CHAPTER V

EFFECT OF FISCAL DEFICIT ON PRIVATE CONSUMPTION BEHAVIOUR IN INDIA

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5.1 INTRODUCTION

It has been argued that fiscal policies do influence consumption expenditure majorly through disposable income and the rate of return, measured by the real rate of interest (Blanchard and Fischer, 1989). If the tax rate should fall thereby implying a higher disposable income, private consumption will rise and vice-versa. The classical economists believe that consumption was a function of the rate of interest. In particular, they believe that an individual saves in order to have a fixed amount at retirement or in the future, she/he will find that at a higher rate of interest, she/he can save less of her/his current income and still reach her/his goal more rapidly. Consequently, she/he can afford to consume more of her/his current income (Olomola and Olagunju, 2004).

However in the context of Indian economy the effect of fiscal deficit on private consumption is still unclear.

Hence, in this chapter, an attempt is made to examine the short run and long run implications of fiscal deficit on private consumption behaviour in India during the period 1980-81 to 2012-13. For the purposes of the study we have gathered data from Reserve Bank of India's Database on Indian economy and from the World Bank. The chapter, also examines the effect of fiscal deficit, in this chapter we will also see the effect of other variables on private consumption expenditure.

Based on the theoretical principles and research experiences, the analysis consists in treating private consumption as a function not only of fiscal deficit, but also as a function of government consumption, disposable income, foreign savings, real interest rate, base money, domestic credit to private sector. Thus for the purpose of the study, the econometrics analysis of this study includes a set of independent variables (government consumption, disposable income, foreign savings, real interest rate, base money, domestic credit to private sector) and dependent variable (private consumption). Furthermore, to account for structural breaks we have included the dummy variables namely D_1 (Liberalisation, 1991), D_2 (Fiscal Responsibility and Budget Management Act (FRBM), 2003) and D_3 (Financial Crisis, 2008).

Moreover an attempt has been made to identify how significant is the impact of the independent variables on the dependent variable both in the short run and long run and in what direction. This will help us to test the hypothesis stated in chapter I and find out if the null hypothesis is rejected or we would fail to reject the null hypothesis.

The assessment of the impact of the independent variables is achieved using Vector Error Correction Model (VECM). At first, the analysis begins by specifying tests theoretical hypotheses and analytical equations, which describes the theoretical relationship.

As the VEC specification only applies to cointegrated series, it is necessary to run the Johansen cointegration test prior to VEC specification. This allows us to confirm that the variables are cointegrated and to determine the number of cointegration equations. A pre-condition for cointegration is to carry out the unit root test for stationarity, we use Augmented Dickey-Fuller (ADF) test to examine each of the variables for the presence of a unit root (an indication of non-stationary).

The chapter is further divided into three sections. The first section presents an econometrics model i.e., private consumption model which will state the consumption function for empirical testing, define its independent and dependent variables and state the expected direction of coefficient of independent variables. The second section is empirical analysis by using Johansen Cointegration and Vector Error Correction Model (VECM). In this section an attempt is made to establish long run relationship and analyse the short term dynamics of the private consumption model, the section begins by describing the specifications of the data sourced and goes on to present a descriptive statistical analysis of variables; builds vector autoregression (VAR) models, explains the relationship and tests the hypothesis in light of the assumptions. Additionally the section also analyses the influences that impulses or shocks in variables have on the VAR model. Finally the last section titled conclusion, summarises the empirical testing.

5.2 ECONOMETRIC MODEL: PRIVATE CONSUMPTION MODEL

The model follows the work of Morande and Schmidt-Hebbel (1991), Islam and Wetzel (1991) and Olomola and Olagunju (2004). To capture the effect of fiscal deficit on private consumption we specify the following relationship:

$$\mathbf{PC = f\ (YD, GC, FD, FS, BM, DCP, R)}$$

where PC is private consumption as % of gross domestic product (GDP), YD is disposable income as % of GDP, GC is government consumption as % of GDP, FD is fiscal deficits as % of GDP, FS is foreign savings as % of GDP, BM is base money as % of GDP, DCP is domestic credit to the private sector as % of GDP, and R is the real rate of interest.

In this study foreign saving (FS), will be defined as gross domestic investment net of gross domestic savings, while fiscal deficit variable FD, is measured as the difference between total revenue and total expenditure. If it is negative, then we have a deficit and if positive, it is taken as proxy for public savings, disposable income YD, defined as income minus taxes (Y-T), real rate of interest R, is measured as real interest rate = nominal interest rate – inflation rate.

The estimating equation is therefore:

$$\mathbf{PC_t = \alpha_0 + \alpha_1 YD_t + \alpha_2 GC_t + \alpha_3 FD_t + \alpha_4 FS_t + \alpha_5 BM_t + \alpha_6 DCP_t + \alpha_7 R_t + \mu} \qquad \mathbf{(5.1)}$$

α_0 is the intercept,

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7$ are the coefficients of the equation and

μ_t is error term

A prior expectation is that: $\alpha_1, \alpha_4, \alpha_5, \alpha_6 > 0$; $\alpha_2, \alpha_3, \alpha_7 < 0$

Studies have indicated that fiscal policies have significant impact on consumption expenditure majorly through disposable income and real rate of interest (Blanchard and Fischer, 1989). A fall in the tax rates would lead to higher disposable income thereby raising private consumption. Hence $\alpha_1 > 0$. In countries such as India where significant portion of the fiscal deficit is met through domestic borrowings, an increase in fiscal deficit is likely to bring about increase in interest rates and would also capture a large portion of the private savings, consequently leading to lower propensity to consume. Putting together the impacts on tax, interest rate and propensity to consume a higher fiscal deficit would lead to lower consumption. Accordingly the coefficient of fiscal deficit i.e., $\alpha_3 < 0$.

The expected effect of government consumption on private consumption is negative because of its crowding out behaviour as public spending crowds-out the private sector. The resultant effect is low investment and decline in consumption spending (Olomola

and Olagunju, 2004, p. 605). Hence $\alpha_2 < 0$. The impact of the foreign saving on private consumption is expected to be positive. "Foreign saving, which acts as an external liquidity constraint, boosts private consumption, as shown by its significantly negative influence on saving" (Schmidt-Hebbel et al., 1992, p. 543). Foreign savings lead to appreciation of the exchange rate, as a result the real wages rise and so do the imports. From a demand perspective, significant dependence on foreign savings leads to reduction in exports, investments and domestic savings. In long term the consequence is that the rate of substitution of foreign for domestic savings will be highly relative, and the country will become indebted to consume, not to invest and grow (Bresser-Pereira and Gala, 2008). Thus $\alpha_4 > 0$. Base money is expected to have positive impact on private consumption since an increase in money base leads to a decrease in interest rates and thus stimulating consumption. Therefore $\alpha_5 > 0$.

The impact of real rate of interest on private consumption is expected to be negative. The argument in favour is that a rise in real interest rates leads to decrease in propensity to consume and consequently an increase in the propensity to save. As per economic theory, how the private consumption is impacted by the real interest rates depends upon the relative magnitude of the substitution and income effect. According to Nakagawa and Oshima (2000), "The substitution effect is the amount that a consumer wins benefit from a decrease in real interest rates by consuming today rather than saving for tomorrow, so it results in an increase in consumption today. The income effect is the effect that a decrease in real interest rates causes by decreasing today's consumption since the amount of lifetime income declines by the reduction in the return on savings. In general, it is said that the substitution effect is larger than the income effect". Hence $\alpha_7 < 0$. The domestic credit to private sector has a positive impact on private consumption as there is easy availability of credit for the consumers, thus in addition to their current income consumers can also consume from their future earning by availing credit. Thus $\alpha_6 > 0$.

5.3 EMPIRICAL ANALYSIS USING JOHANSEN COINTEGRATION AND VECTOR ERROR CORRECTION MODEL (VECM)

The VECM model helps in identifying the long-term relationship and also the short-term dynamics of the endogenous variables. It shows the long-term equilibrium and the adjustment in the short term to achieve equilibrium. To determine the characteristics of

time series for each of the variables in the model, we go through the following 3 steps: Firstly, determine the order of integration of variables using Augmented Dickey Fuller test (ADF), to test the stationarity of the variables. Secondly, if the variables are integrated in the same order, (e.g. I (1)), we apply the Johansen method of cointegration to find long-term relationship and short-term dynamics. Finally, we use the VECM model and arrive at the error correction coefficient that measures the speed of adjustment in the long run equilibrium.

5.3.1 Unit Root Test

Most economic time series exhibits trending behaviour or non-stationarity in the mean. An important econometric task is determining the most appropriate form of the trend in the data. For cointegration modelling the data must be transformed to stationary form prior to further analysis and statistical tests. If the data are trending, then some form of trend removal is required. One of the common trend removal or de-trending procedures are first differencing, unit root tests can be used to determine first differences to render the data stationary. Similarly, it is imperative that all-time series in the cointegration equation have the same order of integration. Thus, we proceeded by determining the underlying properties of the processes that generate our time series, that is, whether the variable in our equation are stationary or non-stationary. We used Augmented Dickey Fuller (ADF) t-test for testing the order of integration. "Augmented dickey fuller test is a test for unit root in time series sample. It is an augmented version of the dickey fuller test for a larger and more complicated set of time series model" (Swamy, Chakravarthy, and Koka, 2014).

