

## EMPIRICAL TESTING OF PERMANENT INCOME HYPOTHESIS FOR PAKISTAN AND U.S ECONOMIES

M. Fahad MALIK\* and Muhammad Mazhar IQBAL\*\*

### Abstract

The permanent income hypothesis (PIH) has been empirically tested widely, but, the results are mixed. The probable reason for mixed results is different methodologies that make different underlying assumptions. The underlying assumptions are often contrary to the spirit of PIH. Moreover, some studies have tested it for a developed country or a set of developed countries, while others have tested it for a developing country or a set of developing countries. Therefore, this study applies both methods and uses the data of a developed country, such as the USA and of a developing country, such as Pakistan. The results show that PIH provides a good approximation of consumption decisions in both economies.

*Keywords:* Permanent Income Hypothesis, Cointegration Analysis, Structural Decomposition, Permanent Shock, Transitory Shock.

*JEL Classification:* E1, E6.

### I. Introduction

A well-established theory of consumer behaviour called the Permanent Income Hypothesis (PIH) states that individual households change their consumption behaviour in response to changes in their permanent income [Friedman (1957), Hall (1978), Hall and Mishkin (1982) and Bernanke (1984)]. Any temporary change in their income has little effect on their consumption pattern [Hsieh (2003)]. In order to estimate their permanent income, individuals have to forecast their future income streams first and then select an appropriate discount factor to get the present value of forecasted future income streams. The discount factor should duly incorporate risk and uncertainty about future income streams. Hardly any data source compiles information on these two variables because forecasting future income streams and selecting of a suitable discount factor depends upon subjective judgment and many simplifying assumptions [Deaton (1992) and Ireland (1995)].

\* Lecturer, Department of Economics, The Islamia University of Bahawalpur, Bahawalpur, \*\* Professor, Faculty of Management and Social Sciences, Capital University of Science and Technology, Islamabad, Pakistan.

Although this difficulty in the estimation of the numerical value of permanent income does not render PIH a useless theory because there is an indirect way to overcome this problem. PIH suggests that people adjust their consumption behaviour only after a change in their permanent income; it implies that permanent income and consumer expenditures are cointegrated. In other words, an observed change in consumer expenditures indicates that consumers have perceived a change in their permanent income, even though they might not have estimated it numerically. Consequently, macroeconomic research establishes that changes in permanent income can be estimated from observed changes in consumer expenditures.

According to PIH, a change in observed income that does not alter the consumption pattern of households is treated as transitory. It is known as transitory or income shock in the literature. On the contrary, a change in observed income that changes the consumption pattern of households is treated as permanent income. It is known as permanent or consumption shock in the literature [Cochrane (1994)]. To verify PIH, one method is to collect time series data on consumption and income and then test for cointegration or long-run relationship between the two variables [King, et al., (1991) and Cochrane (1994)].

The permanent income hypothesis originated from Fisher's (1907) theory of interest. Friedman (1957) generalized the two period's intertemporal utility maximization concept into a lifetime concept. In Friedman's version, the household is assumed to make consumption decisions in any period based on the present value of the lifetime income. The present value of the lifetime income is assessed in each period.

The total income is assumed to be decomposed into two parts. One part of the expected income is permanent, and the other is transitory. The permanent part of income is defined as the portion that, if received with certainty in each period, has a present value equal to the actual path of the household's lifetime income.

The permanent income hypothesis has two important implications. First,  $y^p$  is the income assumed to be received by the household and it is intuitive to deduce that the household makes consumption decisions based on permanent income. Consumers are assumed to make consumption decisions on the basis of permanent income rather than expected lifetime consumption can be related to expected lifetime income.

One method to test the permanent income hypothesis is to estimate the long-run coefficient of average income on average consumption in the framework of cointegration. Since average consumption and average income are more closely related to theoretical concepts of permanent income and consumption, the cointegration approach comes in handy for the estimation and evaluation of the permanent income hypothesis.

Figure A-1 (appendix) shows time series plots for real disposable personal income and private consumption for the economy of Pakistan.

Where:

YPak = personal disposable income for the economy of Pakistan.

CPak = Private consumption expenditure for the economy of Pakistan.

The co-movements in the data series are apparent. It can be seen that large swings in personal disposable income and consumption are also proving this evidence. This figure also shows that a decrease in private consumption leads to a reduction in personal disposable income for the economy of Pakistan. Since consumption is the largest component of aggregate demand, this leading effect of consumption for income is not surprising.

Figure A-2 (Appendix) presents personal disposable income and personal consumption expenditure for the economy of the U.S. YU.S. shows a time series plot for personal disposable income for the U.S. economy and CU.S. presents a time series plot for personal consumption expenditure for this economy. The co-movements are also present in this Data showing interlinks between these variables. Values for all variables for both economies are in their respective local units, i.e., values for the economy of Pakistan are in rupees and values for the U.S. economy are in dollars.

The Second implication is that households can borrow in any period to increase consumption in that period if permanent income is anticipated to increase in the future. In other words, households will save less in such a situation. On the other hand, the household is assumed to save more when there is an expected decline in future lifetime income.

The second implication of the permanent income hypothesis has serious consequences. Since households facing liquidity constraints cannot borrow even when the household is expecting a rise in expected lifetime future income; as a result, the household must rely upon its current resources instead of lifetime expected future income. The permanent income hypothesis might not hold for an economy where a major portion of households is facing liquidity constraints. For a developed economy, a recessionary phase can be a reason for liquidity constraints. On the other hand, imperfections of financial markets and underdevelopment can be the major sources of liquidity constraints for developing economies.

Friedman also assumed that permanent components of income and consumption are uncorrelated with their respective transitory components. This assumption establishes zero correlation between transitory components of consumption and income. These assumptions can be stated in the following expression in Equation (1):

$$\rho_{y_t y_p} = \rho_{c_t c_p} = \rho_{y_t c_t} = 0 \quad (1)$$

Where Subscripts  $y_t$  and  $c_t$  are transitory components of income and consumption, and  $y_p$  and  $c_p$  are permanent components of income and consumption.

- $\rho_{y_t y_p}$  = Coefficient of correlation between transitory and permanent components of income.
- $\rho_{c_t c_p}$  = Coefficient of correlation between transitory and permanent components of consumption.
- $\rho_{y_t c_t}$  = Coefficient of correlation between transitory components of income and consumption.

The decomposition of income is easy to handle in the framework of PIH. This is due to the assumption of zero correlation between transitory income and transitory consumption. Accordingly, it is easy to assume that at least permanent consumption does not respond to unexpected changes in transitory income. Once this assumption is imposed in the form of restriction in VECM, then structural decomposition of income can easily be done. It is because in a system of equations with two variables, only one restriction is required to uncover structural shocks.

The impacts of different shocks that result from unexpected changes are projected on each variable through the impulse response function or the decomposition of the variance of residuals. If PIH provides a valid depiction of the economy, then permanent shock should dominate its effect, whereas transitory shock should have a fleeting effect on income.

