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ESTIMATION OF MPC IN INDIA

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Abstract

This project considers the data on national income and household consumption expenditure of the Indian economy for the period 1995-96 to 2009-10 and finds that the estimated value of marginal propensity to consume during this period is 0.63. It also observes the estimate is significant at 1% level. It infers that fiscal policies would be more effective in India due to such high value of marginal propensity to consume and government needs to encourage foreign direct investment because of the low value of marginal propensity to save.
Index Terms— Marginal propensity to consume, fiscal policies, foreign direct investment, Keynesian model, permanent income hypothesis, marginal propensity to save, net national product.

I. INTRODUCTION

The relation between aggregate consumption and aggregate income is termed as consumption function. It has a considerable importance in macro economic analysis and policy formulation of the government because household's consumption decisions affect the way the economy as a whole behaves. In macroeconomics we come to know that the consumption expenditure made by the household sector forms an important component of aggregate demand of the economy.

The slope of the consumption function is defined as the marginal propensity to consume (MPC) which is the extra amount that consumers consume when they receive an extra dollar of disposable income. The value of MPC lies between zero and unity. This result is very important in macroeconomics as it ensures the stability of short run equilibrium where price is sticky and any disequilibrium is responded by adjustment of output only. Moreover, MPC also appears in the value of different policy multipliers. In the context of simple Keynesian model, we observe that higher the value of MPC, higher is the value of multiplier. Thus estimate of MPC is of utmost importance for the economic planners and policy makers.

The MPC is higher in the case of poorer people than rich. When the income of the person increases, the cost of their basic human needs amount to a relatively smaller fraction of this income and correspondingly their average

propensity to save increases than that of a person with lower income. The marginal propensity to save of the richer classes is greater than that of the poorer classes (with low propensity to consume) .Likewise, if it is desired to reduce community consumption the purchasing power must be taken away from the poorer classes by taxing consumption. In the case of a rich country most common of the basic need have already been satisfied and all the increments of income are saved resulting in a high marginal propensity to save .In a poor country, on the other hand, most of the basic needs of the people remain unsatisfied so that additional increments of income go to increase in consumption resulting in a higher MPC and a lower MPS. The value of MPC in developed countries such as USA, UK, Germany (less than 0.5) is quite low while those of Asian and African countries are quite high (above 0.5)

Factors that determine the marginal propensity to consume:

1. Income levels: An increase in income is likely to see a high marginal propensity to consume, because people with low income level have many goods/ services they need to buy. However, at higher income levels, the tendency of people to save because they have most goods they need already.
2. Interest rates: A higher interest rate may encourage spending rather than consumption; however the effect is fairly limited because higher interest rates also increase income from saving reducing the need to save
3. Consumer confidence: If the confidence is high this will encourage people to spend .If people are pessimistic (eg. Except unemployment/recession) then they will tend to delay spending decisions and there will be a low MPC

II. LITERATURE SURVEY

The theoretical relationship between consumption and income was first studied in a systematic way by John Maynard Keynes in General Theory of Employment, Interest and Money (1936) and he held that the current consumption expenditure is a highly dependable and stable function of current income – that " the amount of aggregate consumption mainly depends on the aggregate income". Ever since Keynes explained such kind of relationship between consumption and income, many empirical studies have been taken up to estimate numerical consumption behavior on a short and long term basis. To mention Arthur Smithies, Simon Kuznets, James Duesenberry, Robert Ando, Franco Modigiliani, Brumberg and Milton Friedman have taken up empirical studies on consumption behaviour and suggested alternative ways of interpreting the data on consumption and income. The consumption function hypothesis developed by J.M.Keynes stated that current consumption expenditure was highly correlated with current income and the marginal propensity to consume was less than average propensity to consume, so the percentage of income saved increased with income.

The Keynesian consumption function is said to have the following properties:

1) Consumption expenditure is a stable function of income ie. Income is the primary determinant of consumption
2) The MPC lies between 0 and 1

3) MPC < APC ie. APC decreases as Y increases.

Keynes believed that saving was a luxury, so the rich is expected to save a higher proportion of their income than the poor people

4) The MPC probably declined as income rises.

