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Asymmetrical effects of macro variables on commercial bank deposits: evidence from Maldives based on NARDL

Udhula Abdul Latheef¹ and Mansur Masih²

Abstract

The study investigates the asymmetrical effects of macroeconomic performance variables (if any) on other depository corporations. Maldives is taken as a case study. The variables selected for macroeconomic presentation are Trade Balance, Exchange Rate, Consumer Price Index, Broad Money Supply (M2) and Interest Rate, while for other depository corporations the proxy used is commercial deposits. Monthly data are taken from statistical publications supplied by Maldives Monetary Authority website from January 2007 to December 2016. Understanding the deposit behaviour to macroeconomic changes is crucial for financial corporations as it serves to generate much needed loans for the required parties. The significance of this study, unlike the previous studies is, to the best of my knowledge, that this is the first attempt made to test the existence of any asymmetry through Nonlinear Auto-Regressive Distributed Lag model developed by Shin et al. (2014). Also, this research is the first such examination on commercial deposits behaviour in response to macroeconomic variables in the Maldives. In order to find any non-linearity between the variables in long run and short run, the variables are decomposed into both positive and negative components applying nonlinear ARDL approach. Findings tend to indicate that only the short run interest rates to commercial deposits signify asymmetrical relationship unlike all other macroeconomic variables including both long and short-run variables confirming that most macroeconomic variables have symmetrical (linear) relationship with commercial deposits in the Maldives.

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1.Introduction

Banking sector dominates the financial system of the Maldives concentrating highly on the traditional banking structure of mobilizing deposits to provide funding to the users. Currently there are eight (8) commercial banks operating in the Maldives (MMA, 2017) two of which are locally incorporated banks; Bank of Maldives and Maldives Islamic Bank. Bank of Maldives Plc was established in 1982 acquiring the largest financial network in the country due to its long lasting existence. On the other hand, Maldives Islamic Bank was incorporated in 2011 – the only fully fledged Islamic financial institution in the country. Remaining six (6) banks are foreign-owned subsidiaries. The financial system of the country relies heavily on dollarization reflecting the same in the balance sheets of commercial banks in the Maldives and due to the excessive dependence on tourism sector and imports making the island-nation vulnerable to fluctuations in the global financial market. Other Depository Corporations (ODC) used in this study consist of all commercial banks that are operating in Maldives. Deposits account for a large percentage of total liabilities providing as a major source of funding for commercial banks in the country (Rashfa, 2015). The structure of balance sheet, particularly behaviour of deposits, is sensitive to the changes in other economic factors. The in-depth understanding of how deposits behave in accordance with the macro economic factors would enable the financial institutions to structure their financial products as well as for policy makers to develop and implement policies supporting the growth of depository corporations in the Maldives.

Regarding the macroeconomic policies, exchange rate in the Maldives is pegged to American Dollar, previously under the fixed regime at the rate of 12.8 Maldivian Rufiyaa per US Dollar. Later, the system was changed to a managed floating exchange rate regime where exchange rates are given a + or – 20 percent boundary to float according to demand and supply within the market. Considering Consumer Price Index, its growth rate provides as a general measure of inflation in the Maldives similar to its theoretical underpinnings. The basket of goods and services together with its corresponding weightage had been revised number of times focusing on consumption behaviour changes of the Maldivians. Interest rates in the Maldives are fairly low – the reason presumed to be behind most Maldivians placing their savings under demand deposits rather than term deposits (Munawar, 2015). Besides, the Treasury bill rates was further reduced for the purpose of facilitating the lending behaviour in the country. In addition to these, money supply is a prime policy tool employed in the Maldives employing monetisation at times of inadequate supply of currency within the circulation when actual

government expenditure takes place. M2 is used as the broadest measure of money supply in the country. Furthermore, the country depends substantially on foreign trade as Maldives is a net food importing country and tourism impacting the financials of the country adversely at times of global financial downturns.

According to Fengler, Ihsan & Kaiser (2008), although a small country, the government of Maldives is an open economy and have considerable experience via central government systems in confronting the macro-economic variations arising due to both environmental and financial vulnerability to the external shocks like natural disasters as well as global financial crisis. Despite the prominent impact of tsunami and financial crises to Maldivian economy, only limited country-specific studies are conducted especially to the financial sector of Maldives giving reference to macro-economic variables.

As commercial deposits account for a larger portion in the financial institutions' capacity to produce loans, it is vital to understand how the deposits behave with reference to macroeconomic changes. This research will depart from previous studies in the manner that to the best of my knowledge, this is the first attempt made to identify the existence of any asymmetries through Nonlinear Auto-Regressive Distributed Lag model (hereafter NARDL) as well as the first such examination on commercial deposits behaviour giving reference to macroeconomic variables in the Maldives.