### *1. Motivation of the Study*

PIH is a well-established theory of consumer behaviour, but its validity remains intact irrespective of resource structure, or it is valid for developed economies only where incomes are much more certain. Since developed economies have sufficient resources to provide buffers against income uncertainty that arise at the macroeconomic level, no such buffers can be imaged in developing economies. This study tries to capture this aspect by testing the validity of PIH for the most productive and resourceful economy of the world, i.e., the U.S. economy with the economy of Pakistan with very meagre resources to avoid income uncertainty.

Consequently, if PIH holds true as a valid theory for explaining consumer behaviour for both economies, then one can assume that PIH provides a good depiction of consumer behaviour irrespective of resource structure. More importantly, in such a scenario, it can be deduced that PIH holds true irrespective of differences in resource structures and does not dependent on income uncertainty. Consequently, it will yield a robustness check for this theory as it can be inferred that PIH remains valid even for economies with no or minimal buffer against income uncertainty.

Therefore, this study fills the gap in the literature by providing a comparative empirical analysis for one of the world's most developed nations with a developing economy. Like many other developing economies, Pakistan is marred with political uncertainty, making its aggregate income uncertain due to internal recurrent political disturbances. Off course, these income uncertainties that result from political upheavals can be seen in fluctuating stock indices, vulnerable foreign direct investment, increasing public debt, imposition of external sanctions and absence of viable long-term economic policies are quite evident for this economy.

Accordingly, the simultaneous existence of PIH as a valid depiction of consumer behaviour for a stable economy with well-established institutional norms and for an economy known for repeatedly moving off course from the path of democracy provides

a valid check for the robustness of this theory. Furthermore, this theory does not only test the validity of PIH through direct estimation of models but also the implications of PIH by imposing structural restrictions from PIH that are well-established in the empirical literature. The validity of PIH is tested directly and also indirectly.

The structure of the paper is as follows: After an introduction in Section I, Section II provides a concise overview of the existing literature. Section III outlines the methodology employed in the study, while Section IV elucidates the data analysis techniques. Finally, Section V presents the study's conclusion along with future implications.

## **II. Literature Review**

The literature review is elaborated into two subsections, literature on the permanent income hypothesis and the decomposition of income.

### ***1. Literature on Permanent Income Hypothesis***

PIH, from its advent, has been tested rigorously for developed economies in general and for the U.S. economy in particular. The empirical studies have shown mixed results. Hall (1978) showed PIH as a good depiction of consumers' behaviour in the U.S. economy as past consumption contained all the information regarding current consumption. However, this study accepted the validity of PIH for the U.S. economy but failed to explain the predictability of consumption through stock prices. Cochrane (1994) showed income is predictable in the presence of consumption, and consumption is a random walk for the U.S. economy. Therefore, PIH was declared as a satisfactory theory of consumer behaviour. Nevertheless, this study showed that income shock explained significant variation in the GNP of this economy over the long horizon, which is at odds with the implication of PIH.

Ireland (1995) found a reduction in U.S. savings before the increase in income as valid proof of the existence of PIH in the U.S. economy. However, this study established the validity of PIH using the implication of PIH instead of directly testing and evaluating it for consumer behaviour. Dejuan and Seater (2006) found a positive link between consumption and permanent income in U.S. economy. Although this study also tested the validity of PIH using the implication of this theory instead of establishing a direct link between consumption and permanent income.

Nelson and Plosser (1982) and Campbell and Mankiw (1987) found a tiny portion of income that is predictable. Accordingly, they suspected PIH based on smooth consumption in relation to volatile income. However, both studies tested the implications of PIH without involving consumption and income simultaneously for the construction of their models. Campbell and Mankiw (1989) found half of the population in U.S. and G7 countries makes their consumption decisions on the basis of permanent income. This study employed instrumental variables approach to test PIH against the hybrid

model. This study concludes that the hybrid model is a good depiction of consumer behaviour for these economies because consumption responds to changes in interest rates. The responsiveness of changes in consumption to changes in interest rate may be due to underlying income uncertainty that results from changes in interest rate. Therefore, consumption is possibly not responding to interest rate changes but to income changes which this study failed to test.

Parker (1999) contradicted the presence of PIH as consumers in the U.S. economy changed their consumption patterns in response to predictable changes in income. However, changes in durables consumption expenditure were observed, which might suggest that households are waiting for such a rise in pay to meet such expenditures. Since the rise in income though expected, but large and for a shorter period of time, meeting expensive expenditures might be an anomaly for a shorter time span instead of a regular deviation from PIH. Morley (2007) found U.S. consumption too smooth and unrelated to volatile permanent income. Although this study used consumption expenditure on non-durables which might not be responding much to income volatility and due to this reason, consumption could appear to be smoother than income.

A brief review of the literature presented above for the U.S. economy clearly shows that there is no consensus regarding PIH as a valid case for the U.S. economy. Since PIH makes some strong assumptions, such as uncorrelated components of permanent and transitory income and the absence of liquidity constraints, once these assumptions are violated, the permanent income hypothesis cannot be assumed to hold. For example, if the future income forecast is highly uncertain for a significant portion of total consumers, then that portion has to rely upon their current income [Campbell and Mankiw (1989)]. Similarly, the correlation between permanent and transitory components of income can lead to the rejection of PIH [Morley (2007)].

Very few studies are available on the permanent income hypothesis for the economy of Pakistan. Khan and Che (2012) found a major portion of consumers in Pakistan make consumption decisions on the basis of current income. On the other hand, Yousafzai (2015) found PIH correctly specified consumers' behaviour for the economy of Pakistan. The main problems with Khan and Che (2012) study are the shorter span of the data set and the use of GDP as a proxy for labour income. Since GDP does not reflect real income available for personal consumption, results can be biased.

## ***2. Literature on the Decomposition of Income***

The decomposition of income into permanent and transitory components has a long history in macroeconomics. However, initial studies relied heavily on statistical techniques. These techniques were based on the regression of income on trend as a long-run component of income and residual as a cyclical component. Earlier instances of these studies are Bodkin (1969), Lucas (1973), Sargent (1978), and Taylor (1979). Nelson and Plosser (1982) suggested U.S. income contains a stochastic trend instead

of a deterministic one. The work of Nelson and Plosser (1982) is further investigated and refined by Campbell and Mankiw (1987a), Clark (1987), and Cochrane (1988), among others.

The use of economic theory, in which output and unemployment are used for the permanent and transitory decomposition of U.S. income, can be traced back to the studies of Campbell and Mankiw (1987b), Evans (1989), Clark (1989), and Blanchard and Quah (1989). Cochrane (1994), Elwood (1997), Kim, et al., (2007), and Gonzalo, et al., (2008), among others, used consumption information as the basis of the decomposition of U.S. GNP.

