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# Testing the Permanent Income Hypothesis

## Motivation

If it were found conclusive that the permanent income hypothesis were true (that individuals effectively smooth out their income inequalities in their consumption levels), then there would be no justification for government intervention to assist individuals in their savings. This conclusion would suggest that the need for Social Security programs (if there sole goal was to provide savings assistance) has been overemphasized and normatively, should be scaled back.

## Positive Question

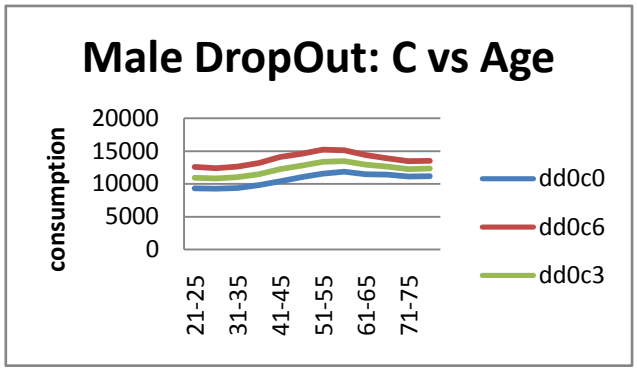
What are individuals' intertemporal elasticity of substation? Do individuals have distaste for unequal consumption levels across their lifetimes? What are individuals' time preferences (beta) and do they depend on demographics? Overall, are the estimated coefficients significant, are the imposed restrictions valid, and does the model do a good job of explaining lifetime consumption behavior? If the coefficients are significant, restrictions are valid, and the model explains the data on lifetime consumption behavior, is there significant evidence that agents smooth their consumption in response to lifetime permanent income, or do agents' consumption levels fluctuate with variations in income levels across their lifetime?

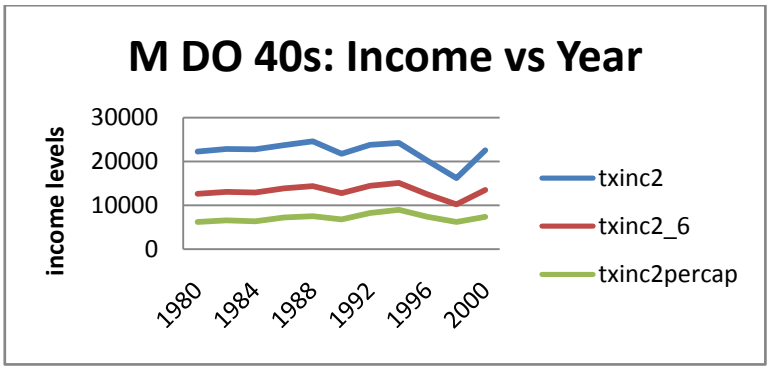
## Methodology

Ideal data for this analysis would consist of accurate consumption and income levels for a representative agents followed throughout their lifetime. Our analysis is somewhat limited by the fact that our data only spans a 20 year period, but it does capture consumption behavior and income levels for lots of individuals of many ages. The idea is to combine similar individuals into one synthetic individual in order to have a full lifetime panel of data. Another drawback of our data set is that our consumption and income data is at the household level and therefore, ad hoc assumptions about the public good aspect and intra-household sharing rules must be asserted in order to achieve data on individual level consumption and income levels.

I begin by asserting a couple different definitions about the public good component of household consumption and income. In each definition I mandate that energy and housing consumption are always pure public goods (every household member enjoys every amount of usage) and then that the other consumption variable can take on different degrees of public-good status. I construct a homotopy that when evaluated at 0 represents that these other

variables are never simultaneously enjoyed, and therefore have only per capita consumption components. The homotopy evaluated at 1 represents that all household consumption is purely public. The homotopy evaluated at .6 represents slightly more public good aspect to these consumption variables than per capita component. Overall, the effect of changing the intra-household sharing rule slightly influence cohort and age income and consumption profiles as illustrated in the following graphs.



