Is Smoking Inferior?

Evidence from Variation in the Earned Income Tax Credit

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ABSTRACT

In this paper we estimate the causal income elasticity of smoking participation, cessation, and cigarette demand conditional upon participation. Using an instrumental variables (IV) estimation strategy, we find that smoking appears to be a normal good among low-income adults: Higher-instrumented income is associated with an increase in the number of cigarettes consumed and a decrease in smoking cessation. The magnitude and direction of the changes in the income coefficients from our OLS to IV estimates are consistent with the hypothesis that correlational estimates between income and smoking-related outcomes are biased by unobservable characteristics that differentiate higher-income smokers from lower-income smokers.

I. Introduction

Prices and income are central to the standard economic model of consumer demand. Estimates of the price-elasticity of cigarette demand continue to attract a great deal of attention because of their relevance to the role of excise taxes in tobacco control. In contrast, estimates of the income-elasticity of cigarette demand currently seem to attract much less attention from either economists or policymakers, and income is often considered only tangentially as a control variable or in the con-

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text of the regressivity of cigarette taxation.[1] In this paper, we focus on estimating the "causal income-elasticity"—that is, the causal effect of income on smoking for lower-income adults. We use data from multiple waves between 1993 and 2007 of the Current Population Survey (CPS) Tobacco Use Supplements (TUS) matched to the CPS Annual Social and Economic Supplement (ASEC). To address the potential endogeneity between income and smoking we adopt an instrumental variables (IV) identification strategy, where our IV is based on changes in the benefit parameters of the Earned Income Tax Credit (EITC).

The income-elasticity of cigarette demand deserves more attention in its own right as an interesting example of the basic economics of health behaviors. Existing evidence seems to suggest that whether the income elasticity is positive or negative varies systematically across time periods, countries, and demographic groups. For high-income countries like the United States the sign appears to have reversed over time so that cigarettes appear to have switched from being a normal good to an inferior good (Wasserman et al. 1991; Cheng and Kenkel 2010). Across the world the prevalence of smoking tends to be higher in low- and middle-income countries than in high-income countries, but within low- and middle-income countries cigarettes still might be a normal good (Bobak et al. 2000; Peck 2011). In the Grossman (1972) model, the demand for a good like cigarettes is partly derived from the demand for health, so these patterns might reflect the relative income elasticities of the demand for smoking as a pleasurable activity versus the income elasticity of the demand for health. Alternatively, the empirical patterns might reflect endogeneity bias. Studies that estimate the income-elasticity of smoking typically treat income as exogenous but sometimes note their skepticism about this assumption. For example, after reporting its estimate that cigarettes are an inferior good, Colman and Remler (2008) immediately mentions possible omitted variable biases and admits that it might seem unlikely that smoking would really decline if income were exogenously increased. The focus of our paper is on the fundamental empirical question: Do the observed patterns reflect the causal impact of an exogenous increase of income on smoking?

The income-elasticity of cigarette demand also deserves more attention because of its policy relevance. The association between low-income and smoking in the United States is strong: In 2010, 33 percent of adults earning less than $15,000 per year smoked compared to only 11 percent of adults earning more than $50,000 per year.[2] If this association at least in part reflects causation, antipoverty programs could help reduce smoking and prevent smoking-related diseases. Knowing the impact of an exogenous increase of income on cigarette demand thus allows more complete policy analysis of antipoverty programs that takes into account smoking-related changes in health. The causal income-elasticity of cigarette demand is also related to policy concerns about disparities in health associated with socioeconomic status more broadly. In an influential paper in medical sociology and public health, Link and Phelan (1995) argues that social conditions are indeed the "fundamental causes of disease." The direct implication is that a wide range of policies from the minimum wage laws to Head

1. The 89 page chapter on the economics of smoking in the *Handbook of Health Economics* provides a three-sentence discussion of income-elasticity estimates (Chaloupka and Warner 2000), compared to a 19-page section on the role of price (pp. 1546–1565). Recent studies of the regressivity of cigarette taxes include Colman and Remler (2008) and Gospodinov and Irvine (2009).

2. Author calculations using the Behavioral Risk Factor Surveillance System (BRFSS) 2010 data.

Start programs intended to reduce socioeconomic disparities can also help reduce health disparities (Phelan, Link, and Tehranifar 2010). Of course, income differences are only one aspect of socioeconomic status, and as Deaton (2002) points out: "Quite different policies are called for to deal with health in relation to income, education, or social class." However, whether the focus is narrowly on income or more broadly on socioeconomic status, the policy implications hinge crucially on whether the observed associations with health-related behaviors like smoking are causal. An alternative explanation is that unobserved individual-level heterogeneity, such as differences in risk- and time-preference, might be the true underlying cause of the individual's income and smoking. Unless antipoverty programs also change these preferences, other public health policies will be needed to reduce smoking among the low-income population.[3]

Our study of the causal effect of income on smoking parallels research on the causal nature of the schooling-smoking gradient (Kenkel, Lillard, and Mathios 2006; Currie and Moretti 2003; de Walque 2007; Aizer and Stroud 2010), the schooling-health gradient more broadly (Cutler and Lleras-Muney 2010; Grossman 2006), and the income-health gradient (Deaton 2004). Our new estimates of the causal effects of income on smoking also complement research on the impact of the business cycle on health behaviors and outcomes (Ruhm 2005, 2000). Moreover, our estimates quantify the potential of income maintenance and antipoverty programs as policy tools to reduce smoking.

In order to identify the causal effect of income on smoking, we implement an instrumental variable identification strategy that exploits exogenous changes in income generated by changes in the parameters of federal and state EITC programs. Targeted at low-income working families, the EITC is the nation's second largest antipoverty program for the nonelderly, with federal expenditures of $57.9 billion and 25.9 million recipients in tax year 2009 (IRS 2011). Over our study time period (1993–2007), the federal government significantly expanded the EITC program. For example, the maximum federal EITC benefit available to taxpayers with two or more children increased in real terms from $1,678 in 1993 to $3,650 in 2007.[4] Over our study period a number of states also launched their own EITC programs, and many state programs adjusted their credits both upward and downward. As a result, the instrument we use — the state/year maximum value of EITC benefits — shows substantial variation. Our IV strategy is similar to the strategy employed by Schmeiser (2009, 2012) to examine the effect of income and the Supplemental Nutrition Assistance Program, respectively, on obesity.

Our IV estimates differ substantially from Ordinary Least Squares (OLS) estimates. Broadly similar to previous research, our OLS estimates suggest that smoking is inferior: The total elasticity of demand with respect to income is –0.078, and the income elasticity of smoking cessation is positive. In contrast, our IV estimates imply that smoking is a normal good: The total elasticity of cigarette demand with respect to income is 5.62, and the income elasticity of smoking cessation is negative. The direction of the changes in the coefficients supports the argument that OLS estimates of the ef-

3. Under the medical sociology theory that social conditions are the fundamental cause of disease, risk- and time-preference might be viewed as factors that mediate the link between lack of resources and unhealthy behaviors.

4. All figures used in our analysis are adjusted to 1997 constant dollars.

fect of income on smoking are substantially biased by the unobservable characteristics of higher-income smokers.

