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Program Report

Health Economics

Michael Grossman*

In the five years since my last report on the NBER's Program in Health Economics, the program has changed from one based mainly in the Bureau's New York office to one with a national presence. The number of program members has increased dramatically. The first group meeting at the Summer Institute was in 2001 and the first spring meeting was held in 2003; these two events now take place on an annual basis. The Program's growth has resulted in a more diversified research portfolio. In my last report, I emphasized studies on the economics of substance use. While I report here on a good deal of new research in this important area, I also summarize studies focusing on the economics of obesity; the roles of such basic economic forces as years of formal schooling completed, unemployment, and welfare reform in health outcomes; and the determinants of the cost of medical care. This research has been supported by grants from the National Institute on Alcohol Abuse and Alcoholism, the National Institute on Drug Abuse, the National Institute on Mental Health, the National Institute of Diabetes and Digestive and Kidney Diseases, the National Institute of Child Health and Human Development, the National Institute on Aging, the Agency for Health Care Research and Quality, and the Robert Wood Johnson Foundation.

The Economics of Substance Use

The economics of substance use considers the determinants and consequences of the consumption of such harmfully addictive substances as cigarettes, alcohol, and illegal drugs. The program continues to provide estimates of the effects of control policies on substance use on consumption and related outcomes.

Cigarettes

Cigarette excise tax hikes, which result in higher cigarette prices, are one possible tool to discourage smoking. This is particularly important

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in the case of smoking by pregnant women, since this behavior accounts for one in five low weight babies and is the most important modifiable risk factor for poor pregnancy outcomes. Greg Colman, Ted Joyce, and I find that pregnant women living in states that raised cigarette taxes between 1993 and 1999 were more likely to quit smoking once they became pregnant than women residing in other states.¹ The magnitude of the effect at issue is substantial. If a penny increase in taxes increases price by one cent, then a 10 percent increase in price would increase the probability that a pregnant woman quits smoking by 10 percent. Over one-quarter of the 9 percentage point increase in quit rates that occurred over the sample period can be explained by increases in cigarette taxes during that period. Colman, Joyce, and I estimate that a 30-cent increase in taxes in constant dollars would have the same effect on quit rates as enrolling women in prenatal smoking cessation programs.

John A. Tauras and Frank J. Chaloupka²; Tauras, Patrick M. O'Malley, and Lloyd D. Johnston³; Henry Saffer and Dhaval Dave⁴; and Tauras and Chaloupka⁵ confirm the importance of price as a determinant of a variety of smoking outcomes in different populations. Tauras and Chaloupka report that price hikes encourage young adult smokers to quit smoking, and Tauras, O'Malley, and Johnston report that price hikes discourage teenagers from starting to smoke. Saffer and Dave find that smoking participation by adults with mental illness is as sensitive to price as participation by adults who are not mentally ill. This is an important finding, because a history of mental illness increases smoking participation (relative to participation in the overall population) by 94 percent. It suggests that tobacco taxes are a valuable policy tool to discourage smoking, even in populations with high participation rates. Tauras and Chaloupka show that decreases in the price of nicotine replacement therapies and increases in the price of cigarettes lead to substantial increases in per capita sales of nicotine replacement therapy products. Hence, the decision to quit depends not only on the cost of cigarettes but also on the cost of techniques that enable smokers to quit.

Alcohol Abuse and Related Outcomes

Unlike the case with cigarettes, many persons regularly consume small quantities of alcohol without harming themselves or others; indeed, moderate alcohol consumption has

been shown to lower the risk of coronary heart disease. Instead, the adverse effects of alcohol spring from the overuse or misuse of this substance. Therefore, Program members have investigated the impacts of alcohol taxes or prices and other regulations on binge drinking (consuming five or more drinks on a typical drinking occasion at least once in the past month or past two weeks), cirrhosis of the liver, various forms of violent behavior, and risky sexual behavior by teenagers.

Jenny Williams, Frank Chaloupka, and Henry Wechsler report that in the period between 1997 and 1999, college students faced with a \$1 increase above the \$2.17 average real price of a drink would have been 33 percent less likely to make the transition from being a moderate drinker to a binge drinker.⁶ On the other hand, binge drinking is no less prevalent on college campuses that ban alcohol consumption by staff and students regardless of age compared to campuses that do not ban consumption except for those under 21. Saffer and Dave find that a 10 percent increase in the price of beer reduces the number of high school students who engage in binge drinking by between 2 and 5 percent.⁷ They also examine the responsiveness of this behavior to increases in alcohol advertising in all media in local market areas. Advertising has a positive effect on whether youth drink at all and on participation in binge drinking; that is, it encourages underage drinking. The relationship is especially pronounced for underage female drinkers. Saffer and Dave do not claim that the alcohol industry has deliberately targeted young people. They simply report that regardless of intent, advertising appears to have influenced underage drinking habits. Their estimates reveal that its complete elimination would lower binge participation from about 12 percent to about 7 percent.

