Consumption Pattern in an Open Economy Setting: A Case of India

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Abstract

Since the publication of the John Maynard Keynes' *General Theory of Employment, Interest and Money* in 1936 economists have been studying different versions of consumption functions. None of these studies, however, have included the effect of openness on aggregate consumption despite the fact that the degree of openness has been increasing significantly in recent years leading to a significant portion of consumption met through import. This paper proposes an estimation of the consumption function in an open economy setting. A consumption function model that includes exchange rate in addition to other relevant variable is developed. Annual time series data from India for a period of 1973 to 2006 are used. Before estimating the model, the time series properties of the data are diagnosed and two versions of the error correction model are developed. The first version includes the real exchange rate. In the second version the real exchange rate is replaced with the nominal exchange rate and the foreign to domestic price ratio. Estimation of both versions of the model supports the proposition that exchange rate is an important determinant of the aggregate consumption function in Indian economy.

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Introduction:

Estimation of aggregate consumption has been considered to be an important exercise by macroeconomists for several decades. A big boost to consumption behavior on theoretical level was offered by John Maynard Keynes in *General Theory of Employment, Interest and Money* (1936) in which he argued that consumption is primarily a positive and linear function of national income. He further maintained that this relationship between income and consumption is fairly stable, and with higher level of national income the level of economy's consumption as well as saving is increased. As it is well-known, that in Keynesian economics, the theory of *consumption function* played a significant role, which led the macroeconomists of 1950s and 1960s to empirically estimate the relationship between consumption and current income. The empirical estimation of the household consumption function did seem to be consistent with the proposition of Keynes, but the "aggregate" consumption was empirically not found to be proportional to the level of "aggregate" income (Romer, 2006). Thus this finding on aggregate level, refuted the Keynesian proposition. While other developments in consumption function theory made a bunch of modifications and justifications, most explanations were carried out for the closed economy behavior. In fact in early days a

little attention was paid to the change in consumption patterns due to the opening of an economy by offering consumers more variety as well as an opportunity to increase the proportion of income consumed. The present paper has main objective of introducing the role of international determinants for consumption pattern of an economy. Assuming that the factors that determine openness of an economy are equally important to determine the consumption, we further notice that countries like India and China where the openness is significant, these factors may have a significant effect on aggregate consumption. Using the modern data for Indian economy, we justify these arguments and explore the changes in aggregate consumption.

The paper is organized as follows: Section 1 makes a survey of (traditional) consumption behavior arguments in closed economy case and introduces an new argument that explores the importance of external factors in consumption behavior. Section 2 uses the Indian data to estimate the results for a time series analysis with the advanced model of consumption behavior. It is pointed out that after 1991 the role of international trade has become more significant in economic decisions including the opportunities for consumers to consume more variety of goods. Section 3 summarizes the results and makes the conclusions.

Section 1: Theoretical Developments in Consumption Theory

After Keynesian revolution started emphasizing the consumption behavior as the prime determinant of saving behavior and expenditure multiplier analyses, there were numerous attempts to estimate consumption behavior on a short and long term basis. Especially in US when the evidence showed that marginal propensity to consume or mpc (ratio of change in consumption and change in income) was constant on a long run basis and volatile in short term, two main explanations popped up. Friedman (1957) proposed the theory of permanent income hypothesis which suggested that the current consumption is a function of permanent income as opposed to current income, where current income is the sum of permanent income and transitory income. Hence when there are short-term (transitory) changes in income, consumers do not find a reason enough to change their consumption habits. For example if there is say a flood in California and if GDP temporarily goes down for few days, would consumers change the consumption habit just for those few days? Friedman thought the answer was No. This implied that the key determinant of the slope of the consumption function (relationship between consumption and income) was the permanent income (which does not change due to transitory changes) rather than the current income.

Later, Hall (1978) demonstrated that the permanent income hypothesis implied that consumption follows a random walk. This argument is essentially true because the

permanent income changes only when the change in GDP is on a long term basis. While the permanent income hypothesis temporarily reconciled the dilemma faced by US economy, (as explained above about the short and long term behavior of national Consumption) there was more interest in finding its empirical relevance. Hence after its introduction, the permanent income hypothesis attracted considerable empirical attention. Several experiments such as Modigliani, (1966); Davidson et.al, (1978); Ghatak, (1998); and Wen-Jen and Hsing, (2005) are famous in literature that focused on the different aspect of the hypothesis including the test of linearity and cointegration between income and consumption in different countries. Another theoretical development was Duesenberry's relative income hypothesis, which argued that personal consumption is more dependent upon a person's relative income, relative to his/her neighbors, friends and other surrounding folks. While this approach also somewhat explained the US economy dilemma, it had practical problems for its estimation. Third, explanation by Ando and Modigliani postulated that consumption goes through a life cycle just as a person finishes his/her life cycle. While young and old generations spend a higher proportion of their income, the middle aged persons become conservative in terms of lowering the proportion of income spent. Hence the life cycle hypothesis provided another avenue to resolve the US economy dilemma. In later years while the strong interest in empirically estimating consumption behavior continued, there were no major theoretical contributions to the consumption behavior of an economy. It is only recently economists have started paying attention to the influence of external factors to consumption determination.