II. Background

To set the stage for our empirical study, it is useful to briefly go back to the basics of the standard model of consumer demand. One of the most basic comparative static exercises is the income expansion path and the related Engel curves that trace out how the consumption bundle changes as income increases (for example,Varian 1978, pp. 87–88). Under homothetic preferences the income expansion path is a straight line and all income-elasticities are unitary. Under more general preferences, the income expansion path can bend toward one good or another, or in the case of an inferior good, it can even bend backward. The comparative static exercise is a thought experiment about what we can learn about an individual's preferences by observing consumption choices at different incomes. In other words, the standard model focuses on the causal income-elasticity that shows how consumption changes in response to an exogenous change in income.

However, empirical demand studies do not typically use data that correspond to the thought experiment just described. Cross-sectional surveys, such as the CPS, provide data on the smoking behaviors of different consumers who have different levels of income. Heterogeneity makes it difficult to use these data to learn about an individual consumer's preferences for smoking at exogenously different income levels. For example, as mentioned above, higher-income consumers might tend to have different risk- and time-preferences, which play central roles in more complete models of health-related and addictive consumption (Grossman 1972; Becker and Murphy 1988). Higher-income individuals may associate a social stigma with smoking based on their peer groups whereas lower-income individuals are less likely to stigmatize smoking (Bell et al. 2010). This differential stigma by income may further bias the OLS estimates found in previous studies. Another possibility is that the smoking behaviors of different consumers who have different levels of income simply reflect differences in tastes for smoking as a pleasurable activity. Economic theory does not provide much guidance as to why tastes for smoking might vary with income so a priori it is hard to predict how this might bias estimates of the causal income-elasticity.

To the best of our knowledge, few previous empirical studies make serious efforts to control for individual heterogeneity or other sources of endogeneity bias when estimating the income-elasticity of smoking behaviors. The exceptions are three recent papers studying the effect of the EITC expansion on women's smoking behavior exclusively. The first, Averett and Wang (2013) uses a difference-in-difference-in-differences with fixed effects estimation procedure, exploiting variation in EITC credits of mothers with two and more than two children, before and after the 1993 EITC expansion, and amongst mothers with high and low education levels. Using the National Longitudinal Study of Youth 1979, it finds that the probability of smoking for mothers with two or more children declined relative to those with only one child. Second, Cowan and Tefft (2012) uses a difference-in-differences strategy before and after the 1993 EITC expansion with data from the Behavioral Risk Factor Surveillance System to show that the expansion decreased the likelihood of smoking for young, single, low-educated

women. Third, Hoynes, Miller, and Simon (2012) also employs a difference-in-differences strategy for two EITC expansions with data from the U.S. Vital Statistics to find that an increase in EITC income lowers the incidence of low birth weights for single, low-educated mothers. This operates largely through an increase in prenatal care and a decrease in smoking for low-educated mothers.

The following analysis differentiates itself from the previous work along four dimensions. First, this study uses an IV identification strategy to investigate the impact of income on smoking behaviors, exploiting intensive margin shifts in state-year EITC maximum payments. Second, we are the first to examine smoking behavior of all low-income individuals. Third, this paper explores three dependent variables: probability of cessation, propensity to smoke, and the number of cigarettes consumed, allowing us to estimate the elasticity of income for multiple smoking behaviors. Fourth, we are the first to document a causal relationship between income and smoking using the pairing of the Current Population Survey (CPS) Tobacco Use Supplement (TUS) and the CPS Annual Social and Economic Supplement (ASEC).

A. The Earned Income Tax Credit Program

To address potential endogeneity bias in estimates of the income-elasticity of smoking, we use an IV approach, where the EITC provides an exogenous source of variation in income. The EITC is a wage supplement program for low-income workers administered through the tax system. The EITC is the second largest antipoverty program for the nonelderly, having only recently been surpassed in annual expenditures by the Supplemental Nutrition Assistance Program (SNAP). The EITC functions as a wage supplement, accruing only to households with eligible labor earnings. The precise benefit amounts depend on earnings, marital status, and the number of eligible children in the tax unit. The program has three earnings ranges used to calculate benefits: the phase-in, plateau, and phase-out ranges. Total benefits rise at a fixed rate with additional wage earnings in the phase-in range of the credit. Once the maximum benefit amount is reached, benefits remain constant for wage earnings in the plateau region, and then decline at a fixed rate for earnings in the phase-out region until the benefit reaches a value of zero.

The benefit amount varies substantially by the number of eligible children in the tax unit, and the relative value of benefits by number of children has also varied substantially over the past 25 years. As the EITC has evolved, the schedules for families without children, families with one child, and families with two or more children have changed at different times. In addition to the federal EITC, 22 states and the District of Columbia provide their own supplemental EITC programs for tax year 2011. Their credits are set at a percentage of the federal EITC benefit and vary in their refundability. For example, New York State has a credit set at 30 percent of the federal EITC that is fully refundable. Thus a family earning the maximum federal benefit of $5,751 for tax year 2011 would also receive $1,725 from New York State.[5] Because the first state EITC supplement was implemented in 1986 these programs have been implemented in 24 states at varying times, with varying credits, and varying changes in the credit rate.

5. Values are 2011 nominal dollars.

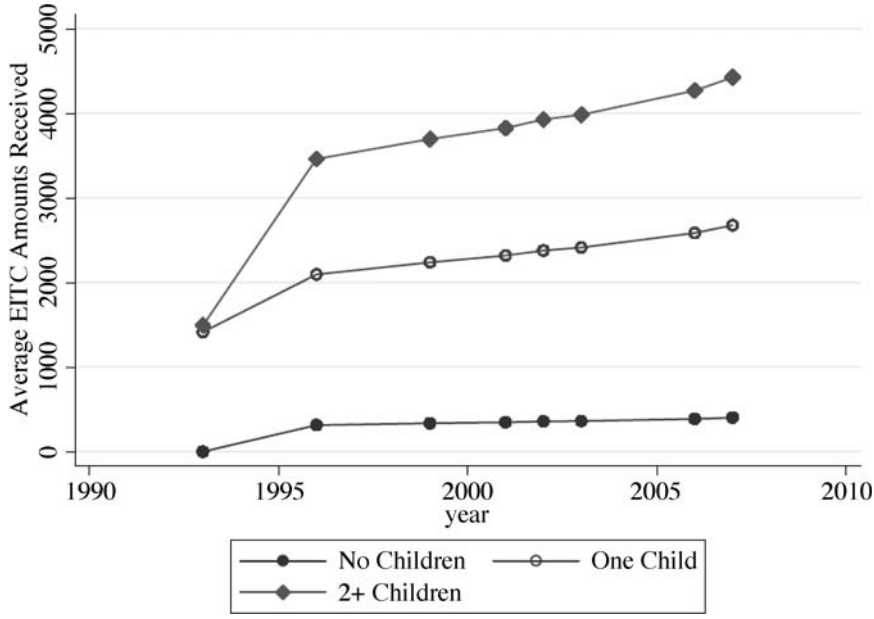

Figure 1
Average Maximum State/Federal EITC by Year and Number of Children

Figure 1 shows how the average real combined maximum of state and federal benefits by number of children varies over our study period.

