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John J. Heim
*Rensselaer Polytechnic Institute*

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Was Keynes Right?  
Does Current Year Disposable Income Drive Consumption Spending?  

John J. Heim\textsuperscript{1}  
Department of Economics  
Rensselaer Polytechnic Institute  
110 8th Street  
Troy, NY 12180  
heimj@rpi.edu

Abstract: In the Keynesian consumption function, current income is asserted to be the main determinant of consumption. This paper examines the extent to which the Keynesian consumption function explains 1960 - 2000 U.S. consumption patterns. The results are compared to the longer term average income variables suggested by Friedman's \textit{Permanent income Hypothesis} and Ando and Modigliani's \textit{Life Cycle Hypothesis} as the income variable affecting consumption. We find variance explained by the consumption function drops dramatically when multi-year average incomes are substituted for the Keynesian current income variable. However, when added to the Keynesian function as a second income variable, they increase explained variance from 88\% to 90\%, compared to the Keynesian income variable alone. This small amount suggests that their may be a small portion of the U.S. population whose consumption decisions follow the more complex formulations suggested by the \textit{Permanent Income} and \textit{Life Cycle} hypotheses, while the simpler current income formulation used by Keynes appears to characterize the consumption function of most of the population. JEL E00, E12

\textit{The General Theory of Employment, Interest and Money} (Keynes 1936) suggests that the major determinant of current year consumption spending is current year income. So, for example, the portrayal of the consumption - income relationship in Ruggles & Ruggles (1956) classic text on National Income Accounting uses the relationship between 1936 income and consumption levels to illustrate this relationship. Kuznets' 1952 American Economic Review paper on the marginal and average propensity to save (and consume) also focus on this current year consumption/saving - current year income tie. Typically, “IS/LM” chapters in textbooks example characterize Keynes’ relationship as one in which current year income determines current year consumption. To some extent, this is done implicitly by the failure to denote any difference in time period for the income and consumption variables. See for example the Mankiw (2006, Cptr.10) or Bernanke’s (2005, Cptr.9) Macroeconomics texts.

\textsuperscript{1} John J. Heim is clinical associate professor of economics at Rensselaer Polytechnic Institute. He has benefited greatly from discussions on various topics with colleagues in the economics department at R.P.I. All responsibility for errors, of course, remains his own.
Keynes did however note that (p.97) full adjustment to consumer spending to income changes might be less than instantaneous, especially during relatively short periods after an income change. But this seems to be the sole qualification to the general notion that current income drives current consumption.

Subsequent work by Friedman (1957) - the “Permanent Income Hypothesis”, and by Ando and Modigliani (1963) - the “Life Cycle Hypothesis” are predicated on the notion that expected levels of income over a longer time horizon determine consumption, not just current year income. Roughly speaking, this longer time horizon refers to some average of anticipated and/or previously experienced yearly. For example, Mankiw, discussing the Permanent Income Hypothesis, notes “permanent income is average income”, and his formulation of Modigliani income variable implies the same, since the income variable times the number of years worked is given as the definition of total lifetime earnings. This of course is only true if the income variable is average income. (Mankiw, 2006, pp. 472, 476),

Our purpose in this paper will be to statistically test the Keynesian consumption function on U.S. data 1960-2000, using current income as the definition of the income level that affects consumption. Other variables will be added to the function to control for other things thought to affect consumption, such as wealth, interest rates and access to consumer credit. We will then replace the current income variable with both adaptive expectations-based and rational expectations-based estimates of likely average income over time. Our goal will be to see if longer period average income variables are more successful at accounting for variance in consumption spending than just the Keynesian current income variable alone.

The Basic Keynesian Function:

Keynes argues in chapter 8 of The General Theory of Employment, Interest and Money (1936) that income, wealth, fiscal policy (taxes) and possibly the rate of interest might influence consumption. However, he felt

... income...is, as a rule, the principal variable upon which the consumption-constituent of the aggregate demand function will depend....(p.96)

though

...windfall changes in capital-values will be capable of changing the propensity to consume, and substantial changes in the rate of interest and in fiscal policy may make some difference (pp.95-96)...

where “fiscal policy” is a reference to tax levels. In chapter 9 he also notes other factors that might affect the level of consumption spending: precautionary saving (for unknown, but potential, future needs), saving for known future needs (like retirement), and saving to finance improvements in future standards of living.

