LOW INCOME AND POOR HEALTH CHOICES: THE EXAMPLE OF SMOKING

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Working Paper #10-3

February 2010

Dept. of Agricultural Economics

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Abstract

People with low incomes tend to make less healthy consumption choices than do high income people. In the case of food, agricultural economists have investigated whether this is due to the cost of a healthy diet. Studies of various aspects of the nutrition-income nexus have generally been inconclusive. We investigate a different possibility, motivated by the fact that low income individuals are most likely to be smokers, which cannot be due to limited budgets. Drawing on a body of related literature, we develop a model in which income serves not only as a budget constraint but also as a source of future utility. We test the model by estimating logistic models of beginning and quitting smoking. We find support for the idea that low income consumers make less healthy choices because they face lower costs in terms of foregone future utility.

Keywords: Income, Food Choice, Smoking

JEL Codes: D12, I12, I18

Introduction

The health of low income Americans is a topic of considerable interest to policymakers and the research community. Among agricultural economists, much concern has focused on the fact that people with low incomes tend to eat less nutritious, more high calorie diets than do other households. (Golan et al., 2008) As a consequence, they are more prone to obesity, diabetes, and other nutrition-related health problems.

There are several hypotheses seeking to explain why low income individuals have less healthy diets. An explanation receiving much attention recently is access: low income households may have less access to sources of fruits and vegetables and other more nutritious foods and relatively easy access to energy dense foods, such as fast food. Several studies have found a positive association between low income neighborhoods and the location of fast food outlets and other sources of what is generally viewed as less nutritious foods (see Cummins and Macintyre 2006 for an overview). But assigning cause with such studies is problematic.

One of the more frequently cited reasons for poor eating patterns among low income households, especially in the nutrition literature, is affordability: healthy food costs more (Drewnowski and Darmon, 2005). Whether this is fact the case is very difficult to determine. It is often based on the observation that the least expensive sources of calories are energy-dense foods with high oil and sugar content, and the perception that fruits and vegetables are particularly high in cost (Drewnowski, 2004; Maillot, et al., 2007). But the link between such contentions and poor nutrition among low income consumers is not clear. It seems to imply that the consumer's objective is to obtain a given quantity of calories at minimum cost, which is inconsistent with the problem of excessive calories. Furthermore, USDA studies have found no evidence that low income individuals are priced out of fruits and vegetables. For example, one study estimated that a typical low income household given $1000 in additional income would not significantly expand its expenditures on fruits and vegetables (Stewart, Blisard, and Joliffe, 2003); another showed that many fruits and vegetables are in fact quite inexpensive (Kuchler and Stewart, 2008).

Implicit in much of this literature is that low income individuals would choose more nutritious diets were it not for the budgetary restrictions they confront.[1] However, as Golan et al. (2008) note, "Affordability …is a surprisingly complex concept to measure." (p.27) Items can be costly to consumers simply because they have more desirable spending alternatives: it depends on their objective function. Blaylock et al. (1999) point out that food choice involves selecting foods with desired characteristics, prominent among which are taste and nutrition, and there is a tradeoff between them. Increasing nutrition typically requires reducing fats and sugars, ingredients whose primary purpose is taste enhancement. Foregoing the pleasure of this taste is a cost of eating a healthier diet, a cost which has nothing to do with the budget constraint: "For many people, healthy eating is just not worth the effort and sacrifice." (p.275) Whether an individual is willing to incur this cost depends upon the benefit obtained from the increased nutrition. A major component of this is an increase in expected lifetime. The argument of this paper is that this benefit tends to be valued less by those with low income.

The hypothesis is motivated by the observation that poor food choice by low income individuals is a just one instance of a more general pattern. When faced with choices involving a trade-off between pleasure and health, low income individuals are less likely to choose health than are other socioeconomic groups. (Lantz et al., 1998) For example, they are more likely to be sedentary, and most significantly, more likely to smoke. If low income limits access to healthy food, why doesn't it restrict use of cigarettes? This inconsistency suggests the involvement of an agency other than the budget constraint in these choices.

In this paper we investigate this possibility, centering attention on the consumption of cigarettes. For our purpose cigarettes have obvious advantages over food: the nature of the healthy choice is clear and there should be no confusion about cost as a barrier to that choice. Cigarettes are the archetypal good with very large, and very well known, negative health effects. Furthermore, cigarette demand is much studied. While the focus has been price rather than income, an important result has emerged. Prior to the 1970's, cigarettes were found to be a normal good, in that consumption increased with income. However, studies using data for periods after the negative health effects of smoking became widely known have found income to be of no significance or to have a negative effect (Wilkins,Yurekli, and Hu 2007: Healton and Nelson 2004; Chaloupka and Warner 1999). This suggests that the health aspect of the good have had a detectable effect on the relation between income and smoking.