According to data series at levels there exist both constant and linear time trend. Accordingly the ADF test can be formulated as follows:

$$\Delta z_t = \alpha_0 + \theta z_{t-1} + \gamma t + \alpha_1 \Delta z_{t-1} + \alpha_2 \Delta z_{t-2} + ... + \alpha_p \Delta z_{t-p} + a_t \qquad (5.2)$$

At first difference we found that there exist only a constant and no trend. Thus its ADF model is as below:

$$\Delta z_t = \alpha_0 + \theta z_{t-1} + \alpha_1 \Delta z_{t-1} + \alpha_2 \Delta z_{t-2} + ... + \alpha_p \Delta z_{t-p} + a_t \qquad (5.3)$$

where, Δ is the first difference operator, z_t is the variable being considered, α_0 is the intercept constant, t is the time trend, θ is the coefficient presenting process root, i.e.

the focus of testing, γ is the coefficient on the time trend, a_t is a random error term, p is the lag-length which is determined by using Schwarz Bayesian Information Criterion (SBIC).

Before we apply the ADF test we make an assumption on the stationarity or non stationarity of the variables and are accordingly required to frame the hypothesis.

The Null Hypothesis of Augmented Dickey-Fuller (ADF) Unit Root Test is

H_0: $\theta = 0$, the series has a unit root, that is, series is non-stationary.

Alternative hypothesis is

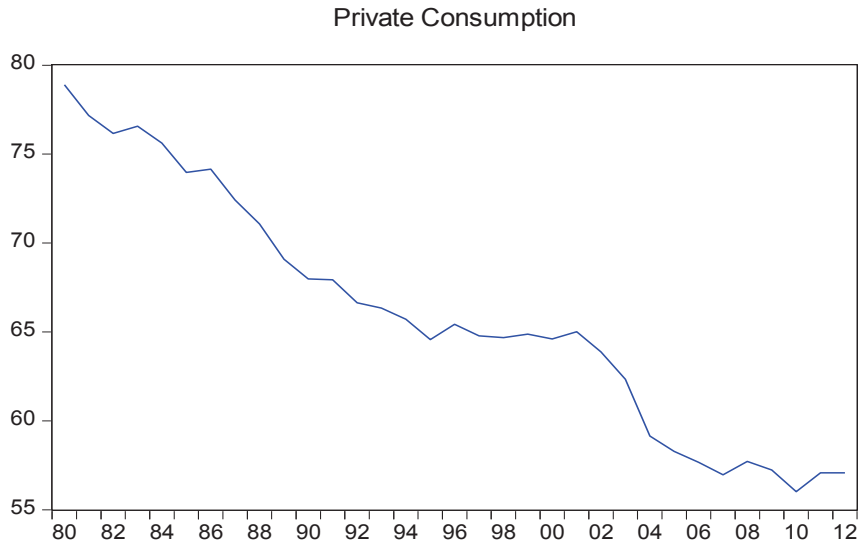
H_1: $\theta < 0$, the series has no unit root, that is, series is stationary.

We consider all the variables one by one for stationarity.

5.3.1.1 Private Consumption (PC)

Assumption: From the time series plot of private consumption (Figure 5.1(a)) we observe that there exists a trend in series and also there is an intercept as trend starts at non-zero value of private consumption. So, we applied ADF test with intercept and trend.

Figure 5.1(a) Augmented Dickey Fuller Test (Private Consumption): Time Series

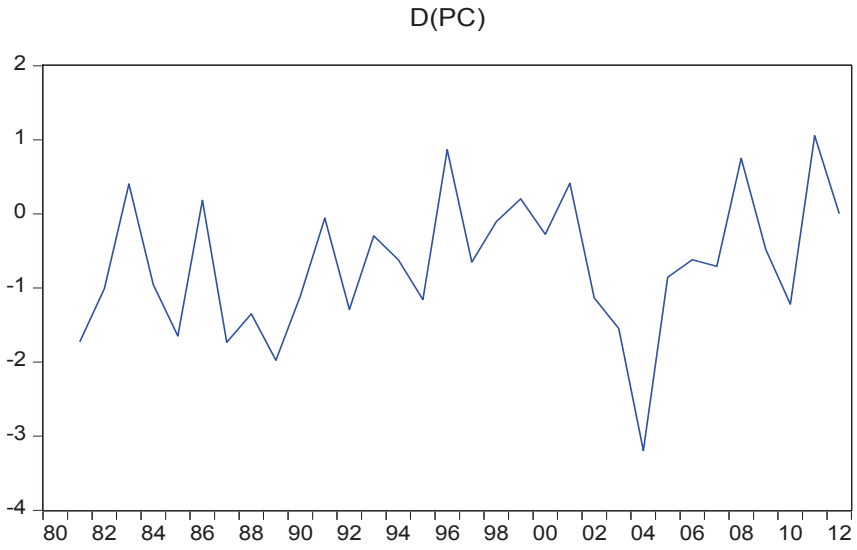


Source: Researcher's own calculation by using database from Components of Gross Domestic Product (At Market Price), Handbook of Statistics on Indian Economy, 2014-15, RBI (see Table A-14).

ADF Test: We found that we have not enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -1.71 and critical t at 5% = -3.56. Hence, private consumption

is non-stationary time series. So, we now look into first difference of private consumption series and the time series plot of first difference of private consumption. Figure 5.1(b) shows that there exist intercept but no trend. Hence, we have again applied ADF test and found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -4.86 and critical t at 5% = -2.96.

Figure 5.1(b) Augmented Dickey Fuller Test (Private Consumption): First Difference



Source: Researcher's own calculation.

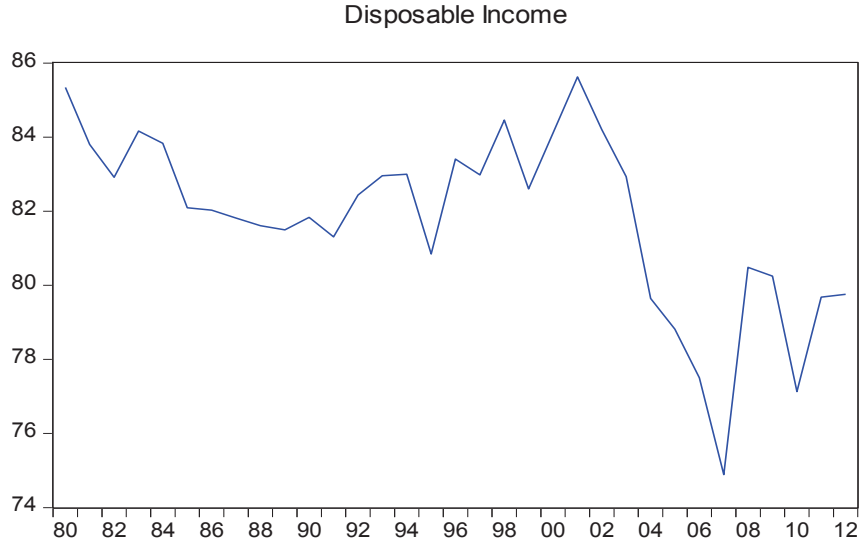
Implications: First difference of private consumption is stationary indicating that private consumption is integrated of order 1, I(1).

5.3.1.2 Disposable Income (YD)

Assumption: From the time series plot of disposable income (Figure 5.2(a)) we observe that there exists a trend in series and also there is an intercept as trend starts at non-zero value of disposable income. So, we applied ADF test with intercept and trend.

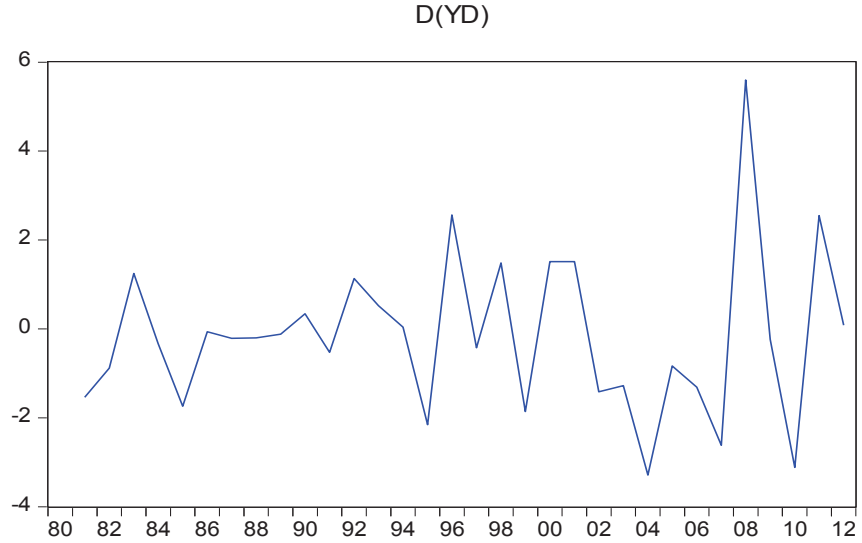
ADF Test: We found that we have not enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -2.81 and critical t at 5% = -3.56. Hence, disposable income is non-stationary time series. So, we now look into first difference of disposable income series and the time series plot of first difference of disposable income. Figure 5.2(b) shows that there exist intercept but no trend. Hence, we have again applied ADF test and found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -6.83 and critical t at 5% = -2.96.