Hence, we can sum up Keynes by saying his determinants of consumption spending included after tax income, wealth, and the interest rate, and a desire to save.
To these, our Keynesian consumption function below will add a “consumer credit crowd out” variable. Prior studies by this author (Heim 2007) strongly suggest another aspect of fiscal policy, the government deficit, systematically reduces savings available to finance larger consumer purchases, such as cars, homes and furniture, or even credit card spending on smaller consumer purchases. This is the same sort of crowd out effect commonly discussed as adversely affecting investment.

Keynes also argued (p. 97) that the proportion of total income saved would grow as income grew, resulting in falling average propensity to consume as income grew.

Typical tests in the late 30’s and early 40’s using cross-sectional data seem to verify this. For example, in Ruggles & Ruggles (1956, p.306) attempt to describe the Keynesian function in their classic text on national income accounting, using the income and consumption patterns of almost 40 million U.S. families in 1935-36 to illustrate a declining average propensity to consume/increasing average propensity to save as income increased. Their data are shown in Table C1. Note that about half of all personal saving was done by the top ½% of all income recipients – those families earning $15,000 or more, and that the bottom two income groups had negative savings, i.e., average propensity’s to consume greater than one. Data like this have provided our standard, though somewhat - even if only slightly – oversimplified (no provision for wealth or interest rate effects), interpretations of the Keynesian consumption function.

<table>
<thead>
<tr>
<th>Income Group (in dollars)</th>
<th># of Families (000)</th>
<th>Personal Income</th>
<th>Personal Taxes</th>
<th>Disposable Income</th>
<th>Consumption Expenditures</th>
<th>Personal Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under $780</td>
<td>13,153</td>
<td>$6,190</td>
<td>171</td>
<td>$6,019</td>
<td>$7,226</td>
<td>$-1,207</td>
</tr>
<tr>
<td>780-1,450</td>
<td>13,153</td>
<td>14,154</td>
<td>616</td>
<td>13,638</td>
<td>13,890</td>
<td>-252</td>
</tr>
<tr>
<td>1,450-2,000</td>
<td>5,974</td>
<td>10,035</td>
<td>409</td>
<td>9,626</td>
<td>9,164</td>
<td>462</td>
</tr>
<tr>
<td>2,000-3,000</td>
<td>4,434</td>
<td>10,577</td>
<td>465</td>
<td>10,112</td>
<td>9,043</td>
<td>1,069</td>
</tr>
<tr>
<td>3,000-5,000</td>
<td>1,818</td>
<td>6,644</td>
<td>343</td>
<td>6,301</td>
<td>5,125</td>
<td>1,176</td>
</tr>
<tr>
<td>5,000-15,000</td>
<td>749</td>
<td>5,839</td>
<td>413</td>
<td>5,426</td>
<td>3,529</td>
<td>1,897</td>
</tr>
<tr>
<td>$15,000 &amp; Over</td>
<td>178</td>
<td>5,820</td>
<td>750</td>
<td>5,070</td>
<td>2,237</td>
<td>2,833</td>
</tr>
<tr>
<td>Total ...................</td>
<td>39,458</td>
<td>$59,259</td>
<td>$3,067</td>
<td>$56,192</td>
<td>$50,214</td>
<td>$5,978</td>
</tr>
</tbody>
</table>

Source: Ruggles & Ruggles, (1956, p.306)

