Income Tax and Older American Workers' Job Transition into Self-employment[*]

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Older workers' job transition into self-employment differs from younger workers in the aspect that it can be considered as retirement process or re-entry to the labor force. Personal income tax may affect older workers' self-employment entry decisions in various ways. This study empirically examines older American workers' duration of wage jobs before they engage in self-employment entry and analyzes how a progressive income tax affects the hazard of self-employment entry. Using substantial variations in personal tax codes in 1980s, this paper finds that the progressive tax reduces the probability of older workers' transition into self-employment. The magnitude of estimates varies by definition of the self-employed, allowance of multiple entries, scenarios on the tax convexity structure and additional control variables. Overall, the finding of this paper implies that flattening tax progressivity by 1 percentage point increases older workers' transition into self-employment by approximately 1.1% to 5.2%. It suggests that the impact of tax progressivity on older workers can be substantial.


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1. INTRODUCTION

Older workers' job transition into self-employment decision differs from younger workers. Self-employment entry of older workers with wage jobs can be considered as retirement process or re-entry to the labor force. American workers remain in the labor force longer than before, making job transition in the older period. Since self-employment offers more job opportunity for older workers, the direction of the job transition is more likely to be from wage jobs into self-employment, rather than from self-employment into wage jobs and within the similar occupations. This job transition into self-employment later in life may be desirable since the probability they stay in the labor force longer may rise with transition into self-employment. Increases in old population cause rapid increases in social spending for pension, medical expenditure and other social services. Stimulating labor force participation of the old has become important policy concerns for sustainable growth.

Income tax policy can affect older workers' decision to make self-employment entry and risk taking by providing various incentives, affecting labor force participation of older workers. Tax progressivity, as well as the level of tax rates, affects older workers' self-employment entry decisions by providing a tax subsidy through deductions and loss offsets, as well as by simply imposing higher tax rates on earnings in higher tax brackets. In principle, the relationship between tax progressivity and self-employment entry decisions can either be positive or negative. More progressive tax system may discourage self-employment entry for workers expecting higher self-employment income than wages, while tax avoidance motives may encourage self-employment entry.

During the period of 1980 to 1991, six tax reforms were passed, leading to substantial changes in the U.S. income tax system (figure 1). The Economic Recovery Tax Act of 1981 (ETRA), otherwise known as Reagan's supply side tax cut, reduced individual income tax rates by approximately 25% over three years. Tax rate on the highest income bracket fell from 70%

Figure 1   Federal Income Tax Brackets and Income Tax Rates
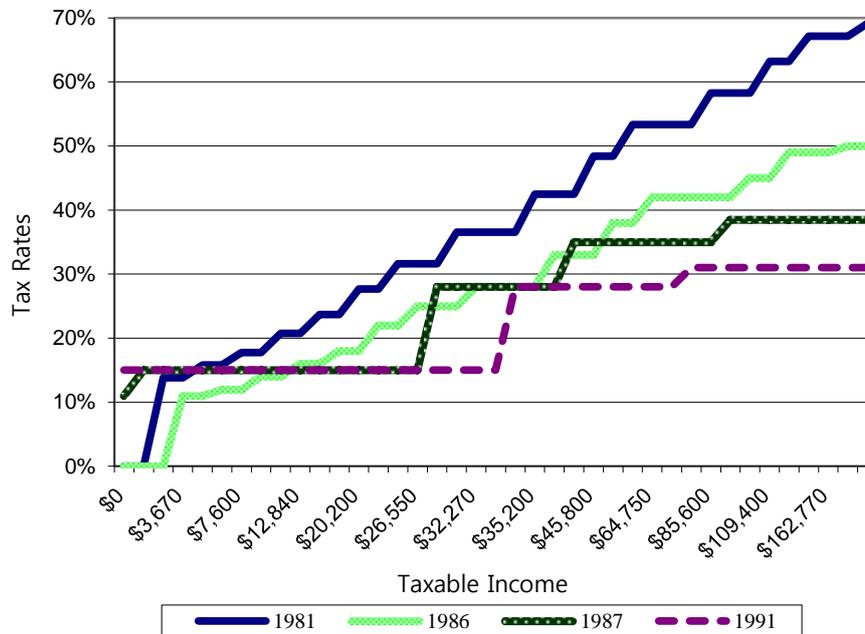
Sources: Joseph Pechman, Federal Tax Policy, Washington, DC: Brookings Institution.
Internal Revenue Service, Statistics of Income, Individual Income Tax Returns.

to 50% beginning from 1982, and the tax rate on the lowest income bracket declined from 14% to 11%.   The most recognized reform, the Tax Reform Act (TRA) of 1986, reduced fifteen income tax brackets to four brackets, and tax rate on the highest income bracket from 50% to 28% beginning from 1988, while raising the tax rate on the lowest income bracket from 11% to 15%.   The taxable income for zero tax rate and the amount of personal exemption increased, and the two-earner deduction, income averaging, and the state and local sales tax deduction were repealed as well.   The Omnibus Budget Reconciliation Act of 1990 (OBRA 90) reduced income bracket further to three, but increased the tax rate on the highest income bracket to 31%.   These substantial variations in income tax rates and tax structure in the 1980s have attracted numerous studies on changes in economic behavior in response to changes in the tax system.