Figure 5.2(a) Augmented Dickey Fuller Test (Disposable Income): Time Series



Source: Researcher's own calculation by using database from Macro-Economic Aggregates (At Current Price), Handbook of Statistics on Indian Economy, 2014-15, RBI (see Table A-14).

Figure 5.2(b) Augmented Dickey Fuller Test (Disposable Income): First Difference



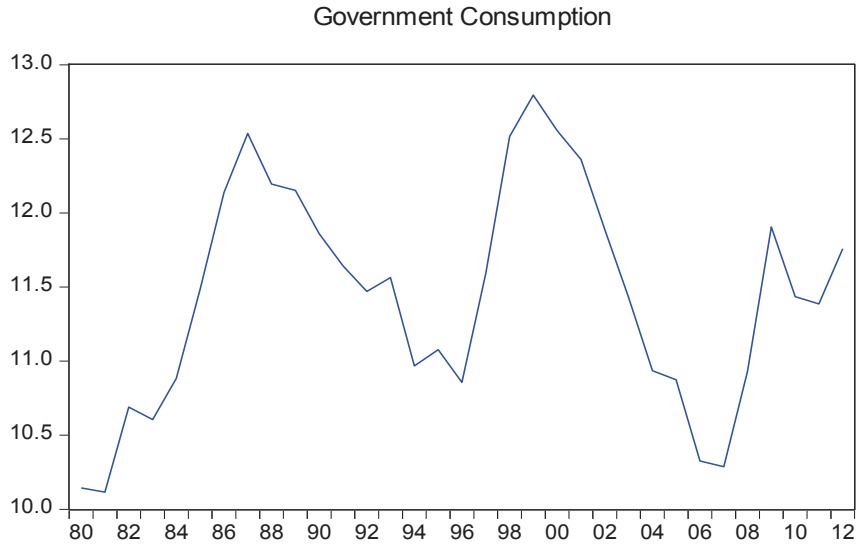
Source: Researcher's own calculation.

Implications: First difference of disposable income is stationary indicating that disposable income is integrated of order 1, I(1).

5.3.1.3 Government Consumption (GC)

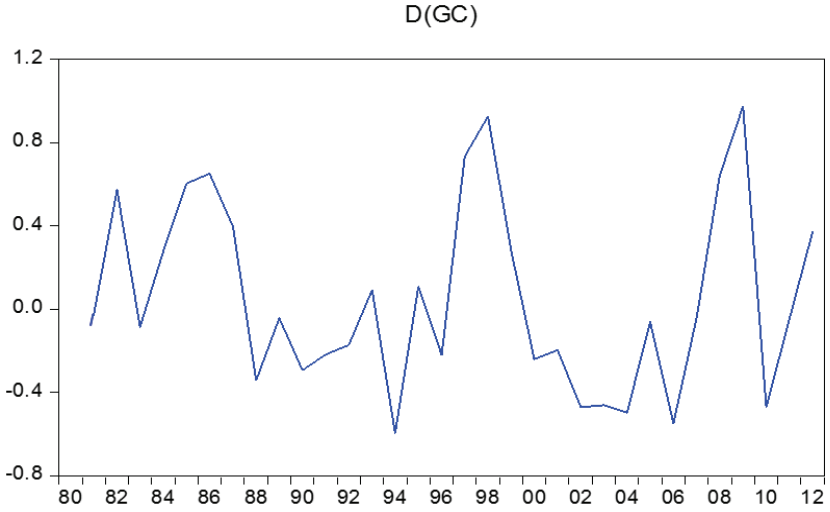
Assumption: From the time series plot of government consumption (Figure 5.3(a)) we observe that there exists a slight upward trend in series and also there is an intercept as trend starts at non-zero value of government consumption. So, we applied ADF test with intercept and trend.

Figure 5.3(a) Augmented Dickey Fuller Test (Government Consumption): Time Series



Source: Researcher's own calculation by using database from Components of Gross Domestic Product (At Market Price), Handbook of Statistics on Indian Economy, 2014-15, RBI (see Table A-14).

Figure 5.3(b) Augmented Dickey Fuller Test (Government Consumption): First Difference



Source: Researcher's own calculation.

ADF Test: We found that we have not enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -3.14 and critical t at 5% = -3.56. Hence, government consumption is non-stationary time series. So, we now look into first difference of government consumption series and the time series plot of first difference of government consumption. Figure 5.3(b) shows that there exist intercept but no trend.

Hence, we have again applied ADF test and found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -3.79 and critical t at 5% = -2.96.

Implications: First difference of government consumption is stationary indicating that private consumption is integrated of order 1, I(1).

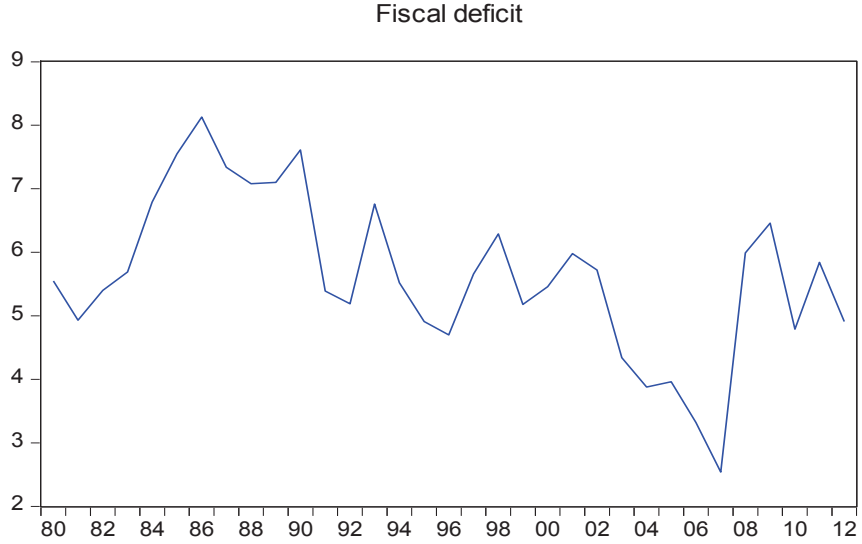
5.3.1.4 Fiscal Deficit (FD)

Assumption: From the time series plot of fiscal deficit (Figure 5.4(a)) we observe that there exists a trend in series and also there is an intercept as trend starts at non-zero value of fiscal deficit. So, we applied ADF test with intercept and trend.

ADF Test: We found that we have not enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -3.12 and critical t at 5% = -3.56. Hence, fiscal deficit is non-stationary time series. So, we now look into first difference of fiscal deficit series and the time series plot of first difference of fiscal deficit. Figure 5.4(b) shows that there exist intercept but no trend. Hence, we have again applied ADF test and found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -5.83 and critical t at 5% = -2.96.

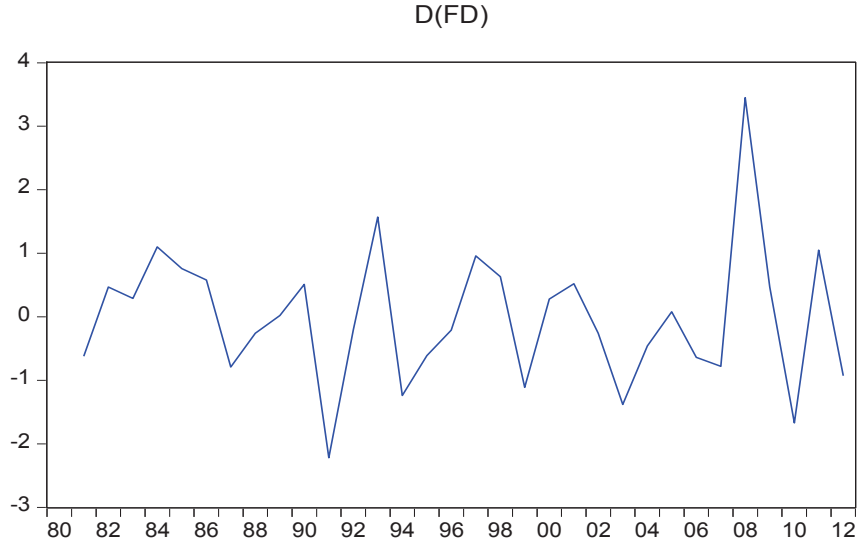
Implications: First difference of fiscal deficit is stationary indicating that fiscal deficit is integrated of order 1, I(1).

Figure 5.4(a) Augmented Dickey Fuller Test (Fiscal Deficit): Time Series



Source: Researcher's own calculation using database from Select Fiscal Indicators of the Central Government (As Percentage to GDP), Handbook of Statistics on Indian Economy, 2014-15, RBI (see Table A-14).