On the basis of these 3 conjectures, Keynesian consumption function is often written as $C = \alpha + \beta Y$

Keynes has stated that such linear relation was on his a priori reasoning based on his observation of consumer psychology and preference. The whole paper coincides with the findings of Keynes and stands on this linear relation between consumption and income.

We came across the idea about "Marginal propensity to consume" from Samuelson, P &William Nordhaus (2010),consumption and investment ,Economics: chapter 21(525-538) and Mankiw, Gregory (2003) consumption, macroeconomics: chapter 16(432-435), The study shows the value of MPC is of utmost significance in filling the gap between income and consumption through planned investment to maintain the desired level of income.Extensive research on the significance of consumption function and MPC has been done from PalleyT.I (2010).The relative permanent income theory of consumption: a synthetic Keynes – Duesenberry – Friedman model, Review of political economy, Taylor and Francis and Sibley D.S(1975) ,"Permanent and transitory income effects in a model of optimal consumption with wage income uncertainty", Journal of economic theory, Elsevier. The study indicates Keynes theory was the major breakthrough research on consumption function. This theoretical impetus was reinforced by the simultaneous and constant development of national accounts supporting with statistical raw material for empirical research on the subject. There is a link between consumption of the present and savings of the future. The MPC is actually the bridge between them

Marginal propensity to save (MPS), a counterpart of MPC plays a central role in Keynesian economics as it quantifies the saving –income relation which is the flip side of consumption – income relation, and according to Keynes it reflects the fundamental psychological law. The MPS is also a key variable in determining the value of the multiplier. From the book Chakroborty, S (1987).Development planning: The Indian Experience: chapter 2&5 (69-75), Clarendon Press, we learned that low propensity to save was one of the primary reasons of structural constraints in the planning regime. Thus the value of MPC and MPS is essential for any future government policies in India.

Previously, Khalid Khan, Sabeen Anwar, and Manzoor Ahmed & M. Abdul Kamal in their paper "Estimation of consumption functions: a case study of Bangladesh, India, Nepal, Pakistan and Sri Lanka" used permanent income hypothesis to estimate the consumption function of SAARC countries and they verified whether permanent income hypothesis existed in the SAARC countries. Dr. S.Limbagoud in his paper "The behavior of consumption expenditure in India: 1975-2008"also used permanent income hypothesis to examine the long run and short run of consumer behavior in India .This term paper differs in the way that it uses only the Keynesian consumption function to determine the value of marginal propensity to consume in India and does not take the wealth-effect into account as in permanent income hypothesis.

III. METHODOLOGY

The data used this study are secondary in nature and have been collected from "National Accounts Statistics Back Series" (2012), Central Statistical Organization, Ministry of Statistics and Programme Implementation, Government of India. We got the data on NNP at factor cost (national income) with 2004-05 as base year and private final consumption expenditure from the above source and the methodology is as follows

The data period chosen for necessary calculations is 1995-96 to 2009-2010so that effect on MPC due to the advent of consumerism as a result of liberalization can be examined. After liberalization there were rampant changes in the Indian Economy and the incomes of the people increased substantially and we aim to assess this effect of the increase in incomes on the consumption of the individuals by calculating the value of Marginal propensity to consume.

First, we regress consumption expenditure on NNP at factor cost and estimate the coefficient of NNP at factor cost to obtain the estimate of MPC. Finally, we perform the significance test of the estimated MPC in order to To apply the tools of "linear regression" and "testing of hypothesis", We took the help of Banerjee and Giri, (2002), Statistical tools and techniques, Academic publishers and Gujarati, D.N. (2007) and the steps are as follows:

Theoretical Background of Linear Regression

Suppose we have '*n*' paired observation *(xi, yi)*on two variables X and Y. This gives a scatter of*n* points justifying the presence of randomness at the level of observations. So, we write the 'observed relation' as following:

$Yi=\alpha+\beta Xi+ui$ i =1, 2,…., n

Where *ui* represents the stochastic disturbance terms or random errors. The error term is included in the model due to:

1. Omission of other explanatory variables, some of which may not be qualified or even identifiable.
2. Unpredictable elements of randomness in human responses.
3. Imperfect specification of the mathematical form of the model.
4. Errors in recording and processing of the data.