This paper examines older workers' duration of wage jobs before they engage in self-employment entry and analyzes how the progressive income tax affects the hazard of older workers' self-employment entry, using the substantial variations in income tax system in the 1980s. Specifically, the paper studies how income tax differential between successful and unsuccessful expected incomes affect older workers' transition into self-employment. The dataset is constructed for the period of 1980 to 1991, by using administrative W-2 self-employment income and Social Security Earnings Records (W-2 Self-employment Income) matched with 1992 Health and Retirement Study (HRS). By providing wages from official W-2 records and self-employment taxable income from Schedule C in federal tax returns, this study avoids many forms of measurement error that may be correlated with other factors when using self-reported data. Using the presence of Schedule C self-employment taxable income from official tax returns data as an indicator of self-employment activity, this study provides more reliable information on job status, definition of self-employment entry and marginal tax rates calculation than from survey data.

Empirical results of this study suggest that the progressive tax discourages older workers' self-employment entry. Specifically, the progressive tax schedule reduces the hazard and the probability of making self-employment entry. The magnitude of estimates varies by definition of the self-employed, allowance of multiple entries, scenarios on the tax convexity structure and additional control variables. Overall, the estimates suggest that increase in progressivity by a 1 percentage point reduces the hazard by approximately 5.2%.

The paper is organized as follows. Section 2 presents the theoretical links between income tax and transition into self-employment, and reviews the previous literature on income tax and self-employment transition and older workers job transition. Section 3 provides data and variable descriptions. Section 4 presents the empirical models such as nonparametric and parametric hazard function. Section 5 examines the empirical results, and section 6 concludes.

2. INCOME TAX, TRANSITION INTO SELF-EMPLOYMENT, OLDER WORKER AND PREVIOUS LITERATURE

Individual income tax rates affect self-employment entry through the curvature and level of tax rates in given tax brackets, except in cases where the income tax system is proportional, offering full business loss offset, and individuals are risk neutral. However, this exceptional case may not be true since the actual income tax system is designed as progressive with equity concerns, and provides some degree of loss offsets, but does not provide full loss offsets. The income tax rates, thus, affects the decision to start new businesses and in principle can either discourage or encourage self-employment entry.

The progressive income tax discourages self-employment entry in a simple two-period self-employment selection model with risk-neutral individuals. For example, suppose a person currently faces a 10% marginal tax rate on his wages, is convinced his business will succeed well enough, and foresees future income streams from business profits that are far greater than income streams from his current paid job. If this person expects that his business profits could fall into the 25% tax bracket, then, compared to the income tax schedule which imposes 15% on the same amount of business profits, his self-employment entry may be discouraged due to the larger tax burden he may have to pay.

However, the progressive income tax may encourage self-employment entry when considering more than two periods of time. It might be permanent income rather than the income of the first few years that concerns the potential entrepreneur.[1] Suppose for the very first few years, such a person expects his new business profit to fall into 5% income tax bracket after loss offsets. If he faces a more progressive tax schedule of 3% with the same expected business profits, a progressive income tax system encourages self-employment entry. In this regard, the question how

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[1] It is likely that a person, who is confident in his business success but at the same time knows that the business may lose during the very first few years but expect higher earnings after years, does not concern the business losses at the very earlier period.

progressive income taxes affect self-employment entry can be better answered empirically than theoretically.

In principal, there are other channels of positive correlation between tax progressivity and self-employment entry.   When the progressive tax system provides tax avoidance incentives through organizational forms such as partnerships, S-corporations, and self-employment, tax progressivity encourages self-employment entry.   Also the progressive tax system can encourage risk-averse workers' business start ups, and the positive correlation between progressive tax and self-employment entry may be larger as the loss offset is greater.

Previous literature on taxes and self-employment entry support the supposition that both tax progressivity and tax rates affect self-employment entry, but found no such positive correlation between tax progressivity and self-employment entry.   Gentry and Hubbard (2000) finds that a less progressive personal income tax encourages self-employment entry.   Using the PSID, they showed that increases in the spread of marginal tax rates by 5 percentage points lowered the probability of making entry into self-employment by 0.26 percentage points.

Bruce (2000) finds similar results that higher marginal tax rates on self-employment income discourage wage workers' transitions into self-employment, focusing on whether differential tax treatment between self-employed and wage workers affects transition into self-employment.   Using the PSID from 1979 to 1991, he found that increases in the marginal tax rate for employment or decreases in the marginal tax rate for self-employment income discourage entry.   He showed that a 5 percentage points increases in tax rates differential reduces the average self-employment transition probability by approximately 2.4 percentage points.

Carroll, Holtz-Eakin, Rider, and Rosen (1998) studied the personal income tax effect on the existing sole proprietors who filed Schedule C, using statistics of individual income tax files for 1985 and 1988.   They found individual income taxes have significant influence on sole proprietor's investment decisions by utilizing the Tax Reform Act of 1986 (TRA 86) as

exogenous variations of tax and user cost.   They showed that a 5% raise in marginal tax rates decrease the proportion of entrepreneurs who make new investments by 10.4%, and reduce mean investment expenditures by 9.9%.

Carroll, Holtz-Eakin, Rider, and Rosen (1999) found that personal income tax has a significant influence on existing sole proprietors' probability of hiring workers, and total wage bills to workers by analyzing the Internal Revenue Service Statistics of Income Individual tax files for 1985 and 1988. Using similar methodology to Carroll *et al*. (1998), they showed that raising tax price by 10% increases the mean probability of hiring by about 12% and the tax price elasticity of the median wage bill is about 0.37.

