

Estimation of Aggregate Consumption Function for Nepal: ARDL Bound Testing Approach

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Abstract

The relationship between aggregate consumption and its determinants is one of the oldest statistical regularities of macroeconomics. It is important for macroeconomists, policy makers and for others as well. This study aims to estimate aggregate consumption function for Nepal employing Autoregressive Distributed Lag Model (ARDL) for the period of 1975 to 2015 using real income, real exchange rate, real interest rate and inflation rate as determinants. ARDL based co-integration analysis finds the existence of long run association among the variables. Furthermore, elasticity coefficient of real income is found significantly positive but the coefficients of other variables are negative. There exists inverse relationship between real depreciation of domestic currency and real consumption in the long run, but short run shows positive relation between them. The long run as well as short run dynamics of the model are significantly stable. Hence, income is a robust determinant of aggregate consumption. Real interest rate seems to generate substitution effects on consumption, and inflation rate evokes real balance effect on the aggregate consumption of Nepal further.

Keywords: Consumption Function, Bound Testing, Stability Test

JEL Classification: C10, E21

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I. INTRODUCTION

Consumption function is the representation and relationship of consumption with its determinants. Estimation of the aggregate consumption has been considered as an important exercise by macroeconomists for several decades (Dhakal, Kulkarni & Upadhyaya, 2006). Fernandez-Corugedo (2004) argues that aggregate consumption function is a key variable for policy makers. An important contribution in this regard was done an English economist John Maynard Keynes by publishing *General Theory of Employment, Interest and Money* in 1936. In the General Theory, Absolute Income Hypothesis for Consumption (AIH) explains that the individual consumer determines his/her consumption according to the availability of the absolute current level of income. Mathematically, it means $C = f(Y_d)$ where, $f: \mathbb{R} \rightarrow \mathbb{R}$ is a function that maps level of current disposable income (income after taxes and transfer payments). Linearly, the hypothesis can be converted as $C = \alpha + \gamma Y_d$; where, C = consumption at current time, α = autonomous consumption, $\gamma = \frac{\partial C}{\partial Y_d}$ = marginal propensity to consume (MPC). In the AIH, Keynes (1936) explained that MPC always falls between zero to one ($0 < \gamma < 1$). It is also known as Keynesian Psychological Law of Consumption.

Furthermore, Duesenbery (1949) challenged Keynesian construction of consumption behaviour. He found some psychological factors (status, attitude etc.), which dictates more consumption expenditure in the society. An individual's psychology to consumption and saving more is guided by his/her income in relation to others than by abstract standard of living. Similarly, Modigliani and Brumberg (1954) introduced another hypothesis named *Life –Cycle Hypothesis for Consumption*, which explains that people make consumption decisions based on resources available to them over their lifetime. According to the hypothesis, people build up assets at active stage, consume apart and separate for future's retirement consumption. Also, people have to pay a part of current earnings for early childhood consumption, whenever they do not have any earnings. Algebraically, this relationship is explained as: $C = \alpha W + \delta Y$; where, C is current consumption, α is marginal propensity to consume for wealth (W), and δ is the marginal propensity to consume for current income (Y). However, Friedman (1957) stated that consumption is determined by the expected or anticipated income to be received over a long period of time (permanent income rather than current income) stretching out a number of future years; the income explained is overall (human and non-human) wealth. The wealth may be in the form of both human (education and experience) and physical assets (share, bond, property etc.); all these wealth determine the permanent income (expected long term average income).

Any attempt to explain consumption function begins with income, the most important determinant as explained by above hypotheses. Yet, there are other macroeconomic factors influencing consumption function in the real world; these factors are interest rate, price level, exchange rate, volume of financial assets held by consumer (Shapiro, 2001). Furthermore, many empirical studies stand on broadening the concept of the consumption function. For instance, Flavin (1981) has revealed the 'transitory income shock' as an important determinant of consumption function; Stephens (2003) has found that 'social security' is the significant determinant of consumption level in the United States.

Similarly, Hall (1978) has reported in his research that ‘past consumption’ induces to current consumption.

