aggregate consumption and permanent income: An empirical investigation for Turkey

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Abstract

We examine the validity of the permanent income hypothesis (PIH) for Turkey by utilizing a general model that nests the PIH. Using quarterly aggregate private consumption data for 1987-1995, we find evidence against PIH since estimation results suggest that approximately 40% of income goes to individuals who consume their current income in Turkey. Our estimation results are robust to changes in the real interest rate, or nonseparabilities in the consumer's utility function. We also examine sub-categories of aggregate consumption and find that for consumption of food and beverages the fraction is 60%. However, estimations using data on consumption excluding durables as well as food and beverages yield an insignificant fraction providing support for the PIH. We also conduct Monte Carlo experiments to analyze small sample properties of the estimation results.

1. Introduction

The nature of the behavior of consumption is extremely important from the standpoint of economic theory and policy since consumption is a large and important component of aggregate demand. Research on aggregate consumption and its determinants such as disposable income, lagged...
consumption, wealth, interest rates, and stock prices have been scrutinized at great length in the economic literature.

Hall (1978), Flavin (1981), Mankiw (1982), and Hayashi (1982) have attempted to empirically implement the forward-looking permanent-income hypothesis (PIH) with rational expectations. Hall (1978) examined the stochastic implications of the life cycle-permanent income hypothesis and showed that no variable apart from current consumption helps to predict future consumption taking the life cycle-permanent income hypothesis as given. In other words, the theory predicts that consumption should follow a random walk. Flavin (1981) showed that the change in consumption equals the unpredictable change in the annuity value of labor income that is in agreement with Hall's "random walk" hypothesis.

Many studies, however, have attempted to test Hall's consumption theory and could not find evidence in favor of it. Hall's own empirical tests suggested that an index of stock prices was able to improve the forecast of one-quarter-ahead consumption. Flavin (1981), Hayashi (1982), and Blinder and Deaton (1985) concluded that consumption is "excessively sensitive" to disposable income. Using time-series data for the United States, they found statistically significant correlations between the change in consumption and lagged consumption and income. Flavin (1993), and Campbell and Deaton (1989) studied the implications of the theory for the "smoothness" of consumption. Campbell and Deaton (1989) reported that the smoothness of consumption cannot be explained by permanent income theory; i.e., consumption is determined by permanent income and not by current income, and permanent income is smooth relative to current income. They showed that consumption is smooth because it responds with a lag to changes in current income. Mankiw (1982) expanded Hall's framework and also included consumer expenditure on durable goods. Mankiw's model implies that durable good expenditures should obey a mixed autoregressive-moving average process, ARMA (1,1). However, his findings suggest that consumer durable expenditure is in fact an AR (1) process which provides evidence against the PIH.

Campbell and Mankiw (1990) have nested the PIH in a more general model in which some fraction of income $\lambda$ accrues to individuals who consume their current income, while the remainder $(1-\lambda)$ accrues to individuals who consume their permanent income. By using this model, called the "rule-of-thumb" model, they showed that consumption growth is

Under the conditions that utility is a quadratic function of consumption and the discount rate equals the (constant) interest rate, consumption should follow a random walk process.
correlated with contemporaneous expected income growth, contrary to the basic stochastic implication of the PIH that the change in consumption is unforecastable. They also found that \( \lambda \) is approximately 50% for postwar quarterly U.S. data. Wirjanto (1991), using seasonally unadjusted quarterly Canadian data for the period 1953-1986, found that there is moderate evidence against the PIH and the fraction \( \lambda \) is in the range 0.13 to 0.23. Roche (1995), using annual Irish data for the period 1960-1991, found that the fraction \( \lambda \) is about 50%.

For industrialized countries, most research on consumption since Hall’s paper has been based on microeconomic foundations, i.e., the household’s Euler equation determines the projection of consumption on lagged information. For developing countries, however, consumption research has been based on conventional theories. Mrayyan (1991) examined the aggregate consumption pattern in Jordan by estimating four functional forms suggested by four major hypotheses on consumption: Absolute Income, Relative Income, Permanent Income, and the Life Cycle hypotheses. Mrayyan’s main empirical findings are that the long-run marginal propensity to consume (MPC) is 0.62 and the long-run average propensity to consume (APC) is equal to the long-run MPC for Jordan.

Gazioğlu (1983) examined the determinants of aggregate consumption for the Turkish economy using annual data for the post-WWII period. She showed that the level and change in current income are significant in estimating private and total consumption expenditures. Additionally, Gazioğlu (1984) found that the pure permanent income and life cycle hypotheses do not perform satisfactorily on Turkish data. Tansel (1986) used the household expenditure survey for 1978-1979 and conducted an Engel curve analysis. Şenesen and Selim (1995) investigated consumption behavior at different income levels for ten expenditure groups by using Turkish data obtained from the 1987 Income and Expenditure Survey of the State Institute of Statistics (SIS). Although there are considerable differences between the elasticities for the lower and higher income groups for almost all the expenditure groups, there is no good that appears as a luxury good for one income level and a necessity for another or vice versa. Significant differences in elasticities between the two income groups support the existence of two types of consumption behavior.

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2 For testing the pure permanent income and life cycle hypotheses, Gazioğlu estimated the following equations: \( c_t = \beta c_{t-1} + \varphi (1-\beta) y_t + \mu_{t-1} - \beta u_{t-1} \) and \( c_t = \alpha_1 y_t + \alpha_2 \left( \sum (y_{t+1} - c_{t+1}) \right) - \alpha_2 L p_t + \mu_t \), respectively. \( c_t \) is log of private consumption, \( y_t \) is log of total income, \( p_t \) is log of price level and \( L \) is a parameter reflecting real holdings of nominally-denominated assets in the economy.
The purpose of this paper is threefold: The first is to examine the validity of PIH for Turkey based on the general model developed by Campbell and Mankiw (1990) using quarterly data 1987-1995. The second purpose is to check for the robustness of the results by relaxing some assumptions such as allowing time-varying real interest rate and nonseparability in utility among the non-durable goods consumption, stock of durable goods and government expenditures. Finally, we test the PIH using data on sub-categories of consumption. Quarterly disposable income data for Turkey is computed for the first time to the extent of the availability of the data. Our main empirical findings suggest evidence against the PIH for Turkey and that at least 40% of income goes to individuals who consume their current income. This result increases the significance of current income for policy-making. In light of the findings it can be said that some consumers in Turkey will change consumption plans even if changes in disposable income appear to be temporary.

The paper is organized as follows. Section 2 explains the theory and model. Section 3 presents the econometric techniques and data used in the study. Section 4 gives the results. Section 5 presents Monte Carlo results to display the finite-sample properties of our tests. Section 6 concludes.

2. Theory

2.1. The permanent income hypothesis and “Rule-of-Thumb” alternative

The permanent income theory by Milton Friedman and the life cycle theory by Ando and Modigliani in the 1950s have served as a foundation for many fore-mentioned rational expectations studies on consumption in the 1970s and 1980s.