The literature on the older workers' transition into self-employment show that major determinants of older workers' transition into self-employment include educational attainment, occupational status, health status, and personal wealth including inheritance (Giandrea *et al*., 2008).   Bruce *et al*. (2000) examined older workers labor force transition, finding that self-employment transition of older workers are affected by the wealth distribution, but are not affected by health insurance.   Giandrea *et al*. (2008) examined older workers' job transitions into and out of self-employment.   Using the Health and Retirement Study (HRS), they find that health status, occupation, and financial variables affect older workers' job transitions into and out of self-employment.

3. DATA AND VARIABLE DESCRIPTION

3.1. Data Description

This study uses administrative Wage and Self-Employment Income in Covered and Non-Covered Jobs (W-2 self-employment Income) of the Health and Retirement Survey (HRS) respondents, matched with the corresponding public-use HRS wave 1 and Social Security Earnings Record. W-2 self-employment income records contain wages posted from W-2

records and self-employment taxable income posted from the IRS Form 1040 Schedule C for HRS respondents who have a verified social security numbers from 1980 through 1991.[2]   The original records of wage and self-employment income are from the detailed part of the Social Security Administration (SSA) Master Earnings File (MEF), which maintains annual wage reports from W-2 records for all workers in the U.S.   It contains all wages from W-2 records, from both the social security covered jobs and non-covered jobs, including the amount of wages subject to Medicare tax and OASDI tax.   Wage records are kept per employer in a given year; Self-employment incomes subject to Medicare tax are also kept with one record per year.   The Health and Retirement Survey (HRS) provides rich information on health, job history and current job, disability, income and wealth, health insurance, and pension plans, as well as demographic background and family structures and transfers.[3]   The survey also includes questions on attitudes, preferences, expectations and subjective probabilities. It provides a source of linkage with administrative data, such as the Employer Pension Study in 1993 and 1999, Social Security Administration earnings and projected benefits data and W-2 self-employment data.

The W-2 matched dataset which this paper uses, hence, shows 11 previous years records for HRS respondents.   Table 1 shows the differences in sample distribution between HRS in year 1991 and W-2 matched dataset for the period of 1980 to 1991.   As in table 1, average age for HRS wave 1 respondents is 55.6, but average age for the matched sample is 48.75. Figure 2 shows the matched sample distribution of age in the initial year 1980.

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[2] Employers have to submit Form W-2 (Wage and Tax Statement) to employees, the IRS and state and local tax agencies.   Form W-2 shows the annual salary and taxes withheld for the year.   A sole proprietor pays income tax on his/her net income from business presented on Schedule C of IRS Form 1040.   Partnership and Subchapter S Corporations pay his/her share of net income on Schedule E of IRS Form 1040.

[3] HRS was designed as a national panel study to provide data on the factors that affect retirement, health insurance, saving and economic well-being.   Beginning in 1992, the initial survey conducted face-to-face interviews in homes with individuals born between 1931 and 1941 and their spouses, regardless of age.   The future waves followed up with the household by telephone every second year with proxy interviews in case of deceased primary respondents.   The initial sample of the HRS wave 1 is about 12,600 persons in 7,600 households.

Table 1   Demographics in HRS and Matched W-2 Sample

	(1) Matched Sample		(2) HRS	
Age	48.75	(6.85)	55.60	(5.66)
Less Than High School	0.213	(0.409)	0.256	(0.437)
Associate Degree	0.037	(0.19)	0.096	(0.295)
Bachelor Degree	0.1	(0.3)	0.035	(0.185)
Masters Degree	0.06	(0.238)	0.051	(0.219)
Law, MD	0.01	(0.099)	0.010	(0.098)
Single	0.035	(0.183)	0.029	(0.167)
Married	0.849	(0.357)	0.782	(0.413)
Hispanic	0.065	(0.246)	0.093	(0.290)
Black	0.137	(0.343)	0.166	(0.372)
Other Race	0.024	(0.154)	0.040	(0.196)
Female	0.52	(0.5)	0.536	(0.499)
Number of Observations	42,417		12,651	

Notes: Sample means in the matched sample and HRS are shown.   Standard errors are in parenthesis.

Figure 2   Sample Distribution of Age in 1980 (W-2 Matched Sample)
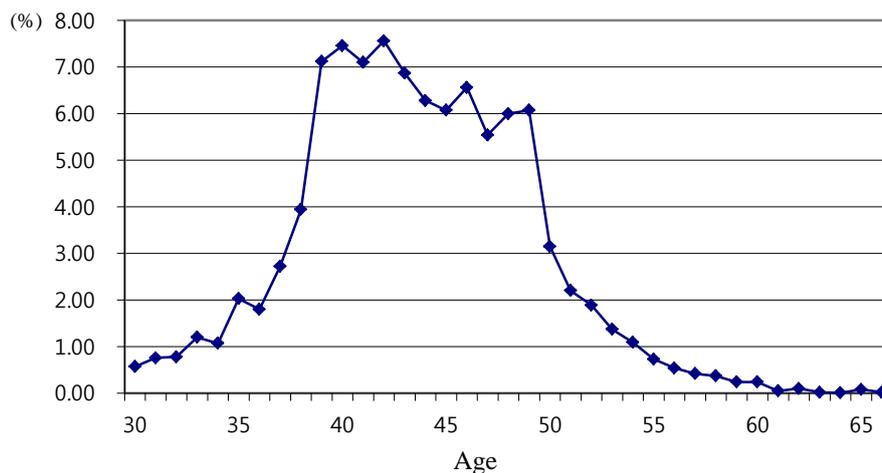
At the starting point, the age distribution shows that the matched sample mostly consists of age groups over 40 years old.[4]

