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„Macroeconomic Determinants of Household Consumption in India: A Multivariate Time Series Analysis“

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Tushar Jangir

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ABSTRACT

Consumption accounts for the most significant share of GDP of any country in the world, thereby explaining the orientation of most of the macroeconomic policies of countries towards aggregate consumption. Therefore, analysis of determinants of consumption becomes very important as it helps in improving the overall effectiveness of the macroeconomic policies which further leads to better economic policymaking. The thesis aims to study certain macroeconomic determinants of household consumption in India. In order to do so, long run relationship between household consumption and its macroeconomic determinants is examined through cointegration method. Johansen Maximum Likelihood Estimator is used as a primary method for the analysis. The major finding of the study is that personal disposable income largely determines household consumption expenditure in the long run as there exists an almost one to one positive relationship between the two aggregates. The results also indicate a trade-off between inflation and interest rate in affecting household consumption expenditure.

Keywords: household consumption, disposable income, cointegration

ABSTRAKT

Der Konsum macht den größten Anteil am BIP in jedem Land der Welt aus und daraus erklären sich die meisten makroökonomischen Maßnahmen in Bezug auf den aggregierten Konsum. Die Analyse der Determinanten des Konsums ist daher insofern von großer Bedeutung, weil die Effektivität von makroökonomischen Maßnahmen verbessert werden kann und daraus folgend zu einer erfolgreichen Wirtschaftspolitik beiträgt. Ziel dieser Masterarbeit ist es, bestimmte makroökonomische Determinanten des privaten Konsums in Indien zu untersuchen. Zu diesem Zweck wird die langfristige Beziehung zwischen dem Konsum der privaten Haushalte und seinen makroökonomischen Determinanten mithilfe der Methode der Kointegration untersucht. Dabei wird der Johansen Maximum Likelihood Estimator als primäre Methode für die Analyse verwendet. Das Ergebnis der Studie zeigt, dass das verfügbare persönliche Einkommen die langfristigen Konsumausgaben der privaten Haushalte bestimmt, da zwischen den beiden Aggregaten ein positiver Zusammenhang mit dem Verhältnis von nahezu eins zu eins besteht. Die Ergebnisse deuten weiters auf einen Kompromiss zwischen Inflation und Leitzins hin, der sich auf die Konsumausgaben der privaten Haushalte auswirkt.

Schlüsselwörter: Konsum der privaten Haushalte, verfügbares Einkommen, Kointegration

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INTRODUCTION

According to the expenditure side GDP approach, consumption expenditure constitutes a dominant share of GDP of any country. Economic growth of most of the countries is driven by aggregate consumption as it is an important part of aggregate demand. Since consumption plays a pivotal role in the economic growth of an economy, most of the macroeconomic policies of countries aim to target consumption in order to stabilize the economy. For example, during deflationary gap situations when the aggregate demand falls short of aggregate supply, consumption is targeted in a way that it stimulates the economy. This is done usually by changing or adjusting different macroeconomic policies like fiscal, monetary, international trade policies etc. Therefore, it is very essential to analyze the drivers of consumption. This not only helps in understanding the determinants of consumption and how these determinants affect consumption but also helps in improving the overall effectiveness of the macroeconomic policies which further leads to better economic policymaking.

India has always been a consumption driven economy. The share of India's final consumption expenditure in GDP was 94% in 1960 (The World Bank and OECD National Accounts Data). Based on this estimate, it can be inferred that India's economy strongly relied on consumption expenditure for economic growth. Though the share declined over time but, in terms of overall economic growth, aggregate consumption still dominated other components of aggregate demand. According to the estimates of the World Economic Outlook by IMF for the year 2023, India will be the fifth largest economy in the world in terms of nominal GDP (3.7 trillion US $) with the share of final consumption expenditure in GDP being 71% for the year 2022 (The World Bank). In line with the arguments highlighting the importance of aggregate consumption for an economy and the strong reliance of India's economy on the same, this thesis aims to answer the following research question:

How certain macroeconomic variables determine household consumption expenditure in India?

Over time, many consumption theories have been developed. With each evolving theory, one or the other determinant of consumption has been included. In order to address the research question, variables have been selected based on macroeconomic literature and in the context of Indian economy. Private Final Consumption

Expenditure (PFCE) is the variable of interest. In terms of determinants, Personal Disposable Income (PDI), Consumer Price Index (CPI) and Bank Rate (BR) have been selected.

My hypothesis is that the personal disposable income positively drives household consumption expenditure whereas consumer price index (inflation) and bank rate (interest rate) negatively determine household consumption expenditure in India.

According to the National Accounts Statistics (NAS) Sources and Methods-1989 (Ministry of Statistics and Programme Implementation, Government of India), 'The household consumption expenditure referred to as private final consumption expenditure (PFCE) in NAS, consists of expenditure by households (including non-profit institutions) on non-durable consumer goods and services and all durable goods except land and buildings.'