To the best of our knowledge, the question of why low income individuals smoke more, or indeed why they generally have poor health behavior, has not been directly addressed. This is the case despite the interest in the health status of low income households, and, in the case of cigarettes, concerns about the regressivity of tobacco taxes (Healton and Nelson, 2004). However, problems similar to the concern of this paper have been studied, and the argument herein is similar to the arguments of many of these. The study is closely related to Grossman's (1972) work on the demand for health capital. Indeed, the results we obtain would seem to follow from a (perhaps liberal) reinterpretation of his model. We consider the demand for health in its capacity as a means to longevity and further consumption, whereas Grossman investigated health demand as the demand for human capital and time for earnings-producing activity. Similarly, in studying rational addiction, Becker and Murphy (1988) point out that higher earnings increase the cost of consuming an unhealthy addictive good because any negative effects on productivity cause a greater loss in earnings.[2]

The work here is also very similar to that of Becker and Phillipson (1998) and particularly to that of Davies and Kuhn (1992). These authors studied the effects of annuities on longevity, focusing on the fact that receiving an annuity increases the value of living longer, thus encouraging healthier behavior. It also parallels Becker and Mulligan's (1997) model of endogenous discounting. Our model is simpler; we do not consider investment or household production but focus entirely on the consumption of a "health good," which, as in Davies and Kuhn, we define as having both direct effects on utility−as does any good-- and effects on health. Although health itself has direct consumption effects (e.g. the absence of pain), we confine attention to its role as a source of longevity, which allows for additional consumption of other goods. The effect of income on the demand for a health good then has two components, its usual role in the demand for the direct utility services of the good, and its effect on the demand for longevity. These can

be quite different, and for goods with negative health effects, such as cigarettes and bacon-topped triple cheeseburgers, they will differ in sign. The basic argument is that income increases the demand for the direct utility services, but it also increases the value of longevity, and that eventually the latter is likely to dominate. As a result, the demand for a negative health good is likely to initially increase with income, but will begin to fall as income continues to grow. It will also differ for the decision to start consuming the good and the decision to cease consumption.

We test the model by using data on smoking behavior from the Behavioral Risk Factor Survey over the period 1994 to 2007. We estimate binary choice models relating the decision to begin smoking and the decision to quit to measures of income and a variety of other demographics. Our results are consistent with predictions of the model, and suggest that poor health behavior by low income consumers may in part be due to economically rational decisions.

The Model

Let x be a good which confers utility in the present but has negative effects on future health. Specifically, it reduces the expected life span.[3] To model decisions regarding x, consider utility maximization as occurring over two periods, "today" (period 1), and "tomorrow" (period 2). Interest is in consumer choice of x today, and how this depends upon income. A key aspect of the model is that life is risky, tomorrow may never come, and whether it does depends on x consumption today.

So consider "lifetime" utility U_L, expressed as

$$\mathbf{U_L=U_1(x,Z)+ \theta(s)\, P(x)\, U_2(g(M)),}$$

where U_1 and U_2 are utilities in periods 1 and 2, and

Z = composite of all other goods;
M = today's income;
$\Theta(s)$ = discount rate at time s within period 1;
$g(M)$ = expected income tomorrow: $g' > 0$;
$P(x)$ = Probability of surviving till tomorrow, with $P(x) < P(0)$.

x and Z refer to consumption today. Their dependence on M is implicit and not expressed. Θ is assumed to be the same for all consumers.[4] The function $g(M)$ can be thought of as expected income in period 2, from the perspective of the first period. The assumption that $g' > 0$ is hardly controversial. The higher is current income, the higher we expect future income to be, either through causality, such as by current saving, or simply through correlation, due to both being functions of the same factors. We are only interested in decisions made today: how income is allocated tomorrow is not of concern. Presumably it will be optimally allocated, according to tastes and prices (and may or may not include consumption of x). Thus tomorrow's utility is expressed solely as a function of expected income.

We focus on period 1, and assume that incomes, prices, and tastes are fixed throughout the period. Our interest is two decisions: whether to consume x in the first place, and if so, whether to subsequently quit. For a good with no health aspects, the mechanism underlying these two

decisions is the same, differing only in direction. If consumption is begun, it will continue as long as prices, income, and tastes are unchanged. However, for a good with a significant health component, this need not be true. In particular, the effect of income on these decisions will differ.

We illustrate this as follows. Because starting and quitting are not concerned with continuous quantities but are binary decisions, we let x be a discrete quantity, such as a pack of cigarettes a day. Indeed, this seems appropriate for health goods, since health effects are generally of significance only under habitual consumption.[5]

Consider the difference in lifetime utility with and without x:

$$\mathbf{D=[\max U_1(x,Z)+ \theta(s)\, P(x)\, U_2(g(M)] - [\max U_1(0,Z)+ \theta(s)\, P(0)\, U_2(g(M)].} \quad (1)$$

If $D>0$, x will be consumed. Rearranging,

$$\mathbf{D = \{\max U_1(x,Z) - \max U_1(0,Z)\} + \{\theta(s)\,[P(x) - P(0)]\, U_2\,(g(M)\} .} \quad (2)$$

$$\mathbf{= D_1 \qquad + \qquad D_2}$$

Note that $D_1 \geq 0$, $D_2 \leq 0$, with equalities if optimal $x=0$. D_1 is the direct effect of x on today's utility;[6] D_2 is the health effect, which affects utility tomorrow.

