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**Article**

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# The New Economics of Smoking

Jonathan Gruber\*

The past six years have seen an enormous change in the treatment of smoking by both the public and policy makers. In 1995, federal and state excise taxes on cigarettes were one-third lower, in real terms, than their peak level of the mid-1960s. But taxes have risen by over 50 percent since then, and now stand at over one dollar per pack.

From the traditional economic perspective, this shift in government policy is unwarranted. The traditional economic model of smoking follows the standard approach to modeling any decision that involves tradeoffs over time<sup>1</sup>. Fully informed, forward-looking, rational consumers make the decision of whether to smoke, weighing the benefits of doing so in terms of smoking enjoyment against the costs in terms of health and other risks. The only call for intervention in such a model is related to the externalities that smokers impose on others, such as increased medical costs for our public insurance programs. But such externalities are in fact fairly small by most measures, since these costs are offset by the savings from earlier mortality of smokers, who pay a lifetime of Social Security taxes but often don't live long enough to collect their benefits. As a result, the traditional economic model would suggest that the "optimal" tax on cigarettes may be below even its 1995 level.

My recent work has questioned the validity of this traditional model. I have developed, in work with Botond Kozzegi, an alternative model of the smoking decision which has radically different implications for government policy, rationalizing large taxes on cigarettes and other types of regulatory

controls<sup>2</sup>. In this article, I describe this "new economics of smoking."

## The New Approach

The fundamental problem with the rational addiction model is that it does not account for the "self-control" problems faced by smokers. There is ample evidence that adults are unable to quit smoking even if they have a desire to do so. Eight in ten smokers in America express a desire to quit the habit, but many fewer than that actually do quit. According to one study, over 80 percent of smokers try to quit in a typical year, and the average smoker tries to quit every eight and half months. Fifty-four percent of serious quit attempts fail within one week.

These facts motivated Kozzegi and me to develop an alternative formulation of the smoking decision which changes the traditional formulation in just one critical way: by allowing smokers to be *time inconsistent*. This approach, now widely used within the new field of "behavioral economics," is one where there is conflict between what the smoker would like for himself today and what he would like for himself tomorrow. Today's "self" is impatient. Faced with the tradeoff between the short-term pleasures of smoking and the long-term health damages of doing so, he will greatly discount the latter and decide to smoke. But tomorrow's "self" is much more patient. That more patient self would prefer to quit smoking. The problem, however, is that *tomorrow never comes*. The next day, the future self who was patient is now the current self who is impatient. So the smoking continues, to the long-term regret of the smoker. This is in contrast with the *time consistent* formulation that is assumed by the traditional economics model. In that formulation, today's self and all future selves are in agreement about the advisability of smoking, leading to no regret or

inability to carry out plans to quit.

This formulation of preferences is one which is much more widely supported by the large literature on experimental evaluations of individual choice over time. Experiments consistently show that consumers are much more patient when making decisions about the future than when those same decisions are made about today. Individuals are much more willing to declare that their diets will start tomorrow than to start the diet today. The problem is that when tomorrow comes, it is once again easier to push off the date that the diet will begin. So, there is a conflict: you would always like to start the diet tomorrow, but you never get to the point where you are actually willing to make that sacrifice.

The key implication of time inconsistent preferences is that one's future self would like to somehow constrain one's current self to behave more patiently (for example to somehow force you today to push away that extra piece of cake). Thus, time inconsistent consumers will have demand for *commitment devices* that can be used to induce more appropriate behavior in the present. Indeed, the search for such commitment devices is the hallmark of most recommended strategies for quitting smoking: people regularly set up socially managed incentives to refrain from smoking by betting with others, telling others about the decision, and otherwise making it embarrassing to smoke.

Unfortunately, such self-control devices are only imperfectly provided by the private market. For every possible device, there is another device that can undo it. I can always cheat on my bets with others, or not go to my support group meetings and smoke instead. There is no way to truly commit oneself to not smoke or to not buy cigarettes through the private market.