Figure 5.4(b) Augmented Dickey Fuller Test (Fiscal Deficit): First Difference

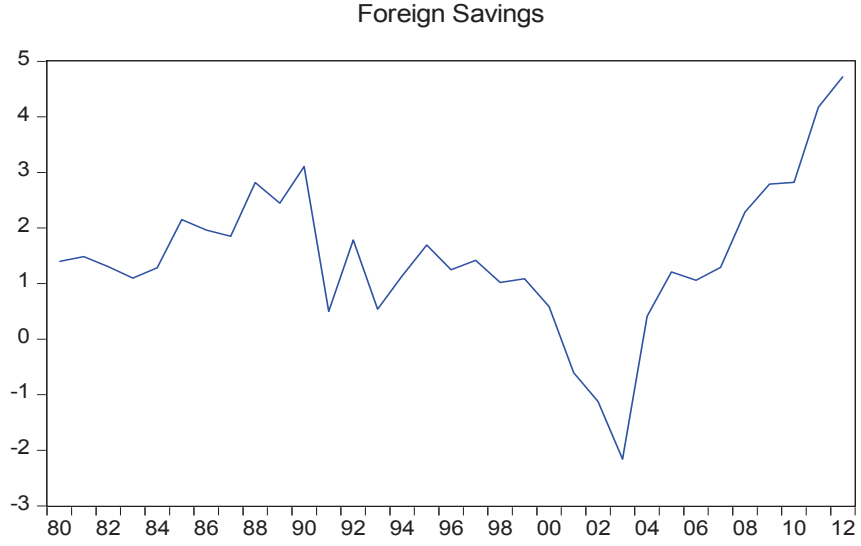


Source: Researcher's own calculation.

5.3.1.5 Foreign Savings (FS)

Assumption: From the time series plot of foreign savings (Figure 5.5(a)) we observe that there exists a slight upward trend in series and also there is an intercept as trend starts at non-zero value of foreign savings. So, we applied ADF test with intercept and trend.

Figure 5.5(a) Augmented Dickey Fuller Test (Foreign Savings): Time Series

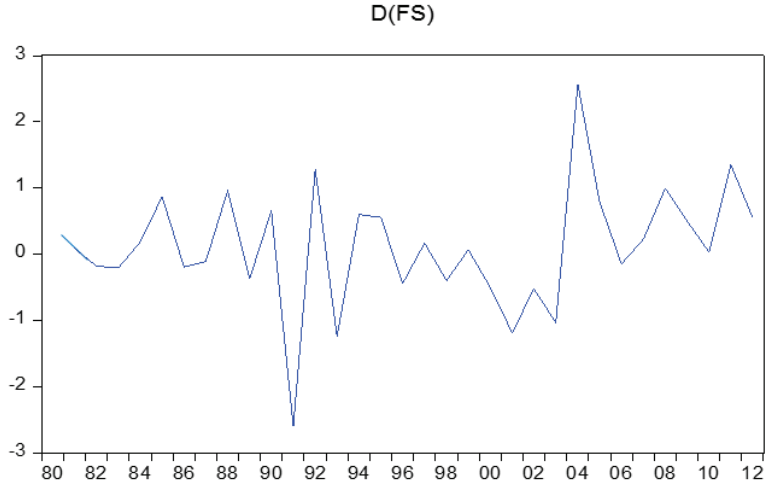


Source: Researcher's own calculation by using database from Macro-Economic Aggregates (At Current Price), Handbook of Statistics on Indian Economy, 2014-15, RBI (see Table A-14).
Notes: Foreign Savings = Gross Domestic Capital Formation – Gross Domestic Savings

ADF Test: We found that we have not enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -1.22 and critical t at 5% = -3.56. Hence, foreign savings is non-stationary time series. So, we now look into first difference of foreign savings series and the time series plot of first difference of foreign savings. Figure 5.5(b) shows that there exist intercept but no trend. Hence, we have again applied ADF test and found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -6.74 and critical t at 5% = -2.96.

Implications: First difference of foreign savings is stationary indicating that foreign savings is integrated of order 1, I(1).

Figure 5.5(b) Augmented Dickey Fuller Test (Foreign Savings): First Difference



Source: Researcher's own calculation.

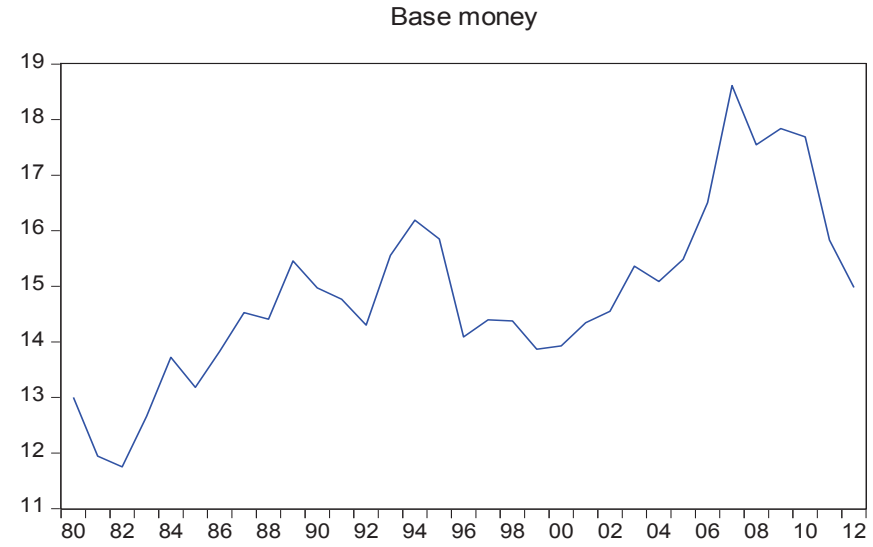
5.3.1.6 Base Money (BM)

Assumption: From the time series plot of base money (Figure 5.6(a)) we observe that there exists a trend in series and also there is an intercept as trend starts at non-zero value of base money. So, we applied ADF test with intercept and trend.

ADF Test: We found that we have not enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -2.02 and critical t at 5% = -3.56. Hence, base money is non-stationary time series. So, we now look into first difference of base money series and the time series plot of first difference of base money. Figure 5.6(b) shows that there exist intercept but no trend. Hence, we have again applied ADF test and found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -5.08 and critical t at 5% = -2.96.

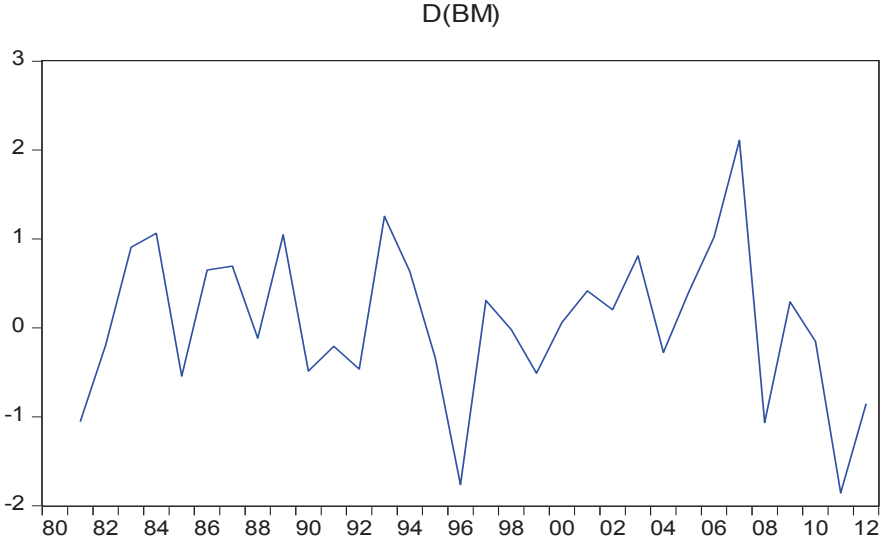
Implications: First difference of base money is stationary indicating that base money is integrated of order 1, I(1).

Figure 5.6(a) Augmented Dickey Fuller Test (Base Money): Time Series



Source: Researcher's own calculation by using database from Components of Money Stock, Handbook of Statistics on Indian Economy, 2014-15, RBI (see Table A-14).

Figure 5.6(b) Augmented Dickey Fuller Test (Base Money): First Difference

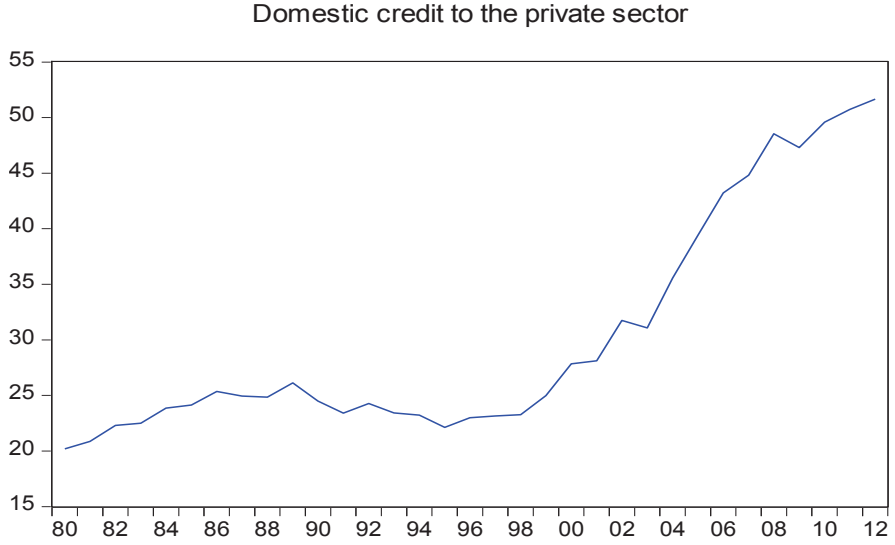


Source: Researcher's own calculation.

