



The Impact of Retirement on Smoking Behavior

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We use data from the Health and Retirement Study to examine the relationship between retirement and smoking decisions. Retirement might affect smoking behavior through a change in the opportunity cost of time, job-related factors or income. To estimate the causal effect of retirement on smoking habits, we exploit eligibility for Social Security benefits at age 62 to account for the endogeneity of retirement. We find suggestive evidence that retirement increases the probability of smoking among ever smokers, but this effect is sensitive to the econometric specification used. We also find evidence of heterogeneity in the impact of retirement.

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INTRODUCTION

Smoking is well known to be a leading cause of preventable mortality and is responsible for 443,000 deaths annually in the US and \$193 billion in annual health-related economic losses [Centers for Disease Control and Prevention (CDC) 2008]. Although there has been a large decline in smoking rates over the past decades, approximately 19 percent of the US population continues to smoke [CDC]. Many factors have been shown to affect a person's success at quitting smoking, including health shocks [Falba 2005; Khwaja *et al.* 2006] and involuntary job loss [Falba *et al.* 2005]. This study examines whether labor force withdrawal among older individuals, specifically retirement, affects smoking rates.

In addition to public health concerns, cigarette consumption raises concerns about social welfare since smokers impose a negative externality via second-hand smoke. Smokers might also impose negative externalities through higher medical costs financed by shared health insurance premiums or payroll taxes for programs such as Medicare. On the other hand, the shorter life expectancy associated with smoking might generate cost savings to pension programs. Manning *et al.* [1989] estimated the lifetime discounted costs imposed by smokers on others to be \$0.15 per pack of cigarettes; they concluded that tobacco excise tax rates prevalent at the time of the study cover these costs. However, their calculations did not include “internal costs.” Recent work in behavioral economics suggests that smokers also face “internalities” [Laibson 1997; O'Donoghue and Rabin 1999; Gruber and Koszegi 2000]. Such models argue that smokers themselves incur a loss in long-run utility by smoking because behavioral factors such as hyperbolic discounting or cue-triggered responses cause them to choose suboptimal consumption levels. Indeed, a few recent studies have provided empirical evidence on time inconsistent preferences [Gruber and Koszegi 2000; Gruber and Mullainathan 2005; Kan 2007], which in turn suggests that policies that lead to a reduction in smoking rates would improve welfare by reducing both externalities and internalities.

Although most studies on smoking focus on reducing initiation among youths, our study examines cessation and relapse among older individuals. Evidence suggests that quitting as late as age 65 leads to substantial gains in life expectancy [Taylor *et al.* 2002]. Moreover, older individuals experience several important life changes that affect smoking behavior and in particular, retirement might play a role. Importantly, policies that affect the timing of retirement might affect health-care expenditures and life expectancy through an effect on (un)healthy behaviors. Changes in life expectancy combined with an aging population generate concerns regarding the financial solvency of public programs such as Medicare and Social Security, and growing health-care expenditures add to these concerns. If retirement affects health behavior, then policies that increase the full retirement age have implications for costs to programs such as Medicare and Social Security.

Several previous studies have examined the impact of retirement on health [e.g. Bound and Waidmann 2007; Coe and Zamarro 2011]. These tend to vary significantly in the measures of health used as well as in their findings. For example, Coe and Lindeboom [2008] examine the impact of retirement on various measures of physical and mental health and find no effect of retirement on health. Using data from the United States, England, and 11 other European countries, Rohwedder and Willis [2010] find that early retirement has a negative impact on cognition. Goldman *et al.* [2008] find evidence of heterogeneous effects, with males retiring from strenuous jobs gaining weight after retirement and those retiring from sedentary jobs losing weight. Charles [2002] finds that retirement has a positive impact on well-being. Most of the extant literature has focused on health outcomes; however, an important pathway by which retirement affects health could be through a change in health behaviors such as smoking.

According to economic theory, the net impact of retirement on smoking is ambiguous. If health is an input into market-based production, then by reducing the opportunity cost of time retirement decreases the incentive to invest in health and thereby increases smoking [Grossman 1972]. Social and environmental factors at the workplace and at home also play a role. For example, smoke-free air laws at the workplace have been shown to reduce smoking rates [Evans *et al.* 1999]. Retirement might lead to increased smoking by removing the restrictions imposed by such laws. On the other hand, job-related stress has been shown to be associated with increased smoking, presumably as a way of coping with stress [Ayyagari and Sindelar 2010]. If retirement reduces stress then it might lead to lower smoking rates. Peers at work or at home might also play a role. Evidence suggests that being surrounded by others who smoke increases the likelihood of own smoking [Cutler and Glaeser 2007; Fletcher 2010]. Finally, retirement is usually associated with a decrease in income which would reduce smoking if cigarettes are normal goods.

Thus, the net effect of retirement on smoking is an empirical question. In order to identify the causal impact of retirement status on smoking, it is necessary to account for the fact that retirement is endogenous to smoking. Both smoking and retirement decisions are likely to be affected by common unobserved variables such as health or preferences. Retirement might also be related to smoking due to reverse causality. Smokers are likely to have more health problems which in turn might induce them to retire early. Indeed, a large literature finds that poor health leads to early retirement [e.g. Bazzoli 1985; McGarry 2004; McGeary 2009]. Alternatively, smokers might continue working longer to keep employer-sponsored health insurance as a way to finance the health consequences of smoking. This study estimates the causal effect of retirement on smoking cessation and relapse using a recursive bivariate probit (BP) model. The estimation strategy uses eligibility for Social Security benefits at age 62 to create an instrumental variable that affects the decision to retire but not the decision to smoke. The results show that retirees are significantly more likely to be current smokers compared with non-retirees and also smoke more cigarettes



per day. We also find evidence of substantial heterogeneity in the impact of retirement on smoking status.

DATA

We use data from the 1992 through 2008 waves of the Health and Retirement Study (HRS). The HRS is a nationally representative longitudinal survey of individuals over 50 years and their spouses. See Juster and Suzman [1995] for more detail on the HRS. We combine the original HRS data with the RAND HRS (version K) data, which is a longitudinal data that includes cleaned versions of the most frequently used HRS variables. The RAND data set was developed at RAND with funding from the National Institute on Aging and the Social Security Administration with the goal of making the data more accessible to researchers.

