apply, up to $2 billion per year, if youth smoking reduction targets are not met. The Senate Commerce Committee proposal would impose larger annual payments beginning at $14.4 billion and increasing to $23.6 billion by the fifth year (with $15.4 billion in the second year, $17.6 billion in the third year, and $21.2 billion in the fourth year). The payments would amount to $512 billion over 25 years. The maximum youth penalty is larger in the Commerce Committee proposal, and is also not tax deductible.

The annual $15 billion payment is equivalent to about 62 cents a pack at current output levels, based on slightly more than $5.6 billion in current cigarette tax revenues and with cigarettes accounting for 96% of the tobacco products market. The Commerce Committee projects a payment of $1.10 a pack (although this amount is less certain because it is based on projected future volume in 2003). It is apparently the intent of both proposals that the payment be passed along in price. However, whether or not the payment will appear in prices cannot be dictated by a legal agreement in the absence of direct administration of prices (although it could well influence price changes in the short run). In this case, the determination of the effects of the tax on price are influenced by the nature of the industry (which is composed of a few producers).

There is also a penalty if youth smoking does not fall enough, capped at $2 billion a year in the June settlement (75% of this payment will be rebated if companies can establish that they pursued all reasonably available measures to reduce youth smoking and did nothing to undermine the reduction goals). The Commerce Committee plan has a larger cap of $3.5 billion and also makes the payment not deductible for income tax purposes, which would require a higher amount of revenues (about $5.3 billion) to both pay the excise tax and cover the increased income tax.[2] This payment and the up-front payment will be considered subsequently; the following discussion relates to the annual payments.

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[2] See CRS Report 98-84 E, Tax Deductibility and the Proposed Tobacco Settlement, by Jane G. Gravelle, for a discussion of tax deductibility.

In a fully competitive market model composed of many identical firms, a tax is normally passed on in price. In such an industry, each firm accepts the market price as given and competition results in no excess profit; imposing a tax causes firms to *lose money on production.* Some firms leave the market and output declines, causing the price to rise to cover the tax so that each firm again has adequate revenues to cover costs. A payment imposed as a lump sum for each firm would ordinarily not be passed on in price, because it does not affect the cost of an additional unit of production. It would be absorbed by the owners of the existing capital (or stockholders), although some transitory price effects could be felt if some firms went out of business because the tax exceeded assets and these firms could not immediately be replaced by new untaxed firms. (This analysis assumes that additional labor and capital can be hired without raising the cost of production, a typical assumption for a single industry.)

In an oligopoly market where the firm has some market power, more or less than 100% of a tax could be passed forward depending on the demand curve facing the firm, and on how firms make their choices. There are many different types of oligopoly models and no single theoretical answer to the incidence question. Some markup of price could occur in the distributional stages, since some costs (of holding inventory, insurance, shrinkage and state and local ad valorem taxes) are related to the manufacturer's price . There is some empirical evidence that price would probably rise, over time, by around the amount of a tax or perhaps a little more.[3] A payment imposed as a lump sum for each firm would be absorbed by the firm, which is already operating at maximum profit and cannot improve its profit by changing output, although if some firms are driven out of the market the price could rise.

It is also possible to have a hybrid between the lump sum payment and the tax-equivalent, a fixed industry payment allocated by market share. This type of payment, which was in an earlier Senate bill and apparently characterizes the youth smoking penalties, is discussed in the Appendix, but is likely to be largely passed through as well.

If there is a desire to have the tax passed along in price and the burden borne by the consumers, making the payment in the form of a tax would be more likely to accomplish that goal. If there is a desire to impose a burden on current stockholders,

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[3] See Theodore Keeler, The-wei Hu, Paul G. Barnett, Willard G. Manning, and Hai-Yen Sung. "Do Cigarette Producers Price Discriminate by State? An Empirical Analysis of Local Cigarette Pricing and Taxation." *Journal of Health Economics* 15 (August 1996), pp. 499-512. This study found that a one-cent state tax increase results in a price increase of 1.11 cents. This finding is similar to Barnett, Keeler and Hu, "Oligopoly structure and the Incidence of Cigarette Excise Taxes," *Journal of Public Economics*, Vol. 57, July 1995, pp. 457-470, who found about a dollar for dollar pass-through for the federal tax and a 90% pass-through for State taxes. Sung, Hu, and Keeler, "Cigarette Taxation and Demand: An Empirical Model," *Contemporary Economic Policy*, Vol. 12, July 1994, pp. 91-100, found a 127% pass-through for state taxes. Jeffrey Harris in, "The 1983 Increase in the Cigarette Excise Tax," in *Tax Policy and the Economy* , National Bureau of Economic Research, Vol. 1, Cambridge, MA: MIT Press, 1987, suggested that the 1983 tax increase was an opportunity to coordinate a general price increase in the industry, so that the price rose by more than the tax.

making the payment in the form of a lump sum for each company would be more likely to accomplish that goal.