The 18th Amendment to the Constitution banned alcohol consumption in the United States from 1920 to 1933. Angela K. Dillon and Jeffrey A. Miron examine the effect of Prohibition on mortality from cirrhosis of the liver in a long time series of state cross sections for the period 1900-97.⁸ They find that it reduced

mortality by between 10 and 20 percent. This reduction may not be as modest as it appears because they argue that black market suppliers may have faced low marginal costs of evasion. Hence, the net effect of Prohibition on the price of alcohol may have been small.

Sara Markowitz considers the effects of alcohol control policies on criminal violence and violence by youths. Her studies in the former area employ victimizations as outcomes. In U.S. cross sections for the period from 1992-4, she finds that increasing the tax on beer decreases the probability of assault, but it has no effect on robbery and rapes and sexual assaults.⁹ A 10 percent increase in the beer tax decreases the probability of assault by 4.5 percent. Moreover, a 10 percent increase in the number of outlets that sell alcohol decreases the probability of rape by almost 20 percent. In a second study she examines crimes worldwide in large samples of respondents from 16 countries for the years 1989 and 1992.¹⁰ Respondents were asked whether they were victims of robbery, assault, or sexual assault. Higher taxes on alcohol lead to lower incidences of all three types of violent crime. A 10 percent increase in the tax leads to a 2 percent decrease in the probability of each type of victimization. In a third study she finds that higher beer taxes lower the probability that U.S. high school students will engage in physical fights but have no impact on the probability of carrying a gun or another type of weapon.¹¹

Markowitz and I examine the effects of beer taxes on risky sexual behavior by teenagers.¹² The tax has no impact on the probability of having sex in the past 3 months or on the number of partners for either males or females. Higher beer taxes, however, raise the probability of using any birth control and condoms for males.

Illegal Drug Use

Illegal drug prices vary over time and at a moment in time among areas of the United States in part because of variations in the certainty and severity of punishment for the sale of these drugs. Rosalie Liccardo Pacula, Chaloupka,

O'Malley, Johnston, Matthew C. Farrelly, and I take advantage of these variations to estimate the sensitivity of marijuana participation by high school seniors to marijuana prices and other variables during the period from 1982 through 1998.¹³ My colleagues and I estimate that a 10 percent increase in price lowers the number of youths who used marijuana in the past year by approximately 2 percent. Our results imply that the sharp increase in price from 1982 to 1992 contributed significantly to the contraction in use in that period. Similarly, the reduction in price after 1992 played an important role in the steady expansion in use through 1998. During those same two periods, adolescent marijuana use seems to have been influenced by perceptions of the harm that marijuana may cause. These perceptions correlate, in part, with the rise and fall of media campaigns designed to illustrate to youths the potential harm of marijuana use. Our study concludes that it is useful to consider price, in addition to the more traditional determinants, in any analysis of marijuana use by youths.

If alcohol and marijuana are substitutes, some of the more than 20 percent increase in marijuana use by college students between 1993 and 1999 may have been attributable to the enactment and more stringent enforcement of anti-alcohol policies by colleges in that period. Williams, Pacula, Chaloupka, and Wechsler report, however, that the two substances are complements in the sense that an increase in the price of alcohol reduces the use of both.¹⁴ In particular, beer excise tax hikes and restrictions on access to alcohol through campus bans or state laws that curtail happy hours cause alcohol and marijuana consumption by college students to fall.

Effects of Alcohol and Illegal Drug Use

Causal effects of substance abuse are well established for such outcomes as motor vehicle accident mortality and deaths attributable to drug overdoses. For other outcomes including suicide attempts, children's behavior problems, risky sexual behavior, cognitive development, and years of formal

schooling completed, positive associations have been documented. It is not clear, however, whether these findings reflect causality from substance abuse or an omitted “third variable” that causes substance abuse and the outcome at issue to vary in the same direction. Program members have addressed this issue by employing a variety of techniques that attempt to establish causality. These include instrumental variables, family and sibling fixed effects, and comparisons between treatment and control groups.