Our findings show that the positive and negative shock magnitudes of macroeconomic variables to commercial deposits in the Maldives are asymmetric however, only short-run interest rates signify the asymmetrical relationship unlike all other variables including both long and short-run variables rejecting the null hypothesis of existence of a non-linear relationship. This confirms that most macroeconomic variables have a symmetrical (linear) relationship except for short-run interest rates in the Maldives.

1.1 Theoretical Framework

The banking and financial systems around the globe perform a pivotal part in the economies – essentially the backbone of financial intermediation in the countries. Similar to any other financial statement, the balance sheet of depository institutions constitute of an asset side and a liability side whereby deposits of commercial banks are on the liability side of the balance sheet representing the sources of fund including capital investment while the loans are under assets side, demonstrating the users of funds. Commercial banks obtain funds from

stockholders, depositors and other lenders –surplus spending units and mobilize them to produce loans to the deficit spending units, hold securities and reserves plus invest in other available types of assets like real estate and foreign assets. In this sense, the larger proportion of funding is generally said to be contributed from deposits from which the finance amount to be issued is determined (Tuyishime, Memba & Mbera, 2015). Sharma (2009) states that both bank credits and bank deposits are closely linked representing ‘two sides of the same coin’. Banks thrive on their capability to generate income via lending activities – only possible through enough funds from their customers. Thus, the depositors’ behaviour plays an integral role in the main function of financial institutions of the economies. However, depositor behaviour may alter according to the variations in macroeconomic factors like those considered in this study; Consumer Price Index (CPI), Interest Rate, Exchange Rates, Broad Money Supply and Trade Balance.

The percentage change in CPI is a measure of inflation. Theoretically there is strong relationship between inflation level of a country and the amount of deposits made to a financial institution as a rise in inflation may mean eroding the purchasing power of money because less can be bought with the same amount of money previously held. In this sense, the commercial deposits would reduce with the same amount of money held under the condition of *ceteris paribus*. Thus CPI, proxy for inflation and commercial deposits are negatively correlated in theory. However, this is not the case with interest rates. The higher the interest rates of a country the more deposits are made into the accounts of financial institutions. According to classical economists, interest rate is a function of saving resulting in direct and positive relationship between the two. (Mushtaq & Siddiqui, 2017). Theoretically exchange rate movements have an impact on commercial deposits but the influence is not direct. Exchange rate fluctuations stimulate other economic elements having an indirect bearing on the deposit behaviour of commercial banks. Similar structure is depicted in theoretical relationship between money supply and deposits specifying both exchange rate and money supply are exogenous variables to deposit behaviour academically. However, theoretical framework is still inconclusive in finding the asymmetrical relationship between these variables to deposit behaviour. Hence the issue remains unresolved and needs to find whether empirically the non-linearity between the variables are being tested or not.

1.2 Literature Review

There are numerous country-specific research studying the macroeconomic determinants of commercial bank profitability in countries like in Nigeria (Ebenezer, Omar & Kamil, 2017), Ethiopia (Rani & Zergaw, 2017), Sub-Saharan Africa (Flamini, Schumacher & McDonald, 2009), Botswana (Seemule, Sinha & Ndlovu, 2017), Pakistan (Javaid, 2016), Ghana (Yakubu, 2016) and China (Sufian & Habibullah, 2009). However, there is a shortfall in the number of studies examining the relationship between commercial deposits and macroeconomic variables especially the existence of any non-linearity.

Hassan, O M. (2016) examines how interest rates affect commercial bank deposits in Nigeria taking sample data from 2000 to 2003. The empirical research employed Ordinary Least Square (OLS) multiple regression method and found that the customers of the banks are not moved by changes in interest rates. The results of non-existent linear relationship may mean that the relationship between interest rates and commercial deposits are non-linear which the researcher failed to observe. Mashamba, Magweva, & Gumbo (2014) studies the relationship between banks' interest rates and deposit mobilisation in Zimbabwe also considering Ordinary Least Square (OLS) method for a sample period of 2000 to 2006 for which the assumption of linearity is still intact. The findings of the study state a positive relationship between interest rates and bank deposits however failing to capture the asymmetrical behaviour of the variables. The former governor of the central bank of Maldives in her PHD research thesis (Adam, 2012) observed that interest rates do not respond to the fluctuations in the market as the changes in interest rates are very little over the sample period considered for the study - January 1991 to December 2010. She conducted time-series approach using co-integration and error-correction model to apprehend the long run and short run relationship between the dynamics of dollarization process in the Maldives. Furthermore, Hassan & Gharleghi (2015) studied the exchange rate behaviour in the Maldives investigating the philosophy of Dornbusch's Sticky price model of exchange rate determination in the context of Maldives. Quarterly data from 2000 to 2013 were utilised where the finding suggested that the sticky price model does not validate to the case of Maldives. The study was also based on linear regression model thus emphasizing on the importance of nonlinear modelling to detect any existence of asymmetrical relationship as the results are in-conclusive under the linearity assumption. Adam (2012) also identifies the real exchange rate changes impact to local currency deposits finding that there is a strong correlation between the two variables. Moreover, Adam (2012) investigated inflation volatility in her Phd thesis finding