Of course, a declining APC means the function has a positive intercept, as is commonly shown in textbook presentations of the Keynesian consumption function.
In another study (Heim, 2007a), this author found that regression results on a modified Keynesian function of the following type explained about 88% of the variance in consumer spending in the 1960 - 2000 period:

\[ C_0 = \beta_1 + \beta_2 (Y - T_G)_0 + \beta_3 (T_G - G)_0 - \beta_4 (PR)_0 - \beta_5 (DJ)_{-2} \]

where

\[(Y - T_G)_0 = \text{Total income minus taxes, defined as the GDP minus that portion of total government receipts used to finance government purchases of goods and services, i.e., total government receipts minus what’s needed to finance transfer payments in the current period.}\]

\[(T_G - G)_0 = \text{The government deficit (interpreted as a restrictor of consumer as well as investment credit. Usually we will disaggregate this into two separate variables in regressions: } \beta_{3A} T_{G(0)} \text{ and } \beta_{3B} G. \text{ because we found the effects of each on consumer spending to differ, with the tax variable the more important. (See Heim 2007)}\]

\[PR_0 = \text{An interest rate measure, the Prime rate, for the current period. This rate is a base rate for much consumer credit.}\]

\[DJ_{-2} = \text{A stock market wealth measure, the Dow Jones Composite Average, lagged two years}\]

**METHODOLOGY**

All data used in the study is taken from the Council of Economic Advisors’ statistical appendix to the *Economic Report of the President, 2002*, Tables B2, B3 ,B7, B26, B54, B60, B73, B82, B90, B95 and B110. All data are expressed in real 1996 dollars, or converted to same using the GDP deflator in Table B3.

First difference versions of this modified Keynesian function (1) were used in regressions to reduce the distorting effects of multicollinearity and non-stationarity inherent in most time series models:

\[(1A) \quad \Delta C_0 = \beta_2 \Delta (Y - T_G)_0 + \beta_3 \Delta (T_G - G)_0 - \beta_4 \Delta (PR)_0 - \beta_5 \Delta (DJ)_{-2} \]

or, entering separately the revenue and government spending components

\[(1B) \quad \Delta C_0 = \beta_2 \Delta (Y - T_G)_0 + \beta_{3A} \Delta (T_{G(0)}) - \beta_{3B} \Delta (G)_0 - \beta_4 \Delta (PR)_0 - \beta_5 \Delta (DJ)_{-2} \]

Each regression below shows the estimated marginal effect (regression coefficient) for the explanatory variables, the t statistic associated with it, the percent of variance explained and the Durbin Watson autocorrelation statistic. Throughout the remainder of the paper, marginal effects with a t-statistic of 1.8 are significant at the 8% level, 2.0 are significant at the 5% level and t-statistics of 2.3 and 2.7 are significant at the 3% and 1% level respectively.
Because of the simultaneity between C (or its component part, M) and Y inherent in these equations, two stage least squares estimates of $\Delta(Y - T_G)_0$ were developed, using the remaining right hand side variables as first stage regressors. Newey-West heteroskedasticity corrections were also made.

**Findings**

**The Keynesian Model: A Consumption Function Using Only Current Income**

Using the variables described above, our regression estimates for the Keynesian consumption function are as follows:

$$\Delta C_0 = .73 \Delta(Y - T_G)_0 + .47 \Delta(T_G - G)_0 - 6.92 \Delta PR_0 + .56 \Delta DJ - 2R^2 = 83\%$$

This regression shows all of the variables Keynes cited as determinants of consumption to be statistically significant at the 2% level or better. They are shown in order of their contributions to explained variance when entered in step-wise fashion. Disposable income accounts for 68% of the variance when entered first, more than any other variable, as Keynes suggested. When consumer credit limitations are added, represented by the size of the government deficit, explained variance increases from 68% to 78% - more than for any other variable entered second after disposable income. Subsequently adding the interest rate variable increases it to 81%, and adding the wealth variable raises it to 83%.