But the government, on the other hand, can provide an excellent com-

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mitment device: cigarette taxation (or legally-induced price rises). By raising the price of cigarettes, the government and courts can make smoking more costly for today's self, helping achieve what the smoker's own long-term self would desire by lowering smoking today. There is a large literature which documents that smoking falls as cigarette prices rise; the best estimates suggest that each 10 percent rise in the price of cigarettes lowers the consumption of cigarettes by 5 to 6 percent. For youth smokers, price sensitivity is even higher. So higher taxes, and therefore higher prices, will significantly reduce smoking today.

## Implications of the New Approach for Government Policy

While this new approach to modeling smoking changes the traditional model in only one way, it has dramatic implications for government policy. In this model, the damage that smokers *do to themselves* is relevant, above and beyond external effects on others. This is because, from their own long-run perspective, smokers are smoking too much. Their long-term selves recognize this failure and would like to reduce smoking. But, their current selves are unable to do so. So the government can do what the private sector cannot; they can make it more costly to smoke in a way that cannot be evaded, combating one's short term impatience on behalf of one's long term interests.

While the damage that smokers do to others is, on net, small, the damage that smokers do to *themselves* is enormous. There are many negative impacts of smoking on individual health, but Koszegi and I focus on only one: the costs in terms of shortened lives. As noted above, on average smokers live about six fewer years than nonsmokers. Economists have spent years showing how we can use individuals' revealed preferences toward risk to value this type of lost life. Putting these estimates together with information on the reduction in years of life attributable to smoking

and the average cigarettes smoked over the smoker's life, Koszegi and I compute that the cost of smoking one pack of cigarettes, in terms of the value of life lost, is *\$35 per pack*. This is an enormous figure which is on the order of 100 times the typical estimate of the external damage done by smoking. Given this enormous damage that smokers do to themselves by smoking, any model which suggests that some share of these "internalities" should be reflected in government policy will suggest very large optimal taxes on cigarettes.

Koszegi and I show this in our work by considering the alternative formulation described above. We first consider a very modest degree of time inconsistency, much below that assessed by most laboratory experiments. Even in that case, we find that the optimal tax on cigarettes, above and beyond any externality effects, is \$1 to \$2. For more severe time inconsistency, which is consistent with laboratory evidence on preferences, the tax is much higher, on the order of \$5 to \$10 per pack. Another common argument against cigarette taxation is on distributional grounds. Smoking in the United States is very socioeconomically concentrated. Expenditures on tobacco products as a share of family income fall from 3.2 percent in the bottom income quartile to only 0.4 percent in the top income quartile. This pattern raises a concern that increased cigarette taxes will be excessively burdensome on those with the lowest incomes.

But this alternative approach to modeling smoking also challenges the standard perception that cigarette taxes are highly regressive. This is because the self-control benefit of cigarette taxation is larger, the larger is the price sensitivity of smoking. That is, for groups who are particularly price sensitive, higher prices are a particularly effective self-control device, since they will have more of the desired effect of reducing their smoking. And lower income groups are much more price sensitive than higher income groups. Indeed, our estimates suggest that the price elasticity of cigarette demand in the bottom quartile of the income distribution is roughly

minus one; that is, when cigarette prices rise, there is no net increase in cigarette spending for the lowest income group. For higher income groups, the price sensitivity is only about one-third as large.

Koszegi and I show that, given these differences, cigarette taxes are in general not very regressive, since the larger self-control benefits for lower income groups compensate for the higher taxes they pay as a share of income. Indeed, if self-control problems are large, then cigarette taxes can be highly *progressive* under this alternative approach. The point is that, with a price elasticity of minus one, the poor as a group spend no more of their incomes on cigarettes after tax increases than they did before; the higher spending among those who still smoke is offset by the savings among those who quit. But, as a group, the poor are much healthier as a result of the fact that they have reduced their smoking. So, on net, they are better off from the higher prices if they wanted to quit smoking, but could not because of self-control problems.

## New Evidence

It is important to highlight that this alternative model is not a radical departure from the traditional economic approach. This formulation continues to assume perfectly rational, forward-looking, fully informed consumers. That is, in every respect but one (time consistency), we retain the features of decisionmaking that economists have used to model behaviors for years. As a result, this alternative model also generates many aspects of real world behavior that are predicted by the traditional model. For example, under both models, smokers react to higher prices by smoking less. But the models do have one key differential prediction. Under the traditional formulation, higher taxes on cigarettes make smokers worse off; the government is constraining their choice of an activity that they are pursuing rationally. But, under this alternative formulation, higher taxes on cigarettes make smokers better off: the government is helping them achieve the self-control

that they cannot achieve through the private market.