Sample selection

The RAND HRS data set is a sample of 30,547 individuals who were interviewed at various waves of the HRS. To obtain a relatively homogenous sample, the sample was restricted to individuals between 60 and 80 years of age. Individuals who reported never working, being self-employed or were not residing in the US at the time of the interview were omitted from the analysis. Ayyagari and Sindelar [2011] use HRS data and show that only 0.28 percent of those who never reported smoking actually initiate smoking in subsequent waves. The authors also suggest that the 0.28 percent who initiate smoking at older ages may have misreported their smoking status. Following Ayyagari and Sindelar [2011], we restrict the analysis sample to “ever smokers.” Thus, the analysis focuses on quitting or relapses into smoking rather than on initiation. Individuals who were not included in the original HRS sampling frame (i.e. spouses of the HRS respondents) were also excluded. Note that we do include spouses who are age eligible for the HRS sample. Finally, observations with missing values for retirement, smoking status or demographic variables were dropped.

The final sample consists of 11,576 individuals and 44,441 person-wave observations. Table 1 presents summary statistics for the analysis sample as well as for the original RAND HRS sample. Given the sample selection criteria, there are some expected differences between the analysis sample and the HRS sample. Individuals in the analysis sample are older, and more likely to be retired and smokers. They are also more likely to be male and white, and have lower educational attainment.

Table 2 presents summary statistics for the analysis sample and then separately for retirees and non-retirees. Approximately 65 percent of the sample is composed of retirees and these individuals are less likely to be smokers as compared with those who have not retired. Retirees are also older on average as is to be expected. The summary statistics suggest that there is substantial selection into retirement. Retirees are more likely to be male, white and have lower educational attainment.

Key variables

The main dependent variable is a binary indicator for whether or not a person reports being a current smoker at the time of the survey interview. We also study the number of cigarettes smoked per day. Quantity smoked is reported in number of cigarettes, packs or cartons. For individuals who reported the number of packs or cartons, the number of cigarettes smoked per day is calculated by assuming that each pack contains 20 cigarettes

Table 1 Comparison of summary statistics (means) for the analysis and original HRS samples

	<i>Analysis sample</i>	<i>HRS sample</i>	<i>Test for differences (P-value)</i>
Retired	0.651	0.427	0.000
Smoke (0/1)	0.234	0.163	0.000
Age	68.648 (6.104)	65.588 (10.407)	0.000
Male	0.536	0.453	0.000
White	0.879	0.867	0.000
Black	0.092	0.093	0.687
Other race	0.029	0.040	0.000
Years of education	12.165 (3.095)	12.491 (3.172)	0.000
New England	0.059	0.050	0.103
Mid Atlantic	0.138	0.133	0.476
EN Central	0.163	0.170	0.029
WN Central	0.084	0.088	0.251
S Atlantic	0.215	0.211	0.435
ES Central	0.057	0.058	0.671
WS Central	0.088	0.097	0.005
Mountain	0.058	0.056	0.758
Pacific	0.139	0.135	0.490
Observations	44,441	274,923	
Number of individuals	11,576	30,547	

Statistics account for *P*-weights, stratification and clustering at the PSU level.
Standard deviations for non-binary variables are presented in parentheses.

Table 2 Comparison of summary statistics (means) by retirement status

	<i>Full sample</i>	<i>Retired</i>	<i>Not retired</i>	<i>Test for differences (P-value)</i>
Retired	0.651			
Smoke (0/1)	0.234	0.216	0.267	0.000
Age	68.648 (6.104)	70.309 (5.816)	65.548 (5.379)	0.000
Male	0.536	0.564	0.482	0.000
White	0.879	0.887	0.865	0.000
Black	0.092	0.088	0.100	0.005
Other race	0.029	0.026	0.035	0.001
Years of education	12.165 (3.095)	12.074 (3.105)	12.334 (3.068)	0.000
New England	0.059	0.058	0.060	0.553
Mid Atlantic	0.138	0.144	0.128	0.107
EN Central	0.163	0.164	0.160	0.701
WN Central	0.084	0.083	0.086	0.744
S Atlantic	0.215	0.208	0.229	0.036
ES Central	0.057	0.057	0.057	0.976
WS Central	0.088	0.086	0.092	0.138
Mountain	0.058	0.058	0.058	0.973
Pacific	0.139	0.143	0.131	0.161
Observations	44,441	29,101	15,340	
Number of individuals	11,576	9,347	6,398	

Statistics account for *P*-weights, stratification and clustering at the PSU level.
Standard deviations for non-binary variables are presented in parentheses.

and that each carton contains 10 packs or 200 cigarettes. For former smokers, the number of cigarettes smoked per day is set to zero.

The main independent variable is an indicator for fully retired status based on the individual's labor force status in the RAND HRS data set. Labor force status in the RAND data set is based on several questions on employment, retirement, and disability. If an individual is not working, not looking for a job and there is any mention of retirement then RAND classifies him/her as fully retired. Employment is classified as full time or part time. If the person is working part time and mentions retirement, she/he is considered to be partly retired. If the person reports looking for a part-time job and there is no mention of retirement then she/he is considered to be unemployed. If a disabled employment status is reported and retirement is not mentioned then labor force status is set to disabled. If none of the above conditions are satisfied, the individual is considered to be out of the labor force.

ESTIMATION METHODS

The basic econometric model for the decision to smoke is given by:

$$(1) \quad s_{it} = I(\beta r_{it} + \mathbf{X}'_{it}\gamma + T_t + \varepsilon_{it} > 0)$$

where $I(\cdot)$ denotes the indicator function, s_{it} is a binary indicator for current smoking status for individual i in survey wave t , r_{it} is a binary indicator for current retirement status, \mathbf{X}_{it} is a vector of observable characteristics, T_t is a vector of survey wave dummies and ε_{it} is an idiosyncratic error term. Assuming that the error term follows a normal distribution, equation (1) can be estimated using a standard probit regression. As discussed above, retirement is likely to be endogenous due to reverse causality as well as due to the presence of unobserved factors that are correlated with the decisions to smoke and to retire. This implies that ε_{it} will be correlated with r_{it} and the estimate of β cannot be interpreted as causal.