Expansions of the state and federal EITC provide a plausibly exogenous source of variation in income through their effect on labor supply incentives and have been used in previous studies as instruments for income and program participation (Schmeiser 2009, 2012). The theoretical effect of the EITC on the decision to work for unmarried individuals is unambiguously positive. For married women, the effect of the EITC on their decision to enter or exit the labor force is more ambiguous given the interaction with their husband's labor supply. For those already in the labor force, the theoretical effect of the EITC on hours worked depends on the region of the EITC into which the worker's labor earnings place them. The three distinct credit regions of the federal EITC program—the phase-in, plateau, and phase-out—each yield their own labor supply incentives for workers already in the labor force. In the phase-in region the EITC supplements wages, so as long as the substitution effect from higher effective wages dominates the income effect, people will desire to increase hours worked. In the plateau region the EITC simply increases income without altering the wage rate and thus only the income effect exists, resulting in a desire to reduce hours worked. In the phase-out region of the EITC both the income and substitution effect induce workers to desire fewer hours as the credit is reduced for every additional dollar of labor earnings.

The different regions of the EITC, with their differential effects on desired hours of

work, raise the theoretical possibility that the use of the EITC as an instrument violates the monotonicity assumption required of an IV. With a sufficiently high elasticity of labor supply and the ability to choose the number of hours worked, it is possible that an expansion of the EITC could actually reduce overall income. For example, an individual who becomes eligible for the EITC through an expansion of the credit and is in the phase-out range could potentially be induced to reduce hours sufficiently to reduce their total income. However, the empirical research into the effect of the EITC on labor supply provides little evidence that the credit has much effect on the intensive margin of labor supply (hours worked) and no evidence of an elasticity of labor supply sufficiently high to induce a reduction in overall income.[6]

A wide range of studies that have evaluated past EITC expansions using a variety of econometric techniques concludes that the credit is an effective means of increasing the labor supply and thus the income of low-wage workers (Liebman 1998; Eissa and Liebman 1996; Meyer and Rosenbaum 2001; Hotz and Scholz 2006). The majority of these studies finds that the effect of the EITC on income is driven by changes along the extensive margin (individuals entering or exiting the labor market), with large increases in the labor force participation of single women with children. However, there is some evidence that the EITC reduces participation by married women (Eissa and Hoynes 2006). The EITC has also been found in some studies to generate variation in labor supply at the intensive margin (number of hours worked by those currently in the labor force). For example, Eissa and Hoynes (2006) finds a modest 1–4 percent reduction in annual hours worked amongst married women. However, it finds no evidence of a reduction in hours for single women, even those in the phase-out region of the credit. Eissa and Liebman (1996) finds that the 1986 EITC expansion resulted in a small increase in the hours worked for single women already in the labor force. When the effect on hours worked is dissagregated by region of the EITC, it finds no reduction in hours worked for women in the phase-out region. When individuals have greater control over their hours worked and total earnings, there is more evidence of responsiveness: Saez (2009) finds bunching at the first EITC kink-point by the self-employed. As with all IVs, our results represent a local average treatment effect (LATE) specific to these low-income families that respond to the EITC.

III. Data

We use data from multiple waves of the Current Population Survey (CPS) Tobacco Use Supplement (TUS), which we then match to the CPS Annual Social and Economic Supplement (ASEC). The TUS contains detailed information on current and previous year smoking status, smoking cessation, and tobacco consumption. The ASEC contains detailed information on income, employment, and family demographics. This gives us the ability to both include specifics of individuals' smoking behavior and specific information regarding all individuals' incomes and demographics in determining how income affects smoking decisions. Additionally, we construct a database of average cigarette prices by state and year from Orzechowski and Walker's

6. See Eissa and Hoynes (2006) for a summary of findings on changes in hours worked in response to the EITC and a detailed discussion of possible explanations for the limited change along the intensive margin.

The Tax Burden on Tobacco: Historical Compilation (2006). To create our IV, we use information from the University of Kentucky's Center for Poverty Research on state and federal maximum EITC benefits for families with zero, one, or two or more children (University of Kentucky Center for Poverty Research 2011).[7] We use state and year variation in EITC benefits by number of children as our instrumental variable for income. We match the appropriate maximum benefit value to the individuals in our sample by state of residence, survey year, and the number of own children in their family. We further recognize that by using the EITC as an instrument, we look specifically at transitory income, and thus are limited to estimating short-run income elasticities.

Pairing TUS and ASEC data gives us eight years of repeated cross sections, covering all 50 states and the District of Columbia for the following years: 1993, 1996, 1999, 2001, 2002, 2003, 2006, and 2007. In order to obtain respondents from this vast geography across the United States, the CPS oversamples individuals in small states. In addition, there are systematic differences in response rates amongst different populations. Thus, we use sample weights throughout our study in order to control for the complex sampling and stratification used in the collection of the CPS data.

Because the EITC is only a useful IV for potentially eligible individuals, we limit our sample to low-income adults, defined as adults who have a family income under $45,000 in 2011 dollars. This value is just beyond the end of the EITC phase-out region for families with two or more eligible children.[8] Because our sample is restricted to adults, we focus on smoking participation, the number of cigarettes smoked per day conditional upon participation, and cessation but not smoking initiation because most individuals who are smokers start smoking by age 21 (DeCicca, Kenkel, and Mathios 2008). Moreover, since additional benefit programs exist for retirees, and their health incentives and behaviors may differ from younger persons, we restrict the sample to those individuals less than 60 years of age.

Table 1 shows the trends over our study period for our dependent variables smoking participation, daily cigarette consumption, and cessation using the weighted sample. The first variable, smoker, indicates whether or not any individual sampled ever smoked in the given year. This includes casual and infrequent smokers as well as daily smokers. Over our study period, the probability that anyone smoked in a given year ranges between 26.8 and 33.1 percent. Limiting the sample to only those who smoked in a given year, the average number of cigarettes smoked decreased steadily from more than 16 cigarettes per day in 1993 to just more than 13 cigarettes per day in 2007. The probability that a daily smoker quit ranged from about 6.5 to 9.5 percent a year. There is a spike in the cessation rate in 1999, which we speculate might be related to the nicotine patch becoming available over-the-counter (Avery et al. 2007), or the antismoking publicity and price hike associated with the 1998 Master Settlement Agreement between the tobacco industry and the states.[9]

Table 2 displays the sample-weighted descriptive statistics for the control variables used in the analysis, which account for race, gender, age, marital status, education, and

7. These data can be downloaded at: http://www.ukcpr.org/AvailableData.aspx.
8. We account for inflation and index all estimates to 1997 dollars for our analysis.
9. Levy and Meara (2006) finds that the Master Settlement Agreement had a relatively small effect on smoking although their results are specific to women smoking during pregnancy.

