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Empirical Tests of the Rational Expectations – Permanent Income Hypothesis: Evidence from Pakistan*

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I. INTRODUCTION

The permanent income hypothesis postulates that at a given point in time, an individual's consumption is determined by his lifetime resources and not by his income. Thus, the hypothesis suggests that an individual's consumption will respond only to changes in permanent income. The insertion of the rational expectations theory into Friedman's permanent income hypothesis by Hall (1978), – called the Rational Expectations/Permanent Income Hypothesis (thereafter RE/PIH) – changed this view, and suggested that current aggregate consumption is determined only by its own lag. Any information that may help in determining current consumption is already included in last period's consumption. Hence consumption follows a random walk.

The testable implication of Hall's hypothesis is that apart from the current period's consumption expenditure, any variable observable in this or earlier periods should not show any predictive power for the next period's consumption expenditure. Therefore, additional lagged values of consumption or any other variable that can reasonably be assumed to be in the consumer's information set at time t should not be statistically significant if regressed over current consumption.

Hall's (1978) study, generated considerable debate, and a significant amount of research has been devoted to empirically testing the validity of RE/PIH for developed countries. Most of these studies concluded that consumption is excessively sensitive to income. One possible reason for this excess sensitivity of consumption to income may be the lack of perfect capital markets. If consumers are liquidity constrained, then current income becomes a major determinant of

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current consumption. If this is the case in developed countries, then the validity of RE/PIH for developing countries is very unlikely, as most of these countries do not have well-established financial and capital markets. Not surprisingly, no formal attempt was made to test the RE/PIH for developing countries, till recently Chow's (1985) study which tested the validity of RE/PIH for the People's Republic of China. Chow was not able to reject the hypothesis. However, this result is surprising in the light of the pervasive influence of Central Planning in China. Thus, his findings on Chinas, raised doubts on the general belief that the RE/PIH is difficult to prevail in developing countries, and provided the inputs for further research.

Zuehlke and Payne (1989) used annual time-series data for a sample of eight developing countries to test the hypothesis. Their empirical evidence led them to reject the RE/PIH for all eight countries. Raut and Virmani (1989) pooled data from sixteen developing countries and concluded that the hypothesis is rejected due to the presence of liquidity constrained individuals in their sample countries. Craigwell and Rock (1992) analysed the empirical validity of the RE/PIH for a group of three Caribbean countries and rejected the hypothesis. Thornton (1993), however, failed to reject the validity of RE/PIH for Singapore.[1]

In the case of Pakistan, there are no studies that explicitly test the RE/PIH using time series data. Haque and Montiel (1989) developed a model to test the Ricardian Equivalence Proposition for a sample of developing countries. The RE/PIH became a special case under the restricted model and is rejected for Pakistan. Khalid (1992) also tested the Ricardian Equivalence Proposition by introducing money in the utility function. This model is also tested for a large number of developing countries. Under the restricted version of the model the random walk hypothesis is rejected for Pakistan. This rejection is basically due to the presence of a large number of liquidity constrained individuals. The conventional Life Cycle model tested for Pakistan by Kazmi (1992) also rejects the validity of the RE/PIH.

From the above discussion, it is clear that what is missing is an exclusive test of the RE/PIH for Pakistan. This is the main objective of this paper. The rest of the paper is organised as follows: Section II describes the estimation procedure and data. Results are discussed in Section III. Finally, Section IV contains some concluding remarks.

[1]The RE/PIH is generally rejected in all studies cited above with the exception of Thornton (1993). It appears, however, that Thornton's (1993) study is subject to measurement error. Correcting on measurement error may cast doubt on Thornton's results.

II. ESTIMATION PROCEDURE AND DATA

While evaluating the consumption-income relationship for developed countries, two approaches have generally been used. First is Hall's (1978) forward-looking RE/PIH model. The second is a backward-looking error correction model (ECM) used by Davidson *et al.* (1981). Recent developments in time-series modelling techniques show that both of these approaches depend on the stationarity of the income and consumption series.