With respect to the latter, however, it is important to note that most of the companies, even in combination with their non-tobacco businesses, do not have enough profit to make these payments (which are very large relative to price).[4] These companies would probably not be able to make dividend payments, if the taxes were not passed forward, and could go bankrupt, presumably contracting the size of the domestic industry, perhaps driving it to a monopoly status, and eventually passing part of the payment on in price. In fact, some tobacco financial analysts suggest that RJR, whose financial performance has lagged, is vulnerable to bankruptcy under the Commerce Committee agreement.[5] Even if most of the cost is passed on in price, there will be a contraction in volume that will reduce profits in the short run.

The $10 billion up-front payment, contained in the June 1997 settlement and in the Commerce Committee bill, should, in theory, fall on shareholders; since it is a one-time payment it could be more easily absorbed by the firms. The youth smoking penalties should be similar to a tax but the effects would also depend on whether the targets are met, whether they are fully enforced, and whether the cap applies. In the June agreement, it was also possible that 75% of the penalty would be rebated, making the payment only $0.5 billion. In either case, a fixed payment per firm should, in theory, fall on stockholders, since firms cannot increase their profits by altering their output and pricing strategy. That is, firms would continue to make the most profit by keeping their output and prices where they are if they are already maximizing profits. However, if the penalty is imposed based on market shares as appears to be the case for the youth smoking penalties, even if there is a fixed payment, the effects could be partially passed through as discussed in the Appendix. (As discussed below, it seems unlikely that the targets would be met because of the price effects of the basic settlement amount.) In a case where the targets are only partially met and increased production increases youth smoking, there will be a more straightforward tax-like effect, and the payments could be passed on in price.

Note that the calculations in this section assume that the payment is deductible for tax purposes, the normal treatment for an excise tax. If the payment is not to be deductible, and the tax is passed on in price, the effect would be larger because the price must go up enough to yield the payment plus the additional income tax. For

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[4] The initial $10 billion payment is tentatively to be allocated based on market value of the firm, while the following payments are to allocated based on market share. In 1995, five of the tobacco companies (including American Brands and B.A.T Industries separately, but not including Lowes) had a little over $10 billion in profits. Philip Morris had profits of $5.3 billion, but would presumably pay about half the settlement after the initial $10 billion payment. RJR Nabisco, with about 25% of the domestic tobacco market, had profits of $1.6 billion, and B.A.T, the parent of Brown and Williamson with about 15% of the market, had $2.6 billion. See Standard & Poor's *Industry Surveys: Alcoholic Beverages and Tobacco*, January 23, 1997.

[5] Robert Samuelson, Smoking Lesson, *Washington Post*, April 8, 1998; Gary Black and Jon Rooney, Tobacco, *Bernstein Research*, Sanford C. Bernstein and Company, New York, April 14, 1998.

example, in the case of the original settlement designed to yield $15 billion, the cumulative price for a year's production would have to go up by about $23 billion. Translated into cents per pack, the amounts after the full payment is due for the original settlement would be 62 cents if deductible for a price increase of 32%, and 95 cents if not deductible for a price increase of 49% (these calculations assume a 35% marginal corporate tax rate and a current $1.95 price).

While all of the payments in the 1997 proposal were tax deductible, the penalty for not meeting youth smoking targets is not tax deductible in the Commerce Committee plan. If we assume that the $3.5 billion penalty ceiling applies and is passed on in prices, it is equivalent, ignoring changes in volume, to receipts of $5.4 billion, a tax of about 24 cents per pack. This amount is significantly above the 8 cents per pack implied by the $2 billion lookback penalty in the June settlement at 1996 volume levels.

Arguments have recently been made that the prices would go up by significantly more than the actual tax paid, for several reasons. Gary Black of Sanford Bernstein and Company claims that the cost of the settlement is not the $1.10 that is popularly discussed, but $2.23 per pack.[6] This higher price reflects the additional lookback penalties which are assumed to apply, some other costs that appear to be contained in the bill, and smaller volume projections. There could also be a further increase because of additional mark-ups at the wholesale and retail level.

Effect on Workers and Suppliers

Although there is some evidence of a full price pass-through, the payments, of either sort, could potentially be passed back to suppliers, as long as they have a marginal effect. (The same possibilities would exist with an excise tax.) Other aspects of the plan could also affect suppliers. The suppliers to the industry include the tobacco farmers who supply tobacco, suppliers of other intermediate goods, workers, and suppliers of capital.

If the tax contracts output, there could be an effect on tobacco farmers. Tobacco farmers are unlikely to absorb much of the payment because the contribution of tobacco to the cost of the product is small. According to the Tobacco Institute, cash receipts from tobacco sales were about $2.2 billion in 1994 (about 5% of U.S. tobacco product sales). Moreover, because of the price-support system, effects would likely appear in quantity rather than price. These effects arise indirectly from a reduction in consumption, which, according to evidence presented in the next section, would be about 11% initially. Tobacco producers would experience some effect in a reduction in allotments, which could be significant relative to their sales if there is a significant reduction in demand. To the extent that returns on growing tobacco are higher than the returns on producing alternative crops and to the extent that assets are specialized in tobacco production, there will be a financial loss.