Table 1
Summary Statistics of Smoking Variables, by Year

	1993	1996	1999	2001	2002	2003	2006	2007
Smoker	0.331	0.318	0.305	0.297	0.292	0.276	0.275	0.268
	(0.471)	(0.466)	(0.461)	(0.457)	(0.455)	(0.447)	(0.447)	(0.443)
N	23929	19278	17398	3689	15777	21157	8537	9097
Daily	16.44	16.37	15.11	15.53	14.53	14.16	14.12	13.14
consumption	(11.55)	(11.73)	(11.60)	(11.71)	(10.80)	(10.81)	(10.77)	(10.76)
N	8214	6425	5670	1140	4939	6178	2472	2723
Cessation	0.0724	0.0741	0.0950	0.0650	0.0773	0.0760	0.0669	0.0908
	(0.259)	(0.262)	(0.293)	(0.247)	(0.267)	(0.265)	(0.250)	(0.287)
N	8214	6425	5670	1140	4939	6178	2472	2723

Notes: Mean of each variable with standard deviation in parentheses. Smoker is whether or not you smoked ever in the last year. Daily consumption is average number of cigarettes smoked per day by a smoker. Cessation is 1 if a smoker in the previous year quit in the current year.

the number of young children in the household. In addition to showing the demographics for the individuals in the data set as a whole, we disaggregate the data by income group—the lowest tercile, the middle tercile, and those with incomes in the top tercile of the income distribution *within our sample*—in order to observe the differences in what we call "low," "middle," and "high" income.[10] We see that within the sample, higher-income individuals are less likely to have a female head of household and less likely be a minority household than lower-income households. At the same time, these higher-income households are more educated and more likely to have a married head of the household. There are no systematic differences by whether or not a household has a child younger than age six, though we do see that the higher-income group is less likely to have multiple children younger than age six. On average, the highest income tercile receives the highest amount of EITC benefits.[11] This distribution of likely EITC eligibility in our sample suggests that those affected by our IV are likely to fall into the phase-in region of the EITC, where higher benefits result in increased labor force participation and additional hours worked amongst eligible individuals. We provide further analysis of the labor supply response to changes in the maximum EITC benefits within our sample below.

In Table 3, we present the averages of the dependent variables based on these three income groups.[12] Amongst the low-income families that comprise our sample, those with the lowest income have the highest probability of smoking and the lowest probability of cessation when compared to the other two income groups. Table 3 thus shows that the correlation between income and cessation is positive even when restricting

10. In the CPS-ASEC, the specific question regarding income is: "How much did (name/you) earn from employment before taxes and other deductions (last calendar year)?" This is intended to be pretax/transfer income and should *not* include the EITC payments received.
11. The EITC variable is measured by our IV, which represents the maximum of state/federal EITC credit for the number of children in the household in the given state of residence.
12. We again provide these descriptive statistics using sample weights.

Table 2
Descriptive Statistics

	All Income Groups	Low Income	Middle Income	High Income
Family income ($1997)	24094.2	10418.5	24696.0	37883.3
	(11973.0)	(4854.6)	(3736.3)	(4000.3)
Maximum federal/state EITC ($1997)	3038.5	2954.6	2966.9	3201.0
	(2863.5)	(2836.0)	(2848.3)	(2901.1)
Real cigarettes price	0.113	0.113	0.114	0.113
	(0.0223)	(0.0223)	(0.0223)	(0.0222)
Female	0.535	0.592	0.513	0.499
	(0.499)	(0.491)	(0.500)	(0.500)
Minority	0.216	0.282	0.199	0.164
	(0.411)	(0.450)	(0.399)	(0.370)
Child younger than six	0.154	0.160	0.148	0.154
	(0.361)	(0.366)	(0.355)	(0.361)
Multiple children younger than six	0.0712	0.0772	0.0695	0.0667
	(0.257)	(0.267)	(0.254)	(0.250)
Age	37.25	36.32	37.00	38.50
	(10.72)	(11.24)	(10.53)	(10.23)
Married	0.454	0.273	0.467	0.631
	(0.498)	(0.446)	(0.499)	(0.483)
Year	1997.5	1997.4	1997.5	1997.4
	(1.530)	(1.529)	(1.529)	(1.530)
High school	0.378	0.358	0.387	0.390
	(0.485)	(0.479)	(0.487)	(0.488)
College	0.426	0.344	0.440	0.499
	(0.495)	(0.475)	(0.496)	(0.500)
Observations	118,862	39,670	39,633	39,559

Notes: Means reported, standard deviations in parentheses. Data restricted to families with < $45,000 annual income. Low Income is bottom tercile; Middle is middle tercile; High is top tercile.

the sample to those with income below $45,000 per year. However, we do see that the higher income groups have a higher average daily consumption of cigarettes.

IV. Methods

As discussed above, the relationship between income and smoking may be endogenous. In order to identify the causal effect of income on smoking, we implement an instrumental variable identification strategy. Specifically, we estimate an equation of the form:

Table 3
Summary Statistics of Smoking Variables, by Income Bracket

	Low Income	Middle Income	High Income
Smoker	0.356	0.306	0.272
	(0.479)	(0.461)	(0.445)
N	39670	39633	39559
Daily Consumption	15.35	15.89	16.19
	(11.73)	(11.73)	(11.55)
N	14795	12340	10626
Cessation	0.0808	0.0832	0.0900
	(0.273)	(0.276)	(0.286)
N	14795	12340	10626

Notes: Mean of each variable reported with standard deviation in parentheses. Low Income is bottom tercile; Middle is middle tercile; High is top tercile. Smoker is whether or not you smoked ever in the last year. Daily consumption is average number of cigarettes smoked per day by a smoker. Cessation is 1 if a smoker in the previous year quit in the current year.

$$(1) \quad S_{ist} = \alpha + \beta X_{ist} + \gamma INC_{ist} + \mu P_{st} + \delta t + \sigma_s + \varepsilon_{it},$$

where S_{ist} is a dependent variable that explains individual smoking decisions. X_{ist} contains observable individual, state, and time covariates such as socioeconomic status, ethnicity, marital status, education, and other important demographics. In our baseline OLS models, we use INC_{ist} to capture the family income of individual i at time t, indexed to 1997 dollars. We take the log of income to address the skewness. To address the endogeneity of income and smoking we use the maximum EITC benefit amount as an instrument in the first stage of our two-staged least squares specification. Equation 1 also contains the real price of cigarettes in each state and year, P_{st}. In addition, we include a linear time trend, as well as state level fixed effects, σ_s, to capture any time-invariant state level unobservables that may affect income and smoking behavior simultaneously. We are careful to again weight all of our observations in order to provide estimates that are nationally representative and account for the complex survey design of the CPS.[13]

While unobserved state-level characteristics may influence smoking behavior, these characteristics may not be correlated with individual-level income. These state-level unobservables are even less likely to drive the variation in individual level income created by cross-state and cross-year variation in the EITC. We therefore provide estimates where we remove the state fixed effects and instead include the measure of state antismoking sentiment from DeCicca et al. (2008) to control for state-level variation in public attitudes about smoking, where this variable varies across states and within a state over time. By removing the state fixed effects we are able to exploit the cross-state variation in the maximum value of EITC benefits rather than simply relying on within-state variation in maximum EITC benefits.

