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RISKY BEHAVIOR AMONG YOUTHS: AN ECONOMIC ANALYSIS

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ABSTRACT

There are a host of potentially risky behaviors in which youth engage, which have important implications for both their well being as youth and their life prospects. The past decade has seen dramatic shifts in the intensity with which youths pursue these risky activities: for example, youth homicide fell by 40%; teen births decline by 20%; youth smoking rose by 33%; and marijuana use among youth virtually doubled. This paper, and the volume it introduces, explores the determinants and implications of risky behaviors by youths. I begin by reviewing perspectives on youth risk-taking from traditional rational-choice economics, developmental psychology, and behavioral economics. I then discuss both cross-sectional and time series evidence on risk-taking by youths, and how this compares to adults. I review the evidence on youth risk taking from the studies in this volume, and highlight the conclusions that (a) economic incentives and macroeconomic conditions are powerful predictors of risk taking by youths, (b) despite this, these factors are not very successful in predicting the dramatic time series swings we see in youth risk taking, and (c) risk taking by youths appears to have important implications for risky behaviors later in life. I also comment on the implications of these findings for policy, and for future economic research.

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There are a host of potentially risky behaviors in which youth engage, which have important implications for both their well being as youth and their life prospects. Activities such as smoking, drinking, sex, and drugs are generally first encountered before individuals are 19, yet they have important ramifications for the remainder of these youth's lives. For example, roughly one-third of high schoolers have smoked in the past 30 days, and over three-quarters of smokers start before they turn 19 years old (Gruber and Zinman, 2000). Over half of individuals first have sexual intercourse in high school, and almost 10% have been pregnant in high school (CDC, 1998). And 80% of high schoolers have imbibed alcoholic beverages, and 63% 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% from 1993 to 1997, and teen births declined by 20% 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 importance of these risky behaviors by youths, and the resulting ramifications for adult well-being, economists have paid relatively little attention to modeling the youth pursuit of risky behaviors, particularly when compared with other disciplines such as developmental psychology. The purpose of this volume is to take a first step towards 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 in their decisions to undertake risky behaviors. These findings were part of the motivation for recent legislative activity to substantially raise the price of tobacco products. In contrast to just a few years earlier, when non-price 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).

Second, there has been a recent growth in both the quantity and quality of data available for studying risky behavior by youths. 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 the CDC's Youth Risk Behavior Survey (YRBS) provided new cross-sectional data on 9^{th} - 12^{th} 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 new rich cross-sectional/longitudinal data source on a wide variety of risky behaviors.

These developments, along with the development of a class of very high quality 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 Dee and William Evans)
- Sex and Pregnancy (Phillip Levine)
- Suicide (David Cutler, Edward Glaeser, and Karen Norberg)

- Marijuana Use (Rosalie Pacula, Michael Grossman, Frank Chaloupka, Lloyd Johnston, Patrick O'Malley, and Matthew Farrelly)
- Crime (Steven Levitt and Lance Lochner)
- Drinking (Phillip Cook and Michael Moore)
- Dropping Out From School (David Card and Thomas Lemieux)
- Mis-Nutrition (Jay Bhattacharya and Janet Currie)

In addition, the first chapter of 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 youth.

In this introductory chapter, I endeavor to both set the stage for the analyses that follow, and to distill their key lessons. I begin, in Part I, 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 on the differences (or lack thereof) between behaviors of youths and adults. In Part II, I provide some facts on both the incidence and time series trends in youth risky behaviors, and draw some comparisons to time trends in adult behaviors. Part III then discusses the lessons for both policy and future research from these analyses. Part IV concludes.

Part I: 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, a focus of the discussion will be 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 over 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 addictive activities such 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 those costs are smaller than the benefits.

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 a 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 that considers a wider variety of factors that might impact 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 peoples choices). Cognitive development consists of three components: capacity for thinking through problems; knowledge of alternatives and their implications; and skills in carrying out analysis 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 towards risky behaviors into one's own decision-making process.

Developmental psychologists have provided a range of evidence which allows one to compare the decision making capacities of youths and adults, and this evidence suggests both important commonalities and important differences. The chapter by O'Donoghue and Rabin (2000) emphasizes the commonalities between decision-making by youths and adults. For example, Beyth-Marom et al. (1993) asked both teens and adults about the perceived consequences from 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) find that, while youths appear to consider themselves somewhat invulnerable to the consequences of risk taking, their perceived invulnerability was no stronger than for adults.

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 in decision-making competence measures such as consideration of all options, risks, and long-term consequences. The differences were particularly striking between adults and younger adolescents (those in the 6th and 8th grades).

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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 on risky decisions than middle-class youths.

Most important among the differences between youths and adults appears to be the role of social reactions. For example, Beyth-Marom et al. find that consequences of risky activities involving social reactions are considered more heavily by youths than by adults. Studies of susceptibility to peer influences, as opposed to self-reliance, tend to find an inverted U relationship, with susceptibility increasing between childhood and early adolescence, peaking sometime around age 14, and declining during the high school years (Steinberg and Cauffman, 1996).

Fischoff (1992) also finds that youths have problems with emotional control when hard thought does not produce clear-cut answers to important decision problems. That is, since youths don't understand that some questions in life have no simple answers, they may react overly by allowing transient emotional states to resolve uncertainties. And existing studies suggest that moodiness (volatility of mood) may be more characteristic of adolescents than adults. In a particularly interesting study, Larson, Cskiszentmihalyi, and Graef (1980) obtained direct data on emotional experiences by having adolescents and adults carry electronic pagers to signal 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 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 adulthood (Steinberg and Cauffman, 1996).

Finally, there are a number of articles which 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 youth adulthood.

Of course, a important limitation with all of this evidence is that it relies on responses by youths and adults to hypothetical scenarios, rather than observations of risk taking in reality. As highlighted by Steinberg and Cauffman (1996), given the important potential role for emotion and social influence, more substantial differences between youths and adults may emerge "in the field" than "in the laboratory". In particular, there is little evidence on the relationship between self-reliance or future orientation and the quality of judgements that are made by teens.