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[6] Gary Black and Jon Rooney, Tobacco, Bernstein Research, Sanford Bernstein and Co., April 14, 1998.

Both the payments and direct restrictions could affect advertisers. The advertising industry as a whole would be little affected, however; according to *Advertising Age*[7] tobacco and related products account for $0.5 billion out of $59.9 billion in sales in 1995 (less than 1%). Some categories would be more affected, however. Tobacco accounted for about 3% of the total $10.1 billion in consumer magazine advertising. It also accounted for 13% of national newspaper advertising, but a much smaller fraction of total newspaper advertising.

Note that these numbers are different from the tobacco advertising and promotional expenditures reported by the Federal Trade Commission (FTC).[8] The FTC reported a $4.8 billion expenditure for 1994. Most of that cost is comprised of promotional expenditures, including payment for shelf space, discounts, giveaways, and offers at point-of-sale, that would not affect the advertising industry. There is a substantial difference in reported amounts for outdoor advertising, which is negligible in the *Advertising Age* numbers for 1995 but reported at $240 million in the FTC numbers for 1994, suggesting a substantial definition or data difference.

Workers could also absorb some of the cost, particularly in the short run; in the long run, alternative employment could presumably be found. New investment would not be expected to be affected; only assets already committed to the industry, generally reflected in equity shares, would be affected.

Note that there is no obvious relationship of the burden of the payment to the effect on tobacco stock prices. To the extent that the potential cost of lawsuits is already reflected in current stock prices, the settlement could be expected to increase stock prices if the payments are expected to be passed on in price and the potential court settlements avoided are significant and would have fallen on profits.[9] This effect would occur even if the liabilities avoided were smaller than the settlement payments. The settlement also decreases risk and uncertainty. The effects of other restrictions and actions that would reduce future demand would, however, be expected to reduce prices by reducing earnings. It is very difficult to predict either the initial, or the permanent, effect of the settlement on stock prices, since that would depend on the extent to which projected liabilities from lawsuits, or the cost of litigation, are already factored into stock prices.

Finally, a loss in government revenue would be expected due to behavioral responses and deductibility of the payments.

Current federal cigarette tax revenues are $5.6 billion, and if the full $15 billion in the June settlement is passed on, there should be a 12 percent decrease in smoking (based on the evidence presented in the next section) and a $0.7 billion fall in existing

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[7] *Advertising Age*, September 30, 1996.

[8] FTC News Release, October 9, 1996.

[9] Even if prices rise, the burden does not fall on new investment. Even though the cost of acquiring the stock has increased, it is offset by the expected increase in profits due to the reduction in future liabilities.

tobacco tax revenues.[10] This calculation does not take into account the recent cigarette tax increase in the 1997 tax legislation; including that 15 cent increase would raise the lost revenue to $1.0 billion. Applying the same methodology to state and local taxes, cigarette tax revenues would be expected to drop by about $0.9 billion. If penalties are collected because of failure to meet youth smoking targets, the additional revenue would be up to $2 billion; however, if this additional revenue is passed on in price, it would also cause a loss in tax revenue. Moreover a fall in smoking will directly reduce the $15 billion in receipts by about 12 percent, or $1.8 billion.

The payment proposal in the Commerce Committee plan is larger and less certain because the payments are not pegged to current consumption, but to future consumption levels. However, taking the proposed price increase of $1.10 per pack, consumption would fall by about 20 percent,[11] and revenues would fall by $1.1 billion for the current 24 cents tax, and by $1.8 billion if the scheduled 15 cent increase is included. State revenues would fall by about $1.5 billion. The cap on individual penalties is higher ($3.5 billion) and not deductible, which would restore some revenue but would also contract consumption if passed on in price.

Typically, an excise tax is assumed to cause a loss in income tax revenues that is assumed to be about 25% of the excise tax receipts. Thus, if the net gain from the annual payments is about $12 billion for the June settlement, there is an offsetting loss of $3 billion in income taxes; that is, the Federal government would net about $9 billion (ignoring the penalties). For the Commerce Committee plan, the offset and the net would be larger. The plan is projected to yield $23 billion by 2004, but that number already takes into account projected post-tax quantity; reducing that amount for the loss in existing tobacco taxes, and then reducing that amount by 25 percent for the income tax offset results in a net revenue of slightly over $15 billion.

In general, there would be little or no offsetting tax savings. None of the individual payments in the June settlement would be taxed to individuals because no punitive damages would be allowed; there would also be little taxation of receipts and payments in the Commerce Committee plan. For both plans, there would also be a small cost in state income tax revenues.