In order to identify the causal effect of retirement we estimate a recursive bivariate probit model, given by:

$$(2) \quad s_{it} = I(\delta_1 r_{it} + \mathbf{X}'_{1it}\delta_2 + \tau_{1t} + u_{it} > 0)$$

$$(3) \quad r_{it} = I(\alpha_1 IV_{it} + \mathbf{X}'_{2it}\alpha_2 + \tau_{2t} + v_{it} > 0)$$

where IV denotes the instrumental variable that affects the decision to retire but not the decision to smoke. The endogeneity of retirement implies that $Cov(u_{it}, v_{it}) = \rho \neq 0$. Assuming that the error terms, u and v , follow a bivariate normal distribution, the above model can be estimated using bivariate probit regression. The vectors \mathbf{X}_1 and \mathbf{X}_2 include age, age squared, years of education, and dummy variables for male, black, and other race (with white being the omitted category). In addition, \mathbf{X}_1 includes dummy variables for the individual's census division of residence. The census division indicators account for geographic differences in factors that may affect smoking rates, such as tobacco prices and taxes or social norms regarding smoking. Secular trends in smoking rates and retirement are accounted for by survey wave dummies τ_1 and τ_2 , respectively.

We also estimate the impact of retirement on the intensive margin using number of cigarettes smoked per day as the dependent variable. For non-smokers, the number of cigarettes is set to zero. We first use ordinary least squares regression to estimate:

$$(5) \quad ncig_{it} = \mu_1 r_{it} + \mathbf{X}'_{1it}\mu_2 + \tau_{3t} + \vartheta_{it}$$

Next, we estimate a treatment effects model that accounts for the endogeneity of retirement. The model is given by the two equations below which are estimated

simultaneously using maximum likelihood methods:

$$(6) \quad ncig_{it} = \mu_1 r_{it} + \mathbf{X}'_{1it} \mu_2 + \tau_{3t} + \vartheta_{it}$$

$$(7) \quad r_{it} = I(\alpha_1 IV_{it} + \mathbf{X}'_{2it} \alpha_2 + \tau_{4t} + v_{it})$$

The correlation between the error terms of equations (6) and (7) is denoted by ρ while the variance of the error term in the outcome equation (6) is denoted by σ . The non-selection hazard is measured by the inverse mills' ratio which is defined as $\lambda = \rho\sigma$.

Identification

To identify the impact of retirement on smoking cessation, we exploit non-linearities in eligibility ages for Social Security benefits to construct instrumental variables. The earliest age of eligibility for Social Security benefits is 62 while the full retirement age for an individual varies depending on their year of birth. For those born in 1937 or earlier, the full retirement age is 65 years. For those born in 1938 or later, the full retirement age gradually increases with year of birth so that for persons born in 1954 the full retirement age is 66. Moreover, the penalty on benefits for early retirement at age 62 varies with year of birth. On the other hand, continuing to work beyond the full retirement age increases the benefits until age 70. This increase in benefits also varies depending on the year of birth. Although benefits are designed to be actuarially fair for any retirement age, there are pronounced peaks in retirement rates at ages 62 and 65, which can be explained through the incentives provided by Social Security and Medicare [Rust and Phelan 1997; Hurd *et al.* 2004].

For the subset of individuals who report that they consider themselves to be completely or partially retired, the HRS contains information on the retirement month and year. Figure 1 presents the histogram of retirement age for individuals for whom retirement month and year are available and whose reported retirement age lies between 50 and 80 (persons = 7,039, observations = 20,870). Note that these individuals do not correspond exactly to the retirees in the analysis sample since we also use responses to other survey questions (e.g. on labor force status) to identify fully retired status. There is a marked increase in the retirement rates at age 62, which is consistent with the existing literature. There is also a moderate increase at age 65 which is the full retirement age for about 76 percent of this subsample. The evidence from prior literature and Figure 1 show that being 62 years or older significantly increases the likelihood of being retired due to eligibility for Social Security benefits.

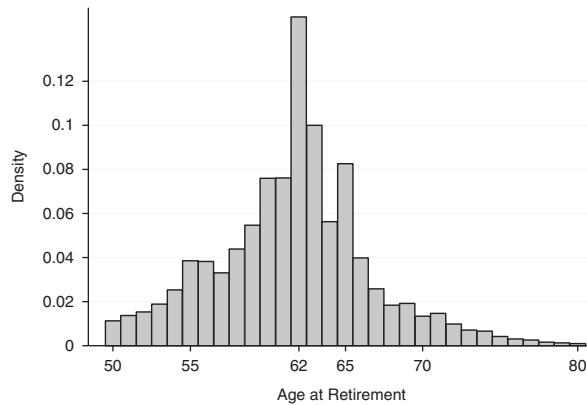


Figure 1. Histogram of age at retirement for subsample with data on retirement date.

Therefore, we define the instrumental variable for retirement as:

$$IV = I(\text{Age} \geq 62)$$

The identifying assumptions for this research design are that IV is correlated with retirement status (“first stage”) but not correlated with smoking decisions except through retirement (“exclusion restriction”). In general, age may be correlated with smoking decisions and this relationship may not be linear. We account for such effects by controlling for a quadratic age term. Conditional on age and year fixed effects, there is no reason that being 62 or older should have a differential impact on smoking compared with being (say) 61 or older. In the case of retirement, there is a differential impact of being 62 or older due to Social Security rules. Thus, the exclusion restriction assumes that Social Security rules introduce a “discontinuity” in the relationship between age and retirement but not in the relationship between age and smoking status.

The identification strategy described above is similar to the methods used in extant literature. Goldman *et al.* [2008] use eligibility for Social Security and Medicare at ages 62 and 65 respectively, to instrument retirement. However, eligibility for Medicare at age 65 might induce a moral hazard problem that violates the exclusion restriction. Rohwedder and Willis [2010] exploit variation in policies across countries to construct their instruments while Charles [2002] uses policy variations by age and birth cohort in the US. Other studies have used early retirement incentives [Coe and Lindeboom 2008] or subjective retirement expectations [Haider and Stephens 2007] as instruments for retirement. A concern with early retirement windows is that such offers might be more common in larger companies and in certain jobs. Given that individuals self-select into their jobs, it is not clear that such offers are exogenous to smoking decisions. Although retirement expectations might be exogenous to consumption, unobserved health is likely to affect both retirement expectations and smoking decisions.

In addition to the bivariate probit model above, we also estimate linear instrumental variables (IV) models. The IV models allow us to test for weak instruments and examine the extent to which results are sensitive to the assumption of bivariate normality. Since the main dependent variable is binary, and evidence suggests that the BP model is more robust to non-normality of the error terms than 2SLS [Bhattacharya *et al.* 2006], the BP model is our preferred specification, but we also present and discuss the results from the linear models below. Robustness of the estimates to alternative specifications, cohort differences, moral hazard, and anticipatory behavior is also discussed further below.

