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Should We Test the Life Cycle-Permanent Income Hypothesis with Food Consumption Data?

WP 9303

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SOCIAL SYSTEMS RESEARCH INSTITUTE

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by John Shea

January 1993

Comments Welcome

Department of Economics, University of Wisconsin, Madison. Support from the Graduate School at the University of Wisconsin and the National Science Foundation is acknowledged.

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ABSTRACT

Most studies of household intertemporal consumption behavior use food consumption data from the Panel Study of Income Dynamics (PSID). A natural question is whether the intertemporal behavior of food consumption is typical of overall consumption. I address this question by examining the time-series behavior of food and other consumption series at the aggregate level. Unfortunately, I find that food is not typical: the life cycle-permanent income hypothesis can be easily rejected for most aggregate consumption series, but not for food. This suggests that tests of the LCH/PIH using PSID data are likely to have low power.

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I. INTRODUCTION

The Life Cycle-Permanent Income Hypothesis (LCH/PIH) is the centerpiece of neoclassical consumption theory. In its purest form, the LCH/PIH assumes that individuals are forward looking, that credit markets are perfect, and that preferences are convex. The most striking implication of the LCH/PIH is that (to a first approximation) predictable income movements should not cause consumption to change, because current consumption should reflect all available information about lifetime income opportunities.

Recent time-series studies of U.S. aggregate consumption behavior (e.g. Campbell and Mankiw (1989, 1990); Beaudry and Van Wincoop (1992)) consistently reject the LCH/PIH. Campbell and Mankiw (1990), for instance, find that the elasticity of aggregate consumption with respect to predictable income movements is between 0.351 and 0.713, depending on how predictable income is measured. Recent studies of household consumption, on the other hand, offer mixed results. Runkle (1991) and Altonji and Siow (1987) find that household behavior is largely consistent with the LCH/PIH, while Zeldes (1989) and Shea (1992) reject the LCH/PIH in household data.

A potential explanation for this inconsistency is the nature of available household consumption data. Most micro studies of the LCH/PIH use data from the Panel Study of Income Dynamics (PSID).[1] The PSID has gathered detailed annual demographic and labor market information for a group of about 5000 households and their splitoffs since 1968. Unfortunately, tracking consumption behavior is not a primary concern of the PSID, and the only consumption data available in the PSID is food consumption, which includes the value of food stamps received, the amount spent on food consumed at home, and (in recent years) the amount spent on food in restaurants.

If the household's period utility function is separable in food and other goods, food should obey an Euler equation identical to the equation governing total consumption in a model with a single good. In principle, then, one can make valid inferences about the LCH/PIH using PSID data despite its incomplete coverage. In practice, many economists are skeptical about using food consumption data to test the LCH/PIH (see Carroll (1992), for instance). At an introspective level, eating habits may respond more slowly to income than spending habits for (say) clothes or entertainment, implying that the short run response of food to income movements (whether predictable or not) may be small. Even in the long run, Engel's Law suggests that food consumption will respond only mildly to income. These considerations suggest that the dynamic behavior of food consumption may not be typical of consumption as a whole.

This note assesses the wisdom of using the PSID to test the LCH/PIH by examining the behavior of food consumption in *aggregate* time-series data. Using Campbell and Mankiw's (1990) methodology (hereafter Campbell-Mankiw), I examine whether predictable income movements cause changes in total nondurables and services consumption, in food consumption, and in other disgaggregated consumption series, using quarterly US data from 1956-1988. I find, unfortunately, that food consumption behaves quite atypically. While the LCH/PIH is almost always rejected for total consumption and is often rejected for components such as gasoline and clothing, I am unable to reject the LCH/PIH with food consumption in any specification. Moreover, the estimated elasticity of consumption with respect to predictable income movements is much smaller for food than for most other consumption series. These results suggest that tests of the LCH/PIH using PSID data will tend to have low power.

II. SPECIFICATION, DATA AND RESULTS

Following Campbell-Mankiw and others, I base my tests of the LCH/PIH on the following equation:

$$\Delta c_t = \mu + \lambda \Delta y_t + \theta r_t + \varepsilon_t \qquad (1)$$

where Δc is the percentage change in consumption, Δy is the percentage change in income, r is the real interest rate, and ε is an error term. Under the LCH/PIH, predictable income movements should not affect consumption once one has controlled for the expected real interest rate. Econometrically, this means that λ should equal zero when (1) is estimated with IV, provided that the instruments used for Δy_t are part of the information set at t-1. Of course, estimates of λ will only be reliable if the selected instruments have predictive power for income growth (Nelson and Startz (1990)). I experiment with 10 sets of instruments, listed in Table 1. These sets are similar to instruments used in Campbell-Mankiw and include lags of consumption growth, income growth, and interest rates.[2]