Demographic information is from wave 1 of the HRS. Section A of the HRS wave 1 asks questions on the highest grade in school or year of college completed, race, marital history and the highest grade of school or year of college that the mother and father completed. The information on education, parental education, marital status, and race are used for corresponding respondents who have W-2 earnings records. For example, section A of HRS wave 1 asks questions regarding current marital status, whether they are married, partnered, separated, divorced, widowed, or never married. It asks marital history up to the 3rd marriage and records the years that marriage began and ended. Marital status from the period of 1980 to 1991 is inferred based on this information. Age is inferred from birth year and age in the face sheet of HRS wave 1. Number of children is inferred from birth years of each child. Other personal characteristics of interest, such as wealth, are also matched to W-2 self-employment income records.[5]

Table 2 presents the summary statistics for variables used in the estimations. About 90% of the sample consists of the wage workers, and 2.25% of the wage workers make the transition into self-employment. Average wage workers are younger than average workers, and those who make self-employment transition are older than those remaining as wageworkers on average. The average age of workers is 48.75 years old, and the average age when workers make the transition into self-employment is 49.61. Average wage workers who make the transition into self-employment are relatively better educated, have better educated parents and have fewer children compared to the average wage workers who do not enter into self-employment. They have a slightly smaller proportion of 'less than

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[4] Two percent of the entire sample consists of individuals who were less than 30 years old in the beginning year, 1980. I restrict the sample to the individuals who are at least 31 years old in 1980, which leaves 42,417 observations.

[5] Section M of HRS wave 1 asks questions such as whether respondents received inheritance, trust, insurance settlements, and the amount of money and assets received from relatives. It records amount and years of such instances up to three times. Years of receiving inheritance are inferred from those questions on HRS wave 1.

Table 2   Summary Statistics

	Total Sample		Wage Workers					
			Total		Entry		No Entry	
Age	48.750	(6.854)	48.621	(6.267)	49.613	(6.242)	48.583	(6.256)
Less Than High School	0.213	(0.409)	0.196	(0.397)	0.206	(0.405)	0.213	(0.409)
Associate Degree	0.037	(0.19)	0.119	(0.324)	0.039	(0.193)	0.037	(0.189)
Bachelor Degree	0.10	(0.3)	0.196	(0.397)	0.148	(0.355)	0.099	(0.299)
Masters Degree	0.06	(0.238)	0.061	(0.24)	0.066	(0.249)	0.061	(0.239)
Law, MD	0.01	(0.099)	0.025	(0.157)	0.027	(0.163)	0.009	(0.096)
Single	0.035	(0.183)	0.017	(0.129)	0.023	(0.151)	0.035	(0.185)
Married	0.849	(0.357)	0.843	(0.364)	0.873	(0.334)	0.842	(0.365)
Hispanic	0.065	(0.246)	0.063	(0.243)	0.062	(0.242)	0.065	(0.246)
Black	0.137	(0.343)	0.062	(0.241)	0.07	(0.255)	0.139	(0.346)
Other Race	0.024	(0.154)	0.008	(0.088)	0.012	(0.107)	0.024	(0.155)
Female	0.52	(0.5)	0.304	(0.46)	0.386	(0.487)	0.526	(0.499)
Receiving Inheritances	0.008	(0.084)	0.009	(0.095)	0.045	(0.207)	0.021	(0.141)
Number of Children (<18)	0.543	(1.038)	0.348	(0.867)	0.425	(0.923)	0.546	(1.034)
Convexity of Tax	7.05	(7.77)	7.46	(7.83)	6.99	(7.10)	7.47	(7.83)
Number of Observations	42,417		38,469		864		37,605	

Notes: Total sample is W-2 Self-employment Income Records matched with HRS.   Standard errors are shown in parenthesis.

high school diploma,' while associate degrees, bachelor's degrees, masters' degrees, and law and MD degrees are more concentrated among average wage workers.   The average proportion of the married workers, black workers, and male workers are higher for workers who make the transition into self-employment.

3.2. Job Status and Tax Progressivity Measure

The administrative earnings records of wages and self-employment taxable income are used to identify wage workers and the self-employed and to define whether a worker makes a transition into self-employment out of their wage jobs in a given year. Compared to the self-reported earnings data mostly used in previous literature, using official data on wages and self-employment taxable income avoids many forms of measurement errors that are correlated with other personal characteristics. In addition, identification of the self-employed is more reliable than self-reported information because the administrative data utilize official information of self-employment entry based on 1040 Schedule C records and W-2 records. One possible weakness of the data is that wages and self-employment taxable income are top-coded up to taxable maximum subject to the FICA tax, and when people have both self-employment taxable income and wages, the self-employment income only shows the difference between the FICA taxable maximum and wages.

