PROPERTY TAXES AND ELDERLY LABOR SUPPLY

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INTRODUCTION

During the late 1990s and early 2000s, the U.S. housing market experienced a remarkable boom, which led to sharp increases in residential property taxes. U.S. Census data indicate that from 2000 to 2005, median housing values went up by 50 percent and median property taxes rose by 30 percent in real terms. Anecdotal evidence suggests that such unexpected rises in property taxes may induce elderly homeowners, especially those housing-rich but income-poor elderly homeowners, to increase their labor supply by delaying retirement. Unfortunately, there have been no systematic studies investigating the link between property taxes and elderly labor supply. This paper serves as the first attempt to study this link.

Property taxes may potentially influence elderly labor supply through two channels: income effect and liquidity constraint. Because higher property taxes reduce after-tax income, elderly homeowners may respond to property tax increases by consuming less leisure and supplying more labor. Property taxes may also cause elderly homeowners to increase their labor supply because of liquidity constraints. For example, according to the 1992-2004 Health and Retirement Study (HRS) sample, 10 percent of the homeowners between age 50 and 75 reported paying 9 percent or more of their income for property taxes. For 25 percent of these homeowners, annual property tax payments represented at least 40 percent of household financial assets. The lack of liquid assets among many elderly homeowners makes them vulnerable to increases in property taxes. Therefore, they may have to delay retirement, reenter the labor force, or work longer hours in order to stay in their homes.

On the other hand, property taxes may not have a significant impact on elderly labor supply for two reasons. First, property tax increases are often driven by soaring housing prices. Higher housing prices make homeowners wealthier, and the housing wealth effect would cause homeowners to reduce their labor supply. Second, elderly homeowners may respond to rising property taxes by relocating to low-tax areas or by downsizing to smaller houses rather than by increasing labor supply. In fact, Shan (2008) finds evidence suggesting that property taxes raise the mobility rate among elderly homeowners. If elderly homeowners have already lowered their property tax burdens by moving to low-tax areas or smaller houses, it may no longer be necessary for them to increase their labor supply at the same time.

In this paper, I empirically test the relationship between property taxes and elderly labor supply. Specifically, I use panel data from the 1992-2004 Health and Retirement Study (HRS) and newly collected data on state-provided property tax relief programs to estimate the property tax effect on the labor supply of homeowners aged 50-75. In particular, I focus on three labor supply measures in my regression analysis: retirement, reentry to the labor market, and working hours. Because property tax payments may be endogenous to individuals' labor supply decisions, I exploit the variation in state-provided property tax relief programs and construct simulated relief benefits as instruments for property taxes. Such simulated relief benefits measure the generosity of property tax relief programs and thus, are negatively correlated with property tax payments. The simulation procedure makes sure that these instruments contain only the variation in program rules and depend exclusively on state, age, and year. To the extent that state, age, and year are exogenous, these simulated instruments satisfy the exclusion restriction.

The central IV estimation results cannot reject that property taxes have no significant impact on elderly homeowners' decisions to retire, to reenter the labor force, or to increase working hours. Such findings imply that incidences reported in news articles where elderly homeowners have been delaying retirement to keep up with rising property taxes are unlikely to be representative. Elderly homeowners may have chosen to move rather than to increase labor supply in their effort to reduce property tax burdens.

The rest of this paper proceeds as follows. The second section reviews the existing literature. In the third section, I describe the data used in this paper. I explain my empirical strategy and discuss the estimation results in the fourth section. The last section concludes and points out policy implications of this paper.

PREVIOUS STUDIES

There is a sizable prior literature on retirement behavior. Earlier works on retirement incentives of Social Security benefits, including Diamond and Hausman (1984), Burtless (1986), Krueger and Pischke (1992), and Blau (1994), generally find that even though the effect of Social Security is statistically significant, it is small relative to the trend toward early labor force exit among older men. More recent works adopt the "option value" approach developed by Stock and Wise (1990) and estimate the dynamic effect of Social Security and pensions on retirement decisions. Samwick (1998), Chan and Stevens (2004), and Coile and Gruber (2007) implement such dynamic models and show that forward-looking incentive measures for Social Security and private pensions are significant determinants of retirement.

The stock market boom and bust, as well as the remarkable housing value run-up in recent years, have provided researchers arguably exogenous sources of variation for studying retirement behavior. Using the HRS data, Coronado and Perozek (2003) find that individuals who held corporate equity immediately before the bull market of the 1990s on average retired earlier than those who did not. Sevak (2005) compares individuals with defined-contribution pension plans and individuals with defined-benefit pension plans. She finds that unexpected gains in wealth during the 1990s bull market induced earlier retirement. Using the HRS, Current Population Survey (CPS), and Survey of Consumer Finances (SCF), Coile and Levine (2006) exploited both the stock market boom in the late 1990s and the stock market bust in the early 2000s to study the impact of wealth shocks on retirement decisions. They find that the stock market has very little influence on aggregate labor market behavior. Farnham and Sevak (2007) and Goodstein (2008) use cross-MSA variation in housing price movements to identify the wealth effect on retirement timing. They find that increases in housing wealth raise the probability of retirement significantly.

Property taxes are responsible for approximately 72 percent of all local tax revenues, representing the most important tax revenue source for local governments. In 2004, property tax collections in the U.S. exceeded $300 billion.[1] The housing market boom of the late 1990s and early 2000s led to significant increases in residential property taxes. Such steep rises in property taxes may be more burdensome to elderly homeowners than to non-elderly homeowners because elderly homeowners typically live on fixed and limited incomes. A few studies have looked at the link between property taxes and elderly homeowners.

Farnham and Sevak (2006) test a life-cycle Tiebout model using the 1992-2000 HRS data and local fiscal data. They find that cross-state, empty-nest movers experience reduced exposure to local school spending and property taxes. Seslen (2005) examines the effect of property taxes on elderly homeowners' downsizing decisions in a competing risk framework. Using the 1969-79 Retirement History Survey (RHS), she finds little evidence that property taxes affect elderly homeowners' decisions to move or to liquidate their housing wealth. Shan (2008) investigates the causal effect of property taxes on elderly homeowners' moving decisions. Using the 1992-2004 HRS data and data on state-provided property relief programs, she finds that rising property taxes induce higher mobility rates among elderly homeowners.