*ui*is distributed normally with the following properties:

(i) $E(ui) = 0$ for all i =1,2,.....,n

(ii) $Var(ui) = \sigma_u^2$ for all$i$ =1,2,.....,n

(iii) $cov(xi,uj) = 0$ *for alli, j*

Let the estimated regression equation be:

$\hat{Y}_i = \hat{\alpha} + \hat{\beta} X_i$

$\hat{\alpha}$and $\hat{\beta}$are the estimates of the parameters α and β respectively and *Yi* is the estimated value of Y for any given value of $X = xi$.

We cannot expect all observations to fall on the estimated regression line. This implies the true value *Yi* and the estimated value *Yi* will differ and this difference is denoted by:

$ei = Yi - \hat{Y}$

$= \hat{Y}_i - \hat{\alpha} - \hat{\beta} X_i$

Note that, *ei*'s can be positive, negative or zero. We choose such values of $\hat{\beta}$&$\hat{\alpha}$ which minimize the sum of squares of the error terms -

i.e we have to minimize $\sum ei^2 = \sum (\hat{Y}_i - \hat{\alpha} - \hat{\beta} X_i)^2$

The first order conditions for maximization require:

$\frac{\partial \sum ei^2}{\partial \hat{\alpha}} = 0$ &$\frac{\partial \sum ei^2}{\partial \hat{\beta}} = 0$

which respectively yield the following two normal equations:

$\sum Y_i = n\hat{\alpha} + \hat{\beta} \sum X_i$ *(1)*

$\sum X_i Y_i = \hat{\alpha} \sum X_i + \hat{\beta} \sum X_i^2$(2)

Solving equations (1) and (2) we obtain:

$\hat{\beta} = \frac{cov(x,y)}{var(x)}$ and $\hat{\alpha} = \bar{Y} - \hat{\beta} \bar{X}$

After estimating the values of α and β we have to test their significance. If the value of a parameter is significant at ε% level then it implies that the parameter resembles the true population characteristic in (1-ε)% of the cases. For the purpose of the paper we would concentrate on the significance test of β.

Let us construct the null hypothesis ,$H_0 : \beta = 0$

This is to be tested against the alternative hypothesis ,$H_1 : \beta > 0$

We know$\hat{\beta} \sim N (\beta , \frac{\sigma_u^2}{\sum x_i^2})$where$x_i = X_i - \bar{X}$

Therefore, $\frac{\hat{\beta}-\beta}{\sigma_u/\sqrt{\Sigma x_i^2}}$ ~ N(0,1)

UnderH_0 ,$\tau_0 = \frac{\hat{\beta}}{\sigma_u/\sqrt{\Sigma x_i^2}}$ (3)

Since$\sigma_u^2$is not known , the above test statistic cannot be calculated numerically.

We may uses_u^2in place ofσ_u^2

We know that$\frac{RSS}{\sigma_u^2} \sim \chi_{n-2}^2$ (4)

If equations (3) and (4) are independent then by combining them we may define a t- value.

$t = \frac{\tau}{\sqrt{\chi_n^2/n}}$

now from equation (3) we have $\tau_0^2 = \frac{\hat{\beta}^2\Sigma x_i^2}{\sigma_u^2} = \frac{ESS}{\sigma_u^2} \sim \chi_{n-1}^2$

we also haveTSS = ESS + RSS

or,$\frac{TSS}{\sigma_u^2} = \frac{ESS}{\sigma_u^2} + \frac{RSS}{\sigma_u^2}$

so, $\frac{TSS}{\sigma_u^2} \sim \chi_{n-1}^2$

now, $\frac{ESS}{\sigma_u^2} \sim \chi_1^2$ and $\frac{RSS}{\sigma_u^2} \sim \chi_{n-2}^2$

again as in cov ($\hat{Y}$, *e*) = 0 , so ESS and RSS are independent.

It implies equations (3) and (4) are independent .