The previous literature on self-employment entry used self-employment (Gentry and Hubbard, 2000; Evans and Leighton, 1989; Evans and Jovanovic, 1989), business ownership (Hurst and Lusardi, 2004), and the presence of the Schedule C tax return (Holtz-Eakin *et al*., 1994a, 1994b) as indicators of self-employment. This paper defines job transition into self-employment as having new records of Schedule C self-employment taxable income at time t and having W-2 wages and salaries records at time *t*-1.[6] Alternative definitions for the self-employed are tested using the self-reported information on the job status as the secondary self-employed and the

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[6] Self-employment transition includes workers who begin to have both Schedule C self-employment income and W-2 wage earnings. These records of having both Schedule C self-employment income and W-2 wage earnings may be interpreted either as the secondary self-employed who have a primary wage job, or the self-employed who have a secondary wage jobs, or receive salary form incorporated business. About 3.6% of the sample consists of such respondents. However, the number of additional transition including two jobs is much smaller than the count itself, and the estimates of the convexity of tax rates do not much differ by inclusion of entry to two job self-employment as job transition.

inference on the incorporation.[7]

The convexity of the income tax is constructed on the basis of a scenario of expected self-employment income, following Gentry and Hubbard (2000).   Starting a new business may be successful or unsuccessful, and wage workers who consider switching into self-employment may expect future incomes if the business is both successful and unsuccessful.   The baseline curvature of marginal tax rates on two states of self-employment income is calculated using the spread between two expected marginal tax rates.[8]   For the marginal tax rates, both income tax and social security tax payments are as well as the marginal income tax rates.[9] Expected self-employment income with business success at time (t+1) is assumed to be 150% of the wage income at time (t), and the expected unsuccessful self-employment income at time (t+1) is projected as 75% of the wage income at time (t).

Alternative convexity of tax measure is tested with more progressive scenarios with a larger spread between the successful and unsuccessful states

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[7] Section F, G, and H of HRS wave 1 asks if respondents have secondary self-employment jobs other than wage jobs for their current, and past jobs that are longer than 5 years. Using questions on years when they began and ended those jobs, I trace current jobs and past jobs, and infer secondary self-employment from 1980 to 1991.   Among W-2 earnings records, which show both wage income and self-employment income, only those who self-reported to have secondary self-employment jobs are considered to be in secondary self-employment, and others who do not report them as self-employed, nor secondary self-employed are excluded from the definition of secondary self-employed.   It turns out that, among workers who have both Schedule C income and W-2 earnings, 33.3% of workers reported them as secondary self-employed or self-employed.

[8] Marginal tax rate is calculated including social security tax payments, in addition to the income tax payments.   Marginal tax rates on income tax payments are calculated using the National Bureau of Economic Research (NBER) TAXIM program (version 5, beta) with household income, marital status, and number of kids exemption.   W-2 wages and the Schedule C self-employment income records are restricted for public use.   To keep confidentiality and calculate the tax rates, I created an earnings grid with units of 500 for each individual respondent, and used the grid to calculate the tax rates.   The calculated tax rates on true earnings are retrieved from the corresponding earnings grid.

[9] The statutory self-employment tax rates and half of the payroll tax rate on wage income have been set equal since 1984 in gross terms, excluding tax-credits and several exclusions. Before 1984, statutory self-employment tax rates were less than half of the payroll tax rate on wage income.   Further equal treatment changes were made in 1990 allowing half of the self-employment tax to be deducted from gross taxable income to ensure the equal treatment to employer's portion of the social security tax deduction.

of self-employment income.[10]   Expected successful self-employment income is projected with 200% of wage income at time t and expected unsuccessful income is projected with 50% of wage income.   This convexity measure of the marginal tax rates is not necessarily positively correlated with the level of marginal tax rate.   One drawback of this approach would be that it ignores the convexity of the tax schedule between two income levels as well as that associated with true tax schedules above the successful income and below the unsuccessful income.

4. NONPARAMETRIC ESTIMATES OF HAZARD FUNCTION AND SPECIFICATION OF HAZARD FUNCTION

With a non-negative random variable for the time to a failure, T, the survival function of T shows the probability of survival after time t. Survival function, $S(t)$, can be written as the reverse cumulative distribution function, $F(t)$, and the density function $f(t)$ can be derived from the survival function.

$$S(t) = \Pr(T > t) = 1 - F(t), \tag{1}$$

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t + \Delta t > T > t \mid T > t)}{\Delta t} = \frac{f(t)}{S(t)}, \tag{2}$$

$$H(t) = \int_0^t h(u)du = \int_0^t \frac{f(u)}{S(u)}du = -\int_0^t \frac{1}{S(u)}\left\{\frac{d}{du}S(u)\right\}du = -\ln\{S(t)\}, \tag{3}$$

$$S(t) = \exp\{-H(t)\}, \tag{4}$$

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[10] Overall, convexity measure with the more progressive spread doubles those with the less progressive spread.

$$F(t) = 1 - \exp\{-H(t)\}, \tag{5}$$

$$f(t) = \frac{dF(t)}{dt} = \frac{d}{dt}\{1 - S(t)\} = -S'(t) = h(t)\exp\{-H(t)\}. \tag{6}$$

Nonparametric estimates of the hazard function and cumulative hazard can be calculated from the Kaplan-Meier estimator (K-M) of the survival function using the theoretical relationship between the survival function and cumulative hazard function, or from the Nelson-Aalen estimator (N-A) of the cumulative hazard function. The Kaplan-Meier estimator (K-M) of the survival function, $S(t)$, and the Nelson-Aalen estimator (N-A) of the cumulative hazard function, $H(t)$ are written as follows.

$$\hat{S}(t) = \prod_{i|t_i \leq t}\left(\frac{n_i - d_i}{n_i}\right), \tag{7}$$

$$\hat{H}(t) = \sum_{i|t_i \leq t}\frac{d_i}{n_i}, \tag{8}$$

where n_i is number at risk at time i and d_i is number of failures at time i. The cumulative hazard function can be estimated using K-M survival function, and the survival function can be estimated from N-A cumulative hazard function. The K-M estimates and the N-A estimates of the hazard function are quite similar. However, the Nelson-Aalen estimator (N-A) for the cumulative hazard function and K-M survival function have better small-sample properties. Once the failure event occurs, the K-M estimator tends to remain as zero regardless of future activity, while the N-A estimator increases with every failure event.

