Social Security MTR Calculation

Introduction:

This document explains the process by which we calculate the marginal tax rates (MTR) for Social Security for individuals in the CPS dataset.

Methodology:

We begin by including only individuals for our MTR calculation that are in the labor force, which we define by three criteria:

1. Their reported age is between 18 and 65 inclusive

2. They're not currently enrolled as a part-time or full-time student (a_ftpt from CPS)

3. Their earned income is greater than 0

Note: We define earned income as the sum of 'wsal_val', 'semp_val', and 'frse_val' from CPS

Once we define the labor force, we use Mincer's earnings function[1] to predict the earnings in a given year of each individual as a function of schooling and experience. This equation is given by

$$\ln(y) = \ln(y_0) + rS + \beta_1 X + \beta_2 X^2$$

where y is earnings, y_0 is the earnings of somebody with no education or experience, S is years of education, and X is years of work experience. To specify S in our calculation, we use the variable 'a_hga' from the CPS dataset and assign each possible category of education a number, which we define as YrsPstHS in the python code, to reflect how many years beyond high school it takes to finish.

Degree Type	YrsPstHS or '*S*'	Degree Type	YrsPstHS or '*S*'
Less than high school	0	Bachelor's degree	5
High school graduate	1	Master's degree	7
Some college but no degree	2	Professional school degree	10
Associate degree	3	Doctorate degree	10

We then assume that each individual in the labor force maintains the same level of education for the remainder of their lives and began working immediately upon completing their education. Thus we define experience as

$$X = age - S - 17$$

(Example: An individual aged 34 received a master's degree. Then X would be 34-7-17 = 10.)

Now that these variables are clearly defined, we were able to perform a regression using the variables earned_income, YrsPstHS, experience, and experience_squared to determine the coefficients *r*, β_1, and β_2. With these coefficients, we can imputed each individual's lifetime earnings for each working year of their life (we assume all begin working after completing education and work until 65).

The results of the regression are below.

OLS Regression Results

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Dep. Variable:	earned_income	R-squared:	0.183
Model:	OLS	Adj. R-squared:	0.182
Method:	Least Squares	F-statistic:	4421.
Date:	Sat, 27 Aug 2016	Prob (F-statistic):	0.00
Time:	15:16:31	Log-Likelihood:	-82210.
No. Observations:	59407	AIC:	1.644e+05
Df Residuals:	59403	BIC:	1.645e+05
Df Model:	3		
Covariance Type:	nonrobust		

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	coef	std err	t	P>|t|	[95.0% Conf. Int.]	
const	9.1374	0.014	665.145	0.000	9.110	9.164
YrsPstHS	0.1576	0.002	98.161	0.000	0.154	0.161
experience	0.0671	0.001	52.443	0.000	0.065	0.070
experienceSquared	-0.0012	2.77e-05	-42.580	0.000	-0.001	-0.001

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Omnibus:	24077.988	Durbin-Watson:	1.951
Prob(Omnibus):	0.000	Jarque-Bera (JB):	177423.838
Skew:	-1.779	Prob(JB):	0.00
Kurtosis:	10.682	Cond. No.	2.93e+03

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We create a vector of lifetime earnings for each year of an individual's working life until the present year by plugging in the individual's education, and their work experience in any given year. We then scale the earnings vector according to an average wage index found at https://www.ssa.gov/oact/cola/AWI.html.

This vector of earnings can then be used to estimate the individuals estimated monthly social security benefit using the Social Security Administration's calculator, called Anypiab, located at website at https://www.ssa.gov/oact/anypia/anypiab.html . Once one downloads the anypiab.exe file into the same directory as our SS_MTR_anypia.py script, our script uses this anypiab applet by filling in .pia files that contain the lifetime earnings, birthday, year of retirement, and gender of each recipient. The anypiab applet takes in the .pia files and then gives an estimated monthly social security benefit.

We format the lifetime earnings vectors four different ways before plugging them into the anypiab applet. First, we assume that there are no future earnings. We do this by setting all future earnings of each individual from the year 2015 until they retire equal to 0. Second, we use our regression to predict the future wages for all the working years of each individual's life (and appropriately scale them with the wage index). Third, we assume that after 2014, earnings remain constant at the 2014 pre-adjustment earnings amount. Lastly, we use the Anypiab program's future earnings projection, called the 2016 Trustees Report Alternative II (which is a moderate wage increase assumption, rather than pessimistic or optimistic). Each of these assumptions produces different SS benefit results, and subsequently different SS MTRs.

To calculate SS MTR amounts for each individual, we first extract the SS benefit amount from the anypiab output file, then we make this benefit representative of a lifetime benefit by multiplying by 12 to make it yearly, then by the number of years remaining in the individual's lifetime, which we assume to be 13 after retirement (78 years old). Once we get this total lifetime benefit, we implement a $500 adjustment/increase to the current year's (2014) earnings in the lifetime earnings vector and recalculate the monthly benefit using the applet (we use a $500 adjustment because any smaller adjustment doesn't change the monthly SS benefit amount on the anypiab app).

Finally, we take this new benefit, and similarly multiply by 12 and 13 to make it a lifetime benefit, take the difference between the old and new lifetime benefit, and divide that difference by the $500 adjustment to get the marginal tax rates for each individual. We perform this set of steps for each individual in the labor force of the CPS dataset.

1. Mincer, Jacob (1958). "Investment in Human Capital and Personal Income Distribution". *Journal of Political Economy*. **66** (4): 281–302. doi:10.1086/258055. JSTOR 1827422.

Average Wage Index (https://www.ssa.gov/oact/cola/AWI.html)

Year	Avg_Wage
1951	2799.16
1952	2973.32
1953	3139.44
1954	3155.64
1955	3301.44
1956	3532.36
1957	3641.72
1958	3673.8
1959	3855.8
1960	4007.12
1961	4086.76
1962	4291.4
1963	4396.64
1964	4576.32
1965	4658.72
1966	4938.36
1967	5213.44
1968	5571.76
1969	5893.76
1970	6186.24
1971	6497.08
1972	7133.8
1973	7580.16
1974	8030.76
1975	8630.92
1976	9226.48
1977	9779.44
1978	10556.03
1979	11479.46
1980	12513.46
1981	13773.1
1982	14531.34
1983	15239.24
1984	16135.07
1985	16822.51

1986	17321.82
1987	18426.51
1988	19334.04
1989	20099.55
1990	21027.98
1991	21811.6
1992	22935.42
1993	23132.67
1994	23753.53
1995	24705.66
1996	25913.9
1997	27426
1998	28861.44
1999	30469.84
2000	32154.82
2001	32921.92
2002	33252.09
2003	34064.95
2004	35648.55
2005	36952.94
2006	38651.41
2007	40405.48
2008	41334.97
2009	40711.61
2010	41673.83
2011	42979.61
2012	44321.67
2013	44888.16
2014	46481.52