To my best knowledge, this is the first study to look at how property taxes affect labor supply. Property taxes are the most important tax revenue source for local governments, and property tax relief programs cost about $10 billion annually in the United States.[2] Studying the behavioral impact of property taxes on elderly homeowners is indispensable for any welfare analysis of property taxes and property tax relief programs. Additionally, while most elderly labor supply studies focus exclusively on retirement decisions, this paper examines both the extensive margin — whether rising property taxes induce elderly homeowners to delay retirement or reenter the labor force; and the intensive margin — whether elderly homeowners work longer hours when property taxes increase.

DATA DESCRIPTION

The data used in this paper has two components: the Health and Retirement Study (HRS) and newly collected data on property tax relief programs. The HRS is a biannual panel of a nationally representative sample of elderly and near-elderly individuals in the United States. At present, seven waves of the survey (1992-2004) have been released to researchers. The HRS includes households from four different cohorts: the HRS cohort (born between 1931 and 1941), the AHEAD cohort (born before 1924), the "Children of the Depression" (CODA) cohort (born between 1924 and 1930), and the "War Baby" (WB) cohort (born between 1942 and 1947).[3] The HRS cohort appears in all seven waves. The AHEAD cohort was first interviewed in 1993 and then in 1995. Since 1998, the AHEAD cohort has been interviewed concurrently with the HRS cohort biannually. The CODA and WB cohorts appear only in the last four waves (1998-2004). The raw dataset has 26,867 individuals and 126,104 person-wave observations.

The HRS data have detailed information on demographics, health, labor supply, and finances. Whenever possible, I use the RAND HRS Data File, a user-friendly version that contains a subset of HRS variables.[4] Figure 1 plots the empirical retirement hazard rate for homeowners between age 50 and 75. Conditional on being in the labor force, the probability that one retires within the next two years goes up with age. For both males and females, the hazard rate increases sharply around age 60 and again around age 70.

To measure changes in labor supply, I use three outcome variables: retirement, reentry to the labor force, and working hours. I define retirement as a transition from working or being unemployed to being retired or out of the labor force. Similarly, a transition from being retired or out of the labor force to working or being unemployed is defined as reentry to the labor force. Working hours refer to the self-reported total number of hours worked during the past year. Table 1 shows that on average, the 2-year retirement rate is 18.3 percent for males and 20.4 percent for females in the sample. The average 2-year reentry rate is much lower: 5.8 percent for males and 5.2 percent for females. Conditional on being in the labor force, male respondents report an average of 2,283 annual working hours, and female respondents report an average of 1,880 annual working hours.

The key independent variable in this paper is property taxes. In all seven waves, respondents were asked to report the amount of property taxes paid on their primary residence during the past year. I assume these self-reported property tax payments are the actual payments after all relevant property tax exemptions, rebates, or refunds have been applied. Such an assumption is crucial for

Figure 1: **Retirement Hazard Rate of Homeowners by Age**

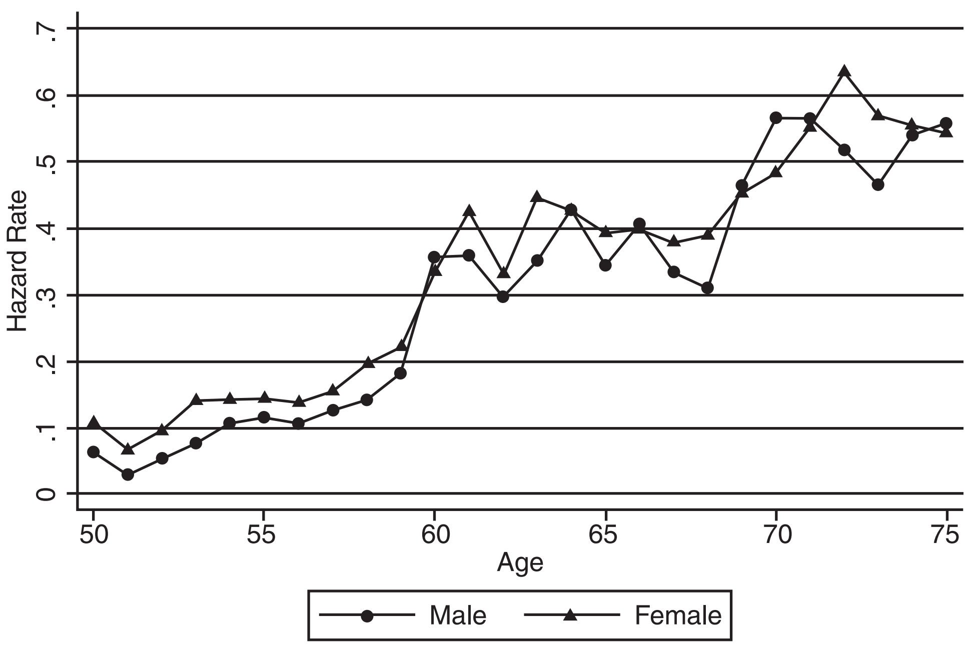

Table 1
Summary Statistics of Analysis Samples

	Male			Female		
	Mean	*Median*	*SD*	*Mean*	*Median*	*SD*
Retirement Sample						
Retire	0.183		0.387	0.204		0.403
Simulated Benefits						
Fraction Eligible	0.050		0.148	0.093		0.163
Conditional Benefits	144	99.5	190	202	154.4	172
Value Freeze	0.075		0.263	0.075		0.264
Tax Freeze	0.134		0.340	0.147		0.355
Property Tax	1,839	1,307	2,149	1,621	1,220	1,727
Household Income	103,582	72,436	179,602	76,915	59,159	104,146
Housing Value	175,393	132,055	222,679	155,066	121,564	122,653
Financial Wealth	125,771	23,320	689,661	85,662	19,144	223,768
Age	57.5	57	4.5	57.2	57	4.4
Black	0.057		0.231	0.068		0.252
Hispanic	0.055		0.228	0.051		0.219
Married	0.876		0.330	0.697		0.459
Recently Hospitalized	0.132		0.339	0.119		0.323
Less than High School	0.162		0.369	0.136		0.343
High School Graduates	0.279		0.448	0.337		0.473
Some College	0.215		0.411	0.286		0.452
College Graduates	0.344		0.475	0.241		0.428
Pension Coverage	0.665		0.472	0.601		0.490
Retiree Health Insurance	0.460		0.498	0.334		0.472
Reentry Sample						
Reentry	0.058		0.235	0.052		0.221
Simulated Benefits						
Fraction Eligible	0.225		0.312	0.272		0.304
Conditional Benefits	179	138	160	194	147	157
Value Freeze	0.101		0.302	0.108		0.310
Tax Freeze	0.176		0.381	0.181		0.385
Property Tax	1,455	1,056	1,520	1,436	1,000	3,381
Household Income	58,901	40,171	75,595	57,313	35,243	123,611
Housing Value	154,180	119,650	132,410	150,789	110,000	190,515
Financial Wealth	164,095	38,134	415,897	155,324	34,334	433,659
Age	66.0	66	6.2	64.6	65	6.8
Black	0.062		0.241	0.059		0.236
Hispanic	0.044		0.204	0.058		0.234
Married	0.842		0.364	0.729		0.444
Recently Hospitalized	0.247		0.431	0.188		0.391
Less than High School	0.255		0.436	0.223		0.417
High School Graduates	0.275		0.447	0.382		0.486
Some College	0.201		0.401	0.229		0.420
College Graduates	0.269		0.443	0.166		0.372

