

---

# The Responsiveness of the Demand for Condoms to the Local Prevalence of AIDS

---

Avner Ahituv  
V. Joseph Hotz  
Tomas Philipson

## ABSTRACT

*This paper investigates the degree to which the local prevalence of AIDS increases the demand for disease-preventing methods of contraception among young adults. Using data from the National Longitudinal Survey of Youth (NLSY-1979), we find substantial evidence that the use of condoms was quite responsive to the prevalence of AIDS in one's state of residence, and this responsiveness has been increasing over time. We present both cross-sectional and longitudinal evidence estimating that a 1 percent increase in the prevalence of AIDS increases the propensity to use a condom significantly and up to 50 percent for the most prevalence-responsive groups. Our findings lend support to the existence of a self-limiting incentive effect of epidemics—an effect that tends to be ignored in epidemiological theories of the spread of infectious diseases.*

## I. Introduction

The increasing prevalence of HIV-positive cases and cases of AIDS, the disease caused by HIV, in the United States and elsewhere in the

---

*Avner Ahituv is a postdoctoral fellow at the Population Research Center, University of Chicago; V. Joseph Hotz is a professor of economics at the Irving B. Harris Graduate School of Public Policy Studies, University of Chicago; and Tomas Philipson is a professor of economics at the University of Chicago. The authors thank two anonymous referees for very useful comments. They also thank William Adkinson, Michael Boozer, Duncan Thomas, Burton Singer, Noel Salinger, and the participants in workshops at the University of Chicago, Bates College, UCLA, UC-Santa Barbara, the University of Michigan, Michigan State University, Yale University, RAND, The World Bank, and the 1994 Conference on Research in Health Economics at the University of Chicago for helpful comments on an earlier draft, and John Wright, Rishi Sood, Honggao Cao, and Paulette Kamenecka for research assistance. Hotz gratefully acknowledges support from NICHD Grant R01-HD-31590 and Philipson from NSF Grant SBR 9409917 and The Earhart Foundation. The data used in this article can be obtained from Professor V. Joseph Hotz, The Harris School of Public Policy Studies, University of Chicago, 1155 East 60th Street, Chicago, Illinois 60637.*

[Submitted November 1994; accepted December 1995]

THE JOURNAL OF HUMAN RESOURCES • XXXI • 4

world has made the control of the pandemic a major policy concern in most countries worldwide. The number of reported cases of AIDS has grown rapidly in the United States and other countries since the official identification of the disease in 1981.<sup>1</sup>

The predominant method of spreading the disease in the United States has been through unprotected sexual intercourse, especially, although not exclusively, among homosexual males. Over 70.0 percent of all U.S. AIDS cases diagnosed through June 1992 were transmitted via sexual activity, of which 90.6 percent were due to homosexual contact. Over the last several years, the number of new AIDS cases that resulted from transmission of the virus by methods other than sexual contact (for example, intravenous drug use) has grown more rapidly than the number of cases transmitted by sexual contact. In addition, transmission via heterosexual contact has increased over time. The Centers for Disease Control and Prevention estimates that 62 percent of the new AIDS cases for 20–24 year olds over the period July 1991 through June 1992 acquired the HIV virus through sexual activity, with 46 percent of new cases attributable to sexual relationships between homosexual males and 16 percent to sexual contact between heterosexual partners.<sup>2</sup>

In recent years, substantial amounts of public and private research funding have been devoted to examining the sexual practices of members of the U.S. population. Yet, remarkably little is known about whether there has been an increase in the demand for safer sex, such as the use of condoms during sexual intercourse, in response to the increase in the prevalence of AIDS and other sexually transmitted diseases (STD)s.<sup>3</sup> For example, Tanfer et al. (1993, p. 61) note

The behavioral response of the American public to the STD epidemic is not well documented. Knowledge about how the spread of these diseases has affected the prevalence of condom use and its variation across population subgroups is particularly limited.

Knowledge of this behavioral response is crucial to understanding and forecasting the spread of AIDS. As the prevalence of the disease increases, individuals engaged in unprotected sexual activity face a higher risk of contracting HIV. If, in response to this increasing risk, the sexual practices (in other words, the demand for safe sex) of sexually active members of the population do not change, then the rate at which AIDS spreads through the population will be determined solely by this increasing level of risk and not by any adaptation in behavior. This assumption of perfectly inelastic responses of sexual behavior to risk of infection underlies many of the epidemiological forecasts of the spread of AIDS and other STDs in human populations.<sup>4</sup>

1. For prevalence estimates by countries, see Mann et al. (1993).

2. U.S. Centers for Disease Control and Prevention (CDCP), *HIV/AIDS Surveillance Report*, July 1992.

3. An important exception to this paucity of empirical evidence on trends in protection during sex is the work of Sonenstein, Pleck, and Ku (1989) and Pleck, Sonenstein, and Ku (1993) on condom use among adolescent males in the United States.

4. See Anderson and May (1991) or Geoffard and Philipson (1995).

In contrast, an economic model of the spread of infectious diseases hypothesizes that individuals will alter their demand for risky activities as risk increases.<sup>5</sup> Such responses to risk would be expected to operate in human populations faced with any infectious disease, in particular, AIDS. All else equal, individuals in the population may prefer unprotected sex. Economic theory would predict that individuals would substitute away from such activity as the "price" of risky sex is increased with prevalence. Sexually active individuals may substitute away from risky sex by using condoms during sexual activity, reducing their number of partners (especially those potential partners whose HIV status is less certain), or abstaining from sexual activity altogether. To the extent that these types of substitutions occur, the risk of exposure for those not infected is reduced and the AIDS epidemic will spread at a slower rate. While such responses are theoretical possibilities, the essential question for understanding the spread of infectious diseases such as AIDS is the quantitative magnitude of the substitution away from risk. *That is, how elastic is the demand for safer, more protected sex with respect to the prevalence of STDs to which individuals are exposed?*

In this paper, we examine the extent to which the use of one form of protection from STDs, condoms, has responded to the increased prevalence of AIDS among young adults in the United States. We focus on condom use, given its suggested importance in stanching the spread of the AIDS epidemic.<sup>6</sup> Using data on young adults gathered during the 1980s, we examine how elastic the demand for condoms was with respect to AIDS prevalence. Previous studies of the methods of protection chosen by young adults have used data from surveys that were conducted in the latter part of the 1980s, well after the epidemic was in full swing. In our study, however, we rely on data on condom utilization for a nationally representative sample of young adults that span the entire decade. This allows us to compare behavior before and during the epidemic. Our study also differs from other studies in that we investigate how the contraceptive methods used by young adults responded to measures of actual objective risk of contracting the HIV virus, as opposed to perceived risk.<sup>7</sup> In particular, we examine how the incidence of condom use among young adults varied with the accumulated number of AIDS cases per capita in an individual's state of residence.

The findings of our paper are summarized as follows. In Section II, we present descriptive evidence regarding the patterns of condom use by young adults using data from the National Longitudinal Survey of Youth (NLSY-1979) over the period 1984 through 1990. We investigate what happened to condom demand over this period and whether it differed by region of the country. The regional variation in condom use is potentially very informative, in light of the strong regional

---

5. See Philipson and Posner (1993) and Geoffard and Philipson (1993).

6. Condom use has been the most commonly prescribed method for reducing exposure to risk of STDs by agencies like the Centers for Disease Control and Prevention and state public health departments.

7. Tanfer et al. (1993) have also examined the relationship between condom use of adult males and their subjective assessment of the AIDS rate in their community compared to the national average. Their study is limited to data on individuals in a single year (1991), and their use of self-reported assessments of risk is subject to the potential of simultaneity bias between one's reported condom use and perceived risk.

differences in the prevalence of AIDS cases in the United States. We find that condom usage rose substantially among 25–27 year olds over this period. While there was no difference in condom demand among United States census regions in 1984 (before AIDS cases were very prevalent), the incidence of condom usage became geographically heterogeneous as the AIDS epidemic progressed, with higher rates of utilization occurring in states with higher AIDS prevalence rates. Moreover, rates of condom use, over this period, grew more rapidly among sexually active single men and single men living in urban areas, demographic groups thought to face greater risk of HIV infection than other segments of the young adult population. This strongly suggests that young adults altered their level of protection against contracting STDs in response to increased risks.

In Sections III and IV we present estimates, for logistic regressions, of the effect of the per capita prevalence of AIDS in a person's state of residence on the contraceptive choices of individuals, after controlling for other factors that might be expected to influence such choices. Even after accounting for the influence of a variety of personal and state-level characteristics, the positive effect of AIDS prevalence on the demand for condoms found in our descriptive analysis persists. As in our first analysis, the HIV prevalence elasticity of demand for condoms is found to be higher for the same demographic groups of young adults: single men, black men, those who are not married, those living in urban areas, and those who are more sexually active. Moreover, the estimated elasticity increased substantially in the second half of the 1980s. Finally, based on these estimates of prevalence elasticity, we find that more than half of the rise in condom use among young adults that occurred during the second half of the 1980s can be explained solely by the increases in local prevalence of AIDS cases that occurred during this decade.

Exploiting the longitudinal feature of the NLSY-1979 data, we also examine whether increases in the local prevalence of AIDS hastened the adoption of condoms as a method of contraceptive protection during the 1980s. We find that the rate of condom adoption among young adults was significantly higher for those individuals living in high-prevalence areas and that this behavioral response grew in magnitude as the epidemic spread. Finally, as in the case of our analysis of incidence among young adults, the estimated effect that local prevalence has on condom adoption is quite robust, controlling for a variety of factors that might account for an individual's decision to adopt this form of protection.

In Section V, we offer some concluding comments on the implications of our findings for future research.

## **II. Patterns of Condom Use by Young Adults and the Prevalence of AIDS over Time and across Regions of the United States**

In this section, we examine the patterns of condom use over time and across regions of the United States for young adults to determine whether there is *prima facie* evidence that the demand for protected sex reflects a response

to the increased risk of AIDS.<sup>8</sup> The data on condom use of young adults are taken from the NLSY-1979, which contains data on approximately 12,000 men and women in the United States who were between the ages of 14 and 21 in 1979. In addition, the NLSY-1979 oversampled blacks and Hispanics, a feature of the data that we use in this study.