Table 3 presents the duration of wage jobs, nonparametric estimates of the survival function, and the hazard function. The second column shows how many workers are observed as still being in wage jobs at the beginning of time t. The third column shows number of wage workers who make self-

Table 3   Duration of Wage Jobs

Time	(1) Still Wage Workers at t	(2) Leaving From Time t	(3) Censored From t- New Entry	(4) K-M Survival Ratio	(5) N-A Hazard Ratio	(6) N-A Cumulative Hazard
1	3,592	61	128	0.983	0.017	0.017
2	3,403	65	52	0.964	0.019	0.036
3	3,286	53	60	0.949	0.016	0.052
4	3,173	61	33	0.931	0.019	0.071
5	3,079	56	48	0.914	0.018	0.09
6	2,975	57	65	0.896	0.019	0.109
7	2,853	57	81	0.878	0.020	0.129
8	2,715	49	60	0.862	0.018	0.147
9	2,606	50	71	0.846	0.019	0.166
10	2,485	52	168	0.828	0.021	0.187
11	2,265	40	2,225	0.813	0.018	0.205

employment entry after time t, and the fourth column gives the net loss caused by censoring and new entry of observations after time t.   The fifth column presents the Kaplan-Meier estimator of the survival function, and the last two columns show the Nelson-Aalen estimator of the hazard function and cumulative hazard function.

The estimates of hazard function are relatively constant over given time period, showing no particular increasing or decreasing patterns over time. Given the age distribution at time t, one might wonder if the older workers tend to make more transition.   I compare the estimates of hazard function of younger workers whose ages are less than 45 years old at time t from those of older workers whose ages are more and equal to 45 years old.   Table 4 shows that the hazard of older workers over 45 years old appears to be slightly higher than that of younger workers for a given time period.

Wage workers' decision to exit a wage-job for self-employment entry and the probability of exiting the wage job is affected by various demographic

Table 4   Nonparametric Estimates for Hazard Function, by Age Group

Time	Age (at time t) < 45	Age (at time t) $\geq$ 45
1	0.015	0.019
2	0.019	0.020
3	0.016	0.016
4	0.018	0.021
5	0.019	0.018
6	0.019	0.019
7	0.023	0.016
8	0.019	0.016
9	0.018	0.022
10	0.018	0.025
11	0.016	0.021

factors and the personal income tax.   With time-varying regressors and time-invariant regressors, the hazard function is being conditioned on these regressors as well as time.   The hazard function, which is the limiting probability of switching into self-employment, conditional upon that worker continuously having worked as a wage worker from the beginning of the time, and control variables (X) is:

$$h(t;\, X) = \lim_{dt \to 0} \frac{P(t \leq T < t + dt \mid T \geq t, X)}{dt} = g(h_0(t),\, X\beta), \qquad (9)$$

where $h_0(t)$ is baseline hazard.

   In order to identify the effect of tax progressivity on self-employment entry, I use an parametric exponential hazard model.   I use the exponential regression model for the baseline hazard in order to identify the effect of the marginal tax rates on the probability of switching into self-employment and hazard.   With exponential waiting time, the baseline hazard is constant and the hazard function can be written as:

$$h(t; X) = \exp(X\beta). \hspace{2cm} (10)$$

For control variables, age, sex, race, marital status, education, number of children, receipt of inheritance, wages received, tax rates on wage jobs, convexity of the tax system, inheritance as an exogeneous proxy variable for wealth are used.[11]   Additional control variables such as industry of employment and years left until receiving social security benefits are tested for sensitivity check.

5. EMPIRICAL RESULTS

Table 5 presents estimates from the exponential hazard model.   The estimated hazard ratio for the convexity of the tax schedule, $\exp(\hat{\beta}_1) = 0.986$, implies that a 1% point increases in the curvature of tax schedule reduces hazard by 1.4%.[12]   The use of alternative convexity measure with more progressive scenario shows similar result.   The estimated hazard ratio of more progressive convexity measure is 0.985, implies that a 1% point increases in the curvature of tax schedule reduces hazard by 1.5%.   The level of tax rates is also found to reduce the hazard ratio, implying higher marginal tax rate discourages self-employment entry. The estimated hazard ratio for marginal tax rates implies that a 1% point increases in marginal tax rates discourages older workers' self-employment entry by 1.5-1.6%, depending on the progressivity measures.   This finding

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[11] Hurst and Lusardi (2004) examined the relationship of wealth and self-employment entry using business ownership in the Panel Study of Income Dynamics (PSID) to define entrepreneurship.   Examining the period from 1984 to 1994, they found that a proxy for wealth such as inheritance and housing capital gains captures more than liquidity constraint and found no relationship between wealth and self-employment entry for most of wealth distributions.   Due to difficulties finding exogenous wealth proxy, I use inheritances despite of possible limitations.