Behavioral Economics

The models of developmental psychologists suggest a number of dimensions along which the economics model might be enriched to think about youth decision making. 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 in the chapter by O'Donoghue and Rabin (2000). 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 that economists typically model the tradeoff between activities that have short run benefits and long run costs. This is a central feature of virtually all of the risky activities that are 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 is simple excessive myopia; that is, from the perspective of a paternalistic adult, youths may simply discount the future too much. The second is that, even if the long run discount rate is "appropriate", youths may have preferences which 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 intra-personal conflict between "selves" in different periods; the decision made by today's self for tomorrow is not the one that tomorrow's self would make when tomorrow comes. And in these models, even though long run discounting is appropriate, there is "too much" pursuit if activities with short run benefits and long run costs, from the perspective of either a patient social planner or even from the perspective of today's self (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 their current states affect their 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 from 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 to them later in life of having a

high school degree can raise their odds of dropping out from 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 youth.

The third is to recognize that risky decisions are made in an uncertain environment, and are made repeatedly, and it is possible therefore that increases in riskiness can actually increase risk-taking behavior. This is because, for many risky activities, the cost is one-time 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 the youth, and he or she finds 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 zero, so raising the risk of AIDS to one 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 to 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 in this volume will not resolve the question about the "correct" way to model youth risk taking. There is clear evidence from a number of the 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 by youths. But, as emphasized by O'Donoghue and Rabin, 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 relationships that can help guide the formulation of future theories, rather than definitively favoring one approach over another.

Part II: Facts on Risk Taking by Youths and Adults

The Incidence of Risky Behaviors Among Youths

As noted earlier, there are a host of data sets now available which provide information on different risky behaviors pursued by youths. For this analysis, I rely on the Youth Risk Behavior Survey (YRBS) from 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 in the YRBS is roughly 20% higher than in the MTF surveys. However, the time trends across these surveys appear comparable for the 1990s, as noted in the chapter on smoking (Gruber and Zinman, 2000).

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 towards 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 is 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 explicitly illegal for younger teens but legal for older teens.

Perhaps reflecting these countervailing influences, Figure 1 illustrates that there is no clear age pattern of risk taking. This figure shows the incidence of eight risky behaviors for the five age groups represented in the YRBS data. The behaviors considered are:

- Smoke regularly over the past month
- Five or more drinks in a row over the past month
- Carry a weapon over the past month
- Attempt suicide over the past year
- Smoke marijuana over the past month
- Using other illegal drugs over the past year
- Have sex without birth control at some point in your life

For some of these activities, there is a clear increase with age, particularly the activities related to drinking (drinking 5 or more drinks in a row, or drinking and driving). For smoking, there is a rise with age but it 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. For marijuana and other drug use, the pattern shows a rise from 9th to 11th grade, and then a fall off in senior year; once

again, the MTF data show a steeper rise with age. But for carrying a weapon, having unprotected sex, and attempting suicide, there is actually declining risk taking with age.

While it is difficult to draw firm conclusions from these types of data, these findings do suggest the power to two important economic variables for determining behavior: age-specific legal penalties, and income. For the two activities where there are clear age-specific rules on legality, driving and drinking, there is the strongest pattern of rising risk-taking with age. For smoking, where there is nominal illegality of purchase for younger teens, there is also a slight rise with age. But for drug use, where the illegality is not age-specific, the age pattern is less pronounced, and actually declines for seniors in the YRBS data; for carrying a weapon, the age pattern is reversed. And for the activities which are not illegal at any age, attempted suicide and unprotected sex, there is actually 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 pattern with age. This is also consistent with the finding in the chapter on crime, which finds that the age pattern of crime follows very precisely the relative penalties on youths and adults for criminal activity. These facts therefore also suggest the potential power of government intervention for deterring risky behavior, through both penalty and pricing policies of risky activities.

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 the number of days smoking cigarettes over the past month, the number of days having a drink over the past month, the

number of times smoking marijuana over the past month, and the number of times having sex over the past three months (where "never had sex" is one option). In every case, while there is a substantial mass of youths with zero incidence, there is also a wide distribution among those youths with positive incidence. Indeed, only for drinking is there a clear pattern of continual decline; for smoking, there is actually more mass at 30 days per month than at any other non-zero value, and teens are almost as likely to have 6 or more sexual partners as they are to have 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 versus the intensity with which that activity is pursued? This is important because some policy tools may be found to reduce either the extensive or the intensive margin, but not both. For example, the chapter on smoking (Gruber and Zinman, 2000) finds that restrictions on youth access to cigarette purchases reduces the intensity of smoking, but not smoking participation, while price increases seem to have a greater impact on participation than on conditional intensity.

Finally, the data suggest that there is no simple model to 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 there is a certain segment of the youth population that is predisposed towards risky activities, and the remainder is not. The "conservation of risk" model, on the other hand, would suggest that most youths have tendency to take some risks, and 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 may suggest that targeted efforts to reduce youth pursuit of risky activities can work more effectively than the "conservation of risk" model, which would imply 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, in the extreme: 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 undertaken by youths in the YRBS data, drawing from the list of eight activities used for Figure 1. Almost half of teenagers engaged in none of these risky activities, but only 22% 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 where 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 20 years are also striking. This is illustrated in two ways in Figures 4 and 5. Figure 4 plots separately for eight of the risky behaviors in this volume the time series patterns of the behavior over the 1976-1997 period; there is no comparable data on nutrition so this is not included. The eight time series depicted are:

- The percentage of high school seniors who smoke over the past 30 days
- Fatal auto accidents per 100,000 16 to 19 year olds
- The percentage of 15 to 19 year old girls giving birth
- The number of suicides per 100,000 15-19 year olds
- The percentage of high school seniors smoking marijuana over the past 30 days
- The number of homicides in the 14-17 year old age group per 100,000 persons
- The percentage of high school seniors having a drink over the past 30 days
- The percentage of 14 to 17 year olds not enrolled in school