RESULTS

Table 3 presents the results from the univariate and the bivariate probit models. The table presents the marginal effects for the probability of smoking in the univariate model and for the marginal probabilities of retirement and smoking in the bivariate model. The univariate model finds a positive impact of retirement on smoking status, but this effect is not statistically significant. When the endogeneity of retirement is accounted for through the BP model, retirement has a large and statistically significant effect on smoking status. Retirement increases the marginal probability of smoking by 22.5 percentage points. Below we examine heterogeneous effects in an attempt to assess the pathways through which retirement may increase smoking rates.

Consistent with the descriptive analysis above, becoming eligible for Social Security benefits at age 62 significantly increases the marginal probability of retirement by 4.6 percentage points. The correlation between the errors terms of the two equations is -0.498 and the associated Wald test rejects the null hypothesis that $\rho=0$. This implies that

Table 3 Effect of retirement on smoking status (marginal effects)

Dependent variable	Probit		Bivariate probit
	Smoking status (1)	Smoking status (2)	Retirement status (3)
Retired	0.00857 (0.00741)	0.225*** (0.0463)	
$I(\text{Age} \geq 62)$			0.0457*** (0.01007)
Age	-0.0110 (0.0115)	-0.0807*** (0.0193)	0.195*** (0.0146)
Age squared	-0.000009 (0.00008)	0.00045*** (0.000131)	-0.00123*** (0.000105)
Male	-0.0608*** (0.0084)	-0.0748*** (0.00823)	0.0706*** (0.00754)
Black	0.0123 (0.0122)	0.0145 (0.0116)	-0.0117 (0.0108)
Other race	0.00457 (0.0233)	0.0128 (0.0224)	-0.0310 (0.022)
Years of education	-0.0146*** (0.00129)	-0.0133*** (0.00137)	-0.00121 (0.00124)
ρ		-0.498*** (0.115)	
Persons	11,576	11,576	11,576
Observations	44,441	44,441	44,441
Survey wave dummies	Y	Y	Y
Census division dummies	Y	Y	N

Notes: Column 1 presents marginal effects for the probability of smoking, column 2 presents marginal effects for the marginal probability of smoking, column 3 presents marginal effects for the marginal probability of retirement; Regressions are weighted and robust standard errors in parentheses are clustered at the individual level.

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

unobserved factors associated with an increased likelihood of retirement have a negative effect on smoking rates. Health shocks are an example of such factors. An elderly person experiencing a major health shock may be more likely to retire and at the same time, individuals have been shown to quit smoking in response to health shocks [Khwaja *et al.* 2006]. The negative correlation parameter suggests that a model which does not account for the endogeneity of retirement would underestimate the true effect. This is evidenced by the substantially larger effect recovered from the BP model.

We also find that smoking rates decline with age and the rate of decline increases with age. Consistent with the large literature on the education health gradient, individuals with more years of education are less likely to be smokers. Surprisingly, men in this sample have lower smoking rates than women, which might be explained by the fact that the sample excludes persons who have never worked and never smokers.

Table 4 presents results separately for men and for women. Retirement has a positive impact for men (marginal effect = 0.277) but a negative one for women (marginal effect = -0.224). The effect for women is significant only at the 10 percent level (P -value = 0.059). These gender differences might reflect the fact that, in this older sample, fewer women are likely to have worked till full retirement age and then retired. Compared with men, women are much more likely to report being out of the labor force for reasons other than disability, unemployment, or retirement (12.97 vs 0.57 percent). It is plausible that unobserved gender differences in preferences for labor force participation may explain the estimated differences. Further, the correlation between

Table 4 Gender differences in the impact of retirement on smoking status (marginal effects)

	<i>Male</i>		<i>Female</i>	
	<i>Smoking status equation</i>	<i>Retirement status equation</i>	<i>Smoking status equation</i>	<i>Retirement status equation</i>
Retired	0.277*** (0.0543)		-0.224* (0.119)	
<i>I(Age ≥ 62)</i>		0.0569*** (0.0132)		0.0381** (0.0149)
Age	-0.0979*** (0.0242)	0.156*** (0.0200)	0.0505 (0.0371)	0.224*** (0.0218)
Age squared	0.0005*** (0.0002)	-0.0009*** (0.0001)	-0.0004 (0.0002)	-0.00145*** (0.0002)
Black	0.0636*** (0.0166)	-0.0130 (0.0150)	-0.0446*** (0.0161)	-0.0121 (0.0155)
Other race	0.0397 (0.0296)	-0.0509* (0.0268)	-0.0203 (0.0357)	0.00621 (0.0334)
Years of education	-0.00827*** (0.002)	-0.00572*** (0.00155)	-0.0163*** (0.0028)	0.00741*** (0.00198)
ρ	-0.674*** (0.160)		0.398* (0.203)	
Persons	6,318	6,318	5,258	5,258
Observations	23,692	23,692	20,749	20,749
Survey wave dummies	Y	Y	Y	Y
Census division dummies	Y	N	Y	N

Notes: Table presents marginal effects for the marginal probability of the dependent variable; Regressions are weighted and robust standard errors in parentheses are clustered at the individual level.

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

error terms (ρ) is negative for men and positive for women, which suggests that unobserved variables affect retirement and smoking decisions differently for men and women. Compared with non-retirees, male retirees are less likely to smoke due to unobserved factors while the reverse is true for female retirees. We further explore the idea of gender differences in labor supply preferences by estimating the model for the subsample of current workers and retirees only. This excludes individuals who are unemployed, disabled, or out of the labor force for other reasons. We find no significant differences between men and women (marginal effect for men = 0.285, marginal effect for women = 0.359; P -value for test of differences = 0.4898). This suggests that the overall differences between men and women are primarily driven by differential selection into work by gender. Married individuals often make retirement decisions jointly and women may be more likely to base their retirement decisions on their spouse's income and Social Security eligibility. To assess whether such retirement decisions have a different impact on smoking, we estimate the BP model for the sample of married women. The impact of retirement is small and insignificant (marginal effect = 0.013; P -value = 0.915) suggesting that for this group retirement does not affect smoking. However, it is important to note that the insignificant effect may be due to the low sample size (2,937 women).