Personal Disposable Income (PDI) points towards the Keynes (1936) consumption theory which states that the current disposable income determines consumption expenditure. Most studies on related topics use either Real GDP or GDP per capita as a proxy for income. Disposable income is a measure of the amount of money left after deducting the applicable taxes. Real GDP in the context of studies on this topic is somewhat a general variable. Therefore, it becomes important to use a variable which would more closely be related to and affecting the consumption expenditure. Personal Disposable Income is that variable as it is the income, which is either to be consumed, saved or in some cases invested.

Consumer price index, proxy for inflation, is a measure of the change in price level. Inflation impacts household consumption in a very significant way. Generally, higher inflation leads to a reduction in disposable income as it adversely affects the purchasing power of households, which in turn leads to decline in consumption and vice versa.

Depending on the country of study, different types of variables are considered for interest rates such as short term and long-term rates which are based on different bonds and treasury bill maturity dates. One of the commonly used variable is the 3-month treasury bill secondary market rate. In this study, Bank Rate is used. The Reserve Bank of India (central bank of India) sets up a rate, under its quantitative monetary policy measures, called Bank Rate. It is the rate at which the Reserve Bank of India lends long term loans to the commercial banks. This rate directly affects the lending rates of the commercial banks to the end consumers. It is a tool under the

monetary policy of the central bank to control the supply of credit in the economy by influencing the credit availability. In a situation when the economy is in a state of deficient demand, the central bank reduces the bank rate which helps commercial banks borrow funds from central banks at low rates and ultimately the commercial banks can offer cheap loans to the end consumers, which then increases the supply of credit in the economy and thereby helping in increasing the disposable income and consumption expenditure of households.

I contribute to the existing literature on this topic in terms of my model which includes all the above-mentioned variables for the Indian economy from the financial year 1960-61 to 2012-13.

LITERATURE REVIEW

THEORETICAL BACKGROUND

Most of the empirical studies on consumption expenditure in macroeconomics are based on the various consumption theories that have been developed over time. The first theory on consumption expenditure in macroeconomics was proposed by Keynes (1936). He developed the Absolute Income Hypothesis which asserts that current disposable income determines the consumption expenditure of an individual. Duesenberry (1949) introduced the behavioral component in his Relative Income Hypothesis which asserts that an individual's consumption behavior depends on the consumption behavior of others and once a high level of consumption is achieved, individual becomes reluctant to go back to low levels of consumption.

Milton Friedman (1957) in his Permanent Income Hypothesis proposed that expectations about future income and smoothening of consumption over lifetime determines consumption expenditure. According to his theory, income is composed of two components, transitory income and the permanent income. He asserted that the driver of change in consumption is the change in permanent income and not the transitory income.

To capture the consumption patterns of an individual, Modigliani and Brumberg (1954 and 1980) introduced the Life Cycle Hypothesis which was further developed by Ando and Modigliani (1963). The hypothesis states that an individual not only considers present level of income but also past and future (expected) levels of income. By considering these three aspects for the level of consumption, individual smoothens consumption over the entire life.

EMPIRICAL STUDIES

Aggregate consumption has been studied and analyzed through various perspectives as it is one of the fundamental concepts of macroeconomics. Therefore, there has been a growing amount of research that aggregate consumption attracts among economists and researchers. But there are not many empirical studies that are specifically concerned with the macroeconomic determinants of household consumption, especially in emerging, low and middle-income economies.

Muzindutsi and Mjeso (2018) analyzed short run and long run relationship between real private consumption and selected macroeconomic variables in South Africa using the cointegration technique of Autoregressive Distributed Lags by Pesaran, Shin and Smith (2001). Authors found that price levels and interest rates have negative effects on consumption in both, short and long run. They also found that in the long run, South African households consumed a very significant share of their real income. Other results of the study showed that exchange rate didn't have any impact on real private consumption in the short run.

Varlamova and Larionova (2015) studied the macroeconomic and demographic determinants of household expenditure in OECD countries using multivariate regression models. Their analysis indicated a highly significant relationship between household consumption expenditure and various macroeconomic indicators, namely, short-term interest rates, government consumption expenditure, price levels, tax on goods and services as share of GDP, growth rate of imports, income. Similar result was observed in terms of the education level of the population. But many other socio-demographic factors didn't have any significant impact on household spending.

Sugiarto and Wibowo (2020) studied the determinants of regional household consumption expenditure in Indonesia using dynamic panel data regressions. The results showed that lagged real household final consumption expenditure, real gross regional domestic product, government spending, inflation rate, and open unemployment rate significantly influence real household final consumption expenditure.

Arapova (2018) carried out a thorough analysis of important factors which affect consumption and its pattern in major Asian countries. Author used Ordinary Least Squares, fixed effects and random effects methods of panel data analysis. The results revealed that the growth in gross national income increased household final consumption expenditure in all the economies although with different levels. Further results indicated evidence in favor of consumption led growth in the countries with the easing of monetary policy.

Bonsu and Muzindutsi (2017) assessed the macroeconomic determinants of household consumption expenditure in Ghana. Authors followed multivariate cointegration approach which involved using vector autoregressive model and Johansen (1988, 1991 and 1995) cointegration technique. The results showed that income and inflation have

a significant effect on household consumption in the long run. In the short run, results showed that inflation affected household spending the most.