However, preliminary testing consistently indicated that increases in the government deficit due to lowering taxes had a more systematic negative effect on consumer spending, presumably by adversely affecting credit availability, than did increasing government spending. Our research here does not permit definitively examining why, but one hypothesis is that the Federal Reserve may be more likely to increase the money supply just before or during periods of increased deficits due to government spending, but not when the deficit increases due to tax reductions. As a result, in future analyses, we will use the disaggregated form of the government budget deficit shown below:

$$\Delta C_0 = .66 \Delta(Y - T_G)_0(\text{Keynes}) + .52 \Delta T_G(0) + .10 \Delta G_0 - 7.23 \Delta PR_0 + .42 \Delta DJ - 2R^2 = 88\%$$

This will now become our baseline Keynesian model. We will then measure the success of other models against this model using multi year income averages to reflect adaptive or rational expectations models of how income affects consumption, as per Friedman and Modigliani.

First, we will attempt to see if consumer spending is driven by only past income history over a number of recent years, i.e., an average or permanent income. This we will call the adaptive expectations version of the income variable because it averages current income only with incomes earned in the past. It views any change in this years’ income above a multi-year average as transitory in nature, not warranting a major expenditure shift.
Further below, we shall also test a rational expectations formulation, using expectations of income to be earned in the future (using actual income earned in the future as a proxy for “rationally expected" income). We will also combine this with past income to find an average of lifetime income, at least from the perspective of what’s been happening in the recent past and likely to happen in the near future. This we will think of as a “Life Cycle” or “Permanent average income variable, after Modigliani and Friedman.

Adaptive Expectations Models:

Our definition of adaptive expectations is that people view their permanent or life cycle income as an average of incomes they have been used to receiving in the past. Below we present results for several possible definitions of this income average, varying the number and combination of years in the past that constitute the average. The subscripts on the income variable denote the years included. The Keynesian “current income only” result from above is restated first for ease of comparison with the non-Keynesian results.

\[ \Delta C_0 = .66 \Delta (Y - T_g)_{0(\text{Keynes})} + .52 \Delta T_{G(0)} + .10 \Delta G_0, - 7.23 \Delta PR_0, + .42 \Delta DJ_2 \]
\[ R^2 = 88\% \]
\[ \text{D.W.} = 1.8 \]

\[ \Delta C_0 = .55 \Delta (Y - T_g)_{1} + .43 \Delta T_{G(0)} + .20 \Delta G_0, - 9.11 \Delta PR_0 + 1.06 \Delta DJ_2 \]
\[ R^2 = 42\% \]
\[ \text{D.W.} = 2.1 \]

\[ \Delta C_0 = .54 \Delta (Y - T_g)_{2} + .71 \Delta T_{G(0)} - .08 \Delta G_0, - 6.20 \Delta PR_0 + .84 \Delta DJ_2 \]
\[ R^2 = 32\% \]
\[ \text{D.W.} = 1.3 \]

\[ \Delta C_0 = .74 \Delta AV(Y - T_g)_{0,1} + .46 \Delta T_{G(0)} + .19 \Delta G_0, - 9.30 \Delta PR_0 + .52 \Delta DJ_2 \]
\[ R^2 = 81\% \]
\[ \text{D.W.} = 1.9 \]

\[ \Delta C_0 = .66 \Delta AV(Y - T_g)_{1,2} + .58 \Delta T_{G(0)} - .29 \Delta G_0, - 8.51 \Delta PR_0 + .75 \Delta DJ_2 \]
\[ R^2 = 48\% \]
\[ \text{D.W.} = 1.6 \]

\[ \Delta C_0 = .58 \Delta AV(Y - T_g)_{2,3} + .68 \Delta T_{G(0)} - .05 \Delta G_0, - 5.20 \Delta PR_0 + .76 \Delta DJ_2 \]
\[ R^2 = 35\% \]
\[ \text{D.W.} = 1.2 \]

\[ \Delta C_0 = .77 \Delta AV(Y - T_g)_{0,1,2} + .57 \Delta T_{G(0)} - .47 \Delta G_0, - 8.83 \Delta PR_0 + .43 \Delta DJ_2 \]
\[ R^2 = 75\% \]
\[ \text{D.W.} = 1.4 \]

