Is Smoking Inferior? Evidence from Variation in the Earned Income Tax Credit

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ABSTRACT

In this paper we estimate the income elasticity of smoking. In contrast to previous research, we address the econometric endogeneity of income as a determinant of smoking participation, cessation, and cigarette demand conditional upon participation. We use an instrumental variables (IV) estimation strategy that exploits exogenous variation in family income generated by changes in Federal and State Earned Income Tax Credit parameters. Using the IV strategy we find that smoking cigarettes appears to be a normal good among low-income adults: higher instrumented income is associated with a higher probability of smoking participation and a lower probability of 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.

Keywords: Smoking, Income Elasticity, Cigarettes, Earned Income Tax Credit, EITC

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1. 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 policy makers, and income is often considered only tangentially as a control variable or in the context of the regressivity of cigarette taxation.[2] In this paper, we focus on estimating the 'causal income-elasticity,' i.e. 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 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 U.S. 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

[2] The 89 page chapter on the economics of smoking in the *Handbook of Health Economics* provides a 3-sentence discussion of income-elasticity estimates (Chaloupka and Warner 2000, p. 1547), 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).

high-income countries, but within low- and middle-income countries, cigarettes might still be a normal good (Bobak 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 their estimate that cigarettes are an inferior good, Colman and Remler (2008, p. 389) immediately mention possible omitted variable biases and admit 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 is also closely related to research and policy questions about the health disparities associated with socio-economic status. The income-smoking gradient in the U.S. 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.[3] A long line of research in health economics focuses on the equally strong schooling-smoking gradient (Kenkel, Lillard, and Mathios 2006; Currie and Moretti 2003; de Walque 2007; Aizer and Stroud 2010). Of course, income and schooling are correlated, but the income-smoking gradient persists after controlling for schooling, and vice versa. For both the income- and schooling-smoking gradients, it is vital to understand how much of the smoking gradient is causal. An alternative explanation is that unobserved individual-level heterogeneity, such as

[3] Author calculations using the Behavioral Risk Factor Surveillance System (BRFSS) 2010 data.

differences in risk- and time- preference, might be the true underlying cause of the individual's income, schooling, and smoking. Our study of the causal effect of income on smoking parallels research on the causal nature of the schooling-smoking gradient, 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 anti-poverty 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 non-elderly, 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 estimates differ substantially from 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

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

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

2. 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 (e.g.,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 towards one good or another, or in the case of an inferior good, it can even bend backwards. 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 like we use 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, 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). To the best of our knowledge, few if any 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 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 non-elderly, 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 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] Since 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. Figure 1 shows how the average real maximum of state and federal benefits by number of children varies over our study period.

We use the exogenous changes in both state and federal EITC programs, and the resulting changes in labor supply, to generate exogenous variation in income. The theoretical effect of the EITC on the decision to work for unmarried individuals is unambiguously positive. 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 is greater than the income effect, the EITC induces people to work more. In the plateau region the EITC simply increases income with no impact on additional wage earnings, so through the income effect the EITC tends to reduce hours worked. In the phase-out region of the EITC the rate at which the credit is phased-out creates a substitution effect towards reducing hours worked, as additional wage earnings are effectively reduced in value.

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

[5] Values are 2011 nominal dollars.

previous studies as instruments for income and program participation (Schmeiser 2009, 2012). A wide range of studies that have evaluated past EITC expansions using a variety of econometric techniques conclude 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 find that the effect of the EITC on income is driven by changes in labor supply is most pronounced on 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 (Hoynes 2006). The EITC also generates 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) find modest changes in hours worked amongst married men and women, while Eissa and Liebman (1996) find changes in the hours worked by single women, and Saez (2009) finds bunching at the first EITC kink-point by the self-employed. Thus our results represent a local average treatment effect (LATE) specific to these low-income families that respond to the EITC.

3. 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 using data from Orzechowski and Walker (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 0, 1, or 2 or more children (University of Kentucky Center for Poverty Research 2011).[6] 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.

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.[7] 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). In addition, since additional benefits exist for

[6] These data can be downloaded at: http://www.ukcpr.org/AvailableData.aspx.
[7] We account for inflation and index all estimates to 1997 dollars for our analysis.

retirees and health incentives may differ for these individuals, we restrict the sample to be individuals under 60 years of age.