Table 1 (Continued)
Summary Statistics of Analysis Samples

	Male			Female		
	Mean	*Median*	*SD*	*Mean*	*Median*	*SD*
Working-Hour Sample						
Working Hours	2,283	2,100	639	1,880	2,080	665
Simulated Benefits						
Fraction Eligible	0.047		0.141	0.090		0.160
Conditional Benefits	142	98	189	200	154	170
Value Freeze	0.073		0.261	0.073		0.261
Tax Freeze	0.133		0.339	0.146		0.353
Property Tax	1,910	1,317	4,149	1,619	1,207	1,688
Household Income	101,912	71,912	168,523	77,651	58,210	113,154
Housing Value	173,267	132,055	169,279	155,439	121,491	125,985
Financial Wealth	121,845	23,048	653,379	92,258	19,144	421,381
Age	57.5	57	4.4	57.2	57	4.4
Black	0.058		0.233	0.067		0.251
Hispanic	0.060		0.237	0.052		0.223
Married	0.876		0.329	0.702		0.457
Recently Hospitalized	0.137		0.344	0.120		0.325
Less than High School	0.167		0.373	0.141		0.348
High School Graduates	0.277		0.447	0.343		0.475
Some College	0.219		0.413	0.285		0.451
College Graduates	0.338		0.473	0.231		0.422

Note: One has to be working or unemployed at time t to be included in the retirement sample. One has to be working at both time t and $t+1$ to be in the working-hour sample. One has to be retired or out of labor force at time t to be included in the reentry sample. Property tax, household income, house value, and financial wealth are in 2000 dollars. Individual weights are applied.

the first-stage regression in my IV strategy. For programs where participation is automatic and property tax bills are mailed to homeowners after benefits have been netted out, this assumption seems justified. For programs where homeowners receive rebate checks soon after paying property taxes, it is unclear whether respondents report their before-relief property tax payments or after-relief property tax payments. For programs that are implemented by state personal income tax credits, respondents are likely to report their before-relief benefits for two reasons. First, relief benefits are usually received long after homeowners have paid their property taxes. Second, property tax relief benefits may appear less salient on state personal income tax returns. For example, filers may view property tax credits that they claim against income tax liabilities as income tax relief benefits rather than property tax relief benefits. Recent studies including Chetty, Looney, and Kroft (2007) and Finkelstein (2007) suggest that tax salience could have a significant impact on behavior. Therefore, I exclude in my regression analysis states where relief benefits are granted by tax credits on state personal income tax returns.[5] The dropped observations represent about 25 percent of the sample. I also drop individuals living in mobile homes and individuals living on farms or ranches because these properties may be treated differently from other residential properties for tax purposes.

Table 1 displays summary statistics of key demographic and socioeconomic variables for the retirement, reentry, and working-hour samples. By definition, individuals have to report "working or unemployed" to be included in the retirement and working-hour samples. Individuals have to report "retired or out of labor force" to be included in the reentry sample. Unsurprisingly, individuals in the retirement and working-hour samples are younger, healthier, better-educated, and have significantly higher household income than individuals in the reentry sample. Individuals in the retirement and working-hour samples also live in more expensive houses and pay higher property taxes than individuals in the reentry sample. On the other hand, they have lower financial wealth than their counterparts in the reentry sample. Such a pattern in housing wealth and financial wealth suggests that homeowners may transform their housing wealth into financial wealth by downsizing as they age and exit the labor force.

In addition to the publicly available HRS data, I obtained restricted access to household-level geographic identifiers in each survey year, including state, county, census tract, and zip code. The state identifier is crucial in my analysis because it links households with the state-provided property tax relief programs for which they are eligible. The county identifier allows me to control for county-year level unemployment rates published by the Census Bureau in my regression analysis.

The second component of the data used in this paper is the data on property tax relief programs. As of the present, all 50 states and the District of Columbia have some form of property tax relief programs for homeowners, especially for low-income and elderly homeowners. Broadly speaking, there are four categories of relief programs: Homestead Exemptions and Credits, Circuit-Breakers, Deferral Programs, and Limitations. Shan (2008) has detailed descriptions on how these programs work, how the data were collected, and how these programs are codified. At the end of the process, a computer program is written to produce three output variables: the amount of benefits from homestead exemption, homestead credit, and circuit-breaker programs that a homeowner is eligible for, whether eligible for an "assessment value freeze" program, and whether eligible for a "property tax freeze" program. Such output variables can be generated for any homeowner in the United States in any year between 1990 and 2004 provided that input parameters, including state of residence, year, age, income, house value, Social Security income, marital status, household size and wealth, are non-missing.

EMPIRICAL STRATEGY AND ESTIMATION RESULTS

In this section, I present the empirical model and estimation results in studying the effect of property taxes on elderly homeowners' decisions to retire, to reenter the labor force, and to increase working hours. Estimations are performed for men and women separately. Robustness checks and extensions are carried out and discussed at the end of this section.