that inflation is a key determinant in making deposits more attractive. Noteworthy is the fact that the study is based on the assumption of linearity leaving the gap of testing for non-linear relationship between exchange rate and commercial deposits in the Maldives. A paper examining the drivers of inflation proxy to Consumer Price Index (CPI) in the Maldives used co-integration and error correction model from January 1990 to December 2010, finds one element of inflation is money supply. The results depicts a parallel proportionate increase in the long run analysis supporting the absolute Purchasing Power Parity theory. Other relationships tested via the study include inflation rate with exchange rate, (Adam, 2014). Yet, none of the studies analyse the asymmetrical relationship between inflation and deposits in the country. The research also analyses co-integration between money supply (M2) and inflation to the Maldives revealing the existence of some price stickiness in the short run indicating that the changes maybe asymmetrical which can only be explained via nonlinear specifications. Fan, Xu, Su & Shi, (2017) explores bootstrap Granger full-sample causality test on trade openness and financial development of China. Outcomes depict a significant bidirectional link between the variables revealing the presence of ‘demand-following’ and ‘supply-leading’ hypothesis. The results are significant to depository institutions specifying that deposits and trade balances have linear connection in both ways despite the fact that intuitively it is hard to believe that the speed of adjustments above and below equilibrium could be equal.

Henceforth, the above empirical findings invite the researcher to examine the long-run and short-run non-linear asymmetries mainly due to the short-coming of linear models which assume that time series data are linear although in reality time series statistics are non-linear. Moreover, to the best of my knowledge, so far none of the existing literature have paid attention in testing macroeconomic statistics via NARDL bounds testing approach developed by Shin et al. (2014) to the Maldives hence the case remains unresolved. Therefore, this paper would make a humble attempt in filling up this significant gap in the literature.

1.3 Main objective of the study

Derived from the above theoretical and literature controversies, the main objective of this study is to examine any significant existence of short run and long run asymmetrical relationship between commercial deposits and macro-economic factors in the Maldives.

1.4 Significance/Contributions of the study

The study investigates the existence of any asymmetrical relationship of commercial deposits with reference to selected macro-economic variables in the Maldives. Understanding the behaviour of deposits in relation to aggregate factors of economic system is crucial to the

financial corporations as deposits serve as the cheapest and largest source of loanable funds available. Hence an increase in deposits could be translated into growth in financial assistance to the public. This research will depart from previous studies in the manner that to the best of my knowledge, this is the first attempt made to test the existence of any asymmetries through NARDL for commercial deposits giving reference to macroeconomic variables in the Maldives. This would also give a prediction to Maldivian policy makers on how soon the affected variables would return back to equilibrium under normal circumstances thus aiding in formulating policies to enhance deposit structure in the Maldives.

1.5 Structure of the paper

The rest of the study is organised in this manner; Section 2.0 provides the methodology employed in to formulate the study and its subsection presenting the data description, Section 3.0 discusses the empirical findings of the study and section 4.0 concludes the study including the limitations and suggestions for further research.

2.0 Data and Methodology

The purpose of this study is to examine the nonlinear (asymmetric) short run and long run impact of Trade Balance (TB2), Exchange Rate (ER), Consumer Price Index (CPI), Money Supply (M2) and Interest Rates (IR) and their associated volatilities (DTB2, DER, DCPI, DM2 and DIR, respectively) on commercial deposits (Dep). Hence, the following function serves as the primary model for this study.

$$\text{Dep} = f(\text{TB2}^+, \text{TB2}^-, \text{ER}^+, \text{ER}^-, \text{CPI}^+, \text{CPI}^-, \text{M2}^+, \text{M2}^-, \text{IR}^+, \text{IR}^-, \text{DTB2}^+, \text{DTB2}^-, \text{DER}^+, \text{DER}^-, \text{DCPI}^+, \text{DCPI}^-, \text{DM2}^+, \text{DM2}^-, \text{DIR}^+, \text{DIR}^-) \quad (1)$$