[12] Percentage change in hazard at any point in time is equivalent to subtracting unity from hazard ratio, that is $[\exp(\hat{\beta}_1) - 1] \times 100$.   With one unit changes in x_j, the percentage change in hazard is $\{\exp(X_j\hat{\beta}_J)\exp(\hat{\beta}_J) - \exp(X_j\hat{\beta}_J) / \exp(X_j\hat{\beta}_J)\}$.

Table 5   Estimates of Hazard Ratio

	Baseline		More Progressive	
	Hazard Ratio		Hazard Ratio	
Less Than High School	0.944	(0.122)	0.948	(0.122)
Bachelors Degree	1.653***	(0.242)	1.635***	(0.240)
Associate Degree	1.309	(0.318)	1.304	(0.317)
Masters Degree	2.030***	(0.328)	2.001***	(0.325)
Law-MD	2.979***	(1.161)	2.90**	(1.153)
Hispanic	0.682*	(0.145)	0.683**	(0.145)
Black	0.422***	(0.076)	0.422***	(0.076)
Other Race	0.437**	(0.182)	0.434**	(0.180)
Female	0.449***	(0.056)	0.441***	(0.055)
Single	0.458**	(0.183)	0.466**	(0.186)
Married	0.758**	(0.119)	0.856	(0.118)
Number of Kids	0.952	(0.054)	0.956	(0.054)
Receiving Inheritance	1.499*	(0.368)	1.494*	(0.366)
Age	0.992	(0.008)	0.990	(0.008)
Convexity of Tax	0.986**	(0.007)	0.985**	(0.006)
Marginal Tax Rates	0.984***	(0.005)	0.985***	(0.005)
Wage Income	0.999**	(0.000)	0.999**	(0.000)
Log Pseudo Likelihood	−1,745.74		−1,744.35	
Observations	31,535		31,535	

Notes: Standard errors in parenthesis shows robust standard errors obtained from the Huber-White-Sandwich estimator of variance, and are clustered by individual workers.   ***: significant at 1% level.   **: significant at 5% level.   *: significant at 9% level.

indicates that a progressive tax system reduces the hazard and the probability of switching into self-employment, providing weak evidence for tax-avoidance, tax subsidies through deductions, and insurance against business losses.

Education, race, marital status, age and wealth affect older workers' transition into self-employment.   The estimates on education suggest that higher education leads to a higher hazard.   The estimated hazard ratio for law-MD degrees suggests that workers who have law-MD degrees face a

Table 6   Estimates of Hazard Ratio with Multiple Entry

	Baseline		More Progressive	
	Hazard Ratio		Hazard Ratio	
Less Than High School	0.996	(0.115)	1.002	(0.116)
Bachelors Degree	1.513***	(0.193)	1.497***	(0.191)
Associate Degree	1.702***	(0.331)	1.694***	(0.330)
Masters Degree	1.752***	(0.259)	1.728***	(0.256)
Law-MD	2.000**	(0.578)	1.956**	(0.577)
Hispanic	0.792	(0.148)	0.793	(0.148)
Black	0.419***	(0.072)	0.429***	(0.072)
Other Race	0.338**	(0.136)	0.337**	(0.135)
Female	0.432***	(0.047)	0.426***	(0.046)
Single	0.465**	(0.161)	0.472**	(0.163)
Married	0.866	(0.103)	0.860	(0.102)
Number of Kids	0.932	(0.051)	0.936	(0.051)
Receiving Inheritance	1.472**	(0.282)	1.467**	(0.281)
Age	1.002	(0.007)	0.999	(0.007)
Convexity of Tax	0.990*	(0.006)	0.988**	(0.005)
Marginal Tax Rates	0.997	(0.003)	0.998	(0.003)
Wage Income	0.999***	(0.000)	0.999***	(0.000)
Log Pseudo Likelihood	−2,309.73		−2,308.19	
Observations	35,224		35,224	

Notes: Standard errors in parenthesis shows robust standard errors obtained from the Huber-White-Sandwich estimator of variance, and are clustered by individual workers.   ***: significant at 1% level.   **: significant at 5% level.   *: significant at 9% level.

hazard 197.9% larger than high school graduates.   The estimate for a master's degree indicates that workers who hold master's degree have larger hazard than college graduates but lower hazard than law or MD degree holders.   Races also affected self-employment transition, indicating the Hispanics and the Blacks appeared to have lower chance to make transition into self-employment than whites.   The Blacks have lower hazard than Hispanics.   The table also shows that exogenous increases in wealth such as receiving inheritance and insurance settlement raise the hazard by 49.9%.