13. Our results are robust to not using the sample weights both qualitatively and in terms of statistical significance.

We focus on three different dependent variables to characterize smoking behavior: whether or not an individual has smoked in the last year, cessation, and average daily consumption of cigarettes. Smoking participation and cessation are both binary variables. Cessation is conditional on the individual being a daily smoker in the last year. The number of cigarettes is treated as a continuous variable, as it ranges from one to 99 per day, with a mean of 16.5 cigarettes (a little less than a pack a day) for smokers. When using the number of cigarettes as a dependent variable, we limit the sample to smokers, and we take the natural log of this variable in our analysis. Given the inclusion of state and year fixed effects in most of our models, as well as the continuous nature of our dependent variable in the first stage of our IV model, we estimate Equation 1 as a Linear Probability Model (LPM) for ease of calculation and interpretation (Angrist and Pischke 2008).[14,15] While the elasticity is easily defined for the log-log specification regarding the number of cigarettes, we calculate the income elasticity for the remaining specifications as $\varepsilon_{inc} = \gamma/\bar{s}$, where $\bar{s}$ is alternatively the average rate of smoking in the sample and the average cessation rate.[16]

V. Results

As a baseline, we first estimate the standard naïve OLS specification for the effect of family income on smoking, where income is assumed to be econometrically exogenous.[17] The models include controls for minority, age, gender, education (high school graduate or attended college at some point, or no high school degree), marital status, and number of children younger than six, as well as a linear time trend. Table 4 reports the coefficient estimates from the standard OLS specification with state fixed effects in Columns 1–3 and without state fixed effects, but controlling for the state antismoking sentiment (SASS) in Columns 4–6. The second to last row of Table 4 shows the income elasticity calculated from the coefficient on family income. The three columns for each of the two groups in Table 4 correspond to the dependent variables: current smoking status; the log of the number of cigarettes smoked per day conditional on being a smoker; and smoking cessation, conditional on smoking the previous year.

The coefficient estimate on income presented in Column 1 indicates that increases in an individual's income are associated with a decreased probability of being a smoker.

14. The qualitative results and statistical significance are robust to using an instrumental variable probit specification instead of the linear probability model with our two dependent binary variables. These are included in the Appendix. Because the daily consumption dependent variable is approximately normally distributed, we only run a least squares specification for this variable.

15. We find that in all specifications nearly every within sample prediction from the linear probability models fall between 0 and 1, validating the model selection.

16. The calculation is as follows:

$$(2)\quad \varepsilon = \frac{\partial s/s}{\partial inc/inc} = \frac{\partial s}{\partial inc}\frac{inc}{s},\ \text{where}\ \frac{\partial s}{\partial inc} = \frac{\gamma}{inc},\ \text{leaving us with}\ \varepsilon = \frac{\gamma}{\bar{s}}.$$

17. We additionally estimate logit and probit specifications for our two dependent binary variables to ensure that the functional form is not driving the results. The marginal effects and statistical significance are substantively similar in these specifications. The logit results comparable to the OLS specification, and the results from an IV probit comparable to the 2SLS specification are included in the Appendix.

Table 4
OLS Results

	State Fixed Effects			Without State Fixed Effects		
	Smoker 1	Log(Number Cigarettes) 2	Cessation 3	Smoker 4	Log(Number Cigarettes) 5	Cessation 6
Log(family income)	–0.0236***	0.0001	0.0040***	–0.0237***	0.0010	0.0046***
	(0.001)	(0.006)	(0.001)	(0.001)	(0.006)	(0.001)
Real cigarette price	0.9895***	–1.6141	0.7215**	0.9011***	–1.0101**	0.0282
	(0.325)	(1.447)	(0.358)	(0.113)	(0.491)	(0.121)
Female	–0.0731***	–0.1116***	0.0019	–0.0732***	–0.1055***	0.0019
	(0.003)	(0.012)	(0.003)	(0.003)	(0.012)	(0.003)
Minority	–0.0763***	–0.4060***	–0.0003	–0.0808***	–0.3925***	–0.0037
	(0.003)	(0.016)	(0.004)	(0.003)	(0.015)	(0.004)
Child younger than six	–0.0038	–0.1024***	–0.0110**	–0.0050	–0.1132***	–0.0116**
	(0.004)	(0.018)	(0.004)	(0.004)	(0.018)	(0.004)
Multiple children younger than six	–0.0189***	–0.0655**	–0.0135**	–0.0183***	–0.0723***	–0.0145**
	(0.006)	(0.026)	(0.006)	(0.006)	(0.026)	(0.006)
Age	0.0007***	0.0170***	–0.0019***	0.0007***	0.0172***	–0.0019***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Married	–0.0705***	0.0291**	0.0032	–0.0700***	0.0291**	0.0023
	(0.003)	(0.013)	(0.003)	(0.003)	(0.013)	(0.003)

Year	–0.0146***	–0.0113	–0.0014	–0.0052***	0.0189***	0.0039***
	(0.004)	(0.016)	(0.004)	(0.001)	(0.006)	(0.002)
High school	–0.0324***	0.0864***	0.0025	–0.0287***	0.0940***	0.0041
	(0.004)	(0.015)	(0.004)	(0.004)	(0.015)	(0.004)
College	–0.1268***	–0.1203***	0.0261***	–0.1237***	–0.1222***	0.0273***
	(0.004)	(0.016)	(0.004)	(0.004)	(0.016)	(0.004)
State antismoking sentiment index				–0.2776***	–1.2293***	0.0746***
				(0.009)	(0.043)	(0.011)
Income elasticity	–0.0782***	0.000148	0.0514***	–0.0785***	0.00100	0.0594***
	(0.00494)	(0.00603)	(0.0193)	(0.00494)	(0.00604)	(0.0193)
Observations	118862	36569	37761	118862	36569	37761
Number of groups	51	51	51			

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Columns 1–3 include state level fixed effects.
Cigarette Price is average state level price per cigarette in 1997 dollars. Smoker is whether or not you smoked ever in the last year.
Number Cigarettes is the average number of cigarettes smoked per day by a smoker. Cessation is 1 if a smoker in the previous year quit in the current year.

If we naïvely interpret this as a causal income elasticity, as shown at the bottom of Column 1, we obtain an income elasticity estimate of –0.078 for being a smoker, significant at the 1 percent level. The estimated income elasticity of the number of cigarettes smoked per day conditional on being a smoker is extremely small and statistically indistinguishable from zero. The total elasticity of the demand for cigarettes with respect to income is the sum of the participation elasticity from Column 1 and the conditional demand elasticity from Column 2, which in this case is effectively just the participation elasticity of –0.078. In Column 3, the positive coefficient indicates that the income elasticity of smoking cessation is positive, meaning that an increase in income is associated with an increase the probability that an individual will quit smoking. The estimated income elasticity of cessation is 0.051, significant at the 1 percent level.

Next, in Columns 4–6 of Table 4 we present the estimates where we drop the state fixed effects and instead include the DeCicca et al. (2008) measure of state antismoking sentiment.[18] The coefficient estimates on income for each specification are very similar to those estimated with fixed effects, and the statistical significance remains consistent as well. In Column 4 income elasticity for being a smoker is –0.079, significant at the 1 percent level. The estimated income elasticity of the number of cigarettes smoked per day conditional on being a smoker presented in Column 5 is again statistically indistinguishable from zero, but has increased in magnitude ten times to 0.001. Lastly, in Column 6, the estimate for the income elasticity of smoking cessation is effectively identical to that found in Column 3.[19] Although not the focus of this paper, broadly in line with previous estimates, we also find that higher prices reduce smoking participation and increase smoking cessation.