Campbell-Mankiw estimate (1) using quarterly per-capita real NIPA Personal Consumption Expenditure (PCE) on nondurables and services. I do the same for purposes of comparison, but also estimate (1) with quarterly per-capita real PCE on food, clothing and shoes, gasoline and oil, housing services, household operation, and transportation; the first three series are components of nondurables consumption, while the last three are components of services. All consumption series are taken from the 1988 edition of the Commerce Department's Business Statistics. My income measure is per-capita real disposable personal income. Consumption and income measures are seasonally adjusted. The nominal interest rate i_t (one of the instruments listed in Table 1) is the quarterly average secondary market three-month Treasury bill yield. The real rate r_t equals the nominal rate for quarter t-1 minus the percentage change in the PCE deflator from quarter t-1 to quarter t. Because this ex-post real rate is not part of the information set at t-1, I treat r_t as endogenous and include lagged real rates in the instrument sets. My sample period is 1956:4 through 1988:4.

Results are shown in Table 2. Column (1) shows the corrected R^2 from the first-stage regression of income growth on the instrument lists shown in Table 1. As in Campbell-Mankiw, lagged consumption growth and lagged nominal interest rate changes appear to be better predictors of income growth than lagged income growth itself.[3] Following Nelson and Startz (1990), parameters estimated with low-relevance instruments are likely to be imprecise (at best) or spurious (at worst); this suggests that the estimates reported in rows 1 and 7 should be taken with a grain of salt.

Columns (2) through (10) report OLS and 10 sets of IV estimates of λ using different measures of consumption. Standard errors and t-statistics (the latter in parentheses) are not corrected for heteroscedasticity or serial correlation; Campbell-Mankiw report that such correction has almost no effect on their standard error estimates. To save space, I do not report estimates of the constant or of θ, the latter of which are either of the wrong sign or insignificant in almost all cases.[4]

The results are striking. As in Campbell-Mankiw, the LCH/PIH is easily rejected when using total nondurables and services consumption. The estimated elasticity of consumption with respect to predictable disposable income is between 0.4 and 0.7; this range is similar to that found by Campbell-Mankiw, who use a slightly different sample period. However, the LCH/PIH cannot be rejected at conventional significance levels for food consumption, regardless of the instrument list used (column (5)). Furthermore, the estimated elasticity of food consumption with respect to predictable income is usually below the elasticities estimated for other consumption series. These results cannot be attributed to the fact that food is a nondurable rather than a service; as columns (3) and (4) show, the LCH/PIH is rejected more strongly for nondurables than for services. Furthermore, the results cannot be explained by arguing that disaggregated consumption series contain more measurement error than aggregate consumption, since the LCH/PIH can be rejected frequently for other disaggregated series such as clothing, gasoline, household operation and transportation.

III. CONCLUSION

Most existing micro tests of the LCH/PIH rely on PSID food consumption data. This study shows that standard time series tests cannot reject the LCH/PIH using aggregate food consumption data, but can reject using other measures of aggregate consumption, including overall nondurables and services consumption. This result suggests that tests of the LCH/PIH using PSID data are likely to have low power, and that failures to reject the LCH/PIH in the PSID (e.g. Altonji and Siow (1987); Runkle (1991)) should not necessarily be regarded as victories for neoclassical consumption theory.

Why does aggregate food consumption behave differently than overall consumption? One possibility is that the LCH/PIH is genuinely true for food consumption, but not for other forms of consumption. It is possible, for instance, that food spending can be changed more quickly than other forms of spending, since households shop for groceries every week but may shop for other nondurables and services infrequently. On the other hand, the LCH/PIH is usually rejected for gasoline (column (7) of Table 2), which is also presumably bought frequently. Another possibility is that the LCH/PIH is false for food but that the tests in Table 2 have low power for food, perhaps because the short-run Engel curve is relatively flat.[5] This explanation is consistent with the following facts: (1) the point estimates of λ for food are always positive and stay within a narrow range; (2) the significance levels for food's λ are frequently in the 80-90 percent range when instruments with strong predictive power for income growth are used; in fact, the LCH/PIH would be rejected at 10 percent for instrument lists 4 and 8 if a one-tailed test was used for λ.