The commonalities as well as the contrasts of 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 activities, such as smoking cigarettes or marijuana or being involved in a fatal car crash, the declines are rather dramatic. For the others, drinking, teen pregnancy, crime, and dropping out, the gains are more modest, but clear. Only for suicides is the trend adverse over this period, and even in this case the trend is relatively modest. This is not a period of general focus of the studies in this volume, but it is a particularly interesting one because of the common reduction in risk taking. 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), and the second from the early 1990s through 1997 (the last year of data available). The trends in risky behaviors are much more heterogeneous over these periods. Over the middle period from 1985-92, there is a continued decline in drinking, smoking, marijuana use, and dropping out. But there is a very sharp rise in the rate of youth homicides, teen pregnancies, and suicides. Both of these trends then reverse over the last period, with teen 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; and 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 of these pairs of series trend closely together, even moving together through very volatile rises and falls; the only exception is the gradual decline for marijuana use over the 1976 to 1991 period, while smoking falls quickly to 1980 and then declines more slowly from there. 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 suggests that there are clear tastes shifts among teens for 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 For Adults

In terms of thinking about what is "special" about youths, it is instructive to contrast these time trends with the trends we have seen over this same period in adult pursuits of risky behaviors. Figure 6 compiles data on time series trends in adult participation in risky behaviors,

paralleling the data for youth (except for dropping out, for which there is no comparable adult behavior). These data are less consistent and more variable in quality than for youths, since they come from a wider variety of sources, and generally not the same sources as for youths. But the basic patterns should reflect general trends in adult behavior.[2]

Comparing this figure to Figure 5, 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 decline 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, and 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 for both teens and adults rose in the last 1970s and declined throughout the 1980s, but while use has been roughly flat for adults in the 1990s it has risen sharply for youths. Homicides rose sharply for teens in the late 1980s while they were flat for adults, although both series show a decline in the 1990s.

These strong differences in time series trends stands somewhat in contrast to the subset of

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[2]Sources: smoking data from CDC web site (www.cdc.gov), tabulated from National Health Interview Surveys over time; vehicle fatalities, birth rates, suicides, and homicides from same sources used for youth in country chapters on these topics; marijuana and alcohol data kindly tabulated by Matthew Farrelly from the National Household Survey on Drug Abuse.

[3]As Cook and Moore (2000) note in their chapter, there is a very tight correspondence between the time series for youth drinking incidence and per capita total consumption of alcohol.

psychological studies which does not document important differences in the decision-making processes of youths and adults. Of course, it is impossible from these figures 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. This extreme variability for youth would be consistent with either more "emotional" (hot affective) decision-making by youth, or with 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 over risky activities in practice, even if these differences are muted in interviews.

Part III: Implications and Directions for Future Work

Risk taking has been an important feature of the teen years for many years, and will undoubtably continue to be one in the future. But the interesting time series patterns that we have seen over the past decade suggests that risk taking is not a static or 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 From this Volume

While the studies in this volume have been carried out in very different ways, there are four clear lessons that 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 either than prices, or other economic/regulatory incentives, matter in a significant way for risk-taking by youths.[4] In particular:

- 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.

- Mandatory seat belt laws reduced vehicle fatalities among youths by 8-10%, and there were significant declines as well associated with higher minimum legal drinking ages

- 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]

- Teen marijuana use is also very sensitive to prices, with central price elasticities of annual participation of roughly -0.24

- A central determinant of the criminality of youths relative to adults is the relative stringency of the legal system with respect to youth and adult crime.

- While the evidence on the impact 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.

- State college tuition policy is an important determinant of the high school dropout decision: when state tuition is low, individuals are more likely to complete high school, as the cost of continuing education is reduced.

- Exposure to free school meals improves the quality of diet of youth

Second, the economic environment in which youths make risky decisions matters, so that

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[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 (2000) 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 to roughly offset each other.

even policies not directly aimed at youth risk taking can have important impacts on these activities. For example:

- A one 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.
- Teen suicide rates fall significantly as median incomes rise
- The share of children in poverty and adults without a high school diploma are significant determinants of homicide rates across Chicago census tracts.
- Dropping out from high school is significantly higher when unemployment rates are low, so that the opportunity costs of schooling are highest.

Third, despite the powerful role for economic incentives 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've seen over the past decade. In particular:

- 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 seniors. Moreover, smoking by younger teens appears to not be price sensitive, yet the upward trend in smoking in the 1990 is similar.
- Less than 20% of the downward trend in youth motor vehicle fatalities can be explained by mandatory seat belt laws or higher minimum drinking ages
- Less than 20% of the fall in pregnancies among black teens can be explained by rising teen/employment ratios.
- 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 towards youth criminals does appear to explain over half of the relative rise in youth crime over the 1978 to 1993 period
- Neither trends in prices nor changes in background characteristics can explain any of the trends in youth drinking behavior.

- The slowdown in college going by recent cohorts of youths cannot be very well explained by either 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 utilization may be explained by trends in marijuana price and potency.[6]

Finally, several papers in this volume have explored the critical issue of intertemporal linkage between risky behaviors as youths and as adults, and have found these links to be strong. Simple correlations between youth and adult risk taking, of course, is difficult to interpret, as it may reflect not habit formation through youth participation, but rather heterogeneity across individuals that cause some persons to participate in risky activities at all ages and other persons to never participate at any age (Cook and Moore, 2000). 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:

- Women who grew up in states with lower cigarette taxes smoke more as adults, even conditional on the cigarette tax they currently face
- Young adults who faced younger legal drinking ages at age 14 were more likely to be binge drinking later in life
- Shifts in the environment which raise dropping out from school (e.g. reductions in the

[6]The results here are somewhat tenuous because the estimated models in Pacula et al. (2000) are fairly sensitive to the form of time trends; the fact cited here is from models that include linear time trends.

unemployment rate) have roughly comparable effects on completed education years later as well; youths don't re-enroll later to make up for this reduction in education.

Thus, the overall lessons 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 which has served economics so well in other contexts can help in this one as well. Moreover, these incentives have not only transitory impacts on decision making as youths, but long run implications on decision-making as adults as well. On the other hand, however, these "price" variables cannot take us very far in explaining the dramatic trends 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 fully model youth risk taking.

Implications for Policy

These findings have important implications for government policy. The government is not powerless to impact 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 into 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 calculus over decisions on economic policy should consider not just their intended effects, but 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 school dropping-out finds that youths that drop out of school due to economic booms are unlikely to ever return. These decisions can therefore have large long run consequences that may be sizeable relative to the short run policy goals of the government.