The NLSY-1979 gathered information on the contraceptive methods used by either the respondent or the respondent's partner/spouse during the previous month in the 1984, 1986, 1988, and 1990 interviews.<sup>9</sup> Individuals were asked to indicate which method or methods they used (they were supplied an extensive list of contraceptive methods that included the pill, condom, IUD, etc.) or to indicate that they used no method at all. Unfortunately, the survey did not determine whether the respondent was sexually active at the time of the 1984, 1986, 1988, or 1990 interviews. Therefore, the response that "no method was used" could indicate either that the respondent had conducted sexual relations during the previous month but used no contraceptive or had not had sex during the previous month. Information on whether a respondent was sexually active was obtained only in the 1985 interview, in which respondents were asked how many times they had experienced sexual intercourse during the previous month. We use the response to this question to create an indicator of whether a respondent has been sexually active. One needs to be cautious in interpreting this measure, however, since it does not necessarily correspond to a respondent's level of sexual activity at the time she was asked about her contraceptive choices.

In this section of the paper, we limit our analysis to data on respondents between the ages of 25 and 27 in the years 1984, 1986, 1988, and 1990 in order to characterize the trends in condom use. The reason for restricting our attention to this age group can be seen by examining Table 1, which displays the number of NLSY-1979 respondents who fell in various age categories in the even years from 1984 through 1990. The fact that we have no observations for individuals in their late 20s (older than 27) in the early part of the decade and none on very young adults (less than age 25) at the end of the 1980 decade is due to the fact that the respondents in the NLSY-1979 are limited to the 1958–65 births cohorts. The 25–27 age category is the only one that is available for all of the years in which we also have data on the contraceptive choices of respondents. To avoid confounding trends in behavior with life-cycle variations in condom use, we restrict our attention to this age group in our descriptive analysis.<sup>10</sup> In the multivariate analyses of condom utilization we conducted, we drop this age restriction and use data on NLSY-1979 respondents of all ages, controlling for age differences with age polynomials. The results from these analyses are discussed in the next section.

In Figure 1, we display the proportions of young adults using condoms, re-

8. A previous working paper that expands these results substantially is available from the authors upon request.

9. The exact wording of the question was: "During the last month, have you or your (partner/spouse) used any form of birth control?"

10. A total of 8,368 respondents were in this age range in at least one of the four years, producing a total of 11,351 person-years of data.

**Table 1**  
*Number of Observations in NLSY Year, by Age Categories and Years*

Age Category	Year				Total
	1984	1986	1988	1990	
<25	6,453	4,200	1,859	0	12,512
25-27	1,973	2,983	3,408	2,987	11,351
>27	0	1,028	2,822	5,106	8,956
Total	8,426	8,211	8,089	8,093	32,819

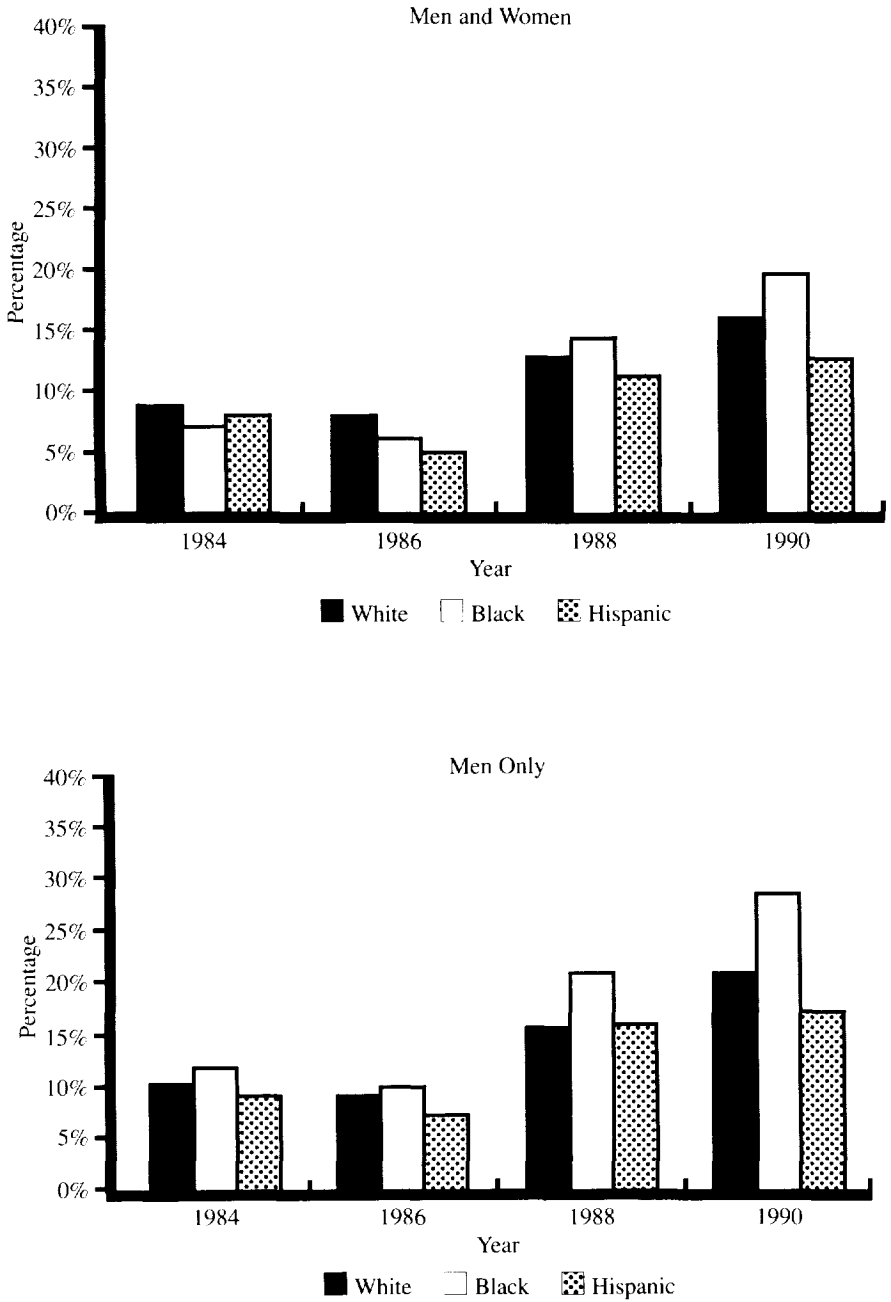
corded separately by year and for whites, blacks, and Hispanics.<sup>11</sup> Over the period 1984-90, the number of AIDS cases per 100,000 population in the United States grew at an annual rate of 80 percent.<sup>12</sup> In 1984, when the prevalence of AIDS in the United States was relatively low (0.4 cases per 100,000 population), the proportion of men and women that reported using condoms was only 7.9 percent, with whites having a slightly higher rate (8.7 percent) than blacks (6.7 percent). By 1990, however, the proportion of 25-27 year olds using condoms had risen to 16.2 percent, with blacks now having the highest rate of condom use (18.7 percent) among the three racial/ethnic groups.<sup>13</sup> That is, over this six-year period during which the AIDS epidemic was rapidly spreading, condom use doubled among young adults in the United States and almost tripled among black young adults.

Figure 1 also displays trends in condom use among men only. As can be seen, men report using condoms at a much higher rate than do women in each year for all three racial/ethnic groups. This pattern may reflect gender differences in the type of protection taken, but, more likely, the lower reported use of condoms by women relative to men is the result of differential reporting. While the respondents were asked to report on the contraceptive methods used by themselves or their partners, lower reports of condom use by women might be expected since condoms are used by males. This differential reporting of methods by sex is corroborated by the fact that women were more likely than men to report that the pill was one of the contraceptive methods used in the previous month.

11. In this section, all estimates that are not reported separately by the race/ethnicity of the respondent are weighted to account for the oversampling of blacks and Hispanics in the NLSY-1979.

12. Figures from the Centers for Disease Control and Prevention, *HIV/AIDS Surveillance Report*, July 1992. After 1988, the annual growth rate in AIDS prevalence declined slightly to around 50 percent.

13. As can be seen in Figure 1, the reported rate of condom utilization actually declined from 1984 to 1986. While we do not have an immediate explanation for the decline, we note that the structure of the question about contraceptive methods was changed after 1984. In 1984, the question on contraceptive utilization was asked after the respondent had completed a sequence of questions about the timing of his first sexual activities and about other aspects of his past sexual behavior. In contrast, in each of the subsequent years the question on contraceptive methods used was asked following a sequence of questions about the children that the respondent either bore or conceived.