Markowitz and Pinka Chatterji indicate that maternal marijuana and cocaine use are positively related to children’s behavior problems, while alcohol use has a less consistent impact.¹⁵ Chatterji, Dave, Markowitz, and Robert Kaestner obtain a causal relationship between clinically defined alcohol use disorders and suicide attempts among girls.¹⁶ Chatterji reports that marijuana and cocaine use in high school lead to reductions in the number of years of formal schooling completed.¹⁷ Pacula, Jeanne Ringel, and Karen Ross report a similar finding with regard to the relationship between marijuana use and cognitive development in panel data.¹⁸ Markowitz and I find that binge drinking lowers the probability of using birth control and condoms among sexually active teens when substance use regulatory variables are used as instruments.¹⁹ However, Kaestner, Markowitz, and I are not able to confirm this result using an estimation technique that assumes that unmeasurable differences between teenagers who do and do not abuse alcohol are similar to measurable differences between these two groups.²⁰

The results of the studies just summarized reflect the difficulty of establishing causality in the social sciences, where natural experiments rarely can be conducted. For that reason, they should be regarded as preliminary. Undoubtedly, program members will continue to study this issue in future research.

The Economics of Obesity

Hardly a day goes by when we do not read in the media about the dire consequences of the increase in obesity.

The percentage of adults who are obese has doubled since the late 1970s and tripled for children. From increases in the size of coffins, to increases in the size of pets, and to the appearance of new diets and new surgical techniques to lose weight, the evidence is everywhere. Obesity is now the second leading cause of death in the United States, and it is rapidly outpacing smoking in being the first. Attributable to approximately 300,000 deaths per year, compared to 400,000 from cigarette smoking, obesity has increased so quickly in the past two decades that the rise cannot be explained by genetic changes because these changes occur very slowly over long periods of time. This suggests that a focus on economic factors in weight outcomes is appropriate.

Shin-Yi Chou, Saffer, and I find that as much as two-thirds of the increase in adult obesity between 1984 and 1999 can be explained by the rapid growth in the per capita number of fast-food and full-service restaurants, especially the former, in the period at issue.²¹ Food served in fast food and in many full service restaurants has extremely high caloric density and almost certainly has contributed to the obesity epidemic. My colleagues and I, however, caution that a good deal of care must be exercised before restaurants are labeled as culprits in undesirable weight outcomes. The growth in restaurants and in the consumption of meals prepared away from home is to a large extent a response to the increasing scarcity and increasing value of nonmarket time, reflected in part by the increases in rates of labor force participation and hours worked by women. Indeed, Patricia M. Anderson, Kristin F. Butcher, and Phillip B. Levine find that the rise in average hours worked by mothers can account for as much as one-third of the growth in obesity among children in certain families.²²

Darius Lakdawalla and Tomas Philipson attribute a significant increase in obesity to reductions in real food prices over time.²³ David M. Cutler, Edward L. Glaeser, and Jessie M. Shapiro present evidence that reductions in the time costs of preparing meals at home for certain groups in the population contribute to an

increase in weight for those groups.²⁴ They attribute the reductions in the daily time allocated to meal preparation (their measure of the time cost) to technological advances. The studies just mentioned do not consider all factors simultaneously, suggesting that more research on obesity would be valuable. They do highlight that the upward trend in obesity may be an unintended consequence of economic progress.

Determinants of Health Schooling

Many studies suggest that years of formal schooling completed is the most important correlate of good health. This finding emerges whether health levels are measured by mortality rates, morbidity rates, self-evaluation of health status, or physiological indicators of health, and whether the units of observation are individuals or groups.²⁵ The interpretation of this finding as reflecting causality from more schooling to better health has been challenged on the grounds that there may be omitted “third variables.” For example, Victor R. Fuchs argues that persons who are more future oriented (who have a high degree of time preference for the future) attend school for longer periods of time and make larger investments in health.²⁶ Thus, the effect of schooling on health is biased if one fails to control for time preference.

Adriana Lleras-Muney addresses the causality issue by employing compulsory education laws in effect from 1915 to 1939 to obtain consistent estimates of the effect of education on mortality in synthetic cohorts of successive U.S. Censuses of Population for 1960, 1970, and 1980.²⁷ This instrument is positively correlated with schooling but highly unlikely to be correlated with unobserved determinants of health, especially because she controls for state of birth and other state characteristics at age 14. Her ordinary least squares estimates suggest that an additional year of schooling lowers the probability of dying in the next ten years by 1.3 percentage points. Her instrumental variables estimate is much larger: 3.6 percentage points.