Table 5 presents the effect of retirement on smoking intensity. We find that retirement is associated with a significant increase in the number of cigarettes smoked. The Wald test rejects the null hypothesis of independent equations (P -value < 0.001). The literature on

Table 5 Effect of retirement on smoking intensity among current smokers

Dependent variables	OLS		Treatment effects model
	Number of cigs per day		Retirement status
Retired	0.356*** (0.115)	0.842*** (0.174)	
$I(\text{Age} \geq 62)$			0.144*** (0.0344)
Age	-1.096*** (0.206)	-1.240*** (0.205)	0.606*** (0.0436)
Age squared	0.00587*** (0.00146)	0.00681*** (0.00145)	-0.00380*** (0.000310)
Male	-0.157 (0.0961)	-0.191** (0.0955)	0.218*** (0.0150)
Black	-1.609*** (0.135)	-1.604*** (0.135)	-0.0322 (0.0226)
Other race	-0.868*** (0.324)	-0.852*** (0.324)	-0.0963** (0.0462)
Years of education	-0.269*** (0.0150)	-0.268*** (0.0150)	-0.00412* (0.00245)
Constant	55.02*** (7.141)	60.17*** (7.122)	-23.26*** (1.508)
ρ		-0.0338*** (0.00623)	
σ		2.150*** (0.0102)	
Inverse Mills Ratio		-0.290*** (0.0537)	
Observations	43,649	43,649	43,649
Persons	11,422	11,422	11,422
Survey wave dummies	Y	Y	Y
Census division dummies	Y	Y	N

Note: Regressions are weighted and robust standard errors are in parentheses.
*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

smoking often estimates a conditional demand equation for smoking intensity by restricting the sample to current smokers. We are not able to report such conditional estimates since the treatment effects model for the sample of current smokers did not converge.

Next, we present results for linear IV models in Table 6. Although retirement is associated with a 22 percentage point increase in the likelihood of smoking in the linear model, this effect is not statistically significant at conventional levels. Linear IV models are known to suffer from low power which may explain the imprecise estimates. Moreover, IV models identify the local average treatment effect or LATE [Imbens and Angrist 1994] which is the effect for “compliers” or persons whose retirement status was changed by the instrument. If the effect of retirement on smoking is very different for this group of individuals compared with the general population, then this would also explain the difference between the effects identified by the IV and BP models. Table 6 also presents the F-statistic for the test of weak instruments which is 26.142, well above the commonly accepted threshold of 10. This supports the assumption that the age 62 cutoff is a valid instrument for retirement. We also estimate the linear IV model for smoking intensity and find that retirement is associated with a significant increase in the number of cigarettes smoked of 8.73 cigarettes. The F-statistic for the smoking intensity specification is 26.147. Table 6 also presents

Table 6 Linear models

<i>Dependent variable</i>	<i>Smoking status</i>	<i>Number of cigs</i>
<i>Model=Linear IV</i>		
Retired (2nd stage)	0.2170 (0.1666)	8.7316** (4.0713)
Age ≥ 62 (1st stage)	0.0583*** (0.0114)	0.0585*** (0.0114)
<i>F</i> -statistic	26.142	26.147
<i>N</i>	44,441	43,649
<i>Model=Linear FE-IV</i>		
Retired (2nd stage)	0.0159 (0.0649)	0.1951 (1.5475)
Age ≥ 62 (1st stage)	0.0783*** (0.0080)	0.0790*** (0.0080)
<i>F</i> -statistic	96.639	97.330
<i>N</i>	42,629	41,781

Notes: All regressions include age, age squared, dummies for census division of residence and year fixed effects; Linear IV models also include indicators for male, black, other race and years of education; Linear IV models are weighted using survey weights; Robust standard errors are in parentheses.

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

results from linear fixed effects instrumental variables (FE-IV) models. The FE-IV model includes individual fixed effects in each equation and instruments retirement using the age 62 cutoff. Therefore, the FE-IV model exploits within-person variation in retirement and smoking while the IV model uses variation in smoking between retirees and non-retirees. Again, we find a positive impact of retirement on smoking but the magnitude of the effect is much smaller when individual fixed effects are included and the effect is not significant at conventional levels. This is true for both the extensive and intensive margin of smoking. The FE-IV model makes the least restrictive assumptions in terms of identification but also has the least statistical power to identify significant effects.

Overall, these regressions provide suggestive evidence that retirement increases smoking but the estimates are sensitive to the econometric model used. The positive relationship between retirement and smoking is consistent with existing studies on work status and health that tend to find that job loss increases unhealthy behaviors. Previous studies have also found evidence of heterogeneous effects. For example, Deb *et al.* [2011] show that involuntary job loss increases BMI and alcohol consumption for individuals who are already in the unhealthy range for these behaviors but not for others. Goldman *et al.* [2008] find heterogeneous effects of retirement on weight based on occupation type. In the following section, we examine heterogeneous effects using the BP model in an attempt to identify the mechanisms through which retirement impacts smoking cessation. These analyses are primarily descriptive but they provide suggestive evidence on the relative importance of various pathways.

Heterogeneous impacts

Table 7 explores heterogeneity in the impact of retirement across work status, marital status, and level of addiction to cigarettes. The table presents the marginal effect of retirement on the marginal probability of smoking, the correlation coefficient, and the P -value for a Chow test of whether the estimated coefficients are different across models.

Table 7 Heterogeneity in the effect of retirement

<i>Sample</i>	<i>Marginal effect</i>	<i>Rho</i>	<i>Num. of obs.</i>	<i>Num. of persons</i>	<i>Chow test (P-value)</i>
Smokers in prior wave	0.157 (0.123)	-0.336*** (0.004)	7,639	2,989	REF
Non-smokers in prior wave	-0.028 (0.025)	0.260*** (0.003)	24,199	7,691	0.0481
Current workers	0.286*** (0.045)	-0.687*** (0.002)	40,196	11,085	REF
Non-workers	0.143*** (0.038)	-0.380*** (0.001)	33,346	9,931	0.0113
White collar	0.186 (0.209)	-0.481** (0.006)	9,786	2,435	REF
Service jobs	-0.120 (0.189)	0.228** (0.004)	13,490	3,343	0.1814
Blue collar	0.214* (0.114)	-0.415** (0.004)	12,869	3,255	0.9372
Married / partnered	0.176*** (0.051)	-0.448*** (0.003)	29,773	8,365	REF
Unmarried / not partnered	0.295*** (0.070)	-0.556** (0.004)	14,637	4,523	0.3388
Married / partnered workers	0.186*** (0.046)	-0.484*** (0.002)	27,184	7,993	REF
Unmarried / not partnered workers	0.390*** (0.014)	-0.929** (0.001)	12,983	4,258	0.0002
Spouse smoker	0.236 (0.442)	-0.372** (0.010)	4,403	1,634	REF
Spouse non-smoker	0.200*** (0.060)	-0.597*** (0.002)	24,479	7,151	0.7806
Age at initiation ≤ 18	0.257*** (0.064)	-0.578*** (0.003)	20,830	4,908	REF
Age at initiation > 18	0.0598 (0.143)	-0.120** (0.005)	14,146	3,197	0.1413
Current smoker or quit ≤ 20 Years	0.303*** (0.050)	-0.604*** (0.002)	33,028	9,826	0.0594