**Figure 1**  
*Condom Use [Last Month] of 25–27 Year Olds by Race/Ethnicity*

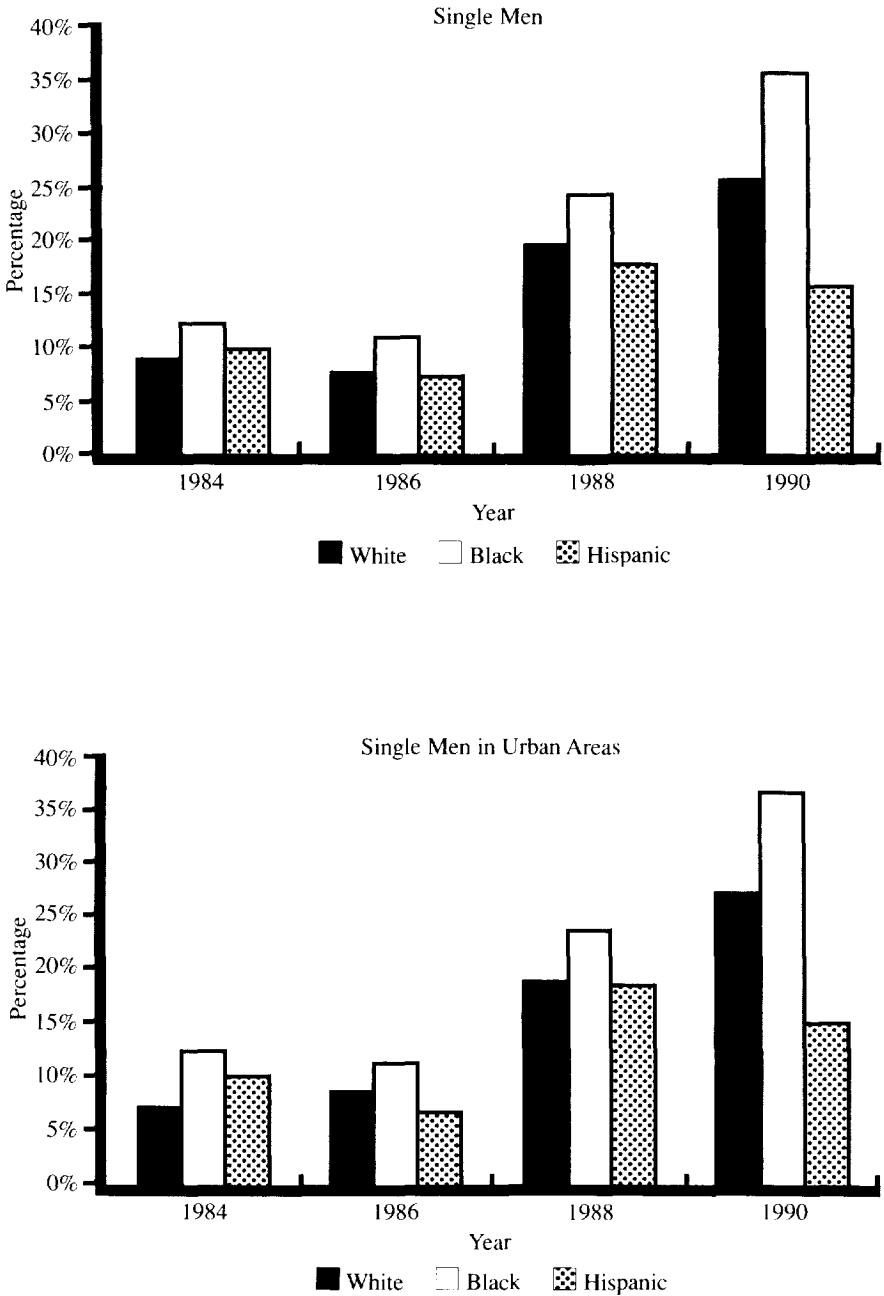
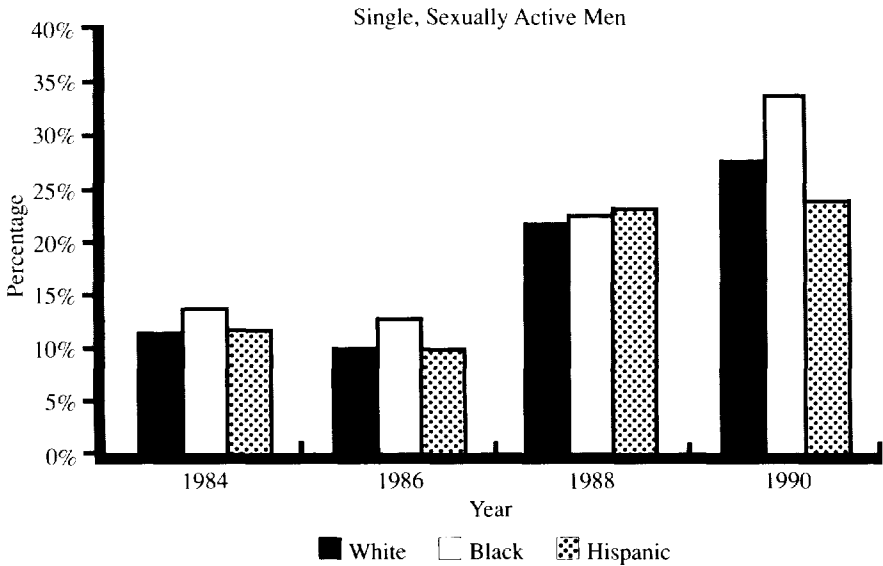


Figure 1 (continued)



**Figure 1** (continued)

Finally, we examine how condom use among young adults changed over the 1980s by gender, marital status, location of residence (urban versus nonurban), and whether a young adult was sexually active. As has been documented in the National Health and Social Life Survey (NHLS),<sup>14</sup> there are substantial differences by gender and marital status in those sexual practices that heighten the risk of contracting AIDS and other STDs, such as the number of sex partners. For example, the NHLS data show that men between the ages of 18 and 29 are significantly more likely to report having more than one sexual partner in the past 12 months than are women (34.3 percent versus 18.6 percent) and, for this age group, single men are much more likely to have multiple partners than are married men (44.7 percent versus 8.3 percent). It is also well documented that the incidence and growth of STDs, including AIDS, have been significantly higher in urban areas of the United States than in rural and suburban areas.<sup>15</sup> As can be seen in Figure 1, the use of condoms by young men grew substantially faster among single men from 1984 to 1990, especially among those living in urban areas and/or those who reported that they were sexually active in 1985, than among the overall population of young adults. For example, among single black men living in urban areas, the proportion using condoms increased from 0.112 to 0.350, more than a threefold increase. The data on condom use from the NLSY-1979 indicate that not only did condom use among young adults increase over the

14. The NHLS is a survey of sexual behavior for a nationally representative random sample of adults in the United States that was conducted in 1992. See Laumann et al. (1994).

15. See data from *The AIDS Public Information Data Set*, Centers for Disease Control and Prevention, Division of HIV/AIDS, Statistics and Data Management Branch 1995.

1980s, but that the largest increases occurred among groups facing higher risks of contracting HIV or other STDs.

Given the rapid spread of the AIDS epidemic over this same period, it would appear that the demand for sexual protection, at least in the form of condoms, was responsive to the increasing risk of unprotected sex.<sup>16</sup> To further explore the relationship between condom use and the prevalence of AIDS, we examine how condom use varied with the prevalence of AIDS in the state of residence of NLSY-1979 respondents.

We use the accumulated number of reported AIDS cases per 100,000 persons in the population of the respondent's state of residence as of a particular year to measure local exposure to risk of infection.<sup>17</sup> As is well known, the spread of the AIDS epidemic was not uniform across regions of the United States. AIDS prevalence rates were highest and grew most rapidly in New York, New Jersey, California, and the District of Columbia.<sup>18</sup> These regional differences provide a source of variation with which to corroborate or contradict the association between condom use and the risk of infection suggested by the aggregate trends in condom use presented in Table 2. Ideally, one would prefer to measure the number of individuals in the population who are HIV-positive, rather than the number of AIDS cases, since the prevalence of the former better characterizes the potential risk of infection. Unfortunately, data on the actual prevalence of HIV infection are not available, as federal regulations require only the reporting of documented AIDS cases to the Centers for Disease Control and Prevention (CDCP). Furthermore, we would prefer to use more geographically disaggregated measures of prevalence rates than those at the state level, since there are substantial differences in prevalence rates at the county or community level. Unfortunately, data on reported AIDS cases at the county level are not publicly available for many counties during the early part of the 1980s due to confidentiality-based restrictions. Because we wish to examine the relationship between condom use and AIDS over as long a period as possible, we rely on state-level prevalence data for the analysis presented in this paper.

In Table 2, we compare, year by year, the demand for condoms among NLSY-1979 respondents by quartiles of the population-weighted distribution of state-of-residence AIDS prevalence. The table displays the proportions of individuals using condoms for each quartile of the state prevalence distribution and *p*-values for two tests: the first is for the test that the incidence of condom use in the first

16. We note that Sonenstein et al. (1989) also find an increase in the rate of condom use over the period 1979–89 among teenage males, and there is also evidence that condom sales in the United States increased between 1986 and 1987. (See Moran et al. 1990.) This evidence, however, does not address the causal link between prevalence and the demand for protection.

17. These data are taken from selected years of the *HIV/AIDS Surveillance Report* published by the Centers for Disease Control and Prevention. The average prevalence rate for a region is calculated by weighting the prevalence rates of states in that region by their population.

18. Over the period 1984–90, the three U.S. census regions with the highest prevalence rates were the Middle Atlantic region (which include the states of New York and New Jersey), the Pacific region (which includes California), and the South Atlantic region (which includes the District of Columbia). The average numbers of accumulated AIDS cases per 100,000 in the population for these regions during the period 1984–90 were 6, 4, and 2.7, respectively, while the corresponding number for the nation as a whole was 2.6 (figures from CDCP 1992).