Manasseh et al. (2018), analyzed the effects of interest and inflation rates on private consumption in Nigeria. The authors applied consumer spending model. Authors found that the most important and significant determinants impacting consumption were interest rates, inflation, per capita income, indirect taxes, and savings. The results of Granger causality test by Granger (1969) showed that private consumption expenditure doesn't act as a predictor for future interest rates and price levels.

Jore & Chowdhary (2019) investigated the relationship between GDP and household final consumption in India. For determining the long run relationship, ARDL approach was used. Authors found that household consumption was impacted significantly as a result of increase in GDP in India, both in short and long run.

Mishra (2011) examined the relationship between real private consumption expenditure and economic growth in India. Johansen cointegration approach and vector error correction model was used for estimating the model. The cointegration results of the study showed that consumption expenditure and economic growth have a long run equilibrium relationship. The VECM provided evidence in favor of a unidirectional causality from private consumption expenditure to GDP. Causal relationship from private consumption expenditure to GDP was revealed in the long run using the Granger Causality test.

Keho (2019) analyzed the relationship between private consumption and its determinants in Cote d'Ivoire. Author employed the ARDL cointegration method for the analysis. The results of the study showed that wealth, government expenditure and current income significantly affected private consumption in the long run. The results also found that both inflation and interest rate exhibited a negative relationship with private consumption.

Iheonu & Nwachukwu (2020) examined the relationship between household consumption and its macroeconomic determinants in selected West African countries. In consideration of heterogeneity and cross-sectional dependence among countries, methodology of panel augmented mean group was used. The results showed that GDP per capita and domestic credit to the private sector significantly increased household spending. In terms of the magnitude and signs of the coefficients and the significance level of the variables, different results were observed for the countries.

DATA & METHODOLOGY

For Private Final Consumption Expenditure (PFCE), Personal Disposable Income (PDI) and Bank Rate (BR), data is sourced from EPWRFITS (Economic and Political Weekly Research Foundation India Time Series), providing time series data across various sectors of Indian economy. EPWRFITS collects data from various government sources such as MoSPI (Ministry of Statistics and Programme Implementation, Government of India), RBI (Reserve Bank of India) etc. The data for Consumer Price Index (CPI) is sourced from International Financial Statistics (IFS) of the International Monetary Fund (IMF). For consistency across variables and unavailability of data reasons, the time period used for the analysis in this study is from the financial year 1960-61 to 2012-13.

Frequency of all the variables is annual. Unit of Private Final Consumption Expenditure (PFCE) and Personal Disposable Income is INR (Indian Rupee) crore. Bank Rate (prevailing at the end of the particular financial year) is measured in percentages. Both PFCE and PDI are based on 2004-05 base year. For the stated base year, the data for PFCE is at constant and current prices but for Personal Disposable Income, it's only at current prices. Since constant prices reflects the real prices, i.e., prices adjusted for inflation in relation to the base year, I have converted the current prices to constant prices for Personal Disposable Income using the concept of deflator (π):

$$\frac{PFCE_t\ current}{PFCE_t\ constant} = \pi_t$$

$$\frac{PDI_t\ current}{\pi_t} = PDI_t\ constant$$

Cointegration procedure is used for examining the long run relationship between household final consumption expenditure and its macroeconomic determinants. A brief overview of the methodology[1] is as follows: augmented Dickey Fuller test is used

[1] The section of methodology is based on Verbeek (2008) and the lecture slides of the course *Macroeconometrics* by Professor Robert M. Kunst, University of Vienna.

to test for the stationarity of the time series variables; Johansen's Cointegration procedure is employed to test if the variables are cointegrated; Vector Error Correction Model is estimated; Robustness tests are conducted.

TESTING FOR STATIONARITY

The first step in a macroeconomic time series analysis involves testing for stationarity. In simple words, stationarity implies that a time series should have same properties today and tomorrow. In econometric terminology, stationary processes are the ones whose order of integration is zero, i.e., I(0). On the other hand, any process which needs to be differenced '*d*' times in order to become stationary is called '*d*' order integrated, i.e., I(*d*). Regressions involving time series can be deceptive if one doesn't account for stationarity of the time series variable. For example, if a non-stationary time series variable, say I(1), is regressed on another non-stationary variable, I(1) and the resulting residuals are also I(1), this would result in 'spurious regression' – a term introduced by Granger and Newbold (1974). Therefore, it is necessary for a time series to be stationary in order to avoid the problem of spurious regression.

The augmented Dickey Fuller test by Dickey and Fuller (1979 and 1981) tests for the presence of unit root in a time series. The test is carried out using three different variants:

i) ADF test on a model which neither includes an intercept (constant) nor a trend.

ii) ADF test on a model which includes a constant but not a trend.

iii) ADF test on a model which includes both a constant and a deterministic time trend.

Assuming a model: $$Y_t = \alpha + \beta t + \phi Y_{t-1} + \varepsilon_t$$

This model represents the third variant of the ADF test. Here, α is a constant, t is a linear time trend. If $\beta = 0$, this represents the second variant while the first variant is represented when $\alpha = \beta = 0$.

