

Examining Bank Deposit and Gross Domestic Product: Building A Better Model through Dynamic Econometric Models with Cointegration Analysis

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Abstract: *Bank deposit is inseparably linked to economic growth of any nation. Proper functioning of these banks leads to economic growth of a nation. They are patterns of resources that aim to meet the needs ranging from personal consumption to business investments. This paper examines the use of dynamic econometric models and cointegration analysis to better model bank deposits and gross domestic product of the Philippines. The annual data was gathered from the Federal Reserve Economic Data of Federal Reserve Bank of St. Louis from 1960 to 2020. Findings revealed that among the three dynamic econometric models, the Autoregressive Distributed Lag Model was found to be the better model on examining bank deposits and gross domestic product. With cointegration analysis, autoregressive variable can significantly affect the entire economic system. In other words, the increase or decrease of bank deposits can significantly cause the entire economic activity. The findings imply that bank deposits consistently impacted by economic development as measured by GDP; and policymakers should focus on this and pay particular attention to the interest rate and the rediscount rate as important tools for monetary policy to draw deposits and finance loans. Heightened monitoring of deposit mobilization must be placed to ensure an increase of economic activity. The Philippines must also maintain political stability to encourage banks to expand their operations and to intensify their efforts to mobilize deposits.*

Keywords: autoregressive, bank deposits, cointegration, GDP, Philippines

I. INTRODUCTION

Financial institutions are crucial to the growth and development of a country. As such, banks' main responsibility is to ensure that there is enough flow of cash to support the economy's weaker sectors and facilitate the transfer of money between them.

The industry of banking is one of the essential sectors for economic growth. There were two basic activities done by banks: generating deposits and lending. The banks attract potential clients to save their money and earn interest known as bank deposits. On the other hand, the lending side of activities is providing loans for investment or for personal consumption imposing interest (Mushtaq, 2016). The lifeblood of banks depends primarily on how many deposits there are to provide sufficient loans available for use. According to Eriemo (2014) the banks' success depends on the mobilization of deposits as this is a major source of working capital for banks as the size of deposits generated from the public through its current, savings, fixed deposits, time deposits, and other depositary instruments are vital to the banks' everyday banking operations. In addition, the government urges banks to exert possible efforts to mobilize deposits to speed up the development of the economy. Gunasekara and Kumari (2018) emphasized that banks should raise sufficient deposits to provide sound economic activity.

The economic theory even suggested that efficient financial systems, composed mainly of banks, stock markets, and bond markets, used for channelling capital are advantageous for sustaining growth in developing economies like Asia (Estrada, Park & Ramayandi, 2010). It is said that growth in the banking sector leads to economic growth of a country because of its ability to influence important economic sectors such as agriculture, industry, and trade Abusharbeh (2017) as cited in (Dayag & Trinidad, 2019).

Furthermore, several studies used dynamic econometric models in examining banking variables. Jawabreh, Ali, Jaber, and Ali (2023) recently used the auto-regressive distributed lag model (ARDL) examining the financial determinants on bank deposits in Jordan. Their analysis revealed that there is a direct and statistically significant long-term relationship between real GDP, deposit interest rates, and financial shocks with bank deposits, as well as an inverse relationship between the rediscount rate and deposits in the long term, and the adjustment speed factor indicates that the deviation of

total deposits during the period. In addition, Islam, Sarker, Mowla, Jahan, Roy, and Ullah (2017) also employed ARDL with cointegration techniques and error correction term to know the determinants of bank deposits in Bangladesh. The study revealed that time deposits positively influenced by the change's per capita income, level of financial deepening, and remittance inflow in the long run. They added that credit to GDP ratio has a significant role to deposit growth in Bangladesh. In Zermeno, Martinez, and Preciado, (2014) they examine the growth, bank credit, and inflation in Mexican banking sector. With the ARDL model suggested that the availability of private sector bank credit in the economy exerts positive impact on real GDP. In addition, inflation rates have contributed negatively to the increase in private credit, liquid liabilities, and financial development. Reinforcing the literature on finance and growth, the study reaffirms that inflation rates are detrimental to long-run financial development and economic growth.

Based on the literature above, the use of dynamic econometric models is used to forecast economic growth with banking deposits to several countries except the Philippines. Mainly, the autoregressive distributed lag model was highly employed by several researchers. In addition, there is dearth of literature that employed distributed lag and autoregressive lag to macroeconomic variables particularly gross domestic product and bank deposits. Hence, this study may be the first in the Philippines that would attempt to examine bank deposit and gross domestic using the dynamic econometric models to build a better model for prediction, forecasting, and cointegration analysis as an empirical basis for future studies. This is safe to say that bank deposits are inseparably linked to the economic growth of any nation. Figuratively, they are like the body and soul in the overall functions of the human person. Banks and other financial institutions may fail to meet their business objectives if they do not have enough deposits.