In the context of Nepal, consumption expenditure has been increasing rapidly. It has been observed that consumption to GDP ratio of Nepal almost greater than 80 percent over the long period of time (NRB, 2017). As it has remarkable share in the GDP, it has raised so many queries now. For example, does GDP affect the consumption or not? If yes, then at what propensity? Today's economy has been enjoying liberalization and globalization. In this regard, it can be suspected that some external as well as internal factors may also influence the aggregate domestic consumption. Thus, the research problem is: what are the macro-economic determinants of aggregate consumption function in Nepal?

The study of aggregate consumption of a country could help an economy to achieve stability, growth and poverty reduction by implementing proper fiscal and monetary policies (IMF, 2001). A change in consumption will have multiplier effect on the level of national income through the working of multiplier (Keynes, 1936). Hence, this paper aims to estimate aggregate consumption function of Nepal. This study is useful for macro-economists, policy makers, researchers and students by providing aggregate consumption behaviour of Nepalese economy.

This paper is organized into six sections; after this first section, second section presents the review of literature covering national and international empirical studies. The third section provides model specification and section four presents data and methodology. Section five describes empirical results and last section six concludes the paper with some recommendations.

II. REVIEW OF LITERATURE

In this section two dimensions of literature are reviewed. It starts from international to national empirical studies as follows. Yang (1964) tested whether the level of current income is the main determinant of the level of current consumption in the short run, and the marginal propensity to consume is less than unity among eighteen sample countries. Applying simple regression and correlation tools, his study found that current income is highly correlated with current consumption. In the study, MPC was recorded higher than unity in three countries only. Tsao (1975) stimulated the linear property of consumption function by applying Maximum Likelihood Method (MLM). After testing the data, he found that consumer's spending decision depends on the relative magnitude of his/her real income and real wealth. Gylfason (1979) estimated the effect of interest rate and inflation rate on aggregate consumption in the United States applying Ordinary Least Square (OLS). After the estimation he found that aggregate consumption is inversely related to interest rate and directly related to inflation rate for the United States. Further Macklem (1994) examined aggregate consumption function in the case of Canada by including financial, physical and human wealth as the probable determinants.

Similarly, Roland and Rock (2006) endeavoured the long run association among variables: disposable income, wealth, government expenditure, relative prices and liquidity constraints (proxied by the unemployment rate) after testing the Engle and Granger Co-integration test. Devereux et al (2009) estimated relationship between real

consumption and real exchange rate in professional forecasts using the data of 28 countries from 1990 to 2008 applying covariance between the variables. They found that positive relationship between expectations of relative consumption growth and real depreciation across countries. On the other hand, Christensen (2012) found that lower the rate of interest leads to the higher the consumption level in the case of United States from 1962 to 2012, applying linear regression model. Ajudua & Ezeji (2015) found that interest rate, price level and exchange rate as significant determinants of aggregate consumption function in Nigeria by applying ADF test and Co-integration test. The study also revealed the existence of long run relationship among the variables.

In case of Nepal, Kanel (1991) examined the demographic impact of household size and composition on the consumption behaviour of Nepali households over the family life-cycle. Finally, he found that demographic variables had a significant effect on household consumption of Nepal using non- liner regression method. Khan et al. (2015) found that MPC of Nepal is the highest among five South Asian countries - Bangladesh, Nepal, India, Pakistan and Srilanka utilizing ARDL model. Bhandari (2016) obtained positive and significant relationship between income and consumption of Nepal, MPC was computed as 0.65 or the period of 2000 to 2015.

In this way, Yang (1964), Khan et al. (2015) and Bhandari (2016) have successfully determined the consumption function using ‘income’ as a main determinant, whereas, Gylfason (1979) revealed the influence of interest rate and inflation rate on aggregate consumption. Mecklem (1994) estimated the unique consumption function by using the financial, physical and human wealth as determinants. Deverux et al (2009) explored correlation between real exchange rate and real consumption. In the same way, Ajudua & Ezeji (2015) found interest rate, price level and exchange rate as the significant determinants of the aggregate consumption function. Regarding national context, there are limited studies on aggregate consumption function. Kanel (1991), Khan *et al.* (2015) and Bhandari (2016) estimated the consumption function of Nepal. While Kanel (1991) used primary data for the study, Khan et al (2015) and Bhandari (2016) used time series data employing only one explanatory variable ‘income’. Hence, aggregate consumption function needs to be re-estimated by using determinants other than income in Nepal.