5.3.1.7 Domestic Credit to Private Sector (DCP)

Assumption: From the time series plot of domestic credit to private sector (Figure 5.7) we observe that there exists a trend in series and also there is an intercept as trend starts at non-zero value of domestic credit to private sector. So, we applied ADF test with intercept and trend.

Figure 5.7 Augmented Dickey Fuller Test (Domestic Credit to Private Sector)



Source: Researcher's own compilation by using database from the World Bank (see Table A-14).

ADF Test: We found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -4.52 and critical t at 5% = -3.61. Hence, domestic credit to private sector is stationary time series.

Implications: As domestic credit to private sector is stationary indicating that domestic credit to private sector is integrated of order 0, I(0).

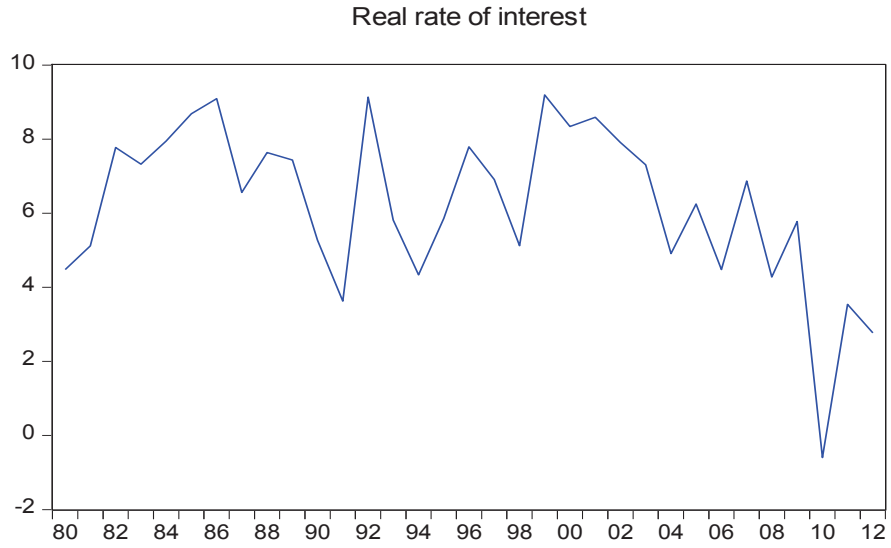
5.3.1.8 Real Rate of Interest (R)

Assumption: From the time series plot of real rate of interest (Figure 5.8) we observe that there exists a trend in series and also there is an intercept as trend starts at non-zero value of real rate of interest. So, we applied ADF test with intercept and trend.

ADF Test: We found that we have enough evidence to reject the null hypothesis at 0.05 level as t-statistic = -4.35 and critical t at 5% = -3.56. Hence, real rate of interest is stationary time series.

Implications: As real rate of interest is stationary indicating that real rate of interest is integrated of order 0, I(0).

Figure 5.8 Augmented Dickey Fuller Test (Rate of Interest): Time Series



Source: Researcher's own compilation by using database from the World Bank (see Table A-14).

Table 5.1 Result of Augmented Dickey Fuller Unit Root Test

Variables	Test Statistics for Level Series	0.05 Critical Value	Prob.*	Test statistic for differenced series	0.05 Critical Value	Prob.*	OI
PC	-1.71262	-3.55776	0.7222	-4.85952	-2.96041	0.0005	I(1)
YD	-2.81132	-3.55776	0.2037	-6.82781	-2.96041	0	I(1)
GC	-3.14388	-3.56288	0.1143	-3.79258	-2.96041	0.0072	I(1)
FD	-3.11609	-3.55776	0.1198	-5.83097	-2.96397	0	I(1)
FS	-1.22467	-3.55776	0.8881	-6.74432	-2.96041	0	I(1)
BM	-2.02464	-3.55776	0.5662	-5.0823	-2.96041	0.0002	I(1)
DCP	-4.51743	-3.61229	0.0077	------	------	------	I(0)
R	-4.34733	-3.55776	0.0084	------	------	------	I(0)

Source: Researcher's own calculation (see Table A-15 to A-28).

Notes: 1. *MacKinnon (1996) one-sided p-values, p-values > 0.05, we accept H_0

2. OI: Order of Integration
3. I(1): Stationary at first difference
4. I(0): Stationary at level

The Table 5.1 presents the estimates of the results of Augmented Dickey Fuller Test. Evidence from the results table confirmed that at 5% significance level the variables private consumption (PC), disposable income (YD), government consumption (GC), fiscal deficit (FD), foreign savings (FS), base money (BM) are non-stationary at levels but are made stationary at first difference, indicating that they are integrated of order

(1) or we can say they belong to I(1) series. Real rate of interest (R) and domestic credit to private sector (DCP) are stationary at levels i.e., I(0) series. Therefore, we have assumed real rate of interest (R) and domestic credit to private sector (DCP) as exogenous variables. Consequently, the presence of significant cointegration relationship among the variables could be determined. We therefore, carried out the Johansen cointegration test by considering real rate of interest and domestic credit to private sector as exogenous variables.

5.3.2 Choice of Lags

Since ADF test have confirmed that the series are integrated in same order, we can now proceed with Johansen's cointegration test. Johansen's procedure of multivariate cointegration requires the existence of a sufficient number of time lags. For this purpose it is necessary to select optimal lag length of initial VAR (Vector Autoregressive). Therefore, different information criteria's were computed for different time lags by using VAR lag order selection criteria. The optimal length is determined by the minimized value of information criteria. We have recorded and compared Akaike information criterion (AIC) and Schwarz information criterion (SIC) for determining the lag length. Results of order selection criteria are given in Table 5.2.

Table 5.2 Result of VAR Lag Order Selection Criteria

Lags	AIC	SIC
0	14.39442	16.04563
1	13.61925	**15.78196***
2	13.12562	16.09590
3	**13.02813***	16.62211
4	13.17538	17.53058
5	13.36950	18.71958
6	14.16612	20.03549

Source: Researcher's own calculation (see Table A-29).
Notes: 1. AIC: Akaike Information Criterion
2. SIC: Schwarz Information Criterion

The results in Table 5.2 showed that we got contradictive results of AIC and SIC because of the differences in their penalty functions. The lowest value of AIC is 13.02813 which indicates VAR with 3 lags and the lowest value of SIC is 15.78196 which indicates VAR with 1 lag. As we have a small sample size, so penalty term to SIC criteria is higher. Hence, when they select different lag lengths, the SIC will choose

a more "parsimonious" lag length than the AIC. Therefore we will use 1 lag in order to be conservative.

5.3.3 Johansen Cointegration

After choosing appropriate lag length, we proceed with the Johansen's cointegration test. The model is estimated under the assumption that there is intercept with no trend. It will determine the long run relationship between fiscal policy and private consumption (Johansen S., 1991) (Johansen and Juselius, Katarina, 1990). The Johansen's framework provides the number of cointegrating equations. The trace test and maximum Eigen test are conducted to establish the number of cointegration relations in each of the equations.

As seen under the unit root tests both domestic credit to private sector (DCP) and real rate of interest (R) are stationary at levels, thus we will consider them as exogenous in our cointegration analysis. Also, we have introduced D_1, D_2 and D_3 as three dummy exogenous variables to provide for the structural breaks in series, where;

D_1: Liberalisation, 1991
D_2: Fiscal Responsibility and Budget Management Act (FRBM), 2003
D_3: Financial Crisis, 2008

According to Temd and Gokmen (2010, p. 135), "Dummy variables are the ones that reflect qualitative changes and take the values such as 0 and 1. It can be used as to take the crisis periods into consideration in the models constituted. Within the equation, the dummy variable takes the value of 1 in the crisis period and 0 in the non – crisis period. Using constant dummy means to reflect a qualitative change by means of a constant term. Within the study, it was decided to use a constant dummy for the reason that the analysed period involves years with substantial policy changes."

Johansen defines two different test statistics for cointegration under his method: the Trace Test and the Maximum Eigenvalue Test. The Trace test is a "joint test that tests the null hypothesis of no cointegration (H_0: $r = 0$) against the alternative hypothesis of cointegration (H_1: $r > 0$)." The Maximum Eigenvalue test conducts tests on each eigenvalue separately. It tests "the null hypothesis that the number of cointegrating vectors is equal to r against the alternative of $r + 1$ cointegrating vectors." (Adhikari and Matta, 2013, p. 13).