The second and third variants are the μ and τ variants of the Dickey Fuller test. The test is based on the t-statistic (DF statistic) for the respective variants:

$$DF = \frac{\widehat{\phi} - 1}{s.e.(\widehat{\phi})}$$

Generally, for the above-mentioned variants, the null hypothesis ($|\phi| \geq 1$) of the time series having a unit root, i.e., it is non-stationary is tested against the alternative hypothesis ($|\phi| < 1$) that the time series has no unit root, i.e., it is stationary.

Cointegration Tests

After having an evidence on the non-stationarity of the time series variables, i.e., the presence of a unit root, the next step involves the investigation of a stable long run relationship among the concerned variables. Generally, most of the aggregate time series are non-stationary but if there exists a linear combination of the time series variables which happens to be stationary, this implies that the variables are cointegrated. For example, if X and Y are two non-stationary I(1) variables but there exists a linear combination of the form $Y - \alpha - \beta X$ which is stationary, this would suggest evidence towards a long run relationship.

Engle & Granger Procedure

The first cointegration test was developed by Engle and Granger (1987). This test involves a 2-step process. By means of Ordinary Least Squares, the cointegrating regression is estimated and then the resultant residuals are subjected to unit root test. If the residuals happen to be stationary, this implies evidence in favor of cointegration.

This procedure is not very efficient as it suffers from some problems. Since cointegration represents a symmetric property, the procedure fails if the residuals from a regression of X on Y are stationary but on the other hand, the residuals from the regression of Y on X are non-stationary. The procedure also fails in case of multiple non-stationary variables. Also, when it comes to small samples, one cannot rely on the results of the regression even if the variables are cointegrated.

JOHANSEN PROCEDURE

The cointegrating procedure by Johansen (1988, 1991 and 1995), Johansen and Juselius (1990) has an important advantage over Engle and Granger procedure as it allows to test for the presence of cointegration of two or more non-stationary variables, i.e., multiple cointegrating relationships.

Johansen's analysis follows a multivariate vector autoregressive VAR(p) model. For example, a multivariate variable X follows a VAR(p) model of the form:

$$X_t = \delta + \Phi_t \, \mathrm{X}_{t-1} + \cdots + \Phi_p \, \mathrm{X}_{t-p} + \varepsilon_t$$

Upon rearrangement it can be written as:

$$\Delta X_t = \delta + \Pi \, \mathrm{X}_{t-1} + \Gamma_1 \Delta X_{t-1} + \cdots + \Gamma_{p-1} \Delta X_{t-p+1} + \varepsilon_t \qquad \text{(I)}$$

Here, Π is a n x n impact matrix (coefficient matrix). Now, there are three possible scenarios:

i) The impact matrix is a zero matrix, i.e., $\Pi = 0$. This implies that there does not exist a cointegrating relationship. So, the VAR(p) model for X is basically a VAR(p-1) model for ΔX.

ii) The impact matrix Π is non-singular, i.e., it has full rank n. This results in X being stationary.

iii) The impact matrix has a reduced rank r, i.e., $0 < r < n$. In this case, according to Granger's representation theorem, there exists r linear independent cointegrating vectors β_j, where $j = 1, \ldots, r$, such that $\beta_j' X$ is I(0). Therefore, the impact matrix can be expressed in the form $\Pi = \alpha\beta'$ where α and β are n x r matrices. The cointegrating vectors are contained in β.

Upon factorization of Π in equation (I):

$$\Delta X_t = \delta + \alpha\beta' \, \mathrm{X}_{t-1} + \Gamma_1 \Delta X_{t-1} + \cdots + \Gamma_{p-1} \Delta X_{t-p+1} + \varepsilon_t$$

This equation represents a Vector Error Correction Model (VECM). It's a balanced and stable equation in the sense that all ΔX_{t-j} are I(0), including $\beta' \, X_{t-1}$. Cointegrating vectors which are represented by β defines the dynamic equilibrium conditions. The speed of adjustment in ΔX_t is estimated by the matrix α, i.e., the reaction of the elements of ΔX_t to deviations from the dynamic equilibrium conditions is explained by the error correction parameter matrix α.

The approach followed by Johansen in estimating the number of cointegrating vectors, i.e., the rank of the impact matrix $\Pi = \alpha\beta'$ is determined by two types of test statistics:

i) Trace Statistic: The value of trace statistic is determined by $\lambda_{trace} = -T \sum_{i=r+1}^{n} \log(1 - \lambda_i)$. Here, eigenvalues are represented by $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_i$ and *T* is the size of the sample. The null hypothesis is that there are at most r cointegrating vectors, while the alternative hypothesis is that there are more than r cointegrating vectors.

ii) Maximum Eigenvalue: This statistic is determined by $\lambda_{max} = -T \log(1 - \lambda_{r+1})$. Here, the null hypothesis of cointegrating vectors being exactly r is tested against the alternative hypothesis of cointegrating vectors being $r + 1$.