How should future empirical work on household consumption proceed? One possibility is to use micro data sets with more comprehensive consumption measures than the PSID, such as the Consumer Expenditure Survey.[6] Unfortunately, these alternative data sets are either cross-sectional or have only a limited panel aspect; the PSID is the only source offering several years of consumption data for each household. Another possibility is to use the PSID but to take special care to find instruments with substantial predictive power for household income growth. Shea (1992), for instance, is able to reject the LCH/PIH by matching a subset of PSID households to particular long-term union contracts, and using published information on these contracts to construct a measure of predictable wage growth. Unfortunately, this procedure is time consuming and yields a relatively small sample. Furthermore, incomplete coverage is only one problem plaguing PSID consumption data; measurement error is perhaps an even more serious issue. As remarked earlier, the PSID does not place a high priority on gathering consumption data. Households are asked only three questions about food purchases (in a section designed primarily to gather information about food stamp program participation), and are not asked to keep logs of grocery or restaurant purchases. As a result, a large fraction of the variance of consumption growth in the PSID appears to be attributable to noise (Shapiro (1982)).

What this discussion suggests is that, unfortunately, the economics profession does not currently have adequate data to study the intertemporal consumption behavior of households. Yet studying behavior at the micro level is crucially important, for two reasons: (1) it is possible for the LCH/PIH to be true at the individual level yet fail in the aggregate (e.g. Gali (1990)), suggesting that aggregate data alone may not provide definitive tests of neoclassical consumption theory; and (2) tests of particular alternatives to the LCH/PIH seem easier to carry out with micro than with macro data, since micro data allow the researcher to exploit cross-section variation in the constraints faced by households (for instance, Zeldes (1989) uses variation in household wealth to test for liquidity constraints). What the profession really needs is a new panel data set which asks households to keep detailed logs of spending behavior in the same way that the Nielsen survey asks households to keep detailed logs of television watching. It's high time to start a "Panel Study of Consumption Dynamics."

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FOOTNOTES

[1]Besides those mentioned above, other papers using the PSID to test the LCH/PIH include Hall and Mishkin (1982) and Shapiro (1982).

[2]Note that all instruments listed in Table 1 are dated t-2 or earlier. I eschew instruments dated t-1 to avoid misspecification due to time-averaging or to information-aggregation bias, and to reduce the potential for misspecification due to the presence of a durable component in the consumption data. See Campbell and Mankiw (1990) for further discussion.

[3]While I use several different measures of consumption as the dependent variable in (1), the consumption measure used in the instrument list is always total consumption of nondurables and services. This is appropriate given that the sole purpose of choosing instruments is to find lagged variables with predictive power for income growth. I did experiment with using lagged food consumption as the consumption instrument when food consumption was the dependent variable; this had no qualitative impact on the results.

[4]Results are qualitatively similar if the real interest rate is omitted from (1) and from the instrument lists; estimates of λ are generally somewhat more precise when the interest rate is included.

[5]Notice, however, that the short-run Engel curve is not completely flat in my sample. The OLS point estimate of λ for food consumption

(reported in the bottom row of Table 2) is 0.226 and is statistically significant (although less significant for food than for most of the other consumption measures included in Table 2).

[6]For example, Carroll (1992) uses data from the Consumer Expenditure Survey, while Flavin (1992) uses data from the Michigan Survey of Consumer Finances.

TABLE 1

Instrument Lists Used in Empirical Work

LIST 1: $\Delta y_{t-2},\ldots,\Delta y_{t-4}$; $r_{t-2},\ldots,r_{t-4}$

LIST 2: $\Delta y_{t-2},\ldots,\Delta y_{t-6}$; $r_{t-2},\ldots,r_{t-6}$

LIST 3: $\Delta c_{t-2},\ldots,\Delta c_{t-4}$; $r_{t-2},\ldots,r_{t-4}$

LIST 4: $\Delta c_{t-2},\ldots,\Delta c_{t-6}$; $r_{t-2},\ldots,r_{t-6}$

LIST 5: $\Delta y_{t-2},\ldots,\Delta y_{t-4}$; $\Delta c_{t-2},\ldots,\Delta c_{t-4}$; s_{t-2}; $r_{t-2},\ldots,r_{t-4}$

LIST 6: $\Delta y_{t-2},\ldots,\Delta y_{t-6}$; $\Delta c_{t-2},\ldots,\Delta c_{t-6}$; s_{t-2}; $r_{t-2},\ldots,r_{t-6}$

LIST 7: $\Delta i_{t-2},\ldots,\Delta i_{t-4}$; $r_{t-2},\ldots,r_{t-4}$

LIST 8: $\Delta i_{t-2},\ldots,\Delta i_{t-6}$; $r_{t-2},\ldots,r_{t-6}$

LIST 9: list 5 plus list 7

LIST 10: list 6 plus list 8

NOTES: This table presents 10 sets of instruments used for IV estimation of equation (1). The symbol Δc denotes the growth rate of per-capita real consumption of nondurables and services; Δy denotes the growth rate of per-capita real personal disposable income; s denotes the log of the ratio of consumption to income; Δi denotes the change in the nominal average secondary market three-month Treasury bill yield; r denotes the ex-post real interest rate, defined as the nominal rate minus the percentage change in the NIPA PCE deflator. All regressions include a constant.