Unanswered Questions and Directions for Future Work

But 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 which are, with some exception, relatively new to economists. As such, the papers have been designed to lay out some basic issues, but not to try to definitely resolve all of 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 the youth, her parents, and her 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. Parental factors do 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 set 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 rapidly propagate through the entire population (through "peer multiplier" effects).

Unfortunately, disentangling the roles of these other factors is a daunting challenge. Modeling parental influences is conceivable, using some of the rich new data sources (such as the NLSY or AddHealth data) that have information on both parents and children. But even these sources do not have much information on parental histories of risky behaviors 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 individuals decisions. For example, if smoking rises among my peers and I also smoke more, is this peer influence or some omitted environmental change that is simultaneously impacting both myself and my peers? While these challenges are daunting, this is clearly the direction that work in this area must head if we hope to explain a larger share 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 available evidence in this model, such as the impact of low unemployment on high school dropping out, 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 to 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 a youth has preferences such that they really enjoy smoking or having unprotected sex, their utility from these activities must be accounted for in the calculation of how tightly to regulate those 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 cross-links (e.g. between drinking and smoking), and has not explored many of the others that may be important (e.g. between drinking, drugs, and unprotected sex). Only through modeling the full system-wide implications of economic incentives and other factors can we completely understand how these incentives will impact on youth risk taking. The growing availability of data sets with information on a variety of risk taking behaviors should make it feasible to further explore these interactions.

Fourth, there should be much more work on the long run implications of risk taking by youth. For many of the activities in this volume (particularly substance use), we care less about the implications for the youths themselves than 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 of these risk taking activities. Moreover, there are implications of these activities 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 risky decisions that they made as youths. This implies that understanding both what drives these decisions, and how they impact on later well being, is a critical priority for future work.

Finally, and perhaps most importantly, there should be a greater attempt to integrate the theoretical insights discussed in Part I with the types empirical analyses conducted here. The papers in this volume, 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 with 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 articles, 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.

Part IV: Conclusions

Risk taking by youths is an area that has received far too little attention from economists. Dramatic changes in the nature of risk taking by youths 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 risky-decision making by youth. 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 chapter, can be helpful for thinking more generally about theories of risk taking among youth. In the future, economists can and should play a more central role in the debate over the positive and normative implications of risk taking by youths in the U.S.

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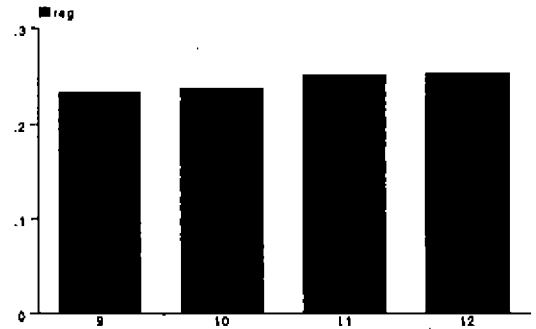