The results for this study are produced via the integrated statistical software package – Stata. In order to estimate the short and long run dynamics, the NARDL bound testing technique established by Shin et al. (2014) is applied as the order of integration is not related. The notion behind NARDL model is inquiring on the standard assumption of symmetrical estimates, whether the magnitude of an increasing variable is equal and directly opposite to the decreasing magnitude of the same variable. The only exception here is that the time series data are assumed to be integrated with the maximum order of one. This can be verified using the unit roots tests. In addition to this, if the co-integration are noted to be in existence in the positive and negative components of time series data then it implies the presence of non-linearity between the variables (Granger & Yoon, 2002). Probable causes for non-linearity

include asymmetrical adjustment process and extreme volatility in the market. (Raza, et al., 2016). NARDL framework provides to model asymmetrical co-integration by decomposing the positive and negative values (partial sum decomposition) to detect the short and long run asymmetrical effects. Moreover, the technique allows to jointly analyse the issue of non-stationarity and non-linearity in an unrestricted error correction model setting. Shin et al. (2014) specifies the following nonlinear co-integrating regression equation:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + \mu_t \quad (2)$$

where β^+ and β^- are the long run parameters of $k \times 1$ vector of regressors x_t , decomposed as follows:

$$x_t = x_0 + x_t^+ + x_t^- \quad (3)$$

where x_t^+ and x_t^- are the partial sums decomposed of positive and negative changes in x_t as follows:

$$x_t^+ = \sum_{j=1}^t \Delta x_j^+ = \sum_{j=1}^t \max(\Delta x_j, 0) \quad (4)$$

$$x_t^- = \sum_{j=1}^t \Delta x_j^- = \sum_{j=1}^t \min(\Delta x_j, 0) \quad (5)$$

After inserting the NARDL (p, q) form of equation (3), the following can be specified as the form of Asymmetric Error Correction Model (AECM):

$$\Delta y_t = \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \sum_{j=0}^q (\pi_j^+ \Delta x_{t-j}^+ + \pi_j^- \Delta x_{t-j}^-) + \varepsilon_t \quad (6)$$

where $\theta^+ = -\rho\beta^+$ and $\theta^- = -\rho\beta^-$. The first two steps of linear and non linear ARDL bound testing framework are similar which is to determine co-integration between the variables, meaning the estimation of equation (6) with Ordinary Least Square (OLS) method and then conducting the joint null hypothesis tests ($\rho = \theta^+ = \theta^- = 0$). Nevertheless, Wald test is utilised in NARDL to assess the long-run ($\theta^+ = \theta^-$) and short run ($\pi^+ = \pi^-$) asymmetrical relationships of the variables. Lastly, the asymmetric cumulative dynamic multiplier effect of a change in one unit in x_t^+ and x_t^- on y_t is examined as follows:

$$m_h^+ = \sum_{j=0}^h \frac{\partial y_{t+j}}{\partial x_t^+}, m_h^- = \sum_{j=0}^h \frac{\partial y_{t+j}}{\partial x_t^-}, h=0,1,2, \dots \quad (7)$$

where $h \rightarrow \infty$, $m_h^+ \rightarrow \beta^+$ and $m_h^- \rightarrow \beta^-$.

2.1 Data and descriptive statistics

Monthly data are used in this study taking samples from January 2007 to December 2016 for Trade Balance, Exchange Rates, Consumer Price Index, Broad Money Supply, Interest Rates and Commercial Deposits. All data are extracted from monthly statistical data published on the central bank – MMA website. Trade balance are denominated in Millions of USD, Exchange Rates are in Maldivian Rufiyaa (MVR) per USD, Consumer Price Index base on June 2012 = 100, Broad Money Supply in millions of MVR, Interest Rates in percentage and Commercial Deposits in millions of MVR. The descriptive statistics are reported in Table 1 below.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
dep	120	17726.38	6942.051	7354.9	30122.06
tb2	120	94.4775	35.08097	1	160
er	120	14.28096	1.279119	12.8	15.41
cpi	120	90.48342	15.27685	62.3	108.97
m2	120	19697.72	7486.416	8395.3	32753.4
ir	120	6.25525	1.700285	3.5	10.27
ddep	108	2329.228	1177.099	-789.5703	5234.314
dtb2	108	-10.47407	24.57526	-69.8	66.6
der	108	.2851852	.8081413	-.0799999	2.61
dcpi	108	4.678241	3.7186	-.8199997	14.7
dm2	108	2500.962	1291.643	-827.2988	5848.301
dir	108	-.2222222	1.891472	-4	2.59

From table 1, the standard deviations are highest for money supply and the lowest to exchange rates indicating the magnitude differed from the mean value.