\[ \Delta C_0 = .66 \Delta AV(Y - T_g)_{1,2,3} + .60 \Delta T_{G(0)} - .21 \Delta G_0, - 6.93 \Delta PR_0 + .73 \Delta DJ_2 \]
\[ R^2 = 45\% \]
\[ \text{D.W.} = 1.5 \]

\[ \Delta C_0 = .76 \Delta AV(Y - T_g)_{0,1,2,3} + .59 \Delta T_{G(0)} - .39 \Delta G_0, - 7.51 \Delta PR_0 + .47 \Delta DJ_2 \]
\[ R^2 = 67\% \]
\[ \text{D.W.} = 1.4 \]

\[ \Delta C_0 = .75 \Delta AV(Y - T_g)_{0,1,2,3,4} + .61 \Delta T_{G(0)} - .24 \Delta G_0, - 6.10 \Delta PR_0, + .41 \Delta DJ_{2,n} \]
\[ R^2 = 65\% \]
\[ \text{D.W.} = 1.4 \]

The regressions above show that when the Keynesian current income variable \( \Delta (Y - T_g)_0 \) is removed from the regression and replaced by an average of several recent past years incomes, the amount of variance explained by the income variable drops considerably. In models that rely totally on prior year income averages, explained variance drops from 88% in the Keynesian model to 31%-48%. Only in models where the income average included current income as well as past years’ income were the results even close to the Keynesian model, with explained variance only falling from 88% to 65%-81%. Even here, the best result, 81%, was only obtained by using a two year average that weighted current income more heavily (50%) in computing the average than in the other models.
Hence, the data do not seem to support an explanation of the average consumer’s behavior consistent with an adaptive expectations formulation of Friedman’s permanent income or Modigliani’s life cycle hypotheses.

However, if we test the hypothesis that some portion of Americans may be Keynesian, while others are more Friedman/Modigliani in their behavior, we find that the test results support such a theory, though only marginally when adaptive expectations alone are used. The results are shown in the following six additional regressions:

\[
\Delta C_0 = .57 \Delta(Y-T_0)_0 + .14 \Delta AV(Y-T_0)_{0-1,2,3,4} + .55 \Delta T_{G(0)} -.02 \Delta G_0 -7.27 \Delta PR_0 + .33 \Delta DJ_2 R^2 = 88% \\
(t) (10.8) (1.8) (5.4) (-0.1) (-3.2) (1.5) DW = 1.6
\]

\[
\Delta C_0 = .54 \Delta(Y-T_0)_0 + .17 \Delta AV(Y-T_0)_{0-1,2} + .54 \Delta T_{G(0)} - .09 \Delta G_0 -7.72 \Delta PR_0 + .37 \Delta DJ_2 R^2 = 89% \\
(t) (7.2) (1.6) (5.3) (-0.4) (-3.7) (1.8) DW = 1.5
\]

\[
\Delta C_0 = .50 \Delta(Y-T_0)_0 + .20 \Delta AV(Y-T_0)_{0,1} + .51 \Delta T_{G(0)} - .03 \Delta G_0 -7.90 \Delta PR_0 + .40 \Delta DJ_2 R^2 = 89% \\
(t) (5.2) (1.6) (5.5) (-0.1) (-3.5) (2.0) DW = 1.5
\]

\[
\Delta C_0 = .59 \Delta(Y-T_0)_0 + .11 \Delta AV(Y-T_0)_{1,2,3,4} + .55 \Delta T_{G(0)} - .02 \Delta G_0 -7.27 \Delta PR_0 + .33 \Delta DJ_2 R^2 = 88% \\
(t) (15.1) (1.8) (5.4) (-0.1) (-3.2) (1.5) DW = 1.6
\]

\[
\Delta C_0 = .60 \Delta(Y-T_0)_0 + .12 \Delta AV(Y-T_0)_{1,2} + .54 \Delta T_{G(0)} - .09 \Delta G_0 -7.72 \Delta PR_0 + .37 \Delta DJ_2 R^2 = 89% \\
(t) (14.4) (1.6) (5.3) (-0.4) (-3.7) (1.8) DW = 1.5
\]

\[
\Delta C_0 = .60 \Delta(Y-T_0)_0 + .10 \Delta(Y-T_0)_1 + .51 \Delta T_{G(0)} - .03 \Delta G_0 -7.90 \Delta PR_0 + .40 \Delta DJ_2 R^2 = 89% \\
(t) (15.5) (1.6) (5.5) (-0.1) (-3.5) (2.0) DW = 1.5
\]