III. MODEL SPECIFICATION

Based on the literate review, real income (Y_t), real exchange rate ($\$_t$), real interest rate (R_t) and inflation rate (π_t) have been taken as the explanatory variables and real consumption (C_t) as the dependent variable in this study. According to Gujarati et al. (2012) and Bierens (1984), model specification of the relationships can be expressed in the following functional form:

$$C_t = f(Y_t, \$_t, R_t, \pi_t) \dots\dots\dots (1)$$

On the basis of facts given by Wooldridge (2013) and Gujarati et al. (2012), equation (1) can be converted into following semi log linear econometric specification:

$$\ln C_t = \alpha + \beta_1 \ln Y_t + \beta_2 \ln \$_t + \beta_3 R_t + \beta_4 \pi_t + \varepsilon \dots\dots\dots (2)$$

Where, α =Drift component, β_i = Regression coefficients, ε = White noise residual and $i=1, 2, 3\dots$

IV. DATA AND METHODOLOGY

Most of the data are collected from various authorized sources of the government bodies and agencies of Nepal. Sample period of the study is 1975 to 2015. Gross Domestic Product (GDP) is used as proxy for national income, Gross Domestic Consumption (GDC) for aggregate consumption, exchange rate of US dollar for exchange rate, and one year average fixed deposit interest rate of the commercial bank for interest rate (R) and change in CPI for inflation rate (π). CPI of USA is taken from the World Bank. GDP, GDC, R, GDP deflator and CPI of Nepal are taken from various *Quarterly Economic Bulletins*, and *A Handbook of Government Finance Statistics 2017* (published by Nepal Rastra Bank) and *Economic Survey of 2016* (published by Ministry of Finance). All variables used in this article are inflation adjusted. Real income and real consumption are computed as: (Nominal value \times 100)/GDP Deflator. Real Interest rate is just difference between nominal interest rate and domestic inflation rate. The real exchange rate is the ratio of the product of nominal exchange rate and foreign price level to the domestic price level. Average of minimum and maximum values of one year fixed deposit interest rate at commercial bank is taken, because of unavailability of weighted interest rate of saving deposit.

Before estimation of the time series data, the asymptotic properties need to be examined first, otherwise, regression model gives spurious result (Gujarati et al., 2012). In econometrics, there are various methods of stationary test of a variable: KPSS Test (Bharagova, 1982), Phillips-Perron (Phillips & Perron, 1988), Augmented Dickey Fuller Test (Dickey & Fuller, 1979), and so on. Here, ADF test has been applied. According to Dickey & Fuller (1979), a variable (eg. $\ln C_t$) can be arranged in the following linear form for stationary test:

$$\Delta \ln C_t = \alpha_0 + \alpha_1.t + \alpha_2. \ln C_{t-1} + \sum_{j=1}^p \alpha_j \Delta \ln C_{t-j} + \varepsilon_t \quad \dots\dots\dots (3)$$

Where, ε_t is pure white noise error term. $\Delta \ln C_{t-1} = (\ln C_{t-1} - \ln C_{t-2})$, $\Delta \ln C_{t-2} = (\ln C_{t-2} - \ln C_{t-3})$ etc. The number of lagged difference term of equation 3 is the serially uncorrelated. In this ADF procedure, null hypothesis (H_0) is tested against alternative hypothesis (H_a) as follows:

$H_0: \alpha_2 = 0$ or, $\ln C_t$ is not a stationary variable.

$H_a: \alpha_2 < 0$ or, $\ln C_t$ is a stationary variable.

Dickey & Fuller (1979) explained if the coefficient is significantly different from zero, then the null hypothesis that $\ln C_t$ contains a unit root is rejected. Rejection of the null hypothesis implies stationary¹. If the calculated value of ADF statistic is higher than McKinnon's critical values in absolute term, then the null hypothesis (H_0) is rejected and

¹ If a time series is stationary, its mean, variance, and auto-covariance (at various lags) remain the same, no matter at what point we measure them; that is, they are time invariant (Gujrati et al., 2012).

the series is stationary or integrated with order zero, I(0). If the series is stationary after first difference, it is I(1).