In conclusion, to carry out Johansen's cointegration procedure for a vector *X* containing *n* time series variables, the following process must be followed:

i) All the variables should be subjected to unit root test. Only with stationary and I(1) variables should be further proceeded. Higher-order integrated variables should not be considered.

ii) This is a very important step as it involves determining the number of autoregressive lag orders of the model. Johansen's procedure is highly sensitive in terms of selection of the lag order because a model estimated with too many lags results in the loss of degrees of freedom. On the other hand, a model estimated with too few lags leads to the problem of serially correlated errors. So, the optimal number of lags is very essential. Usually,

likelihood ratio (LR) test or various information criteria such as Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) are used. LR test is not commonly used as it is less efficient, especially in small samples, than the information criteria.

For VAR model, optimal lag order p determination requires the minimization of various information criteria in their multivariate cases:

$$\text{AIC} = \log \left|\hat{\Sigma}\right| + 2\ \frac{n^2(p+1)}{T}$$

$$\text{BIC} = \log \left|\hat{\Sigma}\right| + \frac{n^2(p+1)}{T} \log T$$

Here, T is the number of observations in the model and the determinant of the estimated error covariance matrix is represented by $\left|\hat{\Sigma}\right|$.

iii) Cointegration tests based on trace statistic or maximum eigenvalue are conducted which provides with the number of cointegrating vectors.

iv) Vector Error Correction Model is estimated.

As stated, if the variables are found to be cointegrated, this implies that there exists a long run relationship among the time series variables which is stable, i.e., they are in equilibrium in the long run. There are also short run dynamics into play which converge the short run equilibrium over time to the long run equilibrium condition. The speed at which this convergence takes place is modeled by the Vector Error Correction Model (VECM). Every cointegrating relationship that has been determined has its own unique convergence speed towards long run equilibrium which is estimated by the error correction term of that particular cointegrating vector (Mishra, 2011).

EMPIRICAL RESULTS

I begin the analysis by taking the logarithm of all the variables in order to stabilize variances. All the variables are then subjected to augmented Dickey Fuller test with a trend and using AIC as information criteria for the determination of lags.

Table 1 presents the results of the ADF test. Based on AIC results, a lag order of 1 is selected at level and first differences. At level, the null hypothesis of the presence of unit root cannot be rejected since the values of the test statistic for all the variables are not less than the critical values at all the given significance levels. Therefore, I take the first difference of the non-stationary variables and further subject them to ADF test with a constant and using AIC as information criteria. At first differences, the null hypothesis of the presence of unit root can be rejected since the values of the test statistic for all the variables are less than the critical values at all the given significance levels. Since the variables are found to be stationary at first difference, it is concluded that all the variables are integrated of order 1, i.e., I(1).

Table 1. Augmented Dickey Fuller Test Results

	Level			First Difference			
Variable	Test statistic			Test statistic			Integration Order
PFCE	0.9492			-3.5822			I(1)
PDI	-0.0939			-4.2328			I(1)
CPI	-3.1326			-5.5401			I(1)
BR	-1.9494			-3.6022			I(1)
Critical Values	1% -4.04	5% -3.45	10% -3.15	1% -3.51	5% -2.89	10% -2.58	

The next step is to investigate for the existence of a stable long run relationship among the time series variables, i.e., to test for cointegration. The cointegration test discussed in methodology requires the selection of optimal number of lags. As already stated, Johansen's cointegration procedure is very sensitive to the lag order. The lag order that minimizes AIC information criteria is 9. But for a small sample of 53 observations, lag order of 9 is very high as it results in the problem of loss of degrees of freedom. Therefore, an inspection of the information criteria results becomes very necessary.

Table 2 shows the results of AIC. The largest decline in AIC can be seen when moving from 3rd lag to 4th lag. This decline is very sharp in comparison to others. Therefore, a lag order of four is considered as optimal.

Table 2. AIC Results

1	2	3	4	5
-0.2648652	-0.2645370	-0.2657279	-0.2722448	-0.2722494
6	7	8	9	10
-0.2763720	-0.2828120	-0.2918213	-0.3281473	NA

Apart from the inspection of information criteria, I also checked for the serial correlation of errors in order to select the optimal lag order. A VAR(p) model of the time series variables was estimated, starting with p = 9 (as stated by AIC results). Since the sample of study is small, therefore, to test for the serial correlation of errors, Edgerton and Shukur (1999) F test was employed. This modified test generalizes Breusch-Godfrey LM test by Breusch (1978) and Godfrey (1978), and the modified statistic is corrected for small sample. The output of the test for p = 9, 8, 7, 6 resulted in F statistic being $-\infty$. This was expected as these are very high lag orders for the given system of time series variables. Similarly, the test was employed for p = 5, 4. Table 3 presents the results of the same. Based on the p-value, for lag 5, the null hypothesis of no serial correlation of errors is rejected at 5% significance level. But for lag 4, the null hypothesis cannot be rejected at 5% significance level. Therefore, on the basis of inspection of AIC results and serial correlation test of errors, lag order of 4 is considered as optimal.