Like the permanent income hypothesis, in the context of Pakistan, few studies have been done on the decomposition of income. Arby (2001) decomposed the GDP of Pakistan using the HP filter and revealed the lasting effect of supply-side disturbances on the GDP of Pakistan. Bukhari and Khan (2008) found output gaps of alternate cycles of excess supply followed by cycles of excess demand for this economy. Tahir (2014) also observed that positive and negative output gaps alternate each other for the economy of Pakistan.

Above mentioned studies point out that acceptance/rejection of PIH depends on variables used to represent labour income, uncertainty about future income, and liquidity constraints faced by workers. It can be hoped that a larger data set for Pakistan with rightly representative variables can provide a better picture. A comparative analysis is provided. The results are compared for Pakistan and U.S. to find whether PIH holds in these economies despite vast differences in resource structures. Hence, more generality regarding PIH can be developed as a valid theory of consumption once it holds true for both economies.

### **III. Methodology**

The methodology comprises two main components, data and Testing of PIH. The Data provides an overview of the dataset employed to evaluate the Permanent Income Hypothesis (PIH) validity. The Testing of PIH concentrates on the implementation of econometric modeling techniques.

#### ***1. Data***

To test PIH empirically, time series data on private disposable income and private consumption expenditures have been collected from 1973 to 2015 for the economy of Pakistan. Data on personal disposable income and personal consumption, which spans from 1973 to 2015, is employed for the U.S. economy. Data for the Pakistan economy has been taken mainly from the Handbook of Statistics 2010 issued by the State Bank of Pakistan and it has been updated from subsequent issues of the Pakistan Economic Survey issued by the Government of Pakistan. The data on two variables



has been deflated by the 2000 GDP deflator to convert it to constant prices. The source of data for U.S. is the Federal Bank of Saint Louis. Data for U.S. economy is also computed at 2000 prices. The frequency of time series data sets for both economies is annual.<sup>1</sup>

### a) Generation of Data

It is important to explain that data on these variables were taken in nominal terms. The GDP deflator for each economy is converted to the year 2000 as a common base for each economy. Each nominal variable is then multiplied by the GDP deflator of the base year and divided by the GDP deflator of the current year to convert nominal variables into real variables. It is also important to explain that data on personal disposable income is computed by subtracting income taxes from nominal income and then converting it into a real variable using the method mentioned earlier for the economy of Pakistan.

## 2. Testing of PIH

PIH is tested through the cointegration method and decomposition of income method—details of these methods as given below.

### a) Testing of PIH through the Cointegration Method

The first step to obtaining the long-run impact of income on consumption through the vector error correction model (VECM) is to check the stationarity of data. The augmented Dickey-Fuller (ADF) test is conducted to test the stationarity of the variables involved in this study. The second step is to test the appropriate lag length of a VAR model containing variables in level form. Information criteria such as Akaike Information Criterion (AIC), Final Prediction Error (FPE), Schwarz Criterion (SC) and Hannan-Quinn Criterion (HQ) are employed for the selection of appropriate lag-length.

Testing of cointegration is the last step before the estimation process of regressions on consumption and income for a VECM model. Johansen's (1988) procedure relies heavily on the relationship between the rank of a matrix and its characteristic roots [Anders (2009)]. For a given model like Equation (2):

$$\Delta X_t = A_0 \prod X_{t-1} + \sum_{i=1}^p A_{1i} \cdot \Delta X_{t-i} + \varepsilon_t \quad (2)$$

<sup>1</sup> Source of Data for Nominal Income of Pakistan: [https://www.sbp.org.pk/departments/stats/PakEconomy\\_HandBook/Chap-1.1.pdf](https://www.sbp.org.pk/departments/stats/PakEconomy_HandBook/Chap-1.1.pdf); Source for private consumption for Pakistan: [https://www.sbp.org.pk/departments/stats/PakEconomy\\_HandBook/Chap-1.4.pdf](https://www.sbp.org.pk/departments/stats/PakEconomy_HandBook/Chap-1.4.pdf); Source for personal disposable income for U.S. economy: <https://fred.stlouisfed.org/series/DSPI>; Source for personal consumption expenditure for U.S.: <https://fred.stlouisfed.org/series/PCE>.



Where  $X$  is the vector of endogenous variables and  $A_0$  is the vector of constants. In Equation (2)  $\Pi$  is the matrix that contains the adjustment coefficients and coefficients of the long-run relationship.  $A_{II}$  is the matrix of coefficients related to the first difference of variables contained in the vector  $X$  and  $\varepsilon_t$  is the vector of residuals.

The rank of a matrix denoted by  $\pi$  shows the number of cointegrating vectors. The test for the number of characteristic roots that are significantly different from zero can be conducted using the following two test statistics in Equation (3) and (4).

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \lambda^i) \quad (3)$$

$$\lambda_{max} = -T \ln(1 - \lambda^{\hat{\lambda}}) \quad (4)$$

Where  $\lambda^{\hat{\lambda}}$  the estimated values of characteristic roots, also known as eigenvalues, are obtained from the  $\pi$  matrix and a total number of observations denoted by  $T$ . For distinct cointegrating vectors ( $r$ ), these statistics are called  $\lambda$ -trace and  $\lambda$ -max. The null and alternative hypotheses for the  $\lambda$ -trace are given as:

$$\begin{aligned} H_0: & \text{Cointegrating Vectors} \leq (r) \\ H_1: & \text{Co-integrating Vectors} > (r) \end{aligned}$$

Similarly, the null and alternative hypotheses for  $\lambda$ -max are given as: -

$$\begin{aligned} H_0: & \text{Cointegrating Vectors} = (r) \\ H_1: & \text{Co-integrating Vectors} = (r+1) \end{aligned}$$

The critical values for these statistics are calculated by the Monte Carlo approach.

When two variables are integrated of order one, and there exists a linear combination that is stationary, then there exists a cointegrating relationship between them. This cointegrating relationship should be included in the functional form, as the exclusion of the cointegrating term from the model would lead to a misspecification of the model. Consider the following functional forms in Equation (5) and (6):

$$\Delta c_t = \alpha_c (c_{t-1} - \beta_{12} \cdot y_{t-1}) + \sum_{i=1}^p \alpha_{11}(i) \cdot \Delta c_{t-i} + \sum_{i=1}^p \alpha_{12}(i) \cdot \Delta y_{t-i} + \varepsilon_{ct} \quad (5)$$

$$\Delta y_t = \alpha_y (c_{t-1} - \beta_{12} \cdot y_{t-1}) + \sum_{i=1}^p \alpha_{21}(i) \cdot \Delta c_{t-i} + \sum_{i=1}^p \alpha_{22}(i) \cdot \Delta y_{t-i} + \varepsilon_{yt} \quad (6)$$

where  $\Delta$  is the change in endogenous variables consumption ( $c$ ) and income ( $y$ ). These variables entering the model in log forms, i.e., natural logarithms, are taken so that one can achieve interpretations of coefficients of these variables in terms of elas-

ticity.<sup>2</sup> The term  $(c_{t-1} - \beta_{12} \cdot y_{t-1})$  is the linear combination of I(1) variables which are consumption and income in this case. If this linear combination turns out to be 1(0), then there exists a cointegrating relationship between these variables. Equations (5) and (6) together make a system which is stationary in the presence of cointegration even though, individually, these variables are non-stationary.  $\alpha_y$  is the adjustment parameter for variable 'y', i.e. how quickly variable 'y' adjusts towards the equilibrium once it deviates from the equilibrium. The same is true for the adjustment parameter of variable  $c$ . Here  $\beta$  is the vector of cointegrating coefficients.