Our baseline results are broadly in line with previous estimates suggesting that smoking is an inferior good in the United States over our sample time period. For example, Colman and Remler (2008) estimates that the elasticity of smoking participation with respect to income is –0.18 and the conditional elasticity is –0.02, for a total elasticity of –0.2.[20]

In our preferred specification, we treat income as an endogenous determinant of smoking. We instrument for income using the maximum value of federal and state EITC benefits. Before turning to our new estimates of the causal income elasticity, it is important to consider evidence on the strength and validity of our IV. In Table 5, we report the first-stage results and all the *F*-statistics. The samples differ across the various first-stage estimates, corresponding to the different dependent variables used in the second stage. The *F*-statistics in the first stage of the IV exceed the Stock and Yogo (2002) 10 percent critical value in Columns 1, 2, 4, and 5. In the sample restricted to individuals who self-identified as smokers in the last year, the *F*-statistics are somewhat lower, closer to 8.4. A standard rule of thumb for detecting weak IVs is that the

18. Our results remain consistent if we exclude both the SASS variable and state fixed effects. These are available upon request.

19. DeCicca, Kenkel, and Mathios (2008) discusses the relationship between the elasticity of smoking participation and the elasticities of cessation and initiation.

20. The Colman and Remler (2008) estimate is derived from a sample covering the full range of income as opposed to just those earning less than $45,000 per year as done here. Our somewhat smaller baseline elasticity of –0.078 may suggest that the income-smoking gradient is stronger at high incomes, so in our sample with a more restricted range of incomes the average association with income is weaker.

Table 5
IV Results Stage 1

	State Fixed Effects			Without State Fixed Effects		
Dependent Variable: Log(Family Income (000s)) Sample	Smoker 1	Log(Number Cigarettes) 2	Cessation 3	Smoker 4	Log(Number Cigarettes) 5	Cessation 6
Maximum federal/state EITC	0.00523*** (0.0012)	0.00922*** (0.0023)	0.00663*** (0.0023)	0.00478*** (0.0012)	0.00970*** (0.0023)	0.00666*** (0.0023)
Real cigarette price	–1.03241 (0.6318)	–1.16028 (1.2565)	–0.54148 (1.2309)	0.04312 (0.2193)	0.28410 (0.4251)	0.28861 (0.4159)
Female	–0.12374*** (0.0052)	–0.11266*** (0.0103)	–0.11202*** (0.0100)	–0.12482*** (0.0052)	–0.11737*** (0.0103)	–0.11532*** (0.0100)
High school	0.35483*** (0.0072)	0.31271*** (0.0131)	0.31440*** (0.0128)	0.36270*** (0.0072)	0.32319*** (0.0130)	0.32516*** (0.0127)
Minority	–0.18449*** (0.0065)	–0.25138*** (0.0136)	–0.22778*** (0.0133)	–0.17976*** (0.0063)	–0.25008*** (0.0132)	–0.22873*** (0.0129)
Age	0.00281*** (0.0003)	0.00199*** (0.0005)	0.00223*** (0.0005)	0.00285*** (0.0003)	0.00211*** (0.0005)	0.00226*** (0.0005)
Child younger than six	–0.15241*** (0.0086)	–0.17797*** (0.0172)	–0.16210*** (0.0169)	–0.15459*** (0.0086)	–0.18180*** (0.0173)	–0.16619*** (0.0170)
Multiple children younger than six	–0.22787*** (0.0119)	–0.24695*** (0.0245)	–0.25900*** (0.0241)	–0.22719*** (0.0119)	–0.25368*** (0.0245)	–0.26397*** (0.0242)
Married	0.52601*** (0.0058)	0.61772*** (0.0115)	0.61425*** (0.0112)	0.52059*** (0.0058)	0.60722*** (0.0115)	0.60445*** (0.0112)
Year	0.02523*** (0.0073)	0.02267 (0.0143)	0.01567 (0.0140)	0.01378*** (0.0028)	0.00833 (0.0054)	0.00722 (0.0052)
College	0.52622*** (0.0072)	0.48318*** (0.0137)	0.48095*** (0.0134)	0.53202*** (0.0071)	0.49255*** (0.0137)	0.48981*** (0.0134)
State antismoking sentiment index				–0.02075 (0.0183)	–0.07393** (0.0374)	–0.05117 (0.0365)
Total observations	118862	36569	37761	118862	36569	37761
F statistic for weak identification	19.11	15.49	8.383	15.99	17.15	8.450

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Columns 1–3 include state level fixed effects.
Cigarette Price is average state level price per cigarette in 1997 dollars. Smoker is whether or not you smoked ever in the last year.
Number Cigarettes is the average number of cigarettes smoked per day by a smoker. Cessation is 1 if a smoker in the previous year quit in the current year.

first-stage *F*-statistic should exceed 10. Given evidence of a border-line weak IV in some specifications, we choose a just-identified specification as an approach to address any potential weak IV problem. This choice is consistent with Angrist and Pischke's recommendation: "Just-identified IV is median unbiased and therefore unlikely subject to a weak instruments critique" (Angrist and Pischke 2008). The sign of the coefficient on the IV is in the expected positive direction and suggests that a higher EITC tends to increase family income. The magnitude of the EITC effect on income is small. This is not unexpected because the EITC effect on income is through labor supply.[21]

To further corroborate the validity of our first-stage results, we estimate an auxiliary regression of the effect of our IV on labor force participation. This allows us to test whether we see the same extensive margin response to changes in the state and federal maximum EITC as found in previous literature. The results presented in Table 6 show that with both state fixed effects (exploiting within state, cross-year variation) and without state fixed effects (exploiting cross-state and cross-year variation), an increase in the maximum EITC benefit amount increases an individual's probability of labor force participation. We expect that some of our identification will come from individuals who work more hours in response to changes in the EITC schedule, but the majority of the first stage identification will come from an extensive margin response to the EITC.

We note that our specification assumes that labor force participation only affects cigarette demand through its effect on income. That is, using the EITC as an IV we are unable to separately identify an income effect versus a labor force participation effect on cigarette demand. Our results could therefore be interpreted as an estimate of the combination of the income effect and the labor force participation effect to the extent that labor force participation affects cigarette demand. Labor force participation might have an independent effect on cigarette demand if, for example, it exposes the smoker to a worksite smoking ban or otherwise limits their ability to smoke, and the reduction in smoking during work is not offset by an increase in smoking when not at work. Although the main goal of a worksite smoking ban is to reduce secondhand smoke, some studies suggest that they also reduce cigarette demand (Evans, Farrelly, and Montgomery 1999). Thus our IV estimate might somewhat understate the income elasticity of demand for cigarettes if increased labor supply reduces cigarette consumption.

Table 7 presents the second stage IV estimates of the impact of income on smoking. In sharp contrast with the OLS results in Table 4, the IV estimates imply that smoking is a normal good. In Column 1 additional income is estimated to increase the probability of being a smoker, with an income elasticity of 3.58, significant at the 1 percent level. In Column 2, income also has a positive effect on the log number of cigarettes smoked daily and is now significant at the 1 percent level. The total elasticity of demand with respect to income (the sum of the participation elasticity and the conditional demand elasticity) is now estimated to be 5.62, so in standard terminology smoking is not only a normal good but is also a luxury good, at least in our low-income sample. Consistent with smoking being a normal good, in Column 3 we estimate that the income elasticity of smoking cessation is negative and statistically significant.