Table 2: Jarque-Bera test

Equation	chi2	df	Prob > chi2
dep	6.294	2	0.04298
ALL	6.294	2	0.04298

Table 2: Jarque-Bera test of normality fails to reject the null hypothesis at 5% significance level stating that all data are distributed normally hence there is no need to change the raw data into natural logarithmic form.

Table 3: Pairwise unconditional correlation

	dep	tb2	er	cpi	m2	ir	ddep	dtb2	der	dcpi	dm2	dir
dep	1.0000											
tb2	-0.8750*	1.0000										
er	0.8440*	-0.7603*	1.0000									
cpi	0.9388*	-0.8118*	0.9303*	1.0000								
m2	0.9997*	-0.8756*	0.8448*	0.9410*	1.0000							
ir	0.0950	-0.0615	0.3727*	0.3174*	0.1096	1.0000						
ddep	0.3960*	-0.3131*	0.3629*	0.3264*	0.3997*	0.1542	1.0000					
dtb2	-0.2500*	0.5500*	-0.2935*	-0.2491*	-0.2471*	0.0780	-0.2251*	1.0000				
der	-0.0917	0.1136	0.2621*	-0.0007	-0.0981	-0.0496	0.3015*	-0.1831	1.0000			
dcpi	-0.5484*	0.4652*	-0.1120	-0.3521*	-0.5539*	0.0783	-0.1224	-0.0562	0.6614*	1.0000		
dm2	0.3379*	-0.2764*	0.3538*	0.2981*	0.3445*	0.2475*	0.9845*	-0.2177*	0.3019*	-0.0705	1.0000	
dir	-0.4427*	0.4065*	0.0262	-0.1706	-0.4355*	0.6626*	-0.1347	0.1193	0.3291*	0.6215*	-0.0209	1.0000

* indicates significance at 5% level

Table 3 shows the pairwise unconditional correlation of commercial deposits with trade balance, exchange rate, consumer price index, money supply and interest rates and with their volatilities. The table depicts that there are significant linear correlations (at 95%) between commercial deposits with long term variables including trade balance, exchange rate, consumer price index, money supply and short term variables of trade balance, consumer price index, money supply and interest rates. However, long run interest rates does not signify any linear correlations as well as short run exchange rate in this unconditional pairwise correlation.

2.2 Estimation

First step in NARDL is to examine the stationarity of each variable: the Augmented Dicky-fuller (ADF) and Philip Perron unit root tests are used. The purpose of making data stationary is due to the financial raw data which tends to produce unreliable and spurious outcomes meaning the time series at level form are non-stationary (Masih, Al-Elg & Madani, 2009). However, NARDL can only be conducted if none of the variables are I(2) at optimum lag order. See Appendix for optimum lag order test results for each variable. Hence, the following table provides the results to compare the Z(t) statistics with its critical values to confirm the stationarity of variables at first difference level.

Conditions for ADF and PP test interpretation:

- H_0 =Non-Stationary (There is a unit root for the series)
- H_1 =Stationary (There is no unit root for the series)
- If T-stat<CV = Fail to reject H_0
- If T-stat>CV = Reject H_0

Table 4: ADF & PP unit-root test

	ADF			PP		
	T-stats*	5% CV	Result	T-stats*	5% CV	Result
At Level Form						
TB2 (3)	1.764	-3.47	Non-Stationary	-0.468	-3.447	Non-Stationary
ER (1)	-4.676	-3.449	Stationary	-4.082	-3.447	Stationary
CPI (4)	-25.188	-3.47	Stationary	-8.438	-3.447	Stationary
M2 (2)	-0.282	-3.455	Non-Stationary	-1.110	-3.447	Non-Stationary
IR (3)	-7.112	-3.46	Stationary	-5.331	-3.447	Stationary
Dep (4)	2.3	-3.47	Non-Stationary	-0.596	-3.447	Non-Stationary
First Difference Form						

DTB2 (3)	-8.089	-3.47	Stationary	-18.121	-3.449	Stationary
DER (1)	-8.520	-3.449	Stationary	-12.364	-3.449	Stationary
DCPI (4)	-7.455	-3.467	Stationary	-7.756	-3.449	Stationary
DM2 (2)	-8.118	-3.455	Stationary	-12.386	-3.449	Stationary
DIR (3)	-9.970	-3.46	Stationary	-8.833	-3.449	Stationary
DDep (4)	-4.617	-3.47	Stationary	-12.212	-3.449	Stationary

*Z(t) at 95% significance results

Note: ADF and PP are empirical statistics of Augmented Dicky-Fuller (1979) and the Phillips-Perron (1988) unit root tests.