When some variables of the time series data are stationary at level I(0) and rest are integrated at first difference i.e. I(1), Pesaran et al. (2001) suggest to use Autoregressive Distributed Lag (ARDL) Model. This test has several advantages over the well-known residual based approach proposed by Engle and Granger (1987) and the maximum likelihood-based approaches proposed by Johansen and Julius (1990), and Johansen (1992). As per the ARDL Bound testing procedure introduced by Pesaran and Shin (1998), and Pesaran et al. (1997 & 2001), for co-integration or bound testing of the model, the following equation is used.

$$\Delta \ln C_t = \alpha + \sum \beta_{0i} \Delta \ln C_{t-i} + \sum \beta_{1i} \Delta \ln Y_{t-i} + \sum \beta_{2i} \Delta \ln \$_{t-i} + \sum \beta_{3i} \Delta R_{t-i} + \sum \beta_{4i} \Delta \pi_{t-i} + \theta_0 \ln C_{t-1} + \theta_1 \ln Y_{t-1} + \theta_2 \ln \$_{t-1} + \theta_3 R_{t-1} + \theta_4 \pi_{t-1} + \varepsilon_t \quad \dots \dots \dots (4)$$

In this equation (4), Δ is the first difference, α is the drift component and ε_t is white noise residual. The coefficients θ_i represent long run relationship, whereas the first part represents short run dynamics of the model (Pesaran & Shin, 1998). It is important to test ‘F-test’ for co-integration. In the procedure, H_0 is tested against H_a as follows:

$$H_0: \theta_0 = \theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$$

$$H_a: \theta_0 \neq \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq 0.$$

Pesaran et al. (2001) explained that the rejection of H_0 implies long-run relationship, if F-statistic is greater than lower and upper critical bound values at certain level of significance. Furthermore, lower critical bound assumes that all variables in the ARDL model are I(0) and upper critical bound assumes I(1). Furthermore, Pesaran et al. (2001) argue the fact that ECMs directly estimate the speed at which a dependent variable returns to equilibrium after a change in other variables. The unrestricted error correction models or short-run dynamics of the model can be extended from equation (4) as follows:

$$\Delta \ln C_t = \beta_0 + \sum \beta_i \Delta \ln C_{t-i} + \sum \rho_j \Delta \ln Y_{t-j} + \sum \delta_k \Delta \ln \$_{t-k} + \sum \theta_x \Delta R_{t-x} + \sum \mu_y \pi_{t-y} + \gamma EC_{t-1} + e_t \quad \dots \dots \dots (5)$$

Where, γ = speed of adjustment parameter or (Error Correction Coefficient)², EC_t = the residuals that are obtained from the estimated co-integration model of equation (2). That is: $EC_t = \ln C_t - \alpha + \beta_1 \ln Y_t + \beta_2 \ln \$_t + \beta_3 R_t + \beta_4 \pi_t$.

The CUSUM (Cumulative Sum of Recursive Residuals) and CUSUMSQ (Cumulative Sum of Squares of Recursive Residuals) tests are for parameter stability and demonstrate

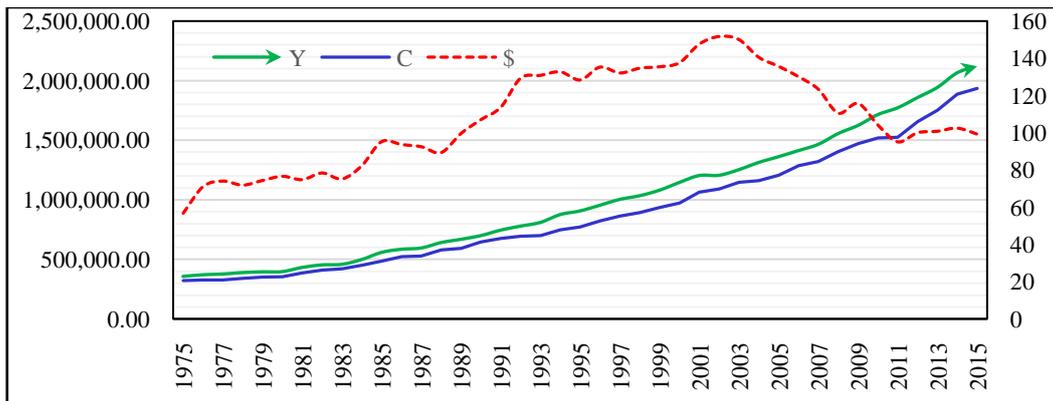
² It shows how the disequilibrium is corrected next time. A positive coefficient indicates a divergence, while a negative coefficient indicates convergence. If the estimate of $\gamma = 1$, then 100% of the adjustment takes place within the period, or the adjustment is instantaneous and full, if the estimate of $\gamma = 0.5$, then 50% of the adjustment takes place each period/year. $\gamma = 0$, shows that there is no adjustment, and to claim that there is a long-run relationship does not make sense any more (Nkoro & Uko, 2016).