Property Taxes and Retirement Decisions

To investigate whether property taxes have an impact on retirement behavior, I start with a simple probit model[6]

$$\textbf{(1)}\quad Pr(retire_{ist} = 1) = \Phi(\beta_1 Tax_{ist} + X_{ist}\Pi + \theta_s + \delta_t),$$

where $retire_{ist}$ indicates whether household i in state s retired between time t and $t + 1$, θ_s denotes state fixed effects, δ_t denotes year fixed effects, and the covariate vector X_{ist} includes a constant, income quintile indicators, house value quintile indicators, financial wealth quintile indicators, race/ethnicity (i.e., white, black, and Hispanic), whether married, education categories (i.e., less than high school, high school graduates, some college, and college graduates), whether hospitalized between the last interview and the current interview, whether have pension coverage, whether have retiree health insurance coverage, county unemployment rate, industry fixed effects, occupation fixed effects, and age fixed effects.[7] The key variable of interest in equation (1) is Tax_{ist}, property tax payments by household i in state s at time t. If higher property taxes cause elderly homeowners to delay retirement, then we expect $\beta_1 < 0$.

Columns (1) and (3) in Table 2 present estimation results of equation (1) for males and females, respectively. To make the results interpretable, I show marginal effects of independent variables by calculating the predicted marginal effect for each observation and then averaging them across all observations. To be consistent with results presented later in this section, standard errors shown in parentheses are bootstrapped by 500 random draws with replacement. I implement a block-bootstrap scheme to make certain that observations are clustered at state level in estimating standard errors. The estimated effects of property taxes are negative as expected, but statistically insignificant. The magnitudes of the marginal effects are small, suggesting that a \$100 increase in annual property taxes is associated with a 0.03 percentage point decrease in 2-year retirement rate for men and 0.09 percentage point decrease for women.

Table 2
Retirement Estimation Results

	Male		Female	
	(1) Probit	*(2) IV-Probit*	*(3) Probit*	*(4) IV-Probit*
Property Taxes (in 10,000)	-0.0264	-0.7057	-0.0905	-1.3460
	(0.0342)	(0.9739)	(0.0580)	(1.1622)
Income Quintile 2	-0.0407*	-0.0319	-0.0505**	-0.0499**
	(0.0230)	(0.0274)	(0.0237)	(0.0236)
Income Quintile 3	-0.0375*	-0.0332	-0.0166	-0.0080
	(0.0215)	(0.0231)	(0.0249)	(0.0263)
Income Quintile 4	-0.0191	-0.0206	-0.0031	0.0037
	(0.0230)	(0.0230)	(0.0275)	(0.0277)
Income Quintile 5	-0.0444*	-0.0205	-0.0081	0.0288
	(0.0237)	(0.0401)	(0.0301)	(0.0478)
House Value Quintile 2	0.0141	0.0285	0.0054	0.0414
	(0.0165)	(0.0233)	(0.0211)	(0.0385)
House Value Quintile 3	-0.0174	0.0151	-0.0020	0.0738
	(0.0183)	(0.485)	(0.0217)	(0.0714)
House Value Quintile 4	-0.0053	0.0535	-0.0031	0.1123
	(0.0204)	(0.0841)	(0.0244)	(0.1082)
House Value Quintile 5	-0.0253	0.1270	-0.0179	0.2221
	(0.0230)	(0.2216)	(0.0277)	(0.2222)
Financial Wealth Quintile 2	0.0198	0.0157	0.0418**	0.0296
	(0.0157)	(0.0177)	(0.0175)	(0.0211)
Financial Wealth Quintile 3	0.0289*	0.0289	0.0748***	0.0652***
	(0.0166)	(0.0179)	(0.0202)	(0.0228)
Financial Wealth Quintile 4	0.0535***	0.0510**	0.0914***	0.0805***
	(0.0174)	(0.0201)	(0.0199)	(0.0239)
Financial Wealth Quintile 5	0.0930***	0.1268**	0.1249***	0.1494***
	(0.0194)	(0.0548)	(0.0229)	(0.0417)
Black	0.0169	0.0112	0.0619***	0.0562**
	(0.0199)	(0.0220)	(0.0202)	(0.0225)
Hispanic	-0.0562**	-0.0505	0.0378	0.0471*
	(0.0248)	(0.0313)	(0.0270)	(0.0273)
Married	-0.0309*	-0.0315	0.0194	0.0057
	(0.0184)	(0.0267)	(0.0161)	(0.0231)

Table 2 (continued)
Retirement Estimation Results

	Male		*Female*	
	(1) Probit	*(2) IV-Probit*	*(3) Probit*	*(4) IV-Probit*
High School Graduate	-0.0220	-0.0200	-0.0240	-0.0151
	(0.0157)	(0.0181)	(0.0163)	(0.0181)
Some College	-0.0177	-0.0165	-0.0300	-0.0146
	(0.0179)	(0.0199)	(0.0187)	(0.0235)
College Graduate	-0.0237	-0.0038	-0.0307	0.0051
	(0.0203)	(0.0392)	(0.0225)	(0.0389)
Recently Hospitalized	0.0479***	0.0507***	0.0527***	0.0522**
	(0.0138)	(0.0165)	(0.0170)	(0.0203)
Pension Coverage	-0.0147	-0.0036	-0.0606***	-0.0721***
	(0.0118)	(0.0191)	(0.0140)	(0.0240)
Retiree Health Insurance	0.0487***	0.0502***	0.0085	0.0036
	(0.0103)	(0.0140)	(0.0139)	(0.0149)
County Unemployment Rate	0.0015	0.0013	0.0000	-0.0025
	(0.0025)	(0.0026)	(0.0029)	(0.0039)
First Stage *F*-stat		2.10		14.28
Hausman Test		3.0650		5.4105***
(coeff on first-stage residuals)		(5.8850)		(1.5272)
N	6,388	6,388	5,657	5,657
Pseudo R2	0.1489	.	0.1093	.

Note: Other control variables are age fixed effects, industry fixed effects, occupation fixed effects, state fixed effects, and year fixed effects. $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$ are used as instruments for Tax_{ist} in the IV-probit specifications. The numbers shown in the table are marginal effects averaged across observations. Standard errors in parentheses are bootstrapped by 500 random draws with replacement clustered at state level. Individual weights from HRS are applied.