The developed country literature in this area uses both approaches but the research can be divided into three broad categories. The first category of research includes studies where Hall's (1978) RE/PIH model is tested by incorporating variables in the consumption function that could potentially influence current consumption. Statistical significance of any variable other than lagged consumption is considered as evidence against the RE/PIH. We call this Hall's (1978) Model. The second category of research is composed of papers along the lines suggested by Flavin (1981). Flavin (1981) extended Hall's (1978) model to suggest that unanticipated changes in current income can lead to revisions in permanent income and therefore to current consumption. Hence, under the RE/PIH only lagged consumption and unanticipated income should be useful predictors of current consumption. Therefore, the significance of expected income variable, or some element of the information set other than lagged consumption is interpreted as evidence against the RE/PIH. We call this Flavin's (1981) Model.

The third category of research originates from Davidson *et al.* (1981) paper. This type of research has become popular due to recent econometric advances in the modelling of time series. The basic idea is to analyse the long-run relationship between consumption and income. If the consumption and income series are stationary in first differences, then the two series may be cointegrated and have an error correction representation. This leads to the empirical investigation of the error correction model (ECM) using cointegration techniques. The RE/PIH may be rejected if the model has an error correction representation.

In this paper the focus of the analysis is mainly on the first two categories.

Hall (1978) Model

Hall's (1978) random walk hypothesis has the simple implication that only consumption lagged one period can predict current consumption. Lagged consumption and other variables such as income are ineffective in determining current consumption. In general, the model may be specified in the following way:

$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \sum_{i=2}^{T} \gamma_i Z_{t-i} + e_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where:

C_t : current period consumption expenditure;

C_{t-1} : previous period's consumption expenditure; and

Z_{t-i} : vector of any other variable lagged one or more periods that may be useful in predicting current consumption.

We used the above specification by employing a combination of different variables as a proxy for the additional information available to economic agents. The simplest model is based on the assumption that $\gamma_i = 0$, i.e.; consumption follows a random walk with drift. Alternative specifications have been tested by using lags of consumption, income, unemployment, and real money balances.[2] The statistical significance of any of these variables would mean the rejection of the null hypothesis, i.e.; RE/PIH. A significant lagged consumption term beyond one period indicates a cyclical pattern of consumption. Significance of lagged income would lead to the conclusion that individuals are liquidity constrained. Significance of the parameters for unemployment rate or real money balances would have the same implication. All these factors would lead to the rejection of the RE/PIH.

DATA

All specifications of Equation (1) are estimated using annual time-series data over the period 1960–92. The variables used in these specifications are private

[2]The following specifications have been used:

$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \eta_t$$
$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_2 C_{t-2} + \gamma_3 Y_{t-1} + \gamma_4 Y_{t-2} + \eta_t$$
$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_2 C_{t-2} + \gamma_5 \Delta Y_{t-1} + \eta_t$$
$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_3 Y_{t-1} + \gamma_4 Y_{t-2} + \gamma_6 Y_{t-3} + \gamma_7 Y_{t-4} + \eta_t$$
$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_2 C_{t-2} + \gamma_8 C_{t-3} + \gamma_9 C_{t-4} + \eta_t$$
$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_{10} M_{t-1} + \eta_t$$
$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_{11} U_{t-1} + \eta_t$$

Where:

C_{t-i} : lagged consumption;

Y_{t-i} : lagged labour income;

M_{t-1} : one period lagged real money balances; and

U_{t-1} : unemployment rates lagged one period.

consumption, labour income, unemployment rate and real money balances. Due to the nonavailability of a decomposition of durable and nondurable consumption expenditure for Pakistan, we used data for private consumption as a proxy for consumption expenditure. Disposable income is used as a proxy for labour income since data on labour income is not available.[3]

The data for all these variables is obtained from various issues of the *Pakistan Economic Survey* and various issues of the *International Financial Statistics*. All variables used are measured in real units using the implicit GDP deflator with base 1980, and then are converted into per capita. In the actual regression the series are used in log form. Since all specifications of the model have a lagged dependent variable. Durbin-*h* statistics is used to test for serial correlation in the estimated equation. In some cases the joint *F*-test is used to test the explanatory power of the variables other than the one period lagged consumption expenditure.