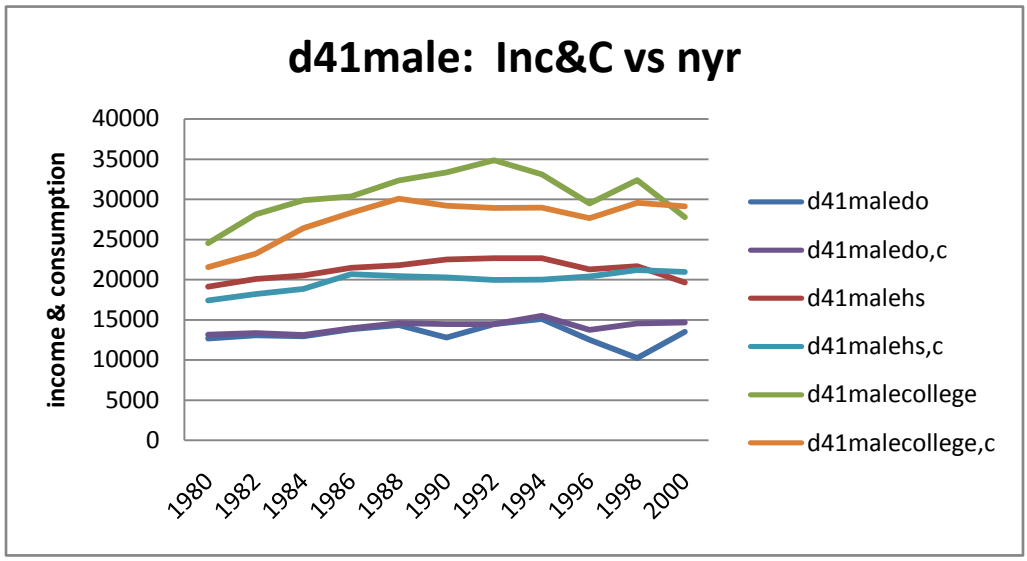

For the rest of the analysis, I use the assumption that both household consumption and income exist at the .6 point on the homotopy. The interpretation on consumption is provided above, and the interpretation for income is that individuals in households would make less if they were not in the household and that 2 together can make more income than 2 separated.

Now, to tackle the panel incompleteness of our data I construct some synthetic cohorts that I can follow throughout their synthetic lives. The cohorts are distinguished according to their gender, educational attainment, and year of birth. Then those cohorts with the same gender and educational attainment are synthetically combined to form a lifetime trace-able synthetic cohort.

| Gender | Education | Year of Birth Range | Observation Years |
|---|---|---|---|
| Male | Dropped Out | 1890-1925 | 1980-2000 |
| Female | High School | 1926-1940 | |
| | College | 1941-1950 | |
| | | 1951+ | |

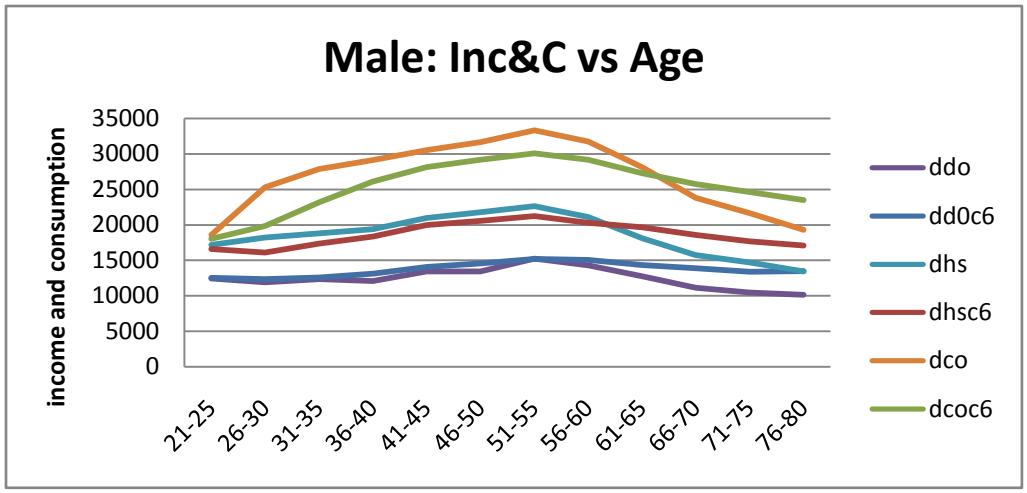
There is a trade-off in determining appropriate categorizations of cohort characteristics. I decided to categorize a little broadly at the cost of cohort uniformity in order to keep sample sizes large and coefficient estimate standard errors low. Also, among the really old, even though the first couple of year-of-birth brackets are large, by the time of the first observation (1980) they are all sufficiently old that I argue their consumption behavior and income levels are not significantly different.