The null hypothesis is to be rejected for the differenced series as first differenced I(1) must be stationary while ideally null hypothesis cannot be rejected for the levels I(0) series – must be non-stationary. In this manner and based from conditions for ADF and PP test interpretation and from the above table, both ADF and PP agree on those variables that are non-stationary at level form. Therefore, after first differencing, all variables become stationary under both tests (with intercept and trend) confirming that none of the variables are I(2) guiding that we can proceed with non-linear ARDL.

Next step is to ascertain the existence of long run asymmetrical relationship between commercial deposits and macroeconomic variables using the bound testing procedure mentioned above in equation (1).

Cointegration test statistics: **t_BDM = 0.8218**
 F_PSS = 2.7654

Above are the estimates of nonlinear specifications where F_PSS denotes F-statistics proposed by Pesaran et al. (2001) to test the null hypothesis of no co-integration. t_BDM is the t-statistic proposed by Banerjee et al. (1998) to test the null hypothesis of no long run relationship. Both tests reject the null hypothesis confirming the presence of long run relationship between commercial deposits and its explanatory variables.

3.0 Interpretations/Discussions

After confirming the existence of co-integration among the variable, the final step is to test the long and short run asymmetrical impact of macroeconomic variables of macroeconomic variables selected for this study on the commercial deposits of the Maldives. The Non-Linear Regression results for long run data are as follows:

Table 5: Long-run NARDL results

Source	SS	df	MS			
Model	223908417	31	7222852.17	Number of obs =	107	
Residual	949594.153	75	12661.2554	F(31, 75) =	570.47	
Total	224858011	106	2121301.99	Prob > F =	0.0000	
				R-squared =	0.9958	
				Adj R-squared =	0.9940	
				Root MSE =	112.52	

Variable	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_ <i>y</i>						
_ <i>y</i>	.018119	.022047	0.82	0.414	-.0258009	.0620388
_ <i>x1p</i>						
_ <i>x1p</i>	2.848452	1.872515	1.52	0.132	-.8817889	6.578693
_ <i>x1n</i>						
_ <i>x1n</i>	3.156732	1.952024	1.62	0.110	-.731898	7.045363
_ <i>x2p</i>						
_ <i>x2p</i>	-147.606	67.56529	-2.18	0.032	-282.2029	-13.00902
_ <i>x2n</i>						
_ <i>x2n</i>	-1076.261	1441.567	-0.75	0.458	-3948.01	1795.488
_ <i>x3p</i>						
_ <i>x3p</i>	-5.322448	9.123948	-0.58	0.561	-23.49828	12.85339
_ <i>x3n</i>						
_ <i>x3n</i>	561.1555	187.9941	2.98	0.004	186.6521	935.6589
_ <i>x4p</i>						
_ <i>x4p</i>	.0583315	.0284989	2.05	0.044	.0015587	.1151042
_ <i>x4n</i>						
_ <i>x4n</i>	-1.698213	1.221644	-1.39	0.169	-4.131853	.735427
_ <i>x5p</i>						
_ <i>x5p</i>	-66.57531	34.10465	-1.95	0.055	-134.5152	1.364633
_ <i>x5n</i>						
_ <i>x5n</i>	43.11656	41.69097	1.03	0.304	-39.9361	126.1692

From Table 5, the first coefficient *y* is the convergence coefficient – the endogenous variable (commercial deposits in this case) and *x1* is the first exogenous variable (trade balance) where *x1p* is the increasing share (positive portion) of trade balance and *x1n* is the decreasing (negative portion) of trade balance. Likewise, for each variable, there is the increasing and decreasing portion which must be equal and significant if the linearity assumption is true for variables. However, none of the exogeneous variables show both positive and negative values are equal specifying that the linearity assumption in most time series techniques unlike NARDL does not hold hence reject the null hypothesis of long-run symmetry of positive and negative components in the examined variables.