Table 7   Sensitivity Check with Additional Explanatory Variables

	(1)		(2)		(3)	
Convexity of Tax	0.990 (0.006)	0.989** (0.006)	0.985** (0.007)	0.989* (0.006)	0.988** (0.007)	0.991 (0.006)
Marginal Tax Rate	0.990** (0.005)	0.991** (0.005)	0.986*** (0.005)	0.986*** (0.005)	0.991** (0.005)	0.991* (0.005)
Industry Dummies	No	No	Yes	Yes	Yes	Yes
Social Security Benefit Dummies	Yes	Yes	No	No	Yes	Yes
Convexity	Baseline	More Progressive	Baseline	More Progressive	Baseline	More Progressive

Notes: 1) Standard errors in parenthesis are robust standard errors obtained from the Huber-White-Sandwich estimator of variance, and are clustered by individual workers.   2) Industry dummies include 'public sector', 'mining and construction', 'transportation', 'sales', 'financial sector', 'business and repair service', 'entertainment', and 'professional services'.   3) Social security benefit dummies include 'no eligibility for pension', 'less than 5 years left until receiving pension benefit', 'more than 5 years and less than 10 years left until receiving pension benefit', 'more than 10 years and less than 15 years left until receiving pension benefit'.   4) Result shown are based on single entry.   ***: significant at 1% level.   **: significant at 5% level.   *: significant at 9% level.

Married person has lower hazard than unmarried person.   Higher wages at $t–1$ reduces the hazard, 1% increases in previous wage reduces the hazard by 0.1%.

The analysis is extended by allowing multiple spells for individuals. Multiple spell data are useful for estimation of models with unobserved heterogeneity when the regressors are not strictly exogeneous (Wooldridge, 2002).   Table 6 shows the estimates of hazard ratio with multiple spells. The estimate hazard ratio for the convexity of tax schedule is 0.990 with base line scenario and 0.988 with more progressive scenario, implying 1% point increases in the curvature of tax schedule reduces older workers' self-employment entry by 1-1.2%.

Table 7 presents the sensitivity of the estimated hazard ratio for the convexity of the tax schedule and marginal tax rate when additional covariates

Table 8   Sensitivity Check with Additional Definition of the Self-employed

	Single Entry		Multiple Entries	
	Less Convex	More Convex	Less Convex	More Convex
(1)	0.957** (0.016)	0.952** (0.016)	0.965* (0.016)	0.956** (0.016)
(2)	0.970** (0.009)	0.961** (0.009)	0.975** (0.009)	0.965** (0.009)
(3)	0.955** (0.014)	0.948** (0.013)	0.963** (0.014)	0.949** (0.013)
(4)	0.982** (0.006)	0.982** (0.006)	0.988** (0.006)	0.985** (0.005)
(5)	0.965** (0.009)	0.959** (0.009)	0.975** (0.009)	0.962** (0.008)

Notes: 1) The self-employed are defined by excluding workers who have both wage and self-employment income records.   2) The self-employed are defined by excluding workers who have both wage and self-employment income records and including workers who self-reported themselves as the secondary self-employed.   3) The self-employed are defined by excluding workers who have both wage and self-employment income records and including workers who are assumed to be incorporated.   4) The self-employed are defined by including workers who are assumed to be incorporated.   5) The self-employed are defined by excluding workers who have both wage and self-employment income records, and including workers who are assumed to be incorporated and workers who are assumed to be the secondary self-employed.   ***: significant at 1% level.   **: significant at 5% level.   *: significant at 9% level.

are added.   Industry of employment and years left until receiving social security benefits may affect older workers' self-employment transition.[13]   Depending on the addition of industry dummy variables and

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[13] Sections F, G, and H of HRS wave 1 ask the industry of employment for their current and past jobs.   After back-casting and identifying current and past jobs for the data, I matched the industry of employment for the current and past jobs.   Industry of employment dummies include 'public sector', 'mining and construction', 'transportation', 'sales', 'financial sector', 'business and repair service', 'entertainment', and 'professional services'.   Sections F, G, and H of HRS wave 1 record information on retirement plans and ask age at which they can receive full benefits and any benefit from retirement plans. Years of receiving benefits are inferred from the information used to construct dummy variables.   Dummy variables for social security benefits include 'no eligibility for pension', 'less than 5 years left until receiving pension benefits', 'more than 5 years and less than 10 years left until receiving pension benefits', 'more than 10 years and less than 15 years left until receiving pension benefits'.

social security benefit dummies, and the use of tax progressivity measures, the estimated hazard ratios for convexity of tax schedule range from 0.985 to 0.989.   The estimated hazard ratios for marginal tax rate range from 0.984 to 0.991.   Sensitivity test for the estimates by using different definition of self-employment, tax convexity measures, and single or multiple entries is shown in table 8.   The estimated hazard ratios for the convexity of tax schedule vary from 0.948 to 0.988, depending on the definition of the self-employed, single entries or multiple entries, and tax convexity measures. In sum, the magnitudes of the estimates suggest that 1% point increases in the curvature of tax schedule discourages older workers' self-employment entry by 1.1% to 5.2%.

6. CONCLUSIONS

Older workers job transition into self-employment differs from younger workers in the aspect that it can be considered as retirement process or re-entry to the labor force.   Personal income tax may affect older workers' self-employment entry decisions in various ways.   The paper empirically examines how progressive tax affects older American workers' self-employment entry, using substantial variations in personal tax codes in 1980s.   Empirical results of the study suggest that tax progressivity as well as tax rates have negative impact on older workers' self-employment entry and provide evidence that progressive taxes potentially hinder profitable self-employment activity and labor force participation of older workers. The magnitude of estimates varies by definition of the self-employed, allowance of multiple entries, scenarios on the tax convexity structure and additional control variables.   Overall, the finding of this paper implies that flattening tax progressivity by 1 percentage point increases older workers' transition into self-employment by approximately 1.1% to 5.2%.   It suggests that the impact of tax progressivity on older workers can be substantial.

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