In a recent study, my coauthor Sendhil Mullainathan and I directly tested this prediction<sup>3</sup>. We did so by assessing whether the self-reported well-being of smokers falls or rises when cigarette taxes increase. Using data from the General Social Survey in the U.S., we find consistently strong evidence that higher cigarette taxes are associated with higher levels of reported well-being among those with a propensity to smoke. Moreover, the effects are almost identical when we replicate the exercise with Canadian data, and, in both countries, these effects are present for cigarette taxes but not for any other excise taxes. While this is not an ideal experimental evaluation of these alternative models, it is much more consistent with the alternative formulation of the smoking decision than it is with the traditional model.

## Youth Smoking

An additional problem with both of these models of smoking is that the decision to initially begin smoking is made primarily by youths, whose ability to make fully-informed, appropriately forward looking decisions is questioned by society in many contexts (for example, minimum ages for drinking, driving, and voting). More than three-quarters of smokers begin smoking before age 19. Moreover, youths apparently initiate smoking without a full appreciation for the long-run implications of their actions. Among high school seniors who smoke more than one pack/day, the smoking rate five years later among those who stated that they *would not* be smoking (74 percent) is actually higher than the smoking rate among those who stated that they *would* be smoking (72 percent).

So how do youths make decisions to smoke, and to engage more generally in the set of risky behaviors that they undertake, such as consumption of alcohol and illicit drugs, criminal behavior, unprotected sex, over- or under-eating, driving dangerously, dropping out of school, or attempting

suicide? This was the question that motivated me to organize the NBER Project on “Risky Behavior Among Youths: An Economic Analysis.”<sup>4</sup> This project brought together ten teams of leading researchers to analyze the risky decisions made by youths. The resulting set of papers on these diverse behaviors yielded several clear and consistent conclusions, as summarized in my introductory chapter. First, economic incentives matter for youths in making these risky decisions; youth behavior in these areas is very sensitive to prices, penalties, and other policy levers that affect the costs of engaging in the activity. Second, these economic incentives nonetheless can explain only a small part of the time-series movements in youth risk taking. For example, the substantial decline in real cigarette prices during the 1990s can explain at most one-quarter of the dramatic rise in youth smoking over this period. Third, macroeconomic conditions matter for youth decisionmaking; dropping out of school goes up, but having unprotected sex goes down, as the economy improves.

Finally, there is clear evidence that the decisions made by youths have long lasting implications for their lives. For example, my analysis of youth smoking with Jonathan Zinman showed that adults who lived in low cigarette tax states as youths were much likelier to smoke as adults than were those who lived in higher cigarette tax states<sup>5</sup>. Our estimates imply that the rise in youth smoking of the 1990s will lead to 3.2 million fewer years of life for this youth cohort. Other papers show that lower drinking ages lead to more adult binge drinking as youths age, and that those who drop out of school because of a good economy never make up those years of lost schooling. Thus, the potential “mistakes” made by youths, such as the understatement of the long-run addictiveness of smoking noted above, can have important future implications.

## What We Have Learned and Where We Need to Go Next

My work on this new economics of smoking over the past few years has shown that there is an alternative formulation of the smoking decision which is more consistent with the existing evidence on behavior, and which has radically different implications for government regulation of this activity. But this is only one alternative to the traditional model; for example, B. Douglas Bernheim and Antonio Rangel recently have developed another alternative which shares many predictions with my model with Koszegi<sup>6</sup>. Thus, there is clearly more work needed in distinguishing these alternatives to the traditional model. And, more work is needed on developing and testing alternative models of other potentially addictive behaviors; David M. Cutler, Edward Glaeser, and Jesse Shapiro provide a nice example of applying these models to the important issue of obesity in the United States<sup>7</sup>.

Moreover, there remains much more to do in terms of understanding the decisions by youths to start smoking, or to engage in other risky activities. While research in this area has shown that economic incentives matter, we have been unsuccessful thus far in developing models that explain the wide variation over time the propensity of youths to engage in these behaviors.