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, Dean Lillard, and Alan Mathios 2006; de Walque 2007; Tenn, Herman, and Wendling 2010). While simultaneously addressing the endogeneity of income and education to smoking behavior is beyond the scope of this paper, we are sensitive to the possibility that the failure to address the endogeneity of schooling may bias our estimates for income. Thus in order to limit the potential for any bias from the inclusion of another endogenous covariate, we drop individuals who have any additional years of education beyond high school from our sample, and re-estimate each of our models on a sample restricted to high school graduates as a robustness check.

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 over 16 cigarettes per day in 1993 to just over 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 anti-smoking publicity and

price hike associated with the 1998 Master Settlement Agreement between the tobacco industry and the states.[8]

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 the number of young children in the household. In addition to showing the demographics for the individuals in the dataset 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.[9] 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 whether or not a household has a child under 6, though we do see that the higher income group is less likely to have multiple children under 6. On average, the highest income tercile receives the highest amount of EITC receipts.[10] 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.

[8] However, Levy and Meara (2006) find that the Master Settlement Agreement had a relatively small impact on smoking during pregnancy.

[9] 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 pre- tax/transfer income and should NOT include the EITC payments received.

[10] 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.

In Table 3, we present the averages of the dependent variables based on these three income groups.[11] 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 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.

4. 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:

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

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

[11] We again provide these descriptive statistics using sample weights.

estimates that are nationally representative and account for the complex survey design of the CPS.[12]

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 1 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, 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).[13]

5. Results

As a baseline, we first estimate the standard naïve OLS specification of the effect of family income on smoking, where income is assumed to be econometrically exogenous.[14] 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 under

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

[13] 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. Since the daily consumption dependent variable is approximately normally distributed, we only run a least squares specification for this variable.

[14] 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.

six, in addition to state fixed effects. Table 4 reports the coefficient estimates from the standard OLS specification for the full sample in Columns (1) through (3) and the sample restricted to high school graduates only in Columns (4) through (6). The second 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 that increases in an individual's income are associated with a decreased probability of being a smoker. If we naively 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% level. The estimated income elasticity of the number of cigarettes smoked per day conditional on being a smoker is also negative, but 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% level.

As previously discussed, several studies have found education level to be endogenous to various smoking related behaviors. While treating schooling as endogenous in our model is beyond the scope of this study, we confirm that this potentially endogenous variable is not biasing our estimates by dropping it from the equation and restricting the sample to high school

graduates only. Columns (4) through (6) of Table 4 present the estimates on the restricted sample. The coefficient estimates on income for the high school only sample are very similar to those estimated for the full sample. In Column (4) income elasticity for being a smoker is -0.095, significant at the 1% level. The estimated income elasticity of the number of cigarettes smoked per day conditional on being a smoker presented in Column (5) is again negative, but has increased in magnitude 100 times to -0.0147. However, it remains statistically insignificant. Lastly, in Column (6), the estimate for the income elasticity of smoking cessation is effectively identical to that found in Column (3) for the full sample; although it is now only marginally significant.[15] 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 U.S. over our sample time period. For example, Colman and Remler (2008) estimate 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.[16]

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. In Table 5, the first-stage models use different samples, corresponding to the different

[15] DeCicca, Kenkel and Mathios (2008) discuss the relationship between the elasticity of smoking participation and the elasticities of cessation and initiation

[16] 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.

dependent variables used in the second stage. For the full sample, the F-statistics in the first stage of the IV exceed the Stock and Yogo (2002) 10% critical value. In the sample restricted to high school graduates only, the F-statistics are somewhat lower, ranging from 4.1 to 8.4. A standard rule of thumb for detecting weak IVs is that the 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, p.213). 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. [17]

To further corroborate that our first-stage results make sense, 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 for both the full sample and the high school only sample, 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

[17] Our measure of family income is pre-tax and thus should not directly include the dollar value of the EITC.

separately identify an income effect versus a labor force participation effect on cigarette demand.[18]

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% 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% 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.

To address any concern about bias resulting from the potential endogeneity of education to smoking behavior, we again estimate the IV for the high school only sample and present the results in Columns (4) through (6) of Table 7. Though our estimates are less precise for the restricted sample due to a halving of the number of observations, the signs on the coefficients and their magnitudes are similar to those found for the full sample. In Column (4) we estimate the income elasticity of being a smoker to be 4.38, significant at the 1% 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 0.47 and no longer statistically significant.