We again estimate the IV without state fixed effects and controlling for the SASS.

21. Our measure of family income is pretax and thus should not directly include the dollar value of the EITC.

Table 6
Labor Force Participation and the EITC

Dependent Variable: Labor Force Participation, Where 1=Employed	State Fixed Effects	Without State Fixed Effects
Maximum federal/state EITC	0.00527***	0.00501***
	(0.000579)	(0.000579)
Real cigarette price	0.255	–1.225***
	(0.305)	(0.106)
Female	–0.143***	–0.144***
	(0.00252)	(0.00253)
Minority	–0.0628***	–0.0655***
	(0.00316)	(0.00306)
Child younger than six	–0.0649***	–0.0661***
	(0.00417)	(0.00418)
Multiple children younger than six	–0.152***	–0.152***
	(0.00576)	(0.00577)
Age	–0.00411***	–0.00422***
	(0.000128)	(0.000128)
Married	–0.0321***	–0.0315***
	(0.00281)	(0.00281)
Year	0.00760**	0.0237***
	(0.00351)	(0.00134)
High school	0.162***	0.166***
	(0.00349)	(0.00348)
College	0.224***	0.228***
	(0.00347)	(0.00346)
State antismoking sentiment index		0.0182**
		(0.00885)
Observations	118,862	118,862
Number of groups	51	

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Excluded groups are: unmarried, white, no children younger than six. Column 1 includes state level fixed effects.

These results are presented in Columns 4–6 of Table 7. Each of these estimates and their statistical significance are similar to those found when state fixed effects are included. In Column 4 we estimate the income elasticity of being a smoker to be 3.80, significant at the 1 percent level. In Column 5, we again find that income has a positive effect on the number of cigarettes consumed, although the estimated elasticity is somewhat smaller at 1.90, statistically significant at the 1 percent level. The total elasticity of demand with respect to income is 5.70, which is extremely close to the 5.62 found in the fixed effects specification. Lastly, in Column 6 we again find that

Table 7
IV Results Stage 2

	State Fixed Effects			Without State Fixed Effects		
	Smoker 1	Log(Number Cigarettes) 2	Cessation 3	Smoker 4	Log(Number Cigarettes) 5	Cessation 6
Log(family income)	1.0812***	2.0414***	–0.8297***	1.1483***	1.8951***	–0.8266***
	(0.279)	(0.596)	(0.305)	(0.320)	(0.536)	(0.303)
Real cigarette price	2.2352***	1.0959	0.1790	0.8717***	–1.4500	0.2418
	(0.831)	(3.048)	(1.104)	(0.281)	(0.951)	(0.374)
Female	0.0600*	0.1033	–0.0872***	0.0696*	0.1021	–0.0897***
	(0.034)	(0.067)	(0.034)	(0.040)	(0.063)	(0.034)
High school	–0.4232***	–0.5493***	0.2639***	–0.4526***	–0.5158***	0.2737***
	(0.099)	(0.188)	(0.096)	(0.116)	(0.175)	(0.099)
Minority	0.1255**	0.1015	–0.1887***	0.1282**	0.0760	–0.1924***
	(0.052)	(0.151)	(0.070)	(0.058)	(0.136)	(0.070)
Age	–0.0023***	0.0135***	–0.0002	–0.0026***	0.0137***	–0.0002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)

Child younger than six	0.1468***	0.2048**	–0.1293***	0.1589***	0.1763**	–0.1328***
	(0.039)	(0.097)	(0.045)	(0.046)	(0.089)	(0.046)
Multiple children younger than six	0.2076***	0.3587***	–0.2056***	0.2234***	0.3302***	–0.2100***
	(0.059)	(0.134)	(0.073)	(0.067)	(0.124)	(0.074)
Married	–0.6589***	–1.2573***	0.5225***	–0.6872***	–1.1458***	0.5120***
	(0.149)	(0.376)	(0.190)	(0.169)	(0.333)	(0.186)
Year	–0.0438***	–0.0614*	0.0127	–0.0215***	0.0022	0.0101**
	(0.012)	(0.036)	(0.013)	(0.006)	(0.013)	(0.005)
College	–0.7054***	–1.0994***	0.4249***	–0.7445***	–1.0482***	0.4323***
	(0.146)	(0.287)	(0.146)	(0.170)	(0.264)	(0.148)
State antismoking sentiment index				–0.2556***	–1.0972***	0.0342
				(0.024)	(0.091)	(0.035)
Income elasticity	3.579***	2.041***	–10.71***	3.801***	1.895***	–10.672***
	(0.923)	(0.596)	(3.937)	(1.059)	(0.536)	(3.910)
Observations	118862	36569	37761	118862	36569	37761
Number of groups	51	51	51			

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Columns 1–3 include state level fixed effects.
Cigarette Price is average state level price per cigarette in 1997 dollars. Smoker is whether or not you smoked ever in the last year.
Number Cigarettes is the average number of cigarettes smoked per day by a smoker. Cessation is 1 if a smoker in the previous year quit in the current year.

the income elasticity of smoking cessation is negative and similar in magnitude and statistical significance to Column 3.

To judge the plausibility of the elasticity of demand for cigarettes generated from our IV estimates we calculate the implied marginal propensity to consume (MPC) from an additional dollar of income. The average smoker in our sample has a family income of $22,532.87 in 1997 dollars and consumes 16.5 cigarettes per day at a cost of $0.113 per cigarette. This yields total annual expenditures on cigarettes of $680.54, or 3.02 percent of family income. Using a conditional demand elasticity of 2.041 from our model with state fixed effects, the higher of our elasticity estimates, a 10 percent increase in income ($2,253.29) would yield a 20.41 percent increase in cigarette consumption amongst smokers, or 3.37 additional cigarettes per day. The average smoker would then spend $139.00 more per year on cigarettes (3.37 * $0.113 * 365) out of their additional $2,253.29 in income for a MPC of 0.061, or 6¢ cents per additional dollar of income. We believe that a smoker spending 6¢ of any additional dollar earned on cigarettes is a perfectly reasonable estimate, particularly given that smoking consumes 3 percent of the average smoker's family income.

There is a significant body of literature demonstrating that education is endogenous with respect to smoking intensity (Bratti and Miranda 2010) and smoking status (Kenkel, Lillard, and Mathios 2006; de Walque 2007; Tenn, Herman, and Wendling 2010). Although simultaneously addressing the endogeneity of both income and education to smoking behavior is beyond the scope of this paper, we are sensitive to the possibility that there may be some interaction between the unobserved correlates of income, educational attainment, and smoking behaviors. While we see no reason why the potential endogeneity of education would bias the estimates from our IV specification, we nonetheless reestimate our models on a sample restricted to the educationally homogenous group of individuals who are high school graduates only. Doing so, we find results highly comparable to those found for the full sample, with our IV coefficients on income not statistically different at the 5 percent level. The one exception occurs with the average daily consumption dependent variable, where we no longer find a statistically significant effect, and the magnitude of the income elasticity (0.47) is smaller than that of the full sample (2.1). We attribute this difference to a heterogeneous treatment effect for this homogenous sample, as well as a lack of power resulting from cutting the sample in half. These results are available upon request.