When deciding whether to consume x, it is logical that a consumer would begin by asking himself whether he would choose to do so if there were no health consequences. That is, he would evaluate D_1. If the answer is no, then there is no need to be concerned with D_2. This initial decision is the same constrained utility maximization used for deciding whether to consume any good. From standard consumer theory, we have that a good y will be consumed if $MU_y/p_y > \lambda$, where λ is the marginal utility of income. Since λ declines with income, we obtain the result that, unless x is inferior, the likelihood it may appear in the optimal consumption bundle, that is, $D_1>0$, increases with income.[7]

If D_1 is positive, then whether x does appear in the optimal consumption bundle depends on D_2. D_2 is nonpositive, so the question is whether it is large enough in absolute value to cancel the positive direct utility difference measured by D_1. Because D_2, in contrast to D_1, unequivocally decreases with income, increasing income makes this cancelation more likely. Thus, the net effect of income on the decision to consume x is ambiguous: it depends on the relative strengths of these two competing effects. These will almost surely differ over the income distribution. At lower incomes, the first effect is likely to dominate. Low income households often have difficulty meeting their basic needs, and only as income rises will funds become available for non necessities like x. Meanwhile, the second term is necessarily of smaller effect when income is low. At higher incomes, it is just the opposite. Expenditures on x are unlikely to have much of an impact on the budget of high income households, while the foregone utility of reduced longevity is much larger. The health factor becomes dominant.

For these reasons, the model predicts that the function relating income to the likelihood of beginning to smoke has a decreasing slope, either falling throughout the relevant range but at an accelerating rate, [8] or parabolic, first rising and then declining as income increases.

This should not be true of the relation between income and the decision to stop consuming x. For a current consumer, the hurdle posed by the budget constraint has been overcome, and, with prices and income unchanged, it has no further role to play. In particular, it will not cause the consumer to cease consumption. That decision is governed solely by changes in D_2. While for a current x consumer D_2 must initially be smaller in absolute value than D_1, with the passage of time it is of growing importance, due to the effect of discounting. With age, the consumer becomes more alert to the approach of the second period and the threat of foregoing its potential utility. If the loss in expected utility eventually exceeds the utility of x, he will quit. Since expected utility rises with income, it immediately follows that quitting is more likely for higher income consumers.

Empirical Investigation

In this section we test the model by examining smoking data from the Behavioral Risk Factor Survey System (BRFS). This is a yearly telephone survey taken by state health departments in conjunction with the Centers for Disease Control and Prevention. The population surveyed is all persons 18 and older. The BRFS survey has been taken since 1984, when only 15 states were involved. In recent years all states have participated, although in any given year one or more states may not. In the initial years the sample sizes for participating states averaged something less than 1000; in 2007 these were 4000 or more for nearly all states. In each year all participating states ask a set of core questions, which have been reasonably stable through the years. In recent years there have been sets of optional questions, use of which is at the states' discretion. These tend to vary across years. We based our analysis on core questions asked by all states.

We estimated two basic sets of binary choice models. In the first, the dependent variable was "Start," a binary indicating whether the individual had ever begun to smoke. This was measured by the question "Have you smoked 100 cigarettes in your life?" The second model explained the variable "Quit," the decision to stop smoking, measured by the question "Do you smoke now?" The entire sample was used in estimating the first model; the sample for the second was confined to those for whom Start=1.

Income

With our focus, the measurement of income is an important issue. In the BRFS data household income is measured by intervals. In 1984, the first year of the survey, there were six intervals, which was increased to seven in the following year. Since 1994 eight intervals have been used. A common approach to interval data is to use the midpoints of income intervals. One problem with this method is that the highest income interval is necessarily open and thus lacks a midpoint. Another is that unless there are a large number of intervals, it may be problematic to impose anything but a simple linear form to the income variable. For reasons such a these, we employed a set of indicator variables for the income classes. This has the advantage of not imposing an implied functional form: indicator variables can capture points along any reasonable curvilinear relation. This feature is useful here because the validity of the model depends upon the shape of the relation between smoking behavior and income. Hence we wish to avoid any a priori

imposition of that shape. Because of the smaller number of income intervals before 1994, we began the sample with that year. This left over three million observations.
A problem with the BRFS data is that the income measure and the smoking decision variables may refer to different points in time. The data is a one-time survey, with a new sample drawn each year. Respondents report their current smoking status and (if a nonsmoker) whether they ever smoked. When these decisions were taken is not reported. They also report their *current* income, which may only approximate their income at the time of those decisions. Thus, we must assume that income is correlated through the life span, which, while not without exception, is hardly controversial. Recall this assumption is a component of the theoretical model. The use of income indicator variables, rather than a numerical value, should reduce its effect: then what matters is that an individual's position in the overall income distribution be reasonably stable. It is most questionable for the "begin" decision for individuals who are middle-aged and older. Because most smokers begin before the age of 25 (Douglas and Hariharan, 1994), this decision may have occurred in the distant past.