that this depends on the nature of the structural change taking place. If some break is in the intercept of the regression equation then the CUSUM test has higher power. However, if the structural change involves a slope coefficient or the variance in the error term, then the CUSUMSQ test has higher power (Turner, 2010). Ploberger and Kramer (1992) extended the CUSUM test to OLS. Also, Pesaran and Shin (1998) expressed in ARDL model that if plot of CUSUM remains within the critical bound at 5% significance level, the null hypothesis that all the coefficients, and the error correction model are stable cannot be rejected. However, if the two lines are crossed, the null hypothesis of coefficient constancy can be rejected at 5% significance level. The same analysis applies for CUSUMQ test, which is based on squared recursive residuals.

V. EMPIRICAL RESULTS

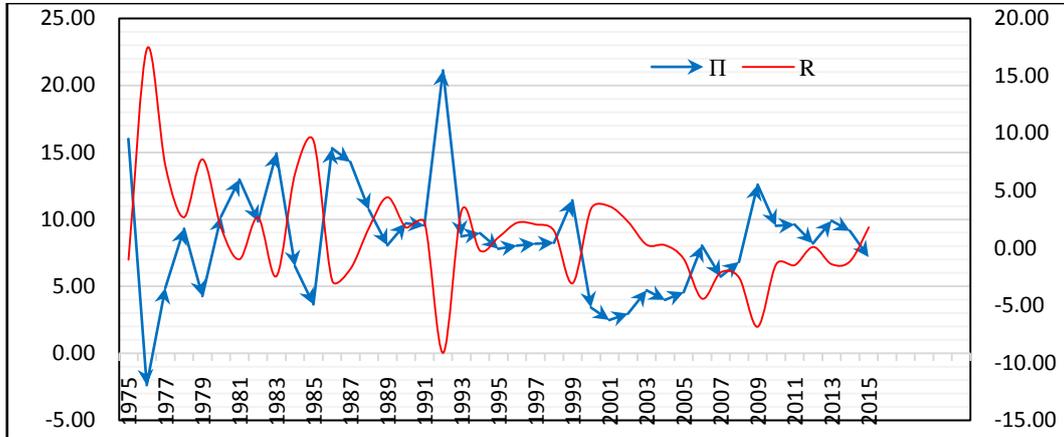
Before we dive into a deep calculation of the data, it needs a glance on the variables' trend over time period as given below (Figure 1). It gives fine overall outlook of the variables to make the study concrete. The trend of the variables is separated into two figures. Figure1 represents the trends of real income (Y), real consumption (C) and real exchange rate (\$).

Figure 1: Trend of real income, consumption and exchange rate



Source: Author's Calculation

Real income and consumption (placed on left axis) are slopping upward in a very similar way. However, real exchange rate, placed on right side axis, persistently increased from 1975 to 2002, then it declined. A declining in the real exchange rate indicates that the Nepalese currency's purchasing power over the overseas consumption basket increases and vice versa. Similarly, Figure 2 shows the trend analysis of real interest (R) and inflation rate (π). Real interest rate (placed on the right side axis) shows the highest value in 1976, which was more than 15 percent. After 1976, its ranged from 10 to -10 percent. Years 1983,1986,1992,1999, 2000, 2005 to 2010, 2013 and 2014 experienced negative real interest rate. In the same way, inflation rate is placed on the left axis- which recorded more than 20 percent in 1992, and negative in 1976.

Figure 2: Trend of inflation and real interest rate

Source: Author's Calculation

Table 1 presents the unit root test (ADF test) carried out for the variables selected for the model. As shown in Table 1, $\ln C_t$ and $\ln Y_t$ are $I(1)$ and $\ln \$$, R_t and T_t are $I(0)$ variables.