Notes: Bivariate probit models include age, age squared, male, black, other race, years of education and years dummies in both equations. The outcome equation also includes census division of residence dummies. The treatment equation includes the instrumental variable $I(Age \geq 62)$; Marginal effects for the marginal probability of smoking status are presented; 3. Regressions are weighted and robust standard errors are in parentheses. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

Quits vs relapse

First, we assess whether the impact of retirement differs based on whether current smokers are quitting or whether former smokers are relapsing. To do this, we estimate the BP model separately for the subsample of persons who reported smoking in the prior HRS wave and for those who reported not smoking in the prior wave. For persons who were smoking at the prior wave, retirement has a positive effect while it has a negative effect for persons who were not smoking at the prior wave, although neither of these estimates are significant. We do find that they are significantly different from each other.

Job-related factors

Next, we estimate the BP model separately for a subsample of retirees and current workers (full time, part time or partly retired) and for a subsample of retirees and non-workers (unemployed, disabled or out of the labor force). The effect of retirement is significantly higher for the current workers sample than it is for non-workers (29 percentage points vs

14 percentage points). In other words, retirees are much more likely to smoke compared with current workers than they are compared with non-workers. This suggests that factors at work such as smoking bans or peers may play a role in reducing smoking rates and that a change in such factors associated with retirement might explain the higher smoking rates among retirees.

We also explore heterogeneity across types of occupation. Individuals were classified into three groups (white collar, blue collar, or service) based on their occupation with the longest tenure. There were no significant differences between white-collar workers (managerial, professional, or technical support) and blue-collar workers (operators, precision production, farming, forestry, fishing, mechanics, constructors, extractors, or members of the armed forces). For individuals with their longest reported tenure in service jobs (sales, clerical, administrative support, other service including cleaning, protection, food preparation, health and personal), retirement has a negative impact on smoking (significant at the 10 percent level) but the Chow test does not reject the null of identical effects.

Marital status

We find no significant differences between those who are married or partnered *vs* those who are not. However, when the sample is restricted to current workers and retirees only, retirement has a smaller impact for individuals who are married or partnered than for those who are not. This suggests that spouses play a role mainly by preventing relapse into smoking among those who transition from a work environment to home. Among those who are married or partnered there is no statistical difference by spousal smoking status, although the lack of significance might be due to low power.

Addiction

Finally, we explore the role of addiction to nicotine. The impact of retirement might be different for individuals who are highly addicted to cigarettes, *vs* those who are not, for two reasons. Highly addicted individuals might differ from light smokers in unobserved ways and secondly, addiction makes it harder for heavy smokers to quit after retirement. Unfortunately, the HRS does not have measures on nicotine dependence; however, it includes information on date of smoking initiation and date of quitting for those who have quit smoking. Studies have shown that individuals who start smoking at younger ages are more likely to develop nicotine dependence and to become chronic smokers [Everett *et al.* 1999a]. A lower initiation age is also associated with the number of cigarettes smoked per day [Everett *et al.* 1999b]. Therefore, we use age at smoking initiation as a proxy for the level of addiction. Table 7 presents results separately for individuals who started smoking at age 18 or younger and for those who started smoking after age 18. We find a larger effect of retirement for the early initiators compared with those who started smoking after age 18, although these differences are not significant. Overall, the results are consistent with the hypothesis that early initiators are more addicted to nicotine, and therefore, are less likely to quit or more likely to relapse post retirement.

Next, we estimate a specification that excludes those who quit smoking more than 20 years ago. Former smokers who quit more than 20 years back are unlikely to start smoking after retirement. They are probably more similar to never smokers than to those who quit more recently. The coefficient on retirement is slightly larger than the estimate in Table 3. This is consistent with the hypothesis that recent quitters are more susceptible to factors associated with retirement that induce smoking as compared with those who quit smoking a while back.

Robustness checks

Alternative models

To evaluate the sensitivity of our results to alternative specifications we estimate a series of alternative models (see Table 8). First, we estimate the BP model controlling for the type of job that the person had, to account for differences in retirement and smoking rates by job type. Based on longest tenured job, we create binary indicators for blue collar and service jobs (white collar forms the reference group). Since job type is missing for 18.67 percent of the sample, we also include a dummy for missing occupation. The marginal effect is smaller when we include dummies for job type but still positive and significant. We also examine the role of health shocks, which may affect both smoking and retirement decisions. In each wave, the HRS asks respondents whether they have been diagnosed for specific health conditions. We use these responses to create indicators for new diagnosis of high blood pressure, diabetes, cancer, lung disease, heart problems, and stroke. Since spousal shocks may also affect retirement and smoking, we create indicators for each respondent's spouse being diagnosed with these conditions. Then we estimate the BP model including these self and spouse health shock dummies in the model. Since health shocks are defined in terms of a change in diagnosis, we cannot use the first wave of the survey to estimate our model. While both own and spousal health shocks significantly affect retirement and smoking, these variables do not substantially alter the marginal effect of retirement. Next, we estimate the BP model without including the instrument. Identification in this case is based solely on functional form assumptions. The effect of retirement is similar to what we find when including the instrument. Next, we estimate models that constrain the correlation between errors to be a specific value (−0.1, −0.3 and

Table 8 Robustness checks

<i>Model</i>	<i>Marginal effect</i>
Job type indicators	0.165*** (0.0715)
Health shocks	0.202*** (0.049)
No IV	0.230*** (0.0441)
$\rho = -0.1$	0.0559*** (0.0071)
$\rho = -0.3$	0.144*** (0.00645)
$\rho = -0.5$	0.226*** (0.00585)
$\rho = -0.8$	0.340*** (0.0048)
$\rho = 0.2$	−0.0936*** (0.008)
$\rho = 0.6$	−0.329*** (0.00799)
$\rho = 0.9$	−0.521*** (0.00572)

Notes: Bivariate probit models include age, age squared, male, black, other race, years of education and years dummies in both equations. The outcome equation also includes census division of residence dummies. The treatment equation includes the instrumental variable $I(Age \geq 62)$; Marginal effects for the marginal probability of smoking status are presented; Regressions are weighted and robust standard errors are in parentheses.

