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Introduction

Jonathan Gruber

There are a host of potentially risky behaviors in which youths engage, all of which have important implications for both their well-being and their life prospects. Activities such as smoking, drinking, having sex, and taking drugs are generally first encountered before age nineteen, yet they have important ramifications for the remainder of these youths' lives. For example, roughly one-third of high schoolers have smoked in the past thirty days, and over three-quarters of smokers start before they turn nineteen (Gruber and Zinman, chap. 2 in this volume). Over half of individuals first have sexual intercourse in high school, and almost 10 percent have been pregnant in high school (CDC 1998). And 80 percent of high schoolers have imbibed alcoholic beverages, and 63 percent of high school seniors have been drunk (University of Michigan 1998).

Moreover, the past decade has seen dramatic shifts in the intensity with which youths pursue these risky activities. The youth homicide rate fell 40 percent from 1993 to 1997, and teen births declined by 20 percent from 1991 to 1998. At the same time, youth smoking rose by one-third from 1991 to 1997, and marijuana use virtually doubled over this same period.

Despite the significance of these youth risky behaviors and the resulting ramifications for adult well-being, economists have paid relatively little attention to modeling the youth pursuit of risky behaviors, particularly

Jonathan Gruber is professor of economics at the Massachusetts Institute of Technology and a research associate of and director of the Program on Children at the National Bureau of Economic Research.

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when compared with the attention paid the subject in other disciplines, such as developmental psychology. The purpose of this volume is to take a first step toward remedying this deficiency. Two recent developments suggest that it is an auspicious time to consider such a perspective. First, there is some preliminary evidence that youths are very responsive to economic factors, such as prices, when deciding whether to undertake risky behaviors. These findings were part of the motivation for the recent legislative activity that substantially raised the price of tobacco products. In contrast to just a few years earlier, when nonprice regulatory barriers were perceived as the most appropriate impediment to youth smoking, the Clinton administration claimed, during the recent policy debate, that "the most reliable method for reducing teen smoking is to increase the price of cigarettes" (U.S. Department of the Treasury 1998, 1).

Second, there has been a recent growth in both the quantity and the quality of data available for studying youth risky behavior. Analysis has traditionally been limited to either the cross-sectional data on high school seniors from the Monitoring the Future (MTF) study or sporadic questions in the National Longitudinal Study of Youth (NLSY). But, in the 1990s, the MTF added cohorts of eighth and tenth graders, and, in the Youth Risk Behavior Survey (YRBS), the Centers for Disease Control (CDC) provided new cross-sectional data on ninth to twelfth graders to complement the MTF; the CDC made available for this project, and for all future work, state identifiers for the YRBS that are not generally available for the MTF. There was also the introduction of the Adolescent Health Survey (AddHealth), a rich new cross-sectional/longitudinal data source on a wide variety of risky behaviors.

These developments, along with the development of a group of first-class economists who are specifically interested in youth behavior, suggested that the time was right for an analysis of youth risky behavior from an economics perspective. This volume provides such an analysis. It incorporates studies from nine teams of leading empirical economists on a variety of behaviors: smoking (Jonathan Gruber and Jonathan Zinman); driving (Thomas S. Dee and William N. Evans); sex and pregnancy (Phillip B. Levine); suicide (David M. Cutler, Edward L. Glaeser, and Karen E. Norberg); marijuana use (Rosalie Liccardo Pacula, Michael Grossman, Frank J. Chaloupka, Patrick M. O'Malley, Lloyd D. Johnston, and Matthew C. Farrelly); crime (Steven D. Levitt and Lance Lochner); drinking (Philip J. Cook and Michael J. Moore); dropping out of school (David Card and Thomas Lemieux); and misnutrition (Jay Bhattacharya and Janet Currie). In addition, the first chapter in the volume, by Ted O'Donoghue and Matthew Rabin, provides a theoretical overview of a set of issues from behavioral economics that are relevant for thinking about the modeling of risky behavior among youths.

In this introductory chapter, I endeavor both to set the stage for the

analyses that follow and to distill their key lessons. I begin, in the first section, by providing some theoretical structure for thinking about these issues, drawing on mainstream economic analysis, developmental psychology, and new developments in behavioral economics. I also discuss the existing evidence from developmental psychology for the differences (or the lack thereof) between the behaviors of youths and those of adults. In the next section, I provide some facts on both the incidence of and the time-series trends in youth risky behaviors and draw some comparisons to time trends in adult behaviors. The third section then discusses the lessons for both policy and future research to be learned from these analyses. The last section concludes.

Theoretical Background

In this section, I review the theoretical perspectives on youth risk taking, first from traditional economic analysis, then from developmental psychology, and, finally, from new developments in behavioral economics. In each case, the discussion will focus on what is "special" about youths. To what extent can the standard framework that is applied to adult decision makers be applied to youths as well, and to what extent are special features required to adapt the model to the youth decision-making process?

Traditional Economic Analysis

The traditional economic approach to modeling decisions over risky activities is expected utility maximization with exponential (time-consistent) preferences. Individuals face some risky choice with benefits (e.g., personal enjoyment or social respect) and costs (e.g., current or future health risks), and they incorporate both into a utility-maximization problem. If the net benefits of pursuing the activity exceed the costs, it is pursued; if there is uncertainty about costs and/or benefits, then the comparison is made over expected utilities.

Perhaps the best-developed example of this approach is the "rational-addiction" model of Becker and Murphy (1988). In their model of the decision to pursue such addictive activities as smoking, forward-looking individuals trade off the benefits from the activity today against its costs, which include both the monetary costs of the activity and the costs in terms of increasing the stock of addiction to the activity. That is, rational addicts recognize the long-run negative implications of pursuing risky activities, but they may pursue them anyway if the benefits outweigh the costs.

In this framework, there is nothing particularly "special" about youths relative to adults; the same utility-maximization calculus is followed independent of age. Nevertheless, there are a number of reasons why, in practice, youths may behave differently than adults. For example, youths may

be more sensitive to the prices of addictive goods because they have lower incomes or because they have built up a lower stock of the addiction.

Developmental Psychology

The standard economics framework is not necessarily at odds with the perspective of the field that has focused the most on youth risk taking, developmental psychology. But developmental psychology provides a much more detailed framework, one that considers a wider variety of factors that might affect youth decisions to take risks, albeit at the cost of much less modeling precision than is provided by the parsimonious economics model. The developmental perspective on risk taking is nicely summarized in Fischoff (1992).

As noted by Fischoff, the most general definition of *risk taking* is any action having at least one uncertain outcome. The decision to undertake these types of activities will be determined by *cognitive* development (how people think about the world), *affective* development (how people feel about the world), and *social* development (the roles that others play in people's choices). Cognitive development consists of three components: capacity for thinking through problems; knowledge of alternatives and their implications; and skill in carrying out analyses of the alternatives. Affective development consists of *hot affect,* the deep states of arousal (fear, anger, passion) that can drive people to action or inaction, and *cold affect,* the more dispassionate cognitive representations of those desires (what might be labeled *values*). Social development consists of incorporating society's attitudes toward risky behaviors into one's own decision-making process.