Figure 1a: Smoking Regularly Past Month

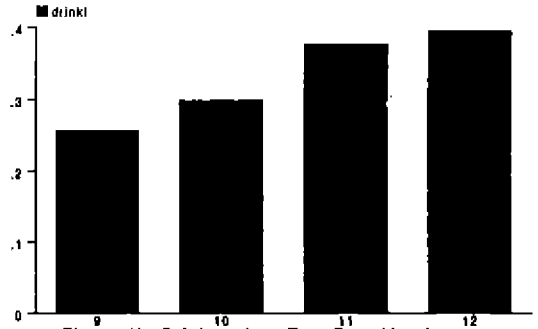

Figure 1b: Drink 5+ in a Row Past Month

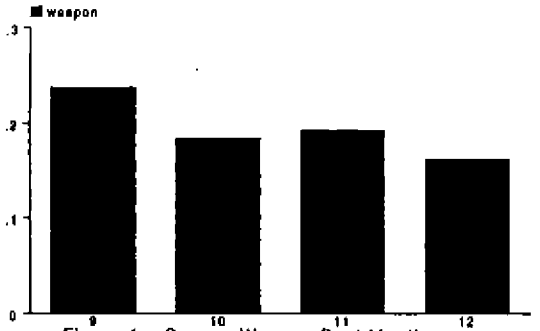

Figure 1c: Carry a Weapon Past Month

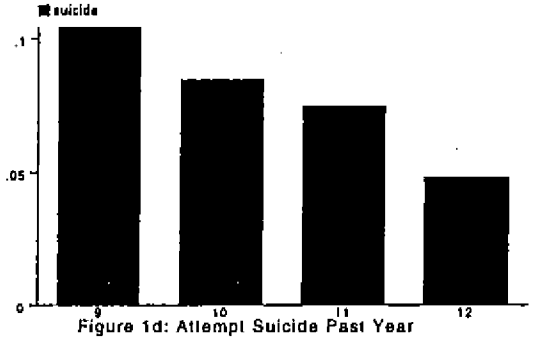

Figure 1d: Attempt Suicide Past Year

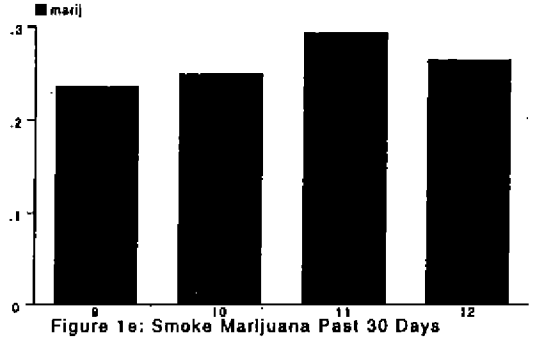

Figure 1e: Smoke Marijuana Past 30 Days

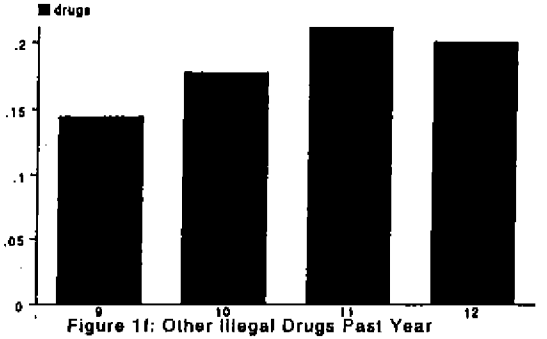

Figure 1f: Other Illegal Drugs Past Year

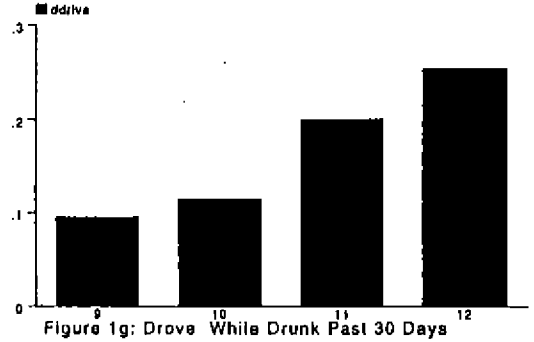

Figure 1g: Drove While Drunk Past 30 Days

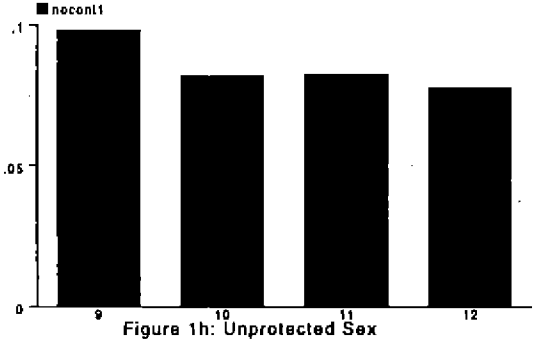

Figure 1h: Unprotected Sex

Figure 1: Distribution of Risky Behaviors by Age