***significant at the 1 percent level.
** significant at the 5 percent level.
* significant at the 10 percent level.

There are two reasons why such estimates of β_1 may be inconsistent. First, property taxes are used to provide local public services. Higher property taxes often correlate with better local public services. If local public services such as parks and senior centers are complements to the consumption of leisure, we will not be able to estimate β_1 consistently without controlling for local public services which are unobservable to econometricians. Second, property tax payments are self-reported in the HRS. To the extent that elderly homeowners do not know or report property taxes accurately, measurement errors will cause attenuation bias in estimating equation (1). To deal with these two problems, I use measures of property tax relief program generosity to instrument for property taxes.

More specifically, I use the set of instruments – $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$ - that are described in detail in Shan (2008). Because property tax relief benefits reduce property tax payments, these measures of program generosity should be negatively correlated with property tax payments. Such a negative correlation serves as the first stage in this paper. On the other hand, these instruments essentially capture variations in property tax relief program rules and are rid of variations stemming from individual characteristics. Thus, they are orthogonal to the individual level error term ε_{ist} and satisfy the exclusion restriction. Table 1 illustrates the summary statistics of $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$. In the retirement sample, 5.0 percent of males and 9.3 percent of females are eligible for relief benefits from homestead exemptions, homestead credits, and circuit-breakers. Conditional on eligibility, the average benefits from these programs are $144 for males and $202 for females. In addition, 7.5 percent of both males and females are eligible for assessment value freeze programs; 13.4 percent of males and 14.7 percent of females are eligible for property tax freeze programs.

To implement the simulated IV strategy in a probit framework, I use the 2-step estimator suggested by Rivers and Vuong (1988).[8] Beside computational ease, the Rivers-Vuong 2-step IV approach has another appealing feature. The usual probit t-test on $\hat{v}$, which is a consistent estimate of the first-stage error term, is a valid test of the null hypothesis that Tax_{ist} is exogenous. Such a test is equivalent to the Hausman specification test suggested by Hausman (1978). Because I use a 2-step procedure to estimate the IV-probit model, standard errors need to be adjusted accordingly. I choose to obtain consistent estimates of standard errors by bootstrapping in lieu of the delta-method for two reasons. First, bootstrapping is computationally easier to implement. Second, bootstrapping provides higher-order refinements while the delta-method is only a first-order approximation.[9]

Columns (2) and (4) of Table 2 show the IV-probit estimation results using $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$ as instruments. The estimated marginal effects of property taxes remain negative and statistically insignificant. The magnitudes of these marginal effects become much larger than the probit results. They suggest that a $100 increase in annual property tax payments reduces the 2-year retirement rate by 0.71 percentage points for men and 1.35 percentage points for women. Given the average 2-year retirement rate of 18.3 percent for men and 20.4 percent for women, these represent a 3.9 percent decline in retirement rate for men and 6.6 percent decline for women. Although the point estimates imply a sizable property tax effect on retirement behavior, the standard errors are large and we cannot reject the null hypothesis that property taxes do not affect retirement. Note that the first-stage F-statistic is only 2.10 for the male sample and 14.28 for the female sample. Stock, Wright, and Yogo (2002) suggest that the rule of thumb for detecting weak instruments is to check whether the first-stage F-stat exceeds 10. By this standard, the male sample may have a weak instrument problem and the IV-probit estimates may be biased in the direction of the probit estimates. Moreover, the Hausman test rejects the null hypothesis that property tax payments are exogenous in the female sample but not in the male sample.

The estimated marginal effects of the other covariates are mostly consistent with our expectation and previous literature's findings. For example, health shocks, approximated by the indicator variable "whether the respondent was recently hospitalized," raise the 2-year retirement rate by 5 percentage points for both men and women, or a 25 percent increase from the baseline level. Financial wealth is correlated with higher probability of retirement. However, such a correlation should not be interpreted as causal since individuals who have strong desires to retire early may have saved more aggressively over their life cycle. In addition, male respondents who have retiree health insurance coverage are more likely to retire than those who do not, but the effect is insignificant for females. Female respondents who have pension coverage are less likely to retire than those who do not, but the effect is insignificant for males. Black and Hispanic women are more likely to retire than white women, although race/ethnicity does not appear to matter among male respondents. Such differences between males and females highlight the importance of analyzing male and female individuals separately in studying labor supply behavior.

Property Taxes and Reentry Decisions

In the previous section, I estimate a retirement regression model and the results cannot reject the null hypothesis that property taxes do not have a significant effect on elderly homeowners' retirement decisions. In this section, I explore the impact of property taxes on labor force reentry behavior in a similar regression analysis by estimating the following probit model:

(2) $Pr(reentry_{ist} = 1) = \Phi(\beta_2 Tax_{ist} + X_{ist}\Pi + \theta_s + \delta_t),$

where $reentry_{ist}$ indicates whether individual *i* who is out of the labor force at time *t* reenters the labor force between time *t* and *t* + 1. If higher property taxes cause retired elderly homeowners to reenter the labor force, then we expect $\beta_2 > 0$.

I again use $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$ as instruments for property taxes to obtain consistent estimates of β_2. As shown in Table 1, individuals in the reentry sample are relatively older and have lower household income because they have to be out of the labor force to be in this sample. As a result, they are more likely to be eligible for property tax relief programs that target low-income and elderly homeowners. On average, 22.5 percent of males and 27.2 percent of females in the reentry sample are eligible for homestead exemptions, homestead credits, or circuit-breakers; 10.1 percent of males and 10.8 percent of females are eligible for assessment value freeze programs; and 17.6 percent of males and 18.1 percent of females are eligible for property tax freeze programs. The average 2-year reentry rate among homeowners age 50-75 is low, 5.8 percent for males and 5.2 percent for females.

Table 3 presents estimation results of both probit and IV-probit specifications for males and females separately. For the male sample, the estimated marginal effect of property taxes is positive but statistically insignificant in the probit specification. The marginal effect doubles in the IV-probit specification, but remains statistically indistinguishable from zero. For the female sample, both the probit and IV-probit specifications produce negative estimates of β_2, and the marginal effects of property taxes on reentry behavior are also statistically insignificant. The first-stage relationship between property taxes and the instruments are strong, with an *F*-statistic of 138.47 for the male sample and 11.09 for the female sample. All told, the evidence does not support the claim that homeowners who face higher property taxes are more likely to reenter the labor force.

