New Estimates of the Fraction of People Who Consume Current Income

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Abstract: Using data from 1953-1986, Campbell and Mankiw (1989) estimate the fraction of consumers who consume their current income. They estimate their model on data through 1986. We find that after 1986 the estimate of the fraction of consumers who spend all of their current income drops by 51% when compared to the estimate from the earlier time period. These results suggest that after 1986 temporary tax cuts will be comparatively less successful and permanent tax cuts will be comparatively more successful.

I. Introduction

Campbell and Mankiw (1989) divided consumers into two groups, one follows consumption smoothing and the other follows the rule of thumb that consumers spend based on current income. Using data from 1953-1986, they estimate the fraction of people who consume current income. This paper estimates the model with data from 1953-2009. When the model is applied to data from 1987 to 2009, we find a 51% drop in the estimated coefficient that represents the percentage of consumers that consume their current income.

II. Methodology

Typically a representative consumer is used to explain aggregate consumption decisions. Campbell and Mankiw argue that aggregate consumption can be better explained with two types of consumers. One type of consumer consumes all of their current income. The other type spends according to the permanent income hypothesis (Friedman, 1957). This hypothesis states that a consumer will spend based on their long-term income expectations which arise from the consumer's physical and human capital. Consumers will smooth their consumption

over their lifetime. Under the permanent income hypothesis, short term income changes will not impact consumption.

In the Campbell and Mankiw model a fraction of income (λ) is allocated to individuals who consume their current income, while the remainder (1- λ) is allocated to individuals who consume their permanent income.

Incomes of the two groups are denoted Y_{1t} and Y_{2t}. It then follows that the total income is:

$$Y_t = Y_{1t} + Y_{2t}.$$

Because the first group receives λ of total income and the second group receives (1- λ) of income, this implies that:

$$Y_{1t} = \lambda Y_t$$
$$Y_{2t} = (1 - \lambda)\, Y_t.$$

The first group consumes their current income while the second group obeys the permanent income hypothesis.

$$\Delta C_{1t} = \lambda \Delta Y_t$$
$$\Delta C_{2t} = (1 - \lambda)\varepsilon_t$$

Using these facts, the change in aggregate consumption can be written as

$$\Delta C_t = \Delta C_{1t} + \Delta C_{2t}$$

This can be rewritten as

$$\Delta C_t = \lambda \Delta Y_t + (1 - \lambda)\varepsilon_t.$$

In this model the change in consumption is a weighted average of the change in current income and the unforecastable innovation in permanent income.

A λ value close to zero would imply that the permanent income theory is approximately true. The model will reduce to the permanent income hypothesis when λ = 0. If λ is found to be large, this would imply the permanent income hypothesis is not true.

The model is estimated by an instrumental variable approach. The model cannot be directly estimated using ordinary least squares since the error term ε_t may be correlated with ΔY_t. Instruments are used to find estimated values in the equation

$$\Delta c_y = \mu + \Delta y_t$$

The main instruments chosen for computation are:

$$\Delta y_{t-2}, \dots, \Delta y_{t-4}$$
$$\Delta c_{t-2}, \dots, \Delta c_{t-4}$$
$$\Delta i_{t-2}, \dots, \Delta i_{t-4}$$
$$c_{t-2} - y_{t-2}$$

In this paper, we use sample ranges from the first quarter of 1953 to the last quarter of 2009. In the model y_t is disposable personal income per capita in 1996 dollars. Consumption (c_t) is the measure of non-durables and services consumed per capita, in 1996 dollars. A quarterly average of three-month nominal Treasury bill rates (i_t) was also an instrument. The data for all three instruments was obtained from St. Louis Federal Reserve. Campbell and Mankiw's data was obtained from Data Resources, Inc. and is not publically available. Our data is publically available on the St. Louis Federal Reserve's web site.

Following Campbell and Mankiw's specification, we take the natural logs of all variables. This was done because the relationship between consumption and income seem to be log-linear. Another correction is needed to deal with serial correlation. This correction is

accomplished by starting with at least a lag of two periods in the model. The authors argue that if the permanent income hypothesis were to hold true, then consumption would be a random walk.