Across our various specifications, the differences between the OLS and IV results are in the expected direction and suggest that the OLS estimates are biased downward by unobservable heterogeneity associated with higher incomes. As in the income-health and schooling-health gradients, the bias might reflect systematic differences in time- and risk-preferences, differences in social networks or other factors.

VI. Conclusions

In this paper we examine the relationship between income and smoking, focusing on the potential endogeneity of income. While our baseline OLS results are consistent with previous estimates that smoking is now an inferior good in the U.S., our IV results imply that smoking is a normal or even a luxury good. Our results are partly consistent with Ruhm (2005), which finds that smoking declines during

temporary economic downturns and increases during economic expansions. However, Ruhm suggests that this might mainly reflect changes in nonmarket time available for healthy lifestyle investments. Although virtually any IV can be criticized, we believe that our IV based on the EITC is plausibly exogenous, and our first-stage results show no signs of a weak IV problem for the full sample. We also note that the difference between the OLS and IV results is in the direction predicted ex ante, and is similar to biases discussed in research on the income-health and schooling-health gradients. These lines of argument suggest that our results should be viewed as credible evidence that for the low-income population we study, smoking is still a normal good.

One implication of our results is that increasing the income of low-income families through government transfers may have the unintended health consequence of increasing smoking and decreasing smoking cessation. Because recipients can spend cash transfers as they like, by their nature such transfers are prone to such unintended consequences. For example, Dobkin and Puller (2007) finds that recipients of Supplemental Security Income increase their consumption of illegal drugs when their checks arrive at the beginning of the month, leading to increases in drug-related hospitalizations and deaths. On the other hand, several recent studies estimate that the EITC expansions reduced maternal smoking and thus improved infant health (Averett and Wang 2013; Cowan and Tefft 2012; Hoynes, Miller, and Simon 2012). Because we study all low-income individuals and not just mothers, our results are not necessarily inconsistent with these estimates; future work could explore the differences in more depth. Hoynes, Miller, and Simon (2012) stresses that health improvements and related external benefits should be taken into account when discussing the value of antipoverty programs that make up the safety net. By the same token, a complete policy analysis of the safety net should also account for the health losses and related social costs that could result from possible increases in smoking. In light of the unintended health consequences, it might also make sense to couple antipoverty programs with antismoking programs targeted at low-income populations. Our results provide a cautionary tale that, at least in some circumstances, reducing socioeconomic disparities via income transfers might not go hand-in-hand with reducing health disparities.

Appendix

Table A1
Logistic Regression Marginal Effects Are Similar to OLS Results

	State Fixed Effects		Without State Fixed Effects	
	Smoker 1	Cessation 2	Smoker 3	Cessation 4
Log(family income)	–0.0220***	0.0045***	–0.0220***	0.0049***
	(0.001)	(0.002)	(0.001)	(0.002)
Real cigarette price	0.9188***	–0.0606	0.9200***	–0.0541
	(0.330)	(0.331)	(0.112)	(0.108)
Female[a]	–0.0727***	0.0020	–0.0731***	0.0034
	(0.003)	(0.002)	(0.003)	(0.003)
Minority[a]	–0.0789***	0.0009	–0.0817***	–0.0039
	(0.003)	(0.004)	(0.003)	(0.003)
Child younger than six[a]	–0.0011	–0.0109***	–0.0030	–0.0125***
	(0.004)	(0.003)	(0.004)	(0.003)
Multiple children younger than six[a]	–0.0178***	–0.0191***	–0.0179***	–0.0176***
	(0.006)	(0.004)	(0.006)	(0.005)
Age	0.0004***	–0.0026***	0.0004***	–0.0025***
	(0.000)	(0.000)	(0.000)	(0.000)
Married[a]	–0.0705***	0.0060**	–0.0703***	0.0034
	(0.003)	(0.003)	(0.003)	(0.003)
Year	–0.0138***	0.0075**	–0.0050***	0.0044***
	(0.004)	(0.004)	(0.001)	(0.001)
High school[a]	–0.0368***	0.0057	–0.0320***	0.0067*
	(0.003)	(0.004)	(0.003)	(0.004)
College[a]	–0.1335***	0.0264***	–0.1290***	0.0296***
	(0.004)	(0.004)	(0.004)	(0.004)
State antismoking sentiment index			–0.2928***	0.0693***
			(0.010)	(0.009)
Observations	118,862	37761	118,862	37,761
Number of groups	51	51		

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Columns 1–2 include state level fixed effects. Cigarette Price is average state level price per cigarette in 1997 dollars. Smoker is whether or not you smoked ever in the last year. Cessation is 1 if a smoker in the previous year quit in the current year.
a. implies a change from 0 to 1.

Table A2
IV Probit Results are Similar to Two Staged Least Squares Results

	State Fixed Effects		Without State Fixed Effects	
	Smoker 1	Cessation 2	Smoker 3	Cessation 4
Log(family income)	1.89898***	–1.90234***	1.98167***	–2.00090***
	(0.3873)	(0.6567)	(0.4248)	(0.6975)
Real cigarette price	–0.31653	0.44923	–0.84414**	2.01420**
	(0.4129)	(0.9268)	(0.3849)	(0.8501)
Female	0.08692*	–0.26255***	0.09601*	–0.28026***
	(0.0461)	(0.0953)	(0.0505)	(0.1024)
High school	–0.78364***	0.73247***	–0.79786***	0.78342***
	(0.1340)	(0.2205)	(0.1486)	(0.2381)
Minority	0.17411**	–0.54315***	0.15437**	–0.57495***
	(0.0745)	(0.1671)	(0.0787)	(0.1753)
Age	–0.00401***	–0.00621***	–0.00408***	–0.00618***
	(0.0011)	(0.0021)	(0.0012)	(0.0022)
Child younger than six	0.20765***	–0.27402***	0.21170***	–0.28779***
	(0.0493)	(0.0915)	(0.0531)	(0.0966)
Multiple children younger than six	0.33187***	–0.60836***	0.34573***	–0.62570***
	(0.0836)	(0.1848)	(0.0902)	(0.1933)
Married	–1.28141***	1.21337***	–1.30287***	1.24439***
	(0.2008)	(0.3853)	(0.2162)	(0.4006)
Year	–0.00697**	0.00489	0.02356***	–0.02253***
	(0.0031)	(0.0069)	(0.0030)	(0.0068)
College	–1.36434***	1.15120***	–1.39040***	1.21625***
	(0.1923)	(0.3124)	(0.2125)	(0.3358)
State antismoking sentiment index			–0.80144***	0.53267***
			(0.0522)	(0.1224)
Observations	118862	37761	118862	37761
Number of groups	51	51		

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Columns 1–2 include state level fixed effects. Cigarette Price is average state level price per cigarette in 1997 dollars. Smoker is whether or not you smoked ever in the last year. Cessation is 1 if a smoker in the previous year quit in the current year.

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