[18] Put differently, our results can be interpreted as an estimate of the combination of the income effect and the labor force participation effect. Labor force participation might have an effect of cigarette demand if it exposes the worker to a worksite smoking ban. Although the main goal of worksite smoking ban is to reduce secondhand smoke, some studies suggest that they also reduce cigarette demand (Evans, Farrelly, and Montgomery 1999).

However, the total elasticity of demand with respect to income is 4.85, which is only slightly lower than the 5.62 found in the full sample. Lastly, in Column (3) we again find that the income elasticity of smoking cessation is negative and similar in magnitude, but no longer statistically significant.

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.

6. 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), who finds that smoking declines during temporary economic downturns and increases during economic expansions. However, Ruhm suggests that that this might mainly reflect changes in non-market 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. In addition, the limited information maximum-likelihood IV results are consistent with the two-stage least squares IV results, which further the validity claim for our instrument. 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) find 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. Replacing cash with in-kind transfers might reduce the unintended consequences, but simple economic theory predicts that in many situations cash and in-kind transfers will be equivalent. When cash and in-kind transfers are not equivalent, recipients strictly prefer cash transfers. From the perspective of neoclassical welfare economics, even if transfers increase smoking they still increase recipients' utility. An alternative analytical approach considers the impact of policies on smoking from the perspective of behavioral economics. As is discussed in more detail by Colman and Remler (2008), some behavioral economics models imply that higher cigarette taxes might make poor smokers better off. The corollary relevant to our results -- that if the poor spend some of their extra income on smoking, reducing income transfers might make them better off – seems even more controversial.

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1 Figures and Tables

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

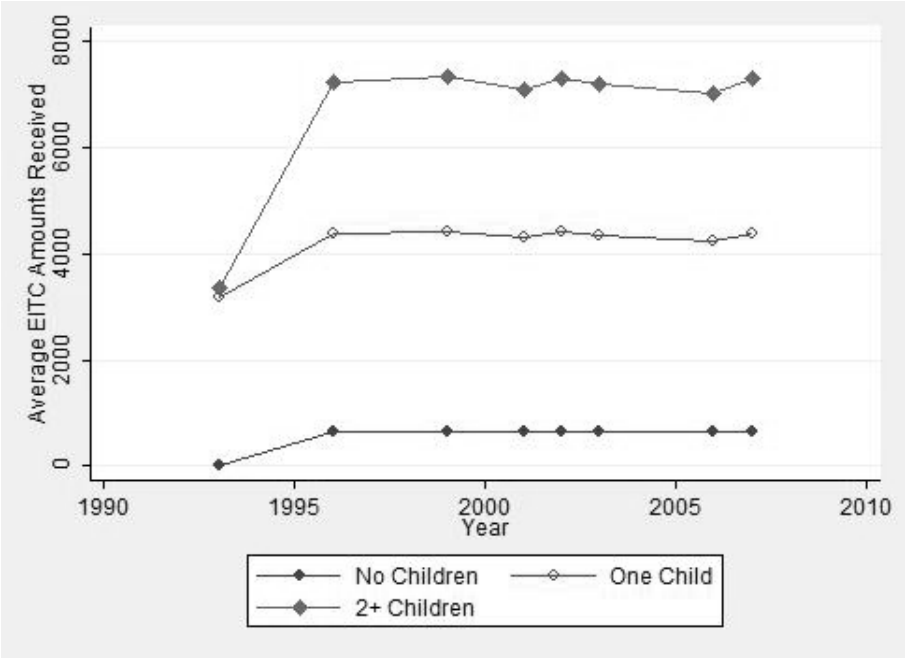

Table 1: Summary Statistics of Smoking Variables, by Year

	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 Consumption	16.44	16.37	15.11	15.53	14.53	14.16	14.12	13.14
	(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

Note: 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.

Table 2: Descriptive Statistics

	All Income Groups	Low Inc	Middle Inc	High Inc
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 under 6	0.154	0.160	0.148	0.154
	(0.361)	(0.366)	(0.355)	(0.361)
Multiple Children under 6	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

Means reported, standard deviations in parantheses

Data restricted to families with <45,000 annual income

Low Income is bottom tercile; middle is middle tercile; high is top tercile.

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

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.