Presented below are examples of cohort and age income and consumption profiles.




Cohort Income And Consumption Profiles

Males, Born in 40s




Income and Consumption Age Profiles

Males

It is with these cohort consumption paths that I can estimate a permanent income hypothesis model. I employ the standard time-separable constant-IES utility preferences in the infinite time environment. The log linearization of the resulting Euler Equation:

$$\Delta \log(\widehat{c_{t+1}}) = \text{constant} + \sigma \log(1 + r_{t+1}) + \theta' \Delta \widehat{z_{t+1}} + \epsilon_{t+1}$$

The key assumption that introduces uncertainty in the model and allows non-zero likelihood estimation is that agents face uncertainty in tomorrow's interest rate. I claim that 2 period+ lags on interest rate do not lend predictive power beyond the current interest rate. In fact, I use these lags along with some other variables as instruments under the hypothesis that

their variation is independent of the residuals. Further, I will test that these parameter identifying instrumentation restrictions are valid (not over-identifying).

For the interest rate values I use FRED data on bank prime loan interest rates. I chose this specification of the interest rate as I believed that it was the most consistent with the savings interest rate presented to the agents in our model at each of their consumption-savings junctures.

Results

Here are the dynamic panel data GMM regression results.

| variable | coefficient | standard errors |
|---|---|---|
| lr | 0.0410075 | 0.212826 |
| age | 0.0134317 | 0.0028119 |
| ltxinc2_6 | 0.1555791 | 0.0319728 |
| dmarried | 0.0511254 | 0.0838723 |
| a2 | -0.0000397 | 0.0000302 |
| lai | 0.3502149 | 0.0368959 |
| _cons | 7.316604 | 0.3132695 |

The coefficient on lr (log interest rate) corresponds to the inter-temporal elasticity of substitution parameter. It is not significantly different than zero.

In this regression, as instruments (parameter identifying moment restrictions) I imposed that 2$^{nd}$ and 4$^{th}$ previous interest rate lags do not explain variation in the residual, that lag consumption and income values are also independent of the error term, as well as some exogenous individual characteristics such as age and age^2. I felt comfortable adding parameter identifying restrictions because, even though the probability that my Sargan (Hansen J test) test of over-identifying restrictions increased in probability of being over-identified with each instrument, the probability that the model was over-identified never reached much beyond 5%. In fact, with the above specifications, the result of the Sargan Test were (right)

Sargan test of overidentifying restrictions
H0: overidentifying restrictions are

chi2(168) = 199.1068
Prob > chi2 = 0.0507

## Conclusion

The results suggest that consumption is not excessively sensitive to fluctuations in income. One argument is that even though the coefficient for change in log consumption with respect to log income is significantly different than zero, it is not large. Second, adding income lags as an instrument did not devastate my Sargan test results. Thus neither present income nor prior income level fluctuations greatly influence the consumption path.

Conversely, the subjective rate of time preference is sensitive to demographics such as age. The coefficient on age is .013 with a standard error of .0028. Previous literature which concludes that permanent income hypotheses of lifetime consumption smoothing do not account for this significant factor, which may account for their resulting oversensitivity of consumption to income fluctuations and trends.

Although both Attanasio and I conclude by disagreeing with previous rejections of the permanent income hypothesis, our estimates do have their own differences. Possible reconciliations for differences in results between my estimates and Attanasio's results include data, consumption and income variable definitions, and model specifications. In particular, Attanasio uses quarterly data. He most likely does not use my exact same definition of which consumption goods are pure public goods and then further, for those that aren't, the degree to which they are shared. Also, given the difference in the data set, I used different categorizations on my cohort definitions to get my best balance between uniformity of cohorts and low standard errors on coefficient estimates. Lastly, given these differences, we would expect him to be able to include different choices of and numbers of instruments.

In summation, the results and predictions of the model are far from perfect. There exists room for improvement in developing more accurate models of dynamic consumption behavior, but the rigorous analysis performed here does implicate that the permanent income hypothesis should not readily rejected. The data and model do suggest real possibility of consumption smoothing. These ambiguous conclusion are hardly justification for enormous government intervention in the form of programs such as Social Security, if their sole goal was to assist in savings behavior.