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

so on). We find very different estimates based on the value of the correlation coefficient. However, for values that are close to the correlation estimates in Tables 3 and 4, the marginal effects are similar to what we find in the unconstrained models.

Cohort effects

A concern with using IVs that are based on birth year is that they might be correlated with cohort effects. Individuals from earlier cohorts might have very different preferences for leisure and smoking compared with those from later cohorts. If such cohort effects coincide with the birth years used to construct the instruments, then this would invalidate the IVs. To test this, we estimate the bivariate model separately for those born prior to 1933 (the median birth year in the sample) and for those born in 1933 or later. The marginal effect for persons born prior to 1993 is 0.209 while for the latter group it is 0.228. A Chow test for significant differences in the effect of retirement across these subsamples is unable to reject the null of no differences (P -value = 0.5838). Although this subsample analysis cannot conclusively rule out cohort effects that are correlated with the IVs, it suggests that cohort effects do not fully explain the estimated effects.

Moral hazard

A second concern is that age 65 is the normal eligibility age for Medicare in addition to being the normal retirement age for individuals born in 1937 or earlier. Medicare coverage might introduce a moral hazard problem whereby individuals who are 65 or older smoke more since they know that any consequential increase in health-care utilization will now be covered. Most existing studies on ex ante moral hazard in health insurance suggest that it is not a significant concern. The Rand Health Insurance Experiment found that health insurance had no significant effect on smoking rates [Newhouse 1993]. Card *et al.* [2004] find that obtaining Medicare at age 65 has no effect on smoking habits. Dave and Kaestner [2009] extend this analysis by allowing for an indirect effect of Medicare, which operates through greater contact with doctors. They find that Medicare receipt is associated with an increase in unhealthy behaviors. To account for moral hazard, we include a dummy variable for age greater than or equal to 65 in equation (2). This variable does not have a significant effect on smoking status and including it in the regression does not substantially alter the impact of retirement on smoking. Despite the insignificant effect of age greater than or equal to 65, moral hazard due to Medicare might exist as shown by Dave and Kaestner [2009]. However, controlling for age greater than or equal to 65 in the regression allows us to separate the impact of retirement from the impact of Medicare coverage among retirees.

Anticipation effects

A third concern relates to anticipatory effects. Individuals might anticipate that retirement would affect their incentive to smoke and might change their behavior prior to retirement, thus biasing the estimate. However, given the addictive nature of cigarettes it seems unlikely that current smokers will successfully quit smoking in anticipation of future retirement. Approximately 70 percent of smokers report that they want to quit smoking, but few are successful. However, once they are retired, the change in job related or other factors might induce former smokers to relapse into smoking. It is unlikely that former smokers will *start* smoking in anticipation of retirement. To check for anticipation effects, we analyze the relationship between expectations of future work and current smoking decisions among non-retirees. If anticipatory effects exist, individuals with a higher probability of retiring early should be less likely to smoke. The HRS asks individuals to report the expected probability of working full time after ages 62 and 65. For these

individuals, we estimate a probit regression of current smoking status on the self-reported probability of future work. We find no effect of expectations of working beyond 62 on smoking expectations (coefficient = -0.0000115 , P -value = 0.983 , $n = 3,393$) nor for expectations of working beyond 65 (coefficient = -0.000134 , P -value = 0.790 , $n = 5,518$). Controlling for age, gender, race, and wave dummies in the regression does not alter the significance of the estimated effects. This suggests that anticipatory effects are not likely to bias the estimate of retirement on smoking.

DISCUSSION

Using data on older individuals, this study finds suggestive evidence that retirement increases the probability of smoking and smoking intensity. However, the estimates are sensitive to the econometric model employed. In particular, models including individual fixed effects find that retirement has a small, insignificant effect on smoking while models without fixed effects find a large positive effect. A concern with both fixed effects and instrumental variables is that they may result in imprecise estimates due to low power. On the other hand, the FE-IV model is based on the least restrictive identifying assumptions and the estimates identified by the bivariate probit and linear IV models are surprisingly large. Further research is required to fully understand the underlying causes of these differences.

The results also indicate that unobserved heterogeneity may be an important factor in studying the relationship between retirement and smoking. The large positive effect of retirement on smoking appears to mainly impact men, who are also more likely to be eligible for social security benefits based on own work history. For this older cohort of women, the estimated effect is likely driven primarily by selection into the labor force. It will be interesting to see if future cohorts of women exhibit similar patterns of smoking behaviors after retirement as men. Using the bivariate probit model, we also find significant differences in the impact of retirement by work status and by whether someone is quitting or relapsing. The descriptive analysis on heterogeneous impacts provides some evidence on the mechanisms through which retirement affects smoking. A change in job-related factors and spousal effects appear to play a role in explaining smoking rates post-retirement. While these analyses are informative, further research is required to identify causality since variables such as occupation and marital status are likely to be endogenous. Heterogeneous effects might also explain the mixed evidence on retirement and health in existing literature and the sensitivity to econometric specifications.

Our study suffers from certain limitations that are important to acknowledge. The first is related to selective mortality. Smoking is associated with higher mortality rates and so, heavy smokers might be underrepresented in the analysis sample due to mortality at younger ages. This would bias the estimates since retirement and smoking are observed only for the relatively healthy individuals or for the light to moderate smokers who might also be less likely to relapse after retirement. Secondly, the publicly available HRS data does not contain state identifiers and therefore, we are not able to control for state-level factors and policies that affect tobacco use, such as cigarette prices or clean air laws. To the extent that state variation in these factors is not correlated with state variation in retirement rates they should not bias our results; however, we cannot rule out such correlation. This study also ignores transition into retirement. Many individuals do not transition directly from full-time working to full-time retired but instead take up part-time jobs before transitioning into a fully retired state. Moreover, the study ignores long-run effects of

retirement. Smokers might have high relapse rates immediately after retirement but might quit again once they settle into retired life. Future research could explore such aspects of the impact of retirement on smoking.

This study contributes to the literature on retirement and health by undertaking an in-depth analysis of the causal effect of retirement on smoking behavior. As the US population ages and labor force participation rates change, it will be important to understand how retirement affects health and related behaviors. Further insight on the mechanisms through which retirement affects smoking would help devise policies that encourage smokers to quit.