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[10] The estimated response depends on the price elasticity used (-0.4 in this case), the initial price (assumed to be $1.95 for the overall market), and the functional form of the demand function (a log-linear form). Three typical functional forms are a linear calculation, a constant elastic, or CES, function and a log-linear function. A simple linear calculation (price elasticity multiplied by percentage change in price) produces the largest effect. For example, in the case of the 62 cents tax, the percentage price increase is 32 percent and the reduction in demand is 13 percent (0.4 times 32 percent). A log-linear form allows some curvature in the demand curve, with an elasticity that rises with price; it is an exponential function of the form is $Q = Ae^{-bP}$, where Q is quantity, P is price, and A and b are constants. The CES function has a constant elasticity; $Q = AP^{-E}$, where A is a constant and E is the elasticity. The CES form produces a 10 percent decrease in quantity. The functional form becomes quite important with large changes and high price elasticities. A disadvantage of the linear form is that quantity could reach zero for a large tax.

[11] The linear extrapolations would predict a 23 percent decrease, and the constant elastic function would predict a 16 percent decrease.

Of course, the payments would be received by the government as well. Part of the objective of the settlement is to compensate various parties who might pursue lawsuits. The tentative plan for the division of $15 billion in annual payments in the June settlement (once fully phased in) is as follows: $5 billion for a fund to settle individual lawsuits; $5 billion to reimburse the states for Medicaid costs; $2 billion to fund health insurance for children without coverage and other public health initiatives unrelated to smoking; $1.5 billion for smoking cessation programs, and $1.5 billion for a combination of objectives: funding of federal and state anti-smoking campaigns, research into smoking addiction, regulation, and compensating sporting events that lose sponsorship.[12] Without some adjustment, the plan would add modestly to the federal deficit, but not the state deficit.

If teenage smoking drops more than the aggregate reduction in consumption, or due to other measures, consumption would drop further in the future as there would be a smaller new generation of consumers that would gradually come to dominate the market.

Effect of the Plan on Consumption

The Annual Payment

The effect of the payments on consumption depends on the elasticity of price response. Consumption can also be affected by advertising (positive and negative), and by regulation. Extensive reviews of the literature on price elasticity and regulations for youth are found in Chaloupka and Grossman and the review here reflects their summary.[13] Some of this literature is also reviewed in the 1994 Surgeon General's report.[14] This section also discusses two more recent studies.

An elasticity is the percentage change in quantity bought divided by a percentage change in price; if the elasticity is -0.4, a 10% increase in price would lead to a 4% reduction in quantity demanded. Response is referred to as elastic, if the elasticity is above one and inelastic if the elasticity is below one. This response can be divided into a participation response and an average consumption response. For example, if the participation elasticity for this estimate is -0.25, it means that a 10% price increase will lead to a 2.5% decrease in the number of smokers and a 1.5% decrease in the average amount smoked by those who continue to smoke.

There are many studies of cigarette demand, partly because there is a relatively rich data set (significant variation across states and localities). These studies are referred to as cross-section studies. Most estimates of responsiveness to price find

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[12] Reported in "Smokers Would Pay Bills for Previous Generations," *Washington Post*, June 21, 1997.

[13] Frank J. Chaloupka and Michael Grossman, *Price, Tobacco Control Policies and Youth Smoking*, National Bureau of Economic Research Working Paper 5740, September 1996.

[14] *Preventing Tobacco Use Among Young People*, op cit., 1994.[x]

elasticities to be small overall, between -0.3 and -0.5, with more of the response appearing as a change in participation rather than a change in quantity consumed by participants. Hence, the estimates of consumption reductions for the market as a whole (which is virtually all adults) discussed in the previous section use an elasticity of -0.4.

There is some evidence that younger smokers are more responsive to price than older ones, although the very high elasticities initially estimated for young smokers are found to be reduced in more sophisticated studies that take account of the effects of other policies that are often correlated with higher taxes.

Lewit and Coate[15] found a total elasticity of -0.42, with a participation elasticity of -0.26; but for the group aged 20-25, they found a -0.89 elasticity, with a participation elasticity of -0.74. Evans and Farrelly[16] found lower elasticities and smaller differences across age groups — a total elasticity of -0.6 for those 8-25, -0.4 for 25-39, and a virtually zero elasticity for those 40 and older. For young smokers, Lewit, Coate, and Grossman[17] found a youth elasticity of -1.44 and a participation elasticity of -1.20. Grossman, et al.[18] found a -0.76 elasticity for participation by youth. Chaloupka[19] studied youth and young adults, and found them less responsive but found an effect. Wasserman, et al.,[20] however, found no statistically significant effects (despite a large sample); but they also included a regulatory index that was highly correlated with price.

Chaloupka and Grossman's[21] more recent estimates are statistically significant, but not as high as those of Lewit, Coate, and Grossman.[22] They identify two problems with these earlier statistical studies. First, many policies may be correlated (anti-smoking sentiment in a community or state may be reflected in taxes and non-tax regulatory effects); leaving out regulatory effects will overstate price effects. Including regulatory effects makes it difficult to distinguish between different effects,

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[15] Lewit, E.M., and D. Coate. "The Potential for Using Excise Taxes to Reduce Smoking," *Journal of Health Economics*, 1: 121-145, 1982.

[16] Evans, W.N., and M.C. Farrelly, "Compensating Behavior of Smokers: Taxes, Tar and Nicotine," Working paper, Department of Economics, University of Maryland, 1995.