Developmental psychologists have provided a range of evidence that allows one to compare the decision-making capacities of youths and adults, and this evidence suggests both important commonalities and important differences. Chapter 1 by O'Donoghue and Rabin, emphasizes the commonalities between decision making by youths and decision making by adults. For example, Beyth-Marom et al. (1993) asked both teens and adults about the perceived consequences of youth risk taking along a number of dimensions, such as drinking, smoking, drug use, etc. They found substantial homogeneity in the perceived consequences of these activities.[1] Similarly, Jacobs-Quadrel, Fischoff, and Davis (1993) found that, while youths appear to consider themselves somewhat invulnerable to the consequences of risk taking, their perceived invulnerability was no stronger than was adults'.

1. It is worth noting, however, that, while Jacobs-Quadrel (1990) found that youths and adults drawn from the same middle-class distribution performed similarly when asked to think about the consequences of risk taking, a group of at-risk youths performed much more poorly, demonstrating less knowledge and exhibiting more overconfidence about risky decisions than did middle-class youths.

Other evidence suggests more important differences between how youths and adults make decisions. A recent study by Halpern-Felsher and Cauffman (2000) asked youths and adults about the short- and long-run costs and benefits of different interventions, such as cosmetic surgery or whether to participate in an experimental medical study, and found that adults generally outperformed youths on measures of decision-making competence, such as considering all options, risks, and long-term consequences. The differences were particularly striking between adults and younger adolescents (those in the sixth and eighth grades).

Most important among the differences between youths and adults appears to be the role of social reactions. For example, Beyth-Marom et al. (1993) found that consequences of risky activities involving social reactions are considered more heavily by youths than by adults. Studies of susceptibility to peer influence, as opposed to self-reliance, tend to find an inverted-U relation, with susceptibility increasing between childhood and early adolescence, peaking sometime around age fourteen, and declining during the high school years (e.g., Steinberg and Cauffman 1996).

Fischoff (1992) found that youths have problems with emotional control when hard thought does not produce clear-cut answers to important decision problems. That is, since youths do not understand that some questions in life have no simple answers, they may overreact by allowing transient emotional states to resolve uncertainties. And existing studies suggest that moodiness (volatility of mood) may be more characteristic of adolescents than of adults. In a particularly interesting study of emotional experiences, Larson, Csikszentmihalyi, and Graef (1980) obtained direct data by having adolescents and adults carry electronic pagers and signaling subjects to report on their mood and its intensity at various points in the day. The results indicated that adolescents have more rapid and more extreme mood swings (both positive and negative) than do adults. Moreover, some evidence suggests that adolescents have a harder time controlling their impulses than do adults; the few comparisons of adults and adolescents that exist suggest that thrill seeking and disinhibition are higher during adolescence than during adulthood (Steinberg and Cauffman 1996).

Finally, a number of articles suggest an increase in future orientation with age. Lewis (1981) finds that older adolescents are more likely than younger adolescents to recognize the risks and future consequences of decisions. Greene (1986) and Nurmi (1991) find gains in future orientation both between childhood and adolescence and between adolescence and young adulthood.

Of course, an important limitation with all this evidence is that it relies on responses by youths and adults to hypothetical scenarios rather than on observations of risk taking in reality. As highlighted by Steinberg and Cauffman (1996), given the important potential role of emotional and social influences, more substantial differences between youths and adults

may emerge in the field than in the laboratory. In particular, there is little evidence elucidating the relation between self-reliance or future orientation and the quality of judgments made by teens.

Behavioral Economics

The models of developmental psychologists suggest a number of dimensions along which the economics model of youth decision making might be enriched. Some of these, such as evolving time preferences with age or the role of peer pressure, can be incorporated in a straightforward manner into standard models (e.g., Becker and Mulligan 1997). But others suggest the value of extending the standard framework. This is the goal of recent work in behavioral economics that is nicely summarized here by O'Donoghue and Rabin (chap. 1). They point in particular to three ways in which modeling these decisions by youths could potentially be improved by augmenting the standard model.

The first is to consider alternatives to the way in which economists typically model the trade-off between activities that have short-run benefits and long-run costs. This is a central feature of virtually all the risky activities considered in this volume. O'Donoghue and Rabin point out that there are two problems with the simple standard of exponentially discounted utility for considering these types of decisions by youths. The first problem is simple excessive myopia; that is, from the perspective of a paternalistic adult, youths may simply discount the future too much. The second problem is that, even if the long-run discount rate is "appropriate," youths may have preferences that are *time inconsistent.* Virtually every laboratory experiment that has been run demonstrates that individuals do not use a constant discount rate in considering decisions in the near term and in more distant periods. This suggests that time discounting may be better represented by *hyperbolic* models, which allow the discount rate to be higher in the short run than in the long run. These models have the important feature that there may be intrapersonal conflict between "selves" in different periods; the decision made by today's self for tomorrow is not necessarily the one that tomorrow's self would make. And, from the perspective of either a patient social planner or even today's self, there is "too much" pursuit of activities with short-run benefits and long-run costs in these models, even though long-run discounting is appropriate (Gruber and Koszegi 2000).

The second is to introduce *projection bias,* or the notion that youths may inappropriately project the current moment's preferences onto their future tastes. Once again, there is substantial laboratory evidence that, across identical individuals, random changes to current states affect long-run decision making. This has important implications for youths because they may not appreciate the extent to which their preferences may adapt as they age. For example, high school seniors considering dropping out of

school may not appreciate the fact that, when they are older, they will care about the quality of their job; given today's preferences, all jobs seem equally unappealing. This underestimation of the value later in life of having a high school degree can raise odds of dropping out of school today. O'Donoghue and Rabin point out a variety of other arenas in which this type of projection bias could lead to poor decision making by youths.

The third is to recognize that risky decisions are made in an uncertain environment and are made repeatedly and that it is therefore possible that increases in riskiness can actually *increase* risk-taking behavior. This is because, for many risky activities, the cost is onetime and permanent (e.g., getting AIDS from having unprotected sex). As a result, once the activity has been engaged in to some extent, the marginal risk from additional engagements is lower. Thus, if the activity is highly enjoyed by youths and they find out that the risk is higher than they thought, then they will engage more because they are likely to have already borne the cost. That is, in the limit, if having sex once causes AIDS for sure, then the marginal risk of a second sexual encounter is 0, and raising the risk of AIDS to 1 will increase sexual activity among those already having sex. This is an important point because it can generate significant "multiplier" effects on mistakes made in the past.

Summary

Developing a comprehensive model of how youths make risky decisions is a daunting task. Economists and developmental psychologists have taken very different routes in approaching this task. Economists have used the standard, powerful tools of utility maximization to provide modeling precision and generate sharp, testable predictions. Developmental psychologists have raised a much richer list of considerations that may ultimately be impossible to integrate in one comprehensive model. Recent work in behavioral economics is trying to carve out a middle ground between these two paths, enriching standard models along the lines suggested by the psychological evidence but retaining the rigorous mathematical structure that allows for prediction, welfare analysis, and hypothesis testing.

The analyses presented in this volume will not resolve the question of the "correct" way in which to model youth risk taking. There is clear evidence from a number of studies that the costs and benefits of risky activities are incorporated in youth decision making, which rejects extreme forms of irrationality or purely emotional decision making. But, as emphasized by O'Donoghue and Rabin (chap. 1), these findings are consistent with a broad set of models from economics and psychology. Thus, these analyses are best viewed as generating important facts and empirical relation that can help guide the formulation of future theories rather than as definitively favoring one approach over another.