This dual hypothesis formulation of how income affects consumption adds from 0% to 1% more to explained variance than the current income variable alone. However, the added average income variable is only significant at the 10% (t=1.8) or 11% (t=1.6) level. For many, this would not constitute sufficient evidence that any significant portion of the population is of the (adaptive expectations version) Friedman Modigliani type.

Multicollinearity of the average income variable with the current year income variable could be, but does not seem to be, the reason for the low t-statistic in the six equations. For example, in the 6th equation below, where the average income variable is comprised of current and immediate past year income levels, the correlation between this variable and the Keynesian current income variable is only .17. By comparison, in the equation using current income and a three year average income (current and past two years), the correlation is far greater: .66. However, in both cases the average income variables’ t-statistic is the same (t =1.6).

if you drop the Keynesian current disposable income variable from the joint hypothesis, leaving only the Friedman/Modigliani hypothesis, R^2 falls substantially, from 88-89% to at least 80% and usually much less. The relatively high 80% is only for the two-period average ΔAV(Y-T_0)_{0,1} which includes current income, the one closest to the Keynesian formulation ΔAV(Y-T_0). Without the Keynesian current income variable as part of the average, other past income averages explain even less variance, usually much less.
However, if we drop the Friedman/Modigliani average income variable (at least in its adaptive expectations form), explained variance drops a maximum of one percent. Hence, it would seem that most consumers are Keynesian, with current year income driving the consumption behavior data. At best a small fraction may exhibit Life Cycle/Permanent Income Hypothesis behavior (at least of the adaptive expectations type).

**Note:** In the six equations above, software limitations only allowed 2SLS estimates of $\Delta(Y-T_0)_{t-1}$, but not the income averages containing the current year’s income. However, in previous tests comparing 1SLS and 2SLS results, when only an average income variable was used, we did not find any change in regression results when a income average containing current income was a one stage vs. a two stage estimated variable.

**Rational Expectations Hypotheses:**

Our definition of rational expectations is that people view their permanent or life cycle income as average incomes received in the past and/or reasonably expected to be received in the future, based on the best available information. Below we present results for several possible definitions of the rational expectations income “average” that might determine current year consumption. The Keynesian “current income” result is also restated immediately below for ease of comparison.

\[
\Delta C_t = .66 \Delta(Y-T_0)_{t-1} + .52 \Delta T_{G(0)}, + .10 \Delta G_0, - 7.23 \Delta PR_0, + .42 \Delta DJ_2 \quad R^2 = 88\%
\]

\[
(26.6) (5.2) (0.5) (-3.0) (2.2) \quad D.W. = 1.8
\]

\[
\Delta C_t = .51 \Delta(Y-T_0)_{t-1} + .55 \Delta T_{G(0)}, + .45 \Delta G_0, + .39 \Delta PR_0 + .62 \Delta DJ_2 \quad R^2 = 50\%
\]

\[
(6.6) (3.2) (1.4) (0.1) (1.7) \quad D.W. = 2.6
\]

\[
\Delta C_t = .53 \Delta(Y-T_0)_{t-2} + .73 \Delta T_{G(0)}, - .33 \Delta G_0, - 1.94 \Delta PR_0 - .09 \Delta DJ_2 \quad R^2 = 26\%
\]

\[
(7.6) (4.2) (0.9) (-0.4) (-0.2) \quad D.W. = 1.8
\]

\[
\Delta C_t = .67 \Delta AV(Y-T_0)_{0,1} + .54 \Delta T_{G(0)}, + .08 \Delta G_0, - 2.83 \Delta PR_0 - .29 \Delta DJ_2 \quad R^2 = 82\%
\]