Therefore we may construct the following test statistic:

$t = \frac{\hat{\beta}\sqrt{\Sigma x_i^2}/\sigma_u}{\sqrt{\frac{RSS}{\sigma_u^2}/(n-2)}} \sim t_{n-2}$

or, $t = \frac{\hat{\beta}}{s_u/\sqrt{\Sigma x_i^2}}[s_u^2 = \frac{RSS}{n-2}]$

sinceσ_u^2 is unknown sos_u^2 is an unbiased estimator of σ_u^2

estimated variance $V(\hat{\beta}) = \frac{s_u^2}{\Sigma x_i^2}$

hence, estimated S.E $(\hat{\beta}) = \frac{s_u^2}{\sqrt{\Sigma x_i^2}}$

so we can write $t = \frac{\hat{\beta}}{Estimated\ S.E\ (\hat{\beta})} = \frac{\hat{\beta}\sqrt{\Sigma x_i^2}}{s_u} \sim t_{n-2}$

H_0 is rejected at 1% level of significance, if the calculated value of $t > t_{0.01,\ n-2}$

IV. ANALYSIS

In order to proceed with analysis of the marginal propensity to consume in India we confirm the linear relationship between the house final consumption in India and National Income with the help of a scatter diagram given below

The following data have been collected for the calculation of MPC:

TABLE I

YEAR	Household final Consumption expenditure (Rs-crores)	National Income of India (Rs-crores)
1995-96	11690.34	15474.80
1996-97	12562.58	16757.59
1997-98	13034.50	17451.60
1998-99	13823.93	18612.52
1999-00	15475.09	20012.50
2000-01	16601.03	20748.58
2001-02	16885.76	21907.37
2002-03	18102.58	22783.63
2003-04	19240.03	24660.93
2004-05	18804.81	26291.98
2005-06	20550.82	28772.84
2006-07	22067.49	31491.49
2007-08	23805.30	34518.29
2008-09	26056.47	36643.88
2009-10	27247.02	39596.53

If we plot the values of C and Y on the vertical and horizontal axes respectively, we get the following graph, showing the linear relation between C & Y

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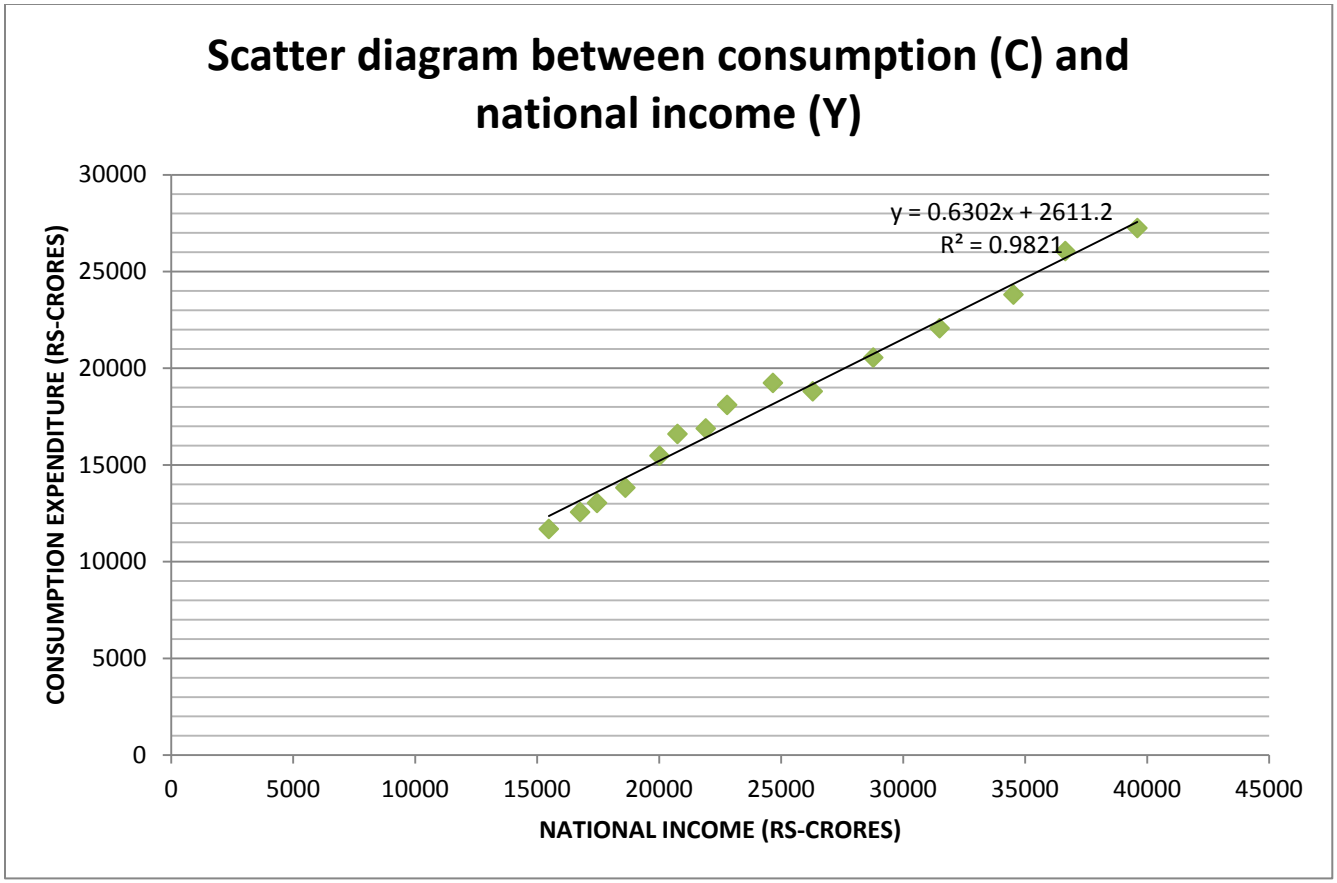