Facts about Risk Taking by Youths and Adults

The Incidence of Risky Behaviors among Youths

As noted earlier, a host of data sets are now available that provide information about different risky behaviors pursued by youths. For this analysis, I rely on the Youth Risk Behavior Survey (YRBS) from the CDC, which provides recent (1997) data for a large number of different risky activities. Before perusing the numbers, however, it is worth noting that the estimates of the incidence of risky behaviors are sensitive to the survey used; for example, the teen-smoking rate is roughly 20 percent higher in the YRBS than it is in the MTF survey. However, the time trends across these surveys appear comparable for the 1990s, as noted in the chapter on smoking (chap. 2, Gruber and Zinman).

These data can be used to highlight three stylized patterns of behavior. First, we can examine the incidence of risky behaviors by age. One theory of the evolution of preferences for risky behavior might be that younger teens are both more impatient (supported by the evidence from Lewis [1981] cited above) and more subject to peer pressure, which could increase risk taking by younger teens relative to older teens. Of course, countervailing this are three factors; biology, which may make some risky activities (e.g., sexual intercourse) more desirable with age; income, as older teens may have more of their own income that can be used to finance risky activities; and the law, in that some risky activities are illegal for younger teens but legal for older teens.

Perhaps reflecting these countervailing influences, figure 1 illustrates that there is no clear age pattern to be found for risk taking. This figure shows the incidence of eight risky behaviors for the four grades represented in the YRBS data. The behaviors considered are smoking regularly in the past month, having five or more drinks in a row in the past month, carrying a weapon in the past month, attempting suicide in the past year, smoking marijuana in the past month, using other illegal drugs in the past year, driving while drunk in the past month, and having sex without using birth control at some point in life.

Some of these activities show a clear increase with age, particularly the activities related to drinking (having five or more drinks in a row; drinking and driving). Smoking shows a rise with age, but that rise is much more modest (although it is important to note that the MTF data used in the smoking chapter show a much steeper rise with age). Marijuana and other drug use shows a rise from the ninth to the eleventh grade and then a falloff in the senior year; once again, the MTF data show a steeper rise with age. But carrying a weapon, having unprotected sex, and attempting suicide actually show declining risk taking with age.

While it is difficult to draw firm conclusions from these types of data,

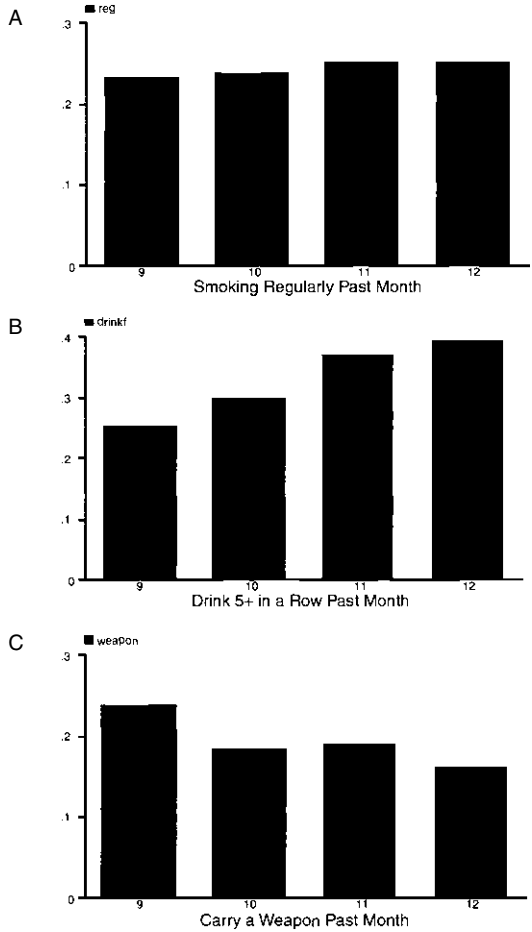


Fig. 1 Distribution of risky behaviors by grade: *A*, smoking regularly in the past month; *B*, having 5 or more drinks in a row in the past month; *C*, carrying a weapon in the past month; *D*, attempting suicide in the past year; *E*, smoking marijuana in the past 30 days; *F*, using other illegal drugs in the past year; *G*, driving while drunk in the past 30 days; *H*, having unprotected sex ever

these findings do suggest the power that two important economic variables have in determining behavior: age-specific legal penalties and income. Drinking and driving—both regulated by clear-cut age-specific laws—show the strongest pattern of risk taking rising with age. Smoking, which is not illegal per se at younger ages—only the purchase of cigarettes is so regulated—also shows a slight rise with age. But drug use—illegal for anyone of any age—shows a less pronounced age pattern and actually declines for high school seniors in the YRBS data. The age pattern for carrying a

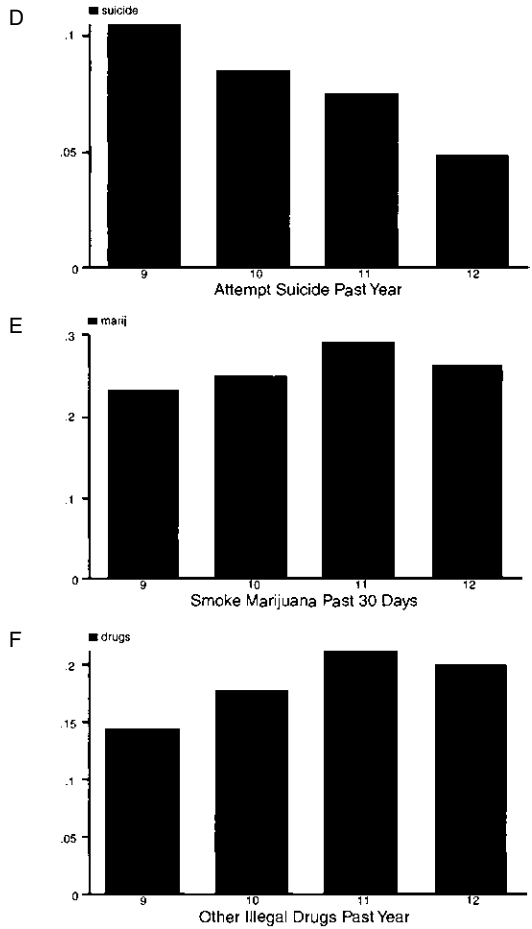


Fig. 1 (cont.)

weapon—again illegal for anyone of any age—is reversed. And attempted suicide and having unprotected sex—which are not illegal at any age—actually show a declining age pattern. These patterns are also consistent with pure income effects in that the activities that cost money (such as purchasing substances) are more likely to rise with age than are activities that are free (sex and suicide).