### ***b) Testing of PIH through Decomposition of Income***

Another way can be employed to test the implications of the permanent income hypothesis. For example, if the permanent income hypothesis holds, then an identification scheme can be imposed to retrieve structural shocks. Cochrane (1994) proposed an orthogonalization scheme based on the implication of PIH that makes consumption invariant to contemporary income shock. Such an identification scheme helps in the decomposition of income into permanent and transitory components. The resulting structural model can be presented as:

$$\begin{vmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{vmatrix} = \begin{vmatrix} a & 0 \\ b & c \end{vmatrix} \begin{vmatrix} U_{ct} \\ U_{yt} \end{vmatrix}$$

Above mentioned structure implies that consumption is unaffected by contemporaneous income shock, whereas contemporaneous income and consumption shocks can alter the level of GDP.

We can define the impulse response in Equation (7):

$$\phi_i = \frac{\partial X_t}{\partial \epsilon_{t-i}} \quad (7)$$

Where  $i=1,2,\dots$ , and  $X_t$  is a vector of endogenous variables. So, the coefficients  $\phi_i$  give the response of a variable in reaction to a shock ( $\epsilon$ ). We can obtain the cumulative response by adding all the effects of structural shocks on  $Z_t$ . The impulse response functions from identified VECM are obtained by imposing zero contemporaneous response of consumption to income shock.

The  $n$  period forecast error  $X_{t+n} - E_t X_{t+n}$  is given in Equation (8):

$$X_{t+n} - E_t X_{t+n} = \sum_{i=0}^{n-1} \phi_i \epsilon_{t+n-i} \quad (8)$$

Given that  $X_t$  is the vector of endogenous variables  $c$  and  $y$ . Separating the  $n$ -step-

<sup>2</sup> Cochrane (1994) is an earlier example for exploring consumption-income relationship using cointegration approach.

forecast error for variable 'y' we obtain in Equation (9),

$$y_{t+n} - E_t y_{t+n} = \phi_{11}(0)\varepsilon_{y_{t+n}} + \phi_{11}(1)\varepsilon_{y_{t+n-1}} + \dots + \phi_{11}(n-1)\varepsilon_{y_{t+1}} + \phi_{12}(0)\varepsilon_{c_{t+n}} + \phi_{12}(1)\varepsilon_{c_{t+n-1}} + \dots + \phi_{12}(n-1)\varepsilon_{c_{t+1}} \quad (9)$$

Taking the variance of Equation (9), we get Equation (10),

$$\sigma_y(n)^2 = \sigma_y^2 [\phi_{11}(0)^2 + \phi_{11}(1)^2 + \dots + \phi_{11}(n-1)^2] + \sigma_c^2 [\phi_{12}(0)^2 + \phi_{12}(1)^2 + \dots + \phi_{12}(n-1)^2] \quad (10)$$

The above equation shows the forecast error variance. We can decompose n-step-ahead forecast error variance into proportions due to each shock. So forecast error variance decomposition shows the proportion of movements into a sequence due to its shocks against shocks to other variables. The structural shocks are identified with the application of structural decomposition. The variance decomposition is also done on the basis of the above-posed identification.

The identification of shocks into permanent and transitory components has a natural interpretation in the context of PIH. An income shock that fails to affect consumption can be treated as transitory. Henceforth, movements in income that result from transitory shock can be treated as transitory and movements in income that result from permanent shock can be treated as permanent.

#### IV. Estimation Results

The estimation results present the outcomes of both testing methods for assessing the Permanent Income Hypothesis (PIH). These include the results obtained from the cointegration method and the findings from decomposing income data into transitory and permanent shocks using the VECM model. Additionally, the projected impacts of these shocks on consumption and income are examined through impulse response functions and variance decomposition.

##### 1. *Results of the Cointegration Method*

The Results of the Cointegration Method consist of four main sections. Firstly, we present the outcomes of the ADF unit root test. Secondly, we discuss the results of the lag-length selection criteria. Next, we present the findings of the cointegration test. Lastly, we depict the parameters that demonstrate a long-run relationship between consumption and income.

##### a) Results of Unit Root Test

Table 1 shows the results of the ADF unit root test for income of both countries at a level and first difference.

**TABLE 1**  
Results of ADF Unit Root Test

	$Y_{pak}$ at level	$Y_{pak}$ at First Difference	$Y_{USA}$ at level	$Y_{USA}$ at First Difference	$C_{pak}$ at level	$C_{pak}$ at First Difference	$C_{USA}$ at level	$C_{USA}$ at First Difference
ADF Calculated								
	-2.134581	-6.295365	-11.14537	-5.838629	-2.931756	-6.443761	-1.676069	-3.880542
Level of signifi- cance	ADF Critical Values							
1%	-4.192337	-3.600987	-2.62119	-3.60099	-4.19234	-3.60559	-3.59662	-3.60099
5%	-3.520787	-2.935001	-1.94889	-2.935	-3.52079	-2.93694	-2.93316	-2.935
10%	-3.191277	-2.605836	-1.61193	-2.60584	-3.19128	-2.60686	-2.60487	-2.60584

Source: Authors' estimation.

Since ADF critical values for the private disposable income of Pakistan ( $Y_{pak}$ ), disposable personal income of USA ( $Y_{USA}$ ), private consumption of Pakistan ( $C_{pak}$ ), and personal consumption of USA ( $C_{USA}$ ) at levels are less than corresponding ADF calculated values at all three levels of significance (1, 5 and 10 per cent) for each of these data series; therefore it is concluded that these variables are not stationary at level. Furthermore, ADF critical values for  $Y_{pak}$ ,  $Y_{USA}$ ,  $C_{pak}$  and  $C_{USA}$  at the first difference, are greater than ADF calculated values at all three levels of significance for each of these data series; therefore, it is concluded that these variables are stationary at first differences.

#### ***b) Results of Lag Selection Criteria***

The results of the four most commonly used lag-length selection criteria of the Akaike Info Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion

**TABLE 2**  
Selection of Lag Length

	<i>Optimal Number of Lags for Pakistan Economy (searched up to 8 lags of levels)</i>		<i>Optimal Number of Lags for U.S. Economy (searched up to 8 lags of levels)</i>	
Akaike Info Criterion	1		Akaike Info Criterion	2
Final Prediction Error	1		Final Prediction Error	2
Hannan-Quinn Criterion	1		Hannan-Quinn Criterion	2
Schwarz Criterion	1		Schwarz Criterion	1

Source: Authors' estimation.