Trace Test Equation:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1 - \lambda_i) \ldots\ldots\ldots\ldots \quad (5.4)$$

Maximum Eigenvalue Test Equation:

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1}) \ldots\ldots\ldots\ldots \quad (5.5)$$

r = number of cointegrating vectors under the null

λ = estimated ith ordered eigenvalue from the $\alpha\beta$' matrices

Taking a lag interval of 1 and the MacKinnon-Haug-Michelis (1999) p-values, we observed that trace test showed three cointegrating vectors and the rejection of null hypothesis of R = 0 at the 5% significance level (Table 5.3). Test statistics from the maximum Eigen value are consistent in suggesting that there are three integrating vectors among the variables. The existence of the cointegrating equations prompts us to confirm the long run equilibrium relation among our macroeconomic time series.

Table 5.3 Summary of Johansen Test for Cointegration

Hyp. No. of CE(s)#	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**	Trace Statistic	0.05 Critical Value	Prob.**
None	0.894350	69.67621*	40.07757	0.0000	158.3979*	95.75366	0.0000
At most 1	0.667516	34.13608*	33.87687	0.0466	88.72169*	69.81889	0.0008
At most 2	0.654969	32.98779*	27.58434	0.0091	54.58561*	47.85613	0.0102
At most 3	0.388376	15.24079	21.13162	0.2724	21.59782	29.79707	0.3214
At most 4	0.155900	5.254022	14.26460	0.7095	6.35703	15.49471	0.6533
At most 5	0.034955	1.103008	3.841466	0.2936	1.103008	3.841466	0.2936

Source: Researcher's own calculation (see Table A-30).

Notes: 1. * denotes rejection of the hypothesis at the 0.05 level

2. **MacKinnon-Haug-Michelis (1999) p-values
3. Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
4. Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
5. # denotes hypothesized number of cointegrating equations

Results of the most efficient cointegration equation based on the a priori signs and statistics is shown in Table 5.4.

Table 5.4 Result for the Estimated Long Run Cointegration Equation

Variables	Coefficients	Std. Error	t-Statistics
PC(-1)	1	-	-
YD(-1)	-2.033834	0.20094	-10.1214
GC(-1)	5.245803	0.30214	17.362
FD(-1)	-2.501677	0.28318	-8.83408
FS(-1)	-1.919445	0.29426	-6.52285
BM(-1)	0.807502	0.19264	4.19169
C	45.06821	-	-

Source: Researcher's own calculation (see Table A-31).

The equation (eq. 5.1) given under the Private Consumption Model earlier can now be restated with the coefficients as follows. The figures in parentheses show the t statistics.

$$\mathbf{PC = -\ 45.07 + 2.03\ YD - 5.25\ GC + 2.50\ FD + 1.92\ FS - 0.81\ BM}$$
$$\mathbf{(-10.12)\quad (17.36)\quad (-8.83)\quad (-6.52)\quad (4.19)}$$

If the dependent variable of imports is interpreted as a LHS variable (Left hand side) in a model, then the RHS coefficient "RHS" (Right hand side) should be multiply by -1. Thus the signs of the coefficients as given in Table 5.4 are reversed and they clearly show that, in the long run, fiscal deficit has a positive impact on private consumption, a unit increase in FD leads to 2.50 units increase in private consumption, this contradicts the expected sign. The reason could be due to the fact that real interest rates have been declining over the years. This leads to a decline in the propensity to save and hence, an increase in consumption expenditure. The impact of disposable income (YD) is positive on private consumption, a unit increase in YD leads to 2.03 unit increase in PC, as expected in the long run. Similarly, the impact of foreign savings (FS) is also positive as expected, a unit increase in FS leads to 1.92 units increase in PC.

Government consumption (GC) has a negative impact as expected in the long run, a unit increase in GC leads to 5.25 units decrease in PC. The impact of base money on private consumption is negative, a unit increase in BM leads to 0.81 units decrease in PC, similar to fiscal deficit, base money also contradicts with the expected sign. The reason could be that an increase in money supply leads to inflation and to a consequent decrease in real income thereby resulting in lower consumption.

Assuming t-statistics greater than 2.0930 (at 5% level) to be significant, we observe that the effect of disposable income, government consumption, fiscal deficit, foreign

savings and base money are significant on private consumption in the long run (Table 5.4).

5.3.4 Vector Error Correction Model

"The Johansen's process is a maximum likelihood method that determines the number of cointegrating vectors in a non-stationary time series Vector Autoregression (VAR) with restrictions imposed, known as a Vector Error Correction Model (VECM)" (Adhikari and Matta, 2013, p. 13).

VECM not only helps us in understanding long run relationship between variables but also introduces the concept of error correction to study how the deviation from the long run are "corrected". Vector Error Correction estimation model is as follows:

$$\Delta X_t = \mu + \sum_{i=1}^{p} \Gamma i \Delta X_{t-i} + \alpha \beta' X_{t=i} + \varepsilon_t \dots\dots\dots\dots\dots (5.6)$$

X_t= (n x 1) vector of all the non-stationary indices in the study

Γ_i= (n x n) matrix of coefficients

α= (n x r) matrix of error correction coefficients where r is the number of cointegrating relationships in the variables, so that $0 < r < n$. This measures the speed at which the variables adjust to their equilibrium (also known as the adjustment parameter).

β= (n x r) matrix of r cointegrating vectors, so that $0 < r < n$. This is what represents the long-run cointegrating relationship between the variables.

Vector Error Correction Model (VECM) is estimated to examine short run dynamics of the variables. While in the long run equation the exogenous variables i.e. rate of interest (R), domestic credit to private sector (DCP) and three dummy variables (D_1, D_2, D_3) are not assigned coefficients, in the short run these exogenous variables are included and are assigned coefficients.

The empirical results of the estimated vector error-correction model are presented in Table 5.5.

Table 5.5 Vector Error Correction Model Showing the Short Run Effects

Variables	Coefficients	Std. Error	t-Statistics
ECM(-1)	-0.084	0.096	-0.869
D(PC(-1))	0.204	0.321	0.634
D(YD(-1))	-0.307	0.187	-1.644
D(GC(-1))	0.204	0.544	0.375
D(FD(-1))	0.146	0.353	0.414
D(FS(-1))	-0.005	0.279	-0.019
D(BM(-1))	-0.345	0.309	-1.116
C	-1.566	1.588	-0.986
DCP	0.007	0.026	0.287
R	0.115	0.132	0.873
D_1	0.727	1.107	0.657
D_2	-1.085	1.028	-1.055
D_3	2.479	1.318	1.881
R-squared	0.412481	Log likelihood	-32.775
Adj. R-squared	0.020801	Akaike AIC	2.953228
Sum sq. resids	15.03873	Schwarz SC	3.554578
S.E. equation	0.914049	Mean dependent	-0.64839
F-statistic	1.053107	S.D. dependent	0.923706

Sources: Researcher's own calculation (see Table A-31).

Putting the coefficients in equation (5.6), the resultant equation will be as follows:

$\Delta PC = - 0.084 [PC(-1) + 45.07 - 2.03 YD(-1) + 5.25 GC(-1) - 2.50 FD(-1) - 1.92 FS(-1) + 0.81 BM(-1)] + 0.204 \Delta PC(-1) - 0.307 \Delta YD(-1) + 0.204 \Delta GC(-1) + 0.146 \Delta FD(-1) - 0.005 \Delta FS(-1) - 0.345 \Delta BM(-1) - 1.566 + 0.007 DCP + 0.115 R + 0.727 D_1 – 1.085 D_2 + 2.479 D_3$

The result shows that the error correction term is negative as expected. The coefficient of ECM is negative indicating that any short term fluctuations between variables will give rise to a stable long run relationship between the variables. The error correction coefficient is -0.084 and it measures the speed of adjustment of private consumption towards long run equilibrium. It showed that a feedback of about 8.4% of the previous year's disequilibrium from the long run elasticity, i.e., deviation of private consumption would be restored at the rate of 8.4%. We observed that in the short run, the effect of disposable income, government consumption, fiscal deficit, foreign savings, base money, domestic credit to private sector, real rate of interest and dummy variables (D_1, D_2, D_3) on private consumption are not significant.

In short run, the adjustments on effect of YD (-0.307), FS (-0.005) and BM (-0.345) on PC is diminishing or negative. The adjustments on effect of GC (0.204) and FD (0.146) on PC is amplifying or positive. The exogenous variables, domestic credit to private sector and real rate of interest both have positive impact on private consumption, but not significant. The impact of domestic credit to private sector is as expected but that of real rate of interest contradicts with the expected sign. The impact of dummy variables D_1, D_2, D_3 on private consumption are 0.727, -1.085 and 2.479 respectively.