\[
(18.3) (6.0) (0.4) (-1.0) (1.4) \quad D.W. = 2.4
\]

\[
\Delta C_t = .71 \Delta AV(Y-T_0)_{1,0,1} + .49 \Delta T_{G(0)}, - .08 \Delta G_0 - 5.45 \Delta PR_0 + .38 \Delta DJ_2 \quad R^2 = 77\%
\]

\[
(18.4) (4.6) (-0.5) (-1.6) (1.8) \quad D.W. = 2.6
\]

\[
\Delta C_t = .70 \Delta AV(Y-T_0)_{0,1,2} + .63 \Delta T_{G(0)}, - .02 \Delta G_0, - 2.20 \Delta PR_0 - .20 \Delta DJ_2 \quad R^2 = 75\%
\]

\[
(20.6) (7.6) (-0.1) (-0.9) (-0.9) \quad D.W. = 2.2
\]

\[
\Delta C_t = .70 \Delta AV(Y-T_0)_{0,1,2,3} + .61 \Delta T_{G(0)}, - .05 \Delta G_0 - 1.69 \Delta PR_0 - .43 \Delta DJ_2 \quad R^2 = 60\%
\]

\[
(14.3) (5.5) (-0.2) (-0.5) (-1.0) \quad D.W. = 2.0
\]

\[
\Delta C_t = .69 \Delta AV(Y-T_0)_{0,1,2,3,4} + .68 \Delta T_{G(0)}, - .14 \Delta G_0, - 4.48 \Delta PR_0 + .19 \Delta DJ_2 \quad R^2 = 54\%
\]

\[
(12.0) (4.4) (-0.5) (-1.1) (-0.4) \quad D.W. = 1.8
\]

\[
\Delta C_t = .76 \Delta AV(Y-T_0)_{1,2,2,1} + .62 \Delta T_{G(0)}, - .33 \Delta G_0 - 4.91 \Delta PR_0, - .10 \Delta DJ_2 \quad R^2 = 69\%
\]

\[
(19.8) (4.9) (-1.6) (-1.2) (-0.4) \quad D.W. = 2.1
\]

\[
\Delta C_t = .74 \Delta AV(Y-T_0)_{1,2,3,4} + .61 \Delta T_{G(0)}, - .23 \Delta G_0 - 3.86 \Delta PR_0 - .31 \Delta DJ_2 \quad R^2 = 48\%
\]

\[
(12.7) (4.1) (-0.8) (-0.8) (0.7) \quad D.W. = 2.0
\]

\[
\Delta C_t = .73 \Delta AV(Y-T_0)_{1,2,3,4} + .67 \Delta T_{G(0)}, - .19 \Delta G_0 - 4.89 \Delta PR_0, - .21 \Delta DJ_2 \quad R^2 = 42\%
\]

\[
(10.4) (3.7) (-0.6) (-1.0) (-0.4) \quad D.W. = 1.8
\]
Here, the results are generally worse than the findings for the earlier-tested adaptive expectations models which used only an average income variable. For any number of forward lags here, (e.g., 0,+1,+2,+3) the rational expectations equation has a lower level of explained variance than the previously tested adaptive expectations model with the same lags, but backward rather than forward, e.g., (e.g., 0,-1,-2,-3). In this case, the difference is 60% vs. 67%

What is most similar about these equations and the earlier adaptive expectations equations is that, generally, those without current income in the average explain less variance in consumption than those with current income in the average.

Hence, a rational expectations version of average income, when used as the only income variable in the consumption function, does not do well. However, it is possible that some parts of the population behave this way, while the rest - a larger group - behave in more Keynesian fashion. If so, we should test both income variables separately in our consumption function and they should explain different portions of the variance in consumption spending. In the equations below, we test the dual hypothesis that a portion of the population responds to income changes in a Keynesian fashion, the rest respond according to the various rational expectations formulations shown above. Again, we also include the simple Keynesian equation to facilitate comparison.