Fig. 1

In the scatter diagram we plot the values of national income on the horizontal axis and the values of household consumption expenditure on the vertical axis. From appendix, the value of correlation coefficient (r) is 0.98 which means the variables are highly positively correlated. Therefore it confirms the linearity of the relationship between the two variables. We, therefore, use the theoretical knowledge described in the previous section to estimate the MPC.

In the present data, national income is the independent variable and household consumption expenditure is the dependent variable. Let us call national income as *Y* and consumption expenditure as *C*. Then the regression equation is taken as the following:

$C = \alpha + \beta Y$

The estimated equation becomes:

C = 2611.2 + 0.63Y (calculations for regression given in appendix)

Where autonomous expenditure is 2611.2 (rs-crores) and slope of the consumption function , the value of MPC is 0.63

From appendix, t = 26.25

At 1% level of significance, tabulated value of t = 2.718
and hence tabulated value of t< calculated value of t (26.25)
So at 1% level of significance the null hypothesis is rejected and we accept the alternative hypothesis. Therefore we conclude that the estimated MPC of the Indian Economy is 0.63 and it is statistically significant at 1% level. The estimated value of MPC is 0.63
Thus we arrive at the following observation:

During the period 1995-96 to 2009-2010, the marginal propensity to consume for the Indian economy was significantly high at 0.63.
The above observation depicts the bias of the Indian economy towards consumption. It implies that if the national income of India increases by Re. 1 then out of it, 63 paisa would be spent in consumption. So the savings would increase by only 37 paisa. The value of Marginal propensity to save is only 0.27.The reason behind this enhanced consumerism could possibly be the expansion of the consumption basket due to the advent of liberalization. Nevertheless this also means that consumer confidence is very high in India But this estimate has significant implications for the policy making. Next we analyze the effect of such high value of marginal propensity to consume on multipliers on the context of Simple Keynesian Model (SKM)and see how it is of uttermost significance to the Indian government.

Effects of Marginal Propensity to consume on government policies

The multiplier effect states that an injection into the circular flow (e.g government spending or investment) can lead to a bigger final increase in real GDP .This is because the initial injection leads to knock on effects and further rounds of spending. The government expenditure multiplier is given by

$$\Delta Y = k\Delta G$$

OR, $\Delta Y = \frac{1}{(1-\beta)}\Delta G$ where β is the MPC

The multiplier effect (k) = $1 / (1 - \beta) = 1/(1-0.63) = 3.27$

OR, $\Delta Y = 3.27\ \Delta G$

The MPC determines the size of the multiplier, i.e., the higher the MPC is, greater will be the multiplier effect. Thus we see in India the multiplier effect due to increase in spending by the government will be of greater effect due to this high MPC .the value of the multiplier becomes 3.27 which is quite high (greater than 1). this will lead to massive increases in spending and aggregate demand (3.27 times the value of ΔG) when the government shall increase its expenditure by ΔG