The impact of dummy variable D_1, i.e. Liberalisation 1991 is positive on private consumption, possibly opening up of the economy with access to more funds and products may have led to higher consumption. The impact of dummy variable D_2, i.e. Fiscal Responsibility and Budget Management Act, 2003 (FRBM) is negative on private consumption possibly as an increase in fiscal deficit would lead rational consumers to believe that there would be an increase in taxes in future and thus the future disposable income would drop. In that expectation the consumers would reduce their current consumption expenditure such that they are able to maintain the same level of real consumption in the future as well. The impact of dummy variable D_3, i.e. Financial Crisis 2008 is positive on private consumption, as India was not affected significantly by financial crisis in 2007-08. Also between 2007-09 the Central government had already scheduled to launch a few expansionary schemes which would lead to increase in demand viz. rural farm loan waiver scheme, the expansion of social security schemes under the National Rural Employment Guarantee Act (NREGA) and the implementation of revised salaries and compensations for the central public servants as per the recommendations of the Sixth Pay Commission and somewhat the General elections in 2008 also had a positive impact on boosting demand and in turn the private consumption expenditure.

5.3.5 Testing Hypothesis

The hypothesis to be tested in this thesis has been constructed as:

The Null Hypothesis (H_0):

There is no significant impact of independent variables (fiscal deficit, disposable income, real rate of interest, foreign savings, base money, domestic credit to private

sector and government expenditure) on dependent variable (private consumption) in the long run.

which is tested against the alternative hypothesis;

Alternative Hypothesis (H_1):

There is significant impact of independent variables (fiscal deficit, disposable income, real rate of interest, foreign savings, base money, domestic credit to private sector and government expenditure) on dependent variable (private consumption) in the long run.

Given the results of the unit root tests the real rate of interest (R) and domestic credit to private sector (DCP) are exogenous variables and thus have not been subjected to further empirical study in the long run. From the results of the Johansen Cointegration and Vector Error Correction Model (VECM) it is visible that we have enough evidence to reject null hypothesis (Table 5.6).

In the long run, the impact of all the endogenous variables i.e., disposable income, government expenditure, fiscal deficit, foreign savings and base money on the dependent variable i.e., private consumption is significant as the value of t-statistics of all the variables are greater than 2.0930 (at 5% level), which mean that the impact of endogenous variables on the dependent variable is significant in the long run.

Table 5.6 Endogenous Variables Coefficients and t-Statistics

Variables	Coefficients	t-Statistics
YD(-1)	-2.033834	-10.1214
GC(-1)	5.245803	17.362
FD(-1)	-2.501677	-8.83408
FS(-1)	-1.919445	-6.52285
BM(-1)	0.807502	4.19169

Source: Researcher's own calculation (see Table A-31).

5.3.6 Assumptions of VECM

As an econometric model the results of the VECM model must also satisfy set of assumptions for it to be considered a valid and reliable function. We now look at the various set of assumptions that our model must adequately meet.

5.3.6.1 Assumption of multivariate normality of residuals

We check the residuals' normality via Jarque-Bera test. From following VEC Residual Normality Tests, we observe that we have not enough evidence to reject the null hypothesis as Jarque-Bera test is not significant, χ^2 (12) = 5.03, p = 0.9569 > 0.05. Hence, assumption of multivariate normality of residuals is satisfied.

5.3.6.2 Assumption of no serial correlation of residuals

We check for autocorrelation in the residuals by means of Lagrange Multiplier (LM) test. The results of VEC Residual Serial Correlation Lagrange Multiplier (LM) Tests are as follows from where we have not enough evidence to reject the null hypothesis as test is not significant, $\chi2(36) = 33.76$, p = 0.5757 > 0.05. Hence, assumption of no serial correlation of residuals is satisfied.

5.3.6.3 Assumption of no Heteroskedasticity of residuals

The results of VEC Heteroskedasticity Tests are as follows from where we have not enough evidence to reject the null hypothesis as test is not significant, $\chi2(441)=431.04$, p = 0.6238 > 0.05. Hence, assumption of no Heteroskedasticity of residuals is satisfied.

Table 5.7 presents a summary of the assumptions and their respective results in relation to our model. We see that the results of our model meet the set of assumptions thereby rendering reliability and validity to our model.

Table 5.7 Summary of Assumptions

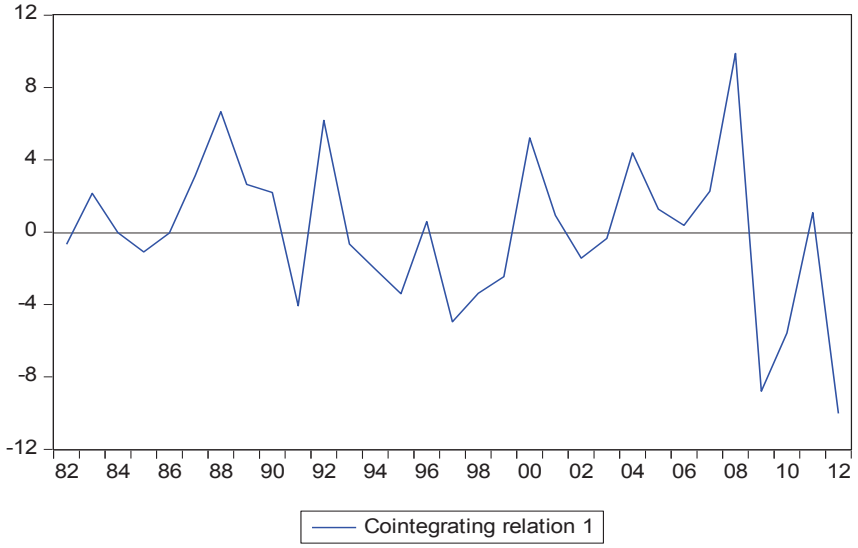
The tests for normality, autocorrelation, heteroskedasticity			
	H_0	**df**	**prob**
VEC Residual Normality Tests	residuals are multivariate normal	12	0.9569
VEC Residual Serial Correlation LM Tests	no serial correlation at lag order h	36	0.5757
VEC Residual Heteroskedasticity	Residuals are homoskedastic	441	0.6238

Sources: Researcher's own calculation (see Table A-32 to A-34).
Notes: If p > 0.05, we accept H_0
df – degrees of freedom

5.3.6.4 Cointegration Equation Stationarity

The cointegration graph showed that the first cointegration equation is stationary as movements are up and down around the horizontal linear and hence stationary (Figure 5.9).

Figure 5.9 Cointegration Equation Stationarity

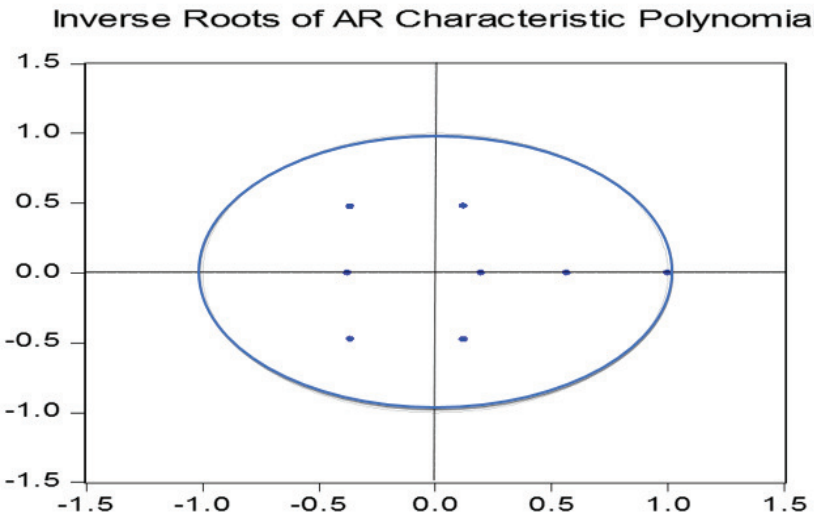


Source: Researcher's own calculation

5.3.6.5 Eigenvalue Stability

In addition we check if the model satisfies eigenvalue stability/cointegration conditions.

Figure 5.10 Eigenvalues Stability Circle



Source: Researcher's own calculation

For this we created a plot from where we observe that some of the eigenvalues are inside the unit circle and some are equal to one and none is greater than 1. This states that necessary condition of cointegration that no root greater than 1 exists (Figure 5.10).

5.3.7 Impulse Response Analysis and Variance Decomposition

Under the Vector Error Correction (VEC) a shock to any one variable not only impacts the variable itself but its effect is also passed on to the other endogenous variables as well. This transmission of effect is achieved through the VEC's dynamic lag structure. The effect of a shock on endogenous variables on the current and future values put together forms an Impulse Response Function (IRF).

An impulse response function differs from variance decomposition as "variance decomposition separates the variation in an endogenous variable into the component shocks to the VEC. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VEC" (Ezeabasili, Mojekwu, and Herbert, 2012, p. 113).