(HQ) and Schwarz Criterion (SC) have been obtained by estimating the VAR model. These criteria are used for Pakistan and U.S economies for both private consumption and private disposable income in the case of Pakistan and personal consumption and personal disposable income for the U.S. These results are shown in Table 2.

All criteria select one lag length for the economy of Pakistan. Except for SC criterion, all other criteria select two lag lengths for the U.S. economy.

### c) *Results of the Cointegration Test*

The cointegration test is run on the basis of the following equation that shows VECM in its compact form shown in Equation (11).

$$\Delta X_t = (A_{02} + \Pi X_{t-1}) + \sum_{i=1}^n A_{1i} \Delta X_{t-i} \quad (11)$$

Here  $X_t$  is the vector of endogenous variables, private consumption and private disposable income for Pakistan and personal consumption and personal disposable income for the U.S economy. Table 3 shows the results.

**TABLE 3**

Cointegration Test for Consumption and GDP in Pakistan and USA

<i>Johansen Trace Test for Pakistan Economy</i>				<i>Johansen Trace Test for U.S. Economy</i>			
<i>sample:</i>		<i>[1973, 2015], T = 43</i>		<i>sample:</i>		<i>[1973, 2015], T = 43</i>	
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value
None*	0.543105	34.79123	20.26184	None *	0.314723	17.16173	15.49471
At most 1	0.063181	2.675890	9.164546	At most 1	0.039831	1.666492	3.841466

*Source:* Authors' estimation.

For Pakistan's economy, since the calculated value of the  $\lambda$ -trace statistic is 34.79, which is greater than its corresponding critical value of 20.26; therefore we reject the null hypothesis of no cointegration between income and consumption and accept the alternative hypothesis of at least one cointegrating equation between them. For the U.S economy, the calculated value of the  $\lambda$ -trace statistic, 17.16, is also greater than its corresponding critical statistics, 15.49; therefore, we reject the null hypothesis and accept the alternative one.

Furthermore, the model for each economy is selected based on information criteria in order to get the best model. Therefore, AIC and SC show that a model with no drift in the deterministic component but constant in the cointegrating vector is best among other standard models for Johansen's (1988) cointegration procedure. On the

other hand, the lowest values of AIC and SC for U.S. economy are for a model that incorporates drift in a cointegrating vector along with a constant in the deterministic part.

***d) Results of Long Run Relationship***

Values for the cointegrating vector for Pakistan's data after normalization are given as,

$$\beta = \begin{pmatrix} \beta_{11} & 1 \\ \beta_{12} & -1.07 \end{pmatrix}$$

Results for  $\beta$  vector reveal that a one per cent increase in the private disposable income of Pakistan would increase private consumption in the long run by 1.07 per cent for this country with a standard error of 0.08. The restricted cointegrated vector with the imposition of one to one relationship between private consumption and private disposable income of Pakistan is not rejected. Hence, it seems PIH provides a valid explanation for the private consumption behaviour of Pakistan.<sup>3</sup>

The next step for testing the validity of PIH for this economy is through parameters of the speed of adjustments. The values for the economy of Pakistan are given as follows.

$$\alpha = \begin{pmatrix} \alpha_c & 0.075 \\ \alpha_y & 0.080 \end{pmatrix}$$

The values of t-statistics are 5.04 and 6.54, respectively. It implies that neither of these variables can be described as weakly exogenous. Therefore, the construction of two equations cointegrating systems is justified. The PIH, in its complete prevalence in describing consumer behaviour, also requires that the transitory part make all the adjustments that do not seem to be the case for the economy of Pakistan. One can accept PIH as an approximation, but not in its absolute dominance for explaining consumer behaviour for this economy.

The normalized values of the cointegrating vector for US data are given as.

$$\beta = \begin{pmatrix} \beta_{11} & 1 \\ \beta_{12} & -1.06 \end{pmatrix}$$

It is evident from the results that a one per cent increase in personal disposable income leads to a 1.06 per cent increase in personal consumption with a standard error of 0.007. The restricted vector of a one-to-one long-run relationship is not accepted by the likelihood ratio (LR) test. It seems that PIH, at most, is an approximation of consumption behaviour for U.S. economy.<sup>4</sup>

<sup>3</sup> Raut and Virmani (1989) found PIH as a good depiction of consumer behavior for twenty-three developing economies.

<sup>4</sup> Madsen and McAleer (2001) showed that consumption is smoothed relative to permanent income for twenty-two The Organization of Economic Cooperation and Development OECD.

For the U.S. economy, estimated values of parameters for the speed of adjustment are given below. The values of t-statistics for the coefficients are -2.02 and 1.12, respectively. Therefore, an error correction mechanism seems to exist for this economy, but all error correction is from consumption. So it seems that PIH is, at best, an approximation and does not hold in its complete prevalence for explaining consumer behaviour for this economy.

$$\alpha = \begin{pmatrix} \alpha_c & -0.40 \\ \alpha_y & 0.20 \end{pmatrix}$$

Above results can be used for the decomposition of income by appropriate restrictions implied by PIH. According to the implication of PIH, the permanent shock of consumption should be dominant in comparison with temporary income shock.

## ***2. Results for Decomposition Method***

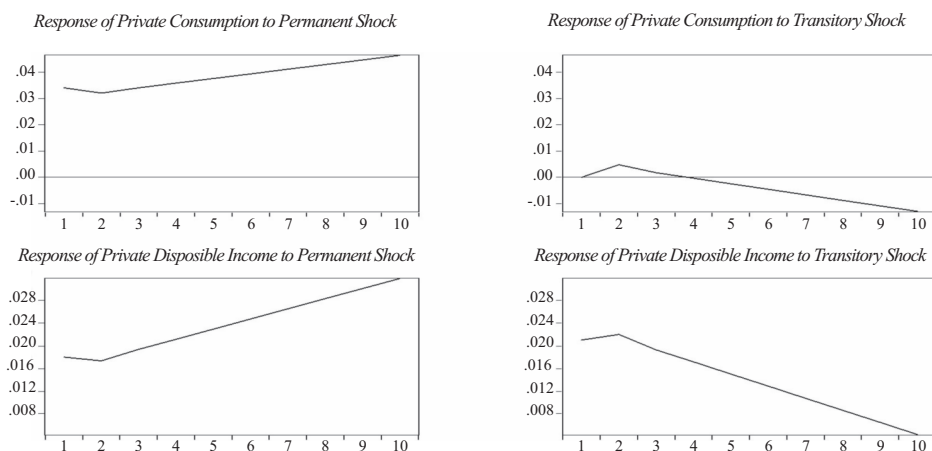
The decomposition of income is done by imposing theoretical restrictions in the VECM model. In this study, these restrictions have been framed in light of results from VECM. The decomposition is done by imposing zero contemporaneous impact of income or temporary shock in the VECM model. Then the impact of temporary and permanent shocks has been portrayed through the impulse response function, and its results are shown below. The impact of these shocks is also captured through the disaggregation of residuals' forecast variances.