[17] Lewit, E.M., D Coate, and M. Grossman, "The Effects of Government Regulations on Teenage Smoking," *Journal of Law and Economics*, 24: 545-69, 1981.

[18] Grossman, M., D. Coate, E.M. Lewit, and R.A. Shakato, *Economics and Other Factors in Youth Smoking*. Final Report, National Science Foundation, 1993.

[19] Chaloupka, F.J., "Rational Addictive Behavior and Cigarette Smoking," *Journal of Political Economy*, 99: 722-42, 1991.

[20] Wasserman, J.W.G. Manning, J.P. Newhouse, and J.D. Winkler, "The Effects of Excise Taxes and Regulations on Cigarette Smoking," *Journal of Health Economics*, vol. 10, 43-64.

[21] Chaloupka and Grossman, *Price, Tobacco Control Policies, and Youth Smoking*, op. Cit., 1996.

[22] Lewit, Coate, and Grossman, "The Effects of Government Regulations on Teenage Smoking," op. Cit., 1981.

leading to less precision. Of course, even with controls for all regulatory effects, there is likely to be an independent effect from the local attitudes towards smoking that may be correlated with price, and would cause elasticities to be overstated.

The second problem is referred to as "butt-legging" — going to other places to buy cigarettes. These studies generally ask teenagers about their smoking habits, and that survey information provides the data on quantity smoked. If smokers go to other jurisdictions to buy, then the average difference in price they confront is less than the local tax. If the elasticity were measured by dividing estimated differences in consumption by the true difference in price (as opposed to the difference based on local price observations), it would be higher; hence, not controlling for this factor causes measured elasticities to be too low. Most studies have included controls for this effect. However, the "butt-legging" problem is less severe with teenagers who often cannot drive.

Chaloupka and Grossman present four sets of estimates for youth smoking responses to price increases (total and participation elasticities are given): one with omission of other effects and no controls for butt-legging (-1.450, -0.799); one with inclusion of other effects and no controls for butt-legging (-0.84, -0.376); one with omission of other effects and controls for butt-legging (-1.790, -0.923); one with inclusion of other effects and controls for butt-legging (-1.254, -0.602). Assuming ones with controls for butt-legging are better, -1.790 is upper bound for total response and -0.923 is upper bound for participation. The estimates that control for other effects, which are generally preferable, are -1.254 for the total elasticity and -0.602 for the participation elasticity.

Using a starting price of $2.05 per pack[23] and the -0.6 participation elasticity, if the payment were exactly passed forward as a price increase, the percentage reduction in the number of youth smokers under the June 1997 settlement would be about 17%.[24] These calculations suggest that the payment alone will be inadequate to accomplish the settlement targets of a 30% reduction in 5 years, a 50% reduction in 7 years, and a 60% reduction in 10 years. Even with the much higher elasticities estimated by some studies and assumptions of full pass-through, the reduction is unlikely to exceed 40%. For example, doubling the elasticity to match that of Lewit, Coate and Grossman, would lead to only a 26 percent reduction. The larger amounts in the Commerce Committee proposal (using the $1.10 figure) would lead to a reduction of 28 percent at a 0.6 elasticity, and with an elasticity that is twice as high, the decrease would be 47 percent.[25]

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[23] In November 1997, the average price was $1.95, according to the Tobacco Institute's *The Tax Burden on Tobacco*. This number includes generic brands; the average price for full-priced brands, which are more popular with teenagers, was $2.05. This latter price was used as the starting price in the calculations.

[24] This estimate uses a log-linear function. A linear estimate would result in an 18 percent reduction, while a constant elastic function would produce a 15 percent reduction.

[25] This estimate does not account for the effect of the recently passed tax increases This estimate uses a log-linear function. Note that as elasticities and price increases rise, the functional form becomes more important. For a -0.6 elasticity and a 62 cent increase, the

(continued...)

The payment because of failure to meet youth smoking reduction targets may well apply; at the maximum level and with full pass-through to price, the payment would reduce participation by an additional 2% at the -0.6 elasticity. The effects would be over two times as large in the Commerce Committee plan.

Recent research has cast further doubt on the existence of an elastic participation response, and even on the more modest -0.6 underage participation elasticity. One of the problems with these cross-section studies is the existence of an unobserved variable, the general community attitude toward smoking. Communities that are less tolerant of smoking would tend to have higher taxes and more restrictions, and while there are attempts in the Chaloupka and Grossman study to control for restrictions, there are no controls for community attitude. A recent study by DeCicca, Kenkel, and Mathios[26] using panel data (data that tracks individuals over time) found smoking participation to be sensitive to price at roughly the same levels as Chaloupka and Grossman – their estimates ranged from -0.5 to -0.7. While this study could not control for "butt-legging," because of data limitations, there were many socioeconomic variables that were included. The authors also estimated the effect of taxes on the onset of smoking after the 8th grade and found virtually no effect for their 10th grade and 12th grade students. This finding basically arose from the fact that this estimate excluded students already smoking in the 8th grade. While there are some theoretical reasons that might explain this result, one possibility is that more smoking at these earlier ages is correlated with local cultural attitudes. The authors explored this effect further by eliminating the three tobacco producing states from their 8th grade cross section and again found that the price elasticity is essentially zero.