For this reason (and given the importance of stage of life in smoking decisions), we estimated the models separately for three age groups: 18 to 30; 31 to 50; and 51 and over. The youngest age group is most relevant for the decision to begin smoking, since their reported income is most likely to match their income status when that decision was made. However, most smokers who ultimately quit do so later in life, so the older age groups are more useful for the analysis of quitting. Older smokers are necessarily closer to "tomorrow."

Demographics
The BRFS data contains a broad set of demographic variables, on which we based our additional explanatory variables. These included the variables listed in table 1, which are measures of educational attainment, race and gender, and household structure, including marital status and presence of children. We also included sets of state dummy variables.[9] The latter are strictly control variables and their results will not be presented. The same variables were used for the start model and the quit model.

Regarding expected effects for these variables, some are fairly obvious. For example, the presence of children in the household should discourage smoking. Generally, we expect smoking prevalence to be lower in larger households, due to smokers' concern over second-hand smoke and nonsmokers' encouraging smokers to quit. Thus, individuals living alone (especially after the loss of a spouse due to death or marital breakup [Becker and Murphy]) are likely to be more inclined to start smoking and less inclined to quit. While a priori there are no obvious reasons to expect racial differences in smoking behavior, a consistent finding in prior work is that, as compared to whites, blacks are significantly less likely to begin smoking, but if they do begin they are significantly less likely to quit (Novotny et al., 1988). Females have been found to be less likely to begin smoking (Douglas and Hariharan, 1994).

The most consistent finding across studies dealing with a wide range of health behaviors is a positive association between education and healthier choices (De Walque, 2007; Sander, 1995). This has certainly been true for smoking behavior. A common explanation for this result is that more highly educated individuals have more information concerning the consequences of

unhealthy behavior. For example, Nayga (2000) found that knowledge accounted for the fact that education is negatively related to obesity. However, studies that have corrected for information typically find it only explains part of an education effect, which suggests there must be other reasons (Kenkel 1991). One possibility is that people who discount the future highly are less likely to invest in education and more likely to smoke, implying that an education effect is at least partly not causal (Farrell and Fuchs, 1982; Fuchs, 1982). Another is Grosman's argument that education increases the efficiency of health production, which could affect smoking (perhaps from knowing more strategies to avoid cigarettes). In any case, to control for the effects of education on smoking behavior, we include a set of binary variables measuring the extent of respondents' education.

Table 1 shows the sample means for variables, by age group. Since these are included as repressors', there is not a great deal of concern about the representativeness of the sample. On that point, we note that it is not representative by gender, for nearly 60 percent of the sample is female. Perhaps this reflects a tendency in households with a couple for the female to answer the telephone, or simply that female respondents are more cooperative. This illustrates that the sample cannot be regarded as fully random. To control for this, the survey provides sampling weights, and these were used in the estimation below.[10]

Results

The estimation results for the logit models of initiating and quitting smoking are presented in tables 2 and 3, respectively. Each table has results for the three age groups, in the form of estimates and values of associated t statistics. The latter are tests of differences as compared to the reference group, so with groups having more than two possibilities (e.g. income) the t's may not be individually of great meaning but should be viewed broadly as a group. For this reason we do not include allusions to levels of significance: in all cases the sample sizes are very large, so a t exceeding 2 can be viewed as significant at at least a 95% level of confidence. The R^2's in the table are squared simple correlations of the predicted and actual values of the dependent variable. They range between 9 and 11 percent, which is a typical fit for cross section data on individuals. Estimated probabilities for the income groups and other important categorical factors are presented in table 4.[11]

The estimates in tables 2 and 3 and the probabilities in table 4 support the theoretical development above. In the case of smoking initiation, we see that, at low income levels, smoking probability rises with income; at higher levels it begins to fall as income increases. The reference group is income group 4, roughly in the middle, and the most significant differences (as indicated by the t statistics) occur at endpoints. This pattern suggests the increasing importance of the second term on the right in (2) as income rises. For the younger two groups the maximum probability of beginning to smoke occurs at incomes below average, and the lowest probability occurs for those with highest income. For the oldest group, the peak occurs toward the high end of the distribution, and the least likely to begin smoking is the lowest income group. Although this may simply reflect that current income and income at the time of the smoking decision are less closely linked for the older group, the difference is consistent with the fact that cigarettes have become an inferior good in recent decades. Note also that the estimated probabilities across

groups reflect the decline in new smokers in recent years, although the lower probability for the youngest group is partly because some have yet to take up the habit.