Table 1: Results of Augmented Dickey Fuller (ADF) Test

Variable	Level		First Difference		Remark
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	
$\ln C$	0.29 (0.97)	3.06 (0.106)	7.62*** (0.0000)	7.53*** (0.0000)	$I(1)$
$\ln Y$	0.43 (0.89)	1.27 (0.88)	6.06*** (0.000)	5.84*** (0.0000)	$I(1)$
$\ln \$$	2.79* (0.069)	6.59*** (0.000)	-	-	$I(0)$
R	5.07*** (0.0002)	6.59*** (0.0000)	-	-	$I(0)$
π	5.53*** (0.000)	5.45*** (0.0003)	-	-	$I(0)$

Note: 1. * and *** shows the 10% and 1% significance level respectively.

2. Numeric values between (...) express corresponding p- values and Non-parenthesis are absolute t- statistics.

Since the variable are $I(0)$ and $I(1)$, ARDL model are used for estimation. Similarly, AIC suggests selecting the proper lag structure in the model according to which lag 4 is selected.

Table 2: Bound Test for Co-integration Analysis

<i>F- Statistics Values</i>		5.077	
Significance Level	Lower bound	Upper Bound	
10 %	2.2	3.09	
5%	2.56	3.49	
2.5%	2.88	3.97	
1%	3.29	4.37	

Co-integration test for the model shows whether there exists long run association among the variables or not. It is also called bound testing in the ARDL model (Pesaren and Shin (1998). On the basis of the given F statistics of the model with its lower and upper bound critical values at the corresponding significance levels, long run association is determined. In Table 2, F –statistics value is 5.077, and all corresponding lower bound critical values and upper bound critical values are smaller than the F-statistics value at the 1 percent level of significance. Hence, the null hypothesis of $\theta_0 = \theta_1 = \theta_2 = \theta_4 = 0$ is rejected. The rejection of this hypothesis implies that there exists long run cointegration among the variables..

Table 3 shows the estimation of long run aggregate consumption function. The column of P-values expresses that all the corresponding coefficients are statistically significant at 1 percent level of significance. Finally, we can express the estimated long run aggregate consumption function as follows:

$$\ln C_t = 0.626 + 0.998 \ln Y_t - 0.138 \ln \$_t - 0.0117 R_t - 0.0105 \pi_t \dots\dots\dots (6)$$

Table 3: Estimated Long-run Coefficients of the Consumption Function

Dependent Variable: Real Consumption (lnC _t)				
	Coefficient	S. Error	t-Statistics	p- value
lnY _t	0.998***	0.010	98.188	0.0000
ln\$ _t	-0.14***	0.025	-5.45	0.0000
R _t	-0.012***	0.0025	-4.75	0.0001
π _t	-0.011***	0.0023	-4.62	0.0001
Constant	0.626***	0.182	3.44	0.0020

Note: *** denotes the significance at 1% significance level.

Equation (6) explains that if real income increased by 100 percent, real consumption increases by 99.8 percent on average. Real exchange rate, real interest rate and inflation

rate have negative coefficients with very low values in the long run. It shows inverse relationship between real exchange rate and real consumption. The intercept of the long run consumption function shows the autonomous consumption; which is $e^{0.626} = 1.870$ million Nepalese rupee, which is also significant at the 1 percent level of significance.

The coefficient of real interest rate shows that consumers are dedicated to save a part of their current income by reducing the current consumption for expected more income in future in case there is a higher interest rate. It is *substitution effect* of real interest rate over *income effect*³ (Shapiro, 2001). On the other hand, there are two effects of rising inflation in the economy, one is substituting personal saving for consumption expenditure or consumption expenditure for personal saving. Coefficient of inflation rate is negative; indicating reduction in consumption with higher inflation because of reduction in purchasing power. The reduction in consumption due to increment in inflation is called *real balance effect*; this is because the rise in inflation, real value (i.e. purchasing power) of the people's money balances and financial assets with fixed monetary values declines (Ahuja, 2011). Similarly, real depreciation of domestic currency shows the costs of imported goods increases thereby reducing the aggregate consumption.