A new study by Evans and Huang[27] which also uses panel data and examines changes over time within states, finds elasticities that range from -0.2 for the period 1977-1992, although a higher elasticity of -0.5 is found for the 1985-1992 time period. This study controlled across states, but did not control for changing attitudes across states.

The findings in these studies cast doubt on the large participation elasticities that were initially assumed in formulating policies to reduce teen smoking. In some ways, however, these results should not be surprising. The normal reason for expecting a higher elasticity for underage smoking is that a large part of the individuals budget would be spent on cigarettes and the price response would be larger for any item that looms large in ones budget. High school students, however, may often not smoke

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[25](...continued)
percentage reductions are 15 percent for the constant elastic function and 18 percent for a linear calculations, close to the figure reported in the text. For the $1.10 increase, these percentage reductions are 23 percent and 32 percent respectively, a much greater difference. For a doubled elasticity of -1.2, the constant elastic function produces a 27 percent reduction and the linear estimate a 36 percent reduction for the 62 cents tax. For the $1.10 increase these amounts are 40 percent and 64 percent..

[26] Philip DeCicca, Donald Kenkel, and Alan Mathios. Putting Out the Fires: Will Higher Taxes Reduce Youth Smoking, Cornell University, December 1997.

[27] William N. Evans and Lynn Huang. Cigarette Taxes and Teen Smoking: New Evidence from Panels of Repeated Cross Sections. University of Maryland. January 6, 1998.

very much. The Center for Disease Control (CDC) reports that while 36.4 percent of high school students smoked in the last month, only 16.7 percent smoked 20 days out of the past month.[28] The University of Michigan's Monitoring the Future Survey reports that 36.5 percent of twelfth graders have smoked in the last month, 24.6 percent smoke daily, and only 14.3 percent smoke more than ten cigarettes per day. If smoking is largely for status and consumption amounts are small, many such students may continue to participate despite significant price increases.

Note also that many underage smokers obtain their cigarettes from sources other than direct purchases and may not be affected, or may be affected less, by price changes. According to the Center for Disease Control Morbidity and Mortatlity Report for May 24, 1996, 39% of underage high school smokers usually purchased their cigarettes from stores and 2% from vending machines: the remainder borrowed from others (33%), gave someone else money to purchase them (16%) or stole them (4%).) While this heterogeneity in source of supply would not likely affect the projections for small changes, it could limit the response for large price changes.

The estimates discussed in this section do not account for the recently passed cigarette tax, set initially at 10 cents per pack in 2000 and scheduled to rise to 15 cents in 2002. The additional tax would be expected to decrease youth smoking rates by an additional 4% to 5%, based on the -0.6 elasticity.

Other Regulatory Policies

Chaloupka and Grossman[29] review the research literature on regulatory policies; they find that strong restrictions on smoking that limit smoking in private businesses have a significant effect on participation, while restrictions in schools or public places have little effect. When combined with price changes, only workplace restrictions are significant. Daily consumption is affected by restrictions in school but not in other places. Legal age of purchase has no effect, but that may well be because of uneven enforcement and very little variation (virtually all states have the same age 18 as the minimum). Restrictions or bans on vending machines had no effect (although enforcement may also vary here as well); most young smokers do not obtain their cigarettes from vending machines. State and local licensing requirements had no effect, but they also may not be enforced. Of course, as in the case of price effects, these results may be overstated due to the omitted variable of community attitude.

Two studies have found significant effects of anti-smoking campaigns comparing changes over time. For youths, Lewit, et al.[30] found a reduction of around 20% from

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[28] Center for Disease Control. Tobacco Use Among High School Students. Mortality and Morbidity Weekly Review, Vol. 97, No. 12, April 13, 1998. 70.2 percent of students have tried smoking.

[29] Chaloupka and Grossman, *Price, Tobacco Control Policies, and Youth Smoking*, op. cit., 1996.

[30] Lewit, Coate, and. Grossman, *Ibid*.

the anti-smoking campaign in the late 1960s, a significant amount. Hu, Sung and Keeler[31] find an effect from the recent campaigns in California.

A reservation about the further effectiveness of this approach is whether one can obtain much additional reduction given the existence of current anti-smoking campaigns and widespread information on health risks. The reduction that has already occurred may leave a group of remaining youth smokers that are less susceptible to persuasion from anti-smoking information. There is evidence that young smokers are aware of and even exaggerate health risks,[32] and much would depend on the design of such a campaign.

While there seems to be an assumption in the public health community that advertising has an important effect on increasing tobacco consumption, many economists are skeptical about this argument.[33] If one thinks about advertising as information, then most individuals can obtain information about the existence of a product without advertising; advertising may function more to provide information on current prices or to differentiate similar products. For most products this point may be obvious: advertising is not important to our purchase of laundry detergent, but it may have an effect on which product we buy. In this view, advertising is more important to market share than to aggregate demand.