III. Results

The model was estimated in a two stage regression. The first stage regression produces results similar to Campbell and Mankiw's results when the model is run on the same sample period. In the first stage regression, Δc_t was regressed against the instrumental variables which are indicated in the first column of Table 1.

$$\widehat{\Delta c_t} = \alpha_0 + \alpha_1 \Delta y_{t-2} + \alpha_2 \Delta y_{t-3} + \alpha_3 \Delta y_{t-4} + \alpha_4 \Delta c_{t-2} + \alpha_5 \Delta c_{t-3} + \alpha_6 \Delta c_{t-4} + \alpha_7 \Delta i_{t-2} + \alpha_8 \Delta i_{t-3} + \alpha_9 \Delta i_{t-4} + \alpha_{10}(c_{t-2} - y_{t-2})$$

The results of this regression can be seen in column 2 and 4 in Table 1. This was done for each of the two different time periods.

The adjusted R square value for the 1953-1986 Δc_t regression in Mankiw's Table 1 is 0.078, while the value obtained from our estimation is 0.089. The difference is likely due to the different sources of data. When expanded to the 1987-2009 time frame, the adjusted R square value for Δc_t was found to be 0.243.

The process was repeated for Δy_t for which the results can be observed in columns 3 and 5 in Table 1.

$$\widehat{\Delta y_t} = \beta_0 + \beta_1 \Delta y_{t-2} + \beta_2 \Delta y_{t-3} + \beta_3 \Delta y_{t-4} + \beta_4 \Delta c_{t-2} + \beta_5 \Delta c_{t-3} + \beta_6 \Delta c_{t-4} + \beta_7 \Delta i_{t-2} + \beta_8 \Delta i_{t-3} + \beta_9 \Delta i_{t-4} + \beta_{10}(c_{t-2} - y_{t-2})$$

The adjusted R square value for the Δy_t regression from Campbell and Mankiw's Table 1 is 0.093, while the value in our Table 1 is 0.135. When the model was applied to the 1987-2009 time frame, the adjusted R square value for the Δy_t regression was found to be 0.214.

Next the predicted values obtained in the first regression were used for the second stage regression. In the second state regression, the predicted values found for Δc_t and Δy_t were used to estimate the equation

$$\widehat{\Delta c_y} = \mu + \lambda \widehat{\Delta y_t}.$$

This was repeated for each of the two time periods. The results of this regression can be found in Table 2. Our λ estimate in the early time period is 0.382. In the 1987-2009 period, the λ estimate is 0.186.

One interesting result of the regressions is that interest rate appears to have a more significant affect on consumption for the 1953-1986 estimate than in the 1987-2009 estimate. The t statistics for i_{t-2} and i_{t-4} in the 1953-1986 regression were -2.38 and -2.76 which are both significant at the 0.01 level. In the 1987-2009 regression, i_{t-2} and i_{t-4} were not significant at conventional levels.

A major difference in the model over different time periods is the estimate of λ. This λ represents the fraction of people consuming their current income. In the model for 1953-1986, the estimate for $\lambda = 0.382$, while the estimate for the time frame 1987-2009 is $\lambda = 0.186$. This represents a 51% drop in the fraction of people consuming their current income.

Table 1: First Stage Regression

1	2	3		4	5
	1953-1986			1987-2009	
Dependent variable =	Δc_t	Δy_t		Δc_t	Δy_t
Name					
Constant	0.010	0.011		0.009	0.018
	(2.99)	(1.86)		(1.70)	(1.45)
Δy_{t-2}	0.012	-0.011		0.045	0.296
	(0.22)	(-0.11)		(0.82)	(2.41)
Δy_{t-3}	0.044	0.053		0.034	-0.212
	(0.77)	(0.51)		(0.60)	(-1.64)
Δy_{t-4}	0.034	-0.145		-0.024	-0.187
	(0.60)	(-1.43)		(-0.43)	(-1.51)
Δc_{t-2}	0.129	0.003		0.158	-0.278
	(1.20)	(0.01)		(1.26)	(-0.98)
Δc_{t-3}	0.118	0.352		0.371	1.115
	(1.08)	(1.79)		(2.70)	(3.59)
Δc_{t-4}	-0.004	0.454		-0.013	-0.652
	(-0.04)	(2.37)		(-0.10)	(-2.21)
Δi_{t-2}	-0.008	-0.011		.001	-0.009
	(-2.38)	(-2.01)		(0.56)	(-1.86)
Δi_{t-3}	-0.001	0.0005		0.0005	0.014
	(-0.42)	(-0.08)		(0.22)	(0.89)
Δi_{t-4}	-0.008	-0.016		-0.002	0.0002
	(-2.76)	(-2.89)		(-0.84)	(-0.047)
$c_{t-2} - y_{t-2}$	0.025	0.049		0.036	0.064
	(1.36)	(1.51)		(1.25)	(0.97)
t-statistics in parenthesis					
Adjusted R Square	0.089	0.135		0.243	0.214
F-Statistic	2.319	3.101		3.922	3.477