Janet Currie and Enrico Moretti present similar findings when they use information on college openings between 1940 and 1990 to construct an availability measure of college in a woman's 17th year as an instrument for maternal schooling in the estimation of birthweight production functions.²⁸ These results certainly suggest causality from more schooling to better health.

Dana Goldman and Darius Lakdawalla²⁹ and Sherry Glied and Lleras-Muney³⁰ provide evidence of plausible mechanisms via which schooling affects health. Both studies show that the more educated respond more rapidly to situations in which new information becomes available or new medical technologies are introduced. Goldman and Lakdawalla consider self-reported CD4 T-lymphocyte cell counts as an outcome in three rounds of a panel survey. A depletion in these cells correlates strongly with the worsening of HIV disease and raises the probability of developing AIDS. They find negative and significant schooling effects on this outcome in the second and third waves of the survey, but not on the baseline wave, with insurance status, self-reported baseline health, and the number of years since the individual had been diagnosed with HIV held constant. Glied and Lleras-Muney find that the negative effects of schooling on mortality are largest for diseases and cancer sites in which the most rapid progress has been made during the 30-year period ending in 1999.

Unemployment

In two related papers Christopher J. Ruhm³¹ and Ulf-G. Gerdham and Ruhm³² contradict the conventional wisdom by showing that a variety of health indicators improve in recessions. The first study presents evidence for several physical health measures in microdata. The second study replicates the finding for mortality and deaths from several common causes in aggregate data for 23 OECD countries for the 1960-97 period. A single percentage point decrease in the national unemployment rate is associated with a 0.4 percent rise in total mortality. In another study Ruhm shows that these

findings may be traced to increases in physical exercise and reductions in obesity and in cigarette smoking during recessions.³³ One interpretation of some of these findings is that the consumer's time is an important input into the production of his or her health and that the price of this input falls in a recession.

Welfare Reform

The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 enacted sweeping changes in the welfare program. These changes included work requirements, lifetime limits on participation, and a family cap, which permits states to deny or reduce cash assistance for additional births to current recipients. Welfare reform has the potential to influence health outcomes in a variety of ways. Joyce, Kaestner, Sanders Korenman, and Stanley Henshaw point out that work requirements, time limits on benefits, and the family cap increase the cost of childbearing among welfare recipients or potential recipients.³⁴ Thus, births to unmarried low-educated women, who have high rates of welfare receipt and are likely to be affected by reform, should fall. In turn, infant health outcomes should improve because infants born to unmarried women and women with low levels of education weigh less than those born to other women.

Kaestner and Won Chan Lee indicate that welfare reform also can influence health by increasing the number of families without health insurance.³⁵ Under the Aid to Families with Dependent Children (AFDC) Program in effect before PRWORA, families on welfare were automatically enrolled in Medicaid. After welfare reform, women transitioning from welfare to work may have taken jobs that did not offer private health insurance benefits. While many of these women remained eligible for Medicaid at least on a one-year transitional basis, they now must go through a separate, unfamiliar application process to enroll. The loss in health insurance may translate into less use of health care and worse health outcomes. Finally, Kaestner and Elizabeth Tarlov

note that reform can affect health via employment stress, organizational stress, and financial stress.³⁶

Many states obtained AFDC waivers in the early 1990s to implement aspects of welfare reform prior to the 1996 legislation. This source of variation and the gradual adoption of Temporary Assistance to Needy Families (TANF) — the new welfare program created by (PRWORA) — has enabled program members to explore the hypotheses listed above in the decade of the 1990s, a period during which the number of welfare recipients fell by approximately 60 percent. Joyce, Kaestner, and Korenman find no consistent evidence that welfare reform, measured in a general manner by whether a state had implemented an AFDC waiver or TANF, reduced rates of non-marital childbearing among women aged 19 to 39 at highest risk of welfare use, relative to women at lower risk.³⁷ This finding is similar to the literature that found little or mixed evidence for an effect of AFDC benefits. Joyce, Kaestner, Korenman, and Henshaw focus on the family cap and consider abortion rates as well as birth rates as outcomes.³⁸ In family cap states, birth rates fell more and abortion rates rose more among high-risk women with at least one previous live birth compared to similar childless women, consistent with an effect of the family cap. This parity-specific pattern of births and abortions, however, also occurred in states that implemented welfare reform with no family cap. Thus, the effects of reform may have differed between mothers and childless women, but there is little evidence of an independent effect of the family cap.