Table 4: OLS Results

	Full Sample			**HS Grads Only**		
	(1)	(2)	(3)	(4)	(5)	(6)
	Smoker	log(Num Cigs)	Cessation	Smoker	log(Num Cigs)	Cessation
log(Family income)	-0.0236***	0.000148	0.00398***	-0.0287***	-0.0147*	0.00396*
	(0.00149)	(0.00603)	(0.00150)	(0.00241)	(0.00801)	(0.00211)
Real cigarettes price	0.989***	-1.614	0.722**	0.744	-8.766***	1.042**
	(0.325)	(1.447)	(0.358)	(0.544)	(1.998)	(0.521)
Female	-0.0731***	-0.112***	0.00187	-0.0741***	-0.200***	0.00256
	(0.00266)	(0.0117)	(0.00287)	(0.00445)	(0.0162)	(0.00419)
Minority	-0.0763***	-0.406***	-0.000278	-0.0975***	-0.468***	0.0122**
	(0.00337)	(0.0157)	(0.00388)	(0.00574)	(0.0225)	(0.00582)
Child under six	-0.00376	-0.102***	-0.0110**	-0.0206***	-0.162***	0.00350
	(0.00403)	(0.0182)	(0.00450)	(0.00664)	(0.0248)	(0.00644)
Multiple Children under 6	-0.0189***	-0.0655**	-0.0135**	-0.0277***	-0.0394	-0.00492
	(0.00552)	(0.0258)	(0.00641)	(0.00936)	(0.0359)	(0.00924)
Age	0.000668***	0.0170***	-0.00193***	-0.000890***	0.0116***	-0.00172***
	(0.000135)	(0.000615)	(0.000150)	(0.000232)	(0.000881)	(0.000226)
Married	-0.0705***	0.0291**	0.00315	-0.0645***	0.0446**	0.00430
	(0.00299)	(0.0133)	(0.00328)	(0.00491)	(0.0180)	(0.00466)
Year	-0.0146***	-0.0113	-0.00138	-0.0115*	0.0753***	-0.00456
	(0.00374)	(0.0164)	(0.00407)	(0.00618)	(0.0226)	(0.00588)
High School	-0.0324***	0.0864***	0.00253			
	(0.00375)	(0.0152)	(0.00374)			
College	-0.127***	-0.120***	0.0261***			
	(0.00377)	(0.0161)	(0.00396)			
Income Elasticity	-0.0782***	0.000148	0.0514***	-0.0951***	-0.0147	0.0511*
	(0.00494)	(0.00603)	(0.0193)	(0.00799)	(0.00801)	(0.0273)
Observations	118862	36569	37761	46009	15859	16358
Number of Groups	51	51	51	51	51	51

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Includes state level fixed effects.

Cigarette Price is average state level price per cigarette in 1997 $s. 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.

Table 5: IV Results Stage 1

Dependent Variable: log(Family Income (000s))						
	Full Sample			**HS Grads Only**		
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Smoker	log(Num Cigs)	Cessation	Smoker	log(Num Cigs)	Cessation
Maximum Federal/State EITC (000s)	0.00523***	0.00922***	0.00663***	0.00478**	0.01064***	0.00716**
	(0.0012)	(0.0023)	(0.0023)	(0.0019)	(0.0037)	(0.0035)
Real cigarettes price	-1.03241	-1.16028	-0.54148	-3.22499***	-3.91475**	-2.65429
	(0.6318)	(1.2565)	(1.2309)	(1.0526)	(1.9853)	(1.9334)
Female	-0.12374***	-0.11266***	-0.11202***	-0.16079***	-0.14496***	-0.14499***
	(0.0052)	(0.0103)	(0.0100)	(0.0087)	(0.0163)	(0.0157)
Minority	-0.18449***	-0.25138***	-0.22778***	-0.23866***	-0.30839***	-0.28074***
	(0.0065)	(0.0136)	(0.0133)	(0.0111)	(0.0223)	(0.0215)
Age	0.00281***	0.00199***	0.00223***	0.00232***	0.00100	0.00102
	(0.0003)	(0.0005)	(0.0005)	(0.0005)	(0.0009)	(0.0008)
Child Under 6	-0.15241***	-0.17797***	-0.16210***	-0.14823***	-0.16697***	-0.15728***
	(0.0086)	(0.0172)	(0.0169)	(0.0140)	(0.0267)	(0.0259)
Multiple Children Under 6	-0.22787***	-0.24695***	-0.25900***	-0.27015***	-0.25742***	-0.28808***
	(0.0119)	(0.0245)	(0.0241)	(0.0197)	(0.0385)	(0.0372)
Married	0.52601***	0.61772***	0.61425***	0.54591***	0.61565***	0.60926***
	(0.0058)	(0.0115)	(0.0112)	(0.0095)	(0.0180)	(0.0173)
Year	0.02523***	0.02267	0.01567	0.03621***	0.02759	0.01675
	(0.0073)	(0.0143)	(0.0140)	(0.0119)	(0.0225)	(0.0218)
High School	0.35483***	0.31271***	0.31440***			
	(0.0072)	(0.0131)	(0.0128)			
College	0.52622***	0.48318***	0.48095***			
	(0.0072)	(0.0137)	(0.0134)			
Total Observations	118862	36569	37761	46009	15859	16358
F statistic for weak identification	19.11	15.49	8.383	6.005	8.426	4.102

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Includes state level fixed effects.

