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
==============================================================================
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
==============================================================================
                        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
==============================================================================
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
==============================================================================
```

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. 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 and fills in the lifetime earnings, birthday, year of retirement, and gender. The anypiab applet gives an estimated monthly social security benefit. We extract that amount for each individual and then we convert this benefit to represent 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 add $500 to the current year (2014) in the lifetime earnings vector and recalculate the monthly benefit using the applet. We add $500 because anything less than that adjustment doesn't yield any difference to the monthly benefit. Finally, we take this new benefit, 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 rate 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.