The theoretical model predicts that the probability of quitting cigarettes rises with income, and this is generally what we find. With a small number of exceptions, the estimated quitting probability steadily rises with income. The exceptions occur within the lower income range for younger smokers. The gradient is steeper for the middle and older groups. In terms of the model, these people are closer to (or in) period 2 of the model. Note that for these two the difference in probability between the lowest and highest income group is a matter of about 20 percentage points. If quitting were primarily induced by, for example, higher cigarette taxes, this is certainly not the pattern one would expect. It is consistent with several studies that have found that those who have successfully quit smoking tend to be consumers who quit due to health concerns rather than those concerned about the cost of cigarettes (Reime, et al., 2006.; Halpern and Warner; 1993; Eisinger, 1971). If the model is valid these people are expected to be those with higher incomes.

Demographics

As expected, the variables measuring educational attainment are found to strongly influence smoking behavior, with large differences in estimated probabilities across the education types. More educated people are less likely to begin smoking, and much more likely to quit when they do, with college attendance and graduation especially important. College graduates are by far the least likely to be smokers, even as compared to those who attended college without graduating. Among the youngest group, college graduates are less than half as likely to become smokers as are high school dropouts. These differences surely reflect more than differences in information. One possibility is a variant of Grossman's argument that education increases the efficiency of health production. Equally reasonable is that it increases the efficiency of consumption. This is essentially the argument of Stigler and Becker (1977) regarding consumption capital. Through exposure to goods like music one learns to gain more utility from them, a process that "might well depend on the level of education and other human capital." (p.79) Thus, more education increases the possibility of future utility, hence increasing the cost of reduced longevity.

For all three age groups males are more likely to begin smoking, but the magnitude of the difference has been narrowing, being smallest for the youngest group. Gender differences for quitting are less consistent and magnitudes are smaller. African Americans are found to be significantly less likely to start smoking than are other races, especially in the youngest group. But they are also less likely to quit. As noted previously, the same result has been found in previous studies. Hispanics are estimated to also be less likely to start but more likely to quit.

Spousal loss (for whatever reason) is associated with higher rates of starting and lower rates of quitting. Causality cannot be assigned for this, however. The trauma of losing a spouse through death or divorce can contribute to smoking, but smoking can itself cause marital friction. The fact that smokers who have never been married are also estimated to be less likely to quit suggests that the absence of a non-smoking spouse may also play a role: there is no one to encourage their wife/husband to quit.

The presence of children reduces smoking among middle aged individuals, both due to less starting and more quitting, but a surprising and perhaps troubling result is that, if anything, the opposite holds for younger individuals. A second unexpected result is that, for all age groups, smokers in households with more adults are less likely to quit, although the probability of starting is lower. There is little to say concerning remaining factors. For example, there is no obvious reason why being currently employed is consistently positively associated with never having smoked (with no strong relation with quitting). We also observe some possibly unexpected results for the trend variable, e.g. a positive sign for smoking initiation among the youngest group. However, these are residual effects, allowing for the effect of the other variables, making interpretation difficult.

Discussion

The results of the estimation regarding the relation between smoking and income are in substantial agreement with the theoretical model. They certainly show that this relation is governed by more than the budget constraint. Indeed, the evidence here is that it is not the primary factor. This is supported by the simple fact that the consumption of what is an expensive good with few if any substitutes are concentrated among low income individuals.

There are two caveats regarding the results. The first is the possible role of nicotine replacement therapy (NRT). While this only applies to quitting, higher income smokers trying to give up cigarettes may be less likely to be deterred by the cost of NRT, and to that extent more likely to succeed. One study found that users of NRT tended to be those in higher income groups (Shiffman, Di Marino, and Sweeney, 2005). However, there is considerable evidence that cost of NRT is not a major factor causing differences in quit rates across income groups. For example, one study found that of those discontinuing use of NRT, only 5% did so due to cost (Burns and Levinson, 2008). Indeed, the cost is not all that high. There are numerous types of NRT available, and, according to the American Lung Association, these vary in cost from approximately $ 2 to $ 15 per day. [12] For many smokers, this is less than what they spend on current cigarette consumption, so in a real sense NRT is costless, and, given even a low probability of success, the expected payoff is surely large in virtually all cases (Bunney, 1999). There have also been studies of the effectiveness of free provision of NRT to primarily low income smokers (Alberg, et al., 2004; Miller, et al., 2002; Okuyemi et al., 2007). Results have been mixed, with most studies showing little if any impact on long term smoking behavior.[13]

A second caveat involves the rate of time preference. In the model above it was assumed that this rate is identical for all consumers. In reality it is likely to vary, and some argue this is a major cause of differing health behaviors across individuals. This is problematic, for time preference is also likely to affect other socioeconomic characteristics. As indicated above, education is an oft-cited example: people with low time preference are expected to be more willing to invest in education. Of importance here is the possibility that a low rate of time discount can result in higher income. For example, an individual with a low rate of discount is more likely to save and

invest. To the extent this is the case, a correlation between income and smoking could be due to the effect of time preference.

