Original article

Effects of wages on smoking decisions of current and past smokers

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ABSTRACT

Purpose: We used longitudinal data and instrumental variables (IVs) in a prospective design to test for the causal effects of wages on smoking prevalence among current and past smokers.
Methods: Nationally representative U.S. data were drawn from the 1999–2009 waves of the Panel Study of Income Dynamics. Our overall sample was restricted to full time employed persons, aged 21–65 years. We excluded part time workers and youths because smoking and wage correlations would be complicated by labor supply decisions. We excluded adult never smokers because people rarely begin smoking after the age of 20 years. IVs were created with state-level minimum wages and unionization rates. We analyzed subsamples of men, women, the less educated, the more educated, quitters, and backsliders. Validity and strength of instruments within the IV analysis were conducted with the Sargan-Hansen *J* statistic and *F* tests.
Results: We found some evidence that low wages lead to more smoking in the overall sample and substantial evidence for men, persons with high school educations or less (<13 years of schooling), and quitters. Results indicated that 10% increases in wages lead to 5.5 and 4.6 percentage point decreases in smoking for men and the less educated; they also increased the average chance of quitting among base-year smokers from 17.0% to 20.4%. Statistical tests suggested that IVs were strong and valid in most samples. Subjects' other family income, including spouses' wages, was entered as a control variable.
Conclusions: Increases in an individual's wages, independent of other income, decreased the prevalence of smoking among current and past smokers.

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Introduction

Epidemiologists have long recognized that low income is associated with smoking in industrialized countries [1,2]. One view is that low income causes smoking. Another view—frequently espoused by economists—is that smoking causes low income or that some unmeasured "third variable" such as ability to delay gratification or self-efficacy is responsible for both smoking and low income [3]. Instrumental variables (IVs) analysis has been suggested to remove the bias from reverse causality and "third variables" [4]. Two sets of economic studies have used IV analysis. In the first, economists find evidence that smoking results in lower wages for full time workers [5,6]. The second finds that increases in the

Earned Income Tax Credit (EITC) lead to decreases in smoking for low-educated women [7–9].

Our study tests whether wages—the largest category of income for most working adults—are causally related to smoking prevalence among current and past smokers. We make several contributions. First, we use unique instruments that, to our knowledge, have not appeared in studies of the effects of wages on smoking: state-level minimum wages and unionization rates. In addition, we statistically test for the validity and strength of these instruments. Second, the influential studies that have considered wages (as opposed to all income) and smoking correlations test whether smoking reduces wages [5,6]; we test for the reverse. Third, we are not aware of any studies that specifically address the separate effects of an individual's wage versus all other family income. The possible negative effect on smoking may be especially strong for wages. Evidence suggests that low wages are associated with low self-esteem and depression that, in turn, predict smoking prevalence and cessation [10,11]. Moreover, focusing on wages is warranted given that there are specific policies affecting wages such as minimum wage laws and business firms' decisions regarding compensation of

employees. Fourth, our investigation differs from the EITC studies: Our samples are broader than low-income mothers; we analyze men and women together and separately; and we analyze individuals with high school educations or less (<13 years of schooling) as well as individuals with some college or college degrees (≥13 years). We stratify by education because our instruments are likely to be stronger predictors of wages for the less educated than the more educated. Fifth, separate analyses are conducted for quitters and backsliders in light of findings in an influential study suggesting different predictors for each [12]. Finally, we use longitudinal data from the Panel Study of Income Dynamics (PSID), a highly regarded data set widely used by social scientists but infrequently used by epidemiologists.

Our samples are restricted to people who either smoke now or used to smoke at younger ages (ever smokers), who are aged 21–65 years, and who are employed full time. We focus on ever smokers because roughly 90% of smokers in the United States begin smoking before the age of 18 years and 99% before 26 years [13]. Our focus on ever smokers follows Ayyagari and Sindelar [14] in their analysis of job stress on smoking. Our sample does not include youths because their inclusion would require a separate analysis of labor supply given that many youths do not work or work part time. Moreover, wage and smoking correlations may sharply differ for youths versus adults [15]. Finally, most studies on the predictors of wages—such as schooling or work experience—exclude youths and the majority focus on full time workers, in part, to minimize any bias imparted by labor supply decisions [16].

Methods, data

The PSID is a longitudinal, representative U.S. sample of adults. It contains much information including subjects' wages, smoking status, and state of residence. We combine data on "household heads" and "wives" (including partners), if any, for six recent waves as follows: 1999, 2001, 2003, 2005, 2007, and 2009. We use lagged socioeconomic variables and wages to predict smoking; that is, for

example, socioeconomic variables in 1999 are used to predict wages in 2000, and wages in 2000 are used to predict smoking in 2001. The information on previous year wages is collected in every wave. Because the critical covariate is wages, we select employees and/or the self-employed working full time defined as 1750+ annual work hours and 49+ weeks per year. Even though our samples are restricted to full time workers, we divide annual earnings by annual hours to obtain wages-per-hour. Annual earnings are not pure measures of wages-per-hour because respondents may work 38 hours or more than 60 hours per week and may work 49 weeks or 52 weeks per year. The dependent variable is prevalence of smoking (yes or no). We exclude persons with missing data. Our largest overall sample contains 7029 person-years. "Ever smoker" refers to respondents who are current or past smokers. The PSID asked respondents: "Do you smoke cigarettes?" and for those who answered "no" the PSID asked "Did you ever smoke cigarettes?" We define respondents as "ever smokers" if a "1" is recorded for either question.