The t-statistics and p-values connote the independent variables whether its coefficients, small or large, have a significant impact on the dependent variables. Here, only *x2p* (positive portion of exchange rate), *x3n* (negative component of CPI) and *x4p* (positive part of M2) have a significant impact on the commercial deposits. A 1% positive change in exchange rate brings

the negative impact of 147.606 million MVR reduction in commercial deposits. This is inline with the theoretical expectations that exchange rate movements do have a bearing on deposit behaviour and in the case of Maldives, the impact is a negative relationship meaning an increase in exogenous variable leads to a decrease in the independent variable. Taking into account the a 1% negative shock to consumer price index, the impact to commercial deposits are positive which increases commercial deposits by 561.155 million MVR. This shows that CPI and commercial deposits are significantly negatively correlated. When comparing this to the theoretical long run relationship, the empirical results here are in line with the theory. A decrease in inflation level of the Maldives means more deposits are made into commercial banks hence supporting the financial institutions to produce more loans with the growing amount of deposits. Another significant relationship existence discovered from the results are money supply and commercial deposits whereby a 1% positive shock give to money supply increases the commercial deposits by 0.0583 million MVR. The positive relationship is also aligned with the theoretical underpinnings.

In the similar manner, the Non-Linear Regression results for short run data are as follows:

Table 6: Short-run NARDL results

_dy	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_dy						
L1.	-.6465864	.0979733	-6.60	0.000	-.8417592	-.4514136
_dx1p						
--.	1.813643	1.704752	1.06	0.291	-1.582398	5.209683
L1.	.6188493	1.624925	0.38	0.704	-2.618167	3.855865
_dx1n						
--.	2.15001	1.065147	2.02	0.047	.0281276	4.271892
L1.	-.5353665	1.408116	-0.38	0.705	-3.340477	2.269744
_dx2p						
--.	54.3419	48.19026	1.13	0.263	-41.65802	150.3418
L1.	187.2458	43.71735	4.28	0.000	100.1563	274.3352
_dx2n						
--.	-6.978859	853.0442	-0.01	0.993	-1706.33	1692.372
L1.	1305.185	1420.286	0.92	0.361	-1524.17	4134.541
_dx3p						
--.	-18.98879	11.63071	-1.63	0.107	-42.15836	4.180777
L1.	-27.14966	11.28521	-2.41	0.019	-49.63096	-4.668357
_dx3n						
--.	153.7498	152.0873	1.01	0.315	-149.2236	456.7232
L1.	(omitted)					
_dx4p						
--.	.9224834	.0209419	44.05	0.000	.8807649	.9642018
L1.	.5402334	.0842914	6.41	0.000	.3723162	.7081505
_dx4n						
--.	1.167481	.0871729	13.39	0.000	.9938239	1.341139
L1.	3.449522	1.66078	2.08	0.041	.1410797	6.757965
_dx5p						
--.	-23.40365	29.88683	-0.78	0.436	-82.94128	36.13397
L1.	67.95359	33.9305	2.00	0.049	.3605759	135.5466
_dx5n						
--.	-56.08476	19.54811	-2.87	0.005	-95.0266	-17.14293
L1.	-102.191	45.94449	-2.22	0.029	-193.7171	-10.6649
_cons						
	34.02164	246.3058	0.14	0.891	-456.6446	524.6879

From the above table, the first coefficient δ_1 is the short-run convergence coefficient. dx_1 is the first exogenous variable where dx_{1p} is the increasing share (positive portion) of short-run changes in trade balance and dx_{1n} is the decreasing (negative portion) of dx_1 -trade balance. Likewise, for each variable, there is the increasing and decreasing portion of short run shocks in the macroeconomic variables to commercial deposits. The positive and negative shocks in macroeconomic variables' volatility have different impacts on commercial deposits. Previous month's positive shock in interest rates (L1 of dx_{5p}) reduced the commercial deposits from positive to negative 23.40 million of MVR this month. However, previous month's negative shock in interest rates (L1 of dx_{5n}) impacted positively on commercial deposits reducing the negative amount to 56.08 million MVR indicating more deposits were made today than yesterday with lowering interest rates by 1%. This contradicts the finding of Hassan (2016) stating that there is no significant changes made to customer deposits with a change in interest rates. This maybe because of the assumption of linearity in Hassan (2016)'s research confirming my intuition that removal of linearity assumption depicts the relationship between interest rates and commercial deposits. Moreover this non-linear relationship is an important discovery made to Maldives as Adam (2012) did not observe such a relationship in her research via time-series co-integration technique with the assumption of linearity still intact.

Considering the exchange rate short run movements, the results of a 1% positive shock are significant and positive to commercial deposits at a decreasing rate however. This is inline with the previous literature on Hassan & Gharleghi (2015) who finds that the sticky price model is not reflected in the Maldivian economic environment. Moreover, a 1% positive change in inflation rates (CPI: x_{3p}) reduces the amount of deposits made to commercial banks confirming it is true with 1 month previous data. This is aligned with past researchers as there is a significant relationship between consumer price index and commercial banks in the Maldives however contradicting to the fact is the relationship here is non-linear. Therefore, it is vital to see the overall impact to find the results of the main objective of this study.