Flavin's (1981) Model

Tests of the type suggested by Flavin (1981) require the estimation of both a consumption function and forecasting equation for income. The forecasting equation determines the expected and unexpected components of income. The consumption function is therefore, estimated in two steps. In the first step, the following forecasting equation for income is estimated using OLS:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \alpha_3 C_{t-1} + \alpha_4 C_{t-2} + V_t \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

In the second step, the predicted value of income from Equation (2) is used to represent the expectations of current income, conditional on information available in the previous period. To ensure an empirically meaningful decomposition of income into its expected and unexpected components, the prediction equation should have a high degree of explanatory power and be free from autocorrelation. OLS is then used to estimate the consumption function of the following form:

$$\Delta C_t = \beta_0 + \beta_1 C_{t-1} + \beta_2 (Y_t - EY_t) + \beta_3 EY_t + u_t \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Similar to the earlier estimation, real per capita private consumption expenditure and real per capita disposable income is used over the period 1960–92.

[3]As an alternative, we used GNP and GDP to proxy for labour income. The results, however, are not altered significantly. The results reported in the next section are based on disposable income as the measure of labour income.

III. RESULTS

Table 1 reports the results of Equation (1) and its six alternative specifications. Surprisingly, the data is unable to reject the RE/PIH for all of the alternative specifications. No variable other than the lagged consumption turns out to be statistically significant. This seems to be a very strong result and is unexpected for a country like Pakistan where a majority of individuals are liquidity constrained.

Table 1

	Equ. 1	Equ. 2	Equ. 3	Equ. 4	Equ. 5	Equ. 6	Equ. 7
Constant	0.22 (0.61)	0.30 (O.83)	0.41 (0.93)	0.56 (1.32)	0.57 (1.21)	0.22 (0.59)	0.81 (1.16)
C_{-1}	0.97* (20.12)	0.69* (2.98)	0.87* (3.38)	0.50* (2.91)	0.83* (3.87)	0.97* (15.92)	0.89* (9.1)
C_{-2}		–0.18 (–0.74)	–0.88 (–0.22)		–0.09 (–0.13)		
C_{-3}			0.16 (0.75)		0.14 (0.51)		
C_{-4}					0.05 (0.22)		
Y^D_{-1}		0.06 (0.14)		0.27 (0.65)			
Y^D_{-2}		0.38 (0.79)		0.05 (0.11)			
Y^D_{-3}				–0.32 (–0.66)			
Y^D_{-4}				0.43 (1.08)			
ΔY^D_{-1}			–0.02 (–0.05)				
M_{-1}						0.007 (0.16)	
U_{-1}							0.01 (0.65)
R^2	0.93	0.93	0.90	0.91	0.89	0.93	0.91
D - W	2.00	1.97	1.92	1.82	1.91	1.997	2.02

The figures in paranthesis are *t*-value.
*Indicates significance at 5 percent.

These results do not support the findings of earlier studies. One possible explanation could be that the estimated equations are not the true specification of the model. If that were the case, then testing the null hypothesis based on Equation (1) is not a valid test in the first place. Further assume that the true specification of the model in the case of Pakistan is what is implied by the permanent income hypothesis (PIH), i.e.:

$$C_t = \gamma_0 + \gamma_1 Y_t^D + e_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1a)$$

then testing the RE/PIH on Equation (1) without having current income (Y_t^D) on the right-hand side may not be valid. This is because whatever impact current income has on current consumption, it is absorbed by lagged consumption.

To explore this further, we used three more specifications of the model both nested and non-nested. In the first scenario, the true model is assumed to be the one consistent with the random walk hypothesis, i.e.; current consumption depends only on its own lag. The second scenario is to assume the pure permanent income hypothesis as the true specification, i.e.; Equation (1a). In the third scenario, the unrestricted case, we use both lagged consumption and current and lagged income as determinants of current consumption.[4] The results are reported in Table 2. It is obvious from these results that current income turns out to be an important determinant of current consumption. A very high *F*- value for the regression shows the explanatory power of the equation. In the second equation, both lagged consumption and current income are statistically different from zero at 5 percent level of significance. The Durbin-*h* statistics is within the acceptance region that rejects any serial correlation in the model. δ_2 is statistically different from zero based on *F*-test. This means that current income is a significant factor in influencing the consumption decisions of economic agents. The last result also shows that both of these variables are statistically different from zero and are equally important for determining current consumption.