### ***a) Results of Impulse Response Function***

Impulse responses to one standard deviation temporary and permanent shocks for both private consumption and private disposable income of Pakistan have been generated according to Equation (7).

Impulse responses to one standard deviation transitory and permanent shocks for the Pakistan economy are shown in Figure 1. It is evident that the impact of consumption or permanent shock is positive, and its effect increases over time for both private consumption and private disposable income. On the other hand, the impact of an income or transitory shock diminishes over time. It means that permanent shock of consumption has a very strong influence for private consumption and private disposable income for the economy of Pakistan. Hence, the implication of PIH is that consumption shock is a more prominent factor for changes in income; it reflects changes in consumption that are responses to income shocks that are assumed to be permanent.





**FIGURE 1**

Responses of Private Consumption and Private Disposable Income to One Standard Deviation Transitory and Permanent Shocks for the Economy of Pakistan

Impulse responses to one standard deviation temporary and permanent shocks for the US economy are shown in Figure 2. The analysis reveals that the impact of consumption or permanent shock is somewhat positive, with a hump shape for U.S. personal consumption. On the other hand, the impact of an income or transitory shock is positive for U.S. personal consumption. It means that U.S. personal consumption responds more significantly to consumption shock, but income shock does not appear to have a transitory influence on personal consumption. As far as personal income is concerned, consumption shock is again a dominant effect on personal disposable income for the U.S. economy in comparison with income shock. The income shock has a diminishing effect for the personal income of U.S., but again the response is positive after two years.

The holistic picture that comes to light from responses of consumption and income depicts a scenario that is expected as for as permanent shock of consumption is concerned. On the other hand, income is less significant for consumption and income for both countries, but the responses never vanish to zero over the forecast horizon.

***b) Results of Decomposition of Forecast Error Variances***

Results for the decomposition of forecast error variance of private consumption and private disposable income for the economy of Pakistan are shown in Table 4.

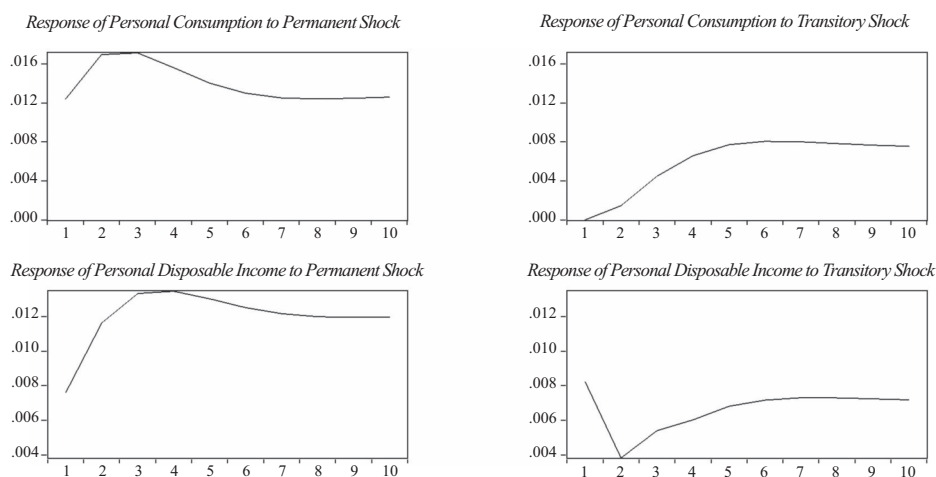


FIGURE 2

Responses of Personal Consumption and Personal Disposable Income to One Standard Deviation Temporary and Structural Shocks for the Economy of the USA

Above results for variance decomposition of private consumption for the economy of Pakistan show that permanent shock (consumption shock) rather than transitory shock (income shock) is the major source of the variance of forecast error over ten years forecast horizon. The table shows that more than 97 per cent of forecast error variance is due to permanent shock. Similarly, permanent shock is also

TABLE 4

Decomposition of Consumption and GDP Variances for Pakistan's Economy

<i>Period</i>	<i>Permanent Shock</i>	<i>Transitory Shock</i>	<i>Permanent Shock</i>	<i>Transitory Shock</i>
1	100.0000	0.000000	42.30804	57.69196
2	98.96760	1.032397	40.29792	59.70208
3	99.23552	0.764479	43.52429	56.47571
4	99.44421	0.555792	47.61354	52.38646
5	99.47584	0.524158	52.05525	47.94475
6	99.31185	0.688149	56.58849	43.41151
7	98.96539	1.034611	61.04834	38.95166
8	98.45970	1.540304	65.31345	34.68655
9	97.82040	2.179602	69.29218	30.70782
10	97.07233	2.927667	72.91842	27.08158

Source: Authors' estimation.

more prevalent in its influence as a source of forecast error variance for the private disposable income of this economy. Dynamics of disposable income to consumption shock show that around seventy-three per cent in the variance of forecast error of private disposable income for this economy is due to permanent shock at the end of the forecast horizon. However, the transitory shock is also important for explaining forecast uncertainty in the short-run for this economy.

Income shock explains roughly twenty-seven per cent of the forecast variance of private disposable income for this economy. Therefore, permanent consumption shock is a more important source for explaining forecast error variance of private disposable income for the economy of Pakistan. It indicates that permanent shock is a major source of uncertainty for consumption over the short-run and the long-run and personal disposable income of this country over the long-run horizon.

The decomposition for personal consumption variance for the US economy has been shown in Table 5. Results in Table 4 show that permanent shock remains a dominant source of forecast error variance for the U.S. economy's personal consumption and personal disposable income. PIH implies consumption as a permanent component of income. The theory of PIH implies that the permanent component of income should matter for the long-run predictability of income. In the case of the U.S. economy, this condition seems to be fulfilled as almost 76 per cent of forecast error variance of personal income over ten years horizon is due to permanent consumption shock. Transitory Income shock appears to be less significant for the long-run forecasts as it explains only 23.86 per cent of forecast error variance in personal income.

**TABLE 5**

Decomposition of Consumption and GDP Variances for U.S. Economy

<i>Period</i>	<i>Permanent Shock</i>	<i>Transitory Shock</i>	<i>Permanent Shock</i>	<i>Transitory Shock</i>
1	100.0000	0.000000	46.18810	53.81190
2	99.52206	0.477945	70.14430	29.85570
3	97.05641	2.943593	76.89414	23.10586
4	93.72523	6.274766	78.89506	21.10494
5	90.39873	9.601274	78.80603	21.19397
6	87.63781	12.36219	78.15336	21.84664
7	85.54666	14.45334	77.44386	22.55614
8	84.02285	15.97715	76.86751	23.13249
9	82.90794	17.09206	76.44492	23.55508
10	82.06381	17.93619	76.14458	23.85542

*Source:* Authors' estimation.