Table 3. Edgerton and Shukur F Test Results

	F-statistic	*p-value*
Lag 4	1.0227	0.4694
Lag 5	1.8628	0.06837

Having selected the optimal number of lags, cointegration tests are conducted. The results of Johansen's trace test statistic are shown in Table 4. The null hypothesis of $r = 0$ and $r \leq 1$ can be rejected at all the given significance levels as the respective test statistic is greater than the critical values. But the null hypothesis of $r \leq 2$ cannot be rejected as the test statistic is less than the critical values at 5% and 1% significance level. Therefore, it is concluded that $r \leq 2$, i.e., there are at most 2 cointegrating equations.

Table 4. Cointegration Test (Trace Statistic) Results

Cointegrating Equations	*Test Statistic*	*Critical Values*		
		10%	5%	1%
$r \leq 3$	5.68	7.52	9.24	12.97
$r \leq 2$	18.92	17.85	19.96	24.60
$r \leq 1$	43.58	32.00	34.91	41.07
$r = 0$	81.87	49.65	53.12	60.16

Table 5 shows the results of Johansen's Maximum Eigenvalue test statistic. Here, the null hypothesis of $r = 0$ can be rejected at all the given significance levels as the respective test statistic is greater than the critical values. The null hypothesis of $r = 1$ can also be rejected at 10% and 5% significance level, but it cannot be rejected at 1% significance level. The null hypothesis of $r = 2$ cannot be rejected at all the given

significance levels. Therefore, it can be concluded that r = 2 at 10% and 5% significance levels but r = 1 at 1% significance level.

Table 5. Cointegration Test (Maximum Eigenvalue Statistic) Results

Cointegrating Equations	*Test Statistic*	*Critical Values*		
		10%	5%	1%
r = 3	5.68	7.52	9.24	12.97
r = 2	13.23	13.75	15.67	20.20
r = 1	24.67	19.77	22.00	26.81
r = 0	38.29	25.56	28.14	33.24

It is up to the author for considering the relevant significance levels. Maximum eigenvalue test suggests 1 cointegrating equation whereas trace test suggests at most 2 cointegrating equations at a high level of significance (1%). Also, in the trace statistic test, since the test statistic (18.2) for $r \leq 2$ is very close to the critical value (19.96) at 5% significance level, this implies a 'near non-rejection' of $r \leq 2$ at 5% significance level. Considering these arguments, in the next step, I estimate two Vector Error Correction Models (VECM). One with a cointegrating rank of 1 and the other with 2. But in any case, the cointegration test results imply that there exists atleast one stable long run relationship among the variables of study.

Since the underlying model of the study is VAR(4), the resulting VECM will be of the order $p - 1$. Therefore, VECM with a lag order of 3 and cointegrating rank of 2 is estimated. I refer it as $VECM_2$. The estimated VECM is in unrestricted form, so the error correction model includes an intercept but, by construction, the cointegrating or the long run relationship does not. Table 6 shows the cointegrating vectors resulting from $VECM_2$. Johansen Maximum Likelihood Estimator method is employed for the estimation.

Table 6. Cointegrating Vectors ($VECM_2$)

Cointegrating Vectors	*BR*	*CPI*	*PDI*	*PFCE*
r1	1	0	13.74802	-16.517298
r2	0	1	5.25926	-8.253716

The normalized cointegrating vectors in Table 6 can be written in the form of long run equations. Following equations are based on the first and second cointegrating vector respectively:

$$BR = -13.74802\ PDI + 16.517298\ PFCE + e_1 \qquad \text{(II)}$$

$$CPI = -5.25926\ PDI + 8.253716\ PFCE + e_2 \qquad \text{(III)}$$

Here, e_1 and e_2 are the error terms. Both equations can be respectively further written in a form where *PFCE* is a function of the other variables:

$$PFCE = 0.83234\ PDI + 0.06054\ BR + e_1^* \qquad \text{(IV)}$$

$$PFCE = 0.63719\ PDI + 0.12115\ CPI + e_2^* \qquad \text{(V)}$$

Equation (IV) and (V) imply that personal disposable income, consumer price index and bank rate positively affect private final consumption expenditure in the long run. The results for both inflation (*CPI*) and interest rate (*BR*) being positively affecting private consumption was not expected. This makes the argument for checking the results with a cointegration rank of 1 stronger.

The error correction terms of the model $VECM_2$ based on the four equations are shown in Table 7. ECT describes the speed of convergence, considering the short run equilibrium, towards the long run equilibrium condition. For ECT 1, it can be seen that only CPI is statistically significant. On the other hand, for ECT 2, CPI and BR are statistically significant. So, based on the second cointegrating vector it can be said that

price level and interest rates are error correcting, i.e., they correct for any deviations in the long run equilibrium.

Table 7. Error Correction Terms ($VECM_2$)

Equations	ECT 1	ECT 2
BR	0.0816 (0.1307)	-0.4614 (0.2399)·
CPI	0.1839 (0.0455)***	-0.3308 (0.0835)***
PDI	-0.0095 (0.0426)	-0.0083 (0.0782)
PFCE	0.0046 (0.0316)	-0.0314 (0.0579)

Note: Significance Level *** (0.1%) **(1%) *(5%) ·(10%)
Standard Errors in parentheses.