These facts suggest that economic incentives do matter for risk taking in that the risks for which there are age-specific penalties or likely income effects show the strongest patterns with age. This is also consistent with the finding in the chapter on crime (chap. 7, Levitt and Lochner) that the age pattern of crime follows very precisely the relative penalties imposed on youths and adults for criminal activity. These facts, therefore, also sug-

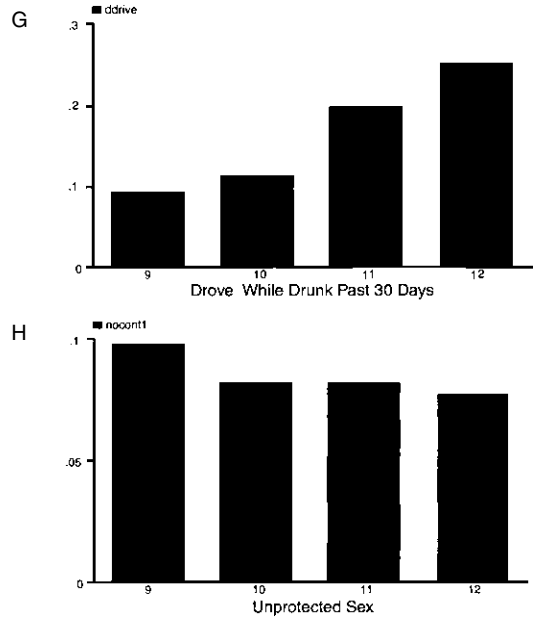


Fig. 1 (cont.)

gest the potential deterrent power that government intervention can have on risky behavior through both penalty and pricing policies.

A second feature of the data is that there is substantial heterogeneity in the intensity with which risky activities are carried out. Figure 2 shows histograms of number of days on which cigarettes were smoked in the past month, number of days on which a drink was had in the past month, number of times marijuana was smoked in the past month, and number of times sex was had in the past three months (where "never had sex" is one option). In every case, while there is a substantial number of youths who have never engaged in the activity in question, there is also a wide distribution among those youths who have. Indeed, only for drinking is there a clear pattern of continual decline; for smoking, there is actually a greater incidence at thirty days per month than at any other nonzero value, and teens are almost as likely to have had six or more sex partners as they are to have had three.

These facts would appear to support the importance of the third theoretical observation discussed in the section on behavioral economics above, that, once risky behaviors are undertaken, there may be low marginal costs to additional risk taking. This also raises an important question for analysis: how does one weight reduced incidence of any activity against the intensity with which that activity is pursued? This is important because some policy tools may be found to reduce either the extensive margin or

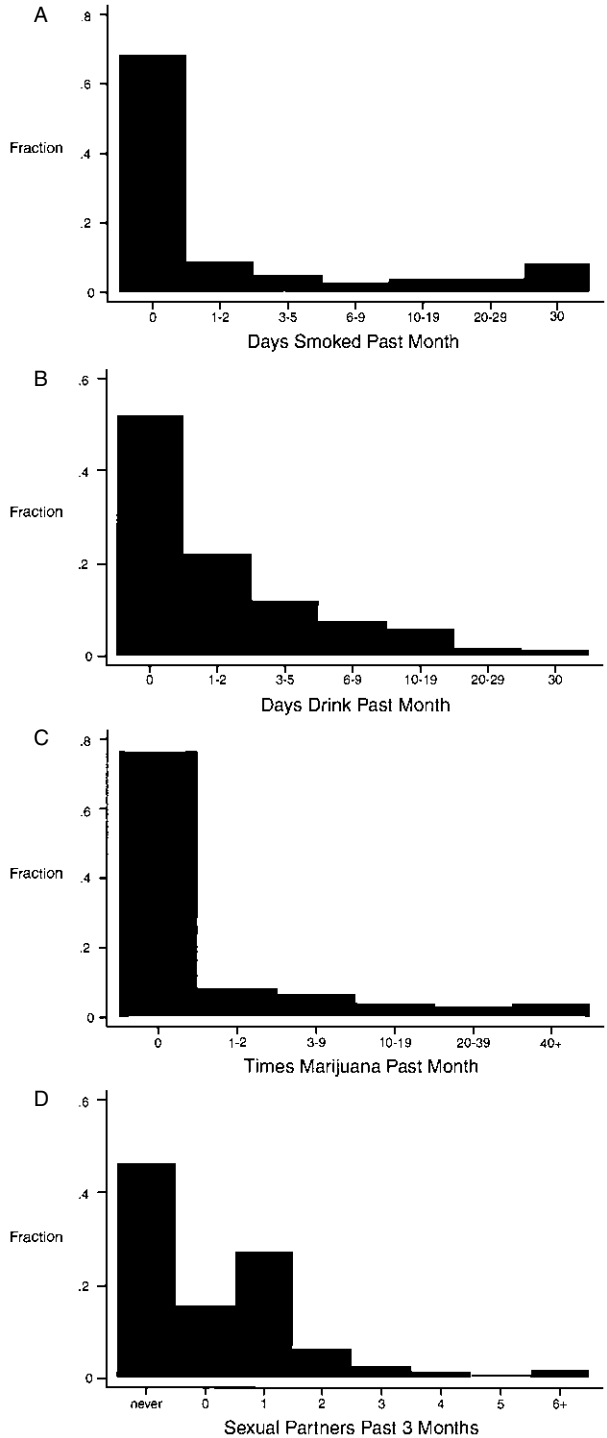


Fig. 2 Distribution of frequencies of risky activities: *A*, number of days on which cigarettes were smoked in the past month; *B*, number of days on which a drink was had in the past month; *C*, number of times marijuana was smoked in the past month; *D*, number of times sex was had in the past 3 months

the intensive margin, but not both. For example, the chapter on smoking (chap. 2, Gruber and Zinman) finds that restrictions on youth cigarette purchase reduce the intensity of smoking but not smoking participation while price increases seem to have a greater effect on participation than on conditional intensity.

Finally, the data suggest that no simple model can describe how youths make decisions across the range of risky activities. Two natural alternatives might be labeled the *bad-seed model* and the *conservation-of-risk model.* The bad-seed model would suggest that a certain segment of the youth population is predisposed toward risky activities and that the remainder is not. The conservation-of-risk model, on the other hand, would suggest that most youths have a tendency to take some risks and that, if they reduce risky activity in one area, they will increase it in another. These two models obviously have very different implications for policy: the bad-seed model would suggest that targeted efforts to reduce the youth pursuit of risky activities can be effective, whereas the conservation-of-risk model would suggest that efforts to reduce one kind of risk taking will simply induce substitution into another mode. They also have very different implications for the distribution of risk taking: the bad-seed model would suggest that the pursuit of risky activities is concentrated in a segment of the youth population that undertakes many of these activities; the conservation-of-risk model would suggest that risk taking is spread more broadly, with most youths taking some risk.

As figure 3 shows, however, neither model is supported in the extreme. This figure plots the histogram for the number of risky activities under-

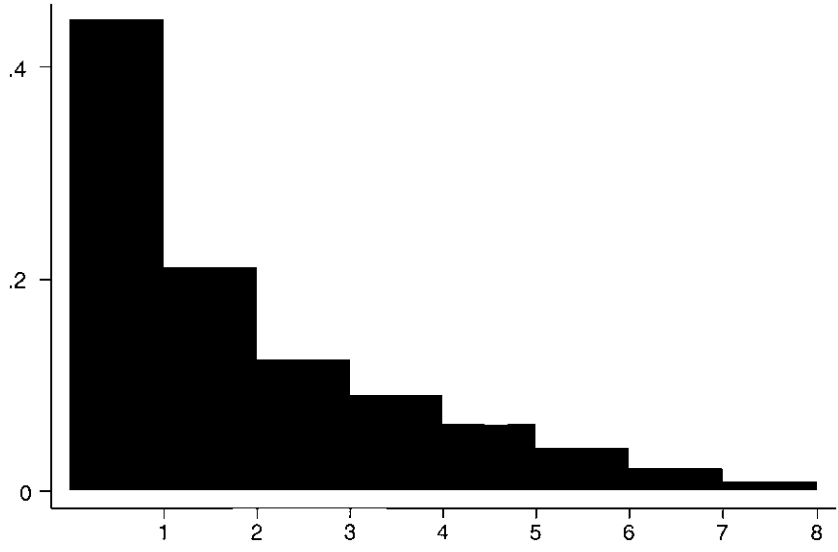


Fig. 3 Frequency of pursuit of risky activities

taken by youths in the YRBS data, drawing from the list of eight activities used for figure 1 above. Almost half of teenagers did not engage in any of these risky activities, but only 22 percent engaged in three or more of them. This appears to suggest neither purely a segment of the youth population that takes many risks nor a model in which every youth takes some risks. Moreover, it is striking to note that this exact pattern emerges within each grade as well and therefore does not reflect compositional effects across grades.