The comparisons that can be made from the results of variance decomposition for Pakistan and U.S. economies are different shocks affect these economies more or less similarly. The permanent shock of consumption affects incomes in both countries substantially. Similarly, transitory income shock is less significant in its effect over disposable income from a long-run perspective. Therefore, implications of PIH seem to hold at greater extent, but not perfectly.

### **3. Comparative Analysis**

The comparative analysis that emerges from the results of this study shows that PIH is a good depiction of consumer behaviour for both economies. Furthermore, a positive consumption shock has an increasing effect over the long-run horizon for private consumption and income, whereas an income shock has decreasing impact on both private consumption and personal disposable income for the economy of Pakistan. However, for the economy of the U.S., consumption shock produces a hump shape with a lasting impact for this economy for both of these variables, but of lesser magnitude.

Moreover, consumption shock is important for most of the forecast error variance of consumption for both short-run and long-run economies. On the other hand, income shock is important for explaining forecast error variance of income in the short-run while its share drops considerably over the long-run horizon. Therefore, consumption shock creates short-run and long-run forecast uncertainty of personal disposable incomes of both economies, whereas income shock is important for explaining forecast uncertainty of this variable in the short-run for both economies.

## **V. Conclusions and Policy Recommendations**

The focus of this study was to test PIH afresh because the results of previous studies have not been unanimous and to provide a comparative analysis for an advanced economy vis-à-vis a developing economy as a robust check for the validity of PIH. There might be many reasons for the mixed results that emerged in previous studies. One important factor for mixed results has been using different methods that make different underlying assumptions. This study inspects the core of PIH, i.e. the long-run effect of disposable income on personal consumption. Responses of consumption and income also verify the implications of PIH. Variance decomposition is done to locate the major source of uncertainty. The comparison between developing economies is made vis-à-vis developed economies to obtain more general evidence.

The results of this study favour the PIH as a good approximation of consumption behaviour for the economy of Pakistan and the U.S. economy. The long-run restricted coefficient in VECM establishes a one-to-one relationship between consumption and income for the economy of Pakistan. The one-to-one long-run relationship between

consumption and income is not established for the U.S. economy, even though the estimate is closer to one. The impulse response of income to consumption shocks is more dominant for both economies, but income shocks are not entirely depleting for these economies. Consumption is the major source of forecast error for both economies.

It can be concluded that both economies have a long-run relationship between income and consumption. The consumption shocks have lasting and prominent effects for income. The income shocks are not diminishing over the forecast horizon. Since income responds strongly to consumption shock, any policy actions that increase consumption can have a lasting impact on income in both economies. Furthermore, policy changes that change income, but fail to affect consumption, can affect income for a considerable span of time. Lastly, permanent shock explains most of the forecast variance of income in both economies, and any policy action that creates uncertainty about consumption can lead income significantly away from a stable path.

There exists slightly more than one-to-one correspondence between private consumption and personal disposable income for both economies. Therefore, it can be suggested that predictable lasting tax cuts, especially indirect taxes in the case of Pakistan, that raise considerable disposable personal income can produce a positive impact on personal consumption expenditure. Since consumption is a major component of aggregate demand, it can boost the incomes of these economies. Similarly, any policy action that creates a perception for households that their permanent income is reduced considerably would result in a reduction in consumption expenditure. Again, consumption being a major component of aggregate demand would result in a reduction in aggregate demand, which could cause a decline in aggregate income for a considerable time.

## References

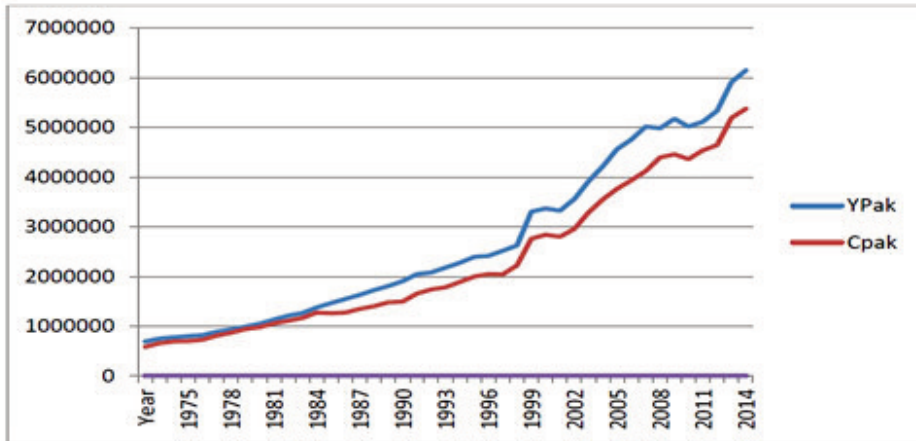
- Bukhari, S. A., and S. U. Khan, 2008, Structural and statistical approaches to estimating output gap: First attempt on Pakistan, *Econometrics, Applied Econometrics and Modelling*, E-Journal, <http://dx.doi.org/10.2139/ssrn.1145083>.
- Arby, M. F., 2001, Long-run trend, business cycles and short-run shocks in real GDP, State Bank of Pakistan, Working Paper, 01, <https://www.sbp.org.pk/publications/wpapers/2008/wp01.pdf>
- Bernanke, B., 1984, Permanent income, liquidity and expenditure on automobiles: Evidence from panel data, *The Quarterly Journal of Economics*, 99(3): 587-614, retrieved from <http://www.jstor.org/stable/1885966>.
- Blanchard, O. J., and D. Quah, 1989, The dynamic effects of aggregate demand and supply disturbances, *The American Economic Review*, 79(4): 655-673, September.
- Bodkin, R., 1969, Real wages and cyclical variations in employment: A Re-Examination of the evidence, *The Canadian Journal of Economics*, 2(3): 353-374, DOI: 10.2307/133479.
- Campbell, J., and N. Mankiw, 1987a, Are output fluctuations transitory?, *The Quarterly Journal of Economics*, 102(4): 857-880.
- Campbell, J., and N. Mankiw, 1987b, Permanent and transitory components in macroeconomic fluctuations, *The American Economic Review*, 77(2): 111-117, May.
- Campbell, J., and N. Mankiw, 1989, Consumption, income and interest rates: Reinterpreting the time series evidence, NBER Chapters, NBER Macroeconomics Annual, The University of Chicago Press, 4: 185-216, doi:10.2307/3584973.
- Clark, P., 1987, The cyclical component of U.S. economic activity, *The Quarterly Journal of Economics*, 102(4): 797-814, <https://doi.org/10.2307/1884282>
- Clark, P., 1989, Trend reversion in real output and unemployment, *Journal of Econometrics*, 40(1): 15-32, ISSN: 0304-4076, [https://doi.org/10.1016/0304-4076\(89\)90027-4](https://doi.org/10.1016/0304-4076(89)90027-4).
- Cochrane, J., 1988, How big is the random walk in GNP?, *Journal of Political Economy*, 96(5): 893-920.
- Cochrane, J., 1994, Permanent and transitory components of GNP and stock prices, *The Quarterly Journal of Economics*, 109(1): 241-265.
- Deaton, A., 1992, *Understanding consumption*, New York: Oxford University Press, <https://doi.org/10.1093/0198288247.001.0001>
- DeJuan, J., and J. Seater, 2006, A simple test of Friedman's permanent income hypothesis, *Economica*, 73(289): 27-46.
- Elwood, S., 1997, Estimating permanent and transitory components of GNP using consumption information, *Southern Economic Journal*, 64(2): 567-575, doi:10.2307/1060868.
- Evans, G., 1989, Output and unemployment dynamics in the United States: 1950-1985, *Journal of Applied Econometrics*, 4(3): 213-237.