**Table 2**  
*Condom Use (Proportion) by Quartiles of State-of-Residence Prevalence per 100,000 Population for 25–27 Year Olds [Data Source: NLSY, Selected Years]*

Quartile/ <i>p</i> -values	Men and Women	Men Only	Single Men	Single Men in Urban Areas	Single, Sexually Active Men	Married Men	Married Men in Urban Areas
1984							
First	0.085	0.105	0.106	0.103	0.145	0.104	0.132
Second	0.082	0.108	0.074	0.048	0.085	0.146	0.150
Third	0.075	0.095	0.104	0.082	0.121	0.080	0.051
Fourth	0.098	0.118	0.092	0.106	0.122	0.166	0.165
<i>p</i> -values	0.481	0.676	0.714	0.934	0.667	0.232	0.586
	0.651	0.893	0.787	0.415	0.709	0.317	0.176
1986							
First	0.075	0.067	0.055	0.076	0.078	0.078	0.087
Second	0.080	0.099	0.088	0.103	0.117	0.112	0.095
Third	0.067	0.072	0.078	0.087	0.109	0.064	0.073
Fourth	0.072	0.105	0.085	0.092	0.101	0.136	0.155
<i>p</i> -values	0.823	0.100	0.296	0.632	0.577	0.123	0.126
	0.833	0.217	0.680	0.884	0.806	0.196	0.223
1988							
First	0.103	0.128	0.163	0.178	0.184	0.081	0.077
Second	0.112	0.146	0.158	0.118	0.161	0.127	0.151
Third	0.131	0.174	0.222	0.228	0.256	0.086	0.076
Fourth	0.158	0.191	0.225	0.248	0.228	0.118	0.113
<i>p</i> -values	0.001	0.013	0.067	0.064	0.329	0.310	0.431
	0.004	0.061	0.073	0.002	0.117	0.478	0.229
1990							
First	0.120	0.152	0.213	0.222	0.253	0.082	0.132
Second	0.159	0.214	0.244	0.245	0.268	0.174	0.177
Third	0.178	0.232	0.309	0.334	0.293	0.129	0.121
Fourth	0.194	0.266	0.305	0.325	0.341	0.208	0.220
<i>p</i> -values	0.000	0.000	0.024	0.025	0.103	0.001	0.074
	0.001	0.001	0.058	0.038	0.367	0.009	0.143

Notes: The categories of states represent the quartile of the annual population-weighted distribution of the state prevalence-per-100,000-population. For each quartile, the entry is the proportion of observations who used condoms last month. The *p*-value entries take the form  $p_1$ ;  $p_2$ , where  $p_1$  is the *p*-value associated with the hypothesis that the incidence of condom use in the first quartile is equal to that in the fourth, and  $p_2$  is for the test of the null hypothesis of no difference in condom use across the four quartiles. All results are based on weighted statistics from the NLSY.

prevalence quartile is the same as that in the fourth quartile, and the second  $p$ -value is that associated with the null hypothesis of no difference in condom use across the four quartiles. In 1984, there appeared to be no differences in condom use across the quartiles of the state AIDS prevalence rates for any of the demographic groups displayed in the table. By 1988 and 1990, however, the incidence of condom use tended to be higher in states in which AIDS was relatively more prevalent. Moreover, the tests of differences in condom use between the first and fourth prevalence quartiles and of differences across quartiles are statistically significant at conventional levels for many of the subgroups of young adults. Note that among all single men and among single men living in urban areas, the positive association between condom use and local prevalence appears to be particularly strong. This evidence of association for all single men and for those living in urban areas is consistent with the view that men who might be expected to face higher risks of contracting the HIV virus responded by increasing their protection. At the same time, it is less apparent that the condom use of married men was higher in high-prevalence states in 1988 or 1990, although the differences of incidence of condom use between the first and fourth quartiles and across all of the quartiles tended to be statistically significant for married men in 1990.

Another way of characterizing the relationship between the demand for protection among young adults and local AIDS prevalence is to examine how their demand for condoms changed as they faced different risks of contracting the HIV virus. In Panel A of Table 3, we display the rate at which young adults *adopted* condoms as their method of protection by the quartiles of the state-of-residence AIDS prevalence rates for the years 1986, 1988, and 1990. We measure the rate of condom adoption by the proportion of respondents who did not use condoms in year  $t - 2$ , but reported using them in year  $t$ .<sup>19</sup> Panel B of Table 3 displays, by prevalence quartiles, the proportion of individuals who reported (in an interview) that they had used condoms both in year  $t - 2$  and two years later in year  $t$ .<sup>20</sup> In each panel, we display condom adoption and continuance rates, by prevalence quartiles, pairs of interviews (for example, the 1984 and 1986 interviews), and different demographic groups.

The evidence on rates of condom adoption across state prevalence quartiles and demographic groups displayed in Table 3 provides less support for the view that condom demand increased as the risk of infection confronting young adults during the 1980s increased. As was the case with the incidence of condom use, we find that the rate of condom adoption among young adults was not strongly related to local prevalence in the early part of the decade (for example, the period covered by 1984 to 1986). While there appears to be a positive association between the rate of condom adoption and local prevalence in the latter part of the 1980s, particularly for the period 1986 to 1988, the differences in adoption

19. There were a total of 8,415 person-years of data on individuals who reported not using condoms in their interview two years earlier and, thus, were "at risk" to adopt them by their next interview.

20. There were a total of 875 person-years of data on individuals who reported using condoms in their interview two years earlier and, thus, were "at risk" to continue to report using them in their next interview.

**Table 3**

*Changes in Condom Use by Quartiles of State of Residence Prevalence per 100,000 Population for 25–27 Year Olds Who Did Not Use Condoms Previously [Data Source: NLSY, Selected Years]*

Quartile/ <i>p</i> -values	Men and Women	Men Only	Single Men	Single Men in Urban Areas	Single, Sexually Active Men	Married Men	Married Men in Urban Areas
Panel A: Proportion that Adopted Condoms Since Last Interview							
1984–86							
First	0.062	0.050	0.022	0.029	0.018	0.073	0.039
Second	0.061	0.075	0.070	0.079	0.105	0.080	0.077
Third	0.054	0.048	0.059	0.065	0.082	0.033	0.045
Fourth	0.053	0.070	0.058	0.070	0.061	0.091	0.110
<i>p</i> -values	0.492	0.316	0.170	0.195	0.257	0.619	0.679
	0.836	0.393	0.312	0.468	0.120	0.355	0.429
1986–88							
First	0.086	0.118	0.152	0.162	0.166	0.072	0.053
Second	0.087	0.114	0.134	0.087	0.139	0.086	0.120
Third	0.108	0.145	0.185	0.187	0.229	0.079	0.077
Fourth	0.136	0.164	0.205	0.224	0.201	0.072	0.055
<i>p</i> -values	0.001	0.066	0.116	0.102	0.447	0.993	0.967
	0.004	0.150	0.143	0.002	0.188	0.974	0.317
1988–90							
First	0.096	0.127	0.189	0.195	0.239	0.062	0.096
Second	0.132	0.188	0.223	0.239	0.261	0.143	0.141
Third	0.140	0.179	0.231	0.248	0.252	0.122	0.112
Fourth	0.154	0.214	0.238	0.262	0.280	0.178	0.195
<i>p</i> -values	0.002	0.004	0.254	0.175	0.499	0.004	0.048
	0.011	0.029	0.689	0.585	0.922	0.026	0.192
Panel B: Proportion that Continued to Use Condoms							
1984–86							
First	0.257	0.250	0.297	0.407	0.394	0.170	0.051
Second	0.257	0.281	0.316	0.360	0.231	0.258	0.200
Third	0.262	0.322	0.335	0.339	0.343	0.312	0.278
Fourth	0.274	0.336	0.275	0.268	0.286	0.422	0.413
<i>p</i> -values	0.850	0.457	0.871	0.397	0.497	0.217	0.101
	0.997	0.873	0.979	0.844	0.805	0.590	0.355
1986–88							
First	0.320	0.280	0.365	0.391	0.462	0.183	0.337
Second	0.351	0.345	0.318	0.292	0.303	0.379	0.321
Third	0.363	0.431	0.478	0.518	0.448	0.241	0.077
Fourth	0.417	0.433	0.422	0.477	0.457	0.452	0.509
<i>p</i> -values	0.275	0.186	0.699	0.589	0.979	0.165	0.449
	0.739	0.482	0.601	0.330	0.669	0.498	0.428
1988–90							
First	0.296	0.285	0.310	0.319	0.295	0.236	0.388
Second	0.337	0.347	0.313	0.237	0.304	0.413	0.475
Third	0.380	0.411	0.490	0.517	0.387	0.183	0.185
Fourth	0.408	0.465	0.529	0.531	0.544	0.344	0.335
<i>p</i> -values	0.092	0.029	0.027	0.045	0.038	0.431	0.753
	0.360	0.139	0.051	0.021	0.138	0.453	0.462

Notes: The categories of states represent the quartile of the annual population-weighted distribution of the state prevalence-per-100,000-population in the subsequent year. The *p*-value entries take the form  $p_1; p_2$ , where  $p_1$  is the *p*-value associated with the hypothesis that the adoption or continuance rate in the first quartile is equal to that in the fourth, and  $p_2$  is for the test of the null hypothesis of no differences in adoption/continuance across the four quartiles.

rates across prevalence quartiles are statistically significant for fewer of the subgroups of young adults than was the case in Table 2. It is also the case that the differences across prevalence quartiles in the proportions of young adults who continue to use condoms (from one interview to the next) are generally not statistically significant, except for the period 1988 to 1990. We do find, however, that the likelihood of married men to continue to use condoms or to adopt them does not vary with local AIDS prevalence rates. This finding is consistent with the fact that married men face a relatively low risk of contracting an STD, regardless of the local prevalence of the disease.

### III. The Effect of State AIDS Prevalence Rates on Condom Demand: Cross-Sectional Estimates

While the evidence presented in the previous section suggests that condom usage among young adults responded to the spread of the AIDS epidemic, questions remain as to the robustness of these findings. It is far from clear that this evidence of a positive association between condom use and measures of local prevalence implies that the demand for protection was responsive to the increase in the "price" of unprotected sex in the 1980s. The increase in condom use among young adults may have been the result of changes in other factors, including changes in the perceived health risks or convenience of alternative forms of contraception such as the pill. Alternatively, the recorded increase in condom demand may simply reflect an increasing propensity of survey respondents to give what they perceived as a more acceptable response to the method of protection they used during sexual relations. Finally, while the positive correlation between condom use and local AIDS prevalence rates documented in Tables 2 and 3 suggests that the upward trend in condom usage is not simply the result of a change in what is socially acceptable to report in a survey, it may overstate the responsiveness of the demand for protection to the rise in the AIDS epidemic in the United States.