The argument is, however, made that in the case of cigarettes, advertising is used to cultivate a demand that would not otherwise exist, presumably among younger smokers. Finding empirical evidence of this effect of advertising is plagued with problems. Unlike studies that assess the effects of taxes and other policies, advertising is generally a national activity that cannot be differentiated easily across locales. As a result, time series must typically be used to associate consumption with advertising and it is hard to control for other factors. Another uncertainty involves causality — does advertising increase because of larger market, or vice versa?

The Surgeon General's 1994 report on youth prevention makes a strong claim for the impact of advertising using studies from many disciplines, but relatively few from economics. Both economic theory and a substantial amount of research suggest that advertising has little effect on consumption in the aggregate, although there is some dispute about this issue (see Doroodian and Seldon[34] for a review of the

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[31] The-Wei Hu, Hai-Yen Sung, and Theodore E. Keeler, "The State Anti-smoking Campaign and the Industry Response: The Effects on Cigarette Consumption in California." *American Economic Review Papers and Proceedings*, May 1995, vol 85, No. 2, 85-90.

[32] W. Kip Viscusi, *Smoking: Making the Risky Decision*. New York: Oxford University Press, 1992.

[33] See, for example, Lynne Schneider, Benjamin Klein, and Kevin M. Murphy, "Governmental Regulation of Cigarette Health Information," *Journal of Law and Economics*, vol. 24, December, 1981, pp. 575-612, who concluded that the advertising ban increased consumption.

[34] Khosrow Doroodian and Barry J. Seldon, "Advertising and Cigarette Consumption," *Eastern Economic Journal*, vol. 17, no. 3, July-September 1991, 359-366.

literature on this issue; see Andrews and Franke for a composite analysis[35]; see Baltagi and Levin for further discussion,[36] and Lewit, Coate and Grossman[37] for a discussion of earlier research). This small effect of advertising is also consistent with a small price elasticity of demand in general.

For the advertising effect on youth there is very little research. Lewit et al.[38] estimated an effect of the 1971 ban on television advertising but it was not large (around a five % reduction). Since the ban immediately followed the anti-smoking campaign, it was not easy to separate out these different effects. Hu, Sung and Keeler,[39] more recently, found some effect from California's anti-smoking education campaign. Chaloupka and Grossman[40] found no effect from distribution of free samples. The 1994 Surgeon General's report[41] claims some evidence of a reduction in smoking following advertising bans in two countries, but Lee[42] cites evidence in other countries where teen smoking rates increased after advertising bans.

Notably, if these studies found effects, the same conclusions would not necessarily apply to marginal changes or additional restrictions. Excluding advertising from TV and radio may have had a different effect from the advertising restrictions under consideration, and the remaining young smokers may be less influenced by advertising since there is less of it available to them.

There are possible circumstances where advertising restrictions could result in increased smoking. If firms are competing for market share and are limited in their use of advertising, they may use price competition instead (and have the funds to cut prices as their advertising costs fall).

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[35] Rick L. Andrews and George R. Franke. "The Determinants of Cigarette Consumption: A Meta-Analysis." *Journal of Public Policy and Marketing*, vol. 10, Spring 1991, 81-100. These authors found a small, but positive, relationship between advertising and tobacco consumption, although over time it had declined to virtually zero.

[36] Badi H. Baltagi and Dan Levin, "Estimating Dynamic Demand for Cigarettes Using Panel Data: The Effects of Bootlegging, Taxation and Advertising Reconsidered." *Review of Economics and Statistics*, vol. 68, February 1986, 148-155.

[37] Lewit, Coate, and. Grossman, "The Effects of Government Regulations on Teenage Smoking," op. cit., 1981.

[38] Lewit, et al. *Ibid*.

[39] Hu, Sung, and Keeler, "The State Anti-smoking Campaign and the Industry Response: The Effects of Cigarette Consumption in California." Op. cit., 1994.

[40] Chaloupka and Grossman, *Price, Tobacco Control and Youth Smoking*, op. cit., 1996.

[41] *Preventing Tobacco Use Among Young People*, op cit., 1994.

[42] Dwight R. Lee, "Will Government's Crusade Against Tobacco Work?" *Contemporary Issues* no. 86, Center for the Study of American Business, Washington Univ., St. Louis, MO, July 1997.

One policy option would be to make advertising more costly, for example, by disallowing the deduction of advertising, or allowing only part of it to be deducted or capitalizing it and allowing recovery over a long period of time.

Effect on Income Distribution

The previous analysis suggests that as a result of the proposed settlement, the price of cigarettes would rise, with modest effects on quantity consumed, especially in the short run when existing adult smokers dominate the market. Some of the payment, especially the up-front payment, could be borne by stockholders. However, most of the burden will likely fall on consumers.