Kaestner and Lee find that welfare reform had relatively small effects on the prenatal care use and infant health of less-educated unmarried women.³⁹ For single mothers with less than 12 years of education, their upper-bound estimates of the impact of reform are a 2 percent decrease in first trimester care, a 10 percent increase in last trimester care, a 1 percent decrease in the number of prenatal care visits, and virtually no change in birthweight. Kaestner and Tarlov indicate that reform had little impact

on measures of physical and mental health reported by low-educated single mothers.⁴⁰ The probability that these women engaged in binge drinking fell, however, and the probability that they engaged in regular and sustained physical exercise rose.

Taken together, the studies just summarized suggest that welfare reform did not reduce fertility among women at risk of poor birth outcomes, but it also did not reduce infant or adult health and may have improved certain healthy behaviors.

The Cost of Medical Care Determinants of Interest Rates on Tax-Exempt Hospital Bonds

The United States spent \$1.55 trillion on medical care in 2002. At 35 percent, hospital services accounted for the largest component of this spending. Consequently, the prices of inputs used by hospitals play a major role in determining the total cost of medical care. Hospitals obtain most of their capital from the proceeds of bonds issued on their behalf by quasi-governmental state, county, and city finance authorities in the tax-exempt municipal bond market. These bonds are backed by hospital revenue, and the hospital rather than the issuer is responsible for interest and principal payments. Their interest rates are the primary factor influencing the price of hospital capital and have the potential to have significant impacts on total medical spending. Yet the tax-exempt hospital bond market and the determinants of interest rates on these bonds has received little attention in the ongoing debate on health care reform.

Alec Ian Gershberg, Fred Goldman, and I try to address this imbalance by exploring the effects of two kinds of competition on the cost of hospital capital in the tax-exempt bond market.⁴¹ The first is competition among underwriters. A hospital can select an underwriter either by soliciting competitive sealed bids or by negotiating directly with an investment banker. The second is competition among issuers. This arises because authorities that issue bonds charge for their services

and because some states allow more competition among them than others.

With regard to competition among issuers, my colleagues and I find that departures from equality in market shares among issuers raise interest rates by 22 basis points (1 basis point equals 1/100 of 1 percent). With regard to competition among underwriters, interest rates would fall by 54 basis points if competitive bidding procedures to select underwriters completely replaced negotiated procedures. To give some perspective and sense of scale, a 76 basis point reduction for all 1,152 bonds issued in 1993 would have yielded \$1.52 billion in terms of the present value of interest cost savings in 1993 dollars and almost \$2 billion in 2002 dollars. This translates into a savings of approximately 5 percent of the total real par value of bonds issued in a typical year in the 1990s.

Managed Care and Hospital Prices

In the past three decades the rapid growth of managed care has dramatically changed the way in which medical care services are financed and delivered. Thirty years ago patients and providers determined the type and quantity of services to be delivered. Insurers reimbursed providers on a fee-for-service-basis. Today, the majority of patients are enrolled in managed care plans that restrict provider choices by patients, limit services, and bargain with provider networks to obtain lower prices. In a widely cited study David M. Cutler, Mark McClellan, and Joseph P. Newhouse show that managed care plans have 30 to 40 percent lower expenditures than traditional health insurance plans in the case of treatment for heart disease.⁴² They also show that both actual treatments and health outcomes differ little and that almost all the difference in spending comes from lower unit prices. They point out that their findings suggest that medical care costs can be substantially reduced with little or no effect on the quality of care but are careful to question whether their findings generalize to the medical care system as a

whole. In particular, they pertain to a small sample of heart disease patients who are employees of a single firm in Massachusetts. Moreover, they do not estimate separate price discounts for specific treatments received by heart attack victims.

In two related studies, Avi Dor, Siran M. Koroukian, and I extend the research just described by considering managed care discounting of hospital transactions prices for bypass surgery and for angioplasty in a large national sample of patients employed by 80 large firms.⁴³ For bypass surgery, managed care price discounts range from 9 to 24 percent, and for angioplasty, they range from 8 to 24 percent. These results control for patient and provider heterogeneity. In a qualitative sense they buttress the findings by Cutler, McClellan, and Newhouse although the magnitudes of the discounts are somewhat smaller.

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⁵ J.A. Tauras and F.J. Chaloupka, "The Demand for Nicotine Replacement Therapies," NBER Working Paper No. 8332, June 2001, and *Nicotine and Tobacco Research*, 5 (2) (April 2003), pp. 237-43.

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