Table 7: Overall Asymmetry Statistics

Asymmetry statistics:

Exog. var.	Long-run effect [+]			Long-run effect [-]		
	coef.	F-stat	P>F	coef.	F-stat	P>F
tb2	-157.208	.4964	0.483	174.222	.5322	0.468
er	8146.482	.8293	0.365	-59399.628	.3578	0.552
cpi	293.750	.2017	0.655	30970.581	.6748	0.414
m2	-3.219	.4013	0.528	-93.726	.5017	0.481
ir	3674.340	.5002	0.482	2379.635	.4671	0.496
	Long-run asymmetry			Short-run asymmetry		
	F-stat		P>F	F-stat		P>F
tb2	.115		0.736	.09635		0.757
er	.2947		0.589	.3836		0.538
cpi	.6724		0.415	1.682		0.199
m2	.5032		0.480	3.52		0.065
ir	.5721		0.452	7.249		0.009

Note: Long-run effect [-] refers to a permanent change in exog. var. by -1

The above table shows the long run and short run increasing and decreasing effect of exogenous variables to endogenous variable. For example, when trade balance increases by 1, the commercial deposits reduces by 157.208. But when trade balance reduces by 1, it increases commercial deposits by 174.22. This signifies that in the long run, increasing and decreasing values are not symmetrical. Moreover, the significance of long run asymmetry and short run asymmetry are tested via F test. $P < 0.05$ signifies that long run or short run asymmetrical relationship are significant. However, only interest rates show short-run asymmetry unlike all other variables rejecting the hypothesis of non-linear relationship in both long and short run. Therefore, the results confirm all macroeconomic variables perform symmetrically in short and long run except for interest rates which shows a non-linear relationship in reference to commercial deposits in the short run.

After model estimation, four types of diagnostic test results are reported.

Table 8: Other diagnostic tests

Model diagnostics	stat.	p-value
Portmanteau test up to lag 40 (chi2)	7.066	1.0000
Breusch/Pagan heteroskedasticity test (chi2)	1.51	0.2192
Ramsey RESET test (F)	2.191	0.0965
Jarque-Bera test on normality (chi2)	1.201	0.5484

P-values for all tests are more than 0.05 ($p > 0.05$) in the above table 8, illustrating all the tests are insignificant hence no auto-correlation, no heteroscedasticity, no misspecification and no non-normality exists in this model.

4.0 Conclusions and Policy implications

Application of Non-linear ARDL cointegrating bounds which is also called Asymmetric Effects of ARDL (NARDL) proposed by (Shin, Yu & Greenwood-Nimmo, 2014) is applied in this research to analyse the asymmetrical impact of macroeconomic variables (if any) on Commercial deposits in the Maldives. To the best of my knowledge, this is the first of its kind research for the country Maldives taking monthly statistical data from January 2007 to December 2016. The findings of the study indicate that the asymmetry exists only in the short-run interest rates with reference to commercial deposits signifying (at 95% confidence level) that the positive shocks of interest rates impact commercial deposits negatively and in much larger magnitude when compared to a negative shock meaning a reduction in interest rates increases the commercial deposits in the Maldives but with a lesser speed of adjustment.

These findings play an integral part for the government players and for depository corporations as for the former in understanding how to implement policies to support the financial corporations as well as for the latter on how to structure commercial deposit related products in accordance with the policies in place monthly-wise. The confirmation of the impact of other economic variables on commercial deposits are symmetric implying that both the negative and positive speed of adjustment are equal and the relationship maybe linear. Based on the results from the rigorous and most recent econometric technique applied in this study – NARDL, the major policy implication is the required reforms and pro-active macroeconomic policies that can be applied to enhance and support the financial sector growth in an open developing country like Maldives. The simultaneous development of sound financial institutions is crucial to the Maldives to provide ample financial assistance to those in need from which the final aggregate outcome could impact the whole economy positively.

5.0 Limitations of the study and suggestions for future research

Conducting NARDL technique to Maldives was a challenging assignment owing to the absence of proper statistical data maintenance in the country Also, some of the techniques in this research could be further enhanced together with additional tests like KPSS in confirming for stationarity results and generating graphs depicting multiplier effects of adjustment which was not manageable to produce and interpret because of the time constraint to conduct further analysis. Hence, this opens several research gaps that could be fulfilled by future researchers.

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