Thus, none of the approaches mentioned above took into consideration the effect of openness on aggregate consumption despite the fact that the degree of openness is increasing significantly in recent years leading to a large portion of aggregate consumption met through imported goods. Therefore, to estimate the consumption function in an open economy setting is seen to be not only desirable but also necessary. In this paper therefore, we introduce some new explanatory variables depending upon the international trade of the country. It is believed that the domestic consumption changes its level as well as its pattern due to opening of an economy, as new variety of consumption opportunities are made available to the residents. For the estimation purposes of this paper we use the data of the Indian economy. As is made aware by recent events in Indian economy, the overall balance of payments factors have been not only dominant but are also significant in determining the overall functioning of the economy. The exports have grown while imports have quadrupled in 17 years.

Two versions of an appropriate model incorporating open economy variable(s) and the recent developments in the consumption theory are developed in the paper. Annual time series data are used to estimate the model. Before estimation of the model, the time series properties of the data are analyzed. It is hoped that the findings of this paper will help us to better understand the theory and empirical evidence for aggregate consumption behavior.

Section 2: Methodology and Estimation

Household consumption includes both durables as well as non-durable goods. Therefore, the consumption functions can be disaggregated into two categories: (i) consumption of durables and (ii) consumption of non-durables. The consumption of non-durables is further divided leading to an extensive search for accurate specification, by acknowledging the fact that a simple Keynesian linear consumption function does not accurately explain the observed instability that arises from the consumption of durables and the inter-temporal consumption patterns. As discussed in the previous section, these theories have been extensively tested using the data from industrialized countries. It is however noted that the industrialized countries are endowed by high per-capita income as well as developed financial markets. Most developing countries have relatively low per-capita income and the financial markets that rarely follow the laws of efficiency. This hampers the inter-temporal smoothing of consumption patterns. Therefore it is possible that the findings of developed countries may not hold true in case of developing countries. In order to estimate the consumption function for India we postulate the following two consumption functions:

$C_t = f(Y_t, C_{t-1}, R, RER_t)$ (1)

$C_t = f(Y_t, C_{t-1}, R, ER_t, REPR_t)$ (2)

Where,

C = consumption expenditure

Y = disposable income

R = interest rate

ER = nominal exchange rate (the value of U.S. dollar in domestic currency)

*REP*R = relative price ratio defined as the world price index divided by domestic CPI

RER = *ER* multiplied by *REPR*

In equation (1) it is expected *Y* carries a positive coefficient as consumption is positively related with the disposable income. An increase in disposable income makes the economy consume higher quantity. The coefficient of C_{t-1} may carry a positive sign because it is expected that economy goes through the consumption patterns that severely depend upon the last time period's consumption. A higher consumption last year tempts the economic agents to consume higher this year as well. Likewise the coefficient of interest rate (*R)* is easy to investigate. An increase in nominal or real interest rate makes the individuals save more and consume less, so the expected effect of R on the real consumption is negative.

We have estimated two forms of model in order to capture the effect of openness on the consumption function. In equation (1) we have included real exchange rate *(RER)* which essentially captures the effect of a change in real exchange rate on consumption assuming that any changes in nominal exchange rate influences consumption only if it leads to a change in real exchange rate. This approach considers only the effect of a movement in real exchange rate and disregards the combination of nominal exchange rate and foreign to domestic price ratio that generates such a movement. If prices rise at the same proportion as the rate of nominal exchange rate then the real exchange rate remains constant leaving no room of change in consumption. Since this approach ignores any asymmetric influence that an initial jump in the exchange rate may have on consumption vis –a-vis the effect of a gradual rise in the price level we also estimate an alternative equation (equation 2) where instead of real exchange rate we include nominal exchange

rate (ER) and the relative price level (REPR) separately. The coefficient of RER in equation (1) is expected to be negative as a depreciation of domestic currency increases exports and decreases imports leading to a decrease in domestic consumption. Likewise in equation (2) the coefficients of ER and REPR are also expected to be negative.

We have used annual time series data from 1973 to 2006. All the data are in real term and are in U.S. dollar. The data are derived from various issues of the International Financial Statistics published by International Monetary Fund (IMF).