In this section and the next, we present estimates of alternative specifications of individual-level demand functions for condoms in an attempt to better isolate the effects of regional and temporal changes in the full price of unprotected sex. In this section, we present estimates of the effects of local prevalence rates on condom use. Using logistic regression methods, we control for: (1) the respondent's annual income (*AnnInc*); (2) a variety of personal and family background characteristics, including age (*Age*), educational attainment (*HghGrde*), mother's educational attainment (*MomGrade*), parents' income in 1979 (*FamY79*), race and ethnicity (*Black*, *Hispanic*), gender (*Female*), current marital status (*Mar*), residence in an urban area (*Urban*), whether the respondent was sexually active in 1985 (*SexAct*), and personal aptitude as measured by the Armed Forces Qualifying Test (*AFQT*); and (3) differences across markets and/or regions of the country that might affect a person's demand for condoms or other forms of protection. We account for differences across markets by including year dummies and state fixed effects in some of the demand specifications we estimate, making use of the pooled cross-section, time-series features of our data. One might expect

that differences in these characteristics and/or factors account for some of the differences in condom use, net of the risks of contracting an STD such as HIV. The definitions for these variables are found in Appendix Table A1.

To measure the local risk of HIV infection, we continue to use the accumulated number of reported AIDS cases per 100,000 in the population of the individual's state of residence (*PrevPC*) as our measure of local AIDS prevalence. To allow differences in demand elasticities with respect to local prevalence, we include year-specific *PrevPC* variables and include interactions of *PrevPC* with indicators of race, ethnicity, gender, marital status, living in an urban area, and being sexually active in 1985.

Finally, we note that we did not restrict our analysis to person-years for which individuals were between the ages of 25 and 27 in our multivariate analysis. Rather, we used data on all person-years for interviews in 1984, 1986, 1988, and 1990 for individuals who did not reside in small states. Observations for those residing in small states were excluded because we estimated models that included state fixed effects and these effects could not be estimated for states with inadequate numbers of observations.<sup>21</sup> This yielded a sample of 32,815 person-year observations on a total of 8,956 NLSY-1979 respondents. To allow for life-cycle differences in condom use behavior, we included polynomials in age in all logistic regressions.

Estimates for four alternative specifications of the determinants of the propensity to use condoms are presented in Table 4. The four models differ in their specification of the prevalence effects and in the controls they use to account for other state-level differences. An estimate of the basic effect of local prevalence on protective behavior for the most aggregate specification in Table 4 is contained in the first column of Model 1. After controlling for personal and family background characteristics, we still find that the local prevalence measure, *PrevPC*, has a highly significant and positive effect on the propensity to use condoms. In Model 2, we examine whether this responsiveness varies by age, gender, race, ethnicity, educational attainment, residence in an urban area, and the degree to which the individual was sexually active. The resulting estimates indicate that the condom demand response to prevalence varies by demographic groups. Men, individuals living in urban areas, those who are sexually active, and those who are single, all exhibit greater prevalence responsiveness relative to the other young adults. We also find that the prevalence responsiveness of condom demand increases with the respondent's age, although at a decreasing rate. These effects are generally statistically significant, although the prevalence interactions with gender, being sexually active, and years of schooling are not. We also do not find any evidence that prevalence responses differ across blacks, whites, and Hispanics. Finally, we note that the interactions between demographic characteristics and prevalence are jointly significant.

Since we have pooled data for various years in this analysis, we also can

---

21. We dropped the observations of those residing in Delaware, Hawaii, Idaho, Kentucky, Maine, Nebraska, New Hampshire, North Dakota, Rhode Island, South Dakota, Utah, Vermont, and Wyoming, which reduced our sample by 384 observations.

**Table 4**

*Logit Estimates for Condom Use for All Ages [Data Source: NLSY, 1984, 1986, 1988, 1990 Waves]*

Variable	Model 1	Model 2	Model 3	Model 4
<i>PrevPC</i>	0.0034*** (0.0004)	-0.0837** (0.0373)		
<i>PrevY84</i>			-0.0880** (0.0392)	-0.2019** (0.0535)
<i>PrevY86</i>			-0.0914** (0.0398)	-0.1499*** (0.0436)
<i>PrevY88</i>			-0.0894** (0.0403)	-0.0917** (0.0421)
<i>PrevY90</i>			-0.0905** (0.0405)	-0.0976** (0.0416)
<i>PrevFem</i>		-0.0008 (0.0008)	-0.0008 (0.0008)	-0.0006 (0.0008)
<i>PrevMar</i>		-0.0021** (0.0009)	-0.0021** (0.0009)	-0.0025*** (0.0009)
<i>PrevUrb</i>		0.0057*** (0.0018)	0.0057*** (0.0018)	0.0070*** (0.0019)
<i>PrevBlk</i>		0.0001 (0.0009)	0.0001 (0.0009)	0.0015 (0.0010)
<i>PrevHis</i>		-0.0005 (0.0012)	-0.0004 (0.0012)	-0.0009 (0.0012)
<i>PrevSxAc</i>		-0.0012 (0.0010)	-0.0012 (0.0010)	-0.0013 (0.0010)
<i>PrevM_Sx</i>		0.0024* (0.0013)	0.0024* (0.0013)	0.0028* (0.0013)
<i>PrevAge</i>		0.0065** (0.0027)	0.0069** (0.0029)	0.0078*** (0.0029)
<i>PrevAgeSq</i>		-0.124e-3*** (0.477e-4)	-0.131e-3*** (0.509e-4)	-0.147e-3*** (0.518e-4)
<i>PrevGrde</i>		-0.909e-4 (0.152e-3)	-0.881e-4 (0.151e-3)	-0.0001 (0.0002)
<i>AgeLT25</i>	0.2212*** (0.0515)	0.2708*** (0.0551)	0.2747*** (0.0559)	0.2940*** (0.0564)
<i>AgeGT27</i>	-0.1290*** (0.0482)	-0.0398 (0.0561)	-0.0475 (0.0574)	-0.0538 (0.0581)
<i>Black</i>	0.1195** (0.0522)	0.1082* (0.0609)	0.1071* (0.0610)	0.0545 (0.0656)
<i>Hispanic</i>	-0.0596 (0.0586)	-0.0250 (0.0769)	-0.0273 (0.0773)	0.0669 (0.0850)
<i>AFQT</i>	0.0052*** (0.0009)	0.0053*** (0.0009)	0.0053*** (0.0009)	0.0053*** (0.0010)
<i>M_AFQT</i>	-0.0480 (0.1132)	-0.0593 (0.1136)	-0.0615 (0.1137)	-0.0669 (0.1143)
<i>FamY79</i>	0.0029* (0.0016)	0.0027* (0.0016)	0.0027* (0.0016)	0.0023 (0.0016)

Table 4 (continued)

Variable	Model 1	Model 2	Model 3	Model 4
<i>M_FamY</i>	0.0732 (0.0597)	0.0682 (0.0599)	0.0686 (0.0599)	0.0570 (0.0605)
<i>AnnInc</i>	-0.0008 (0.0015)	-0.0006 (0.0015)	-0.0007 (0.0015)	-0.0011 (0.0015)
<i>MomGrade</i>	-0.0079 (0.0069)	-0.0077 (0.0070)	-0.0077 (0.0070)	-0.0075 (0.0070)
<i>M_Mom</i>	-0.1374 (0.1068)	-0.1350 (0.1071)	-0.1346 (0.1071)	-0.1400 (0.1080)
<i>Female</i>	-0.7738*** (0.0392)	-0.7463*** (0.0478)	-0.7465*** (0.0478)	-0.7575*** (0.0485)
<i>Mar</i>	-0.0756* (0.0422)	-0.0013 (0.0529)	-0.0007 (0.0530)	0.0303 (0.0540)
<i>HghGrde</i>	0.1915*** (0.0586)	0.2018*** (0.0592)	0.2021*** (0.0592)	0.2115*** (0.0599)
<i>HghGrdSq</i>	-0.0038* (0.0022)	-0.0040* (0.0022)	-0.0040* (0.0022)	-0.0042* (0.0022)
<i>Urban</i>	0.1008* (0.0530)	-0.0105 (0.0644)	-0.0130 (0.0648)	-0.0444 (0.0741)
<i>M_Urb</i>	-0.1487 (0.1174)	-0.1534 (0.1175)	-0.1550 (0.1175)	-0.1170 (0.1204)
<i>LivHome</i>	0.0422 (0.0439)	0.0427 (0.0440)	0.0431 (0.0440)	0.0200 (0.0444)
<i>SexAct</i>	0.3943*** (0.0518)	0.4421*** (0.0645)	0.4432*** (0.0646)	0.4367*** (0.0654)
<i>M_SexAct</i>	-0.1811** (0.0736)	-0.2787*** (0.0921)	-0.2794*** (0.0921)	-0.3043*** (0.0932)
<i>Year_86</i>	-0.0775 (0.0589)	-0.0819 (0.0597)	-0.0541 (0.0749)	0.0567 (0.0844)
<i>Year_88</i>	0.4603*** (0.0618)	0.4525*** (0.0649)	0.4378*** (0.0773)	0.9349 (0.6471)
<i>Year_90</i>	0.6176*** (0.0747)	0.6538*** (0.0770)	0.6853*** (0.0895)	1.1528* (0.6546)
Constant	-4.5092*** (0.4034)	-4.6076*** (0.4155)	-4.6192*** (0.4166)	-5.8992*** (0.9022)
State fixed effects?	No	No	No	Yes
Number of observations	32,818	32,818	32,818	32,818
Log likelihood	-10,644.67	-10,617.73	-10,617.10	-10,518.62

\* Significant at the 10 percent level.

\*\* Significant at the 5 percent level.

\*\*\* Significant at the 1 percent level.

investigate whether the prevalence responsiveness of condom demand varied over the 1980s. This is done in Model 3, which shows separate prevalence effects for each of the four years (see the coefficients estimates for *PrevY84* through *PrevY90*). Based on this specification, we find no evidence that prevalence effects vary over time; the test that the prevalence-year interactions are the same cannot be rejected at conventional levels of significance.<sup>22</sup> Thus, while the simple trends in condom use presented in the previous section suggested that the prevalence response in condom demand has increased over time, we do not find any evidence of such an increase after controlling for personal and family background characteristics.