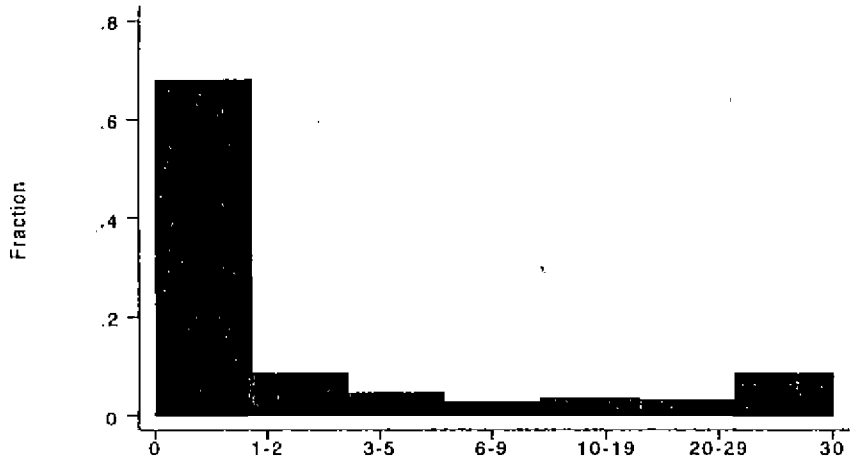

Figure 2a: Days Smoked Past Month

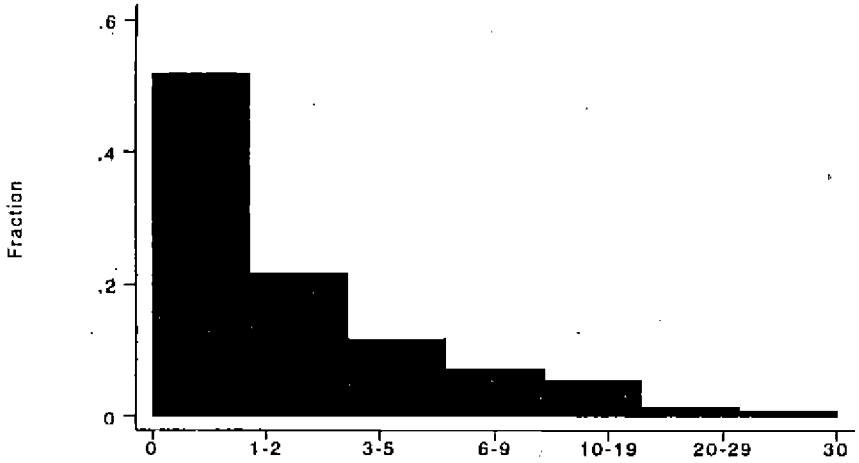

Figure 2b: Days Drink Past Month

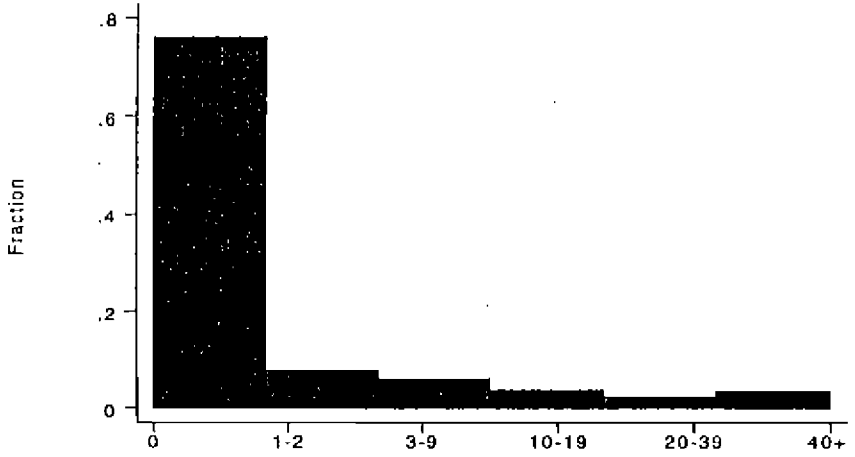

Figure 2c: Times Marijuana Past Month

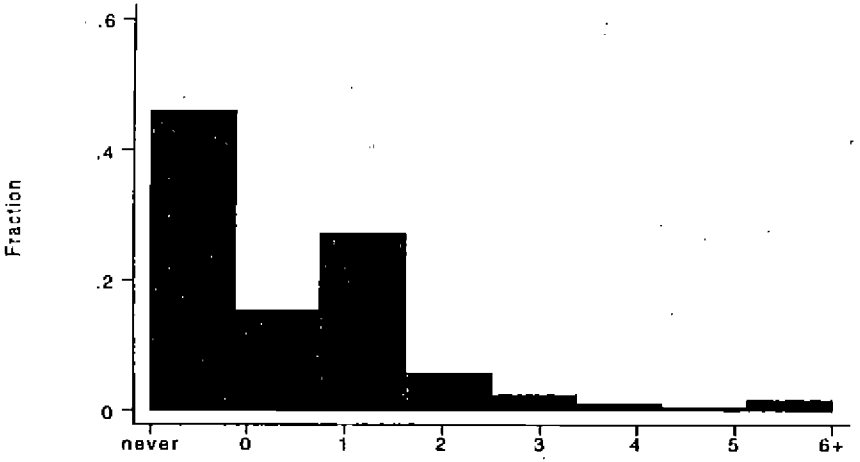

Figure 2d: Sexual Partners Past 3 Months

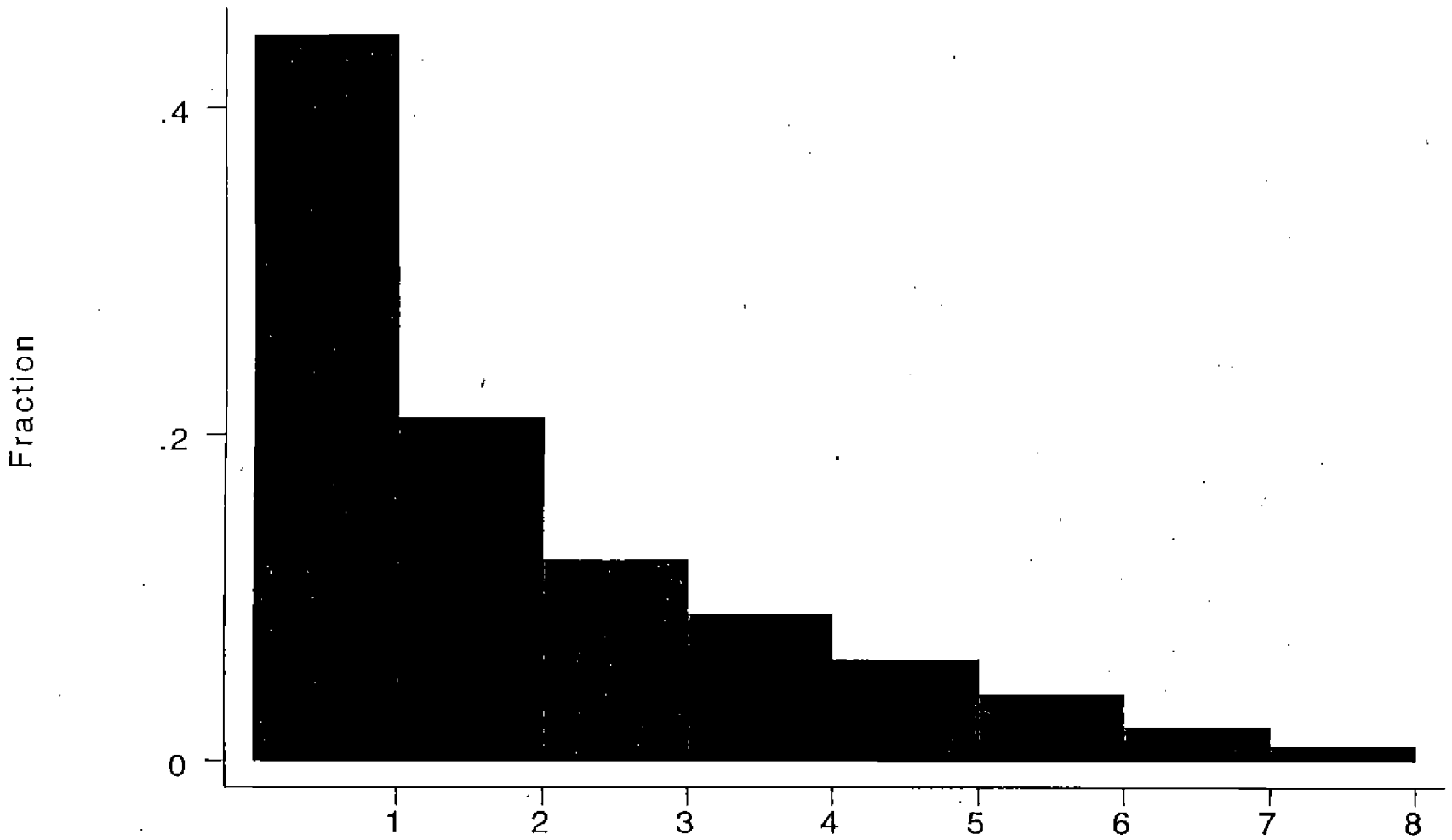

Figure 3: Frequency of Pursuit of Risky Activities

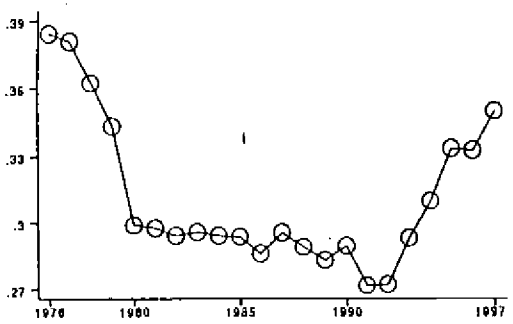

Figure 4a: Smoking Participation Rate for Seniors

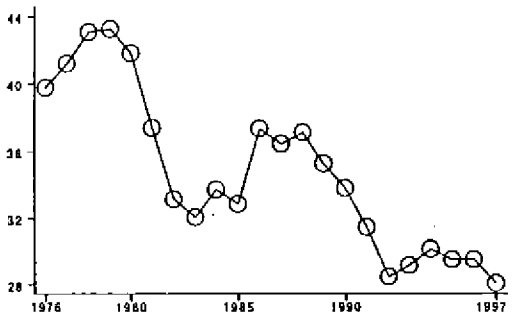

Figure 4b: Vehicle Fatalities Per 100,000 16-19s

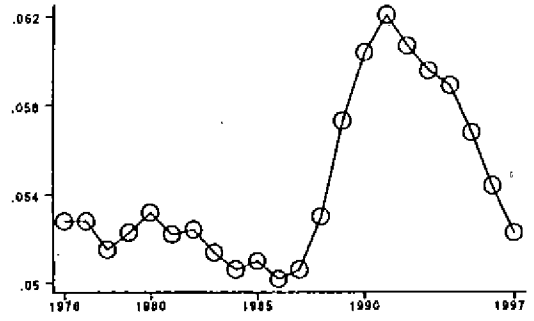