Since it is much easier to assume that the consumption relationship is log linear, the model is estimated in log form, and we transformed equation (1) and (2) as follows:

$$\log C_t = b_0 + b_1 \log Y_t + b_2 \log C_{t-1} + b_3 R_t + b_4 \log RER_t + e_t \quad (3)$$

$$\log C_t = b_0 + b_1 \log Y_t + b_2 \log C_{t-1} + b_3 R_t + b_4 \log ER_t + b_5 \log REPR_t + n_t \quad (4)$$

In equation (3) and (4) e and n are the random error terms. Since the equations are in log form the estimated coefficients also represent the elasticity of consumption with respect to the individual independent variable.

Before carrying out the estimation of equations 3 and 4, we tested for the stationarity of the data series by conducting an augmented Dickey-Fuller test (Nelson and Plosser, 1982). This involved estimating the following regression and carrying out unit root tests.

$$\Delta X_t = \alpha + \rho t + \beta X_{t-1} + \sum_{i=1}^{n} \lambda_i \Delta X_{t-i} + \varepsilon_t \quad (5)$$

In the above equation, X is the variable under consideration, Δ is the first difference operator, t is a time trend, and ε is a stationary, random error term. If the null hypothesis that $\beta = 0$ is not rejected, we know that the variable series contains a unit root and is non-stationary. We identified the optimal lag length in the equation by ensuring a white noise

error term (Enders, 1995). In addition, we supplemented the Dickey-Fuller test with a Phillips-Perron test (Phillips, 1987; Phillips-Perron, 1988). The Phillips-Perron test uses a non-parametric correction to deal with any correlation in the error terms.

The unit root test results are reported in Table 1. Both the Dickey-Fuller and the Phillips-Perron tests indicate that the data series are not stationary at level. Therefore, we performed the same tests on first differences. All the data series were found to be stationary in first differences suggesting that they were integrated of order one.

Having established the stationarity of the data we use the Johansen (1988) and Johansen and Juselius (1990) approaches to test for a long-run equilibrium relationship among the variables. This involves the test of cointegrating vectors. Consider a p dimensional vector autoregression,

$$X_t = \sum_{i=1}^{k} \pi_t X_{t-i} + c + \varepsilon_t \qquad (6)$$

which can be written as

$$\Delta X_t = \sum_{i=1}^{k} \Gamma_i \Delta X_{t-k} - \pi X_{t-k} + c + \varepsilon_t \qquad (7)$$

where

$$\Gamma i = -I + \pi_1 + \pi_2 + \ldots\ldots\ldots + \pi_t \qquad (8)$$

$i = 1,2,\ldots\ldots, k-1$ and

$$\pi = I - \pi_1 - \pi_2 - \ldots\ldots - \pi_k \qquad (9)$$

where p is equal to the number of variables under consideration. The matrix π captures the long-run relationship between p variables, and this can be decomposed into two matrices, A and B, such that $\pi = AB'$. A is interpreted as the vector error correction parameter and B as cointegrating vectors. This procedure is used to test the

existence of a long run relationship among the variables in Equations 1 and 2. The cointegration test results are reported in Table 2 and 3. Test results in both tables indicate that the null hypothesis of no co-integration is rejected. Therefore, following Engle and Granger (1987), the following two error correction models are developed:

$$\Delta \log C_t = b_0 + b_1 \Delta \log Y_t + b_2 \Delta \log C_{t-1} + b_3 \Delta R_{t-1} + b_4 \Delta \log RER_t + b_5 EC + u_t \quad (10)$$

$$\Delta \log C_t = b_0 + b_1 \Delta \log Y_t + b_2 \Delta \log C_{t-1} + b_3 \Delta R_{t-1} + b_4 \Delta \log ER_t + b_5 \log \Delta REPR_t + b_6 EC + v_t \quad (11)$$

In equation (8) EC (the error correction term) in Equation 10 is the lag of the estimated error term in Equation 1 and in Equation 11 it is the lag of the estimated error term from equation 2. The estimation of equations 10 and 11 are as follows:

$$\Delta \log C_t = 0.04 + 0.15 \Delta \log Y_t + 0.23 \Delta \log C_{t-1} - 0.0007 \Delta R_t - 0.14 \Delta \log RER_t - 0.65 EC \quad (12)$$

(2.61)** (2.75)** (0.73) (0.46)

(3.85***) (1.89)*

adj $R^2 = 0.42$ Breusch-Godfrey LM = 1.28 F = 5.54 RESET F = 0.65

$$\Delta \log C_t = 0.03 + 0.17 \Delta \log Y_t + 0.25 \Delta \log C_{t-1} - 0.0007 \Delta R_t - 0.17 \Delta \log ER_t - 0.10 \log \Delta REPR_t - 0.65 EC \quad (13)$$

(2.39)** (2.83)*** (0.86)** (0.51)

(3.20)*** (1.73)* (1.88)*

adj $R^2 = 0.42$ Breusch-Godfrey LM = 1.75 F = 4.68 REST F = 1.30

Note: Figures in the parentheses indicate the t-values for the corresponding coefficients. ***,**,* indicate significant at 1 %, 5%, and 10%, critical level.