That this is a possibility cannot be denied. However, Becker and Mulligan make the opposite argument: wealthy individuals have more of an incentive to develop an appreciation of the future than do people with less wealth, whose futures are not as rosy. They provide some evidence supporting an income-causes-time preference argument, rather than the reverse, such as intergenerational similarities in income and consumption. But in the context of this study it does not appear to be possible to distinguish between the two. Both predict the same relation between income and smoking. In both cases, the reason is that low income individuals have a lower present value of the future. In one case, it is because they have a high time preference; our argument is that the present value of their future is low because the *future* value is low.

We believe the explanation proposed in the paper is the dominant factor in our results. One reason is simply that if individuals A and B are identical except B has a higher expected income, then B's cost of smoking is higher: more potential utility is being put in jeopardy. Thus, unless the only reason for income differences is differences in time preferences (which is surely not the case), income would have a direct effect on smoking. Furthermore, it seems reasonable to suppose that differences in time preference are more related to differences in educational attainment than to income differences. To the extent they are the education variables serve as proxies for time preference in our estimation.

Concluding Remarks

Over the last several decades the health consequences of cigarettes have become widely known. As a result, the percent of the population who smoke has been greatly reduced. While this has occurred across income groups, the reduction has been smaller for those with less income, such that cigarettes have switched from being a normal good to being inferior. This has occurred despite steep increases in cigarette taxes, which if anything should have greater effects on smokers with less income.

In this study we investigated the relation between income and smoking. Our hypothesis is that, in addition to the financial costs of smoking, smokers endure a potentially larger cost, a loss of expected utility due to reduced longevity. Since utility is a function of income, this cost increases as income increases. It also grows with age, as the time of potentially reduced longevity comes nearer. A simple two period utility model shows that, because of this longevity cost, smoking initiation is likely to increase with income at the lower end of the income distribution but to eventually decline with income at higher levels. It also follows that the effect of income on smoking cessation is different from its effect on starting, with the probability of quitting increasing with income throughout the income distribution. This is because the decision to start tends to be influenced more by the financial cost than is the decision to quit, which is more affected by concerns of longevity.

We tested the model using data from the 1994-2007 Behavioral Risk Factor Surveys. We estimated logistic regression for starting and quitting smoking, separately for three age groups.

With few exceptions, the results support the theory. The results show that the high prevalence of smoking among those with low income is not due to a high probability of starting to smoke; the problem is they are less likely to quit. These results should not be too surprising. Cigarettes are addictive and can provide considerable pleasure. Thus, a smoker will often need a strong incentive to quit. The cost of cigarettes, even with the large recent increases in cigarette taxes, may not provide the incentive. The possibility of reduced lifetime often does, as attested by the fact that most successful quitting is inspired by health concerns. This incentive is stronger the more attractive is one's future, e.g. the more income one expects to have. To put it somewhat starkly, the poor have less to look forward to, and their greater reluctance to forego the pleasure of smoking today in order to increase the chance of a longer future is, at some level, quite rational.

A final point is the extent to which the hypothesis of this paper applies to the question of dietary choice by low income consumers. We believe this is quite likely: the same phenomenon is present: switching to a healthier diet involves sacrificing present pleasure for future healthy time. It may be somewhat attenuated, for the link between poor diet and reduced longevity is less firmly established than is the case with smoking. But the results of this study suggest it is a possibility worthy of consideration.[14]

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TABLE 1. Sample Means of Variables, by Age Group.

VARIABLE	18-30	31-50	50+
BEGIN	0.392	0.455	0.535
QUIT (Based on Entire Sample)	0.126	0.208	0.374
INC1: INCOME < $10,000	0.071	0.042	0.073
INC2: $10,000 - $14,999	0.062	0.037	0.081
INC3 :$15,000 - $19,999	0.100	0.056	0.098
INC4: $20,000 - $24,999	0.128	0.077	0.116
INC5: $25,000 - $34,999	0.184	0.129	0.152
INC6: $35,000 - $49,999	0.191	0.194	0.165
INC7: $50,000 - $74,999	0.148	0.207	0.143
INC8: $75,000 OR MORE	0.115	0.258	0.172
MALE	0.414	0.410	0.411
SEPERATED, DIVORCED,	0.063	0.184	0.363
NEVER MARRIED	0.431	0.117	0.050
HIGH SCHOOL GRADUATE	0.308	0.288	0.325
COLLEGE GRADUATE	0.277	0.362	0.293
SOME COLLEGE	0.321	0.281	0.249
CURRENT STUDENT	0.118	0.011	0.002
NUMBER OF ADULTS IN	2.144	1.964	1.773
NO. OF CHILDREN IN	0.969	1.291	0.138
AFRICAN AMERICAN	0.099	0.084	0.064
HISPANIC	0.122	0.083	0.051
AGE	25.106	40.860	64.493
EMPLOYED	0.721	0.812	0.414

Table 2. Estimation Results for Starting to Smoke, by Age Group.