The short run effects or short run dynamics of the ARDL model (3, 0, 1, 0, 0) is shown in Table 4. In the model, the speed of adjustment parameter or the error correction coefficient (γ) is -0.8095, which is also statistically significant at the 1 percent level of significance. This shows 80.95 percent correction of past error in the current year.

In short-run also, selected explanatory variables have statistically significant coefficients. As per the estimation, in the short-run, if $\Delta \ln Y$ increases by one percent, real consumption expenditure increase by 0.81 percent on average. The coefficient of real exchange rate ($\Delta \ln \$$) is positive (0.102). It shows that depreciation of domestic currency will increase the level of real consumption which contradicts with the long-run coefficient. This is, however, similar to the finding of Devereux, Smith & Yetman (2008) which may reflect the adjustment time requirement for change in real exchange rate. Coefficients of the inflation and real interest rate are very low and significantly negative (-0.0058 and -0.0068). These are similar to the long run coefficients.

Diagnostic tests of the residuals are very important to the model. The properties or assumptions should be fulfilled for the accurate results. Otherwise, it provides the spurious result (Wooldridge, 2012). Table 4 also shows the major diagnostic tests. Serial correlation LM test (χ^2_{Auto}) shows the condition of rejection of the null hypothesis. It means the model is free from serial correlation. Ramsey Reset Test (χ^2_{RESET}) also shows that there is no misspecification of the variables in the model.

³ Income effect, which works toward less saving at higher interest rate. For those lower-income individuals who will save only relatively small part of their incomes even at high interest rate (Shapiro, 2001).

Table 4: Error Correction representation of the Model (3, 0, 1, 0, 0)

Dependent Variable: $\Delta \ln C$			
Regressors	Coefficient	t-statistics	p- value
$\Delta \ln C_{t-1}$	0.050	0.644	0.525
$\Delta \ln C_{t-2}$	0.367***	4.42	0.0002
$\Delta \ln C_{t-3}$	0.178	1.511	0.142
$\Delta \ln Y_t$	0.811***	8.307	0.0000
$\Delta \ln \$t$	0.102**	2.445	0.0215
$\Delta \ln \$_{t-1}$	0.152***	2.83	0.0087
$\Delta \pi_t$	-0.0058**	-2.143	0.0416
ΔR_t	-0.0068**	-2.576	0.0160
ECM_{t-1}	-0.8095***	-5.7288	0.0000
$R^2 = 0.99$	$R^2_{adj} = 0.99$	$F = 4510.49 (0.00)$	$S.E. = 0.014$
$DW = 1.88$	$AIC = -5.43$		

Diagnostic Tests

A. Serial Correlation	$\chi^2_{Auto}(2) = 0.59 (0.743)$
B. Functional form	$\chi^2_{RESET}(2) = 0.98 (0.38)$
C. Normality	$\chi^2_{Norm} = 0.49 (0.78)$
D. Heteroscedasticity	$\chi^2_{BP}(2) = 4.55 (0.91)$

Note: ** and *** are represented 5% and 1% level of significance simultaneously

Figure 3 and Figure 4 presents CUSUM and CUSUM Square of recursive residuals to examine the stability properties of the model. In line with Pesaran and Shin (1998) if the plot of CUSUM remains within the critical bounds at 5 percent level of significance (represented by clear and straight lines drawn at 5 percent), the null hypothesis that all the coefficients and the error correction model are stable cannot be rejected. Since both CUSUM and CUSUM Square are within initial bounds at 5 percent level of significance, the above model is considered stable.