Tobacco taxes, which are presumably passed on and are similar in effect to the annual payments, are estimated to be the most regressive of any important federal tax levied currently (i.e., income, payroll, estate and gift, and excises taxes on alcohol and fuels are either progressive or not as regressive). Smoking prevalence is higher at lower income levels. The following results are based on Viscusi's data for 1990.[43] For those with incomes of less than $10,000, which account for the bottom 10% of the population, smoking prevalence is 31.6%, current cigarette taxes are 1.62% of median income in this class, and 5.1% of smoker's median income. Since the cigarette tax would be more than doubled under the June settlement proposal, smokers in this class would pay in excess of 5 per cent of their income in additional taxes.

For the $10,000-$20,000 income class, constituting the next 18% of the population, with a participation rate of 29.8%, the existing federal and state taxes are 0.5% of income for all individuals and 1.7% for smokers. For the $20,000-$35,000 class, constituting the next 22% of individuals, where the participation rate is 26.9%, the tax is 0.25% of income for all individuals and 0.93% for smokers. In the next group, with a smoking prevalence of 23.4%, $35,000-$50,000, the tax is 0.14% of income for all individuals and 0.6% of smokers' incomes. Finally, for the $50,000 and over class, with a smoking prevalence of 19.3%, these current taxes are 0.08% of total income and 0.4% of the income of smokers.

In sum, for the lowest-income families with smokers the cigarette tax increase is a significant percentage of income and of an order of magnitude similar to the individual share of the payroll tax. The effect of the Commerce Committee plan would be at least twice as large. Some consideration might be given to using some of the funds to provide benefits for lower-income families.

To the extent that stockholders bear the tax burden, it will be on higher-income individuals.

The distributional effects also depend on the disposition of the payments. To the extent that states receive benefits, the effects will presumably be shared across taxpayers, perhaps in relation to their contribution to taxes, or would be shared across

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[43] W. Kip Viscusi, Cigarette Taxation and the Social Consequences of Smoking, *op cit*., 1995.

recipients of state and local services. If these tax reductions or spending increases follow the pattern of existing state taxes and benefits, low-income individuals will receive a tax or benefit that is larger relative to income, thus offsetting some of the distributional effect of the payments. However, there is no way to determine how these funds would actually be used.

Appendix: Fixed Payment Allocated by Industry

A fixed payment allocated by market share has some elements of a tax and some elements of a lump sum payment. The consequences of this type of payment structure are more complex. They depend on whether firms expect additional production to add to total market supply or to replace a competitor's supply.

We begin with an analysis that assumes firms choose quantity in order to maximize profit. This analysis is also influenced by how they perceive the aggregate market; basically, they may choose differently depending on whether they expect a unit of their own output to add to total output, or to displace a competitor's output.

If firms expect that an additional unit of their own output would add to the total output, companies should pass on the share of the payment that is equal to 1 minus their share of the market.. (These examples assume an ordinary tax is exactly passed on in price; the amounts should be adjusted up or down proportionally if a tax is assumed to be more or less than 100% passed on in price.)

This effect occurs because the payment is fixed and allocated among producers according to their market share. Assume that 200 units of the good are sold. Company A sells 100 units (a 50% share), company B sells 50 units (a 25% share) and company C sells 30 units (a 15% share). These amounts correspond generally to the shares of Philip Morris, RJR, and Brown and Williamson in the adult market, although not necessarily in the teenage market (where RJR's share, for example, is probably smaller).[44] The total tax is $124 ($0.62 per unit times 200 units); Company A's payment is $62 (half of the total payment, and an average of $0.62 per unit); Company B's payment is $31.

Let company A increase its output by one unit. Its share of the payment is now 101/201, or 50.25%. The product of 0.5025 and $124 is $62.31. Company A's payment rises by $0.31, not by $0.62. Company A passes on a tax equal to half the $0.62 per unit, which is a share equal to one minus its market share. If instead company B increased its output, its share would be 51/201, for a 25.373% share, a payment of $31.46, and an increase of $0.46. This amount is equal to the $0.62 per unit payment times 0.75; the latter is one minus its market share. Company C, by the same calculation, would pass on $0.53 per unit. Overall, using this analysis, the payment would increase the expected marginal cost by about two-thirds, weighted over the firms, of the per-unit payment.

If the firm expects that its additional production will drive out some units of another firm's production, then the marginal cost is higher. If all production is expected to replace that of other firms, Company A (returning to the example) would expect its share to rise to 101/200, which would lead to an increased share of 50.5%, a payment of $62.62 and an additional payment of $0.62. Thus, at the maximum, the payment would be the equivalent of a tax, with the cost rising by the full $0.62.

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[44] "Philip Morris to Pay Most of First Bill," *New York Times*, June 25, 1997, p. D1, D6.

To restate these points, if the payment is fixed, the payment will be partly like a tax and partly like a lump-sum payment, and it will be less like a tax for larger companies

The effects of the penalty on market share are further complicated because they relate to the teenage market. Whether the firm can assess the relationship between additional production for the market as a whole and its change in share of the teenage market is a complicating factor.