Due to the unconvincing results of the model $VECM_2$, it becomes important to estimate VECM with 1 cointegrating vector. Therefore, in the next step, VECM with a lag order of 3 and cointegrating rank of 1 is estimated. I refer to it as $VECM_1$. Again, the VECM is estimated in unrestricted form. Table 8 shows the cointegrating vectors resulting from $VECM_1$. Again, Johansen Maximum Likelihood Estimator method is employed for the estimation.

Table 8. Cointegrating Vectors ($VECM_1$)

Cointegrating Vectors	*BR*	*CPI*	*PDI*	*PFCE*
r1	1	-0.9003435	9.012877	-9.086118

The normalized cointegrating vector in Table 8 can be written in the form of long run equation:

$$BR = 0.9003435\ CPI - 9.012877\ PDI + 9.086118\ PFCE + e \qquad \text{(V)}$$

Here, e is the error term. Again, the equation can be further written in a form where *PFCE* is a function of the other variables:

$$PFCE = 0.99193\ PDI - 0.09909\ CPI + 0.11005\ BR + e^{*} \qquad \text{(VI)}$$

Equation (VI) implies that personal disposable income and bank rate positively affect private final consumption expenditure whereas consumer price index affects private consumption negatively. Since the specification is in log-log, it implies that a 1% increase in personal disposable income is associated with an almost equivalent change, i.e., 1% increase in private consumption. This suggests that there exists an almost one to one relationship between personal disposable income and private consumption expenditure in the long run. The result is in line with the consumption theories in which disposable income of individuals significantly drive expenditure on private consumption. Similarly, a 1% increase in consumer price index is associated with an almost 0.1% decrease in private consumption. Usually, inflation has no effect on real economic variables but since the results of $VECM_1$ provides evidence for inflation negatively affecting private consumption despite private consumption, in this study, being a real variable, this can be viewed as misinterpretation of the rise in price level with rise in relative prices by households, as stated by Deaton (1977). This leads to a state of misapprehension and therefore the households reduce their consumption.

It can also be seen that the coefficient of consumer price index and bank rate are very similar in absolute terms, and at the same time bank rate positively affects private consumption. This indicates a possible trade-off between inflation and bank rate. This result is also along the lines of the result of a study by Patnaik, Mittal and Pandey (2019), which indicated the presence of a trade-off between price stability and financial stability in India.

When consumption led growth occurs in an economy, there is also some degree of upward pressure on prices. To keep the consumption level not to change drastically as

a result of inflationary pressure, central bank aim for the stability of price level, i.e., to monitor inflation. And one of the channels through which inflation can be monitored to stay within central bank's upper limit is by raising the interest rates. This leads to a trade-off between price stability and interest rates, which the Reserve Bank of India has faced especially after the global financial crisis.

The error correction terms of the model $VECM_1$ based on the four equations are shown in Table 9.

Table 9. Error Correction Terms ($VECM_1$)

	BR	*CPI*	*PDI*	*PFCE*
ECT	-0.2377 (0.0792)**	0.0479 (0.0289)	-0.0233 (0.0231)	-0.0179 (0.0173)

Note: Significance Level *** (0.1%) **(1%) *(5%) ·(10%)
Standard Errors in parentheses.

Bank rate is the only variable which is statistically significant. This implies that bank rate is error correcting in the model, i.e., any deviation in the long run equilibrium state is corrected by interest rate through short-run dynamic changes. The speed of convergence corrected each year towards the long run equilibrium is about 23.77%.

Table 10. Lagged Terms ($VECM_1$)

Equation	PDI (-1)	PFCE (-1)	PDI (-2)	PFCE (-2)	PDI (-3)	PFCE (-3)
BR	3.6447 (1.1872)**	-3.7649 (1.4887)*	3.0554 (1.1293)*	-3.6933 (1.3227)**	2.4746 (1.1641)*	-2.5615 (1.3263)·
Equation	CPI (-1)	CPI (-2)	BR (-3)	PDI (-3)	PFCE (-3)	
CPI	0.4048 (0.1447)**	-0.3360 (0.1537)*	0.1331 (0.0783)·	-1.1034 (0.4248)*	1.6555 (0.4840)**	
Equation	CPI (-3)					
PDI	0.3182 (0.1183)*					
Equation	CPI (-3)					
PFCE	0.2394 (0.0884)*					

Note: Significance Level *** (0.1%) **(1%) *(5%) ·(10%)
Standard Errors in parentheses.

Since the VECM model is very large as it contains four variables (therefore four equations) with a lag of 3, it's a bit difficult to precisely get an inference of the lagged variables. Therefore, I have only stated the statistically significant results of the lagged variables based on the model $VECM_1$ in Table 10. The useful insight is that for the bank rate equation, *PDI* and *PFCE* at all lags are significant and for *PDI* and *PFCE* equations, only the 3rd lag of *CPI* is significant.