The lump-some tax multiplier is given by: \

$$\Delta Y = k\Delta T$$

OR, $\Delta Y = \frac{\beta}{(1-\beta)}\Delta T$

$k = -\beta/1-\beta = -0.63/(1-0.63)=-2.33$ whose absolute value is again greater than 1

OR, $\Delta Y = -2.33\Delta T$

Again due to this high value of MPC, greater will be the effect of any tax cuts or tax hike by the government .Thus any tax cuts or hike given by (ΔT) will almost increase or decrease the aggregate demand 2.33 times its value respectively which is again quite high

Thus the effectiveness of fiscal policy actually depends on the value of MPC and so it is an important parameter in government policies and we observe in India fiscal policies will be more effective in bringing the economy in control in case of any shocks due to the high value of the multiplier caused by the high value of MPC. This also means that investment prospects of India in future will be poor due to the small value of MPS (0.27) and government has to solve this issue by encouraging investments from abroad.

V. CONCLUSION

The paper considers data on national income and household consumption expenditure of India for the period 1995-96 to 2009-10 and estimates the marginal propensity to consume to be as high as 0.63. This estimate has significant implications for the policy making because of this high value of MPC, the multiplier effect of fiscal policies of the government will be greater thus fiscal policy will be very effective in stabilizing the economy during any crisis.

The dominant nature of consumerism all over the world during the last decade of 20th century due to globalization is also evident from the high value of MPC in India. From the theory we know that if a country has to maintain the

growth momentum, it has to create productive assets through investments. But investments require savings. Now if the domestic propensity to save is so low then domestic investments would also be low. Then the economy would have to rely on foreign investments to supplement domestic investments. So the planners would have to think much about encouraging foreign investments through FDI and FPI.

This paper captures the linear relation between consumption and income as stated by Keynes. However in reality, income is not the only factor, there are other factors as well attributing to it which are not incorporated in the estimation of MPC in this term paper. One of the most important factors which have been overlooked in this term paper is wealth, which plays an integral part in shaping the consumption pattern of a individual. Wealth can cause the consumption expenditure to change to a large degree even though income remaining same, on the other hand the MPC estimated in this term papers involves only income, The values of household final consumption expenditure used in this term paper is based on a fixed basket of goods consumed by Indian households which include food products, clothing and other necessities. This fixed basket is supposed to change with time and assuming a household shall consume the same basket of goods over the years is hardly plausible in reality. The value of multipliers were also calculated in context of Simple Keynesian Model which assumes investment to be independent of rate of interest , thus the notion of crowding out effect is ignored and this resulted in the overestimation of the value of multipliers.

REFERENCES

[1] Banerjee and Giri, (2002); Statistical tools and techniques, Academic publishers

[2] Chakroborty, S (1987); Development planning: The Indian Experience: chapter 2&5 (69-75), Clarendon Press

[3] Gujarati, D.N. (2007); Basic Econometrics, Tata McGraw –Hill Education Private Ltd, New Delhi, 669-718

[4] Keynes, John Maynard Keynes; (1936) General Theory of Employment, Interest and Money, Macmillan Publishers, Cambridge University Press.

[5] Khan Khalid, Anwar Sabeen, and Manzoor Ahmed, M. Abdul Kamal; (2015), Estimation of consumption functions: a case study of Bangladesh, India, Nepal, Pakistan and Sri Lanka, Pakistan Business Review April 2015.

[6] Limbagoud, S (2012), the behavior of consumption expenditure in India: 1975-2008,International Journal of Multidisciplinary Management Studieshttp://zenithresearch.org.in/

[7] Mankiw, Gregory; (2003), macroeconomics: chapter 16(432-435), Worth publishers

[8] Palley, T.I ;(2010).The relative permanent income theory of consumption: a synthetic Keynes – Duesenberry – Friedman model, Review of political economy, Taylor and Francis

[9] Samuelson, P & William Nordhaus (2010), Economics: chapter 21(525-538), McGraw Hill

[10] Sibley, D.S (1975), Permanent and transitory income effects in a model of optimal consumption with wage income uncertainty, Journal of economic theory, Elsevier

[11] www.mospi.nic.in

[12] www.investopedia.com