Time Trends in Risky Behaviors among Youths

The changes in the incidence of risky behaviors among youths over the past twenty years are also striking. This is illustrated in two ways in figures 4 and 5. Figure 4 plots the time-series patterns for eight of the risky behaviors discussed in this volume over the period 1976–97; there are no comparable data on nutrition, so this is not included. The eight time series depicted are the percentage of high school seniors who smoked in the past thirty days; fatal auto accidents per 100,000 sixteen- to nineteen-year-olds; the percentage of fifteen- to nineteen-year-old girls giving birth; the number of suicides per 100,000 fifteen- to nineteen-year-olds; the percentage of high school seniors who smoked marijuana in the past thirty days; the number of homicides in the fourteen- to seventeen-year-old age group per 100,000 persons; the percentage of high school seniors who had a drink in the past thirty days; and the percentage of fourteen- to seventeen-year-olds not enrolled in school.

The commonalities as well as the contrasts among these series are quite interesting. The first feature to note is the general reduction in teen risk taking from the beginning of the sample period (1976) over the next decade (to 1985). For some behaviors, such as smoking cigarettes or marijuana or being involved in a fatal car crash, the declines are dramatic. For the others—drinking, teen pregnancy, crime, and dropping out of school—the gains are more modest but still clear. Only for suicides is there an adverse trend over this period, and, even in this case, the trend is relatively modest. This is not a period on which the studies in this volume focus, but it is a particularly interesting one because of the reduction in risk taking across the board. Clearly, an important priority for future work is to understand what factors drove the general decline in this period.

The remainder of the period is usefully divided into two eras, the first running from 1985 through the early 1990s (roughly 1992), the second from the early 1990s through 1997 (the last year for which data are available). The trends in risky behaviors are much more heterogeneous over these periods. Over the middle period (1985–92), there is a continued decline in drinking, smoking, marijuana use, and dropping out of school. But there is a very sharp rise in the rate of youth homicide, teen pregnancy, and suicide. Both these trends are reversed over the last period, with teen

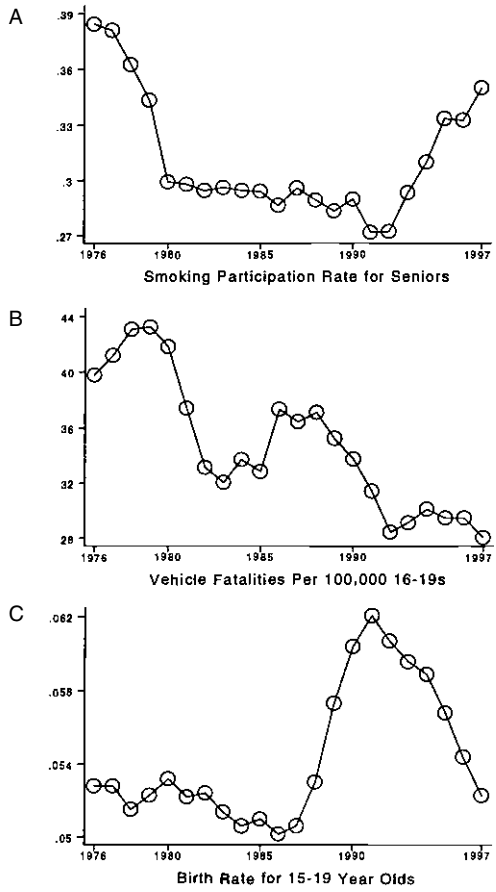


Fig. 4 Time-series trends in youth risky behaviors: *A*, smoking participation rate among high school seniors; *B*, vehicle fatalities per 100,000 16–19-year-olds; *C*, birthrate for 15–19-year-olds; *D*, suicides per 100,000 15–19-year-olds; *E*, percentage of high school seniors who smoked marijuana in the past 30 days; *F*, homicides per 100,000 14–17-year-olds; *G*, the percentage of high school seniors who had a drink in the past 30 days; *H*, the percentage of 14–17-year-olds not enrolled in school

homicides, pregnancies, and suicides plummeting, teen smoking and marijuana use skyrocketing, and drinking and traffic fatalities either flattening or rising modestly.

The patterns over time are particularly interesting, and highly correlated, for two pairs of behaviors: smoking and marijuana use; crime and teen pregnancy. These patterns are illustrated more closely in figure 5, which is drawn "scale free" so that movements in the four series can be viewed along the same scale. Both these pairs of series trend closely to-

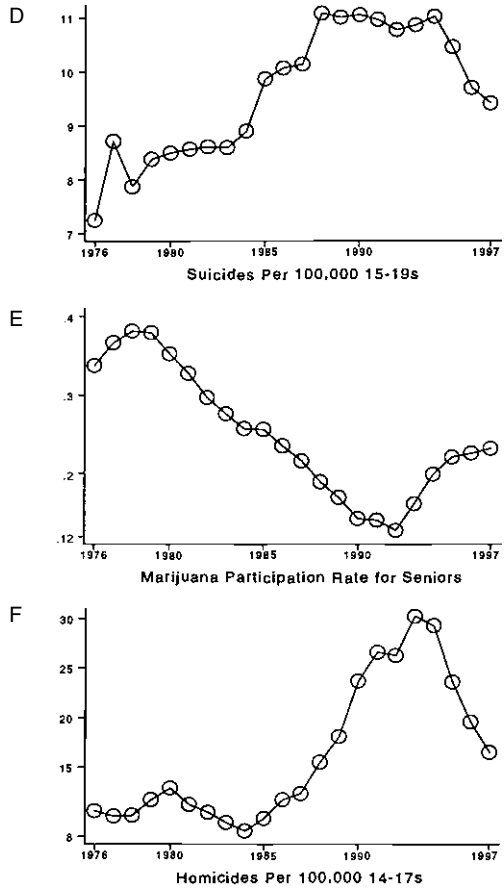
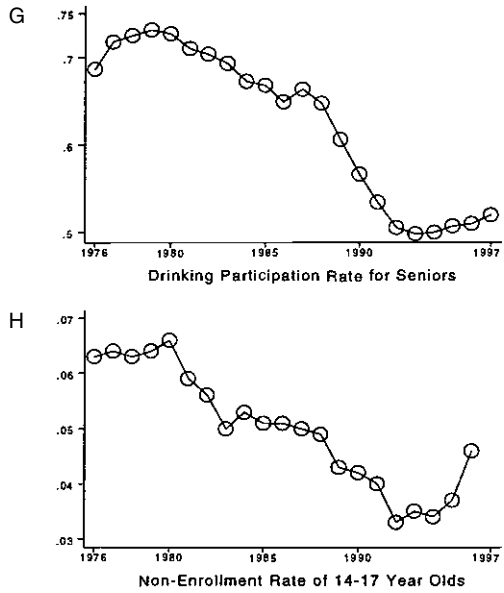


Fig. 4 (cont.)

gether, even moving together through very volatile rises and falls; the only exception is the gradual decline in marijuana use over the period 1976–91, while smoking falls quickly to 1980 and then declines more slowly after that. The time trend for teen suicide also matches fairly well, but not as closely, with the series for pregnancy and homicide.