Figure 4c: Birth Rate for 15-19 Year Olds

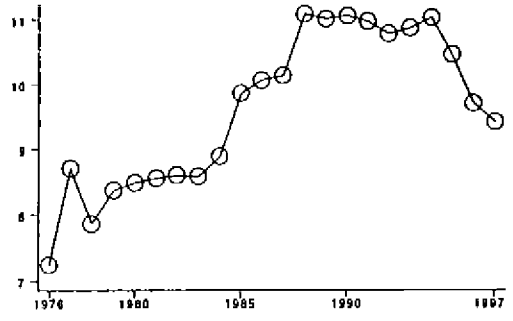

Figure 4d: Suicides Per 100,000 15-19s

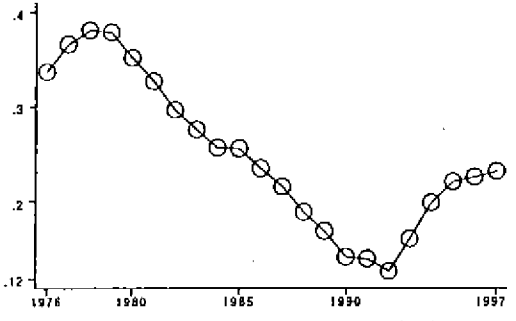

Figure 4e: Marijuana Participation Rate for Seniors

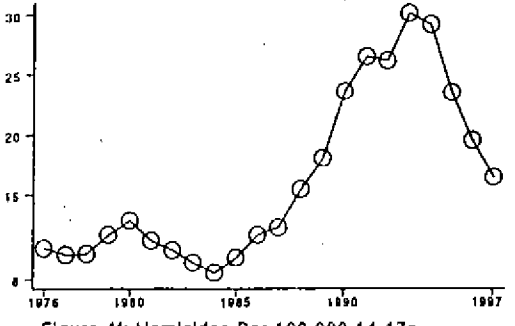

Figure 4f: Homicides Per 100,000 14-17s

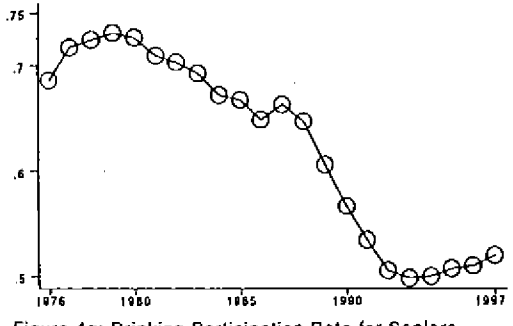

Figure 4g: Drinking Participation Rate for Seniors

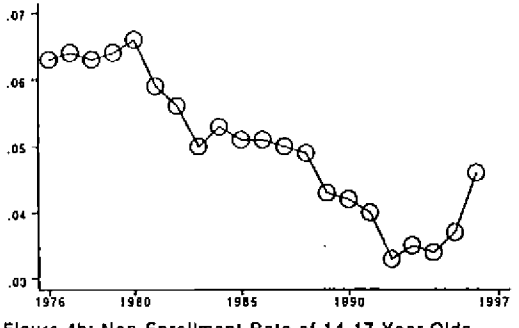

Figure 4h: Non-Enrollment Rate of 14-17 Year Olds

Figure 4: Time Series Trends in Risky Behaviors

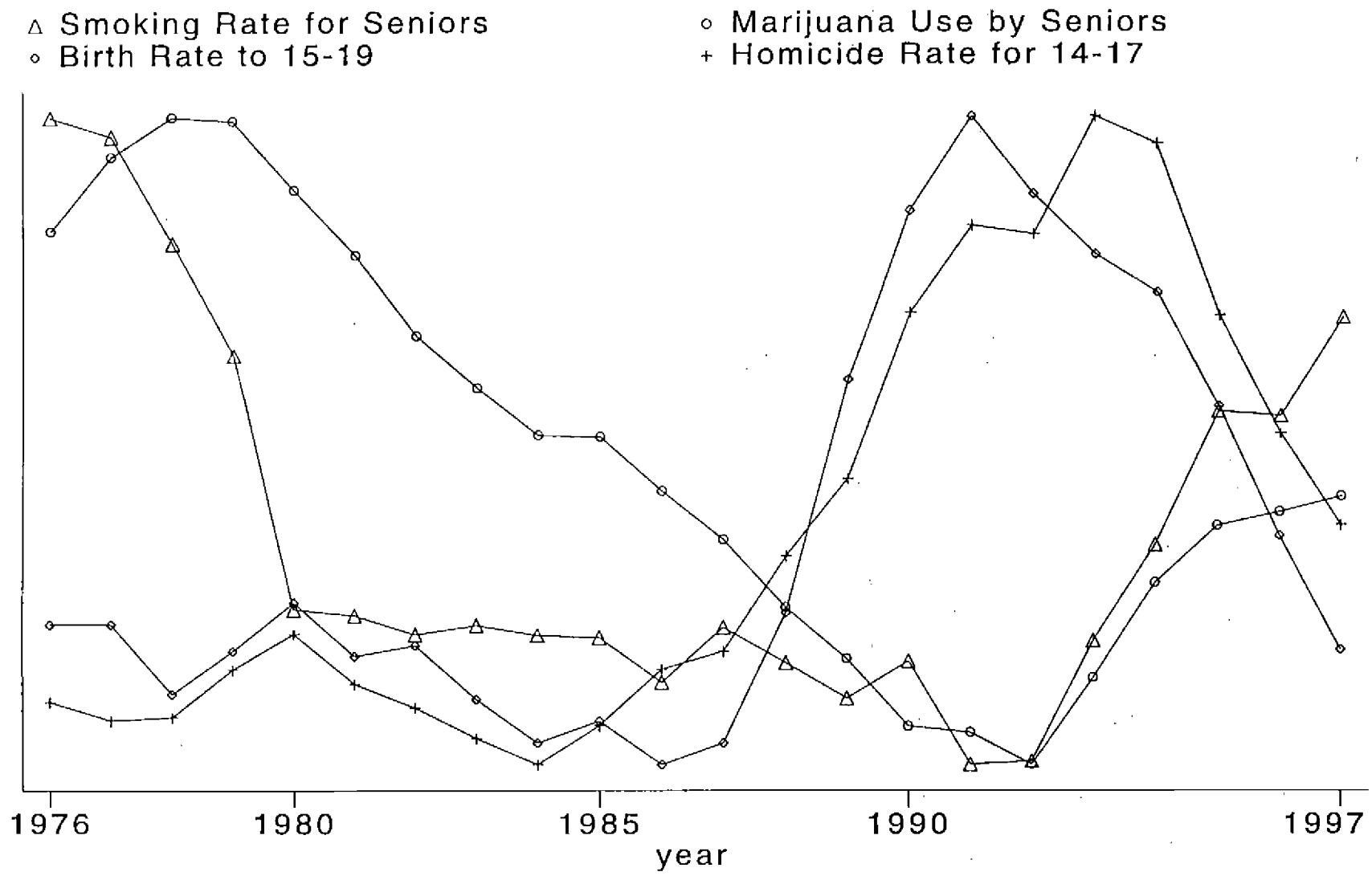

Figure 5: Comparing Time Series Trends