Six subsamples are considered. In the first four, men are separated from women and persons with high school or less education are separated from persons with some college or more. In the quitters subsample, persons who report that they were not smokers in base years are excluded. In the backsliders subsample, persons who report that they were smokers in base years are excluded. The quitter subsample consists of 2765 person-years, and the backslider subsample consists of 2196 person-years.

Wages are calculated as subjects' annual earnings from work divided by annual work hours both measured in the year before the interview. Wages capture all earnings, including wages-per-hour, salary, second jobs, self-employment, bonuses, overtime, tips, and commissions. "Other family income" includes income to the subject from government transfers, interest, rent, dividends, capital gains, and alimony as well as wage and nonwage income from any spouse. The Consumer Price Index is used to adjust for inflation and our data are in 1999 dollars [17].

Table 1 lists means and SDs (continuous variables only) for all variables derived from the overall sample as well as the six subsamples.

Table 1
Descriptive statistics: means (SDs for continuous variables)

Variables, covariates, and instruments	Overall sample	Male	Female	<13 y of school	13+ y of school	Smokers in base years	Nonsmokers in base years
Sample size	7029	4316	2713	3906	3123	2765	2196
Key variables							
Whether currently smokes	0.52	0.51	0.52	0.58	0.44	0.83	0.13
Wages, in 1999 dollars	$14.92 (12.37)	$16.47 (13.92)	$12.46 (8.88)	12.30 (8.09)	18.21 (15.61)	13.99 (11.22)	17.62 (14.54)
Other family income, in 1999 dollars (divided by 10,000)	2.5371 (4.4139)	2.3003 (4.4567)	2.9139 (4.3193)	2.0803 (2.8075)	3.1084 (5.7803)	2.0795 (3.0283)	2.9985 (6.0851)
Covariates							
Male	0.61	—	—	0.63	0.59	0.65	0.67
Age	39.29 (10.77)	39.53 (10.99)	38.89 (10.36)	38.92 (10.49)	39.76 (11.07)	38.74 (9.95)	42.6751 (10.49)
White, non-Hispanic	0.64	0.65	0.61	0.59	0.68	0.62	0.68
African-American, non-Hispanic	0.26	0.23	0.32	0.31	0.21	0.30	0.20
Hispanic	0.05	0.07	0.03	0.07	0.04	0.04	0.07
Others	0.05	0.05	0.04	0.03	0.07	0.04	0.05
Married, spouse present	0.61	0.61	0.50	0.62	0.61	0.58	0.71
Years of schooling	12.69 (2.23)	12.60 (2.37)	12.84 (1.97)	11.26 (1.57)	14.49 (1.51)	12.39 (1.99)	13.06 (2.37)
Self-employed	0.09	0.10	0.07	0.09	0.09	0.07	0.10
Northeast	0.14	0.14	0.15	0.12	0.16	0.13	0.14
South	0.41	0.40	0.42	0.44	0.38	0.44	0.39
Midwest	0.28	0.28	0.28	0.27	0.28	0.30	0.25
West	0.17	0.13	0.15	0.17	0.18	0.13	0.22
State cigarette tax, cents per pack	0.53 (0.45)	0.53 (0.44)	0.54 (0.45)	0.51 (0.42)	0.57 (0.47)	0.51 (0.45)	0.59 (0.46)
State unemployment rate	4.90 (1.11)	4.89 (1.12)	4.90 (1.11)	4.87 (1.13)	4.93 (1.09)	4.89 (1.12)	5.04 (1.08)
Tobacco-control funding per capita, in 1999 dollars	2.64 (2.66)	2.61 (2.63)	2.68 (2.71)	2.72 (2.78)	2.54 (2.51)	2.65 (2.71)	2.68 (2.52)
Number of smoke-free laws	3.04 (1.73)	3.07 (1.73)	2.99 (1.73)	2.94 (1.75)	3.17 (1.70)	2.87 (1.76)	3.29 (1.72)
Instruments							
State minimum wage, in 1999 dollars	$4.89 (0.56)	$4.90 (0.57)	$4.87 (0.53)	$4.87 (0.55)	$4.91 (0.56)	$4.81 (0.52)	$4.94 (0.61)
State unionization percentage	12.91 (6.07)	12.92 (6.10)	12.92 (6.01)	12.56 (5.96)	13.36 (6.18)	12.36 (6.00)	13.29 (6.10)