Figure 3: Cumulative Sum of Recursive Residuals of the Model

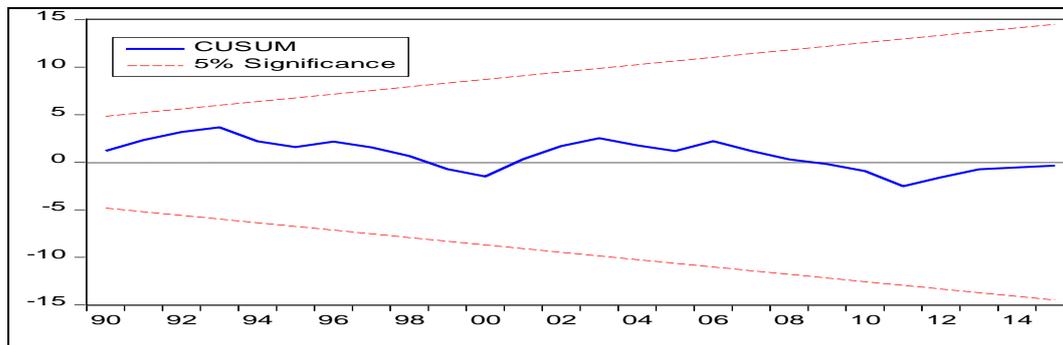
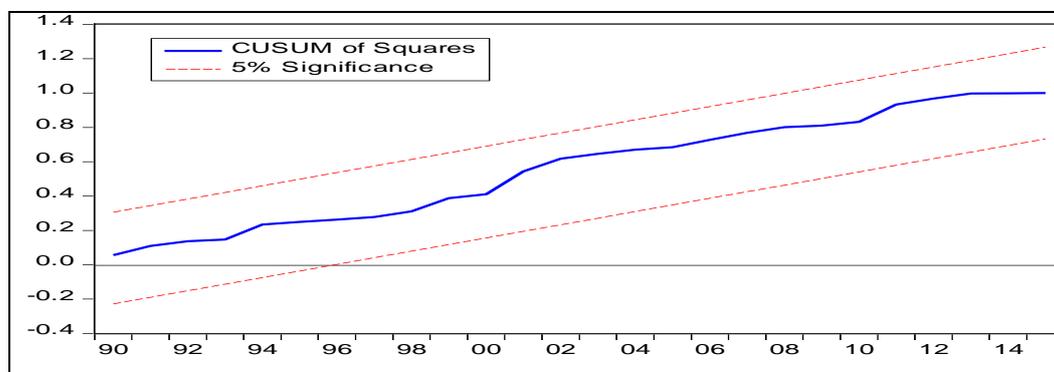


Figure 4: Cumulative Sum of Squares of Recursive Residuals of the Model

VI. CONCLUSIONS

This paper has estimated the aggregate consumption function for Nepal using ARDL approach to co-integration analysis, developed by Pesaran et al (1997 & 2001) for the time period of 1975 to 2015. The bound testing of the estimated model shows the existence of long run association among the selected variables. Real income, exchange rate, interest rate and inflation rate are significant determinants of short run and long run real aggregate consumption function in Nepal. Elasticity coefficient of real income has been found higher, while coefficient of other variables are low but significant. It indicates the existence of robust income– consumption relation. In the same way, real interest rate and inflation rate have significantly negative coefficients in the short run as well as in long run; rise of them lowers real consumption. Negative sign of the real interest rate implies the *substitution effect* of it on aggregate consumption. Furthermore, negative sign of inflation rate indicates the *real balance effect* on aggregate consumption.

The estimated result reveals the existence of inverse relationship between real depreciation and real consumption in long-run. Real depreciation of the domestic currency causes the imports costly thereby reducing consumption. However, there is found positive relationship between real depreciation and real consumption in the short run, in contradiction to long-run coefficient which may imply that some time required for making adjustment after a change in exchange rate. The long-run as well as short run dynamics of the model are significantly stable. Error correction coefficient is 80.95 percent which is significant.

Three important policy implications can be drawn from the above findings. First, marginal propensity of consumption is higher for income. If we use the concept of multiplier, when marginal propensity to consumption for income is higher, size of investment multiplier becomes larger. When investment increases, income, output and employment increase as the size of multiplier. The increase in income and output are further spent on consumption, and the ultimate increase in income and employment is multiple of the original increment in investment. Second, consumer are suffering from real balance effect. If inflation is reduced, people's money balances and financial assets with fixed monetary values (i.e. purchasing power) increases. The increasing purchasing

power initiates the higher the level consumption. Higher the level of consumption demand more investment in the economy. Third, if the real interest rate increases, people induce to substitute present consumption for expected future income. This indicates the motivation of people for saving at current time, which is also important for the economy. Real interest rate can be enhanced by lowering the inflation rate keeping nominal interest rate constant or, increasing the nominal interest rate keeping inflation rate constant or, maintaining the rate of nominal interest rate always higher than inflation rate. Through rising real interest rate, aggregate consumption can be controlled to some extent.

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