Both theories or hypotheses assume that individual consumers are forward-looking decision-makers. According to these hypotheses, aggregate consumption can be modeled as the decision of a representative consumer. The representative consumer is assumed to maximize the expected value of an additively separable utility function $E_0 \sum_{t=0}^{\infty} (1+\delta)^{-t} U(C_t)$ subject to the budget constraint

$$A_t = (1+r_t)[A_{t-1} + Y_t - C_t] \quad U' > 0, \quad U'' < 0$$

(1)

where $E_t$ denotes the conditional expectation operator on all information available at time t; $\delta$ is the rate of subjective time preference ($\delta > 0$); $r$ is the real rate of interest between periods $t-1$ and $t$; $U(\cdot)$ denotes the utility
function: \( C_t \) is the consumption at time \( t \); \( Y_t \) is the non-capital or labor income at time \( t \); and \( A_t \) represents assets apart from human capital at time \( t \).

Assuming consumption decisions are in the interior of the feasible choice set, then the first-order condition of the consumer’s decision problem, also known as the Euler equation, is:

\[
E_t \left[ \frac{(1+\eta_{t+1})U'(C_{t+1})}{(1+\delta)} \right] = 1
\]

or

\[
E_t U'(C_{t+1}) = \left[ \frac{(1+\delta)}{(1+\eta_{t+1})} \right] U'(C_t), \quad t = 0, 1, 2, ...
\]  

(2)

Equation (2) implies that the conditional expectation of future marginal utility is a function of today’s level of consumption alone -- all other information is irrelevant. Hall showed that consumption follows a random walk if marginal utility is a linear function of consumption and also obtained the expression that consumption obeys the exact regression,

\[
C_t = \beta_0 + \gamma C_{t-1} + \nu_t,
\]

where \( \beta_0 = \overline{C}(r - \delta)/(1+r) \), \( \gamma = (1+\delta)/(1+r) \), and \( E_{t-1}(\nu_t) = 0 \) by using the quadratic utility function, \( U(C_t) = -1/2(\overline{C} - C_t)^2 \) where \( \overline{C} \) is the bliss level of consumption. If we assume that \( r = \delta \), from the exact regression, one can obtain the random walk result:\(^3\)

\[
\Delta C_t = \varepsilon_t
\]

(3)

Campbell and Mankiw (1990) have developed an alternative model. They suggested that aggregate consumption is best viewed as generated not by a single forward-looking consumer but by two types of consumers. Consumers in the first group follow the “rule-of-thumb” and consume their current income. Consumers in the second group are forward-looking and behave according to the PIH. If we denote the disposable income of the two groups of agents as \( Y_{1t} \) and \( Y_{2t} \), then the total disposable income \( Y_t \) is just the sum of the disposable income of these two groups: \( Y_t = Y_{1t} + Y_{2t} \). The

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3 One can obtain the random walk result with drift assuming \( r = \delta \) when the utility function is of the quadratic form \( u(c_t) = u_0 + u_1 c_t - \frac{1}{2} u_2 c_t^2 \) where \( u_0, u_1, u_2 > 0 \), and \( c_t \) in the interval \( 0 \leq c_t < u_1/u_2 \) for satisfaction of the restrictions: \( u' > 0 \), \( u'' < 0 \). One can also obtain the random walk result with other sort of approximations, such as the Taylor approximation in Mankiw (1981) or the log-normality assumption in Hansen and Singleton (1983).
first group receives a fixed share $\lambda$ of total disposable income, and so $Y_{1t} = \lambda Y_t$ and $Y_{2t} = (1-\lambda) Y_t$. Agents in the first group consume their current income, so $C_{1t} = Y_{1t}$. Taking first differences, one can obtain $\Delta C_{1t} = \Delta Y_{1t} = \lambda \Delta Y_t$. Agents in the second group consume their permanent disposable income, thus $C_{2t} = Y^{p}_{2t} = (1-\lambda) Y^{p}_{1t}$. By using Hall’s random walk hypothesis, the change in consumption for the second group of agents can be written as $\Delta C_{2t} = \mu + (1-\lambda) \varepsilon_t$, where $\mu$ is a constant and $\varepsilon_t$, a rational forecast error, is the innovation between time $t-1$ and $t$ in the agents’ assessment of total permanent income $Y^{p}_{1t}$. The change in aggregate consumption can thus be written as

$$\Delta C_t = \Delta C_{1t} + \Delta C_{2t} = \mu + \lambda \Delta Y_t + (1-\lambda) \varepsilon_t$$  \hspace{1cm} (4)

Under this alternative hypothesis, the change in consumption is a weighted average of the change in current income and the unforecastable innovation in permanent income.

One can also obtain the log-linear versions of equations (3) and (4). Following Hall (1978) and Wirjanto (1991), assume that the utility function is $U(C_t) = C_t^{1-\frac{1}{\theta}}$, where $\theta > 0$ is the intertemporal elasticity of substitution. Then the Euler equation (2) can be written as

$$E_t \left[ \frac{(1+r_{t+1})}{(1+\delta)} \left( \frac{C_{t+1}}{C_t} \right)^{\frac{1}{\theta}} \right] = 1$$  \hspace{1cm} (5)

Equation (5) implies the following econometric relation:

$$\left( \frac{(1+r_{t+1})}{(1+\delta)} \right)^{\frac{1}{\theta}} \left( \frac{C_{t+1}}{C_t} \right) = 1 - \nu_{t+1}$$  \hspace{1cm} (6)

where $E_t (\nu_{t+1}) = 0$. Taking the logarithms of both sides and assuming that the approximation of $\ln (1+x) = x$ for small values of $x$ holds, one can obtain

$$\Delta c_t = -\theta \delta + \theta r_t - \theta \nu_t \text{ or}$$

$$\Delta c_t = \theta (r_t - \delta) + \xi_t$$  \hspace{1cm} (7)

where $\Delta c_t = \ln C_t - \ln C_{t-1}$. Assuming a constant real rate of interest i.e., $r_t = r$, we obtain the log-linear version of equation (3):

$$\Delta c_t = \mu + \varepsilon_t$$  \hspace{1cm} (3')

where $\mu = \theta (r - \delta)$, which implies that the growth rate of consumption is a
random walk with drift. Additionally, we can write equation (4) in the log-linear version
\[
\Delta c_t = \mu + \lambda \Delta y_t + \varepsilon_t
\] (4')

2.2. Generalizations of the permanent income hypothesis

2.2.1. Changes in the real interest rate

Hall’s random walk result for consumption rests on the assumption that consumers face a known, constant real interest rate. However, it is conceivable that movements in the expected real interest rates may affect the growth rate of consumption. Thus, failure of this assumption might cause spurious rejection of the theory. Mankiw (1981); Hansen and Singleton (1983); and Hall (1988) generalized the consumer’s Euler equation to allow for changes in the real interest rate.