In Model 4, we add dummy variables for states of residence to assess whether the significant AIDS prevalence effects found for the first three regression specifications persist once one allows for other state-based factors to affect the demand for condoms. We include two sets of state dummies, one for the period 1984–86 and another for the period 1988–90. Including both sets allows for the possibility that state-specific factors that might have influenced condom demand, other than prevalence rates, might have changed over the 1980s. There are good reasons to suspect that such factors did change over this period. Over this period, for example, states undertook a variety of public health initiatives to stanch the AIDS epidemic. The trends in per capita state expenditures on AIDS treatment and prevention programs over the 1980s reveal striking differences across states in the timing and extent of these efforts. Moreover, it does not appear that patterns of state spending on AIDS are explained by differences in state prevalence rates. For example, the per capita state expenditures on AIDS treatment and prevention in Massachusetts and North Carolina grew dramatically over the 1980s, even though the rates of increase in prevalence rates in these two states were consistently below the national average. Including both sets of state dummy variables in the specification of condom demand functions will control for the influence of these and other differences across states that are not directly linked to differences in states' AIDS prevalence rates.

Examining the estimates for Model 4, we continue to find evidence of significant prevalence effects in condom demand, even after controlling for these state-specific and time-interacted fixed effects. In fact, the effects of the prevalence variables and their interactions appear to be stronger, both in absolute value and levels of significance, than those found in Model 3.<sup>23</sup> Moreover, controlling for state fixed effects, we also find evidence to suggest that the impact of local prevalence on condom demand increased over the 1980s. The coefficient estimates on the year-specific prevalence variables, *PrevY84–PrevY90*, become less negative in later years, and we can now reject the hypothesis of no differences in prevalence effects over time (*P*-value of 0.023). Finally, we note that, relative to Model 3, inclusion of both sets of state fixed effects significantly improves the fit of the regression model for the condom demand function we estimate for young adults.<sup>24</sup>

22. The *p*-value associated with this test is 0.738.

23. We also note that the addition of the state dummy variables yields a significant improvement in the log likelihood function.

24. The statistic for the likelihood ratio test comparing Models 3 and 4 is 196.96 with 74 degrees of freedom. The *p*-value associated with this difference is 0.00001.

While our primary interest is in the prevalence responses of condom demand, we briefly consider the estimated effects of some of the other control variables included in the models presented in Table 4. We consistently find that individuals with higher educational attainment and higher ability (the latter measured by scores on the AFQT test) are more likely to use condoms. We do not find any evidence, however, of significantly different usage across respondents' income levels or different family backgrounds. Consistent with the patterns of reported condom use by gender (noted in the previous section), we find that females report significantly lower probabilities of condom use by partners. We also find that condom use among adults younger than age 25 is significantly higher than among those who are in the 25–27 age category, the age group used in the analysis presented in Section III. We do not find evidence that marriage or urban residence, per se, has differential effects on condom use, after controlling for other factors (including prevalence). Finally, even after controlling for the variety of factors noted in Table 4, including local prevalence, we do find evidence of an independent upward trend in condom use over the 1980s (see the coefficients on the year dummy variables). Thus, the rise in AIDS prevalence during the 1980s does not fully account for the upward trend in condom use among young adults.

The rise in AIDS prevalence, however, can explain a large part of this growth in the demand for condoms. Using the estimates for Model 4, we examined how much of the change in condom use could be attributed to the trends in AIDS prevalence rates. Exploiting the longitudinal data on condom use of individuals in our sample (as well as the local prevalence rates they faced), we calculated the expected change in the probability of condom utilization between years  $t - 2$  and  $t$  that was attributable to the change in local prevalence rates alone. We then compared this with the actual mean changes in condom utilization observed over the same interval for various demographic groups based on Model 4 estimates. We found that the predicted changes in condom use attributable to the changes in local prevalence alone, accounted for between 32 percent to 65 percent of the actual changes, with the highest degree of "explanatory power" holding for single men living in urban areas.

We conclude this section by offering an alternative way of presenting the implications of our estimates of condom demand prevalence responses. Given the nonlinear form of the conditional expectation function associated with logistic regression models, it is difficult to determine the quantitative magnitude of the prevalence responses from the coefficient estimates in Table 4. Consequently, we present in Table 5 estimates of the *elasticity* of demand, measuring the effect of a 1 percent increase in the local prevalence rate on the change in the propensity to use condoms, using the estimates for Model 4 in Table 4. We present estimates of the mean elasticities for several different subgroups, the various years covered by our data, and for all states versus those states that had high AIDS prevalence rates (as measured by states that were in the top quartile of the prevalence rate distribution). To avoid confounding the secular trends in prevalence rates with the aging of the NLSY-1979 sample over this period, we evaluate the elasticities at the mean characteristics of 25–27 year olds in the sample. For each elasticity estimate, we also provide an estimate of its standard error, calculated under the assumption of fixed (as opposed to stochastic) regressors.

**Table 5**  
*Average Estimated Prevalence Elasticity for the Probability of Condom Use, Evaluated for Selected Subsamples at Mean Characteristics of 25-27 Year Olds<sup>a</sup>*

Population Group	1984		1986		1988		1990	
	All States	High-Prevalence States	All States	High-Prevalence States	All States	High-Prevalence States	All States	High-Prevalence States
All men and women	-0.0306***	-0.1047**	-0.0362***	-0.0991***	0.0592*	0.1605	0.0848*	0.2170*
All men	-0.0401***	-0.1378**	-0.0487***	-0.1324***	0.0784*	0.2048*	0.1099*	0.2674*
White single men	-0.0456***	-0.1563**	-0.0483***	-0.1337***	0.0863*	0.2196*	0.1226**	0.2953*
Black single men	-0.0484**	-0.1384**	-0.0582**	-0.1423**	0.1194**	0.3238*	0.1766**	0.5045**
Hispanic single men	-0.0588**	-0.0908**	-0.0634**	-0.0941**	0.1073**	0.1723*	0.1531*	0.2279*
White single men in urban areas	-0.0518***	-0.1670**	-0.0529***	-0.1459***	0.0982*	0.2422*	0.1427**	0.3203**
Black single men in urban areas	-0.0529**	-0.1421**	-0.0630**	-0.1453**	0.1318**	0.3308*	0.2031**	0.5074**
Hispanic single men in urban areas	-0.0596**	-0.0911**	-0.0650**	-0.0969**	0.1118*	0.1793*	0.1617*	0.2414*
White married men in urban areas	-0.0351***	-0.1333**	-0.0510**	-0.1450***	0.0626	0.1632	0.0955	0.2091
Black married men in urban areas	-0.0333***	-0.1574**	-0.0522**	-0.1550***	0.0978*	0.2563	0.1325*	0.3022*
Hispanic married men in urban areas	-0.0418**	-0.0737**	-0.0576***	-0.0921***	0.0730	0.1080	0.0930	0.1347

\* Significant at the 10 percent level.  
 \*\* Significant at the 5 percent level.  
 \*\*\* Significant at the 1 percent level.

a. All calculations were done using parameter estimates for Model 4 in Table 4. The formula used for the estimated effect of a 1 percent change in prevalence on the probability of using a condom for the *j*th population group is:

$$\frac{1}{N_j} \sum_{i \in \text{group } j} \frac{\partial F(Y_i = 1 | \alpha', X_i)}{\partial \ln \text{Prev} PC_i}$$

For any particular population group, the estimated elasticities become larger over the period 1984 to 1990. In fact, for 1984 and 1986, the early years of the epidemic, we find that the prevalence elasticities were negative and statistically significant for all of the various demographic groups examined. These negative elasticities are entirely consistent with the contention made by public health officials that the low levels of condom utilization in the 1980s contributed to the growth of the AIDS epidemic. Furthermore, our results provide evidence that this causal link between low condom use and increases in the prevalence of AIDS is, if anything, strengthened after the influences of a variety of state-level differences were controlled for by including the state fixed effects for this time period in the regression.

For the years 1988 and 1990, the estimates from Model 4 imply positive prevalence elasticities of condom demand. Moreover, the estimated prevalence elasticities differ substantially across demographic groups in the population and by the prevalence of HIV by state of residence.<sup>25</sup> Consistent with the intertemporal trends in condom demand noted earlier in Figure 1, condom demand of single men is more responsive than that of married men. Demand for condoms of single men living in urban areas is greater than that of single men living in nonurban areas. Based on an elasticity measure, we also find, in almost all cases, the condom demand of blacks is much more responsive to changes in local prevalence than that of either whites or Hispanics. Black males are considered to be a group facing a particularly high risk of becoming infected with the HIV virus or STDs, as they have more sexual partners per year (Laumann et al. 1994), on average, than do whites or Hispanics. The fact that the condom demand of black men is more prevalence-responsive suggests that this group responded to their heightened risk over the latter part of the 1980s. The prevalence elasticity estimates for 1988 and 1990 also indicate that the responsiveness of condom demand to prevalence was greater in high-prevalence states than in the nation as a whole. Finally, we note that the estimated prevalence elasticities derived from the Model 4 specification tend to be statistically significant for all groups except married men living in urban areas. Consistent with our expectations and the results presented in Table 2, the contraceptive choices of married men do not appear to be very responsive to the risk of STD infection.

The results presented in this section provide, we believe, rather compelling evidence that the demand for condoms became quite prevalence-elastic as the AIDS epidemic progressed during the latter part of the 1980s in the United States. Furthermore, this behavioral response to local prevalence was greatest among precisely those groups that are thought to face the greatest risks of infection. Finally, the rise in our measure of risk, state-of-residence prevalence rates, accounted for a substantial share of the increased condom demand among young adults that occurred over the decade.

---

25. We do not include separate calculations in Table 4 for those in our sample who reported that they were sexually active. The estimated elasticities for that group are quite similar in magnitude to those living in urban areas.