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References

- Ayyagari, P., and J.L. Sindelar. 2010. The Impact of Job Stress on Smoking and Quitting: Evidence from the HRS. *The BE Journal of Economic Analysis & Policy*, 10(1).
- Bazzoli, G.J. 1985. The Early Retirement Decision: New Empirical Evidence on the Influence of Health. *The Journal of Human Resources*, 20(2): 214–234.
- Bhattacharya, J., D. Goldman, and D. McCaffrey. 2006. Estimating Probit Models with Self-Selected Treatments. *Statistics in Medicine*, 25(3): 389–413.
- Bound, J., and T. Waidmann. 2007. Estimating the Health Effects of Retirement. Working paper no. 2007-168, Ann Arbor, MI: University of Michigan Retirement Research Center.
- Card, D., C. Dobkin C, and N. Maestas. 2004. The Impact of Nearly Universal Insurance Coverage on Health Care Utilization: Evidence from Medicare. NBER Working Paper No. 10365.
- CDC. 2008. Smoking-Attributable Mortality, Years of Potential Life Lost, and Productivity Losses — United States, 2000–2004. *Mortality and Morbidity Weekly Report* 57(45): 1226–1228.
- Charles, K. 2002. Is Retirement Depressing? Labor Force Inactivity and Psychological Well-Being in Later life. NBER Working Paper No. 9033.
- Coe, N., and M. Lindeboom. 2008. Does retirement kill you? Evidence from early retirement windows. IZA Discussion Paper 3817, Institute for the Study of Labor (IZA).
- Coe, N., and G. Zamarro. 2011. Retirement Effects on Health in Europe. *Journal of Health Economics*, 30(1): 77–86.
- Cutler, D., and E. Glaeser. 2007. Social Interactions and Smoking. Harvard Institute of Economic Research Discussion Paper No. 2153.
- Dave, D., and R. Kaestner. 2009. Health Insurance and Ex Ante Moral Hazard: Evidence from Medicare. *International Journal of Health Care Finance and Economics*, 9(4): 367–390.
- Deb, P., W. Gallo, P. Ayyagari, J. Fletcher, and J. Sindelar. 2011. The Effect of Job Loss on Overweight and Drinking. *Journal of Health Economics*, 30(2): 317–327.
- Evans, W.N., M.C. Farrelly, and E. Montgomery. 1999. Do Workplace Smoking Bans Reduce Smoking? *American Economic Review*, 89(4): 728–747.
- Everett, S., C. Husten, L. Kann, C. Warren, D. Sharp, and L. Crosset. 1999a. Smoking Initiation and Smoking Patterns Among US College Students. *Journal of American College Health*, 48(2): 55–60.
- Everett, S., C. Warren, D. Sharp, L. Kann, C. Husten, and L. Crossett. 1999b. Initiation of Cigarette Smoking and Subsequent Smoking Behavior Among U.S. High School Students. *Preventive Medicine*, 29(5): 327–333.
- Falba, T. 2005. Effects of Health Events on the Smoking Cessation of Middle Aged Americans. *Journal of Behavioral Medicine*, 28(1): 21–33.

- Falba, T., H. Teng, J. Sindelar, and W. Gallo. 2005. The Effect of Involuntary Job Loss on Smoking Intensity and Relapse. *Addiction*, 100(9): 1330–1339.
- Fletcher, J. 2010. Social Interactions and Smoking: Evidence using Multiple Student Cohorts, Instrumental Variables, and School Fixed Effects. *Health Economics*, 19(4): 466–484.
- Goldman, D., D. Lakdawalla, and Y. Zheng. 2008. Retirement and Weight. Working Paper, RAND corporation.
- Grossman, M. 1972. On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy*, 80(2): 223–255.
- Gruber, J., and B. Köszegi. 2001. Is Addiction ‘Rational’? Theory and Evidence. *The Quarterly Journal of Economics*, 116(4): 1261–1303.
- Gruber Jonathan, H., and S. Mullainathan. 2005. Do Cigarette Taxes Make Smokers Happier. *The BE Journal of Economic Analysis & Policy*, 5(1): 1–45.
- Haider, S., and M. Stephens. 2007. Is There a Retirement-Consumption Puzzle? Evidence using Subjective Retirement Expectations. *The Review of Economics and Statistics*, 89(2): 247–264.
- Hurd, M., J. Smith, and J. Zissimopoulos. 2004. The Effects of Subjective Survival on Retirement and Social Security Claiming. *Journal of Applied Econometrics*, 19(6): 761–775.
- Imbens, G., and J. Angrist. 1994. Identification and Estimation of Local Average Treatment Effects. *Econometrica*, 62(2): 467–475.
- Juster, F., and R. Suzman. 1995. An Overview of the Health and Retirement Study. *The Journal of Human Resources*, 30(4): S7–S56.
- Kan, K. 2007. Cigarette Smoking and Self-Control. *Journal of Health Economics*, 26(1): 61–81.
- Khwaja, A., F. Sloan, and S. Chung. 2006. Learning about Individual Risk and the Decision to Smoke. *International Journal of Industrial Organization*, 24(4): 683–699.
- Laibson, D. 1997. Golden Eggs and Hyperbolic Discounting. *The Quarterly Journal of Economics*, 443–477.
- Manning, W., E.B. Keeler, J.P. Newhouse, E.M. Sloss, and J. Wasserman. 1989. The Taxes of Sin: Do Smokers and Drinkers Pay their Way? *JAMA: The Journal of the American Medical Association*, 261(11): 1604–1609.
- McGarry, K. 2004. Health and Retirement. Do Changes in Health Affect Retirement Expectations? *Journal of Human Resources*, 39(3): 624–648.
- McGeary, K.A. 2009. How do Health Shocks Influence Retirement Decisions? *Review of Economics of the Household*, 7(3): 307–321.
- Newhouse, J. 1993. *Free for All? Lessons from the RAND Health Insurance Experiment, A RAND Study*. Cambridge, London: Harvard University Press.
- O’Donoghue, T., and M. Rabin. 1999. Doing it Now or Later. *The American Economic Review*, 89(1): 103–124.
- Rohwedder, S., and R. Willis. 2010. Mental Retirement. *Journal of Economic Perspectives*, 24(1): 119–138.
- Rust, J., and C. Phelan. 1997. How Social Security and Medicare Affect Retirement in a World of Incomplete Markets. *Econometrica*, 65(4): 781–831.
- Taylor, D.H., V. Hasselblad, S.J. Henley, M.J. Thun, and F.A. Sloan. 2002. Benefits of Smoking Cessation for Longevity. *American Journal of Public Health*, 92(6): 990–996.