Overall estimation of both versions our model seems to be good in terms of the coefficient of determination, the F-statistics and the signs of the coefficients. Insignificant Breusch-Godfrey LM statistics suggest that the estimation is not suffering from any autocorrelation problem. Likewise the insignificant RESET F values suggest that the model is not suffering from any specification error.

As reported in equations 12 and 13 the coefficient of *log Y* carries a positive and significant coefficient as expected in the theory of consumption function. Lagged consumption however, carries positive coefficient, but hey are not statistically significant.

The effect of the real interest rate (R) on the real consumption is negative as expected. But it is not statistically significant in both estimations. Given the limitations of very marginally developed urban monetary sector and dominant crude rural monetary sector this finding is not that surprising. While the interest rate charged by banks on their loans may have a negative effect on the real consumption, all changes in real interest rate do not necessarily get transferred into consumption behavior. Moreover, in case of India, a complete control over interest rates of any kind by monetary authorities complicates the monetary behavior even more. In general therefore, we argue that the changes in interest rate in Indian case are not very significant to explain any rational economic behavior.

The main focus of this study however is to focus on the coefficients of *log RER* in equation 3 and *log ER* and *log REPR* in equation 4. As discussed in the theoretical section, we found *log RER* in equation 12, and log ER and log REPR in equation 13 carrying negative and statistically significant coefficient. The coefficient of *log RER* in equation 12 suggest that one percent increase in real exchange rate reduces the consumption expenditure by 0.14 percent. Likewise from equation 13 we see that a one percent increase in nominal exchange and relative price ratio decreases consumption expenditure by 0.17 percent and the 0.1 percent respectively. These findings clearly prove our hypothesis that modern consumption in Indian case is affected by international factors such as exchange rate and relative world price. The traditional consumption behavior does not recognize the importance of these external factors therefore this finding is crucial. We are especially pleased to observe the fact that both international variables have significant and expected effects on the domestic consumption. An increase in exchange rate increases the value of domestic currency leading to lower real domestic consumption as imports increase and substitute the domestic consumption to durables and non-durables.

Table 1: Unit root test

	A-D Test		P-P Test	
Variable	Level	First Difference	Level	First Difference
log C	-2.49	-8.59***	-2.49	-8.59***
log Y	-0.95	-4.42***	-3.87***	-4.77***
R	-2.83	-5.49***	-3.20	-7.61***
Log RER	-2.28	-3.56**	-1.85	-6.46***
log ER	-1.02	-3.30*	-1.61	-3.34*
log REPR	0.42	-6.75***	0.42	-6.71***

Note : ***,**.* significant respectively at 1%, 5%, and 10% critical level. Critical values are from MacKinnon, J. (1990).

Table 2: Johansen's Co-integration Test; variables: *log C, log Y, log R, log RER*

H_0	Trace Statistics	5 % Critical Value	5 % Critical Value
$r \leq 0$	96.73**	68.52	76.07
$r \leq 1$	61.43**	47.21	54.46
$r \leq 2$	33.05*	29.68	36.65
$r \leq 3$	9.10	15.41	20.04

Note: ** and * indicates the rejection of null hypothesis respectively at 1 % and 5 % critical level.

Table 3: Johansen's Co-integration Test; variables: *log C, log Y, log R, log ER, log REPR*

H_0	Trace Statistics	5 % Critical Value	5 % Critical Value
$r \leq 0$	96.73**	68.52	76.07
$r \leq 1$	61.43**	47.21	54.46
$r \leq 2$	33.05*	29.68	36.65
$r \leq 3$	9.10	15.41	20.04
$r \leq 4$	0.15	3.76	6.65

Note: ** and * indicates the rejection of null hypothesis respectively at 1 % and 5 %

Section 3: Conclusion and Summary

This paper intended to infuse the role of external factors such as international prices and exchange rate in the list of determinants of economy's consumption pattern. While it is recognized that the traditional consumption function theories were basically looking at domestic determinants, the paper argues that in an open economy the external factors can equally be crucial. It is proved with simple estimation that the argument is quit applicable to Indian conditions, which have been consistent to opening of the economy. The Indian consumers have not only changed the portfolio of aggregate consumption, but also allowed the imported goods to enter in that portfolio. Clearly variables such as exchange rate and domestic relative price (relative to world prices) have become significant determinants of consumption behavior.

In general it is seen to be a worthwhile argument as well as empirical exercise that clearly vindicate the new emphasis on consumption determinants. We would like to see a few more evidences for other economies that are in a similar globalization mode as Indian economy has been since 1991.

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