<sup>1</sup> G. S. Becker and K. M. Murphy, “A Theory of Rational Addiction,” *Journal of Political Economy*, 96 (1998), pp. 675-700.

<sup>2</sup> J. Gruber and B. Koszegi, “Is Addiction Rational? Theory and Evidence,” NBER Working Paper No. 7507, January 2000, and *Quarterly Journal of Economics*, (116) (4) (November 2001), pp. 1261-1303; and “A Theory of Government Regulation of Addictive Bads: Optimal Tax Levels and Tax Incidence for Cigarette Taxation,” NBER Working Paper No. 8777, February 2002.

<sup>3</sup> J. Gruber and S. Mullainathan, “Do Cigarette Taxes Make Smokers Happier?” NBER Working Paper No. 8872, April 2002.

<sup>4</sup> J. Gruber, “Risky Behavior Among Youth: An Economic Analysis, Introduction” in J. Gruber, ed., *Risky Behavior Among Youth: An Economic Analysis*, Chicago: University of Chicago Press, 2001, pp. 1-28.

<sup>5</sup> J. Gruber and J. Zinman, "Youth Smoking in the U.S.: Evidence and Implications," NBER Working Paper No. 7780, July 2000, and in J. Gruber, ed., *Risky Behavior Among Youth: An*

*Economic Analysis*, Chicago: University of Chicago Press, 2001, pp. 69-120

<sup>6</sup> B. D. Bernheim and A. Rangel, "Addiction and Cue-Conditioned Cognitive Processes," NBER Working Paper No. 9329,

November 2002.

<sup>7</sup> D. M. Cutler, E. Glaeser, and J. Shapiro, "Why Have Americans Become More Obese?" NBER Working Paper No. 9446, January 2003.

## Venture Capitalists As Economic Principals

Steven N. Kaplan and Per Strömberg\*

There is a large academic literature on the principal-agent problem in financial contracting.<sup>1</sup> This literature focuses on the conflicts of interest between an agent — an entrepreneur with a venture that needs financing — and a principal — an investor with the funds to finance the venture. According to these theories, there are a number of ways that the investor/principal can mitigate these conflicts. First, the investor can collect information before deciding whether to invest, in order to screen out ex ante unprofitable projects and bad entrepreneurs. Second, investors can structure financial contracts — that is, the allocation of cash flow, control and liquidation rights — between themselves and entrepreneurs to provide incentives for the entrepreneurs to behave appropriately. And third, the investors can engage both in collecting information and in monitoring it once the project is under way.

Despite the large volume of theory, the empirical work in comparing the

contracts and actions of real world principals to their counterparts in financial contracting theory has lagged behind. In this paper, we describe recent empirical work and its relation to theory for one prominent class of such principals — venture capitalists (VCs). In our view, VCs are real world entities that closely approximate the investors of theory. VCs invest in entrepreneurs who need financing to fund a promising project or company. VCs have strong incentives to maximize value, but at the same time receive few or no private benefits of control. Although they are intermediaries, VCs typically receive at least 20 percent of the profits on their portfolios.

In this article, we describe recent empirical work — both ours and others' — on the three things that VCs do: contracting, screening, and monitoring. Unlike previous empirical work that has relied largely on surveys, our work (and much of the work we describe) relies on detailed information collected from actual VC financings.

### Contracting

In a forthcoming article<sup>2</sup>, we compare the characteristics of real world financial contracts to their counter-

parts in financial contracting theory. We do so by conducting a detailed study of 213 actual contracts between VCs and entrepreneurs. We find first that VC financings allow VCs to separately allocate cash flow rights, voting rights, board rights, liquidation rights, and other control rights. The separation of these rights is apparent, for example, in that VCs control roughly half of the cash flow rights on average, but have a majority of board seats in only 25 percent of the investments.

Second, while convertible securities are used most frequently, VCs also implement the same set of rights using combinations of multiple classes of common stock and straight preferred stock. We also point out that VCs use a variant of convertible preferred called "participating preferred" in roughly 40 percent of the financings. Participating preferred, under most circumstances, behaves like a position of straight preferred stock and common stock rather than like a position of convertible preferred.

Third, cash flow rights, voting rights, control rights, and future financings are frequently contingent on observable measures of financial and non-financial performance. These state contingencies are more common in the early stages of the VC-entrepreneur

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