Estimation results displayed in Table 3 also suggest that both male and female Hispanic homeowners are more likely to reenter the labor force than white and black elderly homeowners. When county unemployment rate is high, older men and women are less likely to reenter the labor force. Higher income is correlated with higher probability of reentry behavior, especially among male homeowners. Among female homeowners, individuals who live in more expensive houses are more likely to reenter the labor force. Among male homeowners, individuals with more financial wealth are less likely to reenter the labor force. Moreover, negative health shocks appear to prevent older men from reentering the labor force. Married women are less likely to reenter the labor force than their unmarried counterparts.

Property Taxes and Working Hours

The previous two sections have examined the property tax effect on the extensive margin of elderly labor supply, namely, whether to exit or reenter the labor market. In this section, I investigate the intensive margin of labor supply by estimating the effect of property taxes on elderly homeowners' working hours. I employ a regression model in the following form:

(3) $hour_{ist} = \beta_3 Tax_{ist} + X_{ist}\Pi + \theta_s + \delta_t + \varepsilon_{ist},$

where $hours_{ist}$ is the total number of hours individual *i* reports working at time *t* conditional on being in the labor force. If higher property taxes indeed induce elderly homeowners to work longer hours, we expect $\beta_3 > 0$.

As before, because Tax_{ist} may be endogenous to individuals' labor supply decisions and cause bias in estimating β_3, I use measures of property tax relief program generosity, $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$, to instrument for $Tax_{ist.}$ Note that the first-stage relationship between property tax payments and property tax relief program generosity may be weak in the working-hour regression. Elderly homeowners have to be in the labor force at both time *t* and *t*+1 to be considered in this analysis. Hence, individuals in the working-hour sample are relatively young and have higher household income. Such characteristics imply that they tend to be ineligible for property tax relief programs that are designed to help low-income and older homeowners. Therefore, the correlation between property tax payments and property tax relief program generosity may disappear. For example, Table 1 shows that on average only 4.7 percent of males and 9.0% of females in the working-hour sample are eligible for homestead exemptions, homestead credits, and circuit-breakers; 7.3 percent of males and 7.3 percent of females are eligible for assessment value freeze programs; and 13.3 percent of males and 14.6 percent of females

Table 3
Reentry Estimation Results

	Male		*Female*	
	(1) Probit	*(2) IV-Probit*	*(3) Probit*	*(4) IV-Probit*
Property Taxes (in 10,000)	0.0263	0.0581	-0.0030	-0.7037
	(0.0188)	(0.4371)	(0.0155)	(0.4619)
Income Quintile 2	0.0253**	0.0255**	0.0156*	0.0156
	(0.0103)	(0.0112)	(0.0081)	(0.0134)
Income Quintile 3	0.0422***	0.0427***	0.0238***	0.0240
	(0.0113)	(0.0125)	(0.0086)	(0.0166)
Income Quintile 4	0.0334***	0.0338**	0.0222**	0.0213
	(0.0120)	(0.0134)	(0.0090)	(0.0173)
Income Quintile 5	0.0870***	0.0859***	0.0284***	0.0519**
	(0.0130)	(0.0250)	(0.0102)	(0.0224)
House Value Quintile 2	0.0032	0.0026	0.0077	0.0288*
	(0.0109)	(0.0151)	(0.0089)	(0.0152)
House Value Quintile 3	0.0025	0.0007	0.0151	0.0578**
	(0.0115)	(0.0254)	(0.0093)	(0.0248)
House Value Quintile 4	-0.0201	-0.0231	0.0073	0.0775*
	(0.0125)	(0.0393)	(0.0102)	(0.0469)
House Value Quintile 5	0.0021	-0.0045	0.0110	0.1512*
	(0.0135)	(0.0747)	(0.0111)	(0.0860)
Financial Wealth Quintile 2	0.0048	0.0049	0.0082	0.0111
	(0.0106)	(0.0115)	(0.0086)	(0.0113)
Financial Wealth Quintile 3	-0.0213*	-0.0216*	0.0068	0.0149
	(0.0112)	(0.0120)	(0.0088)	(0.0123)
Financial Wealth Quintile 4	-0.0393***	-0.0395***	-0.0017	0.0063
	(0.0119)	(0.0129)	(0.0093)	(0.0166)
Financial Wealth Quintile 5	-0.0465***	-0.0479***	-0.0243**	-0.0126
	(0.0127)	(0.0172)	(0.0101)	(0.0183)
Black	-0.0107	-0.0103	0.0111	0.0115
	(0.0127)	(0.0145)	(0.0091)	(0.0125)
Hispanic	0.0323**	0.0322**	0.0188*	0.0338**
	(0.0131)	(0.0147)	(0.0109)	(0.0153)
Married	0.0106	0.0104	-0.0227***	-0.0305***
	(0.0097)	(0.0115)	(0.0071)	(0.0103)

Table 3 (Continued)
Reentry Estimation Results

	Male		Female	
	(1) Probit	*(2) IV-Probit*	*(3) Probit*	*(4) IV-Probit*
High School Graduate	-0.0102	-0.0104	-0.0093	-0.0106
	(0.0092)	(0.0098)	(0.0070)	(0.0097)
Some College	0.0022	0.0020	0.0015	0.0079
	(0.0097)	(0.0115)	(0.0074)	(0.0116)
College Graduate	-0.0122	-0.0133	0.0004	0.0222
	(0.0104)	(0.0195)	(0.0092)	(0.0206)
Recently Hospitalized	-0.0285***	-0.0283***	-0.0023	0.0015
	(0.0087)	(0.0097)	(0.0062)	(0.0107)
County Unemployment Rate	-0.0031*	-0.0032*	-0.0023**	-0.0039**
	(0.0017)	(0.0019)	(0.0011)	(0.0017)
First Stage *F*-stat		138.47		11.09
Hausman Test		-0.3136		5.2854
		(2.4302)		(3.6295)
N	6,475	6,475	9,406	9,406
Pseudo R2	0.1538	.	0.1391	.

Note: Other control variables are age fixed effects, state fixed effects, and year fixed effects. $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$ are used as instruments for Tax_{ist} in the IV-probit specifications. The numbers shown in the table are marginal effects averaged across observations. Standard errors in parentheses are bootstrapped by 500 random draws with replacement clustered at state level. Individual weights from HRS are applied.

***significant at the 1 percent level.
** significant at the 5 percent level.
* significant at the 10 percent level.

are eligible for property tax freeze programs. On average, the male respondents report to work 2,283 hours annually and the female respondents report to work 1,880 hours annually.