[4]The following equations are estimated:

$$C_t = \delta_0 + \delta_1 C_{t-1} + e_t$$

$$C_t = \delta_0 + \delta_1 Y_t^D + e_t$$

$$C_t = \delta_0 + \delta_1 C_{t-1} + \delta_2 Y_t^D + e_t$$

$$C_t = \delta_0 + \delta_1 C_{t-1} + \delta_2 Y_t^D + \delta_3 Y_{t-1}^D + \delta_4 Y_{t-2}^D + e_t.$$

Table 2

Dependent Variable C_t

Variable	Eqn 1	Eqn 1a	Eqn 1b	Eqn 1c
Const	0.22 (0.61)	0.52 (1.29)	0.22 (0.67)	0.15 (0.49)
C_{-1}	0.97* (20.1)		0.53 (4.29)	0.71 (4.80)
Y^D		0.91 (17.8)	0.43 (3.61)	1.10 (3.16)
Y^D_{-1}				–0.63 (–1.48)
Y^D_{-2}				–0.21 (–0.61)
R^2	0.93	0.91	0.95	0.95
DW	2.00	0.64	1.66	1.72
D–h			1.31	1.37
F	404.69	314.99	261.26	141.79
F (4, 26)				7.41
F (2, 28)			4.96	

The figures in paranthesis are *t*-values.

*Indicates significance at 5 percent.

A comparison of Tables 1 and 2 shows that the test of the RE/PIH as specified in Equation (1) may not be a valid test and may lead to misleading conclusions. Our aim in performing these tests is not to support the pure PIH for Pakistan, but rather to see how robust the results are if the RE/PIH cannot be rejected under our specification of the model. It is evident from this exercise that the results obtained in Table 1 are not robust and the inclusion of current income presents completely different findings. This is also consistent with what one would expect in the case of Pakistan.

To further strengthen our results, we now move to the second approach where income is decomposed into its expected and unexpected components.

Flavin's (1981) methodology as discussed in Section 2 requires the estimation of a forecasting equation for income Equation (2) and then the consumption function itself Equation (3). The results are reported in Table 3. Estimated of the forecasting equation for income are provided in the second column of Table 3. The adj-R^2 and *F*-statistics show a high degree of explanatory power for this

equation. Since this is only a forecasting equation, we are less concerned about the significance of the parameter estimates. The Durbin Watson statistic indicates a lack of serial correlation. Recall that in the second stage, we used the forecasted value of Y_t^D in Equation (3). These results are reported in the last column of Table 3. Again the estimated equation shows a reasonable degree of explanatory power. The *F*-statistics for the significance of the regression is significant at the 1 percent level. The RE/PIH would imply that only current unexpected income should influence current consumption. In other words the parameter for current expected income should be insignificant under the null hypothesis. Our results are contrary to this, and both parameters for current unexpected and expected income are

Table 3

Dependent Variable ΔC_t

Variable	Eqn 2	Eqn 3
Const	0.12	0.24
	(0.68)	(0.80)
Y^D_{-1}	0.79	
	(3.65)	
Y^D_{-2}	0.32	
	(1.38)	
C_{-1}	–0.13	–0.39*
	(–1.21)	(–3.12)
C_{-2}	0.006	
	(0.05)	
$Y - EY$		1.11*
		(3.23)
EY		0.35*
		(2.92)
R^2	0.99	0.36
DW	1.98	1.72
F (4, 26)	506.31	
F (3, 27)	404.69	6.74
F (2, 28)		2.52
F (2, 25)		4.33

The figures in paranthesis are *t*-values.

*Indicates significance at 5 percent.

statistically different from zero with estimated t-statistics of 3.23 and 2.92 respectively. Further, the computed F-statistics does not allow us to reject the hypothesis that consumption responds only to current income.

IV. CONCLUSION

Empirical testing of the validity of RE/PIH for Pakistan has been neglected due to a general belief that market conditions are not consistent with what the RE/PIH would require. Nevertheless, such conjectures should be subjected to empirical testing. This paper is a first attempt in empirically testing the RE/PIH in Pakistan. The aim of this paper is not to reject the hypothesis *a priori*, but rather to provide evidence using the time-series data on all possible specifications of the consumption model. The statistical evidence presented in this paper does not support the RE/PIH for Pakistan. Interestingly, the paper finds that performing Hall's test without incorporating any measure of current income for Pakistan data may provide misleading results. The hypothesis is rejected when current income is included in the specification. The paper finds consistent results when income is decomposed into unexpected and expected components.

In the next phase of this ongoing research endeavour we propose to test the long-run relationship between income and consumption by performing the stationarity and cointegration tests. If the two series are cointegrated, they should have an error correction representation. An error correction model will then be developed to analyse short-run dynamics. This phase of research is currently under way.

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