$$\Delta C_0 = .66 \Delta (Y-T)_{(t)}(\text{Keynes Model})$$

$$(t) \quad (26.6)$$

$$\Delta C_0 = .5 \Delta (Y-T)_{(t)} + .13 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (11.1) \quad (2.3)$$

$$\Delta C_0 = .42 \Delta (Y-T)_{(t)} + .27 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (4.0) \quad (2.3)$$

$$\Delta C_0 = .47 \Delta (Y-T)_{(t)} + .24 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (6.1) \quad (2.7)$$

$$\Delta C_0 = .53 \Delta (Y-T)_{(t)} + .20 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (9.7) \quad (2.5)$$

$$\Delta C_0 = .53 \Delta (Y-T)_{(t)} + .17 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (11.4) \quad (2.4)$$

$$\Delta C_0 = .55 \Delta (Y-T)_{(t)} + .16 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (11.4) \quad (2.7)$$

$$\Delta C_0 = .58 \Delta (Y-T)_{(t)} + .15 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (15.8) \quad (2.5)$$

$$\Delta C_0 = .58 \Delta (Y-T)_{(t)} + .14 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (16.4) \quad (2.4)$$

$$\Delta C_0 = .47 \Delta (Y-T)_{(t)} + .24 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (6.5) \quad (2.7)$$

$$\Delta C_0 = .55 \Delta (Y-T)_{(t)} + .19 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (13.2) \quad (3.1)$$

$$\Delta C_0 = .49 \Delta (Y-T)_{(t)} + .24 \Delta AV(Y-T)_{(t)-1,1}$$

$$(t) \quad (8.9) \quad (3.1)$$
\[ \Delta C_0 = .56\Delta(Y-T_G)_t + 1.8 \Delta AV(Y-T_G)_t + 1,2,3,0, +1,2+3 + 53 \Delta T_{G(0)} + .054 \Delta G_0 - 6.07 \Delta PR_0 - .40 \Delta DJ_t \]

\[
(t) \quad (13.4) \quad (2.5) \quad (7.6) \quad (-0.3) \quad (-3.5) \quad (-1.5) \\
R^2 = 87\% \quad D.W. = 1.8
\]

\[ \Delta C_0 = .57\Delta(Y-T_G)_t + 1.6 \Delta AV(Y-T_G)_t + 1,2,3,4,0, +1,2+3, +4 + 56 \Delta T_{G(0)} + .04 \Delta G_0 - 6.81 \Delta PR_0 - .24 \Delta DJ_t \]

\[
(t) \quad (14.5) \quad (2.3) \quad (6.7) \quad (-0.2) \quad (-3.5) \quad (-0.8) \\
R^2 = 86\% \quad D.W. = 1.8
\]

The results clearly indicate that rational expectations models of Modigliani/Friedman average income variables are more systematically correlated with movements in consumption than are adaptive expectations models. All have t-statistics between 2.3 and 3.1, indicating significance at least at the 3% level to well above the 1% level. The t-statistics on the average income variable are the generally the strongest for averages that include one or two years of both future (a proxy for estimated future earnings) and past earnings, and also contain the current year’s income in the average.

Nonetheless, though statistically significant, adding the rational expectations averages only slightly improve on the results from using adaptive expectations averages. There, we saw 0-1% increases in explained variance adding the averages to the Keynesian model, from 88% to 89%. Here we see at best a 1-2% point increase in explained variance from 88% to 90%. This suggests that at best, only a small number of Americans relative to the total population involve themselves in more complex weighing of past and future income potential when deciding what level of consumption is appropriate their income level.

**Note:** In the last equation of the series immediately above, the correlation between the two income variables is .17. This would not suggest multicollinearity is responsible for the relatively low t-statistic on some of the average income variables is the last series of results. Other averages have higher correlations between the income variables, and have even higher t-statistics. For the current income variable and the average of the 5 periods from two forward to two past, the correlation coefficient is .54, but the t-statistic is 3.1. This again suggests the results may not be heavily distorted because of multicollinearity.

**Bibliography**


Friedman, M. *A Theory of the Consumption Function.* Princeton University Press. 1957