Cigarette Price is average state level price per cigarette in 1997 $s. 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.

Table 6: Labor Force Participation and the EITC

Dependent Variable: Binary Variable for Labor Force Participation, where 1=employed		
	Full Sample	Only HS Grads
Maximum Federal/State EITC (000s	0.00527***	0.00406***
	(0.000579)	(0.000929)
Real cigarettes price	0.255	0.0144
	(0.305)	(0.502)
Female	-0.143***	-0.146***
	(0.00252)	(0.00412)
Minority	-0.0628***	-0.0735***
	(0.00316)	(0.00528)
Child under six	-0.0649***	-0.0604***
	(0.00417)	(0.00666)
Multiple Children under 6	-0.152***	-0.142***
	(0.00576)	(0.00940)
Age	-0.00411***	-0.00415***
	(0.000128)	(0.000217)
Married	-0.0321***	-0.0369***
	(0.00281)	(0.00453)
High School	0.162***	
	(0.00349)	
College	0.224***	
	(0.00347)	
Year	0.00760**	0.00573
	(0.00351)	(0.00569)
Observations	118862	46009
Number of Groups	51	51

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Excluded groups are: un-married, white, no children under 6. Includes state level fixed effects.

Table 7: IV Results Stage 2

	Full Sample			**HS Grads Only**		
	(1)	(2)	(3)	(4)	(5)	(6)
	Smoker	log(Num Cigs)	Cessation	Smoker	log(Num Cigs)	Cessation
log(Family income)	1.0812***	2.0414***	-0.8297***	1.4811**	0.4699	-0.5157*
	(0.279)	(0.596)	(0.305)	(0.651)	(0.385)	(0.289)
Real cigarettes price	2.2352***	1.0959	0.1790	5.7718**	-6.7959**	-0.3828
	(0.831)	(3.048)	(1.104)	(2.743)	(2.713)	(1.381)
Female	0.0600*	0.1033	-0.0872***	0.1642	-0.1337**	-0.0701*
	(0.034)	(0.067)	(0.034)	(0.104)	(0.056)	(0.041)
Minority	0.1255**	0.1015	-0.1887***	0.2599*	-0.3213***	-0.1321
	(0.052)	(0.151)	(0.070)	(0.155)	(0.119)	(0.081)
Age	-0.0023***	0.0135***	-0.0002	-0.0041***	0.0113***	-0.0013**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Child Under 6	0.1468***	0.2048**	-0.1293***	0.1827**	-0.0958	-0.0675
	(0.039)	(0.097)	(0.045)	(0.090)	(0.059)	(0.042)
Multiple Children Under 6	0.2076***	0.3587***	-0.2056***	0.3508**	0.0645	-0.1393*
	(0.059)	(0.134)	(0.073)	(0.166)	(0.092)	(0.077)
Married	-0.6589***	-1.2573***	0.5225***	-0.8984**	-0.2612	0.3261*
	(0.149)	(0.376)	(0.190)	(0.360)	(0.244)	(0.179)
Year	-0.0438***	-0.0614*	0.0127	-0.0678**	0.0612**	0.0045
	(0.012)	(0.036)	(0.013)	(0.031)	(0.027)	(0.014)
High School	-0.4232***	-0.5493***	0.2639***			
	(0.099)	(0.188)	(0.096)			
College	-0.7054***	-1.0994***	0.4249***			
	(0.146)	(0.287)	(0.146)			
Income Elasticity	3.579***	2.041***	-10.71***	4.381***	0.470	-7.162
	(0.923)	(0.596)	(3.937)	(1.926)	(0.385)	(4.013)
Observations	118862	36569	37761	46009	15859	16358
Number of Groups	51	51	51	51	51	51

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Includes state level fixed effects.

Cigarette Price is average state level price per cigarette in 1997 $s. 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.