#### IV. Longitudinal Evidence: Adoption of Condoms by Nonusers

In this section we further investigate the prevalence responsiveness of condom use by examining the extent to which local prevalence rates affected the decision of young adults to adopt this form of protection. As we noted in Section II, the rates of condom adoption among young adults appeared to grow over the 1980s. The estimates in Table 3 indicated that these rates were higher in states with higher AIDS prevalence rates. At the same time, the positive association between rates of condom adoption and AIDS prevalence rates was only significant for the period 1988–90. Exploiting the longitudinal information on condom use for the young adults in the NLSY-1979, we reexamine the evidence on how prevalence-responsive the adoption of condoms is among young adults. We again use logistic regression methods to control for personal and family background characteristics, as well as differences in state-of-residence factors, to isolate the responsiveness of adoption rates to the local prevalence rates of AIDS.<sup>26</sup>

Estimates of the effects of local prevalence on the probability that noncondom users choose to adopt this form of protection are presented in Table 6. We use the same four model specifications as used to analyze the incidence of condom demand. The findings with regard to the prevalence responsiveness of condom adoption closely parallel those for the incidence of condom use presented in Table 4. Across all model specifications, we find that the decision to adopt condoms as one's form of protection is responsive to local prevalence rates after controlling for a variety of personal characteristics and two sets of state fixed effects, covering the earlier and later parts of the period of our analysis. Moreover, adoption of condoms is more responsive to local prevalence for men than women, for single than married individuals, and for those residing in urban areas.

As before, we use the coefficient estimates in Table 6 to obtain estimates of prevalence elasticities, evaluated at the mean characteristics for 25–27 year olds. Estimates of these elasticities, and their standard errors, are presented in Table 7 for different demographic groups and for the years 1986, 1988, and 1990. Several conclusions can be drawn from an examination of the estimates in this table. First, we again find no evidence of responses in condom demand, here measured by rates of adoption of condoms by nonusers, to local prevalence at the outset of the AIDS epidemic (1986). Condom demand, however, becomes increasingly responsive to the local risk of AIDS infection over the latter part of the 1980s, and the elasticity estimates for both 1988 and 1990 tend to be statistically significant for all but married men and Hispanic men. Second, we again find that the elasticities of single men, especially those living in urban areas, tend to be larger in magnitude than those of the average young adult. Third, we again find that the

---

26. As with our regression analysis of condom use, we estimate the logistic regression models of condom adoption using data for individuals of all ages in the NLSY-1979. Using data for adjoining interview years in which the questions on condom use were asked (in other words, 1984–86, 1986–88, and 1988–90), we have 21,880 person-years in which NLSY-1979 respondents reported not using a condom in interview year  $t - 2$  and, thus, were "at risk" to adopt condoms in year  $t$ .

**Table 6**

*Logit Estimates for the Decision to Start Using Condoms by Nonusers [Data Source: NLSY-1979, 1986, 1988, 1990 Waves]*

Variable	Model 1	Model 2	Model 3	Model 4
<i>PrevPC</i>	0.0036*** (0.0005)	-0.1214** (0.0487)		
<i>PrevY86</i>			-0.1118** (0.0503)	-0.1266** (0.0533)
<i>PrevY88</i>			-0.1024** (0.0509)	-0.1174** (0.0521)
<i>PrevY90</i>			-0.1036** (0.0511)	-0.1196** (0.0521)
<i>PrevFem</i>		-0.0017* (0.0009)	-0.0017* (0.0009)	-0.0015 (0.0010)
<i>PrevMar</i>		-0.0020* (0.0011)	-0.0019* (0.0011)	-0.0025* (0.0011)
<i>PrevUrb</i>		0.0053** (0.0023)	0.0051** (0.0023)	0.0059** (0.0025)
<i>PrevBlk</i>		-0.0001 (0.0012)	-0.0001 (0.0012)	0.0015 (0.0013)
<i>PrevHis</i>		-0.0013 (0.0016)	-0.0015 (0.0016)	-0.0023 (0.0016)
<i>PrevSxAc</i>		-0.0009 (0.0012)	-0.0009 (0.0012)	-0.0011 (0.0012)
<i>PrevM_Sx</i>		0.0009 (0.0016)	0.0009 (0.0016)	0.0010 (0.0016)
<i>PrevAge</i>		0.0096*** (0.0035)	0.0083** (0.0036)	0.0095*** (0.0037)
<i>PrevAgeSq</i>		-0.180e-3*** (0.625e-4)	-0.158e-3** (0.648e-4)	-0.179e-3*** (0.657e-4)
<i>PrevGrde</i>		-0.0003 (0.0002)	-0.0003 (0.0002)	-0.0003* (0.0002)
<i>AgeLT25</i>	0.2484*** (0.0689)	0.3291*** (0.0752)	0.3171*** (0.0760)	0.3366*** (0.0765)
<i>AgeGT27</i>	-0.1813*** (0.0578)	-0.0810 (0.0673)	-0.0763 (0.0687)	-0.0871 (0.0692)
<i>Black</i>	0.1138* (0.0690)	0.1063 (0.0843)	0.1081 (0.0842)	0.0362 (0.0907)
<i>Hispanic</i>	-0.0833 (0.0777)	-0.0014 (0.1132)	0.0141 (0.1136)	0.1192 (0.1234)
<i>AFQT</i>	0.0042*** (0.0013)	0.0043*** (0.0013)	0.0042*** (0.0013)	0.0042*** (0.0013)
<i>M_AFQT</i>	0.0677 (0.1429)	0.0575 (0.1436)	0.0583 (0.1438)	0.0490 (0.1445)
<i>FamY79</i>	0.0032 (0.0021)	0.0029 (0.0021)	0.0029 (0.0021)	0.0027 (0.0021)
<i>M_FamY</i>	0.0419 (0.0795)	0.0350 (0.0798)	0.0342 (0.0798)	0.0323 (0.0806)

**Table 6** (continued)*Logit Estimates for the Decision to Start Using Condoms by Nonusers [Data Source: NLSY-1979, 1986, 1988, 1990 Waves]*

Variable	Model 1	Model 2	Model 3	Model 4
<i>AnnInc</i>	-0.0007 (0.0019)	-0.0004 (0.0019)	-0.0003 (0.0019)	-0.0004 (0.0019)
<i>MomGrade</i>	0.0020 (0.0092)	0.0023 (0.0093)	0.0023 (0.0093)	0.0025 (0.0093)
<i>M_Mom</i>	-0.0583 (0.1417)	-0.0483 (0.1424)	-0.0466 (0.1424)	-0.0463 (0.1433)
<i>Female</i>	-0.6996*** (0.0512)	-0.6227*** (0.0658)	-0.6235*** (0.0657)	-0.6329*** (0.0667)
<i>Mar</i>	-0.1292** (0.0548)	-0.0480 (0.0730)	-0.0504 (0.0730)	-0.0146 (0.0744)
<i>HghGrde</i>	0.1881** (0.0757)	0.2139*** (0.0775)	0.2126*** (0.0775)	0.2235*** (0.0783)
<i>HghGrdSq</i>	-0.0036 (0.0028)	-0.0040 (0.0028)	-0.0039 (0.0028)	-0.0043 (0.0028)
<i>Urban</i>	0.1301* (0.0704)	-0.0015 (0.0916)	0.0093 (0.0916)	-0.0113 (0.1048)
<i>M_Urb</i>	-0.6681*** (0.2129)	-0.6622*** (0.2129)	-0.6599*** (0.2129)	-0.6526*** (0.2158)
<i>LivHome</i>	0.1090* (0.0590)	0.1070* (0.0592)	0.1091* (0.0593)	0.0898 (0.0597)
<i>SexAct</i>	0.2240*** (0.0658)	0.2686*** (0.0862)	0.2687*** (0.0862)	0.2678*** (0.0871)
<i>M_SexAct</i>	-0.0904 (0.0902)	-0.1273 (0.1175)	-0.1277 (0.1173)	-0.1316 (0.1186)
<i>Year_88</i>	0.5779*** (0.0676)	0.5752*** (0.0691)	0.4277*** (0.0898)	0.3997*** (0.1006)
<i>Year_90</i>	0.6312*** (0.0822)	0.6794*** (0.0837)	0.5829*** (0.1043)	0.5666*** (0.1255)
Constant	-4.8101*** (0.5226)	-5.1072*** (0.5518)	-5.0059*** (0.5537)	-5.2807*** (0.6601)
State fixed effects?	No	No	No	Yes
Number of observations	21,880	21,880	21,880	21,880
Log likelihood	-6,317.36	-6,297.78	-6,294.51	-6,255.88

\* Significant at the 10 percent level.

\*\* Significant at the 5 percent level.

\*\*\* Significant at the 1 percent level.

**Table 7**  
*Average Estimated Prevalence Elasticities for Probability of Adopting Condoms, Evaluated for Selected Subsamples at Mean Characteristics of 25–27 Year Olds<sup>a</sup>*

Population Group	1986		1988		1990	
	All States	High-Prevalence States	All States	High-Prevalence States	All States	High-Prevalence States
All men and women	-0.0018	-0.0042	0.0234	0.0661	0.0358*	0.096
All men	-0.0019	-0.0042	0.0337*	0.0913**	0.0523**	0.133
White single men	-0.0014	-0.0034	0.0386*	0.1004**	0.0613**	0.151
Black single men	0.0008	0.0022	0.0639***	0.1805***	0.1097***	0.331
Hispanic single men	-0.0032	-0.0042	0.0386	0.0614	0.0584	0.087
White single men in urban areas	-0.0008	-0.0024	0.0453**	0.1138**	0.0728***	0.166
Black single men in urban areas	0.0012	0.0026	0.0710***	0.1846***	0.1273***	0.333
Hispanic single men in urban areas	-0.0029	-0.0040	0.0408	0.0646	0.0628	0.094
White married men in urban areas	-0.0026	-0.0069	0.0225	0.0602	0.0378	0.085
Black married men in urban areas	-0.0010	-0.0024	0.0435	0.1180*	0.0653*	0.157
Hispanic married men in urban areas	-0.0045	-0.0069	0.0193	0.0281	0.0220	0.031

\* Significant at the 10 percent level.

\*\* Significant at the 5 percent level.