	18-30		31-50		51+	
Variable	Estimate	tval	Estimate	tval	Estimate	tval
Intercept	-7.921	-23.82	-0.873	-4.05	-3.454	-18.01
INC1	-0.094	-2.96	-0.050	-1.92	-0.150	-7.16
INC2	-0.016	-0.50	0.006	0.24	-0.039	-1.99
INC3	0.022	0.81	0.003	0.11	-0.045	-2.54
INC5	-0.055	-2.40	-0.072	-4.05	0.011	0.69
INC6	-0.141	-6.20	-0.114	-6.75	0.041	2.66
INC7	-0.207	-8.39	-0.181	-10.55	0.057	3.46
INC8	-0.229	-8.35	-0.272	-15.42	-0.054	-3.14
MALE	0.289	22.41	0.355	45.57	0.978	116.04
WIDOWED, SEP.DIV	0.573	19.97	0.445	36.42	0.308	26.64
NEVER MARRIED	0.096	6.01	0.032	2.19	-0.113	-5.24
HIGHSCHOOLGRAD	-0.354	-15.02	-0.314	-18.29	-0.174	-12.67
COLLEGE GRAD	-1.440	-52.30	-1.234	-67.81	-0.593	-37.92
SOME COLLEGE	-0.725	-29.50	-0.546	-30.91	-0.157	-10.49
STUDENT	-0.517	-18.95	0.053	1.38	-0.088	-0.77
NUMBER ADULTS	-0.042	4.33	-0.030	-4.68	-0.082	-10.96
NUMBER OFCHILDREN	0.006	0.87	-0.076	-22.48	-0.024	-3.04
AF-AMERICAN	-1.118	47.95	-0.569	-40.31	-0.230	-13.57
HISPANIC	-0.802	33.50	-0.710	-41.63	-0.550	-23.47
AGE	0.652	24.29	0.066	6.23	0.134	23.95
AGE SQUARED	-0.012	22.96	-0.001	-4.13	-0.001	-28.38
EMPLOYED	-0.073	3.92	-0.126	-11.58	-0.221	-21.65
TREND	0.013	7.44	-0.019	-18.68	-0.006	-5.33
R^2	.098		.089		.071	

Table 3. Estimation Results for Quitting, by Age Group.

	18-30		31-50		51+	
Variable	Estimate	tval	Estimate	tval	Estimate	tval
Intercept	-2.313	-3.89	0.440	1.35	-3.323	-9.24
INC1	0.084	1.49	-0.095	-2.44	-0.258	-8.57
INC2	-0.040	-0.73	0.013	0.34	-0.149	-5.25
INC3	-0.067	-1.51	-0.091	-2.77	-0.090	-3.50
INC5	0.043	1.17	0.148	5.77	0.131	5.72
INC6	0.148	3.98	0.329	13.64	0.219	9.49
INC7	0.266	6.68	0.521	21.15	0.395	16.01
INC8	0.367	8.26	0.776	30.34	0.634	23.67
MALE	-0.078	-3.73	-0.022	-1.94	0.210	17.27
WIDOWED, SEP, DIV	-0.768	-17.38	-0.544	-31.43	-0.528	-31.62
NEVER MARRIED	-0.530	-21.20	-0.447	-19.68	-0.435	-13.45
HIGH SCHOOL GRAD	0.269	6.98	0.198	8.62	0.108	5.59
COLLEGE GRAD	0.945	21.35	0.909	36.51	0.593	25.44
SOME COLLEGE	0.575	14.41	0.407	17.22	0.249	11.76
STUDENT	0.189	4.16	0.255	4.39	0.270	1.90
NUMBER ADULTS	-0.057	3.61	-0.084	-7.74	-0.051	-4.75
NUMBER CHILDREN	-0.037	3.49	0.073	14.38	-0.014	-1.26
AF-AMERICAN	-0.245	5.15	-0.147	-6.34	-0.124	-4.89
HISPANIC	0.354	9.32	0.418	15.93	0.193	5.08
AGE	0.065	1.37	-0.096	-6.01	0.051	4.59
AGE SQUARED	0.000	0.48	0.002	8.28	0.000	1.96
EMPLOYED	-0.069	2.28	0.055	3.39	-0.022	-1.43
TREND	-0.007	2.37	-0.013	-8.42	0.000	0.09
R^2	.075		.101		.112	

Table 4. Estimated Probabilities of Starting to Smoke and Quitting, Conditional on Starting, by Age Group, Selected Categories.