For smoking and marijuana, the correlation is perhaps not surprising and provides some credence to the notion of complementarities between the use of these substances. But the parallel movements in crime and teen pregnancy are more surprising. There is no direct link between these behaviors, one of which is almost exclusively the purview of males and the other by definition exclusively the purview of females. But there is an implicit link as these are the two most "deviant" activities that males and females can pursue as teens. The fact that they move so closely together



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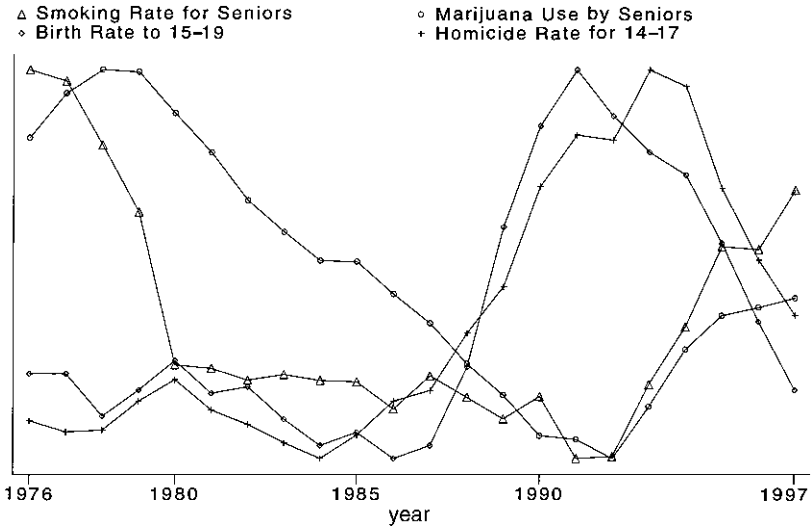

Fig. 5 Comparing time-series trends

suggests that there are clear taste shifts among teens regarding the pursuit of very risky activities and that these tastes can shift quite quickly over very short periods of time; the youth homicide rate almost tripled, and then halved, over a period of only a decade.

Time Trends among Adults

In terms of thinking about what is "special" about youths, it is instructive to contrast these time trends with the trends that we have seen over this same period in the adult pursuit of risky behaviors. Figure 6 compiles data on time-series trends in adult participation in risky behaviors, paralleling the data for youths (except for dropping out of school, for which there is no comparable adult behavior). The adult data are less consistent and more variable in quality than are the youth data since they come from a wider variety of sources and generally not the same sources from which the youth data are drawn. But the basic patterns should reflect general trends in adult behavior.[2]

Comparing this figure to figure 5 above, there are in general substantial differences between the time trends for adults and youths. The only strong exception is vehicle fatalities, where the series are quite similar; the series are also fairly similar for drinking, with a substantial decline from the mid-1980s to the early 1990s, then a modest rise to 1997.[3] On the other hand, adult smoking has declined steadily since the late 1970s, flattening in the mid-1990s, while youth smoking declined precipitously, remained flat, and then rose. Teen fertility rose precipitously in the late 1980s but has declined steadily throughout the 1990s; adult fertility rose slightly in the late 1980s, then declined in the early 1990s, but has started to rise again. Teen suicides rose throughout the 1980s while adult suicides were declining; both series show some decline in the 1990s, although it is much steeper for teens. Marijuana use by both teens and adults rose in the late 1970s and declined throughout the 1980s, but, while use has been roughly flat for adults in the 1990s, it has risen sharply for youths. In the late 1980s, homicides rose sharply among teens while they were flat among adults, although both series show a decline in the 1990s.

These strong differences in time-series trends stand somewhat in contrast to the subset of psychological studies that does not document important differences in the decision-making processes of youths and adults. Of

2. Smoking data were obtained from the CDC website (www.cdc.gov), tabulated from National Health Interview Surveys over time. Data on vehicle fatalities, birthrates, suicides, and homicides were obtained from the same sources used for youths in chapters on these topics. Marijuana and alcohol data were kindly tabulated by Matthew Farrelly from the National Household Survey on Drug Abuse.

3. As Cook and Moore (chap. 8 in this volume) note, there is a very tight correspondence between the time series for youth drinking incidence and per capita total consumption of alcohol.

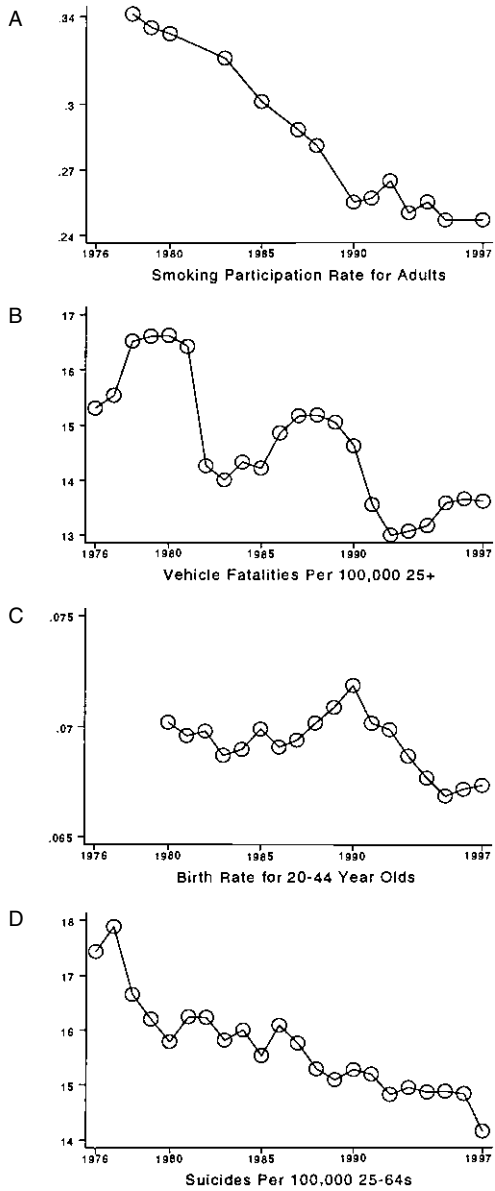

Fig. 6 Time-series trends in adult risky behaviors: *A*, smoking participation rate, age 18 and older; *B*, vehicle fatalities per 100,000 age 25 and older; *C*, birthrate for 20–44-year-olds; *D*, suicides per 100,000 25–64-year-olds; *E*, marijuana use, age 26 and older; *F*, homicides per 100,000 25–34-year-olds; *G*, drinking participation rate, age 26 and older