- Fisher, I., 1907, The rate of interest, New York: MacMillan Company, *The Economic Journal*, 18(69): 66-69, <https://doi.org/10.2307/2221211>
- Friedman, M., 1957, A theory of consumption function, Princeton, N.J: Princeton University Press. National Bureau of Economic Research, Pp 1-6.
- Gonzalo, J., T. Lee, and W. Yang, 2008, Permanent and transitory components of GDP and stock prices: Further analysis, *Macroeconomics and finance in emerging market economies*, 1(1): 105-120, doi: 10.1080/17520840701864955.
- Hall, R., 1978, Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence, *Journal of Political Economy*, 86(6): 971-987.
- Hall, R., and F. Mishkin, 1982, The sensitivity of consumption to transitory income: Estimates from panel data on households, *Econometrica*, 50(2): 461-481, doi:10.2307/1912638.
- Hsieh, Chang-Tai, 2003, Do consumers react to anticipated income changes?, Evidence from the alaska permanent fund, *American Economic Review*, 93(1): 397-405, DOI: 10.1257/000282803321455377.
- Ireland, P. N., 1995, Using permanent income hypothesis for forecasting, *Economic Quarterly*, 81(1): 49-63.
- Johansen, S., 1988, Statistical analysis of cointegration vectors, *Journal of Economic Dynamics and Control*, 12(2/3): 231-254, ISSN 0165-1889, [https://doi.org/10.1016/0165-1889\(88\)90041-3](https://doi.org/10.1016/0165-1889(88)90041-3).
- Khan, K., and M. Memon Che, 2012, The testing of Hall's permanent income hypothesis: A case study of Pakistan, *Asian Economic and Financial Review*, 2(4): 518-522, <https://EconPapers.repec.org/RePEc:asi:aeafj>.
- Kim, C., J. M. Piger, and R. Startz, 2007, The dynamic relationship between permanent and transitory components of U.S. Business Cycles, *Journal of Money, Credit and Banking*, 39(1): 187-204.
- King, R., C. Plosser., J. Stock, and M. Watson, 1991, Stochastic trends and economic fluctuations, *The American Economic Review*, 81(4): 819-840.
- Lucas, R., 1973, Some international evidence on output-inflation tradeoffs, *The American Economic Review*, 63(3): 326-334.
- Madsen, J. B., and M. Mcaleer, 2001, Consumption, liquidity constraints, uncertainty and temptation: An international comparison, *Journal of Economic Psychology*, 22(1): 61-89.
- Morley, J., 2007, The slow adjustment of aggregate consumption to permanent income, *Journal of Money, Credit and Banking*, 39(2/3): 615-638.
- Nelson, C. R., and C. R., Plosser, 1982, Trends and random walks in macroeconomic time series: Some evidence and implications, *Journal of Monetary Economics*, 10(2): 139-162, ISSN 0304-3932, [https://doi.org/10.1016/0304-3932\(82\)90012-5](https://doi.org/10.1016/0304-3932(82)90012-5).
- Parker, J., 1999, The reaction of household consumption to predictable changes in social security taxes, *The American Economic Review*, 89(4): 959-973.
- Raut, L., and A. Virmani, 1989, Determinants of consumption and savings behaviour in developing countries, *The World Bank Economic Review*, 3(3): 379-393.



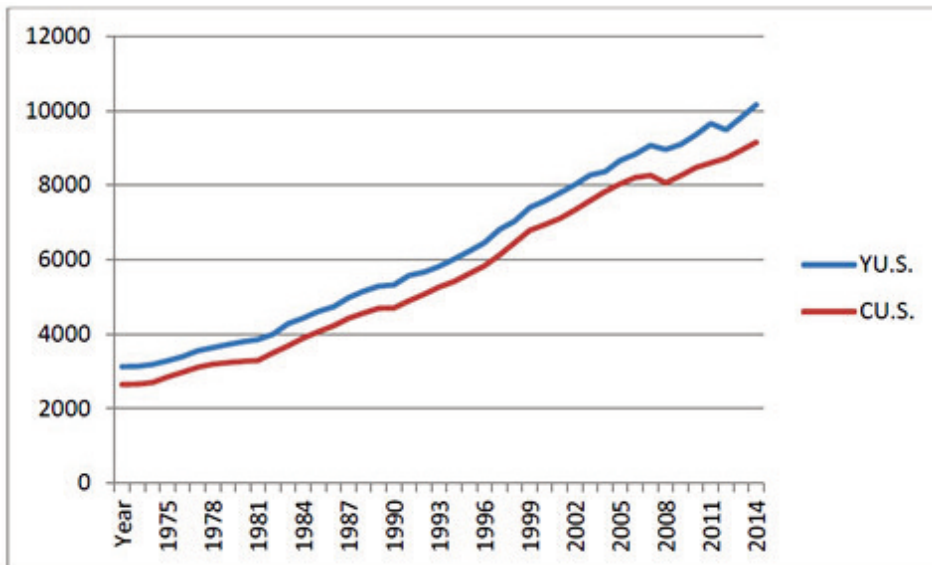
- Sargent, T., 1978, Estimation of dynamic labor demand schedules under rational expectations, *Journal of Political Economy*, 86(6): 1009-1044.
- Tahir, M. A., 2014, Estimating the output gap of Pakistan on quarterly frequency using structural methods, *International Journal of Economics and Finance*, 6(5): doi:10.5539/ijef.v6n5p233.
- Taylor, J., 1979, Estimation and control of a macroeconomic model with rational expectations, *Econometrica*, 47(5): 1267-1286, doi:10.2307/1911962.
- Yousafzai, T. K., 2015, The economic impact of international remittances on household consumption and investment in Pakistan, *Journal of Developing Areas*, Tennessee State University, College of Business, 49(6): 157-172.

**APPENDIX**



**FIGURE A-1**

Disposable Personal Real Income and Private Real Consumption Expenditure for Economy of Pakistan



**FIGURE A-2**

Disposable Personal Real Income and Personal Real Consumption Expenditure for Economy of U.S.