II. METHODOLOGY

The study employed quantitative research design and applied a predictive-causal approach. The predictive approach examines the bank deposit and its lag value together with the lag value of domestic product to build a better model on explaining the gross domestic product of the Philippines. Likewise, the causal approach uncovers the causal relations among variables whereby the independent variables cause the dependent variable and vis-vis. The study made use of secondary data. The data were sourced from the Federal Reserve Economic Data of Federal Reserve Bank of St. Louis (Economic Research Division). The data available on bank deposit and gross domestic product for the Philippines is an annual source covering 1960 to 2020. The data is a time series with 60 observations. Following the concept of Central Limit Theorem that a sample will be considered as large if it is greater than 30.

The Least Squares Regression Method was employed to run dynamic econometric models such as the distributed lag, autoregressive lag, and autoregressive distributed lag model. Prior to proceeding with the method of processing the time series data, checking of any violations of the assumptions of regression shall be performed. Violations such as multicollinearity, heteroscedasticity, and autocorrelation are looked at and were not violated.

For the selection of better model, the Akaike information criterion (AIC), Schwartz/Bayesian information criterion (SBIC), and Hannan-Quinn criterion; these information criteria are the sum of squared residuals which or the error terms in the model. In other words, the model with the smallest value of these information criteria shall be selected as the better model.

Lastly, the Granger Causality Test was employed to determine the cointegration of independent and dependent variables. To check if the data is stationary or not, the Augmented Dickey Fuller (ADF) test is used to analyzed the inclusion of lag values as per the frequency of the data. The null hypothesis of this test is the Variable has a Unit root or non-stationary. To reject the null the test statistics it should be less than the critical value at 1%, 5%, and 10% or the probability value is less than 0.05.

III. RESULTS

Dynamic Econometric Model

Table 1 below shows the distributed lag model with adjusted r^2 of 95% and the following Akaike, Schwartz, and Hannan-Quinn scores of 45.97, 46.07, and 46.01 as the information criterion for goodness of fit and model complexity. Results revealed that Bank Deposit significantly contribute to the gross domestic product with a p value of 0.00 while its lag value at 1 did not contribute to the model with a p value of 0.72.

Table 1. Distributed Lag Model

Variables	B	Std. Error	t-stat	Prob
Constant	9.61	3.48	2.77	0.01
Bank Deposit	1.77	0.06	31.29	0.01
Bank Deposit (-1)	0.02	0.06	0.36	0.72

Adjusted r^2	95%
Akaike	45.97
Schwartz	46.07
Hannan-Quinn	46.01

Table 2 below shows the autoregressive lag model with an adjusted r^2 of 95.20% and the following Akaike, Schwartz, and Hannan-Quinn scores of 45.96, 46.06, and 45.99 as the information criterion for goodness of fit and model complexity. Results revealed that Bank Deposit significantly contributes to the gross domestic product with a p value of 0.00 while the lag value of gross domestic product at 1 did not contribute to the model with a p value of 0.29.

Table 2. Autoregressive Lag Model

Variables	B	Std. Error	t-stat	Prob
Constant	8.58	3.52	2.44	0.02
Bank Deposit	1.76	0.06	31.05	0.00
GDP (-1)	0.03	0.03	0.07	0.29
<i>Adjusted r^2</i>	95.20%			
<i>Akaike</i>	45.96			
<i>Schwartz</i>	46.06			
<i>Hannan-Quinn</i>	45.99			

Table 3 below shows the autoregressive-distributed lag model with adjusted r^2 of 95.83% and the following Akaike, Schwartz, and Hannan-Quinn scores of 45.83, 45.97, and 45.88 as the information criterion for goodness of fit and model complexity. Results revealed that Bank Deposit significantly contributes to the gross domestic product with a p value of 0.00 and the lag values of gross domestic product and bank deposits also significantly contribute to the model with a p value of 0.000.

Table 3. Autoregressive-Distributed Lag Model

Variables	B	Std. Error	t-stat	Prob
Constant	6.61	3.34	1.98	0.05
Bank Deposit	1.75	0.05	33.18	0.00
Bank Deposit (-1)	0.42	0.13	3.29	0.00
GDP (-1)	-0.74	0.24	-3.11	0.00
<i>Adjusted r^2</i>	95.83%			
<i>Akaike</i>	45.83			
<i>Schwartz</i>	45.97			
<i>Hannan-Quinn</i>	45.88			

Moreover, to account all determinant criterion to select a better model from dynamic econometric models summarized in Table 4, based on adjusted r^2 , Akaike, Schwartz, and Hannan-Quinn scores; it can be noted that the autoregressive distributed lag model (ARDL) provides better model for both striking the balance of goodness of fit and model complexity. This affirms that ARDL based on literatures above confirms why this was widely used.