	BEGIN			QUIT		
Variable	18-30	31-50	51+	18-30	31-50	51+
INC1	0.381	0.473	0.502	0.305	0.348	0.626
INC2	0.399	0.487	0.530	0.279	0.373	0.651
INC3	0.409	0.486	0.528	0.274	0.349	0.664
INC4	0.403	0.486	0.540	0.287	0.370	0.684
INC5	0.390	0.468	0.542	0.296	0.405	0.712
INC6	0.370	0.457	0.550	0.319	0.450	0.730
INC7	0.355	0.441	0.554	0.345	0.497	0.763
INC8	0.350	0.419	0.526	0.368	0.561	0.803
FEMALE	0.352	0.415	0.437	0.316	0.454	0.700
MALE	0.420	0.503	0.673	0.299	0.448	0.742
MARRIED	0.362	0.430	0.510	0.373	0.496	0.763
WIDOWED,SEP,DIV	0.501	0.540	0.586	0.216	0.363	0.655
NEVER MARRIED	0.384	0.438	0.482	0.259	0.386	0.675
DID NOT GRAD HS	0.562	0.621	0.603	0.220	0.351	0.667
HIGH SCHOOL GRAD	0.474	0.544	0.560	0.270	0.397	0.690
SOME COLLEGE	0.383	0.487	0.565	0.334	0.448	0.719
COLLEGE GRAD	0.233	0.323	0.456	0.421	0.573	0.783
OTHER RACE	0.430	0.477	0.547	0.304	0.447	0.721
AFR-AMER	0.198	0.341	0.490	0.255	0.411	0.696
HISPANIC	0.253	0.310	0.411	0.384	0.551	0.758

End Notes

[1] An exception is the hypothesis that food stamps, by essentially relaxing the food budget constraint, may contribute to obesity by encouraging low income individuals to consume more food than they otherwise would. Several studies have investigated this question (e.g. (Meyerhoefer and Pylypchuk, 2008; Chen,Yen and Eastwood, 2005). The review by Ver Ploeg and Ralston (2008) concluded there is some modest evidence supporting the hypothesis, but only for middle aged women.

[2] From this they anticipate results pointed out above: "Therefore, the spread of information about the health hazards of smoking should have reduced the income elasticity of smoking, and it could have made smoking an inferior good." (p.688)

[3] For a good like exercise, which has a positive effect on health but (at least for many people) negative effects on present utility, one can define x as *not* exercising.

[4] This is discussed further below.

[5] Most admonitions regarding cigarettes are of the nature of "Do not smoke" and "Quit," rather than "limit cigarettes" or "smoke low tar cigarettes." Health consumption decisions very often involve binary choices, e.g. replacing regular milk with skim milk.

[6] If D_1 were in monetary terms, it would be the willingness to pay for the option of purchasing x at current prices.

[7] In the present context "inferiority" would apply to x only in its capacity as providing direct utility.

[8] This would occur if D_2 exceeds D_1 in absolute value even at very low levels of income.

[9]These capture any effect of taxes. In preliminary work we included taxes, not only current values but, to allow for habits and rational addiction, also lagged and future taxes. Results for these proved to be unstable across years. One possible reason for this is the presence of group (here state) error components, which can cause invalid results for variables which are constant within groups (Moulton, 1986). Dummy variables eliminate such problems, while being able to capture any omitted state effects, including differences in anti-smoking activities. We note that results for other variables, income included, were not meaningfully different in models with taxes and the models presented here.

[10]The estimation used SAS SURVEYLOGISTIC.

[11] We have included all values of the given category, including the reference group. The usual marginal effect is the difference between a given group and the reference group. Thus, the "marginal effect" for income group 1 is the probability in the table minus that of income group 4,

the reference group for income. When calculating the probabilities for each category, variables for other categories were set at sample means.

[12] http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=33566 Accessed June 12,2009.

[13] An issue related to NRT is smokers' access to physician counseling. However, the evidence is there is little relation between income and such access. Houston et al. (2005) found only slightly greater access by higher income groups, while Tairi et al. (1997) found greater access by low income individuals.

[14] An aspect of time preference receiving considerable attention in in the obesity-nutrition literature is "non-rational" choice due to self control problems. (Cutler et al., 2003: Just, 2006) The modern food system has put within easy reach a bounty of fast food and other energy-dense temptations that are a challenge for people with insufficient power of resistance. The challenge will be less as the perceived benefits of avoiding temptation increase. This implies low income individuals may be more susceptible, just as they find the rewards of smoking cessation insufficient to overcome the allure of tobacco.