Table 2: Second Stage Regression

$$\widehat{\Delta c_t} = \lambda \widehat{\Delta y_t} + \mu$$

	1	**2**	**3**
		1953-1986	1987-2009
Name			
Constant		0.005	0.005
		(22.35)	(14.50)
$\widehat{\Delta y_t}$		0.382	0.186
		(15.98)	(4.28)
Adjusted R Square		0.653	0.160
F-Statistic		255.22	18.303

Note: t-statistics in parenthesis

Table 3: Summary Statistics

	1953-1986					**1987-2009**				
	N	**Min.**	**Max.**	**Mean**	**Std. Dev.**	**N**	**Min.**	**Max.**	**Mean**	**Std. Dev.**
Δy_t	136	-.0155	.0457	.0092	.0091	92	-.0222	.0266	.0068	.0085
Δc_t	136	-.0087	.0233	.0089	.0050	92	-.0061	.0142	.0066	.0038
$\widehat{\Delta y_t}$	136	0.0	0.0	.0100	.0040	92	-.0104	.0152	.0068	.0046
$\widehat{\Delta c_t}$	136	.0040	.014	.0080	.0019	92	-.0030	.0107	.0066	.0021

A Chow test was performed on the model expanded over the entire range 1953-2009. The test determined that a structural break exists in the model around the year 1986. This break suggests that the estimated coefficients are not the same in the whole dataset. The model was then broken into two samples at the year 1986.

The evidence suggests the fraction of people making decisions as if they were following the permanent income hypothesis is greater after 1986. This means in the second time frame people are more willing to consume based on their long term income expectations and not on their current income.

Table 3 shows the summary statistics for $\Delta y_t, \Delta c_t, \Delta \hat{y}_t,$ and $\Delta \hat{c}_t$. It should be noted that the means of the variables in the first time periods are close to 30% higher than those in the second time period. The standard deviations are very similar in both time periods although the standard deviation for consumption is higher in the first time period.

One possible reason for the significant change in consumption behavior may be explained by a change in demographics.   Dynan, Edelberg, & Palumbo (2009) claim that demographics may in part explain why, over the past two decades, there has been a smaller response in aggregate consumption to changes in income.

Another possible reason for the difference may be a difference in uncertainty. The first regression covered a period with much higher uncertainty and risk as illustrated by a higher volatility in inflation and GDP. Indeed, the later period has been widely referred to as the "Great Moderation."

IV. Implications

The results in this paper have significant policy implications. When deciding between a tax rebate and a permanent tax cut to stimulate the economy, it would be important to choose the option that would increase consumption the most.

A temporary tax rebate will have a smaller effect after 1986 when consumers are more willing to consume based on their long term income expectations. This implies that a tax rebate would have little immediate influence on consumption because it would be factored into a consumer's long term income expectations. A permanent tax cut would have a larger affect on consumption after 1986. Consumers after 1986 are more likely to make decisions based on long term income.

In our estimates, we found that after 1986 approximately 18.6% of people will consume based on their current income. This finding is largely consistent with Shapiro and Slemrod (2003) when they find that 21.8 percent of people received a tax rebate in 2001 would increase their spending. Later work by Shapiro and Slemrod (2009) found that one-fifth of those polled said that the 2008 tax rebates would cause them to increase consumption.

The finding that a permanent tax change will have a larger affect than a tax rebate is supported by the literature. Blinder (1981) found that a tax rebate will have only 38% of the impact of a permanent tax cut. Souleles (2002) also suggests that a consumer is more likely to increase consumption when income increases are small and spread out over time in contrast to one large lump sum.

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