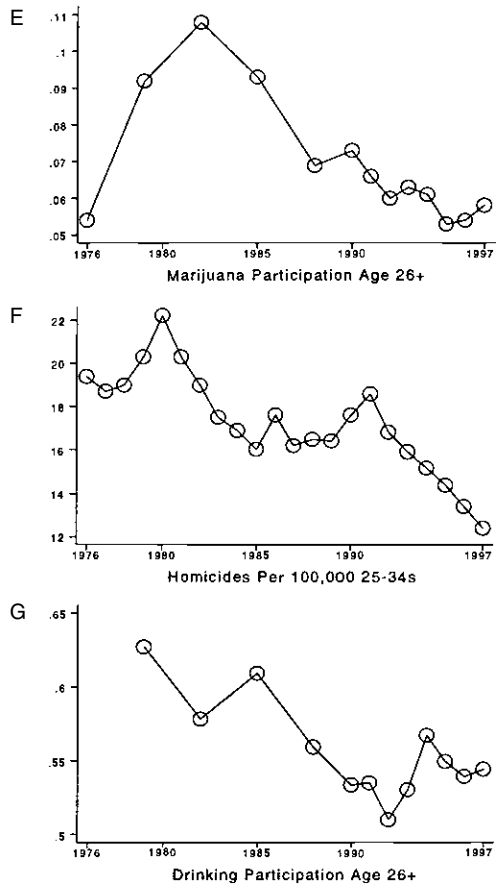

Fig. 6 (cont.)

course, from these figures it is impossible to tell whether it is differences in decision-making processes per se or differences in the underlying context in which these decisions are made that drive these differing time-series patterns. But one interesting feature of the comparison is that the youth series appear much more variable than do the adult series over any given time interval, particularly with reference to the activities that were the focus of figure 5 above. This extreme variability for youths would be consistent with either more "emotional" (hot-affective) decision making by youths or multiplier effects through peer influence. These contrasting time-series patterns therefore suggest that there may be important differences in how youths and adults make decisions about risky activities in practice, even if these differences are muted in interviews.

Implications and Directions for Future Work

Risk taking has always been an important feature of the teen years and undoubtably will continue to be so. But the interesting time-series patterns that we have seen over the past decade suggest that risk taking is not a static or a monolithic process. And the chapters in this volume suggest that risk taking is responsive to a variety of factors that influence a teen's environment.

Lessons to Be Learned from This Volume

While the studies in this volume have been carried out in very different ways, four clear lessons emerge. First, incentives matter. The notion that teens are "pathological" risk takers who are not responsive to economic incentives is strongly rejected by virtually every chapter in this volume. Almost every study finds that either prices or other economic/regulatory incentives matter significantly for youth risk taking:[4] (1) Teen smoking decisions are found to be very sensitive to cigarette prices, with an estimated elasticity of smoking participation with respect to price of −0.67 for high school seniors. (2) Mandatory seat-belt laws reduced vehicle fatalities among youths by 8–10 percent, and there were significant declines as well associated with higher minimum legal drinking ages. (3) Teen pregnancy risk falls as the incidence of AIDS rises (raising the risk of unprotected sex) and as welfare benefits fall (lowering the potential value of support for an out-of-wedlock child).[5] (4) Teen marijuana use is also very sensitive to price, with central price elasticities of annual participation of roughly −0.24. (5) A central determinant of the criminality of youths relative to that of adults is the relative stringency of the legal system with respect to youth and adult crime. (6) While the evidence for the effect of alcohol taxes on drinking is mixed, there is very clear evidence that the age-specific legality of drinking is a key determinant of the age pattern of drinking and particularly of binge drinking. (7) State college tuition policy is an important determinant of the decision to drop out of high school: when state tuition is low, individuals are more likely to complete high school as the cost of continuing education is reduced. (8) Access to free school meals improves the quality of the diet of youths.

Second, the economic environment in which youths make risky decisions matters, and even policies not directly aimed at youth risk taking

4. The one exception is the chapter on suicide, where there is no obvious price or regulatory variable to be studied in this context.

5. The latter conclusion, from Levine (chap. 4 in this volume), is somewhat tenuous because of a wrong-signed coefficient on the welfare-reform variable (more restrictive welfare reforms appear to raise pregnancy risk); on net, these welfare coefficients appear roughly to offset each other.

can therefore have important effects on these activities: (1) A 1 percentage point rise in the teen employment-population ratio, which raises the opportunity cost for teenage girls of having children, is estimated to lower the risk of teenage girls becoming pregnant by 0.2 percentage points. (2) Teen suicide rates fall significantly as median incomes rise. (3) The share of children in poverty and that of adults without a high school diploma are significant determinants of homicide rates across Chicago census tracts. (4) The dropout rate is significantly higher when unemployment rates are low and the opportunity costs of schooling are therefore highest.

Third, despite the powerful role that economic incentives play in driving these behaviors, many of the studies find that neither changes in background factors nor changes in incentives or prices can explain much of the dramatic time-series shifts that we have seen over the past decade: (1) The downward trend in cigarette prices in the early 1990s appears to explain at most about one-quarter of the upward trend in smoking by high school seniors. Moreover, smoking by younger teens appears not to be price sensitive, yet the upward trend in smoking in the 1990s is similar. (2) Less than 20 percent of the downward trend in youth motor-vehicle fatalities can be explained by mandatory seat-belt laws or higher minimum drinking ages. (3) Less than 20 percent of the fall in pregnancies among black teens can be explained by rising teen-employment ratios. (4) The rise in youth homicides across Chicago census tracts between 1980 and 1990 cannot at all be explained by changes in youth poverty or adult education; on the other hand, the relative stringency of legal systems toward youth criminals does appear to explain over half the relative rise in youth crime over the period 1978–93. (5) Neither trends in prices nor changes in background characteristics can explain any of the trends in youth drinking behavior. (6) The decrease in college attendance by recent cohorts of youths cannot be very well explained by changes in family background characteristics, tuition costs, unemployment rates, or cohort size (the latter factor explaining at most a fifth of the trend).

On the other hand, two of the studies do suggest that much of the time-series trend can be explained. Two-thirds of the trend in teen suicide can be explained by rising divorce rates, given the powerful correspondence between divorce rates and suicide in both micro data on suicide attempts and county-level data on suicides. And more than two-thirds of the time trends in marijuana use may be explained by trends in marijuana price and potency.[6]

Finally, several papers in this volume have explored the critical issue of the intertemporal linkage between youth and adult risky behaviors and

6. The results here are somewhat tenuous because the estimated models in Pacula et al. (chap. 6 in this volume) are fairly sensitive to the form of time trends; the fact cited here is from models that include linear time trends.

have found these links to be strong. Simple correlations between youth and adult risk taking, of course, are difficult to interpret, as they may reflect, not habit formation through youth participation, but rather heterogeneity across individuals that causes some persons to participate in risky activities at all ages and other persons never to participate at any age (Cook and Moore, chap. 8 in this volume). But several of these studies use exogenous variation in the underlying environment facing youths to examine the habit component, and the findings suggest important intertemporal correlations: (1) Women who grew up in states with lower cigarette taxes smoke more as adults, even conditional on the cigarette tax that they currently face. (2) Young adults who faced younger legal drinking ages at age fourteen were more likely to be binge drinking later in life. (3) Shifts in the environment that increase dropping out of school (e.g., reductions in the unemployment rate) have roughly comparable effects on completed education years later as well; youths do not reenroll later to make up for this reduction in education.