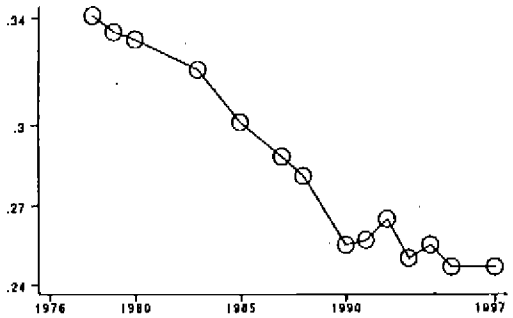

Figure 6a: Smoking Participation Rate for Adults

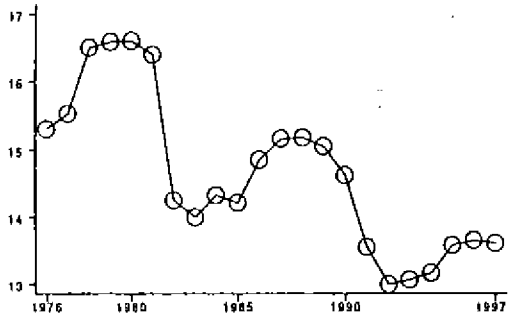

Figure 6b: Vehicle Fatalities Per 100,000 25+

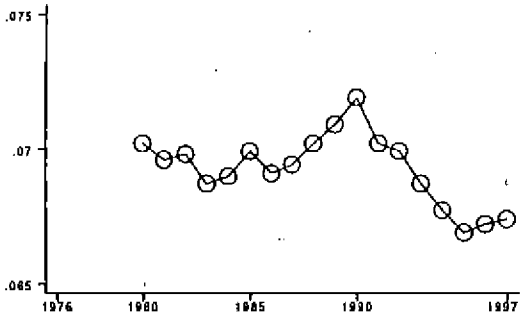

Figure 6c: Birth Rate for 20-44 Year Olds

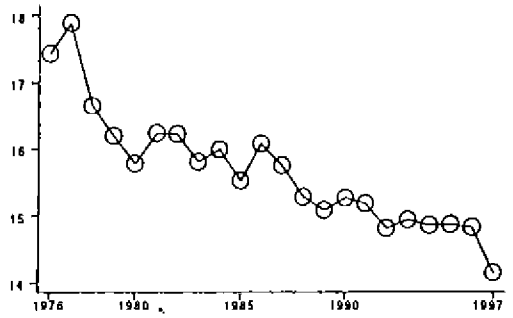

Figure 6d: Suicides Per 100,000 25-64s

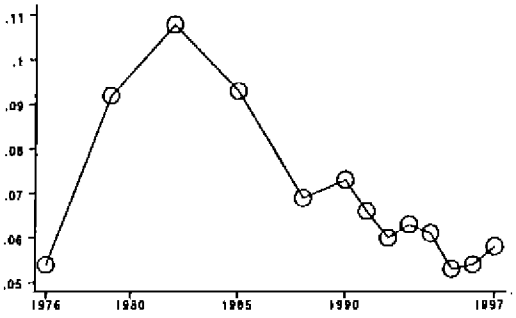

Figure 6e: Marijuana Participation Age 26+

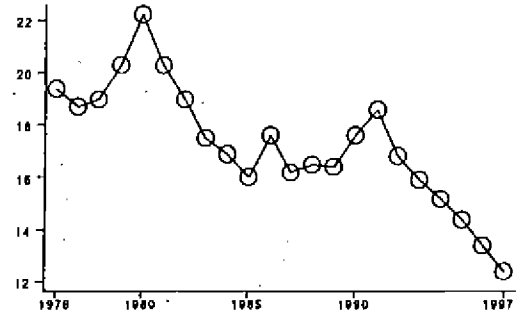

Figure 6f: Homicides Per 100,000 25-34s

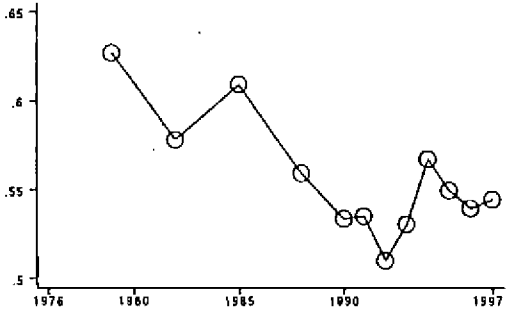

Figure 6g: Drinking Participation Age 26+

Time Series Trends in Risky Behaviors for Adults