Table 4. Summary of Dynamic Econometric Models Criteria

Variables	Distributed	Autoregressive	Autoregressive- Distributed
Adjusted r^2	95.00%	95.20%	95.83%
Akaike	45.97	45.96	45.83
Schwartz	46.07	46.06	45.97
Hannan-Quinn	46.01	45.99	45.88
Rank	3	2	1

Thus, the study suggests that by examining the gross domestic product of the Philippines from 1960 to 2022, the ARDL model should be used. An advantage of ARDL model is that it not only captures the dynamic effects of the lagged Ys (DV) but also those of the lagged Xs (IV). This model was used by previous studies of Zermeno, Martinez, and Preciado, (2014); Islam, Sarker, Mowla, Jahan, Roy, and Ullah (2017); Ludeen and Masih (2017); and (Jawabreh, Ali, Jaber, and Ali, 2023).

Stationarity tests

The Augmented Dickey-Fuller test (ADF) is used in the study to test for unit root. This test analyzes the autocorrelated data which includes the lag variable as per frequency of data. The null hypothesis of this test is the variable has a unit root (non-stationary) and the alternate hypothesis is the variable has no unit root (stationary).

Test results in Table 5 have unit root (absolute value of test statistics is less than critical values at 5% level) at levels while at the first differencing, these variables are found nonstationary. Thus, failed to reject the null hypothesis and that the variables are non-stationary and will proceed to cointegration analysis.

Variables	Augmented Dickey-Fuller test				
	t-stat	1% level	5% level	10% level	Prob
Bank Deposits	-1.36	-4.15	-3.5	-3.10	0.86
Gross Domestic Product	-1.47	-4.14	-3.5	-3.18	0.83

Cointegration tests

Table 6 below revealed that both the t and z values are below the 0.05 significance level. This means that the series cointegrated. In other words, by looking at the Engle Granger test, we can affirm that gross domestic product, bank deposits, and the lag values causes every other variable. This implies that these economic variables with an autoregressive variable can significantly affect the entire economic system. In other words, the increase or decrease of bank deposits can significantly cause the entire economic activity, in this case, the gross domestic product. The growing number of banks over the years has resulted in the banking sector’s efficiency and competition. This has led to growth in banks’ profits. In emerging markets, deposits are core to bank operations. Most businesses heavily resort to bank loans as a source of financing, and deposits largely dictate how much funds are available for lending activities. Ergo, the role of deposits cannot be overemphasized (Ünvan and Yakubu, 2020).

Test Statistics	Value	Prob
Bank Deposits	-7	0.00
Gross Domestic Product	-59.71	0.00

IV. CONCLUSION

The banking sector in the Philippines is one of the fastest growing industries with the influence of digitalization. It is now easy to deposit and mobilize funds to increase economic productivity. This becomes critical to the country’s economic development. Recognizing the influential factors that would improve gross domestic product is vital for Philippines banks in developing viable deposit mobilization policies and procedures. The main objective of the study is to find a better model that would examine the time series data of gross domestic product and bank deposits from 1960-2022. It was concluded that the autoregressive distributed lag model (ARDL) was found to be the better model that would better examine the variables; and the variables included herein are cointegrated with each other. This means that the gross domestic product, bank deposit, and the lag values of dependent and independent variables cause all the variables. This implies that including the prior (t-1) gives a link between gross domestic product and bank deposits.

Bank deposits are consistently impacted by economic development as measured by real GDP; therefore, policymakers should focus on this and pay particular attention to the interest rate and the re-discount rate as important tools for monetary policy to draw deposits and finance loans. Because of this, bank managers in the Philippines must put in a lot of effort to operate, collect, and invest the savings and deposits of their clients, which calls for optimal use and investment.

It is important to note that banks hold most of the value of bank deposits, with the other Philippine banks vying for individual deposits.

Therefore, it is recommended to monitor deposit mobilization to ensure an increase of economic activity. The Philippines must maintain economic stability to encourage commercial banks to expand their operations and to intensify their efforts to mobilize deposits. Furthermore, to lessen the detrimental effects of larger families with bad saving habits on deposit mobilization, the government must educate the population about saving.

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