Thus, the overall lessons to be learned from this volume are mixed. On the one hand, incentives and the economic environment in which risky decisions are made clearly matter for this decision-making process. Clearly, youths are not purely irrational or emotional decision makers, and the standard calculus of cost-benefit comparison that has served economics so well in other contexts can help in this one as well. Moreover, these incentives have not only transitory effects on decision making by youths but long-run implications for decision making by adults as well. On the other hand, however, these "price" variables cannot take us very far in explaining the dramatic trends that we have documented in youth risk-taking behavior. This suggests that the empirical work needs to be enriched, ideally in ways informed by the theory, if our goal is to model youth risk taking fully.

Implications for Policy

These findings have important implications for government policy. The government is not powerless to affect youth risk taking. The types of incentives that are under government control, such as excise taxes or penalties for illegal behavior by teens, make important differences in the level of risk taking. Moreover, the casual evidence presented earlier, as well as more rigorous studies by Farrelly et al. (1999) and Dee (1999), suggest that tougher government regulation of one behavior will not cause youths to substitute other risky behaviors; if anything, these behaviors appear to be complements, not substitutes. So government restrictions on risky behavior can have positive spillover effects in mitigating other risky activities. On the other hand, government regulation is not a panacea. Most of what is driving these decisions is not captured by even the types of rich models estimated by the papers in this volume.

But the third major finding implies that government can have indirect influences on youth risk taking that are very important as well. This suggests that government decisions on economic policy should consider, not just the intended effects, but the unintended consequences for these types of risk taking as well. While these implications may seem modest relative to the direct effects of, say, macroeconomic policy, they may not be. For example, the chapter on dropping out of school finds that youths who drop out in order to take advantage of economic booms are unlikely ever to return. These decisions can therefore have long-run consequences that may be sizable relative to the short-run policy goals of the government.

Unanswered Questions and Directions for Future Work

The most important implications of the findings in this volume are for future work on this array of fascinating topics. The papers contained here are all innovative explorations of topics that are, with some exceptions, relatively new to economists. As such, the papers have been designed to lay out some basic issues but not to try definitely to resolve all the important questions. The simple fact that we are able to explain so little of the time-series trends over the past decade highlights the importance of future investigations of risky behaviors.

There are, in particular, five obvious directions for future work. The first is to try to disentangle the role of youths, their parents, and their peers in driving risky decision making. The papers in this volume have focused largely on incentives for youths per se. But parents and peers are clearly important influences on how these decisions are made. The influence of parents does not seem, at a minimum, to be able to explain the dramatic time-series shifts over relatively short time periods that we have documented in this volume. But, over the long run, parents establish the environment in which many of these decisions are made. Peers may be playing a bigger role in sharp time-series movements since, in peer models, even small shifts in the environment can spread rapidly through the entire population (through "peer multiplier" effects).

Unfortunately, disentangling the roles of these other factors is a daunting challenge. Modeling the influence of parents is conceivable, using some of the rich new data sources (such as the NLSY or AddHealth data) that contain information on both parents and children. But even these sources do not have much information on parents' histories of risky behaviors, histories that might influence how children's decisions are made. Peer influences are even harder to model as there are well-known econometric difficulties with disentangling group effects from omitted factors that might be influencing the individual's decisions. For example, if smoking rises among my peers and I also smoke more, is this the result of peer influence or some omitted environmental change that is simultaneously affecting both me and my peers? While these challenges are daunting, this is clearly

the direction in which work in this area must head if we hope to develop better explanations of how these decisions are made.

The second direction for future work is to think about the *benefits* of risky activities. The studies in this volume are very much written from the perspective of the *costs* of these activities, but youths must be perceiving some benefits from these actions, or they would not be undertaking them. The evidence available in this model, such as the effect of low unemployment on dropping out of high school, suggests that benefits are important in the calculus of risk taking.

Understanding, and ultimately modeling, these benefits is important for two reasons. First, it will help explain better how these decisions are made. But, second, it will assist in normative conclusions about "optimal" levels of intervention in these types of decisions. It is likely, and even probable, that the optimal level of risk taking along the lines described in this volume is not zero (with the possible exception of suicide). If youths' preferences are such that they really enjoy smoking or having unprotected sex, the utility gained from engaging in these activities must be accounted for in the calculation of how tightly to regulate these activities. But economics has very little to say at this point about the gains to risk taking among this population, and a clear priority for future work is to build this into the analysis as well.

The third direction is to consider how these risk-taking decisions fit together. As I have mentioned, the available evidence suggests that many of these risk-taking activities are complements. But this work has explored only a few of the natural links (e.g., between drinking and smoking), and many of the others that may be important (e.g., between drinking, using drugs, and having unprotected sex) have not been explored. Only through modeling the full systemwide implications of economic incentives and other factors can we completely understand how these incentives will affect youth risk taking. The growing availability of data sets with information on a variety of risk-taking behaviors should make it feasible to explore these interactions further.

Fourth, there should be much more work done on the long-run implications of risk taking by youths. For many of the activities considered in this volume (particularly substance use), we care less about the implications for the youths themselves than about the implications for long-term behavior. Several of the papers in this volume provide some initial evidence on the intertemporal correlation of risk taking as a youth and as an adult, but this type of analysis could, and should, be pursued for all these risk-taking activities. Moreover, these activities have implications not only for future risk taking but for other elements of future well-being as well, such as long-run health, education, earnings, and family structure. Thus, a significant determinant of the well-being of many older persons will be the risky decisions that they made as youths. This implies that understanding both what

drives these decisions and how they affect later well-being is a critical priority for future work.

Finally, and perhaps most important, there should be a greater attempt to integrate the theoretical insights discussed above with the types of empirical analyses conducted in the various papers presented in this volume. All of these papers, with the obvious exception of the first chapter, were purposely designed to be purely empirical analyses in order to lay down a set of facts and hypothesis tests that could inform future work on these topics. But integrating these types of empirical analyses and the theoretical insights of standard economic models, developmental psychology, and behavioral economics can lead to a much richer understanding of the underlying processes by which these decisions are made. This integration should be a two-way street: theoretical models can inform the hypotheses that are tested by future empirical work, and the facts documented here can inform the construction of such models. But, ultimately, it is the integration of the two that can most fruitfully advance the economic modeling of these behaviors.

Conclusions

Youth risk taking is an area that has received far too little attention among economists. Dramatic changes in the nature of youth risk taking over the past decade, suggestions that economic incentives matter in important ways for these decisions, and the potentially enormous long-run implications of risk taking for well-being all suggest the value of increased economic analysis of youth risky decision making. Moreover, the advent of excellent new data sources suggests that the time is ripe for work in this area.

This volume provides a rich and exciting set of new analyses of this area that substantially advance our understanding of the role, and limitations, of economic incentives in driving risk taking. Each of these high-quality papers can provide a natural springboard to future work, and the set of conclusions, summarized in this introduction, can be helpful for thinking more generally about theories of risk taking among youths. In the future, economists can and should play a more central role in the debate over the positive and normative implications of youth risk taking in the United States.

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