Table 4 presents the estimation results of the OLS and 2SLS specifications for males and females separately. In the male samples, the OLS estimate suggests that property taxes have a positive, small, and statistically insignificant effect on working hours. In the female sample, however, the OLS estimate suggests that property taxes have a negative and statistically significant effect on working hours. Such a counterintuitive result may reflect that property taxes are endogenous to labor supply decisions. For instance, homeowners who have strong preferences for local amenities such as parks and senior centers also prefer consuming more leisure and work fewer hours. If they choose to live in areas with high property taxes and better local amenities, we would observe a negative correlation between property tax payments and working hours. Once property taxes are instrumented using relief program generosity measures, the effect of property taxes on working hours appears to be negative and statistically insignificant for both the male and female sample. The estimated coefficients are large, but the standard errors are also large and I cannot reject the null hypothesis that property taxes have no impact on elderly homeowners' working hours. Similar to the retirement analysis, the first-stage relationship between property taxes and the instruments is weak for males in the working-hour sample, probably because they have high incomes and they tend to have younger spouses. On the

Table 4
Working Hours Estimation Results

	Male		*Female*	
	(1) OLS	*(2) 2SLS*	*(3) OLS*	*(4) 2SLS*
Property Taxes (in 10,000)	36.4	-776.7	-164.9**	-3069.7
	(23.9)	(2044.0)	(80.8)	(2967.2)
Income Quintile 2	116.0***	98.2	142.7***	146.3**
	(24.9)	(62.6)	(44.2)	(53.7)
Income Quintile 3	168.9***	139.6*	178.3***	195.6***
	(29.6)	(81.2)	(46.0)	(63.0)
Income Quintile 4	198.6***	161.3	230.3***	241.2***
	(28.7)	(109.9)	(51.2)	(63.9)
Income Quintile 5	262.7***	262.3**	271.6***	348.6***
	(34.9)	(65.1)	(51.9)	(112.4)
House Value Quintile 2	-20.6	-2.5	-47.6	29.1
	(31.7)	(69.8)	(42.5)	(100.6)
House Value Quintile 3	-43.5*	16.1	-9.7	155.5
	(21.9)	(160.0)	(42.3)	(197.5)
House Value Quintile 4	-23.6	74.7	-45.8	212.9
	(31.1)	(270.3)	(37.4)	(289.5)
House Value Quintile 5	30.0	227.8	-78.3*	462.0
	(43.9)	(529.2)	(40.5)	(557.7)
Financial Wealth Quintile 2	35.2	25.9	-8.4	-28.3
	(22.9)	(37.5)	(31.4)	(35.8)
Financial Wealth Quintile 3	36.1	43.1	-25.6	-28.8
	(28.5)	(32.5)	(30.7)	(36.0)
Financial Wealth Quintile 4	26.5	32.0	-78.1**	-84.3**
	(34.0)	(37.3)	(31.7)	(39.0)
Financial Wealth Quintile 5	-0.5	45.4	-123.0**	-32.3
	(34.8)	(110.0)	(45.2)	(107.1)
Black	-86.8**	-94.7**	-30.6	-10.7
	(34.5)	(44.2)	(28.9)	(44.0)
Hispanic	-58.9	-62.9	-35.8	6.3
	(44.5)	(50.2)	(41.5)	(65.3)
Married	-22.8	-17.5	-201.7***	-219.1***
	(32.4)	(34.9)	(18.4)	(27.8)

Table 4 (Continued)
Working Hours Estimation Results

	Male		Female	
	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
High School Graduate	-17.0	-2.7	-15.0	3.9
	(24.3)	(33.2)	(37.1)	(37.0)
Some College	-6.4	-2.0	-13.0	17.8
	(31.1)	(27.1)	(47.0)	(55.6)
College Graduate	-35.2	-6.8	114.5**	194.4**
	(37.6)	(64.7)	(52.5)	(87.0)
Recently Hospitalized	-36.1	-46.6	5.2	4.1
	(25.2)	(43.6)	(29.9)	(38.5)
County Unemployment Rate	4.6	6.6	-8.9**	-15.3*
	(4.2)	(9.3)	(3.8)	(7.6)
First Stage *F*-stat		0.90		18.31
Hausman Test		813		2906
		(1851)		(2713)
N	7,442	7,442	6,552	6,552
Pseudo R2	0.3289	.	0.3009	.

Notes: Other control variables are age fixed effects, industry fixed effects, occupation fixed effects, state fixed effects and year fixed effects. $SimBenefits_{ist}$, $ValueFreeze_{ist}$, and $TaxFreeze_{ist}$ are used as instruments for Tax_{ist} in the IV-probit specifications. The numbers shown in the table are marginal effects averaged across observations. Standard errors in parentheses are bootstrapped by 500 random draws with replacement clustered at state level. Individual weights from HRS are applied.

***significant at the 1 percent level.

** significant at the 5 percent level.

* significant at the 10 percent level.

other hand, the first stage *F*-statistic is 18.31 for the females, suggesting that I do not have a weak-instrument problem in the female sample. Nevertheless, the 2SLS estimate of the coefficient on property taxes does not support the hypothesis that higher property taxes induce elderly homeowners to work longer hours.

Results shown in Table 4 also suggest that income is highly correlated with working hours. In the male sample, black homeowners work fewer hours than white and Hispanic homeowners. In the female sample, homeowners with higher financial wealth appear to work fewer hours. Married women work fewer hours than women with other marital statuses. Women with college degrees work more hours than women with less education. Female homeowners living in counties with high unemployment rates work slightly fewer hours compared with those in counties with low unemployment rates.

Robustness Checks

In previous sections, I have used a simulated IV strategy to identify the potential effect of property taxes on elderly homeowners' labor supply decisions both on the extensive margin and the intensive margin. The estimation results suggest that property taxes may have no significant impact on elderly homeowners' decision to retire, to reenter the labor force, or to increase working hours. In this section, I carry out robustness checks by using various subsamples. Because the weak-instrument problem may exist in the male retirement sample and the male working-hour sample, I focus on females when analyzing retirement and working-hour responses, and I look at both males and females when studying reentry behavior.