5.3.7.1 Impulse Response Analysis

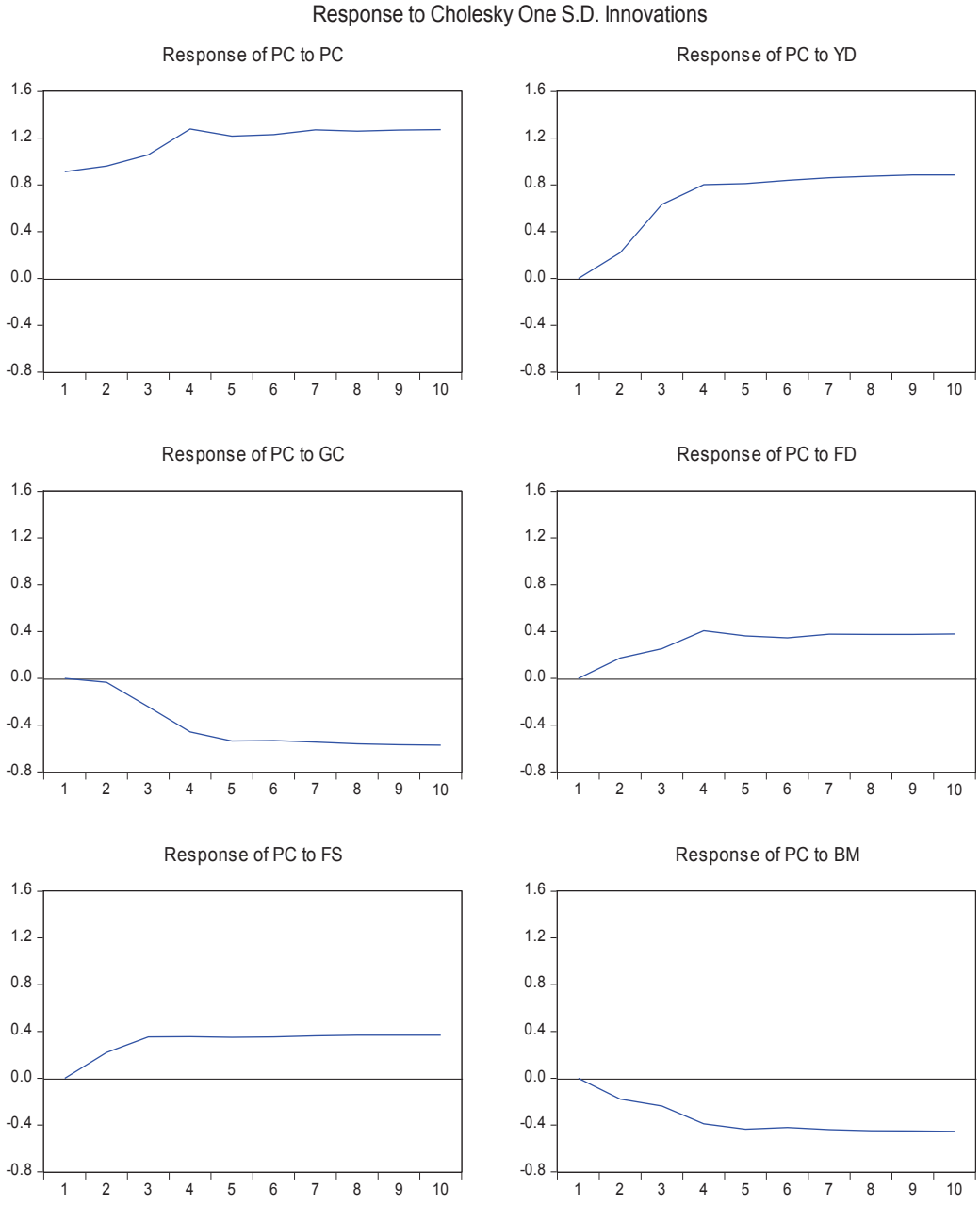
The Impulse Response Function (IRF) is used in order to trace out the responsiveness of the dependent variables to shocks to each of the other variables (Rafiq, Salim, and Bloch, 2009, p. 128). It shows the dynamic impacts of various shocks in the future. The impulse response function of VAR is to analyse dynamic effects of the system when the model received the impulse.

For our VAR model, including PC we have six endogenous variables. We can work the response of each of these variables with themselves and responses between them. The results are presented in Figure 5.11. On the horizontal axis are time periods, taken for a 10 year horizon for all the variables i.e. we are looking at effect that the IRF will have over 10 year period . The vertical axis is expressed in units of the Y variable. The solid line is a point estimate for the amount Y is expected to change following a unit impulse (or a unit shock) after the number of periods on the horizontal axis.

Figure 5.11 depicts in detail the impact that a unit impulse or shock of endogenous variables would have on PC. A unit impulse in PC would have a positive effect on itself, the effect would increase as we move from period 1 to 4 and then stabilise going

forward. Unit shocks in YD, FD and FS will also cause an influence on PC. In response to an impulse from YD and FD, PC would rise up to period 4 and then would have constant effect up to the 10 years, however in terms of significance of impact a unit shock in YD will lead to higher impact vis-à-vis a unit shock in FD.

Figure 5.11 Impulse Response Functions for the Private Consumption Equation



Source: Researcher's own calculation

In terms of the impact from FS impulse PC would rise from period 1 to 3 and then remain almost constant. It's seen in Figure 5.11 that a unit shock in GC and BM would

have negative influence on PC. For both the negative effect would increase up to 5 years and steady. In terms of the quantum of impact impulse in GC will bring about a higher negative impact on PC than would be brought about by a BM impulse. The positive impact of the fiscal deficit (FD), disposable income (YD), foreign savings (FS) and the negative impact of government consumption (GC) and base money (BM) discovered under the VAR model of the private consumption expenditure is confirmed in the impulse response function.

5.3.7.2 Variance Decomposition

The effect of one-time shock to innovation in current and future relationships between private consumption, fiscal deficit, government consumption, disposable income, foreign savings and base money using variance error decomposition within a 10 period is shown in Table 5.8

The result of the variance decomposition estimates of private consumption in Table 5.8 indicates that disposable income shocks explain about 21.99% of the variation in private consumption in the 10^{th} period. This is followed by government consumption which explains about 8.34% changes in private consumption during the same period. However, about 5.61%, 4.32% and 4.31% of the future changes in private consumption are attributable to changes in base money, foreign savings and fiscal deficit respectively, while about 55.44% of future changes in private consumption are explained by present private consumption.

Table 5.8 Variance Decomposition of Private Consumption Equation

Period	S.E.*	PC	YD	GC	FD	FS	BM
1	0.914049	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	1.385177	91.63971	2.525028	0.056467	1.586231	2.541658	1.650906
3	1.935580	76.82578	12.02536	1.615545	2.539889	4.650191	2.343240
4	2.584602	67.58467	16.36783	4.054655	3.904194	4.492898	3.595751
5	3.090991	62.78376	18.33810	5.834563	4.114010	4.420985	4.508589
6	3.532437	60.21152	19.67997	6.744824	4.113093	4.382961	4.867631
7	3.950080	58.51843	20.49750	7.293804	4.202972	4.352840	5.134451
8	4.330050	57.17449	21.14002	7.741254	4.249447	4.347320	5.347463
9	4.684241	56.18721	21.63114	8.077892	4.277993	4.334188	5.491581
10	5.016245	55.44098	21.98548	8.337400	4.305784	4.320555	5.609798

Source: Researcher's own calculation
Notes: *Standard Error

From the variance decomposition of PC we observe that in the first period 100% of PC variance could be interpreted by current PC variance and the percentages are still significant over the forecasted period. Furthermore, YD and GC have high contribution to variance while FD, FS, BM have almost similar contributions. So we may conclude that YD and GC explains most of the variations in the model and thus PC is better explained by YD and GC.

5.4 CONCLUSION

The objective of this study is to examine the long run and short run linkages between fiscal deficit and private consumption expenditure in India by using annual time series data for the period 1980 to 2012. This study uses time series econometric tools such as Augmented Dickey Fuller unit root tests, Johansen cointegration and Vector Error Correction Models to investigate the dynamic relationship between fiscal deficit and private consumption. We carried on empirical research to investigate the impact of fiscal deficit, government consumption, disposable income, foreign savings, base money, real rate of interest, domestic credit to private sector on private consumption for the Indian economy. The study period also considered three dummy variables i.e., D_1 (Liberalisation, 1991), D_2 (FRBM Act, 2003) and D_3 (Financial Crisis, 2008) provide for structural breaks.

The results of ADF unit root test show that except real rate of interest and domestic credit to private sector all other variables are stationary in the first difference. The Johansen cointegration modelling techniques used in this paper have revealed that there is a significant long run relationship between dependent and independent variables. Empirical evidence emerges that there is a positive impact of fiscal deficit, disposable income and foreign savings on private consumption expenditure. Government consumption and base money have negative impact on private consumption expenditure.

The result shows that in both short run and long run, increase in fiscal deficit have generated substantial increase in private consumption expenditure in India. Base money has a negative impact on private consumption expenditure in India in both short and long run.

Unlike long run there is a positive impact of government consumption on private consumption expenditure in the short run. The impact of disposable income and foreign

savings on private consumption expenditure also contradicts in long run and short run. In long run disposable income and foreign savings both have a positive impact and in short run have a negative impact. In long run the impact of all the endogenous variables are significant but in short run the impact is not significant on private consumption expenditure.

The impulse response function also confirmed the positive impact of the fiscal deficit (FD), disposable income (YD), foreign savings (FS) and the negative impact of government consumption (GC) and base money (BM) discovered under the VAR model of the private consumption expenditure in the long run.

The result of variance decomposition of private consumption over a 10 year period shows that about 55.44% of future changes in PC is explained by PC itself. Furthermore, YD and GC explain most of the variation in the model followed by BM, FS and FD.