Assuming a constant relative risk aversion (CRRA) type utility function of the form \( U(C_t) = \frac{1}{1 - A} C_t^{1 - A} \) where \( A \) is the Arrow-Pratt measure of relative risk aversion, Mankiw (1981) by allowing a time-varying interest rate in the PIH, showed that the real interest rate is significant in a consumption growth equation while other current variables are insignificant. In other words, Mankiw obtained an equation similar to that of equation (7). Using quarterly postwar U.S. data, Mankiw estimated \( G_{t+1} = a_0 + a_1 r_t + b X_t + u_{t+1} \), where \( G_{t+1} \) is the growth rate of consumption and \( X_t \) is per capita real disposable income, and found evidence against the PIH.\(^4\)

Equation (7) -- also known as the log-linear version of the Euler equation -- implies that changes in consumption are positively correlated with expected real interest rates because consumers postpone consumption when expected interest rates are higher. If higher income growth is associated with higher real interest rates, this could explain the deviation from the permanent income hypothesis. In order to examine this possibility Campbell and Mankiw (1990) considered a more general model. In their model, a fraction, \( \lambda \), of income goes to individuals who consume their current income; \( c_{it} = y_{it} \) and so by differencing, it is \( \Delta c_{it} = \Delta y_{it} = \lambda \Delta y_{it} \). The remainder, \( (1-\lambda) \), goes to individuals who satisfy equation (7). Then,
\[
\Delta c_t = \mu + \lambda \Delta y_t + \Phi r_t + \varepsilon_t
\] (8)

\(^4\) Additionally Hansen and Singleton (1983) studied the joint distribution of the rate of growth of consumption and asset returns in the conventional expected intertemporal utility framework. By using a CRRA type utility function and assuming that consumption and asset returns are log-normally distributed, they proceeded to derive a relation between forecastable movements in consumption and forecastable movements in asset returns.
where $\Phi = (1-\lambda)\theta$, and $y_t$ is the log of $Y_t$

2.2.2. Nonseparability in the utility function

The random walk hypothesis assumes that consumption of nondurable goods is additively separable from other goods in the utility function. If this assumption is violated, the PIH will be rejected because the expected changes in consumption in all other goods will be correlated with the expected changes in consumption of nondurables and this may result in significant parameter estimates on income growth. In the literature, various nonseparabilities have been proposed. One type of nonseparability may arise if the stock of consumer durable goods leads to changes in nondurable goods consumption and in its marginal utility. When durable goods are considered as wealth, the effect of increasing the stock of durable goods on nondurable consumption expenditure should be positive. If the durable goods expenditures are perceived as substitutes for nondurable goods expenditures, the effect should be negative. Startz (1989) investigated the nonseparability between durable and nondurable goods and found that the U.S. data tend to support the existence of nonseparability. Campbell and Mankiw (1990), however, found no evidence of nonseparability in the utility function. One way of allowing for nonseparability in the utility function is to replace $r_t$ with the growth rate of per capita durable stock in equation (8).

Wirjanto (1991) assumes a utility function of the form

$$U(C_t, D_t) = \left(C_t^\alpha D_t^{1-\alpha}\right)^{\frac{1}{1-\alpha}}$$

where $D_t$ is the stock of durable goods and $\alpha \in [0, 1]$. Under the assumption of a constant real interest rate, substituting this utility function into the Euler equation (2) gives

$$\Delta c_t = \mu + \eta \Delta d_t + \xi_t$$

where $d_t$ is the log of $D_t$. If we assume that a fraction $\lambda$ of income goes to individuals who consume their current income and the remainder goes to individuals who behave as described by equation (9), then

$$\Delta c_t = \mu + \lambda \Delta y_t + \eta \Delta d_t + \epsilon_t$$

Equation (10) specifies the model with a stock of durable goods under the assumption that nondurable goods consumption is not additively separable in utility from durable goods consumption.

One other form of nonseparability may be introduced using the public and private purchases of nondurable goods; the idea is that changes in
government purchases may affect the marginal utility of private consumption (Aschauer (1985) and Kormendi (1983)). Kormendi (1983) concluded that government spending financed by current-period taxation reduces the permanent disposable income leading to a decrease in private sector consumption. Additionally, increasing government spending on consumption-type goods that are perceived as substitutes for privately provided consumption goods cause a relatively greater reduction in private sector consumption. However, government spending on investment-type goods yielding goods and services in the future, which are perceived to be substitutes for future privately provided consumption goods, will cause a relatively smaller reduction in private sector consumption. This kind of nonseparability is examined by replacing $\Delta d_i$ with the growth rate of per capita government purchases in equation (10) as done in Campbell and Mankiw (1990). The following section presents the estimation methodology and describes the data used in the estimations.

3. Methodology and data

3.1. Estimation

One cannot estimate (4) or (4') using Ordinary Least Squares (OLS) since the error term, $\varepsilon_i$, is not necessarily orthogonal to changes in current disposable income $\Delta Y_i$, implying inconsistent OLS estimates of $\lambda$. Instead the Instrumental Variable (IV) technique can be used to derive consistent estimates of $\lambda$. Since the error term $\varepsilon_i$ is an innovation, it is orthogonal to any variable that is in the agents' information set at time $t-1$. Thus any lagged variables that are highly correlated with $\Delta Y_i$ are potentially valid instruments. Lagged growth rate of consumption, lagged growth rate of disposable income, lagged values of changes in nominal interest rates and lagged values of log consumption minus income are used following the literature. In the light of Working's (1960) result, Campbell and Mankiw (1990), Wirjanto (1991), and Roche (1995) used the instruments lagged more than one period. In this study we also used instruments lagged more than one period.

As noted in Campbell and Mankiw (1990) and Wirjanto (1991), equation (4) estimated by the IV procedure can be viewed as a restricted

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5 Working's (1960) result implies that time-averaged consumption growth rates will be correlated at the first lag and this may account for rejections of the discrete time PIH models.
version of the following two-equation system in which $\Delta C_t$ and $\Delta Y_t$ are regressed directly on the instruments:

$$C_t = \alpha_0 + \alpha Z_{t-j} + u_{1t}$$

$$Y_t = \beta_0 + \beta Z_{t-j} + u_{2t}$$

for $j \geq 2$  \hspace{1cm} (11)

where $Z_{t-j}$ is a $q$-vector of instruments, the most recent measured during period $t-2$. The PIH implies that the vector $\alpha = 0$. When there is more than one instrument used in estimating the restricted model (4), one has to impose over-identifying restrictions on (11). The restrictions can be summarized as $\alpha = \lambda \beta$. It follows that testing the null hypothesis of $\alpha = 0$ in equation (11) is equivalent to testing the null hypothesis of $\lambda = 0$ in equation (4). Additionally, when $q$ instruments are used in estimating the restricted model (4), we impose $(q-1)$ over-identifying restrictions on the unrestricted model (11). We test for these over-identifying restrictions by regressing the residuals from the IV estimation of (4) on the vector of instruments and then compare $T$ (the sample size) times the $R^2$ from this regression with the $\chi^2$ ($q-1$) distribution where $(q-1)$ is the degrees of freedom.

3.2. Data

For Turkey, gross national product data is calculated using the expenditure method after 1987. Our quarterly data set, due to this constraint, covers the period from 1987 until 1995. Official personal disposable income data is not available for Turkey.\(^6\) We calculated Turkish quarterly personal disposable income using available statistics and data.\(^7\)

In this study the following data are used; \textit{rpconl}, real per capita consumption expenditure excluding expenditure on durables in 1987 prices; \textit{rpinc1}, real per capita personal disposable income in 1987 prices; \textit{nint}, average three-month nominal treasury bill rate over the quarter; \textit{infl}, the percentage change in the consumer price index (CPI, 1987=100); \textit{rintl}, the \textit{ex post} real interest rate.\(^8\)

\(^6\) Annual \textit{private} disposable income data are calculated by the State Planning Organization (SPO). It is not possible to convert the data of the SPO from annual to quarterly frequency because the SPO collects public sector income at an annual basis.

\(^7\) The data are in Akçin (1996) and are available from the authors upon request.

\(^8\) $r_t = \left[ \frac{1+(1-\varphi)\pi_t}{1+\pi} - 1 \right] \times 100$ is used to compute the ex post real interest rate.
4. Empirical results

4.1. Seasonality and stationarity

We deseasonalized the quarterly data by using the X-11 filter\textsuperscript{9}. In equation (4') we assume that the logarithm of consumption and income is integrated of order one, denoted as I(1). In this study, we initially applied the testing procedure suggested by Hylleberg, Engle, Granger, and Yoo (1990) which accounts for both long-run (zero) and seasonal frequency unit roots. Test results show that the seasonally adjusted data (adjusted by the X-11 filter) \textit{lrcpconls} and \textit{lrcpnc1s} have a unit root at the long-run frequency $\theta = 0$. When the same test was applied to the growth rates of consumption and income, \textit{dlrcpconls} and \textit{dlrcpnc1s} respectively, we reject the null hypothesis of a unit root at seasonal long-run frequencies. Next we applied the Kwiatkowski-Phillips-Schmidt-Shin (1992) stationarity test.\textsuperscript{10} Based on the results of this test, we rejected the null hypothesis of stationarity around a level for the series \textit{lrcpconls} and \textit{lrcpnc1s}. We fail to reject the null hypothesis of trend stationarity, though. When the same test is applied to the series \textit{dlrcpconls} and \textit{dlrcpnc1s}, the null of stationarity around the level cannot be rejected. In the light of these test results, we concluded that the seasonally adjusted logarithm of consumption and income series are integrated of order one. The Augmented Dickey-Fuller, ADF, unit root test rejects the presence of a unit root in the log consumption-income ratio, \textit{dlfcys}, in real interest rates, \textit{rintl} and changes in the nominal interest rates, \textit{dnint}.

We also regressed \textit{lrcpconls} on a constant and \textit{lrcpnc1s} and tested for cointegration. The ADF test statistics obtained gave support to the conclusion that \textit{lrcpconls} and \textit{lrcpnc1s} are cointegrated.

4.2. Results of the models

Table 1 presents the results from the basic model (4'). The second column gives the instruments. A constant term is always included as both an

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\textsuperscript{9} We also deseasonalized the series by regressing the series on a constant, three centered seasonal dummy variables and the polynomial, $P$, matrix then using the residuals. However, there was no significant change in the obtained results, and hence our estimates are insensitive to the choice of deseasonalization method.

\textsuperscript{10} The distinguishing feature of this testing procedure is that it tests the null hypothesis of stationarity against the alternative of a unit root.
instrument and a regressor but is not reported in the tables. The third and fourth columns give the adjusted $R^2$ statistics for the OLS regressions of $\Delta y$ and $\Delta c$, on the instruments and the columns also report, in parentheses, the $p$ value for the Wald test of the null hypothesis that all coefficients in the regressions are zero except the constant term. The fifth column gives the $p$ estimate of $\lambda$ with its standard error. The final column gives the adjusted $R$ statistics for the OLS regression of the residuals from the IV regression on the instruments. The final column also reports, in parentheses, the $p$-value for a Wald test of the over-identification restrictions of equation (4') on the unrestricted model (11).

Columns 3 and 4 of Table 1 show that only instruments belonging to rows 10 and 11 are significant in forecasting $\Delta y$ and $\Delta c$. Analysis of column 5 reveals that $\lambda$ is around 0.4 and significantly different from zero, suggesting evidence against the PIH since the PIH would have implied an insignificant $\lambda$. Column 5 reports no evidence against the model with the parameter $\lambda$.

Since only two types of instrument sets were significant in forecasting $\Delta y$ and $\Delta c$, one criticism may be that this result cannot be conclusive since different instruments may yield different results. We searched over fifty different instrument sets using variables such as real interest rates, inflation, durable goods purchases, and government purchases. We report results of only those instruments that are significant in forecasting $\Delta y$ and $\Delta c$ in column 2 of Table 2. Column 3 shows that the previous result hold under alternative instrument sets.

As mentioned previously, this test will not be valid if the real interest rate varies over time or if the utility function is nonseparable. Table 2, row 4, 6, and 8 report the estimated $\lambda$s and corresponding asymptotic standard errors using models that incorporate changes in real interest rates and nonseparability of the utility function by including consumption of durable and government purchases in the estimations respectively. We see that the estimated values of $\lambda$ are similar to the values reported in column 3 thus strengthening the evidence against the PIH.
Table 1

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<td></td>
<td></td>
<td>(0.238)</td>
<td>(0.166)</td>
<td>(0.254)</td>
</tr>
<tr>
<td>8</td>
<td>Δy_{t-2} ...... Δy_{t-6}, c_{t-2} -y_{t-2}</td>
<td>-0.032</td>
<td>0.073</td>
<td>0.369*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.528)</td>
<td>(0.224)</td>
<td>(0.210)</td>
</tr>
<tr>
<td>9</td>
<td>Δc_{t-2} ...... Δc_{t-6}, c_{t-2} -y_{t-2}</td>
<td>0.142</td>
<td>0.177</td>
<td>0.467*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.100)</td>
<td>(0.062)</td>
<td>(0.191)</td>
</tr>
<tr>
<td>10</td>
<td>Δy_{t-2} ...... Δy_{t-4}, Δc_{t-2} ...... Δc_{t-6}</td>
<td>0.168</td>
<td>0.240</td>
<td>0.398*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.091)</td>
<td>(0.032)</td>
<td>(0.163)</td>
</tr>
<tr>
<td>11</td>
<td>Δy_{t-2} ...... Δy_{t-4}, Δc_{t-2} ...... Δc_{t-6}</td>
<td>0.145</td>
<td>0.218</td>
<td>0.405*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.132)</td>
<td>(0.052)</td>
<td>(0.161)</td>
</tr>
</tbody>
</table>

* Seasonally adjusted data of c and y series are obtained using the X-11 seasonal filter.
* (**) Reject the null hypothesis that λ is zero with 95% (90%) confidence level.

Notes: The instruments vector always includes a constant. The statistics in columns 3 and 4 are adjusted R² values from OLS regressions of Δc and Δy on the instruments z and the p-value for the null hypothesis that all coefficients except the constant are zero (in parentheses). The statistics in column 5 are the instrumental variables’ estimate of λ, with its standard error (in parentheses). Column 6 reports the adjusted R² from a regression of the IV residuals onto the instruments z and the p-value for a Wald test of over-identifying restrictions of the IV model.

The data is taken from Akçin (1996) and is also available from the authors upon request.
Table 2
Comparative Analysis (logs, seasonally adjusted data \textsuperscript{8})
Consumption = Private Consumption Less Durable Goods

<table>
<thead>
<tr>
<th>Row</th>
<th>Instruments (2)</th>
<th>Model 1 \textsuperscript{9}</th>
<th>Model 2 \textsuperscript{9}</th>
<th>Model 3 \textsuperscript{9}</th>
<th>Model 4 \textsuperscript{9}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\lambda_1$ (s. e.)</td>
<td>$\lambda_2$ (s. e.)</td>
<td>$\theta$ (s. e.)</td>
<td>$\lambda_1$ (s. e.)</td>
</tr>
<tr>
<td>1</td>
<td>$\Delta c_{t-2} \ldots \Delta c_{t-6}, \Delta c_{t-2} - \Delta y_{t-2}$</td>
<td>0.467\textsuperscript{*}</td>
<td>0.455\textsuperscript{*}</td>
<td>-0.003</td>
<td>0.491\textsuperscript{*}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.191)</td>
<td>(0.213)</td>
<td>(0.009)</td>
<td>(0.206)</td>
</tr>
<tr>
<td>2</td>
<td>$\Delta y_{t-2} \ldots \Delta y_{t-4}, \Delta c_{t-2} \ldots \Delta c_{t-6}$</td>
<td>0.398\textsuperscript{**}</td>
<td>0.596\textsuperscript{**}</td>
<td>-0.007</td>
<td>0.401\textsuperscript{*}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.163)</td>
<td>(0.307)</td>
<td>(0.006)</td>
<td>(0.170)</td>
</tr>
<tr>
<td>3</td>
<td>$\Delta y_{t-2} \ldots \Delta y_{t-4}, \Delta c_{t-2} \ldots \Delta c_{t-6}$</td>
<td>0.405\textsuperscript{*}</td>
<td>0.497\textsuperscript{*}</td>
<td>-0.004</td>
<td>0.408\textsuperscript{*}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.161)</td>
<td>(0.213)</td>
<td>(0.003)</td>
<td>(0.165)</td>
</tr>
<tr>
<td>4</td>
<td>$\Delta y_{t-2} \ldots \Delta y_{t-4}, \Delta c_{t-2} \ldots \Delta c_{t-6}$</td>
<td>0.373\textsuperscript{*}</td>
<td>0.375\textsuperscript{*}</td>
<td>-0.000</td>
<td>0.380\textsuperscript{*}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.152)</td>
<td>(0.157)</td>
<td>(0.002)</td>
<td>(0.157)</td>
</tr>
</tbody>
</table>

\textsuperscript{8} Seasonally adjusted data of the c and y series are obtained using the X-11 seasonal filter.

\textsuperscript{*} (**) Reject the null hypothesis that $\lambda$ is zero with 95% (90%) confidence level.

Model 1: $\Delta c_t = \mu_1 + \lambda_1 \Delta y_t + \varepsilon_{1t}$.

Model 2: $\Delta c_t = \mu_2 + \lambda_2 \Delta y_t + \theta r_t + \varepsilon_{2t}$.

Model 3: $\Delta c_t = \mu_3 + \lambda_3 \Delta y_t + \eta_d \Delta d_t + \varepsilon_{3t}$.

Model 4: $\Delta c_t = \mu_4 + \lambda_4 \Delta y_t + \eta_g \Delta g_t + \varepsilon_{4t}$.

When we analyze row 5, we observe that the estimates of the parameter for real interest rates are close to zero and insignificant, suggesting that the real interest rate is not associated with the growth rate of consumption. Moreover, they also imply an intertemporal elasticity of substitution of the magnitude zero for Turkey that may be due to very high uncertainty.

One of the crucial assumptions of the random walk hypothesis is that consumption of non-durables is additively separable in utility from that of all other goods. Rows 6 and 8 show that the results obtained from the basic model are robust to the separability assumption by considering the effects of durable consumption and the possibility that changes in government purchases of goods and services affect the marginal utility of private consumption\textsuperscript{11}. There is no evidence in favor of either of these effects.

\textsuperscript{11} Using 1987 Income and Expenditure Survey for Turkey, the consumer durables stock at the beginning of the sample period is calculated in two steps. First, we constructed an end-of-
We next conduct the same type of analysis to sub-sections of consumption and use data on (i) consumption on food and beverages and (ii) aggregate consumption less durables, food and beverages\textsuperscript{12}. Table 3 reports the results of the same methodology on consumption of food and beverages. We see that our results using the previous definition of consumption is strengthened as the value of $\lambda$ increases toward 0.6 suggesting further evidence against the PIH. When we use data on the aggregate consumption less durables, food and beverages, however, all $\lambda$ estimates turn out insignificant suggesting evidence in favor of the PIH for this type of consumption in Turkey (see Table 4). Next we check the small sample properties of our data set since we rely on asymptotic distributions in conducting tests of significance.

5. A Monte Carlo experiment

The analysis in the previous section using Turkish data suggests evidence against the PIH. However, since our sample size is not large our results may be subject to small sample bias. Mankiw and Shapiro (1985) performed Monte Carlo experiments to demonstrate the bias in the standard test procedure and also showed that the conventional test is biased toward rejection. Additionally Nelson and Startz (1990a) showed that if the instruments have only a weak forecasting power for the independent variables, the IV coefficients will appear to be highly significant even if the true coefficients are zero. Campbell and Mankiw (1990) performed Monte Carlo experiments to examine the small sample distribution of test statistics by using a data generating process that both obeys the restriction of their models and matches the moments of the US consumption and income data. In this section, we conduct Monte Carlo experiments using the continuous-time model developed by Campbell and Kyle (1988) and later used by Campbell and Mankiw (1990).

\textsuperscript{12} That is, consumption of semi and nondurables including energy, transportation, communication, services, and ownership of dwelling.
Table 3
Comparative Analysis (logs, seasonally adjusted data 5)
Consumption: Food and Beverages

<table>
<thead>
<tr>
<th>Row</th>
<th>Instruments (z)</th>
<th>Model 1 7</th>
<th>Model 2 7</th>
<th>Model 3 7</th>
<th>Model 4 7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\lambda_1$ (s. c.)</td>
<td>$\lambda_2$ (s. c.)</td>
<td>$\theta$ (s. c.)</td>
<td>$\lambda_3$ (s. c.)</td>
</tr>
<tr>
<td>1</td>
<td>$\Delta c_{t-2},...,\Delta c_{t-6}$, $\Delta y_{t-2}$</td>
<td>0.636 7</td>
<td>0.737 7</td>
<td>0.003</td>
<td>0.681 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.262)</td>
<td>(0.352)</td>
<td>(0.005)</td>
<td>(0.305)</td>
</tr>
<tr>
<td>2</td>
<td>$\Delta y_{t-2},...,\Delta y_{t-4}$, $\Delta c_{t-2},...,\Delta c_{t-6}$</td>
<td>0.531 7</td>
<td>0.541 7</td>
<td>-0.000</td>
<td>0.500 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.189)</td>
<td>(0.211)</td>
<td>(0.003)</td>
<td>(0.211)</td>
</tr>
<tr>
<td>3</td>
<td>$\Delta y_{t-2},...,\Delta y_{t-4}$, $\Delta c_{t-2},...,\Delta c_{t-6}$</td>
<td>0.518 7</td>
<td>0.514 7</td>
<td>0.000</td>
<td>0.503 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.184)</td>
<td>(0.190)</td>
<td>(0.002)</td>
<td>(0.191)</td>
</tr>
<tr>
<td>4</td>
<td>$\Delta y_{t-2},...,\Delta y_{t-4}$, $\Delta c_{t-2},...,\Delta c_{t-6}$</td>
<td>0.559 7</td>
<td>0.570 7</td>
<td>-0.000</td>
<td>0.544 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.179)</td>
<td>(0.205)</td>
<td>(0.003)</td>
<td>(0.194)</td>
</tr>
</tbody>
</table>

5 Seasonally adjusted data of c and y series are obtained using the X-11 seasonal filter.
6 (**) Reject the null hypothesis that $\lambda$ is zero with 95% (90%) confidence level.

Model 1: $\Delta c_{t} = \mu_{1} + \lambda_{1} \Delta y_{t} + \varepsilon_{1t}$.
Model 2: $\Delta c_{t} = \mu_{2} + \lambda_{2} \Delta y_{t} + \theta r_{t} + \varepsilon_{2t}$.
Model 3: $\Delta c_{t} = \mu_{3} + \lambda_{3} \Delta y_{t} + \eta_{d} \Delta d_{t} + \varepsilon_{3t}$.
Model 4: $\Delta c_{t} = \mu_{4} + \lambda_{4} \Delta y_{t} + \eta_{g} \Delta g_{t} + \varepsilon_{4t}$.

Seasonally adjusted income and consumption series have the following properties: (i) log income and consumption are each first order integrated processes; (ii) the log consumption-income ratio is stationary; (iii) the growth rate of income has no forecasting power for the growth rate of income and consumption; (iv) growth rates of consumption and the log consumption-income ratio do help forecast the growth rate of income; (v) the standard deviation of consumption growth is 0.029 and the standard deviation of income growth is 0.042; (vi) the standard deviation of log consumption-income ratio is 0.039 and the correlation with its first lag is 0.46; (vii) the contemporaneous correlation of income growth and consumption growth is 0.46.

Our data properties (i)-(iv) are similar to those of the US data analyzed by Campbell and Mankiw (1990). Thus we have chosen the data generating process developed by Campbell and Kyle (1993). Next to obtain properties (v)-(vii), we calibrated the free parameters of the model. We set the coefficient $\lambda$ to 0 and 0.5, and fixed the real interest rates at 0.01 per quarter (the median and the mean of the real interest rate data are 0.0088 and
Table 4
Comparative Analysis (logs, seasonally adjusted data $^3$)
Consumption: Aggregate Consumption less Food, Beverages and Durables

<table>
<thead>
<tr>
<th>Row</th>
<th>Instruments (z)</th>
<th>Model 1: $\lambda_1$ (s.e.)</th>
<th>Model 2: $\lambda_2$ (s.e.)</th>
<th>Model 3: $\theta$ (s.e.)</th>
<th>Model 4: $\lambda_4$ (s.e.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$\Delta c_{t-2} \ldots \Delta c_{t-n}$, $c_{t-2} - y_{t-2}$</td>
<td>0.222 (0.211)</td>
<td>0.338 (0.347)</td>
<td>-0.004 (0.009)</td>
<td>0.066 (0.216)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.212 (0.219)</td>
<td>-0.227 (0.759)</td>
</tr>
<tr>
<td>2</td>
<td>$\Delta y_{t-2} \ldots \Delta y_{t-4}$, $\Delta c_{t-2} \ldots \Delta c_{t-n}$</td>
<td>0.181 (0.201)</td>
<td>0.420 (0.371)</td>
<td>-0.007 (0.007)</td>
<td>0.179 (0.205)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.184 (0.211)</td>
<td>0.049 (0.755)</td>
</tr>
<tr>
<td>3</td>
<td>$\Delta y_{t-3} \ldots \Delta y_{t-4}$, $\Delta c_{t-2} \ldots \Delta c_{t-n}$, $c_{t-2} - y_{t-2}$</td>
<td>0.179 (0.201)</td>
<td>0.420 (0.367)</td>
<td>-0.007 (0.007)</td>
<td>0.067 (0.204)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.188 (0.210)</td>
<td>0.137 (0.652)</td>
</tr>
<tr>
<td>4</td>
<td>$\Delta y_{t-3} \ldots \Delta y_{t-4}$, $\Delta c_{t-1} \ldots \Delta c_{t-n}$, $\Delta d_{t}$</td>
<td>0.177 (0.195)</td>
<td>0.192 (0.213)</td>
<td>-0.001 (0.003)</td>
<td>0.176 (0.200)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.177 (0.199)</td>
<td>-0.123 (0.551)</td>
</tr>
</tbody>
</table>

$^3$ Seasonally adjusted data of c and y series are obtained using the X-11 seasonal filter.

$^a$ (a.b) Reject the null hypothesis that $\lambda$ is zero with 95% (90%) confidence level.

Model 1: $\Delta c_t = \mu_1 + \lambda_1 \Delta y_t + \varepsilon_{1_t}$
Model 2: $\Delta c_t = \mu_2 + \lambda_2 \Delta y_t + \theta r_t + \varepsilon_{2_t}$
Model 3: $\Delta c_t = \mu_3 + \lambda_3 \Delta y_t + \eta_1 \Delta d_t + \varepsilon_{3_t}$
Model 4: $\Delta c_t = \mu_4 + \lambda_4 \Delta y_t + \eta_2 \Delta d_t + \varepsilon_{4_t}$

0.0189). Additionally, we fixed the standard deviation of changes in labor income at 0.0838 (changes in the log of real labor income per worker).

Table 5 presents some important moments of the actual data with those generated by the continuous time model. Neither versions of the model with $\lambda$ equal to 0 and 0.5, match the moments of the Turkish data exactly. In particular, neither versions of the model are able to account for the small standard deviation of income growth that may be due to the fact that the standard deviation of labor income growth is about twice that of income growth. Just like Campbell and Mankiw, the model with $\lambda = 0.5$ matches the moments better than the model with $\lambda = 0$. The parameter values that best match the moments of the observed data are $\alpha = 0.05$, $\rho = 0.7$ for $\lambda = 0$ (artificial data set 1) and $\alpha = 0.25$, $\rho = 1.8$ for $\lambda = 0.5$ (artificial data set 2). For each $\lambda$ the parameter values are chosen from 380 different sets of $\alpha$ and $\rho$. 


Table 5
Calibration of a Monte Carlo Experiment

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Actual Data</th>
<th>Data Set 1 (true $\lambda=0$)</th>
<th>Data Set 2 (true $\lambda=0.5$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma(\Delta y_{t})$</td>
<td>0.042</td>
<td>0.068</td>
<td>0.068</td>
</tr>
<tr>
<td>$\sigma(\Delta c_{t})$</td>
<td>0.029</td>
<td>0.078</td>
<td>0.028</td>
</tr>
<tr>
<td>Corr ($\Delta y_{t}, \Delta c_{t}$)</td>
<td>0.463</td>
<td>0.487</td>
<td>0.463</td>
</tr>
<tr>
<td>Corr ($\Delta y_{t}, \Delta y_{t-1}$)</td>
<td>-0.140</td>
<td>-0.092</td>
<td>-0.088</td>
</tr>
<tr>
<td>Corr ($\Delta c_{t}, \Delta c_{t-1}$)</td>
<td>-0.128</td>
<td>-0.105</td>
<td>-0.110</td>
</tr>
<tr>
<td>Corr ($\Delta y_{t}, \Delta y_{t+1}$)</td>
<td>-0.255 ... 0.001</td>
<td>-0.374 ... 0.164</td>
<td>-0.371 ... 0.169</td>
</tr>
<tr>
<td>Corr ($\Delta c_{t}, \Delta y_{t+1}$)</td>
<td>-0.256 ... 0.058</td>
<td>-0.289 ... 0.094</td>
<td>-0.280 ... 0.096</td>
</tr>
<tr>
<td>Corr ($\Delta y_{t}, \Delta c_{t+1}$)</td>
<td>-0.292 ... 0.047</td>
<td>-0.278 ... 0.387</td>
<td>-0.280 ... 0.380</td>
</tr>
<tr>
<td>Corr ($\Delta c_{t}, \Delta c_{t+1}$)</td>
<td>-0.309 ... 0.184</td>
<td>-0.223 ... 0.044</td>
<td>-0.229 ... 0.040</td>
</tr>
<tr>
<td>$\sigma (c_{t} - y_{t})$</td>
<td>0.039</td>
<td>0.199</td>
<td>0.112</td>
</tr>
<tr>
<td>Corr ($c_{t} - y_{t}, c_{t-1} - y_{t-1}$)</td>
<td>0.461</td>
<td>0.928</td>
<td>0.854</td>
</tr>
</tbody>
</table>

Notes: Artificial data are generated from the model described in Akçin (1996). Data set 1 has parameters $\lambda=0$, $\alpha=0.05$, and $\rho=7$. Data set 2 has parameters $\lambda=0.5$, $\alpha=0.25$, and $\rho=1.8$. The time index $i$ denotes numbers from 2 to 6.

The results of the Monte Carlo experiment are presented in Tables 6a ($\lambda=0$) and 6b ($\lambda=0.5$) using the parameters given in Table 5. For each process, we generated 1000 series of length 36 and applied the econometric methods of Table 1. The eight different instrument sets are used as shown in the second column of Tables 6a and 6b.

The results presented in Table 6a indicate an upward bias in the IV estimate of $\lambda$ and confirm the theoretical analysis of Nelson and Startz (1990b). Since the lagged income growth rates have no forecasting power for the income growth rate, this bias gets larger. When the consumption growth rates are used as instruments, the forecasting power increases and then the bias gets smaller. When three instruments are used, the rejection rates of the IV tests are not very far from their theoretical values, but increase with the number of instruments.

An analysis of Table 6b indicates a severe downward bias in the IV estimate of $\lambda$. Although the true value of $\lambda$ is 0.5, the estimates of $\lambda$ are about 0.12 and insignificant. Accordingly, the IV estimate of $\lambda$ in the previous section is biased downward and the true value of $\lambda$ is in fact greater. The upward bias in which $\lambda=0$ and the downward bias in which $\lambda=0.5$ also appeared in Campbell and Mankiw’s paper and the magnitude of the biases are comparable.
Table 6a
Monte Carlo Results. Artificial data set 1 (true \( \lambda = 0 \))

<table>
<thead>
<tr>
<th>Row</th>
<th>Instruments (z)</th>
<th>Mean ( \lambda ) estimate</th>
<th>Rejection probabilities</th>
<th>Empirical Critical values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \Delta_c )</td>
<td>( \Delta_y ) on z</td>
<td>Mean ( R^2 ) statistics</td>
<td>OLS 5% (OLS 1%)</td>
</tr>
<tr>
<td>A</td>
<td>None (OLS)</td>
<td>0.415</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>( \Delta y_{t-2}, \ldots, \Delta y_{t-4} )</td>
<td>-0.002, -0.007</td>
<td>0.418, 0.139</td>
<td>0.067, 0.024</td>
</tr>
<tr>
<td>C</td>
<td>( \Delta y_{t-2}, \ldots, \Delta y_{t-6} )</td>
<td>-0.008, -0.019</td>
<td>0.420, 0.242</td>
<td>0.028, 0.031</td>
</tr>
<tr>
<td>D</td>
<td>( \Delta c_{t-2}, \ldots, \Delta c_{t-4} )</td>
<td>0.008, 0.002</td>
<td>0.386, 0.173</td>
<td>0.053, 0.016</td>
</tr>
<tr>
<td>E</td>
<td>( \Delta c_{t-2}, \ldots, \Delta c_{t-6} )</td>
<td>-0.020, 0.001</td>
<td>0.369, 0.132</td>
<td>0.052, 0.020</td>
</tr>
<tr>
<td>F</td>
<td>( \Delta y_{t-2}, \ldots, \Delta y_{t-6} )</td>
<td>0.011, 0.004</td>
<td>0.360, 0.141</td>
<td>0.057, 0.035</td>
</tr>
<tr>
<td>G</td>
<td>( \Delta c_{t-2}, \ldots, \Delta c_{t-6} )</td>
<td>-0.000, 0.017</td>
<td>0.342, 0.131</td>
<td>0.084, 0.035</td>
</tr>
<tr>
<td>H</td>
<td>( \Delta y_{t-2}, \ldots, \Delta y_{t-4} )</td>
<td>-0.021, -0.006</td>
<td>0.394, 0.130</td>
<td>0.088, 0.038</td>
</tr>
<tr>
<td>I</td>
<td>( \Delta y_{t-2}, \ldots, \Delta y_{t-4} )</td>
<td>-0.000, 0.011</td>
<td>0.378, 0.128</td>
<td>0.110, 0.057</td>
</tr>
</tbody>
</table>

Notes: This table presents Monte Carlo simulation results for the true \( \lambda = 0 \). The artificial data set was generated 1000 times of length 36 from the model described in Akçin (1996). Columns 3 and 4 give the empirical mean adjusted \( R^2 \) when \( \Delta c \) and \( \Delta y \) are regressed on the instruments \( z \). Column 5 gives the empirical mean instrumental variable estimate of \( \lambda \) with its standard errors (in parentheses). Column 6 gives the empirical rejection probabilities for a 5\% (1\%) test of the hypothesis that all coefficients are zero when \( \Delta c \) is regressed on the instruments \( z \). Column 7 gives the empirical rejection probabilities for a 5\% (1\%) test of the hypothesis that \( \lambda = 0 \). Column 8 gives the empirical 5\% (1\%) critical values for the t-statistic on \( \lambda \).
### Table 6b
Monte Carlo Results. Artificial data set 2 (true $\lambda = 0.5$)

<table>
<thead>
<tr>
<th>Row</th>
<th>Instruments $(\zeta)$</th>
<th>Mean Adjusted $R^2$ statistics</th>
<th>Rejection probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\text{Ac}$ on $\zeta$</td>
<td>$\text{Ay}$ on $\zeta$</td>
</tr>
<tr>
<td>A</td>
<td>None (OLS)</td>
<td>0.139</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.050)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>$\Delta Y_{t-2}, \ldots, \Delta Y_{t-4}$</td>
<td>-0.005</td>
<td>-0.010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.329)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>$\Delta Y_{t-2}, \ldots, \Delta Y_{t-6}$</td>
<td>-0.005</td>
<td>-0.023</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.191)</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>$\Delta Y_{t-1}$</td>
<td>-0.010</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.377)</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>$\Delta Y_{t-1}, \ldots, \Delta \gamma_{t-2}$</td>
<td>-0.024</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.178)</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>$\Delta Y_{t-1}, \ldots, \Delta \gamma_{t-2}$</td>
<td>-0.003</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.142)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>$\Delta \gamma_{t-2}, \ldots, \Delta \gamma_{t-6}, \ldots, \Delta \gamma_{t-2}$</td>
<td>-0.015</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.140)</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>$\Delta \gamma_{t-2}, \ldots, \Delta \gamma_{t-4}$</td>
<td>-0.026</td>
<td>-0.010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.122)</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>$\Delta \gamma_{t-2}, \ldots, \Delta \gamma_{t-4}$</td>
<td>-0.014</td>
<td>0.027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.107)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** This table presents Monte Carlo simulation results for the true $\lambda = 0.5$. The artificial data set was generated 1000 times of length 36 from the model described in Akçin (1996). Columns 3 and 4 give the empirical mean adjusted $R^2$ when $\text{Ac}$ and $\text{Ay}$ are regressed on the instruments $\zeta$. Column 5 gives the empirical mean instrumental variable estimate of $\lambda$ with its standard errors (in parenthesis). Column 6 gives the empirical rejection probabilities for a 5% (1%) test of the hypothesis that all coefficients are 0 when $\text{Ac}$ is regressed on the instruments $\zeta$. Column 7 gives the empirical rejection probabilities for a 5% (1%) test of the hypothesis that $\lambda = 0$. 
Overall, the results of the Monte Carlo experiments which are parallel to those of Campbell and Mankiw (1990) suggest that the IV instrumental variable procedure should be used only when the instruments have some forecasting power for the explanatory variables and that one should use a moderate number of instruments. The experiments especially emphasize the importance of forecastability of income by the IV method of estimation. Since we only used instruments that are significant in explaining income and consumption for our analysis, the conducted Monte Carlo experiments do not provide evidence against our methodology. Since no instrument turned out significant in forecasting either income or consumption in the Monte Carlo experiments, we cannot provide evidence in favor of small sample properties based on the Monte Carlo experiments.

6. Conclusion

The empirical investigation of the quarterly Turkish aggregate consumption data for 1987-1995 provides evidence against the implication of the permanent income hypothesis (PIH) that changes in consumption are unforecastable. Our estimates suggest that at least 40% of income goes to individuals who consume their current income. When we considered food and beverages consumption, the fraction turns out to be around 60%. This result points to the significance of current income for policy-making for aggregate private consumption and food and beverages consumption expenditures. However consumption of semi and nondurables, including services, transportation, energy, communication, gives support for the PIH since the fraction is an insignificant amount. The Monte Carlo results suggest that when instruments have low forecasting power, estimates of the fraction may have a downward bias; in our analysis we only used instruments that are significant in explaining consumption and income. We also examined whether the empirical failures of the random walk hypothesis can be attributed to the failure of the auxiliary assumptions used to derive the hypothesis — constant real interest rates and nonseparability in utility function. We found no evidence that the real interest rate is associated with the growth rate of consumption in the model with the time-varying real interest rate. We also found no evidence of nonseparability in the utility function between consumption and other goods (the stock of durable goods and government purchases).
References


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**Özet**

Genel Tüketim ve Sürekli Gelir: Türkiye Üzerine Ampirik Bir Çalışma

Bu çalışmada, sürekli gelir hipotezinin Türkiye için geçerli olup olmadığını, sürekli gelir hipotezini de içine alan daha genel bir model yardımıyla incelemiştir. Bulgular sürekli gelir hipotezi yaklaşılarının Türkiye için geçerli olmadığını yönündedir. Çalışma sonucunda, toplam gelirin yaklaşık %40'ının günlük gelirine bağlı olarak tüketim yapan insanların aldığı ortaya çıkmıştır. Sürekli gelir hipotezi yaklaşılarının geçerli olmadığını yönündeki bu bulgu daha önceki bu tipe çalışmalara yöneltilen eleştirilerden olan i) reel faiz oranlarındaki değişine, ii) tüketici fonksiyonlarında mal ve hizmet tüketiminin, iii) dayanıklı tüketim mali stoku, iv) kamu mal ve hizmetlerle ilgili nihai tüketim harcamalarıyla ayrıştırılmamasıyla da açıklanamamaktadır. Ayrıca genel tüketimin alt kalemleri de incelenmiş, yiyicik ve içecek tüketim verisi ile bu oranın %60 olduğu ama dayanıklı tüketim, yiyicik ve içecek tüketimi dışındaki tüketim ise hesap edilen oranının istatistik olarak sıfırdan farklı olmadiği ortaya çıkmıştır. Eldeki verilere küçük-örnek özellikleri Monte Carlo deneyleri ile incelemiştir.