ROBUSTNESS TESTS

To check for the robustness of the results of $VECM_1$, some tests involving testing for serial correlation of errors, autoregressive conditional heteroscedasticity and normality of residuals are conducted. The results of the robustness tests are shown in Table 11. Again, considering the small sample size, Edgerton-Shukur F test is employed. The null hypothesis of no serial correlation of errors cannot be rejected, therefore the model doesn't suffer from the problem of serially correlated errors. ARCH-LM Test by Engle (1982) is used for testing autoregressive conditional heteroscedasticity. Based on the results, the null hypothesis of no ARCH effects cannot be rejected, therefore it can be concluded that the residuals are not conditional heteroscedastic. The null hypothesis of the residuals being normally distributed can be rejected as per Jarque and Bera (1987) test, therefore the residuals of the model are not normally distributed, although the estimates will still be consistent. Overall, the model performs well in terms of robustness tests.

Table 11. Robustness Test Results

	Test statistic	*p-value*
Edgerton-Shukur F Test	1.0866 (F-statistic)	0.3797
Engle ARCH-LM Test	416.26 (Chi-squared)	0.2773
Jarque-Bera Test	72.919 (Chi-squared)	1.286e-12

Based on the results of the $VECM_2$ and $VECM_1$, it can be said that $VECM_1$ results are more effective, intuitive and along the lines of many fundamental theories of

consumption. Since the results were estimated using Johansen's Maximum Likelihood Estimator, it also becomes interesting to check how the results hold using another cointegration method and also, which of the results of the two estimated VECMs comes close to another method. Therefore, I estimate the long run relationship among the time series variables using Fully Modified OLS, a method developed by Phillips and Hansen (1990). Unlike Johansen's method, FM-OLS is a non-parametric method. Since FM-OLS is a regression-based method, one has to explicitly state or presume that a certain variable is the response variable whereas in Johansen's method, all the variables are considered endogenous and affect each other over time with their own lags as well as other variables' lags. So, I consider private final consumption expenditure (*PFCE*) as the response variable and personal disposable income (*PDI*), consumer price index (*CPI*) and bank rate (*BR*) as the predictor or the explanatory variables. Table 12 shows the results of FM-OLS.

Table 12. FM-OLS Results

	Estimates	p-value
PDI	1.0038328 (0.0020382)	2.2e-16***
CPI	-0.1044828 (0.0037549)	2.2e-16***
BR	0.0462631 (0.0124696)	0.0005206***

Note: Significance Level *** (0.1%) **(1%) *(5%) ·(10%)
Standard Errors in parentheses.

The results of FM-OLS are very much in line with the results obtained using Johansen's cointegration procedure for $VECM_1$. The signs and the magnitude of the coefficients are very similar. Personal disposable income and bank rate positively affect private consumption. Here also, there exists an almost one to one relationship between private consumption and disposable income. Price level negatively affects household consumption. Its coefficient is almost identical to the one obtained in $VECM_1$. Therefore, the results of FM-OLS provide one more evidence against $VECM_2$. This clearly suggest that there exists only one linear combination of the variables which is stationary in the long run.

CONCLUSION

The study examined the drivers of household consumption expenditure in India during the period 1960-61 to 2012-13. Variables were selected based on macroeconomic literature and in the context of Indian economy. Private Final Consumption Expenditure (PFCE) was selected as the variable of interest. The other variables of the study constituted – Personal Disposable Income (PDI), Consumer Price Index (CPI) and Bank Rate (BR).

The first step in the analysis involved testing for stationarity of all the variables. Augmented Dickey Fuller test was employed for the same and it was found that all the variables were integrated of order one. Two cointegration tests based on Johansen's cointegration procedure were applied and an evidence in favor of a stable long run relationship was found. Based on the results of the cointegration test, two different vector error correction models, $VECM_2$ and $VECM_1$, were estimated. The results of $VECM_1$ were better than $VECM_2$ in terms of intuition and along the lines of consumption theories.

The results based on $VECM_1$ implied that personal disposable income largely determines household consumption expenditure in India as there exists an almost one to one positive relationship between the two variables in the long run. It was also found that consumer price index negatively affected household consumption expenditure while the relationship between bank rate and household consumption expenditure was found to be positive. The argument towards inflation negatively affecting private consumption despite private consumption being a real economic variable hinges on the state of misapprehension of rise in price level with rise in relative prices by households, as stated by Deaton (1977). This leads to a decline in private consumption expenditure.

The results also indicated a possible trade-off between inflation and interest rate in determining private consumption expenditure as the coefficients of both consumer price index and bank rate were very similar in magnitude with bank rate positively affecting private consumption expenditure.

Though personal disposable income, inflation and interest rates are prominent macroeconomic determinants of private final consumption expenditure, but they are

not the only ones. For future research, the study can be extended in terms of modern consumption theories which take into account forward guidance. Not only current rate of inflation but also expectations of future inflation by the households, time inconsistency problem in the monetary policy also plays a pivotal role in determining the consumption of households. Therefore, it is imperative to analyze the degree to which these factors influence consumption decisions of households in India.

Also, in the context of Indian economy, personal remittances have gained significant importance in the modern era of globalization. According to the World Bank staff estimates based on IMF balance of payments data, India received 111.22 billion (current US $) in personal remittances of the total 758.95 billion (current US $) for the year 2022. Based on this estimate, it can be inferred that personal remittances might play an important role in determining household spending in India.

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