TABLE 2

Estimates of λ

$$\Delta c_t = \mu + \lambda \, \Delta y_t + \theta \, r_t + \varepsilon_t$$

Instrument List	First-Stage Corrected R-Squared	Category of Consumption: Total	Nondurables Only	Services Only	Food
	(1)	(2)	(3)	(4)	(5)
1	0.026	0.531 *(2.142)	0.634 (1.816)	0.439 (1.808)	0.383 (0.909)
2	0.082	0.503 *(3.648)	0.709 *(3.410)	0.328 *(2.581)	0.290 (1.221)
3	0.071	0.520 *(3.179)	0.654 *(2.783)	0.403 *(2.571)	0.173 (1.050)
4	0.121	0.535 *(4.320)	0.730 *(3.987)	0.367 *(3.225)	0.282 (1.366)
5	0.079	0.426 *(3.314)	0.564 *(2.951)	0.305 *(2.463)	0.218 (0.931)
6	0.121	0.460 *(4.452)	0.634 *(4.100)	0.313 *(3.202)	0.224 (1.218)
7	0.037	0.685 (1.905)	0.937 (1.792)	0.438 (1.456)	0.389 (0.744)
8	0.100	0.511 *(3.590)	0.768 *(3.483)	0.278 *(2.194)	0.331 (1.355)
9	0.092	0.438 *(3.574)	0.556 *(3.090)	0.328 *(2.756)	0.199 (0.897)
10	0.119	0.445 *(4.561)	0.602 *(4.137)	0.308 *(3.305)	0.218 (1.241)
None (OLS)	---	0.260 *(6.308)	0.348 *(5.589)	0.180 *(4.412)	0.226 *(2.826)

NOTES: This table presents the OLS estimate and 10 sets of IV estimates of the parameter λ in equation (1), for various aggregate consumption series. The instrument lists are presented in Table 1. Regressions also include a constant and the ex-post real interest rate, whose coefficients are omitted to save space. T-statistics are in parentheses and are not corrected for heteroscedasticity or serial correlation. A (*) denotes significance at the 5 percent level. Data are quarterly and the sample period is 1956:4 through 1988:4. See the text for further details on data and specification.

TABLE 2 (Continued)

Estimates of λ

$$\Delta c_t = \mu + \lambda\ \Delta y_t + \theta\ r_t + \varepsilon_t$$

Instrument List	Clothing	Gasoline	Housing Services	Household Operation	Transportation
	----------------Category of Consumption----------------				
	(6)	(7)	(8)	(9)	(10)
1	0.204	1.704	-0.096	0.898	-0.066
	(0.278)	(1.563)	(0.596)	(1.104)	(0.102)
2	1.250	1.000	-0.138	0.769	0.033
	*(2.853)	(1.836)	(1.499)	(1.701)	(0.009)
3	0.499	1.423	-0.043	0.644	1.291
	(1.050)	*(2.083)	(0.408)	(1.251)	*(2.449)
4	1.128	1.082	-0.098	0.614	0.588
	*(3.036)	*(2.257)	(1.217)	(1.606)	(1.828)
5	0.500	1.142	-0.154	0.656	0.960
	(1.243)	*(2.081)	(1.612)	(1.501)	*(2.403)
6	0.955	1.075	-0.160	0.702	0.392
	*(2.970)	*(2.523)	*(2.123)	*(2.031)	(1.403)
7	1.023	3.647	-0.590	0.068	-0.593
	(1.127)	(1.680)	(1.548)	(0.074)	(0.648)
8	1.494	1.216	-0.149	0.477	0.128
	*(3.127)	*(2.110)	(1.527)	(1.079)	(0.347)
9	0.558	1.179	-0.213	0.594	0.789
	(1.471)	*(2.257)	*(2.217)	(1.450)	*(2.185)
10	0.915	1.051	-0.162	0.682	0.353
	*(2.992)	*(2.592)	*(2.266)	*(2.069)	(1.324)
None	0.620	0.404	-0.015	0.169	0.249
(OLS)	*(4.533)	*(2.300)	(0.496)	(1.179)	*(2.061)

NOTES: This table presents the OLS estimate and 10 sets of IV estimates of the parameter λ in equation (1), for various aggregate consumption series. The instrument lists are presented in Table 1. Regressions also include a constant and the ex-post real interest rate, whose coefficients are omitted to save space. T-statistics are in parentheses and are not corrected for heteroscedasticity or serial correlation. A (*) indicates significance at the 5 percent level. Data are quarterly and the sample period is 1956:4 through 1988:4. See the text for further details on data and specification.

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