\*\*\* Significant at the 1 percent level.

a. All calculations were done using parameter estimates for Model 4 in Table 6. The formula used for the estimated effect of a 1 percent change in prevalence on the probability of using a condom for the *j*th population group is:

$$\frac{1}{N_j} \sum_{i \in \text{group } j} \frac{\partial P(Y_i = 1 | \hat{\alpha}'X_i)}{\partial \ln \text{PrevPC}_i}$$

condom demand of blacks, especially black men, is substantially more responsive to the local prevalence of AIDS than that of whites or Hispanics. Finally, we find that the decision to adopt condoms became increasingly responsive to variations in the local prevalence of AIDS over the 1980s.<sup>27</sup> Taken together, these results for condom adoption provide further corroboration of the existence of a positive behavioral response of condom use to the local prevalence of AIDS among young adults.<sup>28</sup>

## V. Conclusion

In this paper, we have presented evidence on the impact of higher rates of AIDS prevalence on the use of those contraception methods that afford protection against the risk of contracting HIV. We find consistent evidence that young adults substituted away from methods that provide less protection against STDs and towards condoms as the local prevalence of AIDS increased in one's state of residence. Our major finding is that the preepidemic demand for condoms did not vary across regions but, as the epidemic took off, the demand rose faster in regions with relatively larger prevalence.

Our results seem to conflict with recent claims that there has been a "relapse" of risky behavior in highly infected gay populations. However, more detailed studies of the exact nature of how individuals respond to prevalence may find the two types of behavior to be consistent. This relapse behavior would be consistent with our findings if one's protective response to higher prevalence of AIDS is the establishment of more monogamous relationships in which there is a negative demand for disease protection via condoms. In other words, the difference hinges on the nature of the relationship between the length of monogamous sexual relationships and the likelihood of using condoms. If the propensity to use condoms decreases with the length of a monogamous relationship, and if monogamous relationships are more likely to occur as the risk of infection increases, one would expect to find condom use to be *decreasing* in prevalence. Although we find no evidence for such a negative prevalence effect, it may be that such effects only kick in at very high prevalence levels, such as those found in homosexual communities.

Lastly, the evidence presented in this paper lends support to the existence of a self-limiting incentive effect of the AIDS epidemic. It also supports the case for incorporating such effects into epidemiological models of the spread of infectious

27. The estimated differences in the prevalence effects across years are statistically significant for both Models 3 and 4 in Table 6.

28. While not presented here, we also conducted a parallel set of analyses on whether those individuals who were using condoms in year  $t-2$  continued to use them in year  $t$ . In particular, we estimated versions of the first three model specifications. We found no evidence of a significant relationship between the decision to continue to use condoms and local prevalence rates. While there may be no effect of local prevalence on the likelihood of continued condom use among young adults, we are not very confident about any conclusions concerning the relationship between these two variables, given the relatively small number of observations available in the NLSY-1979 to address this issue (2,305 person-years of data). For example, this sample was not large enough to include state fixed effects in the logistic regression analysis of this outcome.

diseases such as AIDS.<sup>29</sup> Although the equilibrium effects in a dynamic rational model of an infectious disease epidemic cannot be induced from our estimates, our evidence suggests that investigating such effects, and contrasting them to the inelastic assumptions implicit in epidemiological models, may be a useful challenge for future research.

---

29. See Philipson and Posner (1993) and Geoffard and Philipson (1993) on the public health implications of prevalence elastic demand.

**Appendix Table 1**  
*Definitions for Variables Used in Multivariate Analyses*

Variable	Definition
<b>Prevalence and Prevalence Interaction Variables</b>	
<i>PrevPC</i>	Cumulative AIDS cases per 100,000 population in state of residence
<i>PrevY84</i>	<i>PrevPC*Year_84</i> interaction
<i>PrevY86</i>	<i>PrevPC*Year_86</i> interaction
<i>PrevY88</i>	<i>PrevPC*Year_88</i> interaction
<i>PrevY90</i>	<i>PrevPC*Year_90</i> interaction
<i>PrevFem</i>	<i>PrevPC*Female</i> interaction
<i>PrevMar</i>	<i>PrevPC*Mar</i> interaction
<i>PrevUrb</i>	<i>PrevPC*Urban</i> interaction
<i>PrevBlk</i>	<i>PrevPC*Black</i> interaction
<i>PrevHis</i>	<i>PrevPC*Hispanic</i> interaction
<i>PrevSxAC</i>	<i>PrevPC*SexAct</i> interaction
<i>PrevM_Sx</i>	<i>PrevPC*M_SexAct</i> interaction
<i>PrevGrde</i>	<i>PrevPC*HghGrde</i> interaction
<i>PrevAge</i>	<i>PrevPC*Age</i> interaction
<i>PrevAgeSq</i>	<i>PrevPC*Age<sup>2</sup></i> interaction
<b>Background Characteristics</b>	
<i>FamY79</i>	Income of respondent's family in 1979 (1000\$)
<i>M_FamY</i>	Missing <i>FamY79</i> (1 = missing, 0 = not missing)
<i>MomGrade</i>	Highest grade of education completed by respondent's mother
<i>M_Mom</i>	Missing <i>MomGrade</i> (1 = missing, 0 = not missing)
<b>Personal Characteristics</b>	
<i>Age</i>	Current age
<i>AgeLT25</i>	Current age less than 25 (1 = yes, 0 = no)
<i>AgeGT27</i>	Current age greater than 27 (1 = yes, 0 = no)
<i>Black</i>	Black (1 = yes, 0 = no)
<i>Hispanic</i>	Hispanic (1 = yes, 0 = no)
<i>AFQT</i>	Score on Armed Forces Qualifying Test
<i>M_AFQT</i>	Missing AFQT score
<i>AnnInc</i>	Respondent's annual total income (1000\$)
<i>Female</i>	Female (1 = yes, 0 = no)
<i>Mar</i>	Married (1 = yes, 0 = no)
<i>HghGrde</i>	Highest grade completed by respondent
<i>HghGrdSq</i>	<i>HghGrde</i> squared
<i>LivHome</i>	Respondent lives at home (1 = yes, 0 = no)
<i>SexAct</i>	Whether person had sexual intercourse at least once in last month (gathered in 1985 interview) (1 = yes, 0 = no)
<i>M_SexAct</i>	Missing <i>SexAct</i> (1 = missing, 0 = not missing)
<i>Urban</i>	Resides in an urban area (1 = yes, 0 = no)
<i>M_Urb</i>	Missing <i>Urban</i> (1 = missing, 0 = not missing)
<b>Time Dummies</b>	
<i>Year_84</i>	1984 year dummy variable
<i>Year_86</i>	1986 year dummy variable
<i>Year_88</i>	1988 year dummy variable
<i>Year_90</i>	1990 year dummy variable

## References

- Anderson, R., and R. May. 1991. *Infectious Diseases of Humans: Dynamics and Control*. Oxford: Oxford University Press.
- Becker, M., and J. Joseph. 1988. "AIDS and Behavioral Change to Reduce Risk: A Review." *American Journal of Public Health* 78(4):394–410.
- Cates, W., and K. Stone. 1992a. "Family Planning, Sexually Transmitted Diseases and Contraceptive Choice: A Literature Update, Part I." *Family Planning Perspectives* 24(2):75–84.
- . 1992b. "Family Planning, Sexually Transmitted Diseases and Contraceptive Choice: A Literature Update, Part II." *Family Planning Perspectives* 24(3):122–28.
- Geoffard, P., and T. Philipson. 1993. *Public vs. Private Disease Eradication*. Department of Economics, University of Chicago. Mimeo.
- . 1995. "The Empirical Content of Canonical Models of Infectious Disease." *Biometrika* 82(7):101–14.
- Holmes, K., J. Karon, and J. Kreiss. 1990. "The Increasing Frequency of Heterosexually Acquired AIDS in the United States, 1983–1988." *American Journal of Public Health* 80(7):858–63.
- Laumann, E., R. Michaels, J. Gagnon, and S. Michaels. 1994. *The Social Organization of Sexuality*. Chicago: The University of Chicago Press.
- Lawrence, J., H. R. Hood, T. Brasfield, and J. A. Kelly. 1989. "Differences in Gay Men's AIDS Risk Behavior Patterns in High and Low AIDS Prevalence Cities." *Public Health Reports* 102(4):391–95.
- Mann, J., T. Netter, and D. Taralolah. 1993. *AIDS in the World*. Cambridge: Harvard University Press.
- Moran, John S., Harlan R. Janes, Thomas A. Peterman, and Katherine M. Stone. 1989. "Increase in Condom Sales Following AIDS Education and Publicity, United States." *American Journal of Public Health* 80(5):607–608.
- Philipson, T., and R. Posner. 1993. *Private Choices and Public Health: An Economic Interpretation of The AIDS Epidemic*. Cambridge: Harvard University Press.
- Pleck, J., F. Sonenstein, and L. Ku. 1993. "Changes in Adolescent Males' Use of and Attitudes towards Condoms." *Family Planning Perspectives* 25(3):106–110.
- Sonenstein, F., J. Pleck, and L. Ku. 1989. "Sexual Activity, Condom Use and AIDS Awareness among Adolescent Males." *Family Planning Perspectives* 21(3):152–58.
- Tanfer, K., W. Grady, D. Klepinger, and J. Billy. 1993. "Condom Use Among U.S. Men, 1991." *Family Planning Perspectives* 25(2):61–66.
- Winkelstein, W. Jr., D. M. Lyman, N. Padian, R. Grant, M. Samuel, J. A. Wiley, R. E. Anderson, W. Lang, J. Riggs and J. A. Levy. 1987a. "Selected Sexual Practices of San Francisco Heterosexual Men and Risk of Infection by the Human Immunodeficiency Virus." *Journal of the American Medical Association* 257(11):1470–71.
- Winkelstein, W. Jr., M. Samuel, N. S. Padian, and J. A. Wiley. 1987b. "Sexual Practice and Risk of Infection by the Human Immunodeficiency Virus: The San Francisco Men's Health Study." *Journal of the American Medical Association* 257(3):321–25.