In the first robustness check, I limit the sample to homeowners of age 55-70 and investigate whether the estimates change once homeowners younger than 55 or older than 70 are dropped. In the second robustness check, I exclude elderly homeowners who live in California because Proposition 13 may have created a very unusual institutional setting. Proposition 13 was adopted in California in 1978. It limits property tax rates at 1% and requires assessment values to grow no more than 2 percent per year unless the house is sold and reassessment is carried out. In the third robustness check, I drop individuals who claim to be self-employed because self-employed individuals may face higher or lower costs than others when adjusting their labor supply. Lastly, I exclude elderly homeowners who report having moved between time t and $t+1$ and focus on individuals who stay in the same house in both periods.

In the retirement analysis, the estimated marginal effect of property taxes is negative across subsamples for female respondents, which is consistent with the hypothesis that rising property taxes induce elderly homeowners to delay retirement. However, none of the estimates is statistically different from zero at conventional confidence levels; and, thus, I cannot reject the null hypothesis that property taxes have no significant impact on retirement behavior. In the reentry analysis, the estimated coefficient on property taxes is positive in some cases and negative in others. In addition, they are all statistically indistinguishable from zero. Therefore, there appears to be little evidence that elderly homeowners who are out of the labor force actually reenter the labor force in order to boost their incomes and pay for rising property taxes. In the working-hour analysis, most estimates of the property tax effect are negative, which is inconsistent with the notion that higher property taxes may have caused elderly homeowners to work longer hours. Additionally, none of the estimates are statistically significant.

In summary, despite efforts to identify the link between property taxes and elderly labor supply using various subsamples, there appears to be little evidence suggesting that property taxes play a significant role in elderly homeowners' labor supply decisions. Note that the instruments used in this paper to identify the causal effect of property taxes – simulated relief benefits from homestead exemptions, homestead credits, and circuit-breakers, eligibility for assessment value freeze programs, and eligibility for property tax freeze programs – affect property taxes of only homeowners who are eligible for property tax relief programs and actually take up these programs. To the extent that these people are more sensitive and responsive to property taxes, the estimates presented here may provide the upper bound of the property tax impact on elderly labor supply. Therefore, finding little evidence supporting the claim that elderly homeowners respond to rising property taxes by increasing labor supply in this paper implies that property taxes probably play an insignificant role in labor supply decisions of the general public.

CONCLUSIONS

Property taxes are the most important tax revenue source of local governments in the United States. The recent housing market boom led to substantial increases in property taxes which in turn have caught the attention of both policymakers and the general public. News articles have reported anecdotes of elderly homeowners delaying retirement in the face of rising property taxes, but, until now, there has been no empirical study on the relationship between property taxes and elderly labor supply. Exploiting the arguably exogenous variation in state-provided property tax relief programs, this paper is the first study that examines the role property taxes play in elderly homeowners' labor supply decisions. I examine both the extensive and intensive margins of labor supply behavior. Overall, I find little evidence supporting the claim that elderly homeowners have been delaying retirement, reentering the labor force, or working longer hours to deal with increasing property taxes.

In the regression analysis, I have to focus on people who are in the labor force in order to study retirement and working-hour behavior. This limits the power of my instruments significantly in the retirement and working-hour regressions among male respondents because these people are often too young and their incomes tend to be too high for them to be eligible for property tax relief programs. Since weak instruments may bias the IV estimates, the lack of a significant estimated relationship between retirement and working-hour responses and property taxes in the male sample in the IV-probit specification does not completely rule out the possibility that property taxes play an important role in older men's retirement and working-hour decisions. On the other hand, the first-stage is quite strong in the reentry analysis. Nevertheless, there appears to be little evidence of labor force reentry response to property taxes.

Taken together with Shan (2008), the findings of this paper have important policy implications. Shan (2008) shows evidence suggesting that higher property taxes induce higher mobility rates among elderly homeowners. Property taxes may affect elderly mobility through various channels: the income effect, the liquidity constraint effect, and the substitution effect. The income effect exists because increases in property taxes are equivalent to declines in after-tax income. The liquidity constraint effect means that elderly homeowners would have preferred staying in their homes if they were able to afford rising property taxes. The only reason that they move in response to higher property taxes is that they have no incomes or liquid assets to pay for increases in property taxes. The substitution effect refers to the fact that elderly homeowners, who typically do not have school-age children living in the house, often find the marginal cost of paying high property taxes exceeds the marginal benefit of consuming local public services such as schools. Thus, increases in property taxes may trigger an adjustment in their choice of housing consumption bundles, and such an adjustment is usually accomplished by moving. These different mechanisms have different welfare implications. Although Shan (2008) shows the relationship between property taxes and elderly mobility, she does not identify whether this relationship is driven by the income effect, the liquidity constraint effect, or the substitution effect. On the other hand, property taxes affect elderly labor supply only through the income effect and the liquidity constraint effect. This paper finds little evidence supporting that property taxes play a significant role in elderly homeowners' labor supply decisions. It points in the direction of property taxes influencing elderly mobility through the substitution effect. In this case, property tax relief programs may have kept elderly homeowners in their homes when they optimally should have moved to areas with lower property taxes and fewer public services.

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Notes

1 See Bradley (2005) and NCSL (2005).

2 Author's estimate using the 2004 data reported in Lyons, Farkas and Johnson (2007).

3 In 2004, a fifth cohort, Early Boomers (born between 1948 and 1953), was added to the HRS. Because households in this cohort have only been interviewed once and I need at least two adjacent surveys to study whether this period's property taxes affect labor supply between this period and the next period, I exclude them from my analysis.

4 See St. Clair et al. (2006) for more information on the RAND HRS Data File.

5 These states are District of Columbia, Massachusetts, Michigan, Missouri, Montana, New Jersey, New Mexico, New York, Oklahoma, Rhode Island, Vermont, and Wisconsin. I do not exclude states that use rebate checks to implement relief programs because the sample would become too small for meaningful statistical analysis.

6 I use a probit model in this paper because the mean of dependent variables is not near 0.5. A linear probability model may be biased when the dependent variable is close to zero or one, and will produce predictions beyond the range of zero to one.

7 For the first wave in 1992, HRS asked whether the individual was hospitalized in the past year. From the second wave on, HRS asked whether the individual was hospitalized since the last interview.

8 The Rivers-Vuong 2-step approach is a limited information procedure. Thus, it is less efficient than the conditional maximum likelihood estimation (MLE). In practice, I find MLE computationally difficult, and iterations do not converge.

9 See Horowitz (2001).

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