

## Consumption and Income Revisit of Permanent Income Hypothesis With an Application to the Economy of Sri Lanka

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**Abstract-**This paper tests the prediction of the Permanent Income Hypothesis (PIH) that an income innovation generates the same size revision in consumption as in permanent income. It means that there is a proportional relationship but not causal relationship between permanent income and permanent consumption. Time series data over the period 1970-2007 have been used for the SAARC country Sri Lanka.

**Key Words:** ARIMA(p,d,q) Forecasting, Cointegration, Correlogram, Granger Causality, Vector Error Correction Model.

### I. INTRODUCTION

The Permanent-income hypothesis (PIH) of consumption, which was originally developed by Friedman (1957), posits that household's base their consumption decisions not on income received in the current period but rather on expected income over a number of years, perhaps even over the entire lifetime.

There was a number of research works on this hypothesis but the results were not unique. For example, Bilson(1980), using aggregate quarterly time-series data from the US, UK, and Germany, finds support for the implication. Recently, Dawson, DeJuan, Seater and Stephenson (2001) conduct a cross-country study and find that data from industrial countries support the PIH but data from developing countries do not. More recently, DeJuan, Seater and Wirjanto(2004) extend the empirical analysis for the US states and find evidence in support of the PIH.

### II. VARIANTS OF HYPOTHESES

The relation between Permanent Income and Permanent Consumption is really complex and economists differ among themselves on this issue. There are five schools of thought regarding the relationship between Permanent Income and Consumption. These are as follows:

- 1) Permanent Income -Led Permanent Consumption Hypothesis:
- 2) Permanent Consumption -led Permanent Income:
- 3) Permanent Income - Permanent Consumption -led Permanent Income:
- 4) Permanent Consumption - Permanent Income - Permanent Consumption:
- 5) Independence:

### III. OBJECTIVE OF THE STUDY

Under this controversial theoretical framework, we seek to enquire empirically into the relationship between Permanent Income and Permanent Consumption in Sri Lanka, a member country of the SAARC.

### IV. THE DATA

The study involves the use of annual dataset for disposable income and household consumption in Sri Lanka for the period 1970-2007. Wholesale Price Index (WPI) is used with 2000 as the base period (2000=100). The data have been taken from various issues of IFS (*International Financial Statistics*). The log of the data sets has been taken.  $C_p$  is the ARIMA forecast for Consumption and  $Y_p$  is the ARIMA forecast for disposable income. Permanent (ARIMA forecast) Income and Permanent (ARIMA forecast) Consumption are represented by  $Y_t$  and  $C_t$  respectively.

### V. DETERMINATION OF PERMANENT INCOME AND PERMANENT CONSUMPTION THROUGH ARIMA(p,d,q) FORECASTING

The permanent income and permanent consumption are being estimated by separating anticipated (permanent) and unanticipated (transitory) part of the variable concerned through the corresponding ARIMA(p,d,q) univariate forecastings.

The identified Univariate ARIMA(p,d,q) structure for income is ARIMA(1,1,5) and consumption that for is ARIMA(1,1,0).

The corresponding ARIM(p,d,q) equations are

$$\Delta Y_t = 0.042965 + 0.359776\Delta Y_{t-1} - 0.311311u_{t-5} \quad 1$$

S.E.	(0.011752)	(0.169403)	(0.164661)
t-Stats	(3.655834)	(2.123784)	(-1.890613)
Prob.	(0.0010)	(0.0427)	(0.0691)

$R^2=0.213423$ , Adj  $R^2=0.157239$ , DW=2.031931, F=3.798641

$$\Delta C_t = 0.046330 + 0.325614\Delta C_{t-1} \quad 2$$

S.E.	(0.010869)	(0.152111)
t-Stats	(4.262439)	(2.140630)
Prob.	(0.0002)	(0.0396)

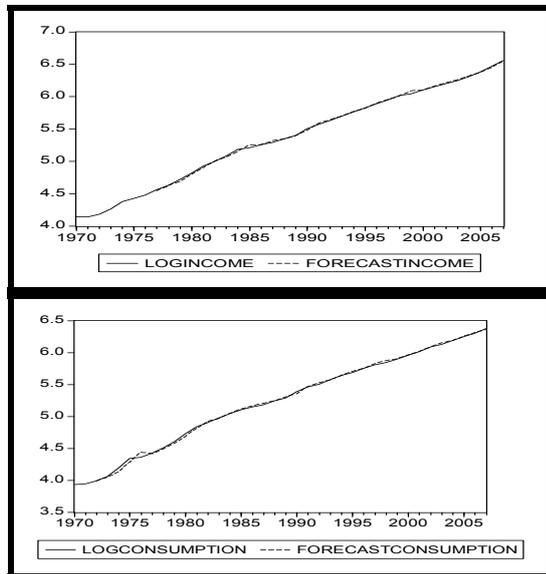
$R^2=0.118767$ , Adj  $R^2=0.092848$ , DW=1.858803, F=4.582297

The time plots of the generated forecasts along with the relevant level datasets are being presented below. These

forecasts represent the permanent parts of income and consumption

Figure 1. The Time Plots Of The GDP Level Data And The Time Plots Of The Consumption Level Data

Figure 2. The Corresponding ARIMA [(1, 1, 5)] Forecasts. And The Corresponding ARIMA(1,1,0) Forecasts.



The correlogram of the forecast errors which are transitory parts of income and consumption are given below. These testify that these forecast errors are white noise.

Figure 3. Correlogram of Residual of Equation-2

Figure 4. Correlogram Of Residual Of ARIMA(1,1,0)

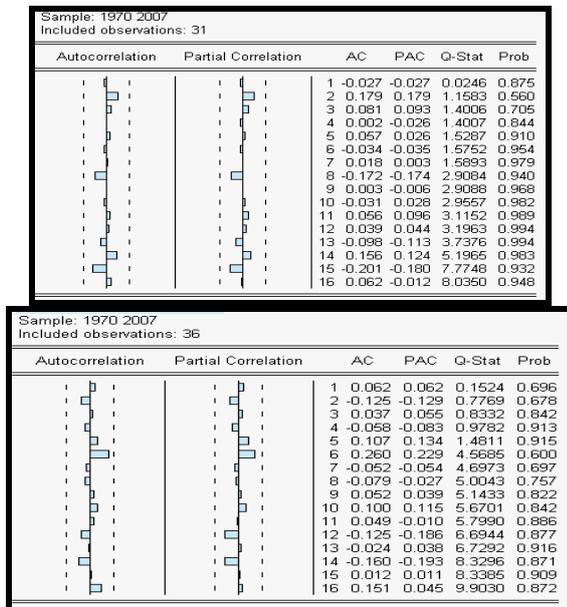


TABLE2. RESULTS OF AUGMENTED DICKEY-FULLER TESTS FOR UNIT ROOT IN PERMANENT INCOME (Y<sub>t</sub>)AND PERMANENT CONSUMPTION (C<sub>t</sub>)

Exogenous: Constant, Linear Trend				Mackinnon Critical Value
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Correlation among Permanent Consumption, Permanent Income, Transitory Consumption and Transitory income is represented by the following correlation matrix:

TABLE1. CORRELATION MATRIX

	Permanent Consumption	Permanent Income	Transitory Consumption	Transitory Income
Permanent Consumption	1.000000	0.433131	0.138685	0.392301
Permanent Income	0.433131	1.000000	0.433408	6.37E-06
Transitory Consumption	0.138685	0.433408	1.000000	0.503642
Transitory Income	0.392301	6.37E-06	0.503642	1.000000

It is observed from the matrix that (i)  $Cov(Y_t C_t) = 0$ , (ii)  $Cov(Y_p Y_t) = 0$ ,  $Cov(C_p C_t) = 0$ . These findings are in conformity with Friedman's assumptions in the formation of Permanent Income Hypothesis.

Results of ADF test of unit roots in the permanent parts of income and consumption are given by the Table-5

## VI. STUDY OF STATIONARITY

Taking the anticipated part of variable as a permanent part of the variables concerned we seek to find out the economic relationship between permanent income and permanent consumption.

Results of the Augmented Dickey-Fuller Tests for the presence of Unit roots in the series for Permanent Income (Y<sub>t</sub>) and Permanent Consumption (C<sub>t</sub>) are being presented through the Table-2.

Variable	ADF Test Statistic	Prob.* value	Lag length	1%	5%	10%
Permanent Income at level	-2.539213	0.3085	0	-4.296729	-3.568379	-3.218382
Permanent Income at 1 <sup>st</sup> difference	-5.062459	0.0017	0	-4.309824	-3.574244	-3.221728
Permanent Consumption at level	-1.892987	0.6368	0	-4.243644	-3.544284	-3.204699
Permanent Consumption at 1 <sup>st</sup> difference	-5.699007	0.0002	0	-4.252879	-3.548490	-3.207094

### VII. THE FINDINGS

The Table -2 gives forth the following observations:

Unit Root hypothesis is accepted for Permanent income ( $Y_t^e$ ) and permanent consumption ( $C_t^e$ ) at the level by Augmented Dickey Fuller test. But Unit Root test is rejected for the variable at the 1<sup>st</sup> difference even at 1% level. It means that  $Y_t$  and  $C_t$  become stationary upon 1<sup>st</sup> differencing.

### VIII. CO-INTEGRATION BETWEEN $Y_T$ AND $C_T$

The co-integration between  $Y_t$  and  $C_t$  is studied following Engle-Granger (1987) through the estimation of the following equation 3 and 4 where  $Y_t$  and  $C_t$  are stationary at 1<sup>st</sup> difference.

$$C_t^e = \alpha + \beta Y_t^e + u_t \quad 3$$

$$Y_t^e = \alpha_1 + \beta_1 C_t^e + v_t \quad 4$$

### Estimation of Equation 3 :

$$C_t = -0.007755 + 0.979348 Y_t \quad 5$$

Std (0.037162) (0.006597)  
t-stat (-0.208689) (148.4494)  
Prob (0.8361) (0.0000)

R-Square = 0.998686, Adjusted R-squared = 0.998640,  
Durbin-Watson stat = 1.512766, F-statistic = 22037.23

The result of Augmented Dickey-Fuller Tests for Unit Root test on the residuals  $\hat{u}_t$  are being presented in the Table- 3

TABLE3. AUGMENTED DICKEY FULLER TEST (UNIT ROOT TEST)

Variables	ADF Test Statistic	Prob.* value	Lag length	Mackinnon Critical Value		
				1%	5%	10%
Residual( $u_t$ ) at level	-4.394313	0.0001	0	-2.644302	-1.952473	-1.610211
Residual( $v_t$ ) at level	-4.357157	0.0001	0	-2.644302	-1.952473	-1.610211

This table shows that  $\hat{u}_t$  is stationary. Consequently,

$Y_t^e$  and  $C_t^e$  are cointegrated

### IX. DYNAMICS OF SHORT-RUN SHOCK AND THE STABILITY OF THE LONG-RUN RELATIONSHIP: THE VECTOR ERROR CORRECTION MODEL (VECM)

There exists a long-run relationship between Permanent Income ( $Y_t$ ) and Permanent Consumption ( $C_t$ ) in the economy of Sri Lanka. The stability of such relationship

$$\Delta Y_t = \gamma_1 + \rho_1 Z_{t-1} + \alpha_1 \Delta Y_{t-1} + \alpha_2 \Delta Y_{t-2} + \alpha_3 \Delta C_{t-1} + \alpha_4 \Delta C_{t-2} + \varepsilon_{1t} \quad 6$$

$$\Delta C_t = \gamma_2 + \rho_2 Z_{t-1} + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \beta_3 \Delta C_{t-1} + \beta_4 \Delta C_{t-2} + \varepsilon_{2t} \quad 7$$

### X. RESULTS OF ESTIMATION

The estimated VEC model consisting of equations 6-7 is given by the Table-4.

TABLE4. THE RESULTS OF THE VEC ESTIMATION [ OF EQUATIONS (9) AND (10)

Dependent Variable	Independent Variable	Coefficients	Standard errors	t-Statistics
$\Delta C$	Constant ( $\beta_2$ )	0.042608	(0.01620)	[ 2.62997]
	$Z_{t-1}$	-0.585323	(0.30343)	[-1.92903]
	$\Delta C_{t-1}$	0.345378	(0.28892)	[ 1.19540]
	$\Delta C_{t-2}$	0.045469	(0.24561)	[ 0.18513]
	$\Delta Y_{t-1}$	-0.021296	(0.29143)	[-0.07307]

	$\Delta Y_{t-2}$	-0.045428	(0.24203)	[-0.18770]
R <sup>2</sup> = 0.308603, F-stat = 1.963927, Log likelihood = 69.44346, AIC = -4.531675, SC = -4.246203				
$\Delta Y$	Constant( $\beta_1$ )	0.044080	(0.02080)	[ 2.11940]
	Z <sub>t-1</sub>	0.159240	(0.38953)	[ 0.40880]
	$\Delta Y_{t-1}$	-0.222487	(0.37413)	[-0.59468]
	$\Delta Y_{t-2}$	-0.133210	(0.31070)	[-0.42874]
	$\Delta C_{t-1}$	0.532169	(0.37091)	[ 1.43478]
	$\Delta C_{t-2}$	0.168000	(0.31530)	[ 0.53283]
R <sup>2</sup> = 0.167457, F-stat = 0.885010, Log likelihood = 62.44935, AIC = -4.032096, SC = -3.746624				

## XI. ECONOMIC INTERPRETATIONS OF THE FINDINGS [EQN 6]

1)  $\hat{\rho}_1$  being insignificant (even at 10% level) indicates that short-run shocks, transmitted through the channel of income, does not affect the long-run relationship which permanent income maintained with permanent consumption.

2)  $\rho_2$  being significant (even at 5% level) indicates that the shocks, transmitted through the consumption channel, disturb the long-run relationship that consumption maintained with income.

3) The negative value of  $\hat{\rho}_1$  indicates that permanent consumption, following any shock transmitted through the channel of permanent consumption, declined. Consequently, short-run permanent consumption shocks appeared to pull down permanent consumption from its long-run equilibrium level.

4)  $|\hat{\rho}_1| < 1$  indicates that permanent consumption oscillated around the long-run equilibrium level following short-run permanent consumption shocks and oscillations was not explosive. Thus the long-run relationship which permanent consumption maintained with permanent income was stable.

5) long-run relationship is stable.

6)  $\alpha_i$  and  $\beta_i$  (i = (1,2,3,4)) are the statistically significant event at 10% level implying the absence of causality between anticipated income anticipate consumption.

## XII. SUMMARY OF FINDINGS:

It is, therefore, observed that in the economy of Sri Lanka over the period 1978-2007

(i) the long-run relationship, that permanent consumption maintained with permanent income, was stable. The shocks, transmitted through consumption channel, exert appreciable impact on the long-run relationship. Consequently, the short-run dynamics of permanent consumption defined a 'stable equilibrium process'.

(ii) there did exist no causal relationship running from permanent income to permanent consumption.

## XIII. CONCLUSION

In Friedman's permanent income hypothesis model, the key determinant of consumption an individual's real wealth, not his current real disposable income. Permanent income is determined by a consumer's assets; both physical and human. These influence the consumer's ability to earn income. The consumer can then make an estimation of anticipated life-time income. Consequently, permanent

income fails to be an element in the vectors for factors used for forecasting consumption.

This paper empirically investigated a key stochastic implication of the permanent income hypothesis (PIH) that an income innovation generates the same size revision in consumption as in permanent income. Using time series data for the period 1970-2007, in Sri Lanka, our results point to a strong acceptance of PIH i.e., there is no causal